CMD 25-H9.REF6 CNSC Staff Submission

Reference Package 6 for CMD 25-H9 CNSC Staff Submission on Denison Mines Licence Application to Prepare Site and Construct the Wheeler River Project

Classification	Unclassified
Type of CMD	References
CMD Number	CMD 25-H9.REF6
Original CMD	CMD 25-H9
Public hearing date	08 December 2025
PDF e-DOC #	7605566
Summary	This document contains documents related to the Environmental Assessment process, as posted to the Canadian Impact Assessment Registry, to be placed on the Record for the proceeding.
Actions required	There are no actions requested of the Commission. This CMD is in support of the actions and recommendations set out in CNSC staff CMD 25-H9.

CMD 25-H9.REF6 Soumission par le personnel de la CCSN

Références liées 6 au CMD 25-H9 Soumission par le personnel de la CCSN la demande de Denison Mines visant à prépare le site du projet de Wheeler River et à entamer les activités de construction

Classification	Choisir un niveau de classification
Type de CMD	Références
Numéro de CMD	CMD 25-H9.REF6
CMD Original	CMD 25-H9
Date de l'audience	08 décembre 2025
Numéro e-Doc du PDF	7605566
Résumé	Ce document contient des documents liés au processus d'évaluation environnementale, tels que publiés dans le Registre canadien d'évaluation d'impact, à verser au dossier de l'instance.
Mesures requises	Aucune mesure n'est requise de la Commission. Le présent CMD appuie les mesures et les recommandations énoncées dans le CMD CMD 25-H9 du personnel de la CCSN.

Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

Canada
Choose a level

CMD 25-H9.REF6

Reference Package 6 for CMD 25-H9 CNSC Staff Submission on Denison Mines Licence Application to Prepare Site and Construct the Wheeler River Project

Signed by:

X Beaton, Dana

Digitally signed by Beaton, Dana
DN: C=CA, O=GC, OU=CNSC-CCSN, CN="Beaton, Dana"
Reason: I am approving this document
Location:
Date: 2025.11.24 08:22:17-05'00'
Foxit PDF Editor Version: 13.0.1

Dana Beaton
Director General, DERPA

Wheeler River Project – Denison Mines

mâci masinahamihk okâwiymâw askiy mêskocipicikêwin wihtamasinahikan

kâ-wî-itôtamihk atoskêwin

anima Wheeler River atoskêwin(anima atoskêwin) anima Denison itascikêwin êkota situ miskêwin (ISR) kaskatêw asiniy wâtihkêwin êkwa osihcikêwin misi-wikamik:

- tânitê: kîwîtinohk Saskatchewan, kanâta
- atoskêwin kîkwaya êkwa itôtamowina: anima tâwayihk atoskêwin kîkwaya anihi ISR wâtihkêwin êkwa anima osihcikêwin misi-wikamik. sihtoskamihk misi-atoskêwin kîkwaya êkwa itôtamôwina astêwa kîkwaya osci wêpinikêwina, nipiy pimipayicikana, wâskwatawêpicikana, êkwa pimitâpâsowin, tâskoc tôhêwina, sâkahikanisa, wikamikwa, mêskanawa, êkwa pimihâkan mêskanaw.
- pihcâyihk: kanâtahk nipiy, nanâtohk âpoya (osci wâtihkêwin, kaskatêw asiniy osihcikêwin, nipiy kanâcihcikêwin), wâskwatawêwin êkwa pimiy.
- wayawê itôtamowina: wêpinikêwin (askiwiya, kanâti asiniy wêpinikêwina, pîtosi wêpinikêwin asiniy (wâtihkêwin askiy), cîki wêpinikêwin, misi wêpinikêwin, sâpipêwina ohci osihcikêwin wikamik êkwa nipiy kanâcihcikêwin, mîsêw âpoy) îhîwina mîna pêwâpisk kaskâpahtêwina (GHGs) kisêwêwin, êkwa kanâcihtâhk nipiy kâ-sîkipitamihk nipîhk.
- kîkway osihtâhk: U3O8 ahpô osâwi-wîhkihkasikan. anima kîkway Denison atâwâkêcik apacihcikâtêw isi pimiy êkota kaskatêwi asiniy wikamikohk, sihtoskamihk okâwiymâw askiy itôtamowin ka-nîkipitamihk GHG kaskâpahtêwina.
- atoskêwin: nântaw 300 atoskêwiyiniwak kâ-osihtâhk êkwa 180 ikospê atoskêwin. anima pimipayicikêwin ka-pihci-pimihâwak êkwa wayawê-pimihâwak atoskêwin.
- atoskêwin ispayik, 5 askiy osci pônihkamihk, êkwa 15 askiya osci kîsihtâhki-pônihkamihk ispayihowina.

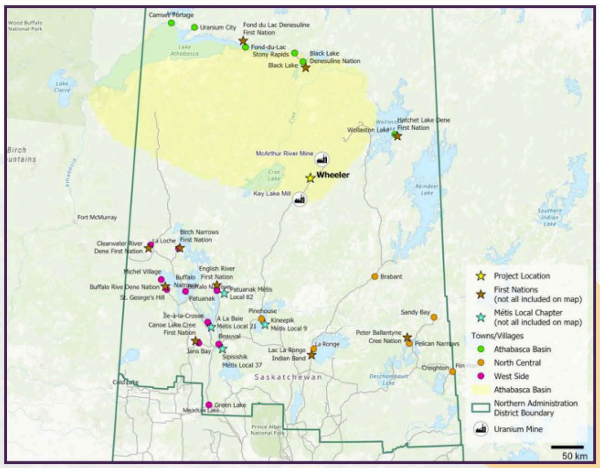
anima okâwiymâw askiy kinwâpahcikêwin (EA) kâ-masinahikâtêk ôta okâwiymâw askiy mêskocipitamihk wihtamâkêwin (EIS) kinwâpahcikâtew êkwa nanisihkâc, askôhamihk itôtamowin ka-kinwâpahtamihk atoskêwina tâskoc mêskocipayinwa. Kakwê osihtâhk kanawêyicikêwin EA masinahamihk, ahpo ayiwâk pihci, anima nistohtamowin misi-

atoskêwin osihcikêwina. Tâskoc, anima tipêyaw nakatamowin osci osihcikêwak masinahikêwina nântaw 75 ha, mâka anima EIS itêhtamwak anima atoskêwin mêskocipayiwin cîki 170 ha. pêyakwan, tahto askiy osihcikêwin osci osihcikêwak osihtâwin anima 6 Mlbs U3O8 tahto askiy iskohk 10 askiya, mâka EIS itêhtamwak osihtâwin 9 Mlbs U3O8 tahto askiy isi 15 askiya, mîna mistahi itôtamowin iskohk 12 Mlbs U3O8 askiy osci itôtamowin waskawêwin. Itastêw, tâskoc, anima EIS kinwâpahtamwak pihcâyihk nitawêhtamihk êkwa wayawêwina osihtâhk tahtwâ askiy 50% ayiwâk kâ-itêhtamihk.

kîkwaya kâ-astêki kâ-kîsi kanâcihtâhk ikospê pihtaw osci askiy ê-kîskatahikâtêk, ayiwâk ayisîniwak ê-pimitâpâsocik, kaskâpahtêw, wêpinikêwina, êkwa nipiy pimipayicikêwin. Kîkway kâ-ispayiki kinwâpahcikâtêwa êkwa itasiwâtamihk anihi EIS anima atoskêwin kâ-kî-osihcikâtêw, pimipayicikâtêw, êkwa pôni-apacihcikâtêw ikospê misi-wikamikwa êta kâ-wîkicik miywâsinwa êkwa ahkami apacihcikâtêwa, kinosêwak êkwa pisiskiwak miywâyâwak, ayisîniw miywâyâwin kanawêyicikâtêw, astêwa kîkway ka-apacihtâhk askiy, tâskoc iyiniw pakitinikowisowina, êkwa ahakami kiyohkêwin êkwa sôniyahkêwin. Anima EIS itasinahikâtêw kwayisk itôtamowina, kinwâpahcikêwina, êkwa asotamâkêwina osci Denison ka-ayâcik sohkêyimowin anima atoskêwin ê-pimipayik êkwa ispayihowin osci atoskêwin osihtâwin, pimipayicikêwin, pôni-apacihcikâtêk astêwa êkota ahpô apisîs itêhtamowina ispayihowina.

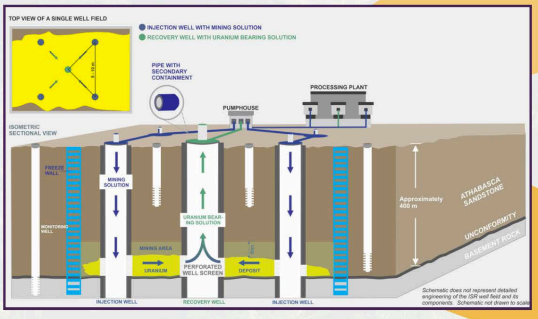
misawê, ôma atoskêwin itêhtâkwan kwayisk ta-ispayik askîhk pihci kotakwa wâtihkêwina. pihtaw osci, anima ISR wâtihkêwin itôtamowin, anima atoskêwin astêwa namôya mistahi kîkway ê-nakacikâtêki kâ-kîsi-kanâcihtâhk pihci kotakwa wâtihkêwina ahpô atâmihk askîhk wâtihkêwina êkwa kotakwa itôtamowina.

mistêhtâkwan, Denison pâ-pîkiskwâtêwak iyiniwak êkwa kotakwa atoskêwikamikwa, ayîsiniwak, êkwa kanawêyicikêwak ikospê 2016. Mâmawi itôtamowin isi pîkiskwêwin êkwa yahtohtahikêwin osci anima atoskêwin wihtamwak ôki ayisîniwak ka-miyo-ispayiki atoskêwina êkwa anihi EA nanâtohk êsi. Denison wâpahtamwak anima EIS tâskoc mistêhtâkwahk wiyascikêwin kîkway ka-sihtoskamihk nîkânihk itôtamowina êkwa pîkiskwêstamwak pêyak itôtamowin êkota kâ-ayimahk EA, masinahikêwin, êkwa pakitinamihk kaskatêwi asiniy wâtihkêwin wikamik êkota kanâta.



êkota SITU kâwi-miskamihk

êkota situ kâwi-miskamihk apacihcikâtêw kisitêk âpoy ka-otinamihk kaskatêwi asiniya osci askîhk isi cîstamihk êkwa kâwi mônahipâna. Anima osihtâwin wikamik astêwa maskimota êkwa apacihcikana ka-otinamihk kaskatêwi asiniy osci situ kâwi-miskamihk isi osâwi wihkihkasikan. Denison ka-atâwâkêwak anima osâwi wihkihkasikan ka-apacihtâhk ka-sipwêpitamihk wâskwatawêwikamikwa, sihtoskâtahkik okâwiymâw askiy itôtamowina ka-nîkipitamihk pihcipowi kaskâpahtêwina.

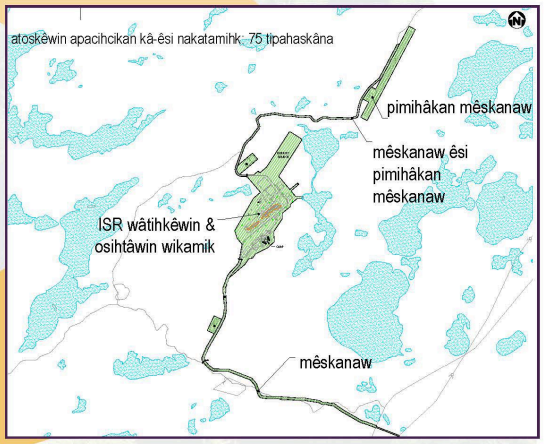


tântê

anima Wheeler River atoskêwin astêw êkotî kîwîtinohk Saskatchewan êkota Athabasca kapâwin.

atoskêwin kâ-êsi nakatamihk

animi kihci atoskêwin apacihcikana astêwa êkota situ kâwi-miskamihk wâtihkêwin êkwa osihtâwin wikamik.



mistakihtêki apacihcikana & atoskêwina waskawêwina

Denison kinwâpahtwak kîkwaya, isihkâtêki mistakihtêki ispayihowina osci anima atoskêwin êyikoni kîkwaya.

Wheeler River Project – Denison Mines

Ëłóchëlë Nih Bazi t’ąú nih besoídi ha si erjtł’is.

T’aghą Holnj si diri nih bazi nuhhel kodi hasj.

Diri Wheeler River – Denison Mines nih sënolye ha si, t’au nih nághjłna ha (situ) Yanathë tthe ghą nade ha si.

- Yathé nene diri Saskatchewan k’eyaghë hoʔą si Canada tth’i k’eyaghë.
- Diri t’au tu t’arat’j si senalye ha, t’a ghą nade si konụhełnj ha. Kon/tthe sljnj (Uranium) senalye seráde ha, tulu k’e ts’etai sëlye, yoh tth’i ts’etai sohúde ha. Beyets’et’ali neltła ha tth’i senuhut’a ha. T’aʔu tu t’arat’j si (tu sljnj) sohulye ha. Diri t’aʔu nih t’arat’j si senalye ha hodi sj.
- ‘Senahulye de, tu nezụ, tthe sljnj t’aʔu senalye ha. Kon bët’á asi hëtł’ël si, tł’ës tth’i ts’etai sëlye si.”
- Ku diri halye ha si, t’ąchaghë, tthe t’a bohełtaíle si, t’ąʔu nih dałdhe njsi, tu, tujërë-ú, tsą tue-ú, t’ąʔu tthe t’arat’j si tu hël si, sëlye ha. Ku diri asi ghą nade t’a horehtth’a si ya bazj tth’u. T’a tu senalye si eyi tth’i hahodi.
- Diri tthe sljnj (uranium) łes ʔahot’j alya si bët’á kon hołe, kon hełtsi ha. Diri kon uranium t’a holj de, dëhtth’agh hile snj.
- Diri nih Senahulye si bónjther de tononą (300) ts’etai sohulye ha si. Łǫnǫną-jłk’etǫną tth’i Dene ëghádálana ha sj. Diri bónjther de beyets’et’ali t’arat’j ha.
- Diri t’a bëghą Eghalada ha si tǫną-jłk’edjghj nene-ú, nake nene ts’etai sohúde ha-ú, sǫlaghe nene t’a nuhụt’ą si nąnelye ha, Sǫlaghe ts’adhel nene ts’etai senahulye ha.

Diri nih senahulye si horelyụ net’j, nih-ú, ya-u t’ąú besuwidi ha.

T’ąʔu nih ts’etai sëlye ha si, t’a Dene yëghą eritł’is dałtsi hotié dezą (engineering), eritł’is nédhé bets’j dezą, t’ąʔu nih hotié ts’etai ʔalye ha.

Diri t’aʔu aresj henj, nih nechozë ʔałnj sj, jlaisdjghj nih hultsai anjłttha u, kuli horjchoze ʔats’edi sj, T’a ha seráde si tthe sljnj (uranium) halye ha hodi sj łonëną nene ha hodi. Ku diri t’a the sljnj halye hasi, sǫlaghe ts’adhel nene tthe nezụ halye ha henj. T’ąt’u tthe Jłk’etaghë limil (łonëną ąnelt’e) ʔajłdath henj, kuli lota limil tthe hilchu has henj. Kuli sǫlaghe ts’ëdel nene anjłttha de nake ts’adhel limil ʔajłdath the hilchu hasi. Eyi t’a solǫną (percent) hoʔąnelt’e tthe hilchu ha henj sj.

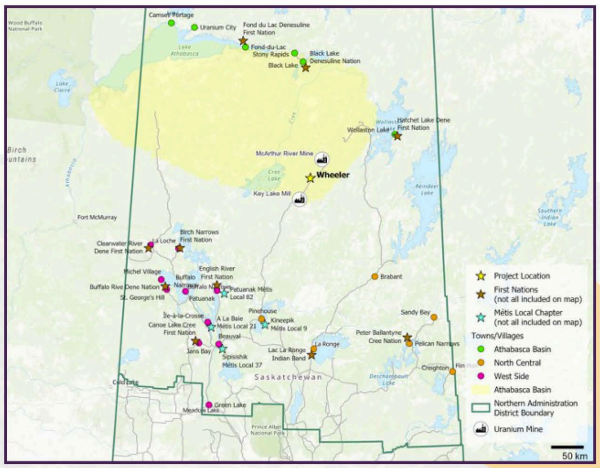
Diri bët'á Eghalada si t'au nih ts'etai sëlye si, bëhchënë tth'i la ha-ú, horetth'a t'au, asiʔaldel tth'i ła-ú, tu t'a bët'á Eghalada si besorįthën ha la. ʔąłu nih, tu-ú, ya ts'en boʔëłta hasą. Kuli yedołnį ha henį.

Diri bëghą Eghalada si, yëghą ëghadálghëna hoyaghë ts'etai sedáhúlye-ú, łue-ú, nųneshe, ëch'ërë, hotié besoídi ha, Dene t'a dághëna. Denesųłine nih t'a dághëna la, nuhhenene theri hoʔą. Nih-u, tu-ú, ya-ú nųhha besudi hoʔą.

Diri t'ąʔu nih ghą ëghádálana si hotié bahodi, t'ąʔu eritł'is holį si hotié dézą, t'ąʔu ts'etai sohúde-ú, t'ąʔu ëghádálana-u, t'ąʔu nih senalye si hotié dézą.

Diri t'ąghą ëghádálana si hotié nih hodi ha henį, yanįzi t'ąʔu nih hesdohołts'į si konalyehaíle dųhų henį. T'a tthe nih-u, tu-u, ya-u bët'á nezųle ni, dųhų tthe sljnj si bët'á nih-u, tu-u, ya-u hesedowełnj ha henj. T'a tthe nih horjcha nailts'el nj, nih yaghë tth'i dëgharë nih nárałts'ul nj – dųhų kone haíle henj.

Dųhų de t'a benené k'e ëghadálghëna si bedóghelnj dézą, hotié t'a ghą ëghadalaida si bełkoridi hoʔą 2016 hots'j. Diri t'a bëghą náide si t'ą benené si beł hoʔą. Nih hodi hoʔą, tu-u, ya-u boghedi ha. Diri t'a eritł'is bet'azi (license) si, horelyų sohúde dézą, diri Canada k'eyaghë tthe sljnj ghą naidi hade.

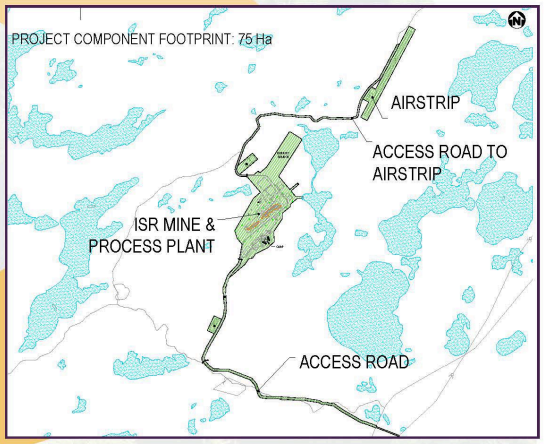


LOCATION

Ku diri k'eyaghë dehtł'is si t'a ts'en ëghadálghëna hasi horet'ı̨ – Dene nenene k'e.

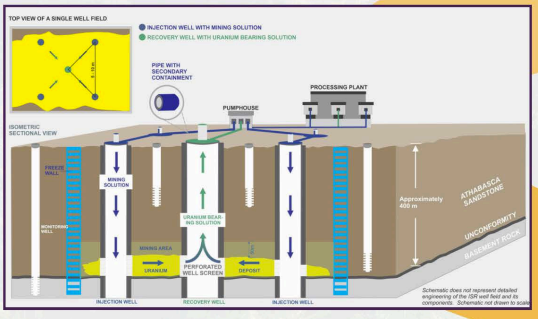
PROJECT FOOTPRINT

Diri t'a yet'a nih ghą nade has si dehtł'is sı̨.



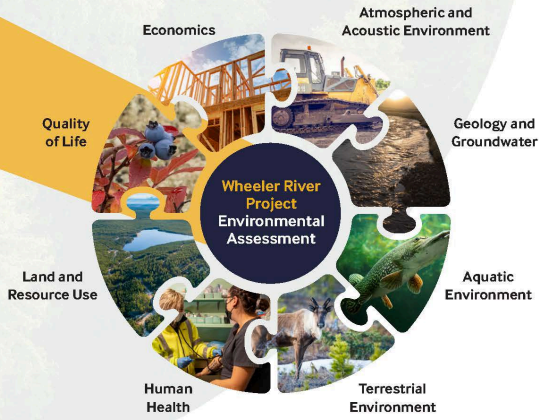
IN SITU RECOVERY

Diri tu hetł'el t'a tthe slı̨nı̨ hilchu, horı̨cha horet'ı̨ la, t'ąt'u tthe sëralye si bët'á łes hołe. Ku eyer hots'ı̨ łes bëghą nánı̨, horelyų nene k'e, t'a horehtth'a ch'a hodołni sı̨. Eyi ʔarałnı̨ Greenhouse Emissions, diri nih k'e náide si besoídi ha.



VALUED COMPONENTS & PROJECT INTERACTIONS

T'aʔu nih besoídi hasi Dene yek'odarëlya hasą.



Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

1 Concordance Tables

Concordance tables have been generated between the Environmental Impact Statement (EIS) for the Wheeler River Project and the following documents:

- Canadian Nuclear Safety Commission (CNSC) – Generic Guidelines for the Preparation of an Environmental Impact Statement Pursuant to the *Canadian Environmental Assessment Act* (CEAA), 2012 (version: March 23, 2021); and
- Denison Mines Wheeler River Terms of Reference (version: May 2019).

Canadian Nuclear Safety Commission – Generic Guidelines for the Preparation of an Environmental Impact Statement Pursuant to the *Canadian Environmental Assessment Act*, 2012

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
PART 2 – Content of the Environmental Impact Statement		
	Presentation and Organization The title page of the EIS and related documents contain the following information: • project name and location; • title of the document, including the term "environmental impact statement"; • subtitle of the document; • proponent name and contact information; and • date.	• Front covers for each section and in Section 1
3. Introduction and Overview		
Section 1.0	The EIS will include: • a glossary of technical terms; • a list of acronyms and abbreviations; and • charts, diagrams, tables, maps and photographs where appropriate to clarify the text.	• Within each section of the EIS
Section 2.0	**Executive Summary** The summary of the EIS is to be provided in English and French, is encouraged to be made available in the language(s) spoken by Indigenous communities (e.g., Cree and Dene) and will include: • a concise description of all key components and related activities; • a summary of the consultation conducted with Indigenous groups, the public, and government agencies, including a summary of the issues raised and the proponent's responses; • an overview of the key environmental effects of the project and proposed technically- and economically-feasible mitigation measures; • the proponent's conclusions on the residual environmental effects of the project after taking mitigation measures into account and the significance of those effects; and • sufficient details for the reader to learn about and understand the project, its potential environmental effects, mitigation measures, the significance of the residual effects and the follow-up program.	• Executive Summary
Section 3.1	**About the Proponent** In the EIS, the proponent will: • provide contact information (e.g., name, address, phone, fax, email); • identify itself and provide the name of the legal entity or entities that would develop, manage and operate the project; • describe corporate and management structures; and	• 1.2

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
	• identify key personnel, contractors and/or sub-contractors responsible for preparing the EIS.	
Section 3.2	**Project Overview** Describe the project, key project components and associated activities, scheduling details, the timing of each phase of the project and other key features	• Executive Summary • Section 1 • Section 2
Section 3.3	**Project Location** The EIS will contain a description of the geographical setting where the project will take place.	• Executive Summary • Section 1
Section 3.4	**Regulatory Framework and the Role of Government** The EIS should identify: • the environmental and other regulatory approvals and legislation, including CEAA 2012, that are applicable to the project at the federal, provincial, regional and municipal levels; • government policies, resource management plans, planning or study initiatives pertinent to the project and/or Environmental Assessment (EA) and their implications; • any treaty or self-government agreements with Indigenous groups that are pertinent to the project and/or EA; • any relevant land use plans, land zoning, or community plans; and • regional, provincial and/or national objectives, standards or guidelines that have been used by the proponent to assist in the evaluation of any predicted environmental effects.	• 1.2; 1.7 • 4.3; 4.4; 4.5; 4.7
4. Project Description		
Section 4.1	**Purpose of the Project** Provide the rationale for the project, explaining the background, the problems or opportunities that the project is intended to satisfy and the stated objectives from the perspective of the proponent.	• 1.3
Section 4.2	**Alternative Means of Carrying Out the Project** Identify and consider the effects of alternative means of carrying out the project that are, from the perspective of the applicant, technically and economically feasible. Conduct an environmental effects analysis where final decisions have not been made about the placement of project infrastructure, the technologies to be used, or if several options exist for various project components.	• 2.10 • Appendix 2-C
Section 4.3	**Scope of the Project** The proponent will consider all phases, components, activities and federal decisions identified in the scope of project as part of the effects assessment. The EIS will include: • a summary of the changes that have been made to the project since originally proposed, including the benefits of these changes to the environment, Aboriginal peoples, and the public; and • a schedule including time of year, frequency and duration for all project activities.	• Section 2

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
5. Scope of the environmental assessment		
Section 5.1	**Factors to be Considered** The EA of the designated project must take into account the following factors, as listed in subsection 19(1) of the CEAA 2012: a) the section 5 environmental effects of the designated project (such as changes to fish and fish habitat, aquatic species, migratory birds), including the environmental effects of malfunctions or accidents that may occur in connection with the designated project, and any cumulative environmental effects likely to result from the designated project in combination with other physical activities that have been or will be carried out;	• 6.1.4 to 6.1.7; 6.2.4 to 6.2.7 • 7.4 to 7.7 • 8.1.4 to 8.1.7; 8.2.4 to 8.2.7; 8.3.4 to 8.3.7; 8.4.4 to 8.4.7; 8.5.4 to 8.5.7 • 9.1.4 to 9.1.7; 9.2.4 to 9.2.7; 9.3.4 to 9.3.7; 9.4.4 to 9.4.7 • 10.1.4 to 10.1.7; 10.2.3 to 10.2.6 • 11.1.4 to 11.1.7; 11.2.4 to 11.2.7; 11.3.4 to 11.3.7 • 12.1.4 to 12.1.7; 12.2.4 to 12.2.7; 12.3.4 to 12.3.7 • 13.3 to 13.6
	b) the significance of those environmental effects;	• 6.1.6; 6.2.6 • 7.6 • 8.1.6; 8.2.6; 8.3.6; 8.4.6; 8.5.6 • 9.1.6; 9.2.6; 9.3.6; 9.4.6 • 10.1.6; 10.2.5 • 11.1.6; 11.2.6; 11.3.6 • 12.1.6; 12.2.6; 12.3.6 • 13.5
	c) comments from the public that are received in accordance with the CEAA 2012;	• 4.3; 4.4; 4.5; 4.6; 4.7
	d) mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project;	• 6.1.5; 6.2.5 • 7.5 • 8.1.5; 8.2.5; 8.3.5; 8.4.5; 8.5.5 • 9.1.5; 9.2.5; 9.3.5; 9.4.5 • 10.1.5; 10.2.4 • 11.1.5; 11.2.5; 11.3.5 • 12.1.5; 12.2.5; 12.3.5 • 13.4
	e) the requirements of the follow-up program in respect of the designated project;	• 6.1.8; 6.2.8 • 7.8 • 8.1.8; 8.2.8; 8.3.8; 8.4.8; 8.5.8 • 9.1.8; 9.2.8; 9.3.8; 9.4.8 • 10.1.8; 10.2.7 • 11.1.8; 11.2.8; 11.3.8 • 12.1.8; 12.2.8; 12.3.8

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
		• 13.7
	f) the purpose of the designated project;	• 1.3
	g) alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alternative means; and	• 2.10
	h) any changes to the designated project that may be caused by the environment.[2]	• Section 15
	In conjunction with subsections 4.1 and 4.4 of REGDOC-2.9.1, Environmental Protection: Environmental Policy, Assessments and Protection Measures, the CNSC requires an environmental risk assessment (ERA) and a human health risk assessment (HHRA) as part of the EIS. • identifies facility- or activity-specific characteristics and site-specific environmental characteristics • identifies interactions between those characteristics • assesses the likelihood and significance of these interactions and the resulting potential effects on the environment and the public	• Appendix 10-A • 10.1.6.1
	Where there is a reliable and feasible methodology for calculating upstream greenhouse gas emissions that are linked to the project, the proponent will be required to provide sufficient information to estimate these types of emissions.	• 2.5
Section 5.2	**Valued Components to be Examined** • The EIS will identify the VCs linked to section 5 of the CEAA 2012, including those identified in section 9.2 (part 2) that may be affected by changes in the environment, as well as species at risk and their critical habitat as per the requirement outlined in section 79 of the *Species at Risk Act* (SARA). • The final list of VCs to be presented in the EIS will be completed according to the evolution and design of the project and reflect the knowledge about the environment acquired through public consultation and Indigenous engagement. • VCs will be described in sufficient detail to allow the reviewer to understand their importance and to assess the potential for environmental effects arising from the project activities. • The EIS will provide a rationale for selecting specific VCs and for excluding any VCs or information specified in these guidelines.	• 4.2.1; 4.3.2; 4.3.4; 4.4.1; 4.4.2 • 5.3 • 6.1.1; 6.2.1 • 7.1.1 • 8.1.1.1; 8.1.1.2; 8.2.1.1; 8.2.1.2; 8.3.1.1; 8.3.1.2; 8.4.1.1; 8.4.1.2; 8.5.1.1; 8.5.1.2 • 9.1.1.1; 9.1.1.2; 9.2.1.1; 9.2.1.2; 9.3.1.1; 9.3.1.2; 9.4.1.1; 9.4.1.2 • 10.1.1.1; 10.1.1.2;10.2.1.1; 10.2.1.2 • 11.1.1.1; 11.2.1.1 • 12.1.1.1; 12.2.1.1; 12.3.1.1 • 13.1.1
Section 5.2.2	**Spatial and Temporal Boundaries** The EIS will describe the spatial boundaries, including local and regional study areas, of each VC to be used in assessing the potential adverse environmental effects of the project and provide a rationale for each boundary. a) the physical extent of the proposed project, including any off-site facilities or activities b) the extent of aquatic and terrestrial ecosystems potentially affected by the project c) the extent of potential effects arising from noise, light and atmospheric emissions d) the extent to which traditional land use or treaty rights could potentially be affected by the project	• 4.3.2; 4.4.1 • 5.3.3; 5.3.4 • 6.1.1.3; 6.2.1.3 • 7.1.3.1; 7.1.3.2 • 8.1.1.3; 8.2.1.3; 8.3.1.3; 8.4.1.3; 8.5.1.3 • 9.1.1.3; 9.2.1.3; 9.3.1.3; 9.4.1.3 • 10.1.1.3; 10.2.1.3 • 11.1.1.3; 11.2.1.3

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
	e) current land and resource use for residential, commercial, industrial, recreational, cultural and aesthetic purposes by communities whose areas include the physical extent of the project f) the size, nature and location of past, present and reasonably foreseeable projects and activities which could interact with items (b), (c), (d) and (e) g) community and Indigenous traditional knowledge, and ecological and technical considerations	• 12.1.1.3; 12.2.1.3; 12.3.1.3 • 13.1.3
6. Public and Stakeholder Consultation		
Section 6	**Public and Stakeholder Consultation** In accordance with CNSC's REGDOC-99.3, *Public Information and Disclosure*, the EIS will describe the ongoing and proposed participation activities that the proponent will undertake or that it has already conducted on the project. It will describe efforts made to distribute project information, and describe the information and materials that were distributed during the public consultation process. The EIS will indicate the methods used, where the consultation was held, the persons and organizations consulted, the concerns voiced and the extent to which this information was incorporated in the design of the project as well as in the EIS. The EIS will provide a summary of key issues raised related to the Project and its potential environmental effects, as well as describe any outstanding issues and ways to address them.	• 3.4 • 4.3; 4.4; 4.5; 4.7 • 5.4 • 6.1.2; 6.2.2 • 7.2 • 8.1.2; 8.2.2; 8.3.2; 8.4.2; 8.5.2 • 9.1.2; 9.2.2; 9.3.2; 9.3.3.1.2; 9.3.3.2.2; 9.3.3.3.2; 9.4.2; 9.4.3.1.2; 9.4.3.2.2; 9.4.3.3.2 • 10.1.2; 10.2.2 • 11.1.2; 11.2.2 • 12.1.2; 12.2.2; 12.3.2 • 13.1.4
7. Indigenous Engagement		
Section 7.	**Indigenous Engagement** In accordance with the CNSC's REGDOC-3.2.2, *Indigenous Engagement*, the EIS will describe the proponent's engagement activities with potentially affected Indigenous groups. The EIS will include, and the proponent should consider engaging with potentially affected Indigenous groups to obtain their views on the following: • the objectives of Indigenous engagement and methods used; • each Indigenous group's potential or established rights including geographical extent, nature, frequency, timing and maps and data sets when this information is provided by a group to the proponent or available through public records; • comments, specific issues and concerns raised by Indigenous groups and how the key concerns were responded to or addressed; • the potential adverse impacts of the project on potential or established Indigenous or treaty rights; • the effects of changes to the environment on Indigenous peoples (health and socio-economic conditions; physical and cultural heritage, including any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and current use of lands and resources for traditional purposes) pursuant to paragraph 5(1)(c) of the CEAA 2012;	• 3.4 • 4.3; 4.4; 4.7 • 5.4 • 6.1.2; 6.2.2 • 7.2 • 8.1.2; 8.2.2; 8.3.2; 8.4.2; 8.5.2 • 9.1.2; 9.2.2; 9.3.2; 9.3.3.1.2; 9.3.3.2.2; 9.3.3.3.2; 9.4.2; 9.4.3.1.2; 9.4.3.2.2; 9.4.3.3.2 • 10.1.2; 10.2.2 • 11.1.2; 11.2.2 • 12.1.2; 12.2.2; 12.3.2 • 13.1.4

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
	• VCs suggested by Indigenous groups for inclusion in the EIS, whether they were included, and the rationale for any exclusions; and • measures identified to mitigate or accommodate potential adverse impacts of the project on the potential or established Indigenous or treaty rights and effects of changes to the environment on Indigenous peoples, including suggestions raised by Indigenous groups.	
8. Description of the Environment		
Section 8.1	**Baseline Environment** The EIS will include a description of the environment, including the components of the existing environment and environmental processes, their interrelations and interactions as well as the variability in these components, processes and interactions over time scales appropriate to the EIS. In characterizing the environmental effects of the project, the proponent will consider the current baseline environment and environmental trends within the project area. The description of the existing baseline and the environmental trends should include a consideration of past projects and activities carried out by the proponent and/or others within the project area. The EIS will present baseline information in sufficient detail to enable the identification of how the project could affect the VCs and an analysis of those effects. The baseline description should include results from studies done prior to any physical disruption of the environment due to initial project activities. As a minimum, the EIS will include a description of the following biophysical and human (health/socio-economic) environmental components:	• 4.3; 4.4; 4.5; 4.6; 4.7 • 5.5
8.2	Baseline - atmospheric environment;	• 6.1.3; 6.2.3
8.3	Baseline - surface water environment;	• 8.1.3
8.4	Baseline - aquatic environment;	• 8.2.3; 8.3.3; 8.4.3; 8.5.3
8.5	Baseline - geological and hydrogeological environment;	• 7.3.1; 7.3.2;
8.6	Baseline -terrestrial environment;	• 9.1.3; 9.2.3; 9.3.3; 9.4.3
8.7	Baseline - ambient radioactivity;	• 6.1.3
8.8	Baseline - human health; and	• 10.1.3; 10.2.3
8.9	Baseline - Indigenous land and resource use.	• 11.1.3; 11.2.3

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
		• 12.1.3; 12.2.3; 12.3.3 • 13.2
9. Effects Assessment		
Section 9.1	**Predicted Changes to the Physical Environment** The assessment will include a consideration of the predicted changes to the environment as a result of the project being carried out or as a result of any powers, duties or functions that are to be exercised by the federal government in relation to the project. These predicted changes to the environment are to be considered in relation to each phase of the project (i.e., construction, operation, decommissioning) and are to be described in terms of magnitude; geographic extent; duration and frequency; and whether the environmental changes are reversible or irreversible. As changes to various parts of the physical environment may be inter-related as part of an ecosystem, the EIS will explain and describe the connections between the changes described.	• 4.3; 4.4; 4.5; 4.6; 4.7 • 5.6; 5.8 • 6.1.6; 6.2.6 • 7.4.2.1; 7.4.2.2; 7.4.2.3; 7.4.2.4; 7.4.2.5; 7.4.2.6 • 8.1.6; 8.2.6; 8.3.6; 8.4.6; 8.5.6 • 9.1.6; 9.2.6; 9.3.6; 9.4.6 • 10.1.6; 10.2.5 • 11.1.6; 11.2.6 • 12.1.6; 12.2.6; 12.3.6 • 13.5
Section 9.2	**Predicted Effects on Valued Components** The proponent is to assess the environmental effects of the project on the VCs identified as per section 5.2.1 (part 2). All interconnections between VCs and between changes to multiple VCs will be described The proponent will use the information in appendix C of the CNSC's REGDOC-2.9.1, Environmental Protection: Environmental Policy, Assessments and Protection Measures and CEAA 2012 guidance documents listed on the Impact Assessment Agency's website for guidance on assessing the environmental effects of the.	• 5.6; 5.8 • 6.1.4; 6.1.6; 6.2.4; 6.2.6 • 7.4.2; 7.4.2.1; 7.4.2.2; 7.4.2.3; 7.4.2.4; 7.4.2.5; 7.4.2.6 • 8.1.4; 8.1.6; 8.2.4; 8.2.6; 8.3.4; 8.3.6; 8.4.4; 8.4.6; 8.5.4; 8.5.6 • 9.1.4; 9.1.6; 9.2.4; 9.2.6; 9.3.4; 9.3.6; 9.4.4; 9.4.6 • 10.1.4; 10.1.4.1; 10.1.4.2; 10.1.6; 10.2.4; 10.2.5 • 11.1.4; 11.1.6; 11.2.4; 11.2.6; 11.3.4; 11.3.6 • 12.1.4; 12.1.6; 12.2.4; 12.2.6; 12.3.4; 12.3.6 • 13.3; 13.5
Section 9.3	**Mitigation Measures** • The EIS will describe the standard mitigation practices, policies and commitments that constitute technically and economically feasible mitigation measures and that will be applied as part of standard practice regardless of location (including the measures directed at mitigating adverse socio-economic effects). • The EIS will describe the project's environmental protection plan and its environmental management system, through which the proponent will deliver this plan.	• 2.8; 2.9 • 4.6 • 5.7 • 6.1.5; 6.2.5 • 7.5.1 • 8.1.5; 8.2.5; 8.3.5; 8.4.5; 8.5.5 • 9.1.5; 9.2.5; 9.3.5; 9.4.5 • 10.1.5; 10.2.5 • 11.1.5; 11.2.5

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
	• The EIS will further discuss the mechanisms the proponent would use to require its contractors and sub-contractors to comply with these commitments and policies and with auditing and enforcement programs. • The EIS will describe mitigation measures that are specific to each environmental effect identified. Measures will be written as specific commitments that clearly describe how the proponent intends to implement them and the environmental outcome the mitigation is designed to address. • The EIS will describe mitigation measures in relation to species and/or critical habitat listed under the SARA. These mitigation measures will be consistent with any SARA permit, applicable recovery strategy and/or action plan. • The EIS will specify the actions, works, minimal disturbance footprint techniques, best available technology, corrective measures or additions planned during the project's various phases to eliminate or reduce the significance of potential adverse effects. The impact statement will also present an assessment of the effectiveness of the proposed technically and economically feasible mitigation measures. The basis used to determine whether the mitigation measure reduces the significance of a potential adverse effect will be made explicit. The proponent is also encouraged to identify mitigation measures for effects that are adverse although not significant. • The EIS will indicate what other technically and economically feasible mitigation measures were considered, and explain why they were rejected. Trade-offs between cost savings and effectiveness of the various forms of mitigation will be justified. The EIS will identify who is responsible for the implementation of these measures and the system of accountability. • For proposed mitigation measures for which there is little experience or that have questionable effectiveness, the potential environmental risks and effects – should those measures not be effective –will be clearly and concisely described. In addition, the EIS will identify the extent to which technological innovations will help mitigate environmental effects. Where possible, it will provide detailed information on the nature of these measures, their implementation and management, and how they are integrated into the follow-up program. • The EIS will document specific suggestions raised by Indigenous groups for mitigating the effects of changes to the environment on Indigenous peoples (section 5(1)(c) of CEAA 2012). For the mitigation measures intended to address the effects of changes to the environment for Indigenous peoples, the proponent must discuss the residual effects with the Indigenous groups prior to submitting the EIS.	• 12.1.5; 12.2.5; 12.3.5 • 13.4
Section 9.4	**Other Effects to Consider** **9.4.1 Accidents and Malfunctions** • The applicant should provide an assessment of potential health and environmental effects resulting from postulated radiological and conventional malfunctions or accidents. The EIS should also include any mitigation measures, such as monitoring, contingency, clean-up or restoration work in the surrounding environment that would be required during or immediately following the postulated malfunction and accident scenarios.	• Section 14 • Appendix 14-A

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
	• The EIS should provide a description of postulated malfunction and accident sequences leading to a radiological or non-radiological release considering, as appropriate, internal events, external events and human-induced events, including their frequency, an explanation of how these events were identified and any modeling that was performed. • The EIS should include the source, quantity, mechanism, pathway, rate, form and characteristics of contaminants and other materials (physical and chemical) likely to be released to the surrounding environment during the postulated malfunctions and accidents.	
	9.4.2 Effects of the Environment on the Project • The EIS shall take into account how the environment could adversely affect the project and how this in turn could result in effects on the project. • The applicant shall also take into account any potential effects of climate change on the project, including an assessment of whether the project might be sensitive to changes in climate conditions during its lifecycle. • The EIS will provide details of planning, design and construction strategies intended to minimize the potential environmental effects of the environment on the project.	• Section 15 • 6.1.7.1; 6.2.7.1 • 7.7.1 • 8.1.7.5; 8.2.7.4; 8.3.7.6; 8.4.7.6. 8.5.7.6 • 9.1.7.1.1; 9.1.7.2.1; 9.1.7.3.1; 9.2.7.1; 9.3.7.4; 9.4.7.5 • 10.1.7.1 • 11.1.7; 11.2.7 • 12.1.7.1; 12.2.7.1; 12.3.7.1 • 13.6.1
	9.4.3 Cumulative Effects The applicant shall assess any residual adverse environmental effects of the project in combination with other past, present or reasonably foreseeable projects and/or activities within the study area.	• 5.9 • 6.1.7; 6.2.7 • 7.7.1 • 8.1.7; 8.2.7; 8.3.7; 8.4.7; 8.5.7 • 9.1.7; 9.2.7; 9.3.7; 9.4.7 • 10.1.7; 10.2.7 • 11.1.7; 11.2.7 • 12.1.7; 12.2.7; 12.3.7 • 13.6
10. Conclusion on Significance of Residual Effects		
10	**Conclusion on Significance of Residual Effects** The applicant shall assess the significance of any residual effects that persist, taking into consideration the proposed mitigation measures. Some specific criteria to be assessed are: • magnitude of the effect • spatial extent of the effect • duration and frequency of the effect • degree to which the effect can be reversed or mitigated • ecological importance	• 5.8 • 6.1.6.2.1; 6.2.6.2.1 • 7.6.1; 7.6.2; 7.6.2.1; 7.6.2.2 • 8.1.6.3; 8.2.6.3; 8.3.6.3; 8.4.6.3; 8.5.6.3 • 9.1.6.4; 9.2.6.5; 9.3.6.6; 9.4.6.5 • 10.1.6.2; 10.1.6.3; 10.2.6 • 11.1.6.4; 11.2.6.4 • 12.1.6.3; 12.2.6.3; 12.3.6.3 • 13.5.3

Section in CNSC Guidelines	Requirement[1]	Section in the EIS
11	**Follow-up Program** The EIS shall include a framework or preliminary program upon which EA follow-up actions will be managed throughout the life of the project. Where applicable, the proponent will describe how the follow-up program relates to the project's environmental protection plan and environmental management system. Environmental assessment effects predictions, assumptions and mitigation actions that are to be tested in the follow-up program must be converted into field-testable monitoring objectives. The monitoring design must include a statistical evaluation of the adequacy of existing baseline data to provide a benchmark for testing project effects, and the need for any additional pre-construction or pre-operational monitoring to establish a firmer project baseline. The proponent will propose a schedule for the follow-up program. The schedule should indicate the timing, frequency and duration of effect monitoring. This schedule would be developed after statistical evaluation of the length of time needed to detect effects given estimated baseline variability, probable environmental effect size and desired level of statistical confidence in the results (type 1 and type 2 errors). The EIS should provide discussion on the follow-up program's requirements, and include: • objectives and structure of the follow-up program and the VCs targeted by the program; • tabular summary and explanatory text of the main components of the program including: – a description of each monitoring activity under that component; – which of the two generic program objectives the activity is relevant to (e.g., verify EA predictions, determine effectiveness of mitigation measures); – the specific statement from the EA that goes along with that generic objective and will be the focus for that activity (e.g., program objective: verify predicted effects; environmental assessment effect: no potential adverse effects); – the specific monitoring objective for that activity; and – planned schedule. • roles and responsibilities to be played by the proponent, regulatory agencies, Indigenous people, local and regional organizations and others in the design, implementation and evaluation of the program results; • possible involvement of independent researchers; • program funding sources; • information management and reporting (reporting frequency, methods and format); and • possible opportunities for the proponent to include the participation of the public and Aboriginal groups, during the development and implementation of the program.	• 4.7 • 5.10 • 6.1.8; 6.2.8 • 7.8.1; 7.8.2; • 8.2.8; 8.3.8; 8.4.8; 8.5.8 • 9.2.8; 9.3.8; 9.4.8 • 10.1.8; 10.2.8 • 11.1.8; 11.2.8 • 12.1.8; 12.2.8; 12.3.8 • 13.7 • Appendix 16-C

1 Canadian Nuclear Safety Commission (CNSC). 2021. Generic Guidelines for the Preparation of an Environmental Impact Statement – Pursuant to the *Canadian Environmental Assessment Act*, 2012. Dated: March 2021.

2 Conditions i and j of subsection 19(1) of CEAA 2012, as listed in CNSC 2021, do not apply to this EA as per CNSC (2019). Request for a Commission Decision on the Scope of an Environmental Assessment CMD: 19-H111. November 29, 2019.

Denison Mines Wheeler River Terms of Reference (May 2019)[1]

Section in Terms of Reference	Requirement	Section in EIS
1.0	**Executive Summary** For efficiency and to improve communication with Stakeholders, Denison Mines Corp. (Denison) will prepare a summary of the Environmental Impact Statement (EIS) for the Wheeler River Project (i.e., Wheeler or the Project) in other languages if requested by Stakeholder groups (i.e., French, Cree and Dene). This will include: • a concise description of all key components of the Project and related activities; • a summary of the consultation conducted with Indigenous groups, the public, and government agencies, including a summary of the issues raised and Denison's responses; • an overview of the key environmental effects of the Project and proposed technically and economically feasible mitigation measures; and • Denison's conclusions on the residual environmental effects of the Project after taking mitigation measures into account and the significance of those effects.	• Executive Summary
2.0	**Environmental Assessment Requirements** The provincial and federal environmental assessment requirements will be outlined in the EIS.	• 1.7
3.0	**Project Introduction and Overview** Denison will summarize the Project's key components and associated activities, scheduling details, the timing of each phase of the Project and other key features. The Project Introduction and Overview will identify the Project's key components; a detailed description of the Project will follow in Section 4 Project Description.	• Executive Summary • Section 1 • Section 2
3.1	**Project Proponent** A profile of Denison will be provided, including the name of the legal entity, the Project contact person(s), and their contact information, including a mailing address. A discussion of Denison's qualifications and expertise will be outlined.	• 1.2
3.2	**Project Location** A description of the geographical setting where the Project will take place including: • maps of the Project location at various relevant scales; • current land use in the area; • distance of the Project to any federal lands; • distance of the Project to nearby communities; • distance of the Project to other past, present or reasonably foreseeable future projects in the area; • environmental significance of the area; • identification of any environmentally sensitive areas; • description of local and Indigenous communities; and • traditional Indigenous territories, reserve lands and harvesting regions.	• 5.9 • 11.1.1.3; 11.2.1.3 • 12.1.1.3; 12.2.1.3; 12.3.1.3 • 13.1.3
3.3	**Regulatory Framework** Denison will identify environmental and other regulatory approvals and legislation applicable to the Project at the federal, provincial, and regional levels. A list of anticipated permits, approvals and licences for the Project	• 1.7

Section in Terms of Reference	Requirement	Section in EIS
	will be provided along with a list of guidelines, policies, and standards used in the development of the Environmental Impact Assessment (EIA).	
4.0	**Project Description** The Project will be described in the appropriate sections of the EIA, and at a minimum will include: • detailed descriptions of all Project components including both on-site and off-site infrastructure and other facilities or activities. • appropriately-scaled maps and/or drawings of the Project components and activities; • all the activities associated with Wheeler will be covered for the life of the Project from construction through decommissioning with an appropriate level of detail; • describe the construction phase and provide a Project schedule, in years; and • describe the benefits of the Project, including jobs created, local training, employment and business opportunities.	• Section 2
4.1	**Purpose of the Project** The EIS will describe the purpose of the Project by providing the rationale for the Project, explaining the background, the problems or opportunities that the Project is intended to satisfy and the stated objectives from Denison's perspective.	• 1.3; • 2.1; 2.10.1
4.2	**Scope of the Project**	• Section 2
	4.2.1 Project Components In the EIS Denison will describe the Project by presenting the Project components, associated and ancillary works, and other characteristics that will assist in understanding the potential environmental effects.	• 2.2; 2.4
	4.2.2 Project Activities The Wheeler EIS will include descriptions of each phase associated with the proposed Project, including descriptions of the activities to be carried out during each phase, the location of each activity, expected outputs and an indication of the activity's magnitude and scale The EIS will include a summary of the changes that have been made to the Project since originally proposed, including the benefits of these changes to the environment and to Project Stakeholders. The EIS will include a schedule including time of year, frequency, and duration for all Project activities.	• 2.3
	4.2.2.1 Decommissioning, Reclamation and Abandonment The EIA will provide a conceptual decommissioning plan that incorporates the following decommissioning objectives: • preferred procedures for decommissioning; • target decommissioning objectives for the mining area; • alternative procedures for decommissioning the site facilities, if applicable; • decommissioning, reclamation and closure of all related works and surface disturbance; • identification of acceptable post-operational land-use options for the Project site; • post-operational landforms and hydrology; • environmental impact mitigation and reclamation measures;	• 2.3.3

Section in Terms of Reference	Requirement	Section in EIS
	• proposed monitoring to determine if species will re-occupy the site; and • proposed contingency measures. As part of the licensing process, Denison commits to completing a preliminary cost estimate for decommissioning and reclamation based upon the conceptual decommissioning plan presented in the EIA. • Denison will also outline criteria for acceptance of the Project into the provincial institutional control program including commitments to monitor for decommissioning success prior to final closure.	
4.3	**Project Alternatives** The following will be included: • a brief description of the alternatives considered that were technically and economically feasible for mining and processing and placement of site infrastructure; • the key issues considered in evaluating the alternatives; • an analysis of the Project alternatives; and • a justification for the preferred alternatives.	• 2.10 and • Appendix 2-C
4.4	**Ancillary Projects** The EIS will provide a general description of ancillary projects associated with Wheeler, including timelines and identifying any major environmental and socio-economic implications.	• 2.4
5.0	**Stakeholder Engagement and Consultation** In the EIS, Denison will provide a summary of the engagement undertaken with local and regional Indigenous communities, regulatory agencies and the general public. This summary will include feedback, issues, questions and concerns raised, and how these issues and concerns were addressed through design of the Project and incorporated into various aspects of the assessment.	• 3.4 • 4.2; 4.3; 4.4; 4.5; 4.6; 4.7 • Appendix 4-A • Appendix 2-A; Appendix 6-B; Appendix 7-B; Appendix 8-A; Appendix 9-A; Appendix 10-B; Appendix 11-A; Appendix 12-A; Appendix 13-A; Appendix 14-A; Appendix 15-A.
6.0	**Scope of the Environmental Assessment**	• Section 5
6.1	**Factors to be Considered** Denison's assessment for Wheeler will take into account the factors listed in subsection 19(1) of CEAA 2012.	• Section 5
6.2	**Valued Components** The EIS will provide rationale for selecting VCs and will describe VCs in sufficient detail to allow reviewers to understand their importance and assess potential effects from Project activities. Justification will be provided for excluding any biophysical or human components identified in provincial and federal EIA guides, such as species of conservation concern. Similarly, Denison will also provide rationale for excluding any biophysical or human components as VCs in the assessment where the component was identified to be of concern from stakeholder engagement.	• 4.3.2; 4.3.4; 4.4.1; 4.4.2 • 5.3.1 • 6.1.1; 6.2.1; • 7.1.1; 7.1.1.1 • 8.1.1.1; 8.1.1.2; 8.2.1.1; 8.2.1.2; 8.3.1.1; 8.3.1.2; 8.4.1.1; 8.4.1.2; 8.5.1.1; 8.5.1.2 • 9.1.1.1; 9.2.1.1;9.3.1.1; 9.3.1.2; 9.4.1.1; 9.4.1.2 • 10.1.1.1; 10.1.1.2; 10.2.1.1; 10.2.1.2

Section in Terms of Reference	Requirement	Section in EIS
		• 11.1.1.1; 11.2.1.1 • 12.1.1.1; 12.2.1.1; 12.3.1.1 • 13.1.1
6.3	**Spatial Boundaries** • In the EIS there will be a description of spatial boundaries related to potential impacts or influences scaled accordingly within the appropriate sections.	• 4.3.2; 4.3.4 • 5.3.3 • 6.1.1.3; 6.2.1.3 • 7.1.3.1 • 8.1.1.3; 8.2.1.3; 8.3.1.3; 8.4.1.3; 8.5.1.3 • 9.1.1.3; 9.2.1.3; 9.3.1.3.1; 9.4.1.3.1 • 10.1.1.3; 10.2.1.3 • 11.1.1.3; 11.2.1.3 • 12.1.1.3; 12.2.1.3; 12.3.1.3 • 13.1.3
6.4	**Temporal Boundaries** • In the EIS, the temporal boundaries will be described as appropriate for each activity and cumulatively will cover the life of the Project	• 4.3.2 • 5.3.4 • 6.1.1.3; 6.2.1.3 • 7.1.3.2 • 8.1.1.3; 8.2.1.3; 8.3.1.3; 8.4.1.3; 8.5.1.3 • 9.1.1.3; 9.2.1.3; 9.3.1.3.2; 9.4.1.3.2 • 10.1.1.3; 10.2.1.3 • 11.1.1.3; 11.2.1.3 • 12.1.1.3; 12.2.1.3; 12.3.1.3 • 13.1.3
7.0	**Effects Assessment** Denison has completed a comprehensive baseline program and commits to providing a transparent examination of potential effects to the identified VCs following the typical EIA analysis. The effects assessment section will be completed for each part of the biophysical and human environments.	• 4.2.2; 4.3.2; 4.3.4; 4.4.1; 4.4.2 • 6.1; 6.2 • 7.3; 7.4 • 8.1; 8.2; 8.3; 8.4; 8.5 • 9.1; 9.2; 9.3; 9.4 • 10.1; 10.2 • 11.1.3; 11.2.3 • 12.1.3; 12.2.3; 12.3.3 • 13.2

Section in Terms of Reference	Requirement	Section in EIS
7.1	**Baseline Environment** Denison commits to gathering enough baseline information on the identified VCs to describe the existing environment and fully support the assessment of potential impacts.	• 6.1.3; 6.2.3; • 7.3.1; 7.3.2; 7.3.2.1; 7.3.2.2; 7.3.2.3; 7.3.2.4; 7.3.3; 7.3.3.1; 7.3.3.2.1; 7.3.3.2.2; 7.3.3.3 • 8.1.3; 8.2.3; 8.3.3; 8.4.3; 8.5.3 • 9.1.3; 9.2; 9.2.3; 9.3.3; 9.3.4; 9.3.6; 9.3.7; 9.4.3 • 10.1.3; 10.2.2 • 11.1.3; 11.2.3 • 12.1.3; 12.2.3; 12.3.3 • 13.2.3
7.2	**Impact Assessment: Project-specific, Regional and Environmental Influence** Denison commits to examining the interactions between the Project and the environment in a comprehensive manner to identify areas of potential concern. This assessment will look at the potential impacts through the life stages of the Project from construction through operation to decommissioning and reclamation. The assessment will consider the ability of the environment to handle the proposed changes (resiliency) by developing a risk profile that considers the basic elements of risk, magnitude and probability of occurrence, with respect to its likely geographic extent, duration, frequency and reversibility. The EIA will also require consideration of the potential impacts in a regional context and Denison commits to completing a cumulative effects assessment as part of the EIA (Section 7.7). This cumulative assessment will include other projects past, present or future where there is a reasonable chance of project overlap and appropriate data is available to complete analysis.	• Section 5 • 6.1.6; 6.1.7; 6.2.6; 6.2.7 • 7.4.1; 7.4.2.1; 7.4.2.2; 7.4.2.3; 7.4.2.4; 7.4.2.5; 7.2.4.6; 7.7; 7.7.1 • 8.1.4; 8.1.6; 8.1.7; 8.2.4; 8.2.6; 8.2.7; 8.3.4; 8.3.6; 8.3.7; 8.4.4; 8.4.6; 8.4.7 • 9.1.4; 9.1.6; 9.1.7; 9.2.4; 9.2.6; 9.2.7; 9.3.4; 9.3.6; 9.3.7; 11.4.4; 9.4.6; 9.4.7 • 10.1; 10.2; Appendix 10-A • 11.1.4; 11.1.6; 11.1.7; 11.2.4; 11.2.6; 11.2.7 • 12.1.4; 12.1.6; 12.1.7; 12.2.4; 12.2.6; 12.2.7; 12.3.4; 12.3.6; 12.3.7 • 13.3; 13.5; 13.6
7.3	**Impact Mitigation** • Denison will outline the mitigations proposed to avoid or minimize potential effects.	• 2.8 • 4.6; 4.7 • 5.7 • 6.1.5; 6.2.5; • 7.5.1 • 8.1.5; 8.2.5; 8.3.5; 8.4.5; 8.5.5 • 9.1.5; 9.2.5; 9.3.5; 9.4.5 • 10.1.5; 10.2.4 • 11.1.5; 11.2.5 • 12.1.5; 12.2.5; 12.3.5 • 13.4

Section in Terms of Reference	Requirement	Section in EIS
7.4	**Monitoring** In the EIS, Denison will describe monitoring programs for assessing any impacts to VCs and proposed methods for measuring the effectiveness of mitigation measures.	• 4.6 • 5.10 • 6.1.8; 6.2.8 • 7.8.1; 7.8.2 • 8.1.8; 8.2.8; 8.3.8; 8.4.8; 8.5.8 • 9.1.8; 9.2.8; 9.3.8; 9.4.8 • 10.1.8; 10.2.7 • 11.1.8; 11.2.8 • 12.1.8; 12.2.8; 12.3.8 • 13.7 • Appendix 16-C
7.5	**Significance of Residual Impacts** The EIA will document any significant residual impacts, and any monitoring programs required to monitor them. The significance of residual impacts will be defined in the same context as the unmitigated impacts through a risk profile that considers the basic elements of risk, magnitude and probability of occurrence, with respect to its likely geographic extent, duration, frequency and reversibility.	• 5.8 • 6.1.6.2.1; 6.2.6.2.1 • 7.6.1; 7.6.2 • 8.1.6; 8.2.6; 8.3.6; 8.4.6; 8.5.6 • 9.1.6; 9.2.6; 9.3.6; 9.4.6 • 10.1.6; 10.2.5 • 11.1.6; 11.2.6 • 12.1.6; 12.2.6; 12.3.6 • 13.5
7.6	**Prediction Confidence and Uncertainty** This section will describe how the EIA process will address prediction confidence and uncertainties. Denison will identify the main sources of uncertainty and discuss how uncertainty was addressed to increase the level of confidence in predicted effects. The monitoring programs will be designed to address the identified uncertainty and provide mitigation if necessary.	• 5.8.1.2 • 6.1.6.2.2; 6.2.6.2.2 • 7.6.2.2.3 • 8.1.2.6; 8.2.2.6; 8.3.2.6; 8.4.2.6; 8.5.2.6 • 9.1.6; 9.2.6; 9.3.6.1.2; 9.4.6.1.2 • 10.1.6; 10.2.6 • 11.1.6; 11.2.6; • 12.1.6; 12.2.6; 12.3.6 • 13.5
7.7	**Cumulative Impacts** Denison commits to including an assessment of how other developments or activities in the area may impact the proposed development, its potential impacts on VCs, and whether they contribute to any cumulative environmental impacts. This will take the form of a cumulative environmental effects assessment as part of the description of project impacts and mitigations that describes the net cumulative impact of the Project. The assessment would also include an assessment of potential impacts due to reasonable emergency or upset conditions.	• 5.9 • 6.1.7; 6.2.7 • 7.7; 7.7.1 • 8.1.7; 8.2.7; 8.3.7; 8.4.7; 8.5.7 • 9.1.7; 9.2.7; 9.3.7; 9.4.7 • 10.1.7; 10.2.7 • 11.1.7; 11.2.7 • 12.1.7; 12.2.7; 12.3.7 • 13.6

Section in Terms of Reference	Requirement	Section in EIS
8.0	**Accidents and Malfunctions** The EIS will provide a description of: • potential credible malfunction and accident sequences leading to a radiological or non-radiological release considering applicable internal, external and human-induced events. Denison will examine each potential accident and malfunction according to frequency and consequence to assign an associated risk ranking for the potential event. Denison will explain of how these events were identified, and describe any modeling that was performed; • the source, quantity, mechanism, pathway, rate, form and characteristics of contaminants likely to be released to the surrounding environment during the potential accidents and malfunctions; and • any mitigation measures such as monitoring, contingency, clean-up or restoration work in the surrounding environment that would be required during or immediately following the postulated malfunction and accident scenarios.	• Section 14 • Appendix 14-A
9.0	**Effects of the Environment on the Project** Denison will provide a description of the potential effects of the environment on the Project. Denison will also take into account any potential effects of climate change on the Project, including an assessment of whether the Project might be sensitive to changes in climate conditions (as they are best understood) during its lifecycle.	• Section 15 • 6.1.7.1; 6.2.7.1 • 7.7.1 • 8.1.7.5; 8.2.7.4; 8.3.7.6; 8.4.7.6. 8.5.7.6 • 9.1.7.1.1; 9.1.7.2.1; 9.1.7.3.1; 9.2.7.1; 9.3.7.4; 9.4.7.5 • 10.1.7.1 • 11.1.7; 11.2.7 • 12.1.7.1; 12.2.7.1; 12.3.7.1 • 13.6.1
10.0	**Commitments Register and Follow up Program** A commitments register will be provided in the EIS that outlines each commitment made to prevent or mitigate the environmental impacts of the preferred alternative and to meet any regulatory requirements. The commitments register will also include specific commitments for monitoring. Denison commits to outlining the scope of a follow-up program in the EIA and incorporating the elements of the follow-up plan within an appropriate management system to ensure it is completed.	• The Follow up Program is provided in Appendix 16-C • The Commitments Register is not included in the EIS, but is a separate, evergreen document, which has been submitted to Provincial and Federal regulators

Section in Terms of Reference	Requirement	Section in EIS
11.0	**Summary and Conclusions** This section will provide a concise, complete statement of the anticipated net environmental effects (both positive and negative). It will also include: • a concise description of all key components of the Project and related activities; • an overview of the consultation conducted with stakeholders (including Indigenous and non-Indigenous communities and government agencies), along with a summary of the issues raised and Denison's responses; • an overview of the key environmental effects of the Project and proposed technically and economically feasible mitigation measures; and • Denison's conclusions on the residual environmental effects of the Project after taking mitigation measures into account and the significance of those effects.	• Section 16

1. Denison Mines Corp. 2019. Denison Mines Wheeler River Terms of Reference. Dated: May 2019.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Section 2: Engagement Database Summary Table – Project Description

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-ERFN-5.35	5	Workshop	2018-03-05	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for ERFN at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting had been delayed many times, and was held in the Health Clinic because there was a regional power outage.	English River First Nation	That would allow some natural filtration. We would have to see what the other members think of it. Because it's further away, there would be more filtration by the time it reached Russell Lake. What about spawning areas, caribou and moose calving areas? Caribou and moose eat low bush cranberries and lichen; lichen takes many years to grow and recover. There may be other things to consider, like medicinal areas - the elders will know.	Denison considered this in section: Project Components, Water Management, Treated Effluent Discharge	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight local emphasis on treated effluent discharge as a topic of importance.
18-EN-VB-4.22	4	Workshop	2018-01-18	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Beauval for community members to attend. The workshop gathered community input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Beauval	Where did you sample?	Denison considered this in section: Project Components, Water Management	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval the year 2018. The record reference serves to highlight the commonality of water management related dialogue. In terms of surface water sampling, multiple sample sites were located in the areas of McGowan Lake, Whitefish Lake, Russell Lake, and Icelander River.
18-EN-VB-4.40	4	Workshop	2018-01-18	Same as above	Village of Beauval	I was concerned about waste water, but a closed loop addresses that.	Denison considered this in section: Project Components, Water Management, Industrial Wastewater Treatment Plant	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual from who attended a workshop in Beauval in the year 2018. The record reference serves to highlight the commonality of industrial wastewater treatment plant related dialogue.
18-EN-VB-4.54	4	Workshop	2018-01-18	Same as above	Village of Beauval	Mining Method (ISR_DirectionalDrilling): Cons - Never been done for uranium; Drill bit will come back hot (radioactive); Reminds me of fracking – negative perception of the term; When will it be tested? When will it be proven? Safety would be one of the biggest concerns in either method. With either method you're breaking new ground.	Denison considered this in section: Project Components, Mining And in section: Project Components, Mining, Wellfield for In Situ Recovery Mining, Wellfield Operation	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference serves to highlight mining process related questions commonly received throughout engagement. Mining methods were evaluated through an increasingly rigorous process and considered factors such as: safety, environment, production rates, capital costs, operating costs, schedule, operational flexibility, and risk. ISR mining for uranium is a common mining method for uranium globally. Denison included the ISR method in the prefeasibility study and the feasibility field test, and this mining method was selected as the basis for the environmental assessment. Denison has completed an environment assessment to understand potential Project impacts on the environment. The assessment considers potential accidents and malfunctions. Denison has

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								determined that there will be no significant impacts as a result of Project activities.
18-EN-VILX-3.33	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Ile a la Crosse	Need a stormwater management plan and a spill response plan.	Denison considered this in section: Project Components, Support Facilities, Hazardous Substances Management for Support Facilities	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. The record reference serves to highlight a local emphasis on appropriate emergency response plans, with particular focus on spill response. Denison will have in place procedures to effectively respond to spills. The waste management program accounts for retention and treatment of potentially contaminated storm water. See the Project Description section of the EIS for more information.
18-EN-VPL-2.49	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	How do you get rid of tailings?	Denison considered this in section: Project Components, Waste Management, Process Precipitate Pond	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight a local emphasis on waste management, with a particular emphasis on gaining clarity around tailings. The proposed ISR mining method for the Project will produce minimal volumes of waste and does not require the development of a conventional tailings management facility. A waste management program will be developed for the Project to support licensing. Denison is proposing to design pond, pad, and landfill liners systems and develop appropriate performance monitoring based on the characteristics of the material being stored.
19-LK-ERFNTrap-134.230	134	Site Visit	2019-10-29	Denison met with local land user and English River First Nation Trapper at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trrapper provided his consent to Denison to use the information he provided in the environmental assessment. He reviewed the notes taken from the meeting, and provided his revisions / modifications to Denison on January 2, 2020.	ERFN Trapper	If the gate at Key Lake is removed or the road is redesigned to go around Key Lake allowing unimpeded access to the north, there would be lots of concerns about the increase in the number of people coming north into this area. However, many people can currently bypass the Key Lake gate and drive along the Fox Lake road. There is a bridge in place (near the south part of Fox Lake road) for access to a drilling camp and this bridge is over a fairly deep river. If this bridge came out, it would restrict access further north along the road. More people have quads these days.	Denison considered this in section: Project Components, Access and Transportation, Roads	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to provide an example of dialogue pertinent to access.
19-LK-ERFNTrap-134.232	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	I believe in climate change.	Denison considered this in section: Greenhouse Gas Emissions	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								serves to highlight a local observation/perspective on climate related changes.
19-LK-ERFNTrap-134.233	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	I have noticed some changes in what animals are here and changes over time including: Some species are disappearing. In the past bear and moose were much more common than they are now. I think moose are moving further south	Denison considered this in section: Greenhouse Gas Emissions	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to highlight a local observation on climate related changes.
19-LK-ERFNTrap-134.234	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	There are fewer loons on Cree Lake even though the number of fish caught here remains unchanged. There are still loons at Russell Lake.	Denison considered this in section: Greenhouse Gas Emissions	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to highlight a local observation on climate related changes.
19-LK-ERFNTrap-134.235	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	There are American pelican at Cree Lake now. They were not here in the past.	Denison considered this in section: Greenhouse Gas Emissions	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to highlight a local observation on climate related changes.
19-LK-ERFNTrap-134.261	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Denison needs to be much more clear that the mining solution is acidic. This is really important. When I was here in August everyone was talking about water and there was not much mention of acid.	Denison considered this in section: Project Components, Mining, Wellfield for In Situ Recovery Mining, Mining Solution	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to highlight the importance of communication of the constituents used in the mining solution. A clear understanding of the constituents used in the mining solution is an important component of ongoing engagement work.
20-LK-LEASESUR-267.62	267	Survey	2020-02-01	Denison sent all known local cabin and lodge leaseholders a survey in the mail to be completed regarding their interests in Wheeler River. Denison received 6 responses from the survey, which has informed it's understanding of leaseholder uses in the area and interests regarding elements to be assessed as part of the environmental assessment.	Leaseholder, Wheeler River Lodge	I am concerned with how Denison will access their mine on the same road as Cameco uses from the Key Lake mine to McArthur. Presently, Cameco has gates which restrict access to that section of road. If these gates are to be removed or altered by Denison so that everyone has access to the section of road between Key Lake and McArthur that would be disastrous to the region. The theft, vandalism and crime would increase astronomically and the region would lose its remoteness, tranquility and quality of fishing and a lot more.	Denison considered this in section: Project Components, Access and Transportation, Roads	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a Leaseholder who completed a survey in the year 2020. The record reference serves to provide an example of comments and concerns raised pertinent to access. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, including fishing. Denison has determined that there will be no significant impacts as a result of Project activities.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
21-EN-ERFN-447.33	447	Virtual Meeting	2021-03-31	Denison hosted a virtual meeting for English River First Nation (Patuanak, La Plonge and Urban Members). Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	English River First Nation	Who is responsible for restoring the environment?	Denison considered this in section: Project Activities, Decommissioning	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2021. The record reference serves to provide an example of comments raised surrounding the importance of successful decommissioning. Denison is responsible for decommissioning, reclamation, and post-decommissioning phases. Post-Decommissioning extends from the end of physical decommissioning until transfer of the site into the provincial Institutional Control Program (Government of Saskatchewan 2009) or direct release of the land back to the Crown.
21-EN-ERFN-447.34	447	Virtual Meeting	2021-03-31	Same as above	English River First Nation	Who is responsible for cleaning up contaminants?	Denison considered this in section: Project Activities, Decommissioning	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2021. The record reference serves to provide an example of comments raised surrounding the importance of successful decommissioning. Denison is responsible for decommissioning, reclamation, and post-decommissioning phases associated with the Project. Post-Decommissioning extends from the end of physical decommissioning until transfer of the site into the provincial Institutional Control Program (Government of Saskatchewan 2009) or direct release of the land back to the Crown.
21-EN-ERFN-447.35	447	Virtual Meeting	2021-03-31	Same as above	English River First Nation	What happens if the environment gets contaminated? How can you restore it to its original state?	Denison considered this in section: Project Activities, Decommissioning	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2021. The record reference serves to provide an example of comments raised surrounding the importance of successful decommissioning. Mitigation and monitoring will be implemented, thereby decreasing the likelihood of accidents and malfunctions, such as leaks. In the event of an accident or malfunction, a detailed process outline within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016). Denison is responsible for decommissioning, reclamation, and post-decommissioning phases. Post-Decommissioning extends from the end of physical decommissioning until transfer of the site into the provincial Institutional Control Program (Government of Saskatchewan 2009) or direct release of the land back to the Crown.
21-EN-ERFN-447.36	447	Virtual Meeting	2021-03-31	Same as above	English River First Nation	Once the mine is closed how will the community know that the environment is restored?	Denison considered this in section: Project Activities, Post-Decommissioning	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2021. The record reference serves to provide an example of the post-decommissioning phase as raised in engagement activities.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								The Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and license conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met. Monitoring reports will be developed and submitted to both the provincial and federal regulators, in accordance with license conditions.
21-EN-ERFN-447.40	447	Virtual Meeting	2021-03-31	Same as above	English River First Nation	Are there tailings?	Denison considered this in section: Project Components, Waste Management, Process Precipitate Pond	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2021. The record reference serves to highlight a local emphasis on waste management, with a particular emphasis on gaining clarity around tailings. The proposed ISR mining method for the Project will produce minimal volumes of waste and does not require the development of a conventional tailings management facility. A waste management program will be developed for the Project to support licensing. Denison is proposing to design pond, pad, and landfill liners systems and develop appropriate performance monitoring based on the characteristics of the material being stored.
21-EN-ERFN-447.42	447	Virtual Meeting	2021-03-31	Same as above	English River First Nation	Are there reservoirs for water treatment?	Denison considered this in section: Project Components, Water Management, Treated Effluent Monitoring and Release Ponds	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2021. The record reference serves to highlight a topic of discussion related to effluent monitoring and release pond plans. Denison plans to construct and operate a number of treated effluent monitoring and release ponds. The effluent monitoring and release ponds will receive treated water from the industrial wastewater treatment plant via the process water pond.
21-EN-FDLFN-570.16	570	Virtual Meeting	2021-09-29	As per the agreed-upon process set between Denison and the Ya'thi Néné Land and Resources Office regarding engagement activities for the Wheeler River Project, Denison hosted a virtual meeting for the leadership of the Athabasca Basin communities where the overall project, alternatives assessments undertaken over the years and Valued Components were discussed.	Black Lake First Nation, Fond du Lac First Nation, Hatchet Lake First Nation, Individual - GP, Northern Hamlet of Stony Rapids, Northern Settlement of Camsell Portage, Northern Settlement of Wollaston Lake, Uranium City, Ya'thi Néné Land and Resource Office, Ya'thi Néné Land and Resources Office	Regarding the wells and reusing the water, is there a liner in the well?	Denison considered this in section: Project Components, Mining, Wellfield for In Situ Recovery Mining, Wellfield Operation, Primary Containment of Mining Solution – Wells	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of the seven Athabasca Basin communities and staff from the Ya'thi Néné Land and Resources Office in the year 2021. The record reference serves to provide an example of a comment raised specifically in relation to well design and the inclusion of a liner in the wells. Each well will have double containment: mining solution will travel inside an inner casing with the outer casing acting as secondary containment for the mining fluid.
21-EN-FDLFN-570.17	570	Virtual Meeting	2021-09-29	Same as above	Black Lake First Nation, Fond du Lac First Nation, Hatchet Lake First	How much water is used? How much is used on a daily basis? Is it treated and where does it go?	Denison considered this in section:	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
					Nation, Individual - GP, Northern Hamlet of Stony Rapids, Northern Settlement of Camsell Portage, Northern Settlement of Wollaston Lake, Uranium City, Ya'thi Néné Land and Resource Office, Ya'thi Néné Land and Resources Office		Project Components, Water Management, Freshwater Supply and Distribution	meeting for residents of the seven Athabasca Basin communities and staff from the Ya'thi Néné Land and Resources Office in the year 2021. In this section, the record reference serves to highlight a topic of discussion related to water usage and maximum water withdrawal. Denison intends to recycle process water to the greatest extent possible, thereby reducing the demand for fresh water supply. In an effort to develop a conservative assessment basis for the EA, the water recycle flows from the industrial wastewater treatment plant back into the processing plant and wellfield have not been incorporated into the estimates for freshwater withdrawal and treated effluent discharge. Water taking at a volume of 35m^3/hr is anticipated throughout the construction. Discharge to the environment is not expected during construction. The main source of water taking for operation of the mine and to maintain water balance will be from groundwater sources. However, to supplement these volumes, surface water taking from Whitefish Lake was considered as part of the Surface Water Quantity assessment. Releases to the natural environment of contact water will be directed through the applicable collection ponds, Industrial Wastewater Treatment Plant, and Effluent Monitoring and Release Ponds. Discharge will only occur once it is safe to do so. Denison does not intend to include constant freshwater withdrawal or effluent discharge throughout operation; however, for the purpose of assessing the scenario of greatest potential effects, the Project was assessed as having a continuous freshwater withdrawal rate of 40.5m^3/hr and a continuous effluent discharge rate of 81.0m^3/hr.
21-EN-LLRIB-392.21	392	Meeting	2021-03-05	As a result of their request, Denison provided a presentation on the Wheeler River Project to the Lac La Ronge Indian Band Lands and Resources Subcommittee.	Lac La Ronge Indian Band	Is this a more environmentally friendly mining method?	Denison considered this in section: Project Components, Waste Management, Process Precipitate Pond	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a member of the Lac La Ronge Indian Band Lands and Resources Subcommittee who attended a meeting in the year 2021. The record reference serves to highlight the commonality of mine waste management related discussions raised throughout community engagement meetings. The ISR mining method for the Project has allowed for Project components to include a reduced Project footprint and no conventional tailings which will reduce potential environmental impacts.
21-EN-VILX-443.17	443	Virtual Meeting	2021-02-10	Denison hosted a virtual meeting for the municipality of Ile a la Crosse. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an	Village of Ile a la Crosse	Is the environment monitored after the closure of the mine? Who monitors it?	Denison considered this in section: Project Activities, Post-Decommissioning	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse in the year 2021. The record reference serves to provide an example of the post-decommissioning phase as raised in engagement activities. The post-decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and license conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met. Additional detail can be found in the Project Description section of the EIS.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				online survey with specific questions pertaining to Valued Components.				
21-EN-VILX-443.24	443	Virtual Meeting	2021-02-10	Same as above	Village of Ile a la Crosse	What is the plan for storing and cleaning the water and where does it flow? What is the impact of ISR mining on water quality?	Denison considered this in section: Project Components, Water Management, Industrial Wastewater Treatment Plant	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse in the year 2021. The record reference serves to highlight the commonality of industrial wastewater treatment plant related questions. Wastewater will be treated as part of water management for the Project. Treated water will be released into monitoring and release ponds prior to release to Whitefish Lake. See Project Description for detailed information. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to water quality. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-VPL-444.18	444	Virtual Meeting	2021-02-11	Denison hosted a virtual meeting for the municipality of Pinehouse Lake. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Pinehouse Lake	Are there current studies on the freeze wall method and climate change?	Denison considered this in section: Greenhouse Gas Emissions	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Pinehouse in the year 2021. The record reference serves to highlight a question raised specifically in relation to the potential effects of the Project on climate change. Studies considered in the environmental assessment for the Project are listed as references within each section of the EIS in which they are referred. Climate change has been considered in relation to the Project components, including the freeze wall.
21-EN-VPL-444.25	444	Virtual Meeting	2021-02-11	Same as above	Village of Pinehouse Lake	If the chemicals are dangerous will Denison have an emergency response team to respond? Are there preventative measures in place to prevent the chemicals from entering the environment?	Denison considered this in section: Project Components, Support Facilities, Hazardous Substances Management for Support Facilities	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Pinehouse in the year 2021. The record reference serves to highlight a local emphasis on appropriate emergency response plans, with particular focus on spill response. Mitigation and monitoring will be implemented, thereby decreasing the likelihood of accidents and malfunctions, such as leaks. In the event of an accident or malfunction, a detailed process outline within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).
21-EN-VPL-444-4	444	Virtual Meeting	2021-02-11	Same as above	Village of Pinehouse Lake	Does Denison anticipate that climate change will potentially impact the EA baseline information?	Denison considered this in section: Greenhouse Gas Emissions	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Pinehouse in the year 2021. The record

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								reference serves to highlight a question raised specifically in relation the potential effects of the Project on climate change. Existing conditions are based on available information and are accompanied by supporting information that includes natural and human caused trends that are presently affecting baseline conditions.
21-EN-YOUTH-445.11	445	Virtual Meeting	2021.02-10	Denison provided a virtual presentation to the high schools in Ile a la Crosse, Beauval and Pinehouse about the Wheeler River Project. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Ile a la Crosse, Village of Pinehouse Lake, Village of Beauval	A few years ago, Denison came to Ile a la Crosse. You asked for input on the location of road construction. We remember the input given but can't make out the location of that road. Please discuss.	Denison considered this in section: Project Activities, Construction, Access and Transportation	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse, Pinehouse, and Beauval in the year 2021. The record reference serves to highlight that several discussions informed the selection of the proposed road alignment. Information from several engagement meetings with local communities informed the selection of the road alignment proposed in the Project EIS, as documented in Appendix 2-C Alternative Means Assessment.
21-EN-YOUTH-445.6	445	Virtual Meeting	2021.02-10	Same as above	Village of Ile a la Crosse, Village of Pinehouse Lake, Village of Beauval	Isn't it correct to say the Brine is in a closed loop system? Like in an artificial ice rink? The brine doesn't actually go into the environment? Is this correct?	Denison considered this in section: Project Components, Mining, Freeze Wall	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse, Pinehouse, and Beauval in the year 2021. The record reference serves to highlight a comparison drawn between the technique used for the freeze wall and the technique used for an artificial ice rink. This information is correct and is noted as a helpful perspective in terms of conceptualizing the freezing technology in relation to the Project.
21-EN-YOUTH-448.1	448	Virtual Meeting	2021-03-31	Denison provided a virtual presentation to the high school in English River on the Patuanak Reserve about the Wheeler River Project. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	English River First Nation	Any chance of the wells blowing and contaminating the ground around it?	Denison considered this in section: Project Components, Mining, Wellfield for In Situ Recovery Mining, Wellfield Installation	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for the English River First Nation high school in the in the year 2021. The record reference serves to highlight dialogue pertaining to the importance of avoiding groundwater contamination. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers accident and malfunction scenarios as well as potential impact to terrain/soil/peat. Denison determined that there will be no significant impacts as a result of Project activities. Mitigation and monitoring will be implemented, thereby decreasing the likelihood of accidents and malfunctions, such as leaks. In the event of an accident or malfunction, a detailed process outline within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).
21-EN-YOUTH-448.7	448	Virtual Meeting	2021-03-31	Same as above	English River First Nation	How will the radium precipitates be stored?	Denison considered this in section:	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
							Project Components, Waste Management, Process Precipitate Pond	meeting for the English River First Nation high school in the in the year 2021. The record reference serves to highlight a local emphasis on waste management, with a particular emphasis on gaining clarity around tailings. The precipitates generated in the processing plant will be transferred to the process precipitate pond. Any radioactive precipitates generated during the first stage of the industrial wastewater treatment plant will also be directed to the process precipitate pond. The precipitates may be stored in totes inside the pond. This pond design will allow the precipitate totes to be stacked below ground level. The pond will be double lined with leak detection capabilities. Any runoff collected in the pond will be directed to the process water pond and recycled through the plant.
22-EN-ERFN-618.17	618	Open House	2022-05-30	In collaboration with the Chief and Council of English River First Nation, Denison hosted an open house event at ERFN Patuanak Reserve, sharing information about the Wheeler River Project, the preliminary effects assessment of the Project, and proposed mitigation and monitoring. Denison advertised the event on the local radio, with posters around the community, on the local cable network, and through social media. Denison had a Dene translator available for attendees. Residents of the Hamlet of Patuanak were also advised about the open house and invited to attend. 31 attendees signed the sign in sheet. Information boards and area models were displayed, and staff Denison staff were available to answer questions. A survey was available for community members to complete, and remaining available online for 2 weeks following the open house.	English River First Nation	How are all the ponds lined? Is there concern for breaches of solutions to near surface groundwaters?	Denison considered this in section: Project Components, Water Management, Process Water Pond	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended an open house meeting in English River First Nation in the year 2022. The record reference serves to highlight a discussion specifically regarding the process water pond. Mitigation and monitoring, including ponds being lined with a double composite high-density polyethylene liner system and leak detection being in place, will be implemented, thereby decreasing the likelihood of accidents and malfunctions, such as breaches of solutions to near surface groundwaters. In the event of an accident or malfunction, a detailed process outline within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).
22-EN-SUR-652.4	652	Survey	2022-06-03	As part of engagement activities for English River First Nation, Beauval, and Pinehouse, Denison prepared and shared, both online and as a hardcopy during Spring Engagement meetings, a survey that asked a series of questions relating to the results of the environmental assessment. A total of 39 surveys were entirely or partially completed.	Unknown	Denison Question: Are there any topics that you would like to see including in monitoring plans? Response: Water consumption, where does water com from, is it treated.	Denison considered this in section: Project Components, Water Management	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who completed a survey made available to members of English River First Nation and residents of Pinehouse and Beauval in the year 2022. The record reference serves to highlight the commonality of water related questions. Denison intends to recycle process water to the greatest extent possible, thereby reducing the demand for fresh water supply. In an effort to develop a conservative assessment basis for the EA, the water recycle flows from the industrial wastewater treatment plant back into the processing plant and wellfield have not been incorporated into the estimates for freshwater withdrawal and treated effluent discharge. Water taking at a volume of 35m^3/hr is anticipated throughout the construction. Discharge to the environment is not expected during construction. The main source of water taking for

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								operation of the mine and to maintain water balance will be from groundwater sources. However, to supplement these volumes, surface water taking from Whitefish Lake was considered as part of the Surface Water Quantity assessment. Releases to the natural environment of contact water will be directed through the applicable collection ponds, Industrial Wastewater Treatment Plant, and Effluent Monitoring and Release Ponds. Discharge will only occur once it is safe to do so. Denison does not intend to include constant freshwater withdrawal or effluent discharge throughout operation; however, for the purpose of assessing the scenario of greatest potential effects, the Project was assessed as having a continuous freshwater withdrawal rate of 40.5m^3/hr and a continuous effluent discharge rate of 81.0m^3/hr.
22-EN-VB/ERFNLP-619.6	619	Open House	2022-05-31	In collaboration with the Chief and Council of English River First Nation, and the Mayor and Village Council of Beauval, Denison hosted an open house event at ERFN La Plonge Reserve, sharing information about the Wheeler River Project, the preliminary effects assessment of the Project, and proposed mitigation and monitoring. Denison advertised the event on the local radio, with posters around the community, on the local cable network, and through social media. Denison had a translator available for attendees. Residents of the Village of Beauval were advised about the open house and invited to attend. Information boards and area models were displayed, and staff Denison staff were available to answer questions. 14 attendees signed the sign in sheet. A survey was available for community members to complete, and remaining available online for 2 weeks following the open house.	English River First Nation, Village of Beauval	How does the freeze wall affect the natural groundwater flow?	Denison considered this in section: Project Components, Mining, Freeze Wall, Freeze Wall Timeline	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended an open house meeting in La Plonge, hosted for both members of English River First Nation and residents of Beauval, in the year 2022. The record reference is provided as context in relation to freeze wall removal and groundwater flow. The freeze wall will prevent groundwater flow in the area surrounding the ore body. The removal of the freeze wall will allow groundwater to re-establish its original flow path through the area.
16-EN-DesNd-101.1	101	Meeting	2016-09-26	Des Nedhe and Denison held an introductory meeting regarding relationship development and business and procurement opportunities in the future.	Des Nedhe	Interested in any future business opportunities that may be available as Denison advances their Wheeler River Project.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual from English River First Nation and the Des Nedhe Group of Companies, who attended a meeting in the year 2016. The record reference serves to highlight interest in business opportunities, which is then used in relation to the potential opportunity for domestic waste disposal economic opportunities.
16-EN-ERFN-100.15	100	Community Meeting	2016-07-27	Denison hosted a community meeting in Patuanak for English River First Nation members, the purpose of which was to	English River First Nation	In that territory near the Wheeler River there are a lot of spawning and calving areas for moose, caribou;	Denison considered this in section Appendix 2-C:	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a community

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				provide an overview of the Wheeler River Project.		those creeks are for whitefish spawning. There's lots of heavy muskeg there. A lot of us have been there, and we'd like to know there'll still be access to the area.	Alternative Means Assessment, Waste Management – Domestic Waste Disposal And in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	meeting for members of English River First Nation in the year 2016. The record reference serves to highlight dialogue on the importance of the environment, namely fish and wildlife, and the protecting of these resources and access to these resources. This is considered in relation to domestic waste disposal and access road alignment in terms of the alternative means assessment.
16-EN-ERFN-100.17	100	Community Meeting	2016-07-27	Same as above	English River First Nation	Today because of climate change, things are starting to happen that normally didn't happen. Even the permafrost is now further down. In the Wheeler River area, where there's some permafrost, have your environment guys seen a change? Will there be a change? These are some of the questions that need to be answered in order to come out with a positive spin.	Denison considered this in section: Greenhouse Gas Emissions And in section Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a community meeting in English River First Nation in the year 2016. The record reference serves to highlight an instance of commentary related to climate-related changes Additionally, the record reference serves to highlight dialogue on climate change, which links to greenhouse gas emissions, and was considered in relation to domestic waste disposal and access road alignment in terms of the alternative means assessment where one option would generate more GHGs compared to other alternative means. The Project is in a mapped area designated as Sporadic Discontinuous Permafrost. Large and/or expansive areas of continuous cryosolic soil and permafrost terrain do not occur within the RSA. For this reason, the potential effects are not expected to affect terrain stability within the Project Area within the life of the Project. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment provides a description of the existing environment for valued components, including geological & groundwater, and terrestrial environments. Existing conditions are based on available information and are accompanied by supporting information that includes natural and human caused trends that are presently affecting baseline conditions. Denison determined that there will be no significant impacts as a result of Project activities.
16-EN-MLA-109.26	109	Community Meeting	2016-12-07	Denison hosted a community meeting in Ile a la Crosse to introduce the company and introduce the Wheeler River Project.	MLA - Athabasca, Village of Ile a la Crosse	They hit the nail on the head regarding which communities are chosen. When you pick some, it creates problems and resentment between communities. The north is the north. It's not deserved, nor is it proper. People bite their tongue because it's their own people. Did the mining companies anticipate that? They shouldn't be doing that, and I urge Denison to get away from that. The other option is in relationships with local businesspeople: a lot of times the companies deal with local development corporations, but they are not the only answer. Some don't have the capacity to provide some of these services and business skills. The	Denison considered this in section: Project Components, Mining And in section Appendix 2-C: Alternative Means Assessment, Mining	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a community meeting in Ile a la Crosse in the year 2016. The record reference serves to highlight the mining industry within the context of northern Saskatchewan economies.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
						business sector needs more and better engagement than even our local development corporations, because in some instances they add more to the economy of the community. There is a thriving private sector. Don't pick and choose winners; certainly, don't only go through development corporations if you have a business opportunity. Businesses deserve to be part of the opportunity as well. Why should businesses compete with tax-funded development corporations – they're competing against their own tax dollars, which is not fair to them. Where you have the opportunity, look at the private contractor as long as they're based in the north. There has to be a capacity process in how you build up these companies. Companies are not given the opportunities because nobody's listening. These meetings are really productive. A lot of us have opinions, and everyone has a right to express themselves in these meetings.		
16-EN-VB-107.17	107	Community Event	2016-12-06	Denison participated in a community meeting for a local co-management board in Beauval to introduce the company and explain the Wheeler River Project.	MLA - Athabasca, Northwest Communities Management Company, Sipishik Métis Local #37, Village of Beauval	Are you planning to mill on site?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – On-site Processing Methods	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a community event hosted for Beauval's local co-management in the year 2016. The record reference serves to highlight an instance of commentary related to processing location in terms of the alternative means assessment. Denison intends to process uranium on site. Processing plant components were considered as part of the environmental assessment for the Project.
18-EN-ERFN-5.44	5	Workshop	2018-05-03	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for ERFN at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting had been delayed many times, and was held in the Health Clinic because there was a regional power outage.	English River First Nation	That would take a lot of engineering and monitoring. I was there when they hit the Cigar deposit in August of 1978. I saw that excitement. They were using choppers to move the rigs. Later I worked at McClean for three months.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop for English River First Nation in the year 2018. The record reference serves to highlight local familiarity of the jet-boring mining method in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-ERFN-5.48	5	Workshop	2018-05-03	Same as above	English River First Nation	How would it be powered? Would a solar system be able to do it? One of the biggest potentials for turbine wind is at Close Lake, just a stone's throw away. We are environmentally conscious, but we also want to see what's available in terms of renewable resources. Just a thought.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Power – Primary Power Supply	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop for English River First Nation members in the year 2018. The record reference serves to highlight dialogue related to the primary power supply in terms of the alternative means assessment. Electrical service to the Project will be provided via an approximate 5-km extension tap from the existing 138 kV overhead transmission line that runs along Highway 914. To provide electrical service during times of utility outages, diesel generators will be installed to service the site and maintain essential functions.
18-EN-VB-4.23	4	Workshop	2018-01-18	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Beauval for community members to attend. The workshop gathered community input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Beauval	There are also action levels. LA-1 has high spawning levels.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Water Management – Treated effluent discharge locations for surface water	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference serves to highlight dialogue related to treated effluent discharge locations for surface water in terms of the alternative means assessment.
18-EN-VB-4.34	4	Workshop	2018-01-18	Same as above	Village of Beauval	Preference to discharge into swift-flowing water.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Water Management – Treated effluent discharge location	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference serves to highlight dialogue related to treated effluent discharge locations in terms of the alternative means assessment.
18-EN-VB-4.35	4	Workshop	2018-01-18	Same as above	Village of Beauval	There is a benefit in discharging into water flowing through the whole system to filter (dilute) it.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Water Management – Treated effluent discharge location	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference serves to highlight dialogue related to treated effluent discharge locations in terms of the alternative means assessment.
18-EN-VB-4.4	4	Workshop	2018-01-18	Same as above	Village of Beauval	Road Alignment Phoenix Option 1: Pros - Shorter distance than Option 3	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference serves to highlight dialogue related to access road alignment in terms of the alternative means assessment.
18-EN-VB-4.51	4	Workshop	2018-01-18	Same as above	Village of Beauval	Mining Method (ISR Directional Drilling): Pros - Closed-loop system; water is treated at the end; Seems economically feasible; The technology makes a lot of sense; Saves time – no shaft needed; No direct exposure to	Denison considered this in section: Project Components, Mining In section:	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference serves to highlight dialogue related to treated effluent discharge and the ISR mining method. Additionally, the record reference serves to highlight

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
						radiation; No direct exposure to radiation; New opportunity for northern Saskatchewan.	Project Components, Water Management, Treated Effluent Discharge And in section Appendix 2-C: Alternative Means Assessment, Mining – Methods	dialogue related to mining methods in terms of the alternative means assessment.
18-EN-VB-4.54	4	Workshop	2018-01-18	Same as above	Village of Beauval	Mining Method (ISR Directional Drilling): Cons - Never been done for uranium; Drill bit will come back hot (radioactive); Reminds me of fracking – negative perception of the term; When will it be tested? When will it be proven? Safety would be one of the biggest concerns in either method. With either method you're breaking new ground.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Permeability Enhancement	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference highlights dialogue related to permeability enhancement in terms of the alternative means assessment. Mining methods were evaluated through an increasingly rigorous process and considered factors such as: safety, environment, production rates, capital costs, operating costs, schedule, operational flexibility, and risk. ISR mining for uranium is a common mining method for uranium globally. Denison included the ISR method in the prefeasibility study and the feasibility field test, and this mining method was selected as the basis for the environmental assessment. Denison has completed an environment assessment to understand potential Project impacts on the environment. The assessment considers potential accidents and malfunctions. Denison has determined that there will be no significant impacts as a result of Project activities.
18-EN-VB-4.6	4	Workshop	2018-01-18	Same as above	Village of Beauval	Road Alignment Phoenix Option 2: Cons - Road is too close to cabin, concerned about noise and dust; Too close to water.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Worker Transportation And in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference highlights dialogue related to worker transportation and access road alignment in terms of the alternative means assessment.
18-EN-VB-4.7	4	Workshop	2018-01-18	Same as above	Village of Beauval	Road Alignment Phoenix Option 3: Pros - Farthest from both cabin and any lakes.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Beauval in the year 2018. The record reference highlights dialogue related to access road alignment in terms of the alternative means assessment.
18-EN-VILX-3.1	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation	Village of Ile a la Crosse	Road Alignment Phoenix Option 1: Pros - Intermediate (neutral) distance to the cabin; Shortest distance; Fill could be re-used; Shortest option; preferred option; Road not that far and has least disturbance	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. The record reference highlights dialogue related to access road alignment in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				to road alignment options, treated effluent discharge locations, and mining methods.				
18-EN-VILX-3.43	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Treated Effluent Discharge LA-7 Option: Cons - Whatever we out into LA-7 winds up everywhere; Concerns about sensitive species and habitat.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Water Management – Treated effluent discharge locations for surface water	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. The record reference highlights dialogue related to treated effluent discharge locations for surface water in terms of the alternative means assessment.
18-EN-VILX-3.68	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Mining Method (ISR): Pros - We know it works in other places; No major safety issues; No waste piles.	Denison considered this in section: Project Components, Mining In Section: Project Components, Waste Management, Process Precipitate Pond And in Section Appendix 2-C: Alternative Means Assessment, Mining – Methods	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. The record reference serves to highlight dialogue related to mining and waste management. Additionally, the record reference serves to highlight dialogue related to mining methods in terms of the alternative means assessment.
18-EN-VILX-3.69	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Mining Method (ISR): Pros - Not enough information to understand the pros and cons; People will have a lot of questions because it hasn't been done in Canada; Lab work is still ongoing.	Denison considered this in section: Project Components, Mining And in Section Appendix 2-C: Alternative Means Assessment, Mining – Methods	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. The record reference serves to highlight dialogue related to mining. Additionally, the record reference serves to highlight dialogue related to mining methods in terms of the alternative means assessment.
18-EN-VPL-2.1	2	Workshop	2018-01-16	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Pinehouse Lake for community and Kineepik Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Pinehouse Lake	Road Alignment Phoenix Option 1: Pros - Quick travel; shorter distance; Farther from water; Not the closest to the cabin.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to access road alignment in terms of the alternative means assessment.
18-EN-VPL-2.10	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	The farther from the cabin and the lakes, the better. From a contractor's perspective, the more dirt to move, the better – a long road, or more cut-and-fill.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to access road alignment in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VPL-2.11	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Treated Effluent Discharge: Pros - LA-7 closer to the mine, so less disturbance; LA-7 Farther from the cabin so fewer people disturbed; Russell Lake holds the most water; LA-7 largest lake; LA-7 closer to the mine; LA-5 and LA-6 closer than LA-1 and Russell Lake; LA-1 large; Russell Lake large	Denison considered this in section: Project Components, Water Management, Treated Effluent Discharge And in section Appendix 2-C: Alternative Means Assessment, Water Management – Freshwater Supply	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to treated effluent discharge. Additionally, the record reference serves to highlight dialogue related to freshwater supply in terms of the alternative means assessment.
18-EN-VPL-2.15	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Treated Effluent Discharge: Any lakes are OK except for Russell Lake because of the fishing	Denison considered this in section: Project Components, Water Management, Treated Effluent Discharge Denison considered this in section Appendix 2-C: Alternative Means Assessment, Water Management – Treated effluent discharge locations for surface water	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to treated effluent discharge. Additionally, the record reference serves to highlight dialogue related to treated effluent discharge locations for surface water in terms of the alternative means assessment.
18-EN-VPL-2.2	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Road Alignment Phoenix Option 1: Cons - A lot of material to be moved; Not farthest from the cabin.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to access road alignment in terms of the alternative means assessment.
18-EN-VPL-2.3	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Road Alignment Phoenix Option 1: Cons - Close to cabin; will scare game away; Don't want tourist access to the area.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to access road alignment in terms of the alternative means assessment.
18-EN-VPL-2.38	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Radiation exposure is higher in longhole stoping. Raiseboring and jet boring are more protective but costs are high. There's not much for safety in stope mining; you breathe the air and the exhaust and even with ventilation workers are still at risk. Would it be regulated so you mine little bits at a time? Different ground responds differently to blasting. You don't know till you get there.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Methods	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to mining methods in terms of the alternative means assessment. The assessment basis assumes an annual average production of 9 million pounds U3O8, with an annual peak production of 12 million pounds U3O8, over an operating period of 15 years. This conservative assessment basis provides operational flexibility from one year to the next and appropriately bounds the assessment of effects. The freeze wall will be created in phases to support the mine plan.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VPL-2.6	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Road Alignment Phoenix Option 2: Cons - Too close to the lake.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to access road alignment in terms of the alternative means assessment.
18-EN-VPL-2.9	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Road Alignment Phoenix Option 3: Cons - Farther distance; More disturbance.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. The record reference serves to highlight dialogue related to access road alignment in terms of the alternative means assessment.
19-EN-CNSC-1.23	1	Workshop	2018-01-16	Denison hosts the MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals at the Project site for a site tour and to discuss the Project, along with representatives from the Canadian Nuclear Safety Commission and the Province of Saskatchewan, Ministry of Environment.	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	How long to freeze?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop hosted for MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals in the year 2018. The record reference serves to highlight dialogue related to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. Modelling predicts that each section of the freeze wall will require approximately 12 months to be established. The freeze wall will be created in phases to support the mine plan. The freezing methodology used by the Project will be the same as that which is presently used at McArthur River and Cigar Lake, and Denison will use the learnings from those operations to implement the freeze wall for the Project.
19-EN-CNSC-1.26	1	Workshop	2018-01-16	Same as above	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Would the freeze wall be kept intact for the life of the operation?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop hosted for MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals in the year 2018 The record reference serves to highlight dialogue related to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. After decommissioning and remediation has been deemed complete in accordance with regulatory requirements, refrigeration will be turned off and the freeze wall will begin to melt.
19-EN-PBN-135.5	135	Meeting	2019-02-01	Denison and Pinehouse leaders (Village, Kineepik Métis, and Pinehosue Business North) held a meeting, in which Denison provided an update on the Wheeler River Project, including the pending submission of the Project into the environmental assessment process.	Kineepik Métis Local #9, Village of Pinehouse Lake	Inquired into the different levels of education that would be required for the various permanent positions coming out of the project.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – On-site Processing Methods	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a meeting in Pinehouse in the year 2019. The record reference serves to highlight dialogue related employment opportunities, which is used in the context of on-site processing in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-EN-VB-132.5	132	Meeting	2019-02-01	Denison and Beauval held a meeting, in which Denison provided an update on the Wheeler River Project, including the pending submission of the Project into the environmental assessment process.	Village of Beauval	There may be an opportunity to maximize apprenticeship programs during the construction phase that could turn into northerners being trained and certified as Journeyman trades people ready to take on the permanent positions at Wheeler following the construction phase.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a meeting in Beuaval in the year 2019. The record reference serves to highlight dialogue related to employment and training opportunities, which is used in the context of waste disposal in terms of the alternative means assessment.
19-EN-YNLR-83.3	83	Meeting	2019-07-31	Denison and staff from the Ya'thi Néné Lands and Resources Office met to provide an overview of the Wheeler River Project. A follow up email was sent by Denison to confirm that the notes accurately reflected the meeting, which were confirmed by the YTNLRO.	Ya'thi Néné Land and Resource Office	General question about freezing and how it works.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Project Description of the EIS serves as a perspective representing local interest, documented as coming from YNLR staff who attended a meeting in the year 2019. The record reference serves to highlight dialogue related to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. The freeze wall is intended for tertiary containment of mining solution to support a defense in depth strategy as additional, site-specific data is obtained on hydraulic containment. The freeze wall around the mining area will extend from the surface to the basement rock, isolating the mining area from regional groundwater. The freeze wall is expected to be a minimum of 10 m thick, be installed 25m away from the uranium deposit, and extend 30 m into the basement rock. Data from the groundwater monitoring network installed in and around the wellfield and freeze wall will make sure the freeze wall is meeting design specifications.
19-EN-YNLR-84.1	84	Meeting	2019-06-18	Denison met with the Ya'thi Néné Lands and Resources Office regarding the Project Description for the Wheeler River Project and provided an overview of the Project, prior to the YTNLRO submitting comments on the Project Description.	Ya'thi Néné Land and Resource Office	Very positive and complimentary about the minimal environmental effects (no tailings, small volumes of waste rock) associated with ISR; how minimal the surface disturbance was and that the injection/recovery wells were not too high density.	Denison considered this in section: Project Components, Waste Management, Process Precipitate Pond	The context in which this comment was used within the Project Description of the EIS serves as a perspective representing local interest, documented as coming from YNLR staff who attended a meeting in the year 2019. The record reference serves to highlight dialogue related to the process precipitate pond and more broadly related to general Project components.
19-LKERFNTrap-134.173	134	Site Visit	2019-10-29	Denison met with local land user and English River First Nation Trapper at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trapper provided his consent to	ERFN Trapper	Caribou: Woodland caribou use of the area has changed since highway 914 (Key-McArthur Road) was built. Caribou don't seem to be bothered by visual sightings of vehicles (smaller trucks) but seem to react to regular traffic of larger bigger vehicles and are sensitive to the vibrations	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Water Management – Drinking Water	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from ERFN Trapper, who attended a site visit in the year 2019. The record reference serves to highlight dialogue related to vehicle traffic, which is used in relation to drinking water in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				Denison to use the information he provided in the environmental assessment. He reviewed the notes taken from the meeting, and provided his revisions / modifications to Denison on January 2, 2020.				
19-LK-ERFNTrap-134.226 19-LK-ERFNTrap-134.224	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	If the gate at Key Lake is removed or the road is redesigned to go around Key Lake allowing unimpeded access to the north, there would be lots of concerns about the increase in the number of people coming north into this area. However, many people can currently bypass the Key Lake gate and drive along the Fox Lake road. There is a bridge in place (near the south part of Fox Lake road) for access to a drilling camp and this bridge is over a fairly deep river. If this bridge came out, it would restrict access further north along the road. More people have quads these days.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment And this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Stream Crossing Structures	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to highlight dialogue related to vehicle traffic, which is used in relation to drinking water in terms of the alternative means assessment.
19-LK-ERFNTrap-134.232	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	I believe in climate change.	Denison considered this in section: Greenhouse Gas Emissions And in Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to highlight dialogue related to climate change, which is then used in relation to domestic waste disposal in terms of the alternative means assessment.
19-LK-ERFNTrap-134.248	134	Site Visit	2019-10-29	Same as above	ERFN Trapper	Of the three options, Bobby prefers option #1 (image below). If he was the company this is what he would do since it is the straightest line and maybe lowest cost. Thinks the power line will come straight in and not follow the road alignment (if the preferred option for Denison is #3).	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Power – Primary Power Supply -	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a trapper from English River First Nation who took part in a site visit in the year 2019. The record reference serves to highlight dialogue related to primary power supply in terms of the alternative means assessment.
20-LK-LEASESUR-267.99 to 20-LK-LEASESUR-267.108	267	Survey	2020-02-01	Denison sent all known local cabin and lodge leaseholders a survey in the mail to be completed regarding their interests in Wheeler River. Denison received 6 responses from the survey, which has informed it's understanding of leaseholder uses in the area and interests regarding elements to be assessed as part of the environmental assessment.	Leaseholder, Wheeler River Lodge	Denison Question: What issues or concerns are of particular interest to you? What do you feel should be considered in the Project Environmental Impact Assessment? Response: Changes in traffic.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – Location of Processing And in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Worker Transportation	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who completed a survey sent to leaseholders in the year 2020. The record reference serves to highlight dialogue related to traffic, which is used in relation to the location of processing and worker transportation in terms of the alternative means assessment. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers changes in traffic volume. While it is expected that traffic north of the

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								Key Lake gatehouse will increase by 23% during construction and 30% during operation, proven mitigation options are planned to reduce the risk of increased traffic. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-ERFN-447.28	447	Virtual Meeting	2021-03-31	Denison hosted a virtual meeting for English River First Nation (Patuanak, La Plonge and Urban Members). Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	English River First Nation	Is the product going to be milled at Key Lake?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – Location of Processing	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2020. The record reference serves to highlight dialogue related to the location of processing in terms of the alternative means assessment. Denison intends to process uranium on site. Processing plant components were considered as part of the environmental assessment for the Project.
21-EN-ERFN-447.29	447	Virtual Meeting	2021-03-31	Same as above	English River First Nation	Is production at Key or McArthur? Will there be minimal buildings at the site? Is there a slurry plant?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Support Facilities – Camp Location Optimization	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2020. The record reference serves to highlight dialogue related to Project components, which is used in relation to camp location optimization in terms of the alternative means assessment. Various components and activities are required to support the ISR mining and processing activities. This includes infrastructure and systems for water management, waste management, site access and transportation, power, heating, and other support features, such as a camp. Processing will take place at the Project location. Refer to the Project Description section of the EIS for more detail on Project components.
21-EN-ERFN-447.38	447	Virtual Meeting	2021-03-31	Same as above	English River First Nation	A footprint is a footprint. There is no such thing as a small footprint. You need to think like community members, not as company employees.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Support Facilities – Camp Location Optimization	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for members of English River First Nation in the year 2020. The record reference serves to highlight dialogue related to Project footprint, which is used in relation to camp location optimization in terms of the alternative means assessment.
21-EN-ERFN-458.11	458	Advisory Committee Meeting	2021-04-22	English River First Nation and Denison held it's first Nuhtsiye-kwi Benéne (Ancestral Lands Committee) meeting. Topics discussed were visioning for the Committee, an overview of the Wheeler River Project, the 2021 geotechnical permitting program, and planning for the next meeting.	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	Are the holes lined?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021. The record reference serves to highlight dialogue in related to freezing, which is used in relation to freeze design for tertiary containment of mining solution in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								Each well will have double containment: mining solution will travel inside an inner casing with the outer casing acting as secondary containment for the mining fluid.
21-EN-ERFN-473.2	473	Advisory Committee Meeting	2021-06-15	Denison and the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) of ERFN held a meeting. During the meeting topics discussed were: concluding discussions related to the geotechnical permit for the Wheeler River Project for 2021, site access considerations (related to ERFN usage of the Fox Lake road), a report on a subsidence assessment report undertaken by Denison and requested by ERFN, and an overview of a pilot project being undertaken by Denison related to reclamation of linear features in and around the Wheeler River Project area.	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	Can this planned activity impact or disturb game – where we will be hunting during the cultural camp?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Organic Waste Disposal	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021. The record reference serves to highlight dialogue related to wildlife, which is used in relation to organic waste disposal in terms of the alternative means assessment.
21-EN-ERFN-473.6	473	Advisory Committee Meeting	2021-06-15	Same as above	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	There hasn't been a problem with the access set-up with Cameco, so I don't anticipate one with this. I know a few areas where there is a good hunting and berry picking. I don't go through the gate, I go via the old Fox Lake road – you wouldn't even know I was around there. I don't think there will be a problem.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Access Road Alignment	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation and participant in the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) who attended an advisory committee meeting in the year 2021. The record reference serves to highlight dialogue related to access, which is used in relation access road alignment in terms of the alternative means assessment.
21-EN-LLRIB-392.3	392	Meeting	2021-03-05	As a result of their request, Denison provided a presentation on the Wheeler River Project to the Lac La Ronge Indian Band Lands and Resources Subcommittee.	Lac La Ronge Indian Band	How is ISR working so far?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Permeability Enhancement	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a meeting for the Lac La Ronge Indian Band Lands and Resources Subcommittee in the year 2021. The record reference serves to highlight dialogue generally related to ISR mining, which is used in relation to permeability enhancement in terms of the alternative means assessment. While the ISR method has been used to mine uranium globally for many years, the Project aims to be the first application of this method of uranium mining in Canada. If successful, the Project will pioneer the use of the ISR method amongst the high-grade uranium deposits of the Athabasca Basin region in northern Saskatchewan.
21-EN-LLRIB-392.4	392	Meeting	2021-03-05	Same as above	Lac La Ronge Indian Band	Is it the same extraction method as oil? Is fracking involved?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Permeability Enhancement	The context in which this comment was used within the Project Description section of the EIS serves as a local perspective, documented as coming from an individual who attended a meeting for the Lac La Ronge Indian Band Lands and Resources Subcommittee in the year 2021.. The record reference serves to highlight dialogue generally related to ISR mining, which is used in relation to

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								permeability enhancement in terms of the alternative means assessment. The in situ recovery mining method does not include fracking, as is used in the oil industry. In situ recovery mining uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below the surface. The movement of the fluids occurs with the application of very low pressures. This mining method can extract the uranium mineralization without physically removing the host rock for processing on the surface.
21-EN-SUR-446.10	446	Survey	2021-02-16	As part of engagement activities for the municipalities of Beauval, Ile a la Crosse and Pinehouse Lake, Denison prepared and shared an online survey which included information about Denison, the Wheeler River Project, and posed validation questions about the Valued Components being assessed as part of the environmental assessment process. A total of 68 responses were received and 62 of the responses were considered complete, for a 91% completion rate. The information related to the Valued Components was incorporated into the assessment and questions asked on the surveys was incorporated into the overall engagement database.	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	What is in the freezing solution?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey intended for members of English River First Nation, residents of Pinehouse, and residents of Beauval in the year 2021. The record reference serves to highlight dialogue related to freezing technology, which is used in relation to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. A chilled brine solution (e.g. a calcium chloride brine) will be circulated to remove heat from the ground thereby establishing the freeze wall.
21-EN-SUR-446.21	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Why did you choose these valued components? Response: Economy is important for jobs/employment of northerners. Water, land and animals are all connected. We still use the land for livelihood.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – On-site Processing Methods	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey intended for members of English River First Nation, residents of Pinehouse, and residents of Beauval in the year 2021. The record reference serves to highlight dialogue related to employment, which is used in relation to on-site processing methods in terms of the alternative means assessment.
21-EN-SUR-446.48	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could benefit, or work well for your community? Response: Employment. Partnerships. Business opportunities	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey intended for members of English River First Nation, residents of Pinehouse, and residents of Beauval in the year 2021. The record reference serves to highlight dialogue related to employment, which is used in relation to domestic waste disposal in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
21-EN-SUR-446.61	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could benefit, or work well for your community? Response: Setting aside a legacy fund to benefit impacted communities now and into the future. Ensure employment is available to my community including a pick up point so that there is no undue hardship for workers.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Worker Transportation	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey intended for members of English River First Nation, residents of Pinehouse, and residents of Beauval in the year 2021. The record reference serves to highlight the commonality of water related questions. The record reference serves to highlight dialogue related to employment, which is used in worker transport in terms of the alternative means assessment.
21-EN-SUR-446.68	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Traditional land users & wildlife interruption	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey intended for members of English River First Nation, residents of Pinehouse, and residents of Beauval in the year 2021. The record reference serves to highlight dialogue related to employment, which is used in relation to domestic waste disposal in terms of the alternative means assessment. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional land use activities and wildlife. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-SUR-446.74	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Vehicles ruining the road.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – Location of Processing	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey intended for members of English River First Nation, residents of Pinehouse, and residents of Beauval in the year 2021. The record reference serves to highlight dialogue related to traffic, which is used in relation to location of processing in terms of the alternative means assessment. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers changes in traffic volume. While it is expected that traffic north of the Key Lake gatehouse will increase by 23% during construction and 30% during operation, proven mitigation options are planned to reduce the risk of increased traffic. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-SUR-446.75	446	Survey	2021-02-16	Same as above	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: The transportation of dangerous chemicals concerns me.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – Location of Processing	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey intended for members of English River First Nation, residents of Pinehouse, and residents of Beauval in the year 2021. The record reference serves to highlight dialogue related to transportation, which is used in relation to location of processing in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers transportation. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-VILX-443.19	443	Virtual Meeting	2021-02-10	Denison hosted a virtual meeting for the municipality of Ile a la Crosse. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Ile a la Crosse	What happens when the freeze wall melts? Will there be monitoring of ground water during this?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse in the year 2021. The record reference serves to highlight dialogue related to the freeze wall, which is used in relation to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. Mining area remediation will continue until recovered water reaches and is demonstrated to be stabilized (maintained) at acceptable mining area decommissioning objectives. Once the mining area decommissioning objectives have been met, the perimeter freeze wall will be turned off and allowed to thaw. This will allow the eventual re-establishment of the pre operational groundwater flow regime in the former mining area.
21-EN-VILX-443.2	443	Virtual Meeting	2021-02-10	Same as above	Village of Ile a la Crosse	With two other mines in the area, what is the need for another airstrip? Another airstrip will cause more environmental disturbance.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Access and Transportation – Worker Transportation	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse in the year 2021. The record reference serves to highlight dialogue related to the air strip, which is used in relation to worker transportation in terms of the alternative means assessment. The Project is proposed as a fly in-fly out operation. An air strip and terminal are included as project components and were assessed as part of the environment assessment, as Denison must consider the stand-alone components necessary to advance the Project.
21-EN-VILX-443.35	443	Virtual Meeting	2021-02-10	Same as above	Village of Ile a la Crosse	Will any migration routes or critical habitat be impacted by the project?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Process Precipitate Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse in the year 2021. The record reference serves to highlight dialogue related to impacts, which is used in relation to process precipitate disposal in terms of the alternative means assessment. Denison has completed an environment assessment to understand Project impacts on the environment. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-YOUTH-445.2	445	Virtual Meeting	2021-02-10	Denison provided a virtual presentation to the high schools in Ile a la Crosse, Beauval and Pinehouse about the Wheeler River Project. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an	Village of Ile a la Crosse, Village of Pinehouse Lake, Village of Beauval, Denison	If the other mines are closed (or production is slowed down) how is this one moving forward?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Processing – Location of Processing	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended a virtual meeting for residents of Ile a la Crosse, Pinehouse, and Beauval in the year 2021. The record reference serves to highlight dialogue related to ISR, which is used in relation to location of processing in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				online survey with specific questions pertaining to Valued Components.				The ISR mining method proposed for the Project has the potential to improve overall economics for smaller-scale uranium deposits while minimizing disturbance to the land and resources in the area.
22-EN-EQC-648.1	648	Presentation	2022-03-03	Denison Mines presented to the Northern Saskatchewan Environmental Quality Committee, via Microsoft Teams, on March 2-3, 2022. A schedule, with time allotments for several guests and presenters, was provided for the two day event. Denison's presentation focused on providing the EQC with an update on the Wheeler River Project.	Lac La Ronge Indian Band, Métis Local #39 (La Loche), Northern Saskatchewan Environmental Quality Committee, Sakitawak Development Corporation, Village of Beauval, Village of Pinehouse Lake	What are the concerns with groundwater monitoring once mining is done and the freezing comes out?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from a presentation attendee from the Northern Saskatchewan Environmental Quality Committee in the year 2021. The record reference serves to highlight dialogue related to the freeze wall, which is used in relation to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. Mining area remediation will continue until recovered water reaches and is demonstrated to be stabilized (maintained) at acceptable mining area decommissioning objectives, as set by the regulators. Once the mining area decommissioning objectives have been met, the perimeter freeze wall will be turned off and allowed to thaw. This will allow the eventual re-establishment of the pre-operational groundwater flow regime in the former mining area.
22-EN-ERFN-618.26	618	Open House	2022-05-30	In collaboration with the Chief and Council of English River First Nation, Denison hosted an open house event at ERFN Patuanak Reserve, sharing information about the Wheeler River Project, the preliminary effects assessment of the Project, and proposed mitigation and monitoring. Denison advertised the event on the local radio, with posters around the community, on the local cable network, and through social media. Denison had a Dene translator available for attendees. Residents of the Hamlet of Patuanak were also advised about the open house and invited to attend. 31 attendees signed the sign in sheet. Information boards and area models were displayed, and staff Denison staff were available to answer questions. A survey was available for community members to complete, and remaining available online for 2 weeks following the open house.	English River First Nation	I worked at Cluff Lake; I saw how they dealt with the contaminated waste, they just put it into an open pit and buried it. What are you going to do with the materials left over that are waste?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Process Precipitate Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who attended an open house in English River First Nation in the year 2022. The record reference serves to highlight dialogue related to the freeze wall, which is used in relation to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. A waste management program will be developed for the Project to support licensing and permitting. The waste management program and associated plans developed to support licensing will be based on the 4 R's: Reduce, Reuse, Recycle, and Recover, and will detail how each type of waste generated on site will be managed.
22-EN-ERFN-621.15	621	Meeting	2022-05-30	Denison hosted a meeting with the Chief and Council of English River First Nation, hosted in ERFN Patuanak, to share information about the Wheeler River Project, preliminary effects assessment of the Project, and proposed mitigation and monitoring. A representative from the Canadian Nuclear Safety Commission and from the Province of Saskatchewan were also in attendance.	English River First Nation	Is climate change considered?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from English River First Nation leadership who attended a meeting in the year 2022. The record reference serves to highlight dialogue related to climate change, which is used in relation to domestic waste disposal terms of the alternative means assessment. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers climate change within each valued component section. Climate change has been included in the cumulative effects section because it

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								is an external force that can influence the potential effects of the Project.
22-EN-SUR-652.21	652	Survey	2022-05-30	As part of engagement activities for English River First Nation, Beauval, and Pinehouse, Denison prepared and shared, both online and as a hardcopy during Spring Engagement meetings, a survey that asked a series of questions relating to the results of the environmental assessment. A total of 39 surveys were entirely or partially completed.	Unknown	Denison Question: Are there any topics of particular concern that Denison needs to pay special attention to? Response: More recycling projects	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Organic Waste Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey for members of English River First Nation, Beauval, and Pinehouse in the year 2022. The record reference serves to highlight dialogue related to waste, which is used in relation to organic waste disposal in terms of the alternative means assessment. A waste management program will be developed for the Project to support licensing and permitting. The waste management program and associated plans developed to support licensing will be based on the 4 R's: Reduce, Reuse, Recycle, and Recover, and will detail how each type of waste generated on site will be managed.
22-EN-SUR-652.23	652	Survey	2022-05-30	Same as above	Unknown	Denison Question: What additional information would be helpful for you to understand the Project and its potential impacts to people and the environment? Are there any topics of particular concern that Denison needs to pay special attention to? Response: More practice on recycling	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Organic Waste Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey for members of English River First Nation, Beauval, and Pinehouse in the year 2022. The record reference serves to highlight dialogue related to waste, which is used in relation to organic waste disposal in terms of the alternative means assessment. A waste management program will be developed for the Project to support licensing and permitting. The waste management program and associated plans developed to support licensing will be based on the 4 R's: Reduce, Reuse, Recycle, and Recover, and will detail how each type of waste generated on site will be managed.
22-EN-SUR-652.57	652	Survey	2022-05-30	Same as above	Unknown	Denison Question: Are there any topics of particular concern that Denison needs to pay special attention to? Response: Climate change-exploitation of the north, no returns	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Domestic Waste Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey for members of English River First Nation, Beauval, and Pinehouse in the year 2022. The record reference serves to highlight dialogue related to climate change and environmental impacts, which is used in relation to domestic waste disposal in terms of the alternative means assessment. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers climate change and cumulative effects. Denison has determined that there will be no significant impact as a result of Project activities.
22-EN-SUR-652.87	652	Survey	2022-05-30	Same as above	Unknown	Denison Question: Are there any topics of particular concern that Denison needs to pay special attention to? Response: (environment) restoring to how it was after the project.	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Waste Management – Process Precipitate Disposal	The context in which this comment was used within the Project Description of the EIS serves as a local perspective, documented as coming from an individual who completed a survey for members of English River First Nation, Beauval, and Pinehouse in the year 2022. The record reference serves to highlight dialogue related to decommissioning and reclamation, which is used in relation to process precipitate disposal in terms of the alternative means assessment.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								The conceptual decommissioning plan highlights that remediation of the mining area will continue until water reached and is demonstrated to be stabilized at acceptable mining area decommissioning objectives as set out in regulatory requirements. Additional detail will be provided in the preliminary decommissioning plan (PDP), which will be submitted to regulators as part of Project licensing and permitting. Prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan, that builds upon the PDP, to regulators for acceptance. A Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and licence conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met.
22-EN-VPL/ML9-620.15	620	Open House	2022-06-01	In collaboration with Kineepik Metis Local and the Village Council of Pinehouse Lake, Denison hosted an open house event at the Village of Pinehouse Lake, sharing information about the Wheeler River Project, the preliminary effects assessment of the Project, and proposed mitigation and monitoring. Denison advertised the event on the local radio, with posters around the community, on the local cable network, and through social media. Denison had a Cree translator available for attendees. Information boards and area models were displayed, and staff Denison staff were available to answer questions. 52 attendees signed the sign in sheet. A survey was available for community members to complete, and remaining available online for 2 weeks following the open house.	Village of Pinehouse Lake	How does the freezing technology work?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Program Description section of the EIS serves as a local perspective, documented as coming from an individual who attended an Open House in Pinehouse in the year 2022. The record reference serves to highlight dialogue related to the freeze wall, which is used in relation to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. The freeze wall is intended for tertiary containment of mining solution to support a defence in depth strategy as additional, site-specific data is obtained on hydraulic containment. The freeze wall around the mining area will extend from the surface to the basement rock, isolating the mining area from regional groundwater. The freeze wall is expected to be a minimum of 10 m thick, be installed 25m away from the uranium deposit, and extend 30 m into the basement rock. Data from the groundwater monitoring network installed in and around the wellfield and freeze wall will make sure the freeze wall is meeting design specifications.
22-EN-VPL/ML9-620.19	620	Open House	2022-06-01	Same as above	Village of Pinehouse Lake	How does ISR mining work?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Mining – Freeze design for tertiary containment of mining solution	The context in which this comment was used within the Program Description section of the EIS serves as a local perspective, documented as coming from an individual who attended an Open House in Pinehouse in the year 2022. The record reference serves to highlight dialogue related to the ISR mining method, which is used in relation to freeze design for tertiary containment of mining solution in terms of the alternative means assessment. ISR refers to a mining method that uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
22-EN-VPL/ML9-620.8	620	Open House	2022-06-01	Same as above	Village of Pinehouse Lake	Where will the drinking water (for the camp) come from?	Denison considered this in section Appendix 2-C: Alternative Means Assessment, Water Management – Drinking Water And in section Appendix 2-C: Alternative Means Assessment, Water Management – Freshwater Supply	The context in which this comment was used within the Program Description section of the EIS serves as a local perspective, documented as coming from an individual who attended an Open House in Pinehouse in the year 2022. The record reference serves to highlight dialogue related to the water, which is used in relation drinking water and freshwater supply terms of the alternative means assessment. Potable water will be generated on site by a prefabricated modularized potable water treatment plant (WTP) comprised of a treatment plant, a 2,000 L storage tank, and a bottle filling station. Potable water will be piped to the camp, the fire water tank, the operations centre, and the processing plant to provide water for food preparation, hygienic usage, safety showers, eyewash stations and fire suppression requirements. Other locations, such as the airstrip terminal and satellite lunch trailers (during Construction), will receive bottled water as required.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Appendix 2-B

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Memorandum

To: Janna Switzer, Xavier Lu Dac

From: Jennifer Skilnick

Date: April 20, 2022

Re: Traffic Volumes

Executive Summary

With the development of any new Project, positive and negative impacts will be felt within communities in the surrounding area. One key concern for communities of interest around the Wheeler River Project (the Project) is the impact of traffic on northern Saskatchewan highways. The purpose of this memo is to determine the percent increase in average daily traffic and truck daily traffic on roads leading to the Project site.

Data for this report was largely supplied by Saskatchewan Ministry of Highways and Infrastructure (MHI), although not all segments of road were available from them. For the section of highway north of Key Lake, data from the Millennium Environmental Impact Statement (EIS) was used as it was determined to be most accurate for the purpose of this study. Highway segments were chosen based on MHI data and those highways facing the biggest impact from traffic volume increases.

Denison Mines Corp. (Denison) was able to provide an accurate estimate of truck traffic travelling to the Project site during construction and operation phases of the Project life. After looking at Truck Annual Average Daily Traffic (TAADT) and Annual Average Daily Traffic (AADT), we were able to use these estimates to establish expected traffic increases due to the Project on highways of interest. Results show that increases to traffic will be most significant on Highway 914, south of Key Lake, with impacts becoming negligible as you travel further south. On this segment of Highway 914 we could see truck traffic increase up to 51% per day through the operation phase. More southern highway segments fall within a 20% to 30% daily increase. Based on the information presented within the memo, the impacts from the Wheeler River Project related to traffic will be relatively minor.

Traffic Study

Highway 914 north, between Key Lake mill and McArthur River uranium mine, is a private road operated by Cameco. Consequently, traffic data for this section of highway is relatively unmonitored and unavailable from the MHI. In early 2022, Cameco announced that both Key Lake and McArthur River will be coming back online by the end of the year. Operations at these locations ceased in 2018 due to prolonged market weakness. For the Millennium Environmental Impact Statement (EIS) in 2012, a traffic study was completed on the unmonitored section of Highway 914 between Key Lake and McArthur River when both operations were in production. Due to the changes recently announced by Cameco, data from the Millennium EIS will be the greatest resource to give us a clear understanding of traffic volumes on Highway 914 during operation of both the Key Lake mill and McArthur River uranium mine.

Table 1: Description of highway segments near the Wheeler River Uranium Project.

Segment		Highway	From	To
1		Access Road	Wheeler River Project Camp	Highway 914
2		Highway 914	Wheeler River Project Access	Key Lake Gatehouse
3	A	Highway 914	Key Lake Gatehouse	Gordon Lake Access
	B	Highway 914	Gordon Lake Access	Snake Rapids Bridge
	C	Highway 914	Snake Rapids Bridge	Pinehouse Lake Access
4		Highway 914	Pinehouse Lake Access	Highway 165
5	A	Highway 165	Highway 914	Highway 918
	B	Highway 165	Highway 918	Highway 155
6	A	Highway 165	Highway 914	Highway 910
	B	Highway 165	Highway 910	Highway 2

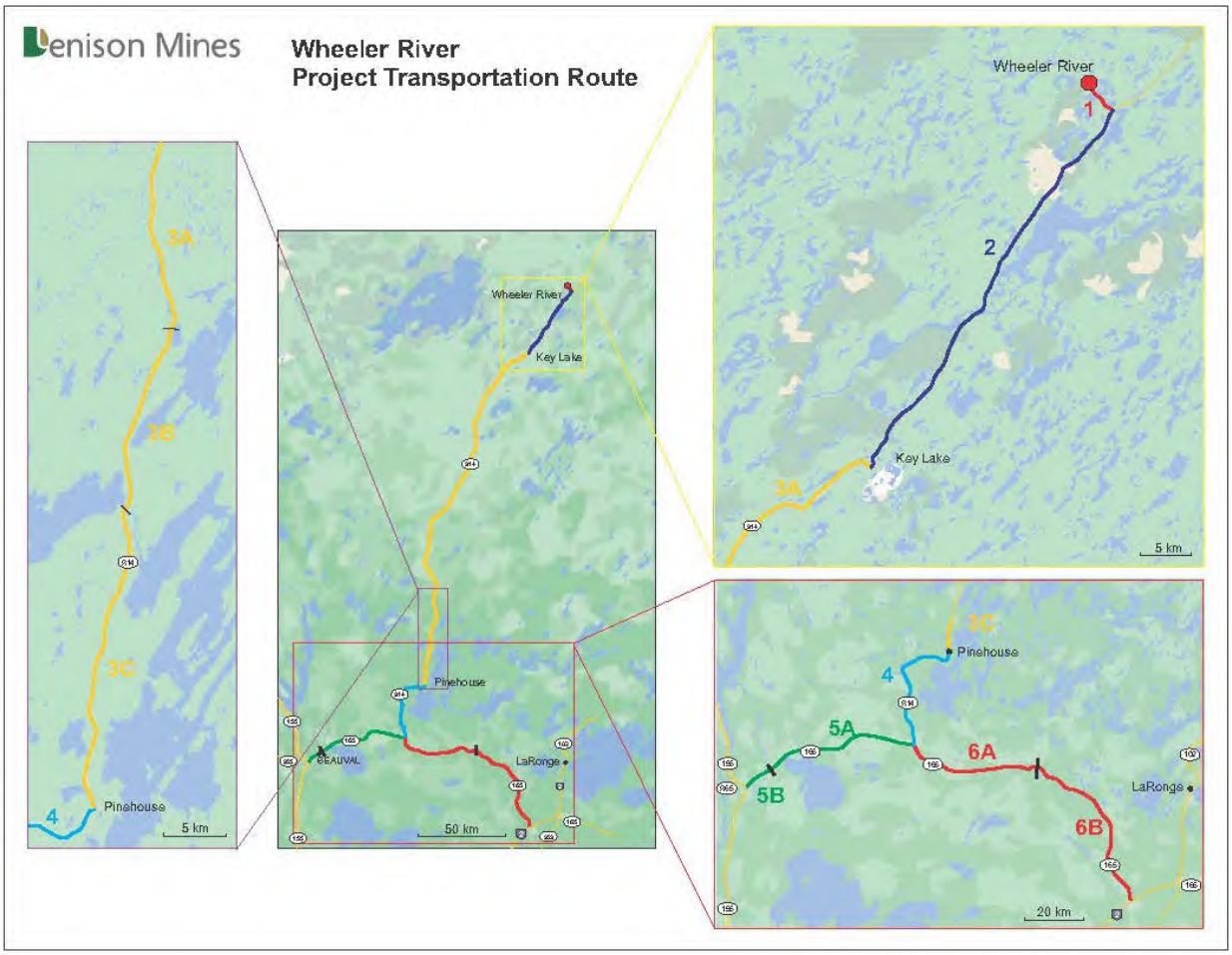

Figure 1: Highway segments affected by Wheeler River Project traffic.

Truck Annual Average Daily Traffic (TAADT) and Annual Average Daily Traffic (AADT) data has been received from the MHI for 2011 through 2019 and is shown in tables 2 and 3. AADT is a count of all vehicles travelling on the highway, including TAADT.

Table 2: Truck Annual Average Daily Traffic (TAADT) data received from the MHI on northern Saskatchewan highways affected by the Wheeler River Project. Refer to Table 1 for segment details.

Segment	TAADT 2011	TAADT 2012	TAADT 2013	TAADT 2014	TAADT 2015	TAADT 2016	TAADT 2017	TAADT 2018	TAADT 2019	TAADT AVG 2011-2019
1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2[1]	58[2]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3A	35	35	35	35	35	35	35	35	35	35
3B	35	35	35	35	35	35	35	35	35	35
3C	40	40	40	40	40	35	35	35	35	38
4	65	65	65	65	65	50	50	50	50	58
5A	35	40	40	40	40	35	35	35	35	37
5B	50	65	65	65	65	60	60	60	60	61
6A	25	30	30	30	30	30	30	25	25	28
6B	30	30	30	40	40	40	40	45	45	38

[1]TAADT is unavailable for this section of highway beyond 2010 (Cameco, 2012).
[2]Data is the 2010 TAADT used in the Millennium EIS (Cameco, 2012) for this segment of highway.

Table 3: Annual Average Daily Traffic (AADT) data received from MHI on northern Saskatchewan highways affected by the Wheeler River Project. Refer to Table 1 for segment details.

Segment	AADT 2011	AADT 2012	AADT 2013	AADT 2014	AADT 2015	AADT 2016	AADT 2017	AADT 2018	AADT 2019	AADT AVG 2011-2019
1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2[1]	60[2]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3A	50	50	50	50	45	45	45	45	45	47
3B	50	50	50	50	45	45	45	45	45	47
3C	90	90	90	90	90	90	90	90	90	90
4	170	170	230	230	230	230	230	190	190	208
5A	300	270	300	300	240	240	240	180	180	250
5B	740	780	810	810	960	960	960	780	780	842
6A	120	120	130	130	130	130	130	70	90	117
6B	220	220	230	230	230	230	230	210	190	221

[1] AADT is unavailable for this section of highway beyond 2010 (Cameco, 2012).
[2] This data is the 2010 AADT total used in the Millennium EIS (Cameco, 2012) for this segment of highway.

As shown on tables 2 and 3, there is no data for the Wheeler River Project access road and limited data available for Highway 914 north of Key Lake. The AADT and TAADT data reflects a decrease in vehicle and truck traffic occurring alongside the move from operations to care and maintenance for Key Lake and McArthur River. Due to Cameco's recent announcement on the reopening of Key Lake and McArthur River, 2017 traffic data will be most accurate in reflecting the operating volumes of these locations as they had ceased operation in 2018. Data for the section of Highway 914 north of Key Lake was pulled from the Millennium Environmental Impact Statement – Main Body (Cameco, 2012). This data is the most recent that is publicly available. In Table 4 the percent of truck traffic along the highway segments under study can be seen.

Table 4: The percentage of daily traffic that is trucks travelling along northern Saskatchewan highways affected by the Project.

Segment	Highway	2017 TAADT	2017 AADT	% of total traffic that is trucks
1	Access Road	n/a	n/a	n/a
2[1]	914	58	60	97
3A	914	35	45	78
3B	914	35	45	78
3C	914	35	90	39
4	914	50	230	22
5A	165	35	240	15
5B	165	60	960	6

6A	165	30	130	23
6B	165	40	230	17

[1] *TAADT and AADT values from the Millennium EIS are used to accurately reflect traffic on this section of highway (Cameco, 2012).*

As the Wheeler River Project progresses into construction and operation, estimates on truckloads are available in Table 5 below. These trucks include estimates of wellfield mobilization, wellfield material deliveries, construction equipment deliveries, food and fuel/propane deliveries anticipated through both construction and operation phases of the Project.

Table 5: The anticipated volume of vehicles to the Wheeler River Project during construction (year 1 and 2) and operation (year 3 through 18). These volumes assume travel to site and return occur on the same day.

Phase	TAADT expected increase	AADT expected increase
Construction	14	54
Operation	18	18

Currently, it is assumed that 50% of trucks will be travelling along Highway 165 originating west of Beauval, and 50% of trucks will be originating in Saskatoon or other southern locations and travelling the eastern portion of Highway 165.

Table 6: Expected increased in TAADT during the Project construction phase (year 1 and 2).

Segment	Highway	2017 TAADT	2017 AADT	TAADT Increase	% Truck Increase	Overall % Increase in Traffic
1	Access Road	n/a	n/a	14	n/a	n/a
2	914	58	60	14	24%	23%
3A	914	35	45	14	41%	31%
3B	914	35	45	14	41%	31%
3C	914	35	90	14	41%	16%
4	914	50	230	14	28%	6%
5A	165	35	240	7	20%	3%
5B	165	60	960	7	12%	0.7%
6A	165	30	130	7	23%	5%
6B	165	40	230	7	18%	3%

Table 7: Expected increased in TAADT during the Project operation phase (year 3 to 18).

Segment	Highway	2017 TAADT	2017 AADT	TAADT Increase	% Truck Increase	Overall % Increase in Traffic
1	Access Road	n/a	n/a	18	n/a	n/a
2	914	58	60	18	31%	30%
3A	914	35	45	18	51%	40%
3B	914	35	45	18	51%	40%
3C	914	35	90	18	51%	20%
4	914	50	230	18	36%	8%
5A	165	35	240	9	26%	4%
5B	165	60	960	9	15%	0.9%
6A	165	30	130	9	30%	7%
6B	165	40	230	9	23%	4%

Conclusion

As expected, the Project will have the highest impact on Highway 914. Land users north of the Key Lake gatehouse would expect to see an increase in traffic of 23% to 30%. On Highway 914 between Key Lake

and Pinehouse, road users would expect to see an overall increase in traffic of 16% to 40% over the life of the mine. Trucks travelling this section of highway will increase from 35 to 53 at peak operational times. The Northern Community of Beauval will see truck increases of up to 26% during the life of the mine.

Based on the data presented within this memo, impacts from truck traffic to the Wheeler River Project Site will be relatively minor.

References

Cameco Corporation. 2012. Millennium Project Environmental Impact Statement: Main Document.

Clifton (Clifton Associates Ltd.). 2011. Millennium Traffic Study, Proposed Millennium Mine Site, Saskatchewan – Revised. File S1716.8 April 19, 2011.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Wheeler River Project

Final Environmental Impact Statement

Alternative Means Assessment

November 2024

Denison Mines Corp.

345 4th Avenue South

Saskatoon, SK, S7K 1N3

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Denison Mines Corp. (Denison) first evaluated production potential from the Wheeler River Project (the Project) in 2010. Since that time, the Project has undergone significant design and review stages and has naturally evolved into the Project described and assessed in this Environmental Impact Statement (EIS). The purpose of this appendix is to describe the alternative means assessment framework employed and the results of the alternatives assessment for key Project components and activities. The selected alternative(s) were carried forward into the environmental assessment (EA) process.

1 Alternative Means Assessment Framework

Alternative means are the various ways Denison considered to implement Project components and activities. During the planning process, it is common to consider various means by which to fulfill a specific aspect of the Project.

A systematic assessment of these alternatives was used to select preferred alternatives that are carried forward as Project design elements. These preferred alternatives ultimately become the basis upon which potential Project-related effects are evaluated in the EIS. The preferred alternatives have been presented in the Project Description in Section 2 of the EIS.

The documentation of this systematic alternative assessment provides transparency and traceability with respect to decision making on Project design and also documents how input received by Indigenous groups and other Interested Parties has been considered in the design/planning process.

In the following subsections the alternative means assessment is presented. The alternative means assessment has been carried out in a stepwise fashion as follows:

1. Identification of Alternative Means: Project components for which alternate means were considered are identified;

2. Consideration of Technical Feasibility, Economic Feasibility, and Land Use Factors: the technical and economic feasibility of these alternate means is considered along with a specific screening for land use intensity and importance. Only alternate means that are deemed technically feasible, economically feasible, and passed the land use screening are carried forward in the evaluation.

3. Potential Residual Effects Associated the Alternative Means: the potential residual effects of each alternative, in consideration of mitigation, are described; and,

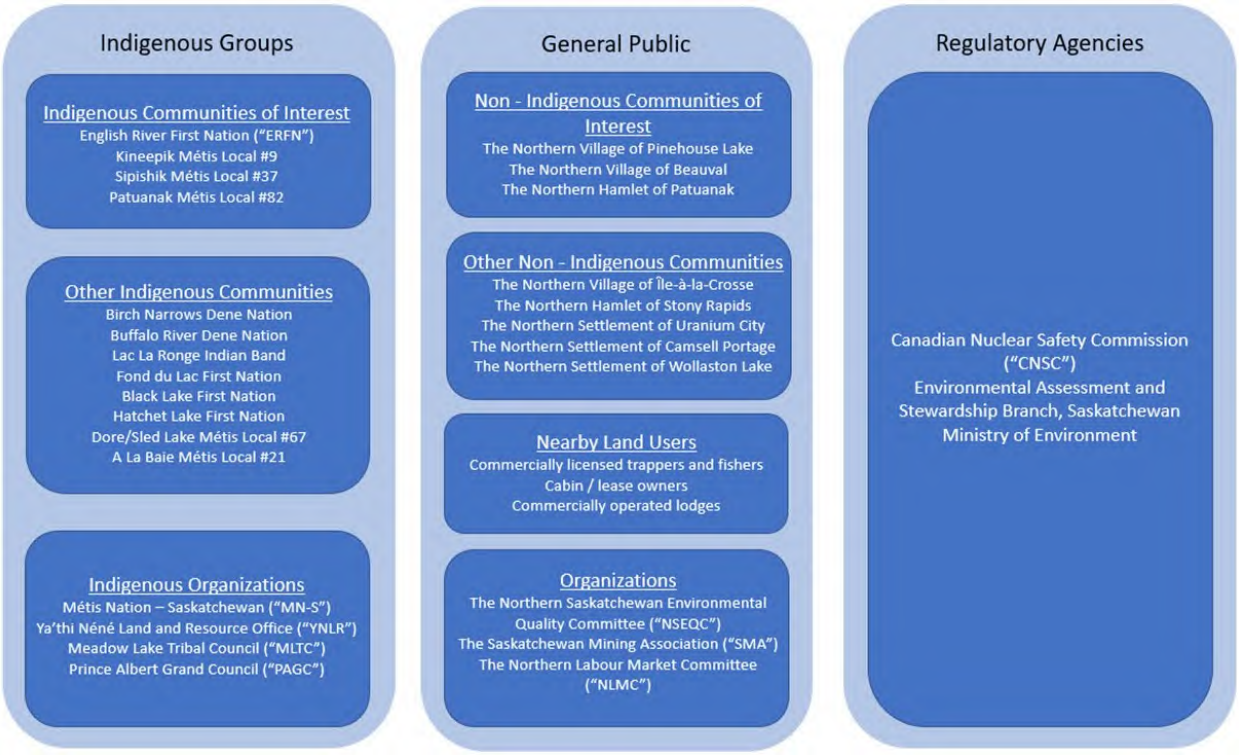
4. Evaluation of Alternative Means: a comparative evaluation of alternative means that considers the potential residual effects for each alternative relative to various assessment criteria and indicators.

Based on the above, a preferred alternative means for each respective Project component or activity evaluated was selected (Figure 2). Rationale for the selection based on the comparative evaluation of alternatives is provided and input received by Interested Parties is presented.

Since 2016, Denison has been engaging with local and Indigenous communities, residents, businesses, organizations, land users and the various regulatory authorities, which are collectively referred to herein as Interested Parties. Interested Parties include the following:

- Indigenous Groups
  - Indigenous Communities of Interest (COI)
  - Other Indigenous Communities
  - Indigenous Organizations
- General Public
  - Non-Indigenous COI
  - Other Non-Indigenous Communities
  - Nearby Land Users
  - Organizations
- Regulatory Agencies

A list of the Interested Parties for the Project can be found in Figure 1.



Note:

- The MN-S holds the delegated Duty to Consult for Dore/Sled Lake Métis Local #67 and A La Baie Métis Local # 21, SML, and PML.
- Engagement activities with the Athabasca Basin First Nations and Communities (Fond du Lac, Black Lake, Hatchet Lake, Stony Rapids, Camsell Portage, Uranium City and Wollaston Lake) occur through YNLR.

Figure 1: Interested Parties for the Project

Refer to EIS Section 4 Engagement for more information. Denison's engagement with Interested Parties helped to develop meaningful relationships and facilitate a collaborative approach to engagement and the advancement of the Project. Engagement with Interested Parties naturally included alternatives means and the engagement input was included in the evaluation of alternative means. Refer to the references list below and *Appendix 2-A Engagement Database Summary – Project Description* for details of engagement information referenced in this alternative means assessment.

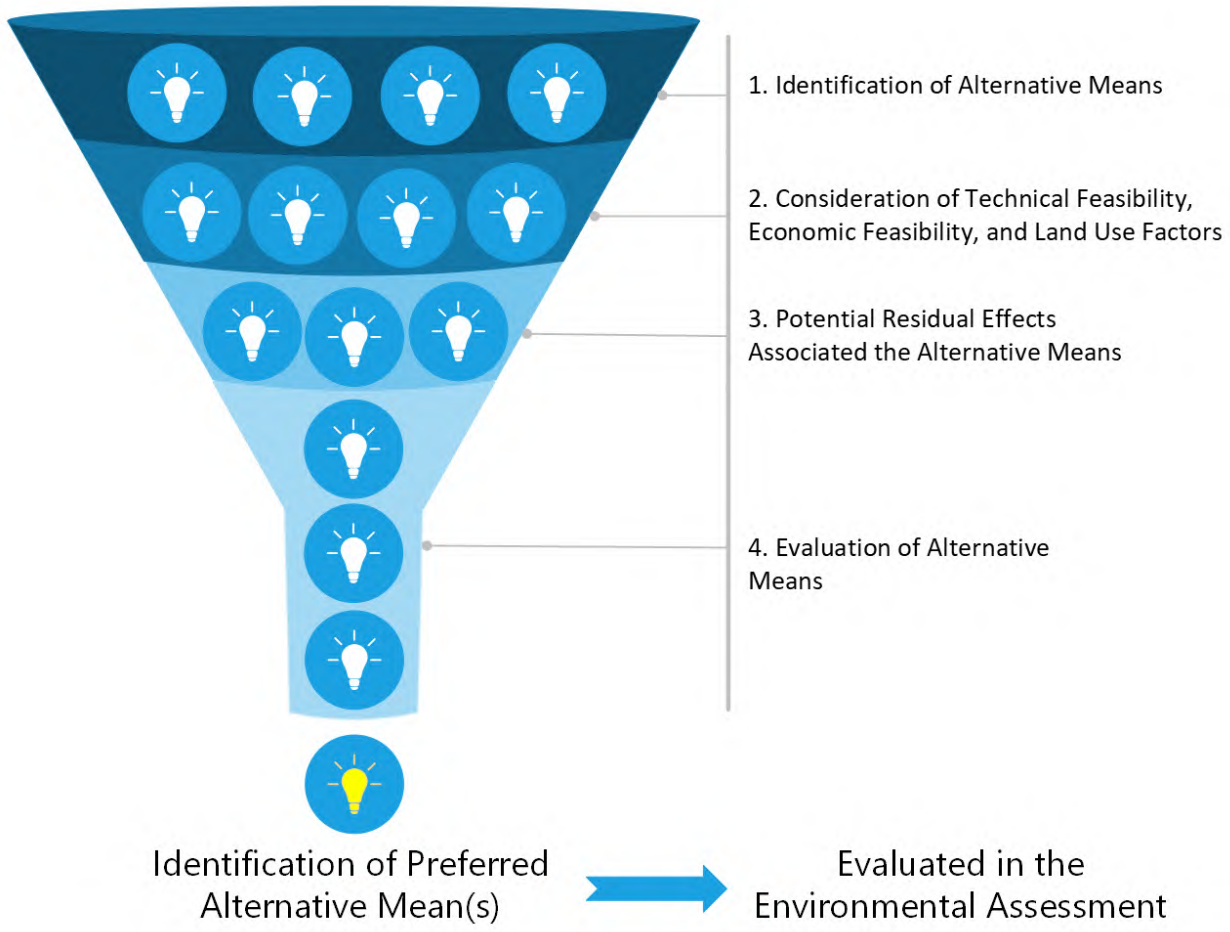


Figure 2: Alternative Means Assessment Framework for the Project

For reference, the alternative means assessment is conducted at a screening level, appropriate for the stage of the Project when the alternatives were considered. The assessment considered both quantitative (where possible) and qualitative information as available. The comparative evaluation identified more preferred versus less preferred alternatives. As indicated above, the preferred alternative(s) was selected and evaluated in much greater detail in the EA.

1.1 Identification of Alternative Means

Project components for which alternate means were considered are described below and summarized in Table 1. For ease of consideration, alternatives have been grouped according to the following main subject categories: mining; processing; water management; waste management; access and transportation; and support facilities (Table 1).

1.1.1 Mining

1.1.1.1 Method

1. Open pit

Open pit mining has been used to develop some of the shallower deposits in the region. Open pit mining involves blasting and bringing volumes of waste rock to surface until the ore is accessible at the bottom of the pit. The Phoenix uranium deposit is an unconformity style deposit and to Denison's knowledge, only two mining methods have been used to extract uranium in these style of deposits in Saskatchewan, one of which is open pit mining.

2. Jet Boring

Jet boring is a vertical stopping with mechanical cutting underground mining method. The jet boring system drills a pilot hole through the orebody. Then the jet boring nozzle is inserted in the pilot hole and the system begins boring through the rock using a high-pressure jet of water. Loose ore is flushed down the pilot hole. After a series of processes, ore is pumped to the surface in a slurry form. This would be an entry type of mining, meaning workers go underground into select areas of the mine workings.

As indicated above, the Phoenix uranium deposit is an unconformity style deposit and to Denison's knowledge, only two mining methods have been used to extract uranium in these style of deposits in Saskatchewan, one of which is jet boring used at Cameco Corporation's (Cameco's) renowned Cigar Lake deposit.

3. Surface Boring

The surface borehole mining method involves the application of petroleum style drilling and state of the art directional drilling technologies to selectively mine the deposit. The boreholes would be drilled from surface, collared vertically, steered through waste rock to a horizontal approach in proximity to the deposit, and continued horizontally through the ore. By strategically placing the collar and curved portion of the boreholes (referred to as the parent borehole) and backfilling completed horizontal portions of the borehole (referred to as the lateral borehole), additional directional drilling at depth would permit multiple lateral boreholes from a single parent borehole. Acceptable recovery rates can be achieved by drilling an array of closely spaced boreholes. As an non-entry mining method, surface boring would be highly mechanized and used remote equipment from the surface. Consideration was given to a slurry system on surface to produce a transportable slurry and use of a surface dry drill handling option across most factors to allow for transportation of dry drill cuttings to an existing mill for processing.

4. Micro Tunnel Boring

Microtunnel boring method would be an underground mining method which uses high-tech mining equipment to bore horizontal cavities. The horizonal cavities are created using automated to semi-automated tunnel boring machines. The tunnels would be 2 to 3 m in diameter. Ore would come to surface as hoisted cuttings or as a slurry. This would be an entry type of mining, meaning workers go underground into select areas of the mine workings.

The techniques and equipment are commonly used in the civil engineering industry. For example, microtunnel boring machines are used to construct utility tunnels.

5. In Situ Recovery

In situ recovery (ISR) mining is also known as solution mining or in situ leaching. It is a surface extraction method using mining fluids to dissolve uranium from the host rock without physically removing the host rock. The ore is dissolved 'in situ' by mining solution and pumped to surface. No underground or open pit workings are required in an ISR operation; no heavy equipment is needed, and people do not work underground (non-entry mining method). The process uses a series of injection wells to inject mining solution into the uranium deposit and another series of wells (recovery wells) to return the uranium rich solution back to surface for processing. There is minimal surface disturbance and minimal waste rock generated. The ISR technology is in widespread use in international uranium operations (USA, Kazakhstan), although it has not been used for uranium mining in Canada. The ISR mining method is amenable to uranium deposits in certain sedimentary formations and is well known in the industry for having comparatively minimal surface disturbance, high production flexibility, and low operating and capital costs relative to open pit or conventional underground mining methods. Continuous development and improvement of ISR mining techniques has occurred in recent years, particularly in the two decades since the International Atomic Energy Agency published the Manual of Acid In-Situ Leach Uranium Mining Technology (IAEA 2001).

1.1.1.2 Freeze design for tertiary containment of mining solution

1. Freeze dome

With a freeze dome design option, tertiary containment of mining solution would be done by creating a freeze wall above and on all sides of the uranium deposit – encapsulating the uranium deposit.

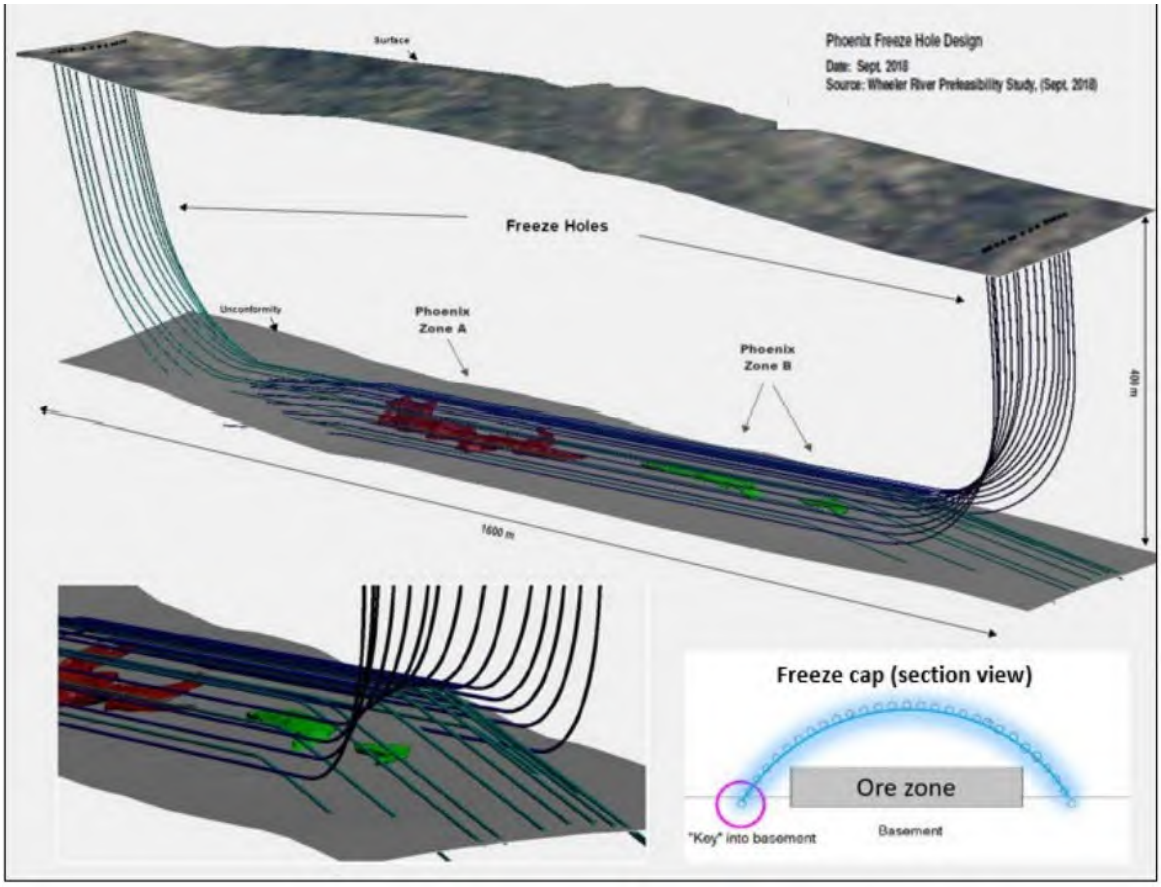


Figure 3: Freeze Dome Option for Tertiary Containment of Mining Solution

The freeze dome would be established by drilling parallel cased holes from surface, starting at both ends of the deposit and travelling horizontally along the long axis of the uranium deposit, anchoring into the impermeable basement rock on the opposite end of the deposit. This process is illustrated above and is expected to be achievable using existing directional drilling techniques.

Once the drill holes have been installed, a low temperature brine solution is circulated through the cased holes to remove heat from the ground, ultimately freezing the natural groundwater and establishing an impermeable, frozen dome to encapsulate the uranium deposit. While a freeze dome would be several metres thick, it would be developed around the uranium deposit, to make sure the uranium deposit itself does not freeze.

Ground freezing technology is well established throughout the world. Its use in a mining environment was pioneered in Saskatchewan's potash mining industry and later adapted for use in Saskatchewan's uranium industry. Ground freezing to control and eliminate groundwater from entering the mining areas is a fundamental component of two existing Athabasca Basin underground uranium mines.

2. Freeze wall

The freeze wall would be established by drilling parallel cased holes from surface, anchoring into the impermeable basement rock. The freeze wall would be constructed to surround the entire mining area. This process is illustrated in Figure 4 and is expected to be achievable using existing commonly used drilling techniques, likely diamond drilling. Once the drill holes have been installed, a low temperature brine solution would be circulated through the cased holes to remove heat from the ground, ultimately freezing the natural groundwater and establishing an impermeable, frozen wall to encompass the uranium deposit. While the freeze wall would be expected to be several metres thick, it would be developed around the uranium deposit, to make sure the uranium deposit itself does not freeze. The ground freezing technology would be the same as that outlined for the freeze dome.

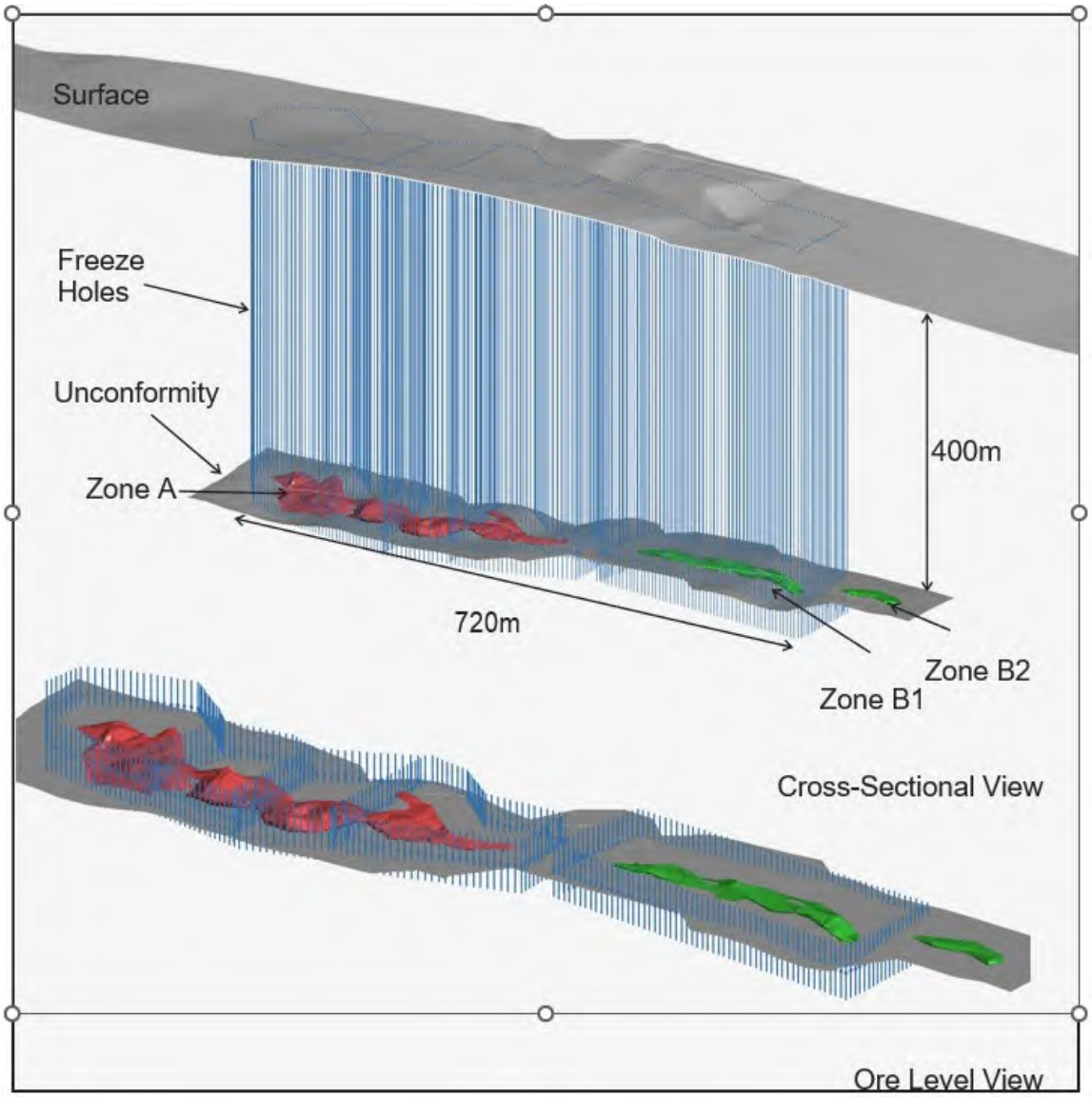


Figure 4: Freeze Wall Option for Tertiary Containment of Mining Solution

1.1.1.3 Permeability enhancement

In situ recovery relies on fluid movement within the mining area. Within the context of the Project, permeability is a measure of the ease of passage of liquids through rock in the mining area. Several permeability enhancement techniques have been considered for the Project to create sufficient permeability for uranium extraction and injection and recovery of solutions.

As Denison advanced the Project as an ISR operation, it was common to receive questions about how the method compared to fracking. For instance, when mining options were presented at workshops in 2018, some members of local communities had reservations because ISR reminded them of fracking, which carried a negative connotation (18-EN-VB-4.54). As context for the evaluation of alternatives means for permeability enhancement, information on conventional fracking is provided here.

Conventional fracking pressures used in the oil and gas industry can vary; however, common pressures to induce fracturing can be on the order of 15,000 psi and require injection of fracking fluids of up to 16,000 liter per minute over periods of three to four days. Fracking fluids are comprised of a slurry of water, proppant (generally silica sand), and chemical additives to support and maintain the open fracture system after fracking is conducted. Conversely, ISR mining is planned at nominal pressures of 100 psi, intermittent pressures of up 250 psi, and average flow rates of 30 liters per minute within a given well.

1. Hydraulic

Hydraulic permeability enhancement is a technique involving the flushing of bedrock formations by a pressurized liquid. The process involves pressure injection of water into a wellbore to create access to existing fractures in the defined formations that may not have been previously connected to the main fracture network due to clays, sands, or other materials being present in the fractures themselves. After hydraulic permeability enhancement, mining solutions may flow more freely. Hydraulic enhancement is used as a means of flushing or cleaning the well and formation in preparation for mining. Hydraulic permeability enhancement pressures can reach up to 250 psi with a consistent duration of 24 to 48 hrs.

2. Propellant

Propellant permeability enhancement methods involve wireline-conveyed tools designed to perforate and stimulate well production using a controlled propellant, e.g., progressively burning solid propellants or gas injection. The wireline tools effectively clean out restricted pathways within the well screen, well bore, and the geological formation and provide increased flow rates in the wells by intersecting and connecting to the naturally occurring fractures within the mining area.

Propellants used are typically classified as a low hazard explosive (S.1 special-purpose explosives, low hazard explosives, per *Explosive Regulations*, Section 36). Propellants technically do not explode (like classic mine explosives which detonate) but rather burn through a process called deflagration. Deflagration means the material burns slower than the speed of sound, thus no shock waves are generated. Propellant permeability enhancement methods reach injection pressures of up to 8,000 psi and are near instantaneous, lasting only over periods of milli seconds.

3. Mechanical

Mechanical permeability enhancement uses a downhole tool that produces clean flow paths radially from an existing borehole into the ore zone. The tool uses mechanical pressure excavation methods to drill penetration tunnels out from the borehole. The resulting tunnels can be up to 1.8 m in length and 1.8 cm in diameter.

1.1.1.4 Mining solution

Two options were considered for mining solution: Option 1: alkaline solution and 2. acidic solution.

Factors determining the choice between acid or alkaline ISR technology are: composition of the host rock and ores, reagent cost and consumption, the degree of uranium recovery, and the intensity of the process (IAEA 2001). The leach intensity is determined as the sum of the leach duration, solution ratio (liquid/solid), and average uranium concentration in the recovery solution.

Alkaline or high-pH mining solutions are used at a number of uranium ISR operations. The mining solution is typically made with carbonate or bicarbonate. The single most important factor in the process is the rock composition within the productive aquifer, and in particular, the concentration of calcium carbonate. Ores with a higher carbonate content normally require alkaline (bicarbonate) leaching.

Acidic or low-pH mining solutions are used at a number of uranium ISR operations. The acidic mining solution is typically made with dilute sulfuric acid. The single most important factor in the process is the rock composition within the productive aquifer, and in particular, the concentration of calcium carbonate. For economic sulphuric acid leaching, the carbonate content should not exceed 2% CO_2.

In 2017, Denison completed core testing at a laboratory in the United States that was familiar with in situ recovery (ISR) mining and processing methods. The two lixiviant or leach solutions were 1) an alkaline solution and 2) an acidic solution. The alkaline solution was comprised of 2,000 ppm sodium bicarbonate and 500 ppm hydrogen peroxide. The sodium bicarbonate is a complexing agent and the hydrogen peroxide is an oxidant. This alkaline leach solution used in the laboratory is similar to lixiviant solutions used for ISR mining in the US. The acidic solution was prepared with sulfuric acid and hydrogen peroxide, in varying concentrations as the testing proceeded. After 30 pore volumes, the alkaline leach had recovered less than 1% of the uranium in the core. For comparison, the acidic leach recovered around 30% of the uranium in the core after 30 pore volumes and just under 90% of uranium was recovered after 120 pore volumes.

At the Phoenix deposit, carbonate and organic concentrations are quite low, which makes acid leach for uranium much more amenable at reasonable concentrations. Moreover, the ISR test work completed in 2017 highlighted alkaline leach would be ineffective and uneconomical. An excerpt below from the 2017 ISR laboratory report highlights the challenges with alkaline leach, pointing to the deposit specifics (depth, grade, location) which inhibit the ability to leach via alkaline methods:

- “Bicarbonate is limited in practice by the chemical cost and physical ability (chemical addition rates) to increase wellfield concentrations appreciably above 2-3 g/L as HCO3.”

- "Field oxygen additions are limited by injection well depths (i.e., depth to ore) which, along with injection pressures, determines the maximum concentration of O2(g) which could be successfully introduced to the wellfield."
- "pH control is critical to prevent potential calcium carbonate (Calcite, CaCO3) precipitation within the wellbore and/or orebody."

In 2018, Denison contracted a third-party consultant with expertise in Australia's ISR industry to complete a desktop review of various ISR test work completed for the Phoenix deposit, including the 2017 study described above. The third-party review of the alkaline and acid leach test work noted that for the alkaline bottle roll leach, it was unsurprising that the uranium extraction, 0.8%, was so low. Assuming the formation of the UO2(CO3)22- complex, the sodium bicarbonate consumption by the uranium would be ~188 kg/t, not including any potential bicarbonate consumption by any other phases present in the ore. The amount of sodium bicarbonate added in the test is calculated to be 7.2 kg/t, which was grossly inadequate. It is likely that given sufficient carbonate/bicarbonate and oxidant, alkaline leaching of the ore would technically be feasible, but it is likely in practice that the carbonate consumption would be excessively high. The rate of carbonate leaching is also much slower than acid, and the introduction of oxidant is also more difficult in an alkaline system.

Alkaline leach is commonly used in the United States due to the primary components that make up their ore bodies. They are rich in carbonates and organics, which makes uranium quite difficult and costly to mine via acid leach as the acid is consumed by these constituents prior to any uranium being liberated and leached itself. These issues are not of concern with alkaline leach. There is currently one operation in the United States (Lance Uranium Project – Eastern Wyoming) that uses acid leach. The company had switched to acid leach after a failed trial of alkaline leach/mining due to high carbonates in the ore body that were not previous examined in detail.

1.1.2 Processing

1.1.2.1 Location of processing

1. Off-site processing at an existing mill

Off-site processing at an existing mill would require temporary on-site handling of ore, ore slurry, or uranium bearing solution (depending on the associated mining method) produced at the Project site. This would require construction, operation, and decommissioning of surface facilities for safe storage and load-out of the uranium-containing material into approved containers for transport. This could include ponds, pads, buildings, and associated water management facilities. The ore, ore slurry, or uranium bearing solution would be sold, loaded onto appropriate transport containers, and transported along existing public provincial highways to an existing uranium mill. At the off-site mill, the ore, ore slurry, or uranium bearing solution would be processed through the mill for production of yellowcake and disposal of any resulting wastes under the licence and permits associated with the off-site facility. This option was considered in conjunction with a number of mining methods evaluated for the Project.

Evaluation of this option within the alternatives means assessment framework is focused on the activities and components that would be under Denison's operational control. Once the material is sold and leaves the Project site, the transport and transfer to an existing, licensed facility, the

assessment of processing is under the regulatory responsibility of the buyer/existing mill's operator, and as such, those of-sire activities fall outside the bounds of the Project-specific evaluation of alternative means.

2. On-site processing in purpose-built processing plant

The construction, operation, and decommissioning of a purpose-built, on-site processing plant would allow for processing of uranium bearing solution to yellowcake. On-site processing in a purpose-built processing plant was primarily considered for uranium bearing solution produced via ISR mining. This option would create wastes (process precipitates) that would require temporary handling on site before transported off site for reprocessing and final disposal.

1.1.2.2 On-site processing method

1. Ion exchange

Ion exchange is one of the most prevalent process technologies that is used in association with ISR mining. The process considers pumping uranium bearing solution from the recovery wells to the processing facilities. The initial step is to pump the uranium bearing solution into ion exchange columns where the uranium is filtered through the resin columns and loads up on the resin beads within. The resin columns are then stripped, and the resulting solution is sent to precipitation, dewatered and dried, and yellowcake is produced.

Due to the expected high dissolved uranium content in the uranium bearing solution and considering the limited capacity of the commercially available resin to load uranium operating in an acidic environment, the ion exchange columns considered for this Project would necessarily be of unique design.

Because the flow rate is so low and the grade so high, the columns would require a larger number of smaller columns than normal and would require a very complex piping system to constantly fill, strip, and refill the columns.

2. Solvent extraction

The option to add a solvent extraction circuit ahead of precipitation was also included as an alternative. The equipment required for solvent extraction is similar to ion exchange, with the addition of the mixer settler units.

3. Direct precipitation

Due to the high-grade nature of the uranium bearing solution returning from the wellfield the Project Wheeler, direct precipitation was considered as an alternative means. The direct precipitation process would operate exactly as the back end of the ion exchange and solvent extraction options, but without the concentrating and clarification step up front.

Uranium liberated from underground is routed to an iron-radium 226 removal circuit, where the pH of the solution is adjusted to allow the precipitation of iron hydroxide and other metals (process precipitates). Once the iron hydroxide has precipitated and fallen out of the solution, the uranium

bearing solution would be routed to the uranium precipitation circuit. Yellowcake would be produced from the uranium bearing solution following iron removal. The uranium bearing solution would be pH-adjusted to optimal levels for uranium precipitation with sodium hydroxide, then yellowcake product would be precipitated with hydrogen peroxide using sodium hydroxide to maintain optimal pH. Following uranium precipitation, the barren lixiviant or mining solution would be reconstituted to the proper acidity level prior to being pumped back to the wellfield for reinjection.

The precipitated yellowcake slurry would be transferred to a filter press, where excess liquid is removed. Following a freshwater wash step to further clean the yellowcake product, the resulting yellowcake would be transferred to the yellowcake dryer or calciner, which further reduces the moisture content, yielding the final dried, free-flowing product. Refined yellowcake is packaged in 55-gallon steel drums.

1.1.3 Water Management

1.1.3.1 Freshwater supply

Freshwater supply is needed for drilling, processing, the potable water plant, fire water system, and wash bay. The approximate freshwater needs during Operation have been estimated to be 40.5 m^3/hr or 0.01125 m^3/second.

1. Groundwater

A shallow groundwater well with a pipeline back to the main Project Area was considered as an alternative means for freshwater supply. The groundwater supply in the Athabasca Basin is abundant and requires less treatment than surface water to meet potable water requirements. The exploration camp for the Project has historically used groundwater as its potable water source. Groundwater withdrawal for the Project would occur at a shallow depth outside of the freeze wall to avoid any potential interaction with mining solution.

2. Surface water

Sourcing freshwater from a surface waterbody was included as an alternative means. This option would include an intake pipe and pump, with a surface pipeline back to the main Project Area. Information on nearby lake and stream hydrology was available from baseline programs to support evaluation of this option. Refer to details in the treated effluent discharge location assessment.

1.1.3.2 Drinking water

1. Truck drinking water to site

The option to bring treated drinking water to site was considered. This option would allow for less water treatment on site, with a simplified plant (likely a chlorination step) to generate water of a sufficient quality to meet other on-site water needs, such as hygiene water for showers and sinks.

The other freshwater needs for the Project (e.g., water needed in the process plant, drilling) would be obtained from a local freshwater supply. Evaluation of this option within the alternatives means

assessment framework included the transport component within the bounds of the Project-specific evaluation of alternative means.

2. Generate drinking water on site with a potable water treatment plant

The option to generate drinking water on site would require construction, operation, and decommissioning of a potable water treatment plant. The water treatment details would be defined later but would likely include ultrafiltration or reverse osmosis with ultraviolet filtration.

The other freshwater needs for the Project (process water, drilling) would be obtained from a local freshwater supply.

1.1.3.3 Treated effluent discharge location

The approximate treated effluent release rate anticipated during Operation and Decommissioning of the Project is 36.5 m^3/hr.

1. To groundwater

In this option, following treatment through the industrial wastewater treatment plant (IWWTP), treated effluent could be released to groundwater. Treated water would be of adequate quality for release and meet any applicable regulatory requirements or performance objectives that would be defined. A pipeline or series of pipelines would be constructed from the IWWTP to one or more purpose-built treated effluent discharge wells. The wells would be located in areas where the aquifer can accept the volume of treated effluent expected. The effluent discharge line on surface would be double walled with heat tracing to prevent operational issues with cold weather temperatures.

2. To surface water

Following treatment through the industrial wastewater treatment plant (IWWTP), treated effluent could be released to a nearby surface waterbody. Treated water would be of adequate quality for release and meet any applicable regulatory requirements or performance objectives that would be defined. A pipeline would be constructed from the IWWTP to a nearby lake, enter the lake, run along the bottom of the waterbody, and release treated effluent into the lake through a multi-port diffuser. The effluent discharge line on surface would be double walled with heat tracing to prevent operational issues with cold weather temperatures.

1.1.3.4 Treated effluent discharge location to surface water

Treated effluent discharge to surface water involved evaluation of a number of options (lakes) for discharge location. The approximate treated effluent release rate anticipated during Operation and Decommissioning of the Project is 36.5 m^3/hr.

See Figure 5 for a map of the lakes in the area, including lakes considered for treated effluent discharge location. See Figure 6 for the local drainage basin flows in the Icelander River drainage and Williams Lake drainage.

The Project site lies within the Wheeler River watershed, which is part of the Churchill River Basin. The Water Survey of Canada operates a hydrometric station on the Wheeler River downstream of Russell Lake (Station 06DA005). The station is located about 25 km east of the Project site and records flows from a contributing drainage area of 3,030 km^2. The hydrometric station has been in operation from 1973 to the present and discharge at Wheeler River downstream of Russell Lake ranges from approximately 10 to 27 m^3/second, with average flows around 18 m^3/second.

Surface water from the Project area is drained by two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage (Figure 6). Both drainages flow generally south into the northwest portion of Russell Lake. The estimated drainage areas of the Icelander River drainage and the Williams Lake drainage are 371 km^2 and 78 km^2, respectively. Downstream of Russell Lake, the Wheeler River flows into the Geikie River, which subsequently discharges to Wollaston Lake.

Figure 5: Waterbodies in the Project Area

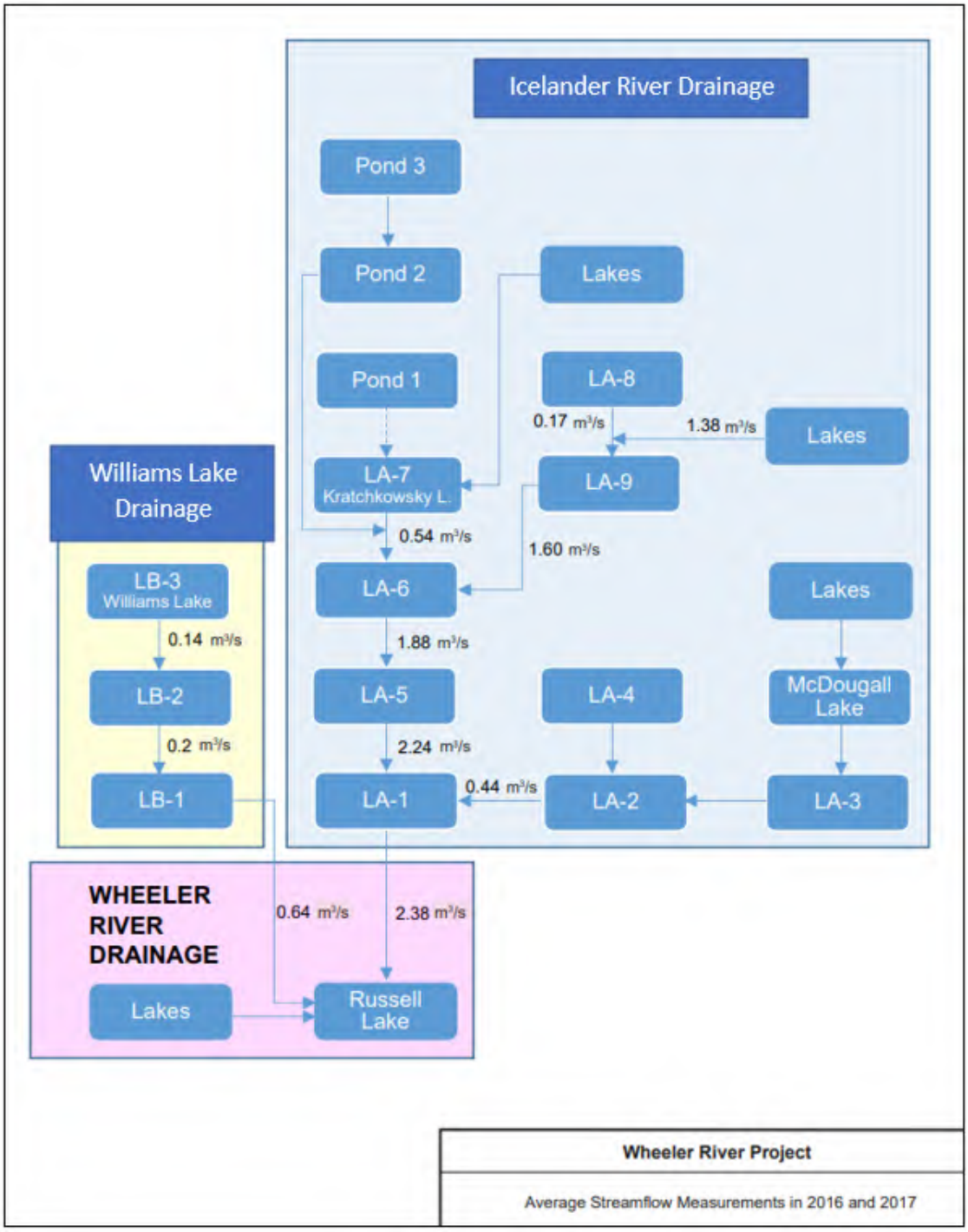


Figure 6: Average Streamflow Measurements in 2016 and 2017

As part of baseline studies, aquatic environment characterization efforts have included surveys and sampling for hydrology, water quality, limnology, sediment quality, aquatic habitat, bathymetry, plankton community, benthic invertebrate community, benthic invertebrate tissue chemistry, fish community, fish spawning habitat, and fish tissue chemistry. The more relevant aquatic environment

details for the assessment of alternative means are provided in each option below, with additional information in the aquatic baseline report for the EIS.

Water quality samples of the lakes considered for treated effluent discharge location were collected and analyzed as part of baseline environmental studies. Water quality in the lakes was generally characterized by neutral or slightly acidic pH values, low concentrations of nutrients and ions, as well as metal and radionuclide concentrations that were near or below analytical detection limits. Average streamflow measurements from 2016 and 2017 are shown below.

For the alternatives means screening, it was assumed that with any of the options, suitable specific locations for discharge can be determined without affecting fish habitat or spawning grounds and that a suitable land corridor for a discharge pipeline, and adjacent trail for monitoring purposes, can be determined.

1. Kratchkowsky Lake (LA-7; identified on Figure 5 and Figure 6)

   Kratchkowsky Lake is situated within the Icelander River drainage area, upstream of lake LA-6. Compared to Lakes 1, 5, and 6, Kratchkowsky Lake is a large waterbody. This lake has relatively low flow entering and discharging from the lake.

   Similar to Russell Lake, as part of baseline studies, a small portion of the lake was surveyed: the south-east bay of the lake. These surveys and summaries provided here are not representative of the entire lake, but provide information on the specific areas surveyed. Habitat assessments found the shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris. Within the area surveyed, the maximum depth was 6.78 m and the mean depth was 2.90 m. Using a straight line, Kratchkowsky Lake (LA-7) is approximately 3 km from the Project.

   A local resource user has commercially pulse fished on Kratchkowsky Lake in previous years (19-LK-ERFNTrap-134.68). Pulse fishing is fishing for one year at a lake and then not fishing at it for the following two years. The resource user fished using nets and would target Walleye, as well as Northern Pike, Whitefish, and Trout. No commercial fish harvests were reported from lakes local to the Project for the past five years (Government of Saskatchewan 2021).

2. Whitefish Lake north (LA-6; identified on Figure 5 and Figure 6)

   Whitefish Lake north is a relatively small lake. The lake has a surface area of 262,740 m^2, maximum depth of 2.71 m, mean depth of 1.57 m, and volume of 413,505 m^3. The substrate is sand and organic material. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes with presence of active erosional areas. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris. This lake receives flows from two separate streams, Kratchkowsky Creek (from LA-7; Figure 7) and Hart Creek (from LA-9; Figure 8). Considering the small size of the lake in

combination with the flows in and out, water in Whitefish Lake north (LA-6) has a relatively short retention time or flushing time. Using a straight line, Whitefish Lake north (LA-6) is approximately 900 m from the Project.

Figure 7: Kratchkowsky Creek flowing toward Whitefish Lake north (LA-6) from Kratchkowsky Lake (LA-7)

Figure 8: Hart Creek flowing toward Whitefish Lake north (LA-6) from LA-9

3. Whitefish Lake (south LA-5; identified on Figure 5 and Figure 6)

   Whitefish Lake south (LA-5) is a relatively small lake. The lake has a surface area of 324,049 m^2, maximum depth of 4.07 m, mean depth of 1.08 m, and volume of 332,503 m^3. The substrate is sand and organic material. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris. This lake receives flow from Whitefish Lake north (LA-6). Considering the small size of the lake in combination with the flows in and out, water in Whitefish Lake south (LA-5) has a relatively short retention time or flushing time. Using a straight line, Whitefish Lake south (LA-5) is approximately 500 m from the Project.

   A photo from September 2016 (Figure 9) shows the connecting channel between Whitefish Lake north (LA-6) and Whitefish Lake south (LA-5).

Figure 9: Connecting channel between Whitefish Lake north (LA-6) and Whitefish Lake south (LA-5)

4. McGowan Lake (LA-1; identified on Figure 5 and Figure 6)

   McGowan Lake (LA-1) is located upstream of Russell Lake along the Icelander River drainage. The lake has a surface area of 1,485,480 m^2, maximum depth of 9.67 m, mean depth of 5.51 m, and volume of 8,189,320 m^3. The substrate is sand and boulders. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by

jack pine forest and shallow to steep slopes with presence of old and active erosional areas. Cover observed included emergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation. McGowan Lake (LA-1) is downstream of LA-5, and LA-6 and, therefore, has slightly higher inflows and outflows than those lakes. Figure 10 shows the stream between Whitefish Lake south (LA-5) and McGowan Lake (LA-1) in September 2016. Using a straight line, McGowan Lake (LA-1) is approximately 2 km from the Project. A recreational lease (cabin) is located on the southwest portion of LA-1 and an industrial property (Rio Tinto) is south of LA-1.

Figure 10: Stream between Whitefish Lake south (LA-5) and McGowan Lake (LA-1)

5. Russell Lake (identified on Figure 5 and Figure 6)

Russell Lake is the largest lake evaluated and is located the furthest from the proposed Project Area. Russell Lake is located on the opposite side of Highway 914 from the Project. Wheeler River flows through the lake from the southwest and out towards the northeast. Russell Lake receives drainage basin on the southwest end of the lake where Cameco's Key Lake Operation releases treated effluent approximately 20 km upstream. The lake also receives drainage from two drainage basins near the proposed Project: the Icelander Lake drainage and the Williams Lake drainage.

As part of baseline studies, the portion of Russel Lake at the mouth of the Icelander River was surveyed. These surveys and summaries provided here are not representative of the entire lake but provide information on the specific areas surveyed. Habitat assessments found the shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes with presence of old and active erosional areas. Cover observed included

emergent and submergent vegetation, interstitial spaces in coarse substrate, and overhanging vegetation. In the area surveyed, the maximum depth was 18.78 m and the mean depth was 3.04 m.

A local land user (ERFN Trapper) has commercially pulse fished on Russell Lake in previous years (19-LK-ERFNTrap-134.68). The resource user fished using nets, targeting target Walleye, as well as Northern Pike, Whitefish, and Trout. No commercial fish harvests were reported from the lakes local to the Project for the past five years (Government of Saskatchewan 2021).

Russell Lake is used for recreational fishing. A number of recreational leases and one traditional land use lease can be found along the lake shore, many of which have cabins that are used primarily for a few weeks in the summer months. Additionally, outfitters operate on Russell Lake and are mainly fly-in fishing camps. Information available from ERFN showed a historical winter route crossing a large portion of Russell Lake. Two industrial use properties (SaskPower) occur on the southwest portion of Russell Lake. Using a straight line, Russell Lake is over 8 km from the Project site.

6. Mardoc Lake (LA-4; identified on Figure 5 and Figure 6)

   Mardoc Lake is situated within the eastern sub-basin of the Icelander River drainage area, upstream of LA-2 and McGowan Lake (LA-1). It is a headwater lake with a maximum depth of 13 m. Flows out from the lake (via LA-2) are relatively low at approximately 0.44 m^3/second.

7. Williams Lake (LB-3; identified on Figure 5 and Figure 6)

   Williams Lake is a headwater lake located in the Williams Lake drainage and upstream of LB-2. The lake is close to Denison's exploration camp. A local land user (ERFN trapper) had an identified winter route crossing through Williams Lake (LB-3).

   The lake has a maximum length of 3.5 km, surface area of 1,522,984 m^2, maximum depth of 17.82 m, mean depth of 4.55 m, volume of 6,933,788 m^3. The substrate is boulders and sand. The habitat assessment completed found shoreline vegetation mainly consisted of shrubs and black spruce backed by jack pine forest and shallow to steep slopes. Cover observed included emergent and submergent vegetation, interstitial spaces in coarse substrate, overhanging vegetation, and woody debris.

1.1.4 Waste Management

1.1.4.1 Organic waste disposal

Organic waste generated on site is expected to be mainly food waste, but can also include cardboard, paper, wood chips, brown paper lunch bags, and other compostable materials.

Following stringent waste characterization and segregation, organic waste generated in the camp and other facilities would be organic material without hazardous material or radionuclide contamination. Assuming 150 individuals on site generating a food waste volume of 250 g per meal/person, the Project

could produce approximately 788 kg of food waste per week. Adding other organic wastes (cardboard, paper, wood chips, brown paper lunch bags, and other compostable materials) would increase the total volume of organic waste requiring disposal.

At a later stage, Denison may consider adding biosolids (e.g., solids from the domestic wastewater plant) to the organic waste stream as the Project engineering advances and during Operation. For the purposes of this alternative means evaluation, the following three options were considered for the disposal of organic wastes generated as part of Project activities.

1. On-site disposal using an incinerator

   With this option, organic waste would be separated from other waste streams. Organic waste would be collected on a regular collection schedule for incineration. An on-site incinerator would be required; the design, construction, operation, and decommissioning of the incinerator would be the responsibility of Denison and its contractors. Testing and monitoring for the incinerator's performance criteria and emissions would be done to meet requirements in approvals.

2. On-site disposal in domestic landfill

   With this option, organic waste would be combined with domestic waste and disposed of in an on-site domestic landfill. It is assumed the contribution of organic wastes would slightly increase the total volume of domestic waste expected over the life of the mine and selecting this option would result in the need for a bigger domestic landfill footprint. The domestic waste landfill would be designed, constructed, operated, and decommissioned on site by Denison staff and contractors. It would be designed according to best practices and meet guidelines.

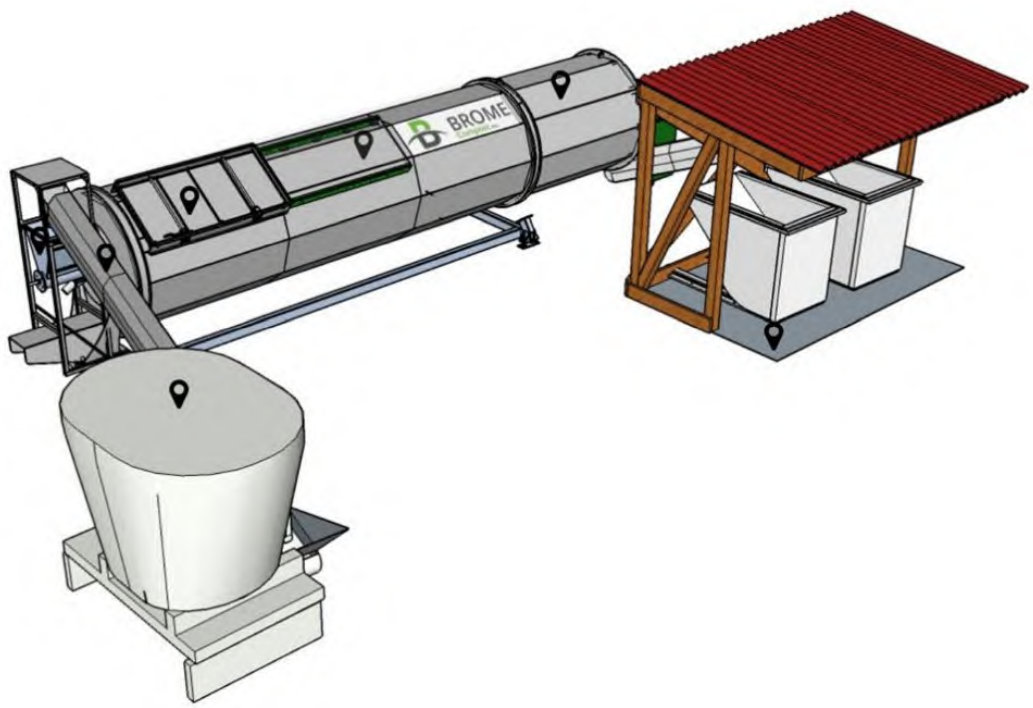
3. On-site composting

   A contained and partially automated composter, such as the Brome composting system, is an example of what could be used for on-site composting. The composting system would likely be contained within a seacan near the proposed domestic waste landfill, although the exact location would be determined as engineering advances.

   Organic waste would be separated from other waste streams. Organic waste would be collected in clear, compostable bags on a regular collection schedule. A sorting step may be required for greater control of waste streams entering the composter and to provide optimal quality of the final compost product. After sorting, the waste will be added into the composter where it has a residence time of 9 to 20 days. The compost would be automatically rotated at regular intervals to help maintain the required anaerobic environment and the temperature inside the composter would be kept above 55°C. Gases produced during the composting process are to be vented to the outside through a vent hood at the output of the composting unit. Compost would be discharged with each rotation and collected in bins where it would be screened and large material removed and returned to the composter for additional decomposition.

After composting is complete, an outdoor curing phase will be required during summer months. Based on experience with the Brome composting system at other mine sites, the finished compost is not expected to be a wildlife attractant. Prior to any compost being used on site for remediation purposes, the compost will be tested to determine its suitability for unrestricted or restricted use, based on the Canadian Council of Ministers of the Environment guidelines for compost quality (Canadian Council of Ministers of the Environment 2005).

Figure 11 shows a typical Brome composter set up. The mixer with a conveyor and feeder moves organic material into the composting vessel. At the discharge point, two bins collect mature compost that is ready for curing.



Source: www.bromecompost.com

Figure 11: Typical Brome Composter

1.1.4.2 Process precipitate management

Process precipitates will be generated in the processing plant prior to the uranium extraction circuit and in the first water treatment stage of the industrial wastewater treatment plant (IWWTP). These precipitates will contain non-radionuclides (e.g., sulphur, iron, copper) and radionuclides (e.g., uranium, radium-226, thorium-230) extracted from the ISR mine and brought to surface in the uranium bearing solution. Two options were evaluated as alternative means for disposal. The process precipitates are expected to contain economical concentrations of uranium in the range of 2%. The volume of process precipitates generated during the life of mine is expected to be around 50,000 m^3; however, it should be noted that this volume is very conservative as it incorporates a 15-year Operation phase and this production assumption exceeds the known reserves at the Phoenix deposit.

1. On-site permanent disposal

   Under this option, Denison would design, construct, operate, and decommission an on-site permanent disposal area for the process precipitates. This area would need to be designed to meet the CNSC's requirements for safety and control areas for protection of workers and the environment.

2. Off-site reprocessing and final disposal

   With this option, the process precipitates would be temporarily stored on site on an appropriately designed area for worker and environmental protection, e.g., an area double lined with leak detection capabilities. Contact water would be captured and treated on site before release to the environment.

   As part of Decommissioning, the process precipitates would be removed off site for reprocessing and eventual disposal at an appropriately licensed, third-party facility.

1.1.4.3 Domestic waste disposal

Following stringent waste characterization and segregation, the domestic waste generated as part of Project activities would comprise non-recyclable, non-hazardous material without radionuclide contamination and would, therefore, be suitable for disposal in a domestic waste landfill. The expected volume of domestic waste generated over the life of mine is 34,400 m^3. Examples of waste destined for disposal in a domestic landfill are non-recyclable plastics, broken furniture, textiles, and wood. Domestic waste is not expected to contain organic waste.

1. Collection and disposal off site by a third-party contractor

This option assumes a regional off-site landfill would have capacity to accept the domestic wastes generated at the site over the life of mine. Domestic waste would be collected by Denison and temporarily stored and managed on site in appropriate containers. Transport of domestic waste from the Project to the approved landfill facility would be done by a third-party contractor.

2. Collection and disposal in an on-site domestic landfill

This option assumes a dedicated domestic waste landfill is designed, constructed, operated, and decommissioned on site by Denison staff and contractors. Conceptually, the domestic landfill would have a composite liner system with leachate collection. The design consists of a high-density polyethylene (HDPE) liner directly over a geosynthetic clay liner (GCL), with leachate collection system above the composite liner. The leachate collection pond associated with the domestic landfill would have a double composite liner system with leak detection. The leachate would be collected by vacuum truck and treated in the industrial wastewater treatment plant. The landfill would be fenced and the surface contoured to direct non-contact runoff away from the facility. The domestic landfill would require regular covering with clean soil to prevent wind borne litter leaving the landfill and to avoid attracting wildlife and birds. Performance of the domestic landfill and leachate containment system would be monitored through a network of groundwater monitoring wells, including at a minimum one upgradient and two downgradient wells.

1.1.5 Access and Transportation

1.1.5.1 Access road alignment

1. Option 1 – Direct route

The first option considered for accessing the Project site was a direct route that intersected a drumlin and followed the height of land to the location of the proposed site facilities. The alignment has a total length of 5.31 km and would result in a total cut of 904,400 m^3 and 36,100 m^3 of fill. Based on a review of the orthophoto, the route would not require a stream crossing. This route is at least 200 m away from an open water body and is more than 500 m from the recreational lease/private cabin on McGowan Lake (LA-1), as illustrated in the plan and profiles in Figure 12, Figure 13.

2. Option 2 – Direct route to reduce cut volumes

The second option considered for accessing the Project site attempted to reduce the cut volume generated in Option 1, which directly intersected a drumlin. To do so, Option 2 skirted the perimeter of the drumlin and then followed the height of land to the location of the proposed site facilities. The alignment has a total length of 5.77 km and would result in a total cut of 85,200 m^3 and 71,100 m^3 of fill. Based on a review of the orthophoto, the route would not require a stream crossing. This option is within 200 m (approximately 140 m) of an open waterbody and is located approximately 240 m from the recreational lease/private cabin on McGowan Lake (LA-1), as illustrated in the plan and profiles in Figure 12 and Figure 14.

3. Option 3 – Following part of the existing exploration access road

The third option considered for accessing the Project site considered following near the current exploration access road, following the height of land to the location of the proposed site facilities. The alignment has a total length of 6.47 km and would result in a total cut of 57,300 m^3 and 37,100 m^3 of fill. Based on a review of the orthophoto, the route would not require a stream crossing. This option is at least 200 m away from an open water body and is more than 1,000 m from the recreational lease/private cabin on McGowan Lake (LA-1), as illustrated in the plan and profiles in Figure 12 and Figure 15.

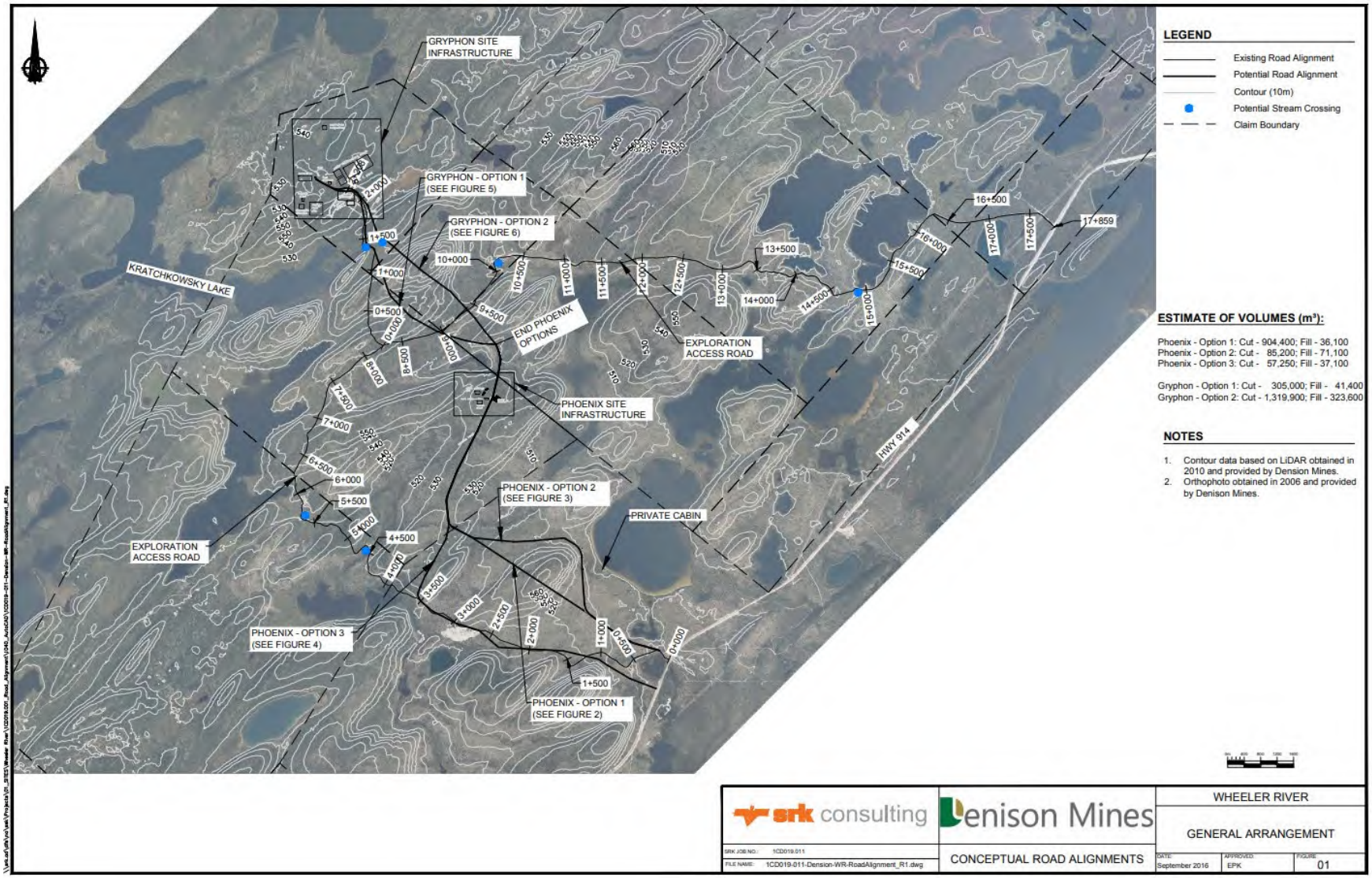


Figure 12: Overview of Three Access Road Alignment Options

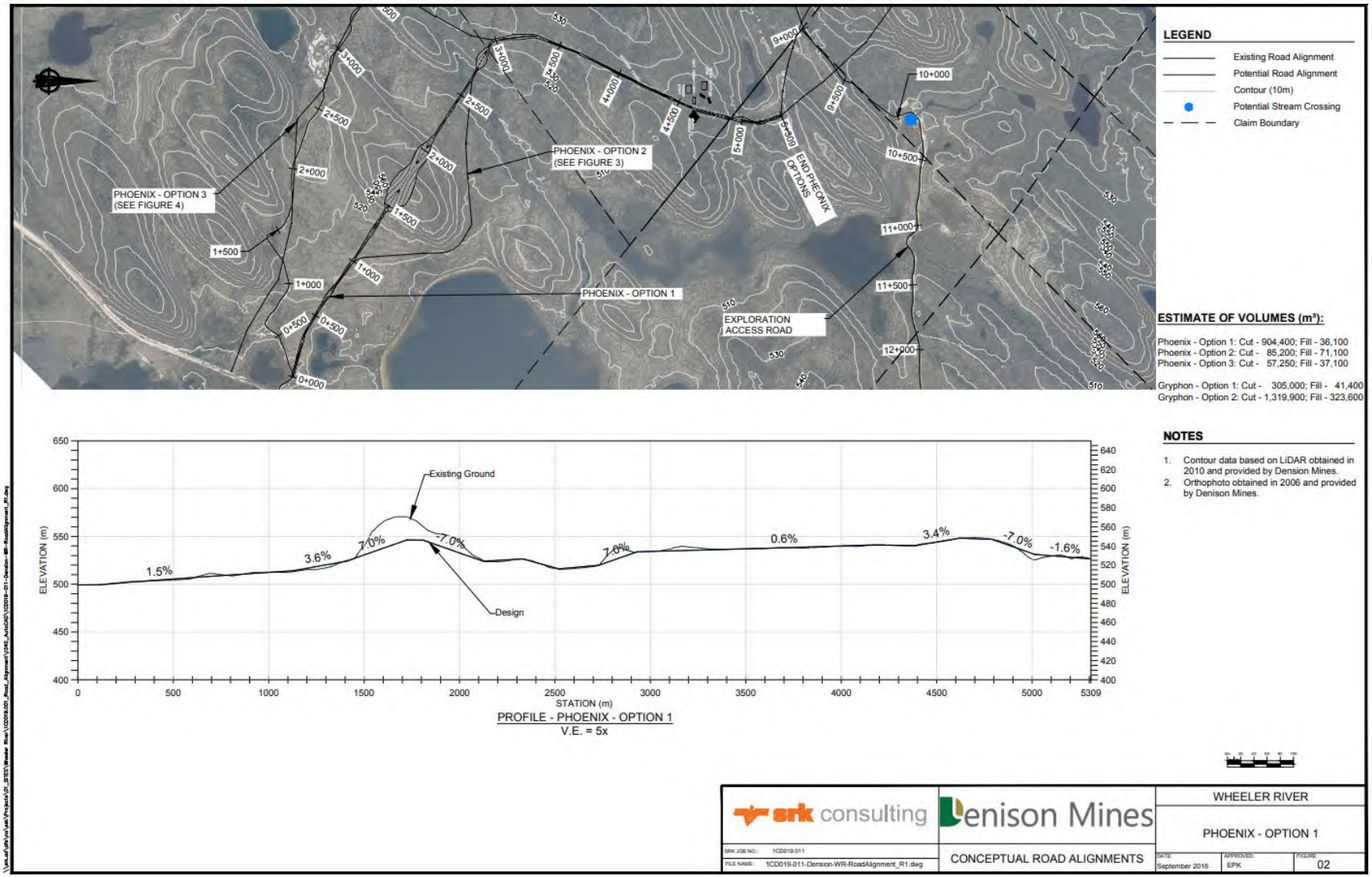


Figure 13: Access Road Option 1

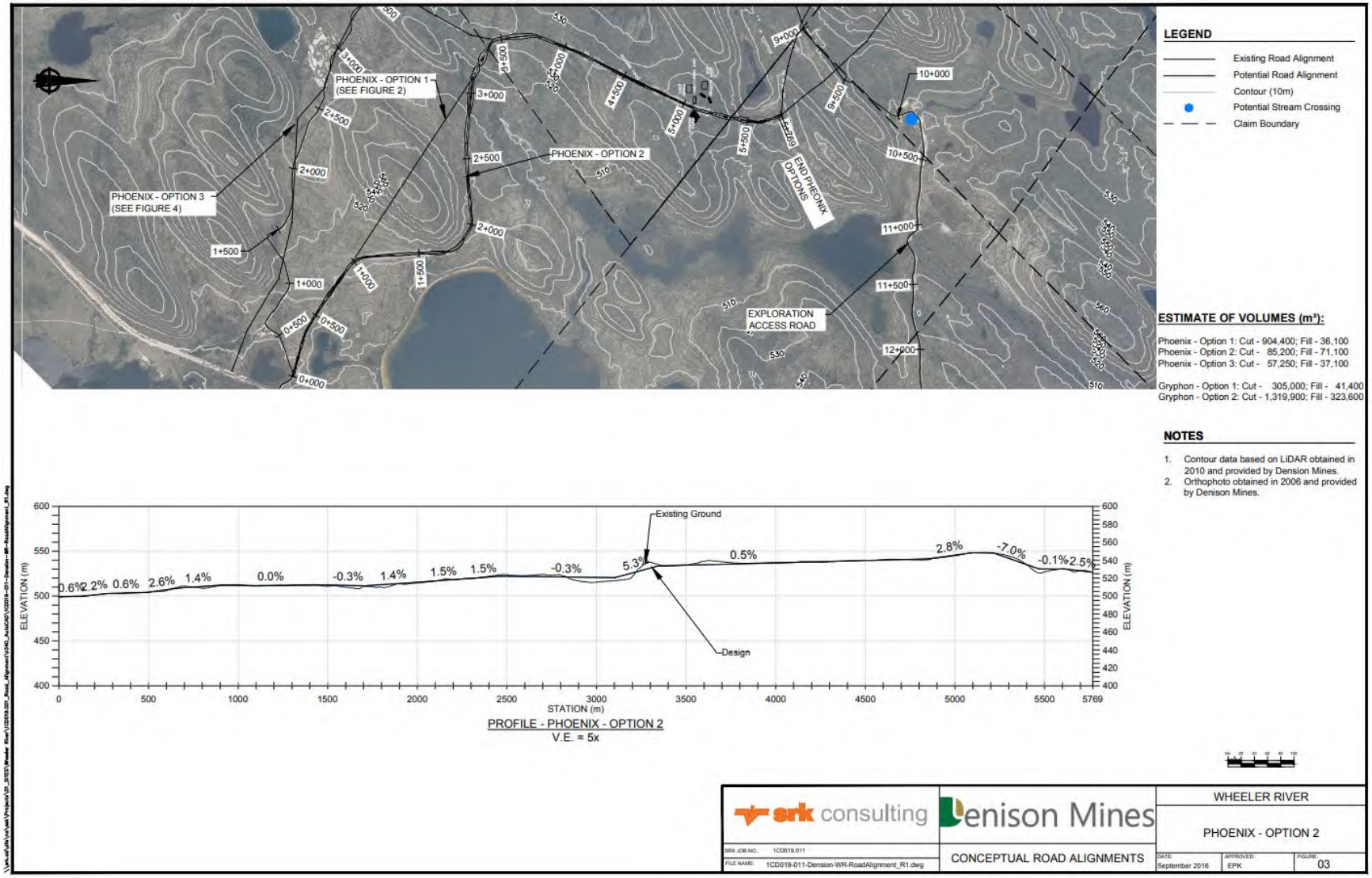


Figure 14: Access Road Option 2

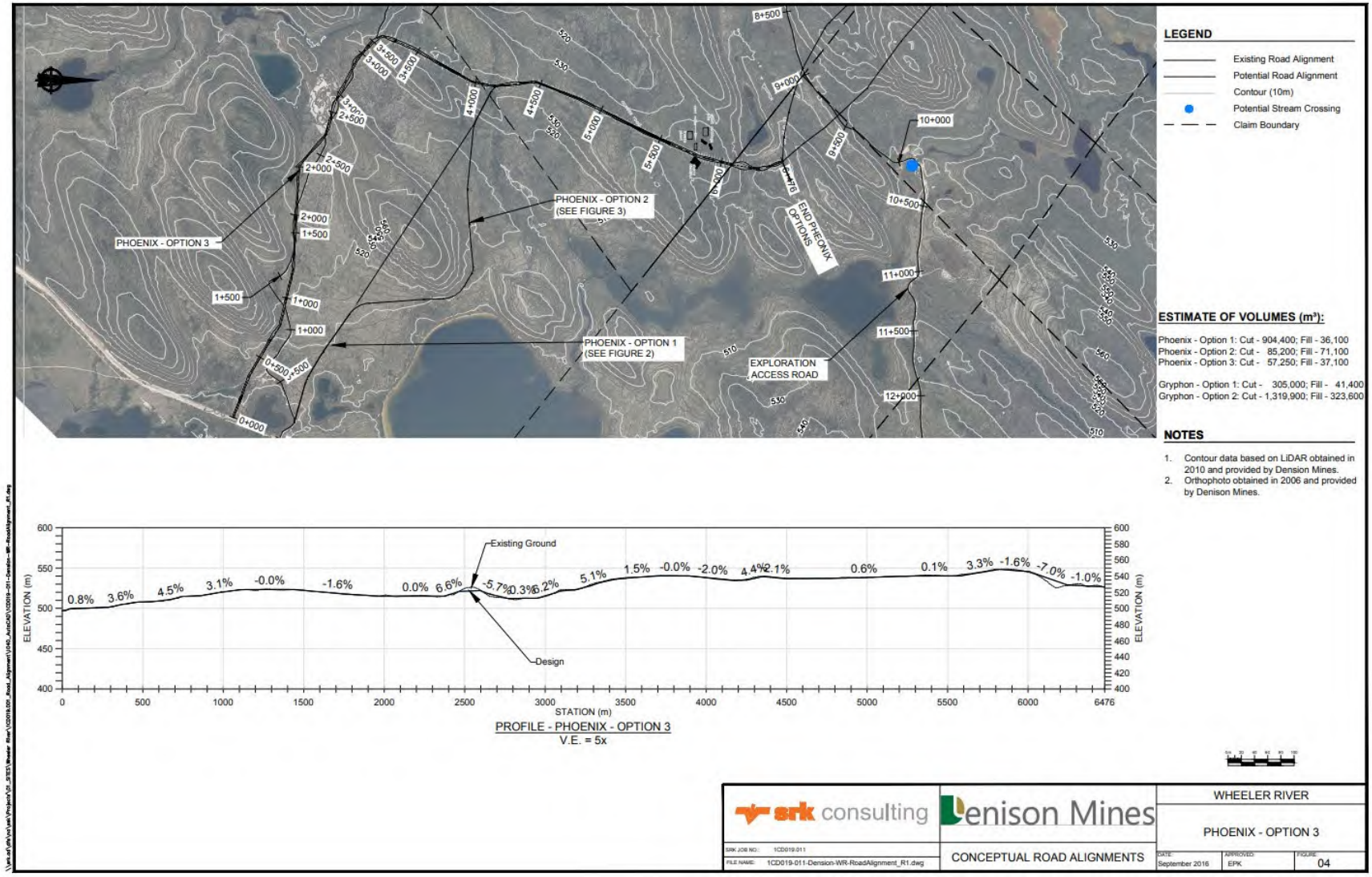


Figure 15: Access Road Option 3

1.1.5.2 Stream crossing structures

The proposed road from the Project Area to the proposed on-site airstrip would cross two streams. Both stream crossings are upstream of Whitefish Lake north (LA-6). Kratchkowsky Creek is downstream of Kratchkowsky Lake (LA-7) and Hart Creek is downstream of LA-9. Refer to Figure 5, Figure 6, Figure 7, Figure 8, and Figure 16.

The two stream crossings would be installed at locations where crossings previously existed, but were decommissioned by Cameco in 2015. The previous stream crossings at these locations were clear span bridges. The crossing at Kratchkowsky Creek was a 15 m single span steel girder bridge. The crossing at Hart Creek was a 30 m double span steel girder bridge with a mid-channel steel culvert for support. Two options were considered for these two crossings associated with the Project: culverts and clear span bridges.

1. Culverts

   Depending on the width of the stream, one or a series of large-diameter round culverts were considered as an option for stream crossing structures. Culverts would be designed following best practice for design, construction, and maintenance as indicated by standards and codes of practice for fish passage and to withstand a flood event.

   Vegetation removal, fill, and grading would be required only to the extent necessary to prepare the area for culvert installation. Laydown areas would be kept adjacent to the roadway and above the flood-prone area. Culverts would be pre-assembled in the laydown area and lifted into place in the stream bed.

   Culverts placement in the streams would result in unavoidable harmful alteration, disruption, or destruction (HADD) of fish habitat under subsections 34(1) and 35(2) of the *Fisheries Act* (Government of Canada 2019).

   Culverts would be inspected periodically to remove accumulated material and debris that may prevent efficient passage of water and fish through the structures.

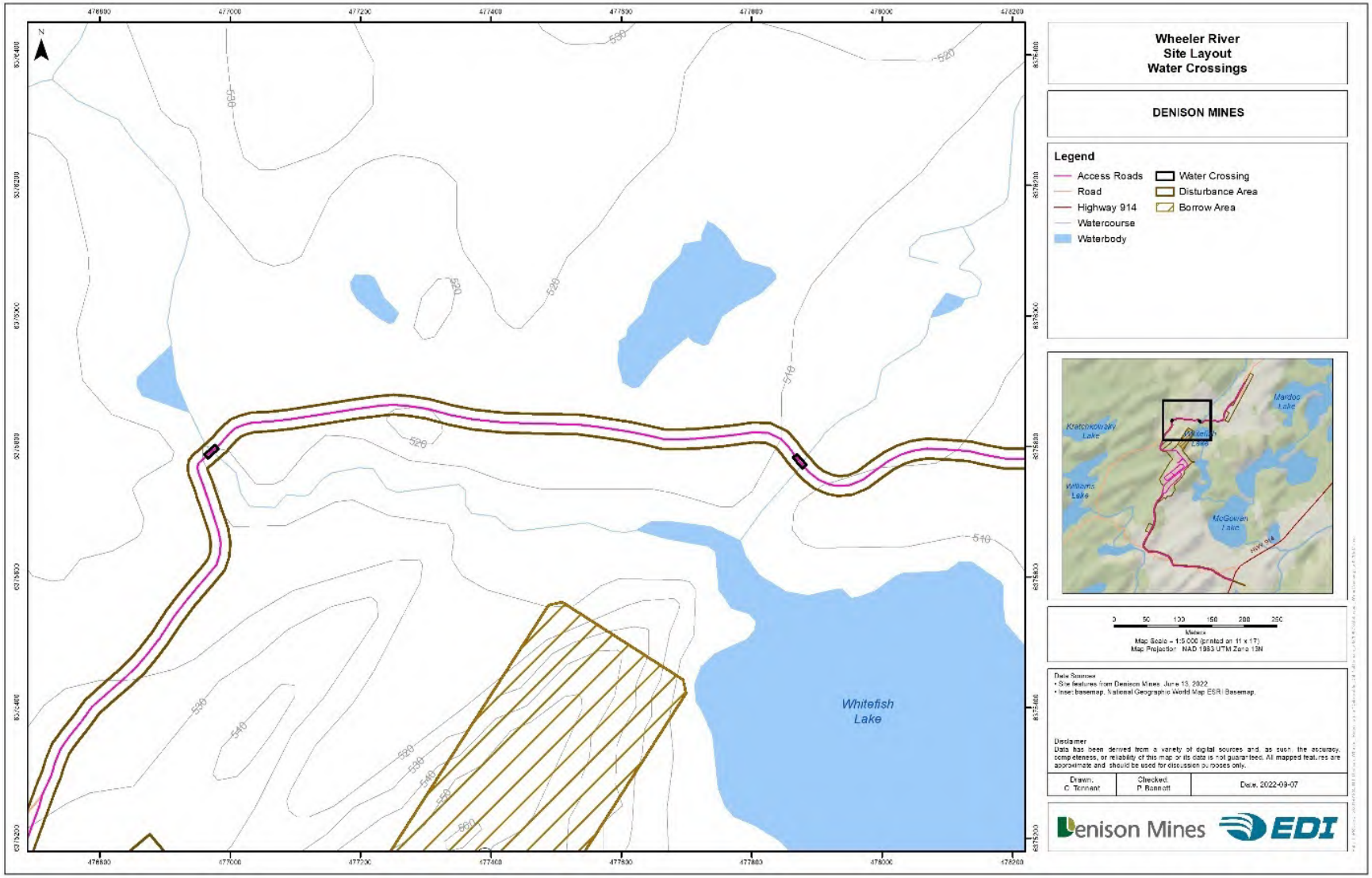


Figure 16: Proposed Stream Crossing Locations

2. Clear span bridges

   The option for clear span bridges allows for road crossing without in-water works, supports or buttresses. This option would also be similar to what was previously in place at these locations.

   Vegetation removal, fill, and grading would be required only to the extent necessary to prepare footings for the bridge, which would remain above the high-water mark. Heavy construction equipment would be needed to prepare footing areas for concrete. Laydown areas would be kept adjacent to the roadway and above the flood-prone area. Crossings would be pre-assembled in the laydown area and lifted into place.

   It is expected that the works associated with construction of clear span bridges could be either conducted to avoid fish habitat or conducted over a short duration, at a small spatial scale, and during appropriate timing windows. As such, the use of clear span bridges for the stream crossing structures would not be expected to constitute a HADD of fish habitat under subsections 34(1) and 35(2) of the *Fisheries Act* (Government of Canada 2019).

   Clear span bridges would be inspected periodically to remove accumulated material and debris upstream and downstream, although accumulated debris volumes are expected to be minimal because the bridge will span the full width of each stream.

1.1.5.3 Worker transportation

For all worker transportation options, pick-up points would be available at key communities based on an analysis of transportation efficiency. All of the worker transportation alternative means assume a worker rotation system would be in place for staff and contractors.

1. Ground transport

   Ground transportation involves using buses, vans, and trucks to transport Denison staff and contractors between pick-up points and the camp at the Project. Ground transport is the current, main mode for mobilizing Denison's exploration staff to and from the site.

   Approximate distances and travel times to the Project Area are provided for context:
   - 740 km or 10 hours from Saskatoon;
   - 470 km or 7.5 hours from La Ronge;
   - 450 km or 7 hours from Patuanak; and
   - 355 km or 5 hours from Pinehouse.

   Evaluation of this option within the alternatives means assessment framework assumes the ground transport is Denison's responsibility, and as such, the transport was considered within the bounds of the Project-specific evaluation of alternative means.

2. Air transport to existing airstrip at nearby Cameco operations

   Cameco operates two existing airstrips, one at each of the Key Lake and McArthur River operations. For this option, an agreement would need to be developed between Denison and Cameco. For the purposes of this alternative means screening assessment, it is the assumed that an agreement is attainable.

   Air transport would be chartered through a third-party carrier. Approximate flight time from Saskatoon to the Key Lake or McArthur River operations airstrip, with a pick-up stop in La Ronge, would be 2 hours.

   On shift change days, Denison staff and contractors would travel by van or bus between the airstrip and the camp. The distance between the Project and the McArthur River Operation airstrip is about 40 km and the drive would take approximately 30 minutes. The distance between the Project and the Key Lake Operation airstrip is about 30 km and the drive would take approximately 25 minutes.

   Evaluation of this option within the alternatives means assessment framework assumes the ground transport component of the routing is Denison's responsibility, and as such, the ground transport was considered within the bounds of the Project-specific evaluation of alternative means.

3. Air transport to new airstrip constructed and operated by Denison

   For this option, Denison would design, construct, operate, and decommission an airstrip as part of the Project to meet the need for staff and contractor transportation to and from site. This option also requires the construction of a 5 km long road from the main area of Project infrastructure to the proposed airstrip, which would require two stream crossings (Figure 17). An airstrip terminal building would be required near the airstrip, which would have electricity, heat, and washroom facilities. Two double-walled Jet A fuel tanks would be needed to provide site service to aircrafts as required.

   A 1,600 m long airstrip would be positioned in a natural and relatively flat area, and an area to the northeast of the main Project infrastructure was selected based on topography and proximity to the main Project components (Figure 17). The magnetic headings are 03/21, which is similar to both the Collins Bay airport and Key Lake Operation airstrip. The runway would be designed to accommodate the aircraft presently used by existing mining operations in northern Saskatchewan to transport workers into and out of site. The approach line to the airstrip from the southwest would clear the surface facilities by 500 m.

   Air transport would be chartered through a third-party carrier. Approximate flight time from Saskatoon to the airstrip, with a pick-up stop in La Ronge, would be 2 hours. On shift change days, Denison staff and contractors would travel by van or bus between the airstrip and the camp. The distance between the camp and the airstrip is about 5 km and the drive would take approximately 5 minutes.

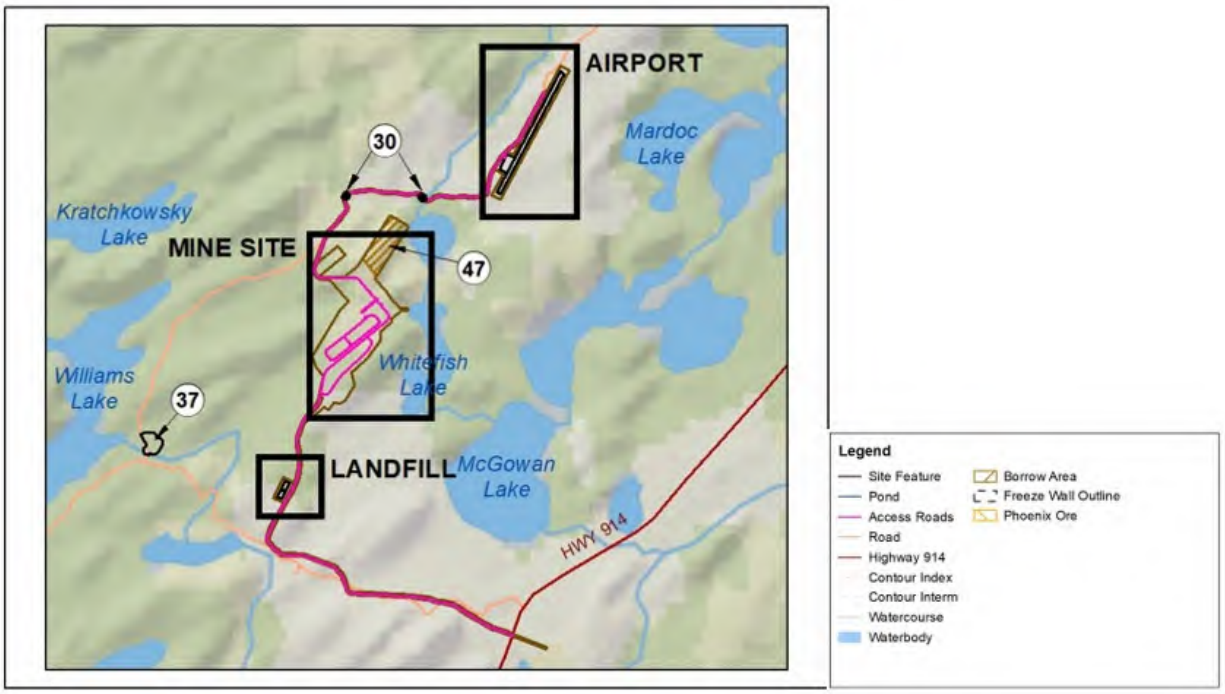


Figure 17: Potential Site Layout for On Site Airstrip Option

1.1.6 Power

1.1.6.1 Primary power supply

The estimated peak power demand for the Project is 7.6 MW. A variety of options have been considered for the primary power supply.

1. Liquefied natural gas (LNG) power plant

   Powering the Project with LNG would require appropriately designed tanks to store approximately 250,000 L. Liquefied natural gas would be transported to the Project on a regular basis by third-party suppliers; however, there are currently no existing or proposed LNG facilities in Saskatchewan. As a partial estimate of operating costs, the purchase of liquefied natural gas to meet the Project's power demand could be in the range of $8M per year. This does not include other costs for transportation of LNG, power plant equipment purchase or rental, construction and monitoring of tanks and containment systems. In addition to the above, the evaluation of this option within the alternatives means assessment framework also included the transport component (need to transport LNG to site) within the bounds of the Project-specific evaluation of alternative means.

2. Solar photovoltaic power plant

   Photovoltaic panels are used to convert thermal energy into electricity. As a very rough approximation, a 1 MW solar photovoltaic power plant requires approximately 4 ha of land area to house the photovoltaic panels. With a peak power demand of the Project being 7.6 MW, it is

reasonable to assume that an area of approximately 30 ha would be needed for panels. This estimate does not consider the Project's latitude, power losses, plant output, an inverter, and batteries for storage needs to consistently meet power demands. As a comparison, a 10 MW solar project proposed in southern Saskatchewan consisted of 37,000 photovoltaic panels and all solar project components combined to cover an area of 35.8 ha (Saskatchewan Environmental Assessment Branch 2020). The cost of a 10 MW solar photovoltaic power plant is estimated at >$15M.

3. Diesel generators

Powering the Project with diesel would require appropriately designed tanks on site to store approximately 500,000 L. Diesel would be transported to the Project on a regular basis by third-party suppliers. As a partial estimate of operating costs, the cost of diesel to meet the Project's power demand is approximately $12M per year. This does not include other costs for transportation of fuel, generator purchase or rental, construction and monitoring of tanks and containment systems. In addition to the above, the evaluation of this option within the alternatives means assessment framework also included the transport component (need to transport diesel to site) within the bounds of the Project-specific evaluation of alternative means.

4. Provincial power grid

SaskPower is the electricity transmission and distribution provider for the province of Saskatchewan. This option involves tying into one of SaskPower's existing distribution lines: the 138 kV overhead transmission line that runs along Highway 914. The installation costs of the power line extension from the existing line into the Project site are approximately $6M. Most power feeding the line is generated at the Island Fall hydroelectric station. Annual electrical costs are estimated at $4M per year. An electrical substation would be needed on site to step down and distribute the power from the transmission line to the site.

With this option, SaskPower will be responsible for conducting activities such as line routing, environmental studies, permitting, public consultation, and engineering design work as applicable to the load interconnection. Although it would be largely ancillary to the Project, some of this information was considered in the evaluation of alternative means.

1.1.7 Support facilities

Efforts have been made to reduce the overall footprint of the Project as the design process has progressed; however, the overall process has been one of incremental optimization as opposed to considering alternative locations that would fundamentally change the Project assessment basis or unnecessarily expand the site footprint/Project Area. Denison has also made efforts to minimize new clearing of vegetation by optimizing the site layout within previously disturbed areas. As with many natural resource projects, the location of the resource dictates the mining location and, therefore, the location of supporting infrastructure.

As an example of incremental optimization, the evolution in the proposed camp location is presented in the alternative means assessment.

1.1.7.1 Camp location optimization

All alternative camp locations were positioned close to the site road. The camp locations were also located southwest of all the main sources of air emissions (processing plant, special waste rock pad, precipitate storage areas) based on prevailing wind information.

1. First location – Prefeasibility

At the prefeasibility stage, a camp location was selected to provide views over the nearby lake. On further review this location required a large fill volume to develop.

2. Second location - Reduce fill volumes

At the next design stage, the location of the camp was moved south and west along the access road. It was still very close to the other Project components, but reduced the fill volumes relative to the first location.

3. Third location – Southwest from second location

As the technical assessments for the environmental assessment were underway, the air dispersion modelling results flagged potential minor air quality concerns at the camp location (i.e., the “second location”). Although the predictions were based on conservative assumptions, Denison made the decision to evaluated a camp location further south and west along the access road to potentially provide increased distance between the camp and other Project components.

Table 1: List of Project Component and Activity Alternative Means

Project Component		Alternative Means Considered						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Mining	Method	Open pit	Jet Boring	Surface Boring	Micro Tunnel Boring	ISR		
	Freeze design for tertiary containment of mining solution	Freeze dome	Freeze wall					
	Permeability enhancement	Hydraulics	Propellant	Mechanical				
	Mining solution	Alkaline solution	Acidic solution					
Processing	Location of processing	Off-site processing at an existing mill	On-site processing in purpose-built processing plant					
	On-site processing method	Ion exchange	Solvent extraction	Direct precipitation				
Water management	Freshwater supply	Groundwater	Surface water					
	Drinking water	Truck drinking water to site	Generate drinking water on site with a potable water treatment plant					
	Treated effluent discharge location	To groundwater	To surface water					
	Treated effluent discharge location to surface water	Kratchkowsky Lake (LA-7)	Whitefish Lake north (LA-6)	Whitefish Lake (south LA-5)	McGowan Lake (LA-1)	Russell Lake	Mardoc Lake (LA-4)	Williams Lake LB-3
Waste management	Organic waste disposal	On-site disposal using an incinerator	On-site disposal in domestic landfill	On-site composting				
	Process precipitate management	On-site permanent disposal	Off-site reprocessing and final disposal					

Project Component		Alternative Means Considered						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
	Domestic waste disposal	Collection and disposal off site by a third-party contractor	Collection and disposal in an on site domestic landfill					
Access and transportation	Access road alignment	Direct route	Direct route to reduce cut volumes	Follows part of the existing exploration access road				
	Stream crossing structures	Culverts	Clear span bridges					
	Worker transportation	Ground transport	Air transport to existing airstrip at nearby Cameco operations	Air transport to new airstrip constructed and operated by Denison				
Power	Primary power supply	Liquefied natural gas power plant	Solar photovoltaic power plant	Diesel generators	Provincial power grid			
Support facilities	Camp location	First location - Prefeasibility	Second location – Reduce fill volumes	Third location - Southwest from second location				

1.2 Consideration of Technical and Economic Feasibility along with Land Use Screening

Alternative means considered in an EIS must be technically and economically feasible (CEAA 2015). Technical feasibility pertains to the ability to safely and efficiently implement the Project in a manner that meets Denison's operating requirements and is in compliance with current applicable technical standards and codes. Economic feasibility pertains to the ability to implement the Project in a manner that allows Denison to meet the needs of its customers while remaining financially viable. Environmental or socio-economic factors can affect technical and/or economic feasibility, usually by requiring mitigation measures that are technically challenging or very costly. Accordingly, the need to implement such measures is considered in the identification of technically and economically feasible alternatives.

Denison integrated an additional category at this early stage in the alternative means assessment framework: land use screening. Although technical feasibility can include land use considerations, Denison opted to include land use separately to provide greater transparency on the approach taken and also in recognition of the importance of local land use that has been communicated by interested parties. In conjunction with screening for technical and economic feasibility, an initial evaluation was conducted to review Indigenous and other land use in the area to identify alternative means that may interact with areas of high land use intensity or areas of cultural importance (e.g., known gravesites). Consideration was given to information made available to Denison in the early stages of project planning. Mapped land use information provided by English River First Nation and Pinehouse Kineepik Métis included locations of trails, burial/sacred locations, plant harvesting, hunting, fishing, camping, and cabins. The land lease map identified traditional, recreational, and industrial land uses based on lease data provided by the Saskatchewan government (Figure 18). Subsequent, additional consideration of engagement information, including Indigenous and other land and resource use is completed at later stages in the alternatives means assessment framework. The purpose of considering land use information at this stage was to identify land use that could compromise the feasibility of the Project and screen an alternative means out from additional evaluation.

In consideration of the above, the technical feasibility criteria, economic feasibility criteria, and land use criteria considered by Denison in relation to the Project included the following:

- Technologically feasible: Alternative is based on technology that has not been determined to be adequately effective to the extent that technical uncertainty is such to deem an alternative as unsuitable for implementation. Consideration of technical feasibility includes a consideration of safety.

- Financial feasibility: Alternative results in capital (i.e., equipment purchase, installation, construction), operating (e.g., reagents, consumables, operating risks, labour requirements) and/or closure costs (i.e., decommissioning duration and scope) that threaten the economic feasibility of the Project.

- Land use: Alternative will interact with an area of high land use intensity or an area of high cultural importance based on information available to Denison during early Project planning that would compromise the feasibility of the Project.

For each Project component identified in Table 1, a consideration of the technical, economic, and land use characteristics of each alternative is provided in Table 2 to identify feasible alternatives for further assessment and to eliminate those alternative means that are not considered to be feasible from a technical, economic, or land use lens. Only those alternatives that are deemed technically and/or economically feasible and avoided interaction with areas of high intensity or high importance land use, are carried forward for further assessment. The initial screening of alternatives is summarized in Table 3.

Figure 18: Provincial Land Leases for Traditional, Recreational, and Industrial Land Uses

Table 2: Screening of Alternative Means for Technical and Economic Feasibility with Consideration of Land Use Factors

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
Mining	Method	Option 1 Open pit Option 2 Jet Boring Option 3 Surface Boring Option 4 Micro Tunnel Boring Option 5 ISR	The financial cost associated with Option 1 deems this option as uneconomic. Options 2, 3, 4, and 5 would be technically and economically feasible.	Options 1 through 55 would result in similar footprint locations (to match the uranium deposit location), although the size of the footprint would vary. Overall, the options would have a similar interaction with known land use and proximity to the closest recreational land lease. Based on available land use information, Options 1 through 5 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 was screened out from additional evaluation for economic factors. Options 2, 3, 4, and 5 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Freeze design for tertiary containment of mining solution	Option 1 Freeze dome Option 2 Freeze wall	Option 1 is technically and economically feasible using directional drilling techniques; the costs and risks are higher than Option 2. Option 2 is technically and economically feasible using diamond drilling techniques. The ground freezing technology is the same for both options.	Options 1 and 2 would result in similar footprint locations (because the freeze wall is close to the uranium deposit) and similar interaction with known land use and proximity to the closest recreational land lease. Based on available land use information, Options 1 and 2 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Permeability enhancement	Option 1 Hydraulics Option 2 Propellant Option 3 Mechanical	All options are technically and economically feasible in terms of operability within the context of increasing connectivity within the mining area.	Because permeability enhancement options are an underground activity, they would be conducted within the footprint for the ISR mining method (considered separately). The permeability enhancement options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Mining solution	Option 1 Alkaline solution Option 2 Acidic solution	Option 1 is not technically feasible based on the uranium deposit geochemistry. Option 2 is technically and economically feasible based on the uranium deposit geochemistry and ability to dissolve uranium.	The mining solution options do not interact with an area of high land use intensity or an area of high cultural importance.	Option 1 was not technically feasibility and not carried forward as an alternative. The EIS evaluated use of an acidic mining solution.
Processing	Location of processing	Option 1 Off-site processing at an existing mill	Options 1 and 2 are technically and economically feasible. Option 1 would be contingent on the sale (or pre-sale) of ore, ore slurry, or uranium bearing solution	Assuming the location selected for the surface handling and loadout facility (Option 1) or on-site processing plant (Option 2) are	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
		Option 2 On-site processing in purpose-built processing plant	at the time the material is loaded onto appropriate containers and leaves the Project site.	close (e.g., within 1 km) to the mining area and within what is generally expected to be the development footprint of the Project, this option would not interact with an area of high land use intensity or an area of high cultural importance.	
	On-site processing method	Option 1 Ion exchange Option 2 Solvent extraction Option 3 Direct precipitation	The processing plant methods evaluated were for an on-site processing plant for processing of uranium bearing solution generated via the ISR mining method. Each option would require different processing plant design (e.g., tanks, piping, reagents, control systems) but at the initial screening level, all three options were individually considered to be technically and economically feasible.	Assuming the location selected for an on-site processing plant is close (e.g., within 1 km) to the mining area and within what is generally expected to be the development footprint of the Project, the three options for on-site processing methods do not interact with an area of high land use intensity or an area of high cultural importance	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Water management	Freshwater supply	Option 1 Groundwater Option 2 Surface water	Options 1 and 2 are technically and economically feasible based on the estimated freshwater needs of the Project in the context of environmental baseline data collected for the local groundwater environment and surface water quantity (hydrology) and quality.	Freshwater supply associated with Options 1 and 2 could interact with surface water flows. However, based on the low volume of withdrawal relative to the baseline flows and no discernable changes in local lake hydrology (flows, water levels) would be experienced by land users at nearby lakes.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Drinking water	Option 1 Truck drinking water to site Option 2 Generate drinking water on site with a potable water treatment plant	Options 1 and 2 are technically and economically feasible.	Based on available land use information, Options 1 and 2 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Treated effluent discharge location	Option 1 To groundwater Option 2 To surface water	Options 1 and 2 are technically and economically feasible with consideration of expected volumes and quality.	Based on land use information available Options 1 and 2 do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Treated effluent discharge location to surface water	Option 1 Kratchkowsky Lake (LA-7)	Option 6 (Mardoc Lake, LA-4) and Option 7 (Williams Lake, LB-3) were removed from further consideration due to technical feasibility. Options 6 and 7 are both	Option 7 (Williams Lake, LB-3) overprints with a winter trail route for a local land user (ERFN trapper) and does not pass the land	Option 6 was removed at this stage for technical reasons. Option 7 was removed at this stage based on the land use screening in conjunction with technical considerations.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
		Option 2 Whitefish Lake north (LA-6) Option 3 Whitefish Lake (south LA-5) Option 4 McGowan Lake (LA-1) Option 5 Russell Lake Option 6 Mardoc Lake (LA-4) Option 7 Williams Lake LB-3	headwater lakes of small relative size with low flows and little assimilative capacity based on the preliminary screening. Options 1, 2, 3, 4, and 5 are technically and economically feasible.	use criterion, though it had been also screened out for technical reasons. The remaining options were carried forward based on land use screening as they did not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 through 5 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Waste management	Organic waste disposal	Option 1 On-site disposal using an incinerator Option 2 On-site disposal in domestic landfill Option 3 On-site composting	Options 1, 2, and 3 are technically and economically feasible.	The three organic waste disposal options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Process precipitate management	Option 1 On-site permanent disposal Option 2 Off-site reprocessing and final disposal	Both options for process precipitate management are technically and economically feasible.	Assuming the location selected for an on-site disposal permanent (Option 1) or a temporary process precipitates handling area (Option 2) is close (e.g., within 1 km) to the mining area, within what is generally expected to be the development footprint of the Project, and would meet all requirements for radioactive waste management and disposal for protection of the environment and human health, there would be no limiting land use factors associated with this option. For the purposes of this screening, Option 2 assumes existing public transport routes would be used and reprocessing, and disposal would be covered	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
				at an existing facility under that site's licensing and permitting framework.	
	Domestic waste disposal	Option 1 Collection and disposal off site by a third-party contractor Option 2 Collection and disposal in an on site domestic landfill	Both options for disposal of domestic wastes (clean, non-recyclable material such as plastics, wood) are technically and economically feasible.	Assuming the area for Option 2 is close to the main project area and within what is generally expected to be the development footprint of the Project, both options for domestic waste disposal do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Access and transportation	Access road alignment	Option 1 Direct route Option 2 Direct route to reduce cut volumes Option 3 Follows part of the existing exploration access road	All three options are technically and economically feasible. Each alternative route could be safely and economically constructed and operated.	The three access road alignment options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Stream crossing structures	Option 1 Culverts Option 2 Clear span bridges	Large diameter culverts (Option 1) or clear span bridges (Option 2) are both technically and economically feasible ways to cross streams at the two locations on the access road from the site to the airstrip.	The stream crossing structure options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1 and 2 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
	Worker transportation	Option 1 Ground transport Option 2 Air transport to existing airstrip at nearby Cameco operations Option 3 Air transport to new airstrip constructed and operated by Denison	Options 1, 2, and 3 are technically and economically feasible. Note that Option 2 would be contingent on an agreement with Cameco; however, the approach taken at this step in the screening was that this option would remain technically feasible and carried forward for additional assessment.	The three worker transportation options do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.

Project Component		Alternative Means	Technical and Economic Feasibility	Land Use Factors	Conclusion
Power	Primary power supply	Option 1 Liquefied natural gas power plant Option 2 Solar photovoltaic power plant Option 3 Diesel generators Option 4 Provincial power grid	Although Option 2 (solar) would be beneficial for the Project's scope 1 emissions, the area of panels required to meet the peak load demand of 7.6 MW in northern Saskatchewan and the battery requirements for storage needs resulted in this option being screened out for technical and economic factors. Options 1, 3, and 4 were technically and economically feasible.	The primary power supply options do not interact with an area of high land use intensity or an area of high cultural importance.	Option 2 was screened out for technical and economic reasons. Options 1, 3, and 4 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means.
Support facilities	Camp location optimization	Option 1 First location - Prefeasibility Option 2 Second location - Reduce fill volumes Option 3 Third location - Southwest from second location	Options 1, 2, and 3 are technically and economically feasible.	Assuming the camp location options are close (e.g., within 1 km) to the main project area, they do not interact with an area of high land use intensity or an area of high cultural importance.	Options 1, 2, and 3 were deemed technically feasible, economically feasible, and passed the land use screening. These options were carried forward as alternative means, as an examples of site layout incremental optimization.

Table 3: Summary of Alternative Means Carried Forward and those Screened Out from Additional Assessment Due to Technical, Economic, or Land Use Factors

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Mining	Method	~~Open pit~~	Jet Boring	Surface Boring	Micro Tunnel Boring	ISR		
	Freeze design for tertiary containment of mining solution	Freeze dome	Freeze wall					
	Permeability enhancement	Hydraulics	Propellant	Mechanical				
	Mining solution	~~Basic solution~~	Acidic solution					
Processing	Location of processing	Off-site processing at an existing mill	On-site processing in purpose-built processing plant					
	On-site processing method	Ion exchange	Solvent extraction	Direct precipitation				
Water management	Freshwater supply	Groundwater	Surface water					
	Drinking water	Truck drinking water to site	Generate drinking water on site with a potable water treatment plant					
	Treated effluent discharge location	To groundwater	To surface water					
	Treated effluent discharge locations for surface water	Kratchkowsky Lake (LA-7)	Whitefish Lake north (LA-6)	Whitefish Lake south (LA-5)	McGowan Lake (LA-1)	Russell Lake	~~Mardoc Lake (LA-4)~~	~~Williams Lake LB-3~~
Waste management	Organic waste disposal	On-site disposal using an incinerator	On-site disposal in domestic landfill	On-site composting				
	Process precipitate management	On-site permanent disposal	Off-site reprocessing and final disposal					
	Domestic waste disposal	Collection and disposal off site by a third-party contractor	Collection and disposal in an on-site domestic landfill					
Access and transportation	Access road alignment	Direct route	Direct route to reduce cut volumes	Follows part of the existing exploration access road				

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
	Stream crossing structures	Culverts	Clear span bridges					
	Worker transportation	Ground transport	Air transport to existing airstrip at nearby Cameco operations	Air transport to new airstrip constructed and operated by Denison				
Power	Primary power supply	Liquefied natural gas power plant	~~Solar photovoltaic power plant~~	Diesel generators	Provincial power grid			
Support facilities	Camp location optimization	First location - Prefeasibility	Second location – Reduce fill volumes	Third location - Southwest from second location				

Option was removed from further assessment due to technical, economic, or land use factors

1.3 Potential Residual Effects Associated the Alternative Means

Based on the determination in Section 1.1.2 of technically and economically feasible alternatives with consideration of land use factors, Table 4 provides a summary of the expected residual effects following application of mitigation measures assumed to be in place for each of the alternatives. The identification of the potential residual effects of each alternative, in consideration of mitigation, provides the means to compare the alternatives based on the specific assessment criteria and indicators as described below.

Table 4: Mitigation Measures and Residual Effects for Remaining Alternative Means

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
Mining	Method	Option 2: Jet Boring	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria • Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects to local geology by development of underground workings • Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support mining • Effects on air quality via emissions from ventilation of underground workings • Effects on groundwater quantity and flow paths based on need to dewatering underground mine workings • Effects to surface water quality and surface water related receptors whereby mine water is released to local surface water features	6
		Option 3: Surface Boring	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria • Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects to local geology by development of underground workings • Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support mining • Effects on air quality via emissions from ventilation of underground workings • Effects on groundwater quantity and flow paths based on need to dewatering underground mine workings • Effects to surface water quality and surface water related receptors whereby mine water is released to local surface water features	
		Option 4: Micro Tunnel Boring	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria • Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects to local geology by development of underground workings • Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support mining • Effects on air quality via emissions from ventilation of underground workings • Effects on groundwater quantity and flow paths based on need to dewatering underground mine workings • Effects to surface water quality and surface water-related receptors whereby mine water is released to local surface water features	
		Option 5: ISR	• Through design and monitoring, make sure emissions from ventilation meet applicable air quality emissions criteria	• Effects to local geology by development of ISR mining area	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Any water associated with workings and mining activities meets applicable discharge quality criteria prior to release • Limit any surface development to extent practical and avoid areas of significance • Follow best management practices and standards for waste characterization and management, containment of hazardous material, liner designs, fuel management	• Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to support ISR mining • Effects on groundwater quantity and flow paths based on development of ISR wellfield (injection and recovery well systems) • Effects on groundwater quality by introduction of ISR mining solutions to the mining area • Effects to surface water quality and surface water related receptors whereby mine water is released to local surface water features	
	Freeze design for tertiary containment of mining solution	Option 1: Freeze dome	• Minimize development footprint on surface to support freeze dome operations • Employ erosion and sediment control measures during construction activities • Provide appropriate buffer zones around sensitive areas/receptors as needed/appropriate	• Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to freezing process • Effects on groundwater flows paths by constraining flow within the vicinity of the freeze dome	7
		Option 2: Freeze wall	• Minimize development footprint on surface to support freeze wall operations • Employ erosion and sediment control measures during construction activities • Provide appropriate buffer zones around sensitive areas/receptors as needed/appropriate	• Effects on local vegetation, soil, bird, and wildlife habitat as a result of clearing required to develop surface infrastructure to freezing process • Effects on groundwater flows paths by constraining flow within the vicinity of the freeze wall	
	Permeability enhancement	Option 1: Hydraulics	• The mitigation measures outlined for the *Mining method Option 5: ISR* would apply to this option and the other permeability enhancement options	• No specific residual effect to speak of that would be specifically associated with the type of permeability enhancement	8
		Option 2: Propellant	• The mitigation measures outlined for the *Mining method Option 5: ISR* would apply to this option and the other permeability enhancement options	• No specific residual effect to speak of that would be specifically associated with the type of permeability enhancement	
		Option 3: Mechanical	• The mitigation measures outlined for the *Mining method Option 5: ISR* would apply to this option and the other permeability enhancement options	• No specific residual effect to speak of that would be specifically associated with the type of permeability enhancement	
Processing	Location of processing	Option 1: Off-site processing at an existing mill	• Retain appropriately licensed or trained operators to transport ore, ore slurry, or uranium bearing solution off site.	• Direct effect on traffic associated with the transport of ore, ore slurry, or uranium bearing solution off site • Temporary loss of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct the storage area/facility and associated infrastructure	9

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
				• Effects to air quality and those receptors associated with the air emissions pathway from fugitive releases from storge area/facility	
		Option 2: On-site processing in purpose-built processing plant	• Related to construction, operation, and decommissioning of a purpose built processing plant site clearing and other works that involve disturbance of vegetation and/or soil will follow best practices such as: work will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable; cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation; and construction activities restricted to the approved Construction footprint. • During Decommissioning, the plant components and building will be decontaminated, where possible, assets will be removed, and the remaining items will be demolished and disposed of in the industrial landfill. The processing plant footprint will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • The processing plant will be designed using engineering best practices, taking into account potential environmental and health and safety effects and mitigating interactions to the extent possible. For example, the floor will be graded as required and sumps will be installed to collect spills, dust control in place, ventilation consistent with the As Low As Reasonably Achievable (ALARA) principle to provide sufficient worker protection, appropriate containment for chemicals.	• Direct effect on traffic associated with the transport of processing chemicals and other supplies to site and yellowcake off site. • Temporary loss of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct the processing plant and associated infrastructure (ponds, pads). • Changes in air quality from stack emissions. • Changes in noise levels. • Release of treated effluent to local groundwater or surface water, and resulting direct effects on aquatic environment	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
	On-site processing method	Option 1: Ion exchange	• The general mitigation measures outlined for the *Location of processing, Option 2: On-site processing in purpose-built processing plant* for construction, operation and decommissioning of the processing plant would apply to this option and the other processing method options.	• The general residual effects outlined for *Location of processing, Option 2: On-site processing in purpose-built processing plant* would apply to this option and the other processing method option.	10
		Option 2: Solvent extraction	• The mitigation measures outlined for the *Location of processing, Option 2: On-site processing in purpose-built processing plant* for construction, operation and decommissioning of the processing plant would apply to this option and the other processing method options. • Solvent extraction carries a risk of fire associated with the use of low flash point hydrocarbons. Should this be considered in the future a separate building for the solvent extraction circuit with a robust fire suppression system would be required to mitigate fire risk and risks to worker safety.	• The general residual effects outlined for *Location of processing, Option 2: On-site processing in purpose-built processing plant* would apply to this option and the other processing method option.	
		Option 3: Direct precipitation	• The mitigation measures outlined for the *Location of processing, Option 2: On-site processing in purpose-built processing plant* for construction, operation and decommissioning of the processing plant would apply to this option and the other processing method options.	• The general residual effects outlined for *Location of processing, Option 2: On-site processing in purpose-built processing plant* would apply to this option and the other processing method option.	
Water management	Freshwater supply	Option 1: Groundwater	• Install and decommission supply well(s) according to applicable codes/standards and best practices • Limit water taking to that volume that is necessary to support intended supply need • Locate well(s) in that will provide supply need with minimal effect on local water table, surface waters and other users	• Effects (alteration) of local groundwater flow paths and discharge to local receiving waterbodies • Effects to terrestrial vegetation / wetland vegetation by reduction in local water groundwater elevations • Effect to fish and fish habitat through reduction of groundwater discharge to local receiving waterbodies	11
		Option 2: Surface water	• Install supply infrastructure according to applicable codes/standards and best practices, including for example avoiding key aquatic habitat, respecting in- and near-water construction limitation windows, implementing erosion and sediment control during construction, sizing infrastructure appropriately to avoid entrainment, screening intakes appropriately to avoid entrainment.	• Effects to local hydrology • Effects to fish and fish habitat due to reduced flows and through the development of the footprint related to surface water taking infrastructure near- and in-water	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Limit water taking to that volume that is necessary to support intended supply need		
	Drinking water	Option 1: Truck drinking water to site	• Retain appropriately licensed or trained operators to deliver potable water to site. • Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading	• Effects on air quality and traffic associated with delivery of water, including traffic in proximity to local communities and areas of intertest to local Indigenous communities	12
		Option 2: Generate drinking water on site with a potable water treatment plant	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified areas of cultural importance • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required water treatment plant infrastructure	
	Treated effluent discharge location	Option 1: To groundwater	• Development of appropriate performance criteria for discharge groundwater quality so as not to limit beneficial use of the groundwater receiving environment • Injection well design to mitigate potential unplanned releases (e.g., double walled wells, real time monitoring) • Injection of treated effluent to subsurface strata that are not used as potable water or for other uses, or to groundwater environments whose ambient quality precludes beneficial uses • Implementation of effluent and groundwater monitoring programs with contingency plans based on an adaptive management framework	• Direct effect to groundwater quantity and quality in local / regional groundwater environment • Indirect effects to receptors associated with the groundwater exposure pathway • Indirect effect of potential loss of use of groundwater as a resource to traditional land and resources and recreation and resources users	13
		Option 2: To surface water	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework	• Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	
	Treated effluent discharge locations for surface water	Option 1: Russell Lake	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	14
		Option 2: McGowan Lake (LA-1)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.		
		Option 3: Whitefish Lake north (LA-6)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	
		Option 4: Whitefish Lake south (LA-5)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework.		
		Option 5: Kratchkowsky Lake (LA-7)	• Adherence to effluent discharge limits for protection of aquatic life, receptors associate with the water exposure pathway and beneficial uses of water as stipulated in operating permits/licenses and by regulations • Implementation of contact water management best practices on site, including development of appropriate water management programs/plans/procedures • Implementation of erosion and sediment controls during construction • Optimization of discharge infrastructure design to minimize aquatic habitat interactions and maximize mixing of effluent in the receiver • Implementation of effluent and receiver monitoring programs with contingency plans based on an adaptive management framework • .	• Direct effect to water quantity and quality at receiving waterbody • Direct effect to fish habitat, including riparian habitat, for construction and operation of treated effluent discharge infrastructure • Indirect effects to receptors associated with the water emissions pathway, including traditional land and resources and recreation and resources uses	
Waste management	Organic waste disposal	Option 1: On-site disposal using an incinerator	• Train kitchen staff on waste reduction. • Use bulk food containers whenever possible. • Use designated wildlife-proof organic waste containers prior to incineration. • Collect organic waste on a regular schedule. • Incinerate in small batches. • Dispose of incinerator ash. • Regularly maintain incinerator.	• Effects on air quality, associated with emissions for the incineration process (including GHGs, and potential hazardous chemicals) • Effects on receptor exposure pathways associated with air emissions / deposition of air emission constituents	15
		Option 2: On-site disposal in domestic landfill, within the domestic non-hazardous waste landfill	• Train kitchen staff on waste reduction. • Use bulk food containers whenever possible. • Regularly cover material in the landfill with clean fill and soil to bury organic wastes.	• No incremental effects specifically identified with this option since disposal would occur in the on-site domestic non-hazardous waste landfill	
		Option 3: On-site composting	• Train kitchen staff on waste reduction. • Use bulk food containers whenever possible. • Use designated wildlife-proof organic waste containers prior to composting.	• Minor potential effect to soil, terrain and terrestrial habitat VCs to develop compost facility footprint • Effect animal behaviour as odors may act as an attractant	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Collect organic waste on a regular schedule. • Regularly maintain composting system.		
	Process precipitate management	Option 1: On-site permanent	Related to construction, operation, and decommissioning of a process precipitate management cell: • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SKMOESK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, the process precipitates disposal cell will be dewatered to the extent practical, and covered with an engineering covered designed to minimize water infiltration. The process precipitate disposal cell will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity.	• Effect on air quality and receptors associated with the air emissions pathway • Effect on local groundwater flow patterns • Effect of groundwater quality and associated receptors on the groundwater exposure pathway if loss of control of seepage was to occur • Effect on surface water quality and associated receptors on the surface water exposure pathway was to occur • Effect on of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct facility • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land, as well as on the suitability of the area developed for future uses even in consideration of reclamation activities	16
		Option 2: Off-site reprocessing and final disposal	Related to construction, operation, and decommissioning of an on-site temporary storage area (process precipitate pond): • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable.	• Temporary or time limited effects on: – air quality and receptors associated with the air emissions pathway for transport and storage – local groundwater flow patterns – groundwater quality and associated receptors on the groundwater exposure pathway if loss of control of seepage was to occur	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SKMOESK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, the now empty process precipitate pond liner would be cleaned and disposed of in the industrial waste landfill. The pond area will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity.	– surface water quality and associated receptors on the surface water exposure pathway was to occur – vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct facility – Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	
	Domestic waste disposal	Option 1: Collection and disposal off site by a third-party contractor	• Waste management including waste characterization and separation to make sure only non-recyclable, inert materials are included in the domestic waste stream. • Educate employees and contractors on the importance of separating recyclable and hazardous items (and organic waste if applicable based on organic waste disposal analysis) from personal waste. • Use clear garbage bags to facilitate monitoring of waste sorting habitats. • Periodically assess domestic waste to make sure that waste streams are being separated correctly. • Retain appropriately licensed or trained operators to collect domestic waste and transport it off site • Deposition of domestic waste into a licensed waste management facility.	• Direct effect on traffic associated with the transport of material off site • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from material transport operations • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles during material transport • Effects to noise levels through the operation of vehicles during material transport • Direct effect to local economy and infrastructure and services through use of regional facilities	17

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
		Option 2: Collection and disposal in an on-site domestic landfill	• Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, the domestic landfill will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • Waste management including waste characterization and separation to make sure only non-recyclable, inert materials are included in the domestic waste stream • Educate employees and contractors on the importance of separating recyclable and hazardous items (and organic waste if applicable based on organic waste disposal analysis) from personal waste. • Use clear garbage bags to facilitate monitoring of waste sorting habitats. • Periodically assess domestic waste to make sure that waste streams are being separated correctly. • On site domestic landfill would be constructed with a composite liner system with leachate collection.	• Loss (temporary) of vegetation, soil, bird, and wildlife habitat as a result of clearing required to construct a domestic waste landfill for the Project • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• On site domestic landfill would be operated with standard environmental protection measures. • Footprint disturbance related to an on site facility would be reduced to the extent possible. • Segregation of organic waste from the domestic waste (and composting of organic wastes) will minimize birds and wildlife being attracted to the landfill. • Domestic landfill will be fenced to minimize interactions with wildlife.		
Access and transportation	Access road alignment	Option 1: Direct route	• For the suitability of road construction and safety during operation and maintenance, the route design criteria at this preliminary stage included: minimum road width of 10 m, cut and fill slopes along the road alignments were both set to 3H:1V, and a maximum road grade of 7%. • Appropriate road signage will be installed (e.g., speed limits, wildlife crossings) along Project roads to minimize the risk of wildlife-vehicle collisions. • Speed limits will be implemented to reduce the risk of wildlife-vehicle collisions. • Wildlife will have the right-of-way on Project roads, unless it is unsafe to stop (i.e., if a collision is imminent). Vehicles will not be used to encourage wildlife to move off Project roads. • Processes will be implemented for employees and contractors to slow down and/or stop vehicles/equipment to allow animals to move away or off the road before resuming normal road speeds for the area. • Vegetation along Project roads will be managed to reduce attractiveness to wildlife (e.g., forage plants) and maintain appropriate sightlines for drivers to minimize wildlife-vehicle collisions. • Alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) will be implemented, whenever practicable, as salt is known to attract foraging wildlife species.	• Loss of vegetation, soil, and potential wildlife habitat and changes to terrain to construct road. • Alteration of vegetation and ecosystems from dust dispersion and other edge effects • Alteration in how wildlife use habitat near roads due to dust, noise, smells, etc. from traffic. • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from road operations • Disruption to watercourses containing fish habitat as a result of installation of new watercourse crossings • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles • Effects to noise levels through the operation of vehicles • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	18

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Appropriately sized gaps in the roadside snowbanks during winter will be maintained to facilitate wildlife crossing and escape, and, with that, reducing their risk of vehicle collisions. • Employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order. • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Before any site clearing occurs, wildlife, avian, and listed plant species surveys will be conducted to meet various requirements and commitments, including the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* (SK MOE 2017b). • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • During Decommissioning, road will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • A minimum 100 m distance from any waterbody will be maintained for fuel storage, refueling activities, or equipment servicing.		
		Option 2: Direct route to reduce cut volumes	• For the suitability of road construction and safety during operation and maintenance the route design criteria at this preliminary stage included: minimum road width of 10 m, cut and fill slopes along the road alignments were both set to 3H:1V, and a maximum road grade of 7%	• Loss of vegetation, soil, and potential wildlife habitat and changes to terrain to construct road. • Alteration of vegetation and ecosystems from dust dispersion and other edge effects	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Appropriate road signage will be installed (e.g., speed limits, wildlife crossings) along Project roads to minimize the risk of wildlife-vehicle collisions. • Speed limits will be implemented to reduce the risk of wildlife-vehicle collisions. • Wildlife will have the right-of-way on Project roads, unless it is unsafe to stop (i.e., if a collision is imminent). Vehicles will not be used to encourage wildlife to move off Project roads. • Processes will be implemented for employees and contractors to slow down and/or stop vehicles/equipment to allow animals to move away or off the road before resuming normal road speeds for the area. • Vegetation along Project roads will be managed to reduce attractiveness to wildlife (e.g., forage plants) and maintain appropriate sightlines for drivers to minimize wildlife-vehicle collisions. • Alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) will be implemented, whenever practicable, as salt is known to attract foraging wildlife species. • Appropriately sized gaps in the roadside snowbanks during winter will be maintained to facilitate wildlife crossing and escape And, with that, reducing their risk of vehicle collisions. • Employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order. • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Pre-clearing wildlife, avian, and listed plant species surveys will be conducted.	• Alteration in how wildlife use habitat near roads due to dust, noise, smells, etc. from traffic. • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from road operations • Disruption to watercourses containing fish habitat as a result of installation of new watercourse crossings • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles • Effects to noise levels through the operation of vehicles • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• A minimum 100 m distance from any waterbody will be maintained for fuel storage, refueling activities, or equipment servicing. • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • Maintain access roads by periodically regrading and ditching to improve water flow, reduce erosion, and manage vegetation growth. • During Decommissioning, road will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours (slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity.		
		Option 3: follows part of the existing exploration access road	• For the suitability of road construction and safety during operation and maintenance the route design criteria at this preliminary stage included: minimum road width of 10 m, cut and fill slopes along the road alignments were both set to 3H:1V, and a maximum road grade of 7%%. • Appropriate road signage will be installed (e.g., speed limits, wildlife crossings) along Project roads to minimize the risk of wildlife-vehicle collisions. • Speed limits will be implemented to reduce the risk of wildlife-vehicle collisions. • Wildlife will have the right-of-way on Project roads, unless it is unsafe to stop (i.e., if a collision is imminent). Vehicles will not be used to encourage wildlife to move off Project roads. • Processes will be implemented for employees and contractors to slow down and/or stop vehicles/equipment to allow animals to move away or off the road before resuming normal road speeds for the area.	• Loss of vegetation, soil, and potential wildlife habitat and changes to terrain to construct road. • Alteration of vegetation and ecosystems from dust dispersion and other edge effects • Alteration in how wildlife use habitat near roads due to dust, noise, smells, etc. from traffic. • Increased likelihood of wildlife interactions (e.g., mortality from collisions) from road operations • Disruption to watercourses containing fish habitat as a result of installation of new watercourse crossings • Effects on air quality, including dust dispersion and emissions (including GHGs) from vehicles • Effects to noise levels through the operation of vehicles • Effects to traditional land and resources and to recreation and resources uses through development of previously undisturbed land	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Vegetation along Project roads will be managed to reduce attractiveness to wildlife (e.g., forage plants) and maintain appropriate sightlines for drivers to minimize wildlife-vehicle collisions. • Alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) will be implemented, whenever practicable, as salt is known to attract foraging wildlife species. • Appropriately sized gaps in the roadside snowbanks during winter will be maintained to facilitate wildlife crossing and escape And, with that, reducing their risk of vehicle collisions. • Employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order. • Site clearing and other works that involve disturbance of vegetation and/or soil will be completed during least-risk timing windows for wildlife and birds to avoid disturbance during sensitive time periods, whenever practicable. • Pre-clearing wildlife, avian, and listed plant species surveys will be conducted. • A minimum 100 m distance from any waterbody will be maintained for fuel storage, refueling activities, or equipment servicing. • Cleared soil and brush will be stockpiled, when possible, to be used in progressive reclamation. • Restrict all construction activities to the approved construction footprint. • Maintain access roads by periodically regrading and ditching to improve water flow, reduce erosion, and manage vegetation growth. • During Decommissioning, road will be reclaimed to a safe, stable, and self-sustaining landscape. To the extent practical, reclamation of the Project Area will re-instate predominant landscape features, topographical contours		

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			(slope, aspect), and surface drainage patterns in a manner that will tie-in to the existing landscape and maintain surface drainage continuity and hydrologic connectivity. • Much of this proposed route option would be developed within previously disturbed areas, thereby minimizing additional soil, vegetation, wildlife and avian habitat disturbance.		
	Stream crossing structures	Option 1: Culverts	• Implementation of erosion and sediment controls during construction • Timing windows for vegetation clearing and in-water work to protect fish and wildlife • Stream crossings would be constructed in accordance with applicable regulatory requirements to protect fish habitat • Maintenance program to ensure ongoing proper functioning of crossings	• Disruption to watercourses containing fish habitat resulting from watercourse crossing during construction • Temporary disruption/loss of riparian habitat during construction • Effects on fish movement, habitat connectivity – long span culverts may act as barriers to fish movement/migration • Loss of navigability of water course (direct effect) and associated loss (indirect effect) of use	19
		Option 2: Clear span bridges	• Implementation of erosion and sediment controls during construction. • Timing windows for vegetation clearing to protect fish and wildlife. • Stream crossings would be constructed in accordance with applicable regulatory requirements to protect fish habitat • Maintenance program to ensure ongoing proper functioning of crossing.	• Disruption to watercourses containing fish habitat resulting from watercourse crossing during construction • Temporary disruption/loss of riparian habitat during construction • Effects on fish movement, habitat connectivity – long span culverts may act as barriers to fish movement/migration • Loss of navigability of water course (direct effect) and associated loss (indirect effect) of use	
	Worker transportation	Option 1: Ground transport	• Retain appropriately licensed or trained drivers to transport staff and contractors between various pre-defined pick-up points and the Project. • Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading vehicles for worker safety.	• Increased vehicle traffic on provincial road network including through communities of interest and worker/staff pick-up locations resulting in potential for greater human- and wildlife-vehicle interactions • Effects on air quality due to vehicle emissions (combustion products, including GHGs) and dust generated as a result of vehicle operations associated with worker transport • Effects of noise levels through operation of vehicles associated with worker transport • Change in traffic volume (increase) on public roads from Saskatoon through to various pick-up points to the Project Area.	20

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
				• Possible business opportunity for ground transportation creates positive effect on income of local workers	
		Option 2: Air transport to existing airstrip at nearby Cameco operations	• Retain appropriately licensed or trained drivers to transport staff and contractors between Cameco-owned airstrip and the Project. Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading	• Increased vehicle traffic, localized to the section of Highway 914 between Key Lake and McArthur River operations resulting in potential for greater human- and wildlife-vehicle interactions • Effects on air quality due to vehicle emissions (combustion products, including GHGs) and dust generated as a result of vehicle operations associated with worker transport • Effects of noise levels through operation of vehicles associated with worker transport	
		Option 3: Air transport to new airstrip constructed and operated by Denison	• Retain appropriately likened air carrier to transport staff and contractors from pick-up points to Denison's airstrip. • Retain appropriately licensed or trained drivers to transport staff and contractors between the airstrip and the main Project building. Develop and implement transportation program/plan/procedures • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure, particularly on site roads that may require construction and/or upgrading • Road and airstrip construction, use and maintenance conducted in a manner which protects worker health and safety, wildlife, and minimizes dust and noise. Examples include: enforcing speed limits, appropriate water diversion and drainage, maintaining vegetation adjacent to road and airstrip, employing standard operating procedures and completing regular inspections of equipment machinery to make sure it is in good working order.	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required infrastructure (e.g., airstrip, road) • Alteration of vegetation and ecosystems from dust dispersion and other edge effects • Alteration in how wildlife use habitat near road/airstrip operations due to dust, noise, smells • Increased likelihood of wildlife interactions (e.g, mortality from collisions) from road/airstrip operations • Effects on air quality, including dust dispersion and emissions from vehicles along road and planes at the airstrip. • Effects on noise levels with aircraft arrival and departure.	
Power	Primary power supply	Option 1: Liquefied natural gas	• Retain appropriately licensed or trained operators to deliver LNG to site. • Fuels will be stored in approved, above-ground, double-walled storage tank(s) equipped with secondary containment in accordance with provincial regulations and standards.	• Loss of vegetation and potential wildlife habitat to construct LNG related infrastructure • Increased vehicle traffic on provincial road network including through communities of interest associated with LNG delivery resulting in potential for greater human- and wildlife-vehicle interactions	21

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
			• Leave vegetated buffer zones around watercourses and other sensitive features when developing/operating supporting infrastructure • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure	• Effects on Change in traffic volume (increase) on public roads to and from the Project Area. • Change in air quality due to vehicle emissions (combustion products) and dust generated as a result of vehicle operations associated with LNG delivery. • Effects on air quality (combustion products) due to operation of LNG power generation • Effects of noise levels through operation of vehicles associated with LNG delivery Change in sound levels.	
		Option 3: Diesel generators	• Retain appropriately licensed or trained operators to deliver diesel to site • Fuels will be stored in approved, above-ground, double-walled storage tank(s) equipped with secondary containment in accordance with provincial regulations and standards. Leave vegetated buffer zones around watercourses and other sensitive features when developing/operating supporting infrastructure • Implementation of erosion and sediment controls during construction/operation of supporting infrastructure	• Loss of vegetation and potential wildlife habitat to construct LNG related infrastructure • Increased vehicle traffic on provincial road network including through communities of interest associated with diesel delivery resulting in potential for greater human- and wildlife-vehicle interactions • Effects on air quality due to vehicle emissions (combustion products, including GHGs) and dust generated as a result of vehicle operations associated with diesel delivery • Effects on air quality (combustion products, including GHGs) due to operation of diesel power generation system • Effects of noise levels through operation of vehicles associated with LNG delivery • Change in traffic volume (increase) on public roads to and from the Project Area. • Change in air quality from combustion of diesel. • Change in sound levels.	
		Option 4: Provincial power grid	• Optimize transmission right of way route to minimize interactions with key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited grading or stripping within transmission right of way.	• Potential for temporary effects on watercourses containing fish habitat as a result of watercourse crossings/ riparian vegetation removal • Loss of vegetation and potential wildlife habitat as a result of right of way construction	

Project Component		Alternative Means Carried Through after Screening for Technical, Economic, and Land Use Factors	Mitigation Measures	Residual Effects	Alternative Means Assessment Table number
Support facilities	Camp location optimization	First location - Prefeasibility	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited cut and fill operations as is possible needed to support camp development	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required camp infrastructure • Alteration in how wildlife use habitat near camp due to dust, noise, smells, etc. • Increased likelihood of wildlife interactions with humans from camp operations • Effects on hydrology from cut and fill requirements and terrain modification	22
		Second location – Reduce fill volumes	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited cut and fill operations as is possible needed to support camp development	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required camp infrastructure • Alteration in how wildlife use habitat near camp due to dust, noise, smells, etc. • Increased likelihood of wildlife interactions with humans from camp operations • Effects on hydrology from cut and fill requirements and terrain modification	
		Third location - Southwest from second location	• Minimize development footprint to the extent possible to minimize potential interactions with terrestrial habitat and key receptors and identified sites of cultural or built heritage import • Leave vegetated buffer zones around watercourses and other sensitive features • Implementation of erosion and sediment controls during construction • Limited cut and fill operations as is possible needed to support camp development	• Loss of vegetation, soil, and potential wildlife habitat and alteration to existing terrain to construct required camp infrastructure • Alteration in how wildlife use habitat near camp due to dust, noise, smells, etc. • Increased likelihood of wildlife interactions with humans from camp operations • Effects on hydrology from cut and fill requirements and terrain modification	

1.4 Evaluation of Alternative Means

1.4.1 Assessment Criteria and Indicators

Alternatives that were deemed to be technically and economically feasible with consideration of land use factors were assessed by comparing selected evaluation criteria representing biophysical environment factors, socio-economic factors, considerations associated with Indigenous groups and land and resource uses, technical factors, and cost factors. Table 5 describes the evaluation criteria and indicators, including relevant metrics, used to assess Project-related alternatives.

Table 5: Detailed Alternatives Means Assessment Evaluation Criteria and Metrics

Criteria	Section	Valued Component	Indicator	Metric
Biophysical Environment	Atmospheric and Acoustic Environment	Air quality	Changes in air quality, including concentrations of dust, combustion products, uranium, metals and/or radionuclides	Alternatives that minimize changes in air quality and effects on ecological and human receptors are preferred.
		Noise	Changes in sound levels	Alternatives that minimize the increase in sound levels, and subsequent effects on wildlife and human receptors, are preferred.
	Geology and Groundwater	Geology	Changes in geology	Alternatives that avoid or minimize effects on geology are preferred
		Groundwater quantity	Changes in groundwater levels, groundwater flow patterns, and discharge rates to local surface water bodies	Alternatives that minimize interaction with groundwater quantity are preferred.
		Groundwater quality	Changes in concentrations of physical and chemical parameters in groundwater with consideration of discharge to local surface water bodies	Alternatives that minimize changes in groundwater quality, in the context of groundwater discharge to surface water bodies, are preferred.
	Aquatic Environment	Surface Water Quantity	Changes in surface water quantity through water taking, surface water discharge, and project overprinting of drainage areas (footprints)	Alternatives that minimize Project footprint, as well as surface water intake and release to surface water bodies, are preferred.
		Surface Water Quality	Changes in physical and chemical parameters of surface water quality can result from discharge of treated effluent to surface water bodies and land disturbance and clearing can mobilize solids into the aquatic environment	Alternatives that minimize Project footprint and changes in surface water quality and effects on fish, and other ecological receptors, are preferred.
		Fish and Fish Habitat	Changes in fish and fish habitat may develop from Project overprinting of fish habitat (habitat alteration or loss), changes in surface water quantity, surface water quality (physical and chemical parameters), sediment quality, or benthic invertebrates	Alternatives that minimize interaction with fish and fish habitat are preferred.
		Sediment Quality	Changes in sediment quality mainly from discharge of treated effluent to surface water bodies	Alternatives that minimize effects on sediment quality are preferred.
		Benthic Invertebrates	Changes in benthic invertebrate communities and quality from uptake of chemical parameters	Alternatives that minimize effects on benthic invertebrates are preferred.
		Fish Health	Changes in fish health mainly from discharge of treated effluent to surface water bodies	Alternatives that minimize effects on fish health are preferred.

Criteria	Section	Valued Component	Indicator	Metric
	Terrestrial Environment	Terrain	Changes to terrain	Alternatives that minimize interaction with terrain are preferred.
		Soil	Changes in soil quantity or quality	Alternatives that minimize loss or alteration of soil quantity, and minimize changes in soil quality, are preferred.
		Organic matter/peat	Loss of organic matter/peat	Alternatives that minimize loss or alteration of organic matter/peat are preferred.
		Vegetation and Ecosystems	Change in areal extent of vegetation habitat types and ecosystems	Alternatives that minimize loss vegetation and ecosystems are preferred.
		Listed Plant Species	Change in number of listed plant species	Alternatives that minimize direct and indirect effects on listed plant species are preferred.
		Wetlands	Change in areal extent of wetlands	Alternatives that minimize loss or alteration of wetlands are preferred.
		Ungulates	Changes in ungulate habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize ungulate habitat loss or alteration and minimize ungulate mortality are preferred.
		Furbearers	Changes in furbearer habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize furbearer habitat loss or alteration and minimize furbearer mortality are preferred.
		Woodland caribou	Changes in woodland caribou habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize woodland caribou habitat loss or alteration and minimize woodland caribou mortality are preferred.
		Raptors	Changes in raptor habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize raptor habitat loss or alteration and minimize raptor mortality are preferred.
		Migratory breeding birds	Changes in migratory breeding bird habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize migratory breeding bird habitat loss or alteration and minimize migratory breeding bird mortality are preferred.
		Bird species at risk	Changes in bird species at risk habitat (loss and/or alteration) and indirect or direct mortality of individuals	Alternatives that minimize bird species at risk habitat loss or alteration and minimize bird species at risk mortality are preferred.
Human Environment	Human Health	Human Health	Changes in human health from exposure to non-radiological and radiological constituents in air, water, and food	Alternatives that minimize negative changes in human health are preferred.
		Worker Health	Worker conventional health and safety and radiation exposure	Alternatives that reduce conventional health and safety risks and radiation exposure are preferred.

Criteria	Section	Valued Component	Indicator	Metric
	Land and Resource Use	Indigenous Land and Resource Use	Changes in the area of land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	Alternatives that minimize negative changes in Indigenous land and resource use are preferred.
		Other Land and Resource Use	Changes in the area of land available for non-Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	Alternatives that minimize negative changes in other land and resource use are preferred.
		Heritage Resources	Change in the number of known archaeological resources	Alternatives that minimize direct or indirect alteration or loss of archaeological resources are preferred
	Quality of Life	Cultural Expression	Changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet	Alternatives that minimize direct or indirect adverse effects on cultural expression are preferred.
		Community Well-being	Change in income of local workers and community cohesion	Alternatives that minimize direct or indirect adverse effects on community well-being are preferred.
		Infrastructure and Services	Changes in traffic, community infrastructure and services	Alternatives that minimize direct or indirect adverse effects on infrastructure and services are preferred.
	Economics	Economy	Changes in participation in the traditional economy	Alternatives that minimize direct or indirect adverse effects on economy are preferred.
Other Evaluation Factors				
Criteria			**Metric**	
Technical Factors	Complexity of design, construction, operation, and decommissioning		Simple or straightforward designs, construction techniques, and operational procedures based on tested and proven technologies are preferred. Alternatives that are more amenable to decommissioning and/or reclamation are preferred.	
Cost Factors	Capital, operating, and decommissioning costs		Lower capital costs are preferred to reduce the pre-production costs and influence the project economic viability. Lower operational costs are preferred to maintain project economics. Lower decommissioning costs are preferred to reduce long term liabilities	

1.4.2 Comparative Evaluation of Alternative Means

The comparative evaluation of alternative means is presented in Table 6 to Table 22. The evaluation considers the relative residual effects of each of the technical and economically feasible alternatives for each of the evaluation criteria identified in Table 5, following the application of mitigation measures described in Table 4. In each case, the preferred alternative and rationale for its selection are identified. In addition, specific input received from Indigenous groups and other Interested Parties that contributed to the selection of the preferred option is highlighted, when applicable.

The alternative means assessment provided in the tables in this section was conducted at a screening level, appropriate for the stage of the Project when the alternatives were considered. The assessment considered both quantitative (where possible) and qualitative information as available. The comparative evaluation identified more preferred versus less preferred alternatives.

Table 6: Mining – Methods - Alternative Means Assessment

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
Biophysical	Atmospheric and Acoustic Environment	Air quality	Less preferred option. Air quality on surface would be influenced by slurry handling, radon gas, radioactive dust in vent exhaust, dust from surface stockpiles including clean waste rock. Air quality in the mine workings would be managed with ventilation.	More preferred option. Size of mine rock stockpiles and their influence on air quality would be similar to Option 5. Changes in concentrations of radon in air from well development would be similar to option 5.	Less preferred option. Air quality in the mine workings would be managed with ventilation. Air quality on surface would be influenced by hoisted cuttings or slurry, radon gas, radioactive dust in vent exhaust, dust from surface stockpiles including clean waste rock.	More preferred option. Size of mine rock stockpiles and their influence on air quality would be similar to Option 3. Changes in concentrations of radon in air from well development would be similar to option 3.
		Noise	No appreciable difference was identified among the alternatives for changes in noise. Continual noise from surface ventilation fans and noise from mobile equipment. Similar to Option 4.	No appreciable difference was identified among the alternatives for changes in noise. No fans, noise from production drilling from surface includes compressors and mobile equipment would be continual.	No appreciable difference was identified among the alternatives for changes in noise. Continual noise from surface ventilation fans and noise from mobile equipment. Similar to Option 2.	No appreciable difference was identified among the alternatives for changes in noise. No fans, noise from surface drilling equipment includes compressors and mobile equipment would be intermittent as drilling is done only as required.
	Geology and Groundwater	Geology	Less preferred option for changes to geology, compared to options 3 and 5.	More preferred option for geology compared to options 2 and 4 since this is a surface method requiring less excavation.	Less preferred option for changes to geology, compared to options 3 and 5.	More preferred option for geology compared to options 2 and 4 since this is a surface method requiring less excavation.
		Groundwater quantity	Less preferred compared to option 3. Volume of groundwater management during mining would be similar to Option 4.	Preferred option with smallest interaction on groundwater quantity compared to options 2, 4 and 5.	Less preferred compared to option 3. Volume of groundwater management during mining would be similar to Option 4.	Less preferred compared to option 3. Use of ground freezing temporarily interacts with groundwater flow during operations.
		Groundwater quality	No appreciable difference was identified among the alternatives for changes to groundwater quality. Groundwater quality would interact with mine workings in a limited way due to groundwater management during mining.	No appreciable difference was identified among the alternatives for changes to groundwater quality.	No appreciable difference was identified among the alternatives for changes to groundwater quality. Groundwater quality would interact with mine workings in a limited way due to groundwater management during mining.	No appreciable difference was identified among the alternatives for changes to groundwater quality. Mining area remediation during decommissioning would mitigate effects on groundwater quality.
	Aquatic Environment	Surface Water Quantity	Less preferred than options 3 and 5. The volume of water requiring	More preferred option compared to options 2 and 4. The volume of water	Less preferred than options 3 and 5. The volume of water requiring	More preferred option compared to options 2 and 4. The volume of
		Surface Water Quality				

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
		Fish and Fish Habitat	treatment and release would be high, because of the groundwater management required for mine development. This could result in a larger effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.	needed treatment and release to a surface waterbody would be minimal, and as such, this option would have a smaller effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.	treatment and release would be high, because of the groundwater management required for mine development. This could result in a larger effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.	water needed treatment and release to a surface waterbody would be minimal, and as such, this option would have a smaller effect on the aquatic environment. Quality of treated effluent expected to the similar among all four options.
		Sediment Quality				
		Benthic Invertebrates				
		Fish Health				
	Terrestrial Environment	Terrain	This option is less preferred as it may result in a greater potential effect (loss) of terrain, soil, organic matter/peat, vegetation, listed plant species, wetlands and related loss and alteration of wildlife habitat. Largest amount of disturbance due to underground waste rock creating stockpiles of acid generating, contaminated and clean waste rock. Footprint estimated to be similar to Option 4 and double the total disturbance of Option 5.	Direct surface footprint/mining disturbance expected to be the second lowest of the four options. This option is more preferred than option 2 and 4, similar to option 5 with regard to potential effects on the terrestrial environment.	This option is less preferred as it may result in a greater potential effect (loss) of terrain, soil, organic matter/peat, vegetation, listed plant species, wetlands and related loss and alteration of wildlife habitat. Largest amount of disturbance due to underground waste rock creating stockpiles of acid generating, contaminated and clean waste rock. Footprint estimated to be similar to Option 2 and double the total disturbance of Option 5.	Direct surface footprint/mining disturbance expected to be the lowest of the four options. This option is more preferred than option 2 and 4, similar to option 3 with regard to potential effects on the terrestrial environment.
		Soil				
		Organic matter/peat				
		Vegetation and Ecosystems				
		Listed Plant Species				
		Wetlands				
		Ungulates				
		Furbearers				
		Woodland caribou				
		Raptors				
		Migratory breeding birds				
		Bird species at risk				
Human Environment	Human Health	Human Health	Less preferred. Potential exposure to non-radiological and radiological constituents in air, water, and food may be higher with this option compared to options 3 and 5 due to 1. changes in air quality from mine rock, slurry handling, and mine ventilation and 2. larger volume of	More preferred compared to option 2 and 4 due to smaller changes in air quality and smaller volume of treated effluent release	Less preferred. Potential exposure to non-radiological and radiological constituents in air, water, and food may be higher with this option compared to options 3 and 5 due to 1. changes in air quality from mine rock, slurry handling, and mine ventilation and 2. larger volume of treated	More preferred compared to option 2 and 4 due to smaller changes in air quality and smaller volume of treated effluent release

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
			treated effluent release to the aquatic environment.		effluent release to the aquatic environment.	
		Worker Health	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Within this context, underground work is higher risk than surface due to confined working area with heavy equipment underground and higher contaminates in underground atmosphere compared to open air conditions on surface.	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Surface operation with specialized surface equipment to drill horizontal cavities at ore depth. Physical ore cuttings will need to be rehandled on surface to either slurry for wet transport or dewater for dry transport increasing dose relative to Option 5 (which has a fraction of the drill cuttings to handle). Good conventional H&S as there is minimal mobile surface equipment.	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Within this context, this option has potentially the highest dose as workers will have greater potential exposure to radiation while servicing equipment that is working within the ore zone. Underground work is higher risk than surface due to confined working area with heavy equipment underground and higher contaminates in underground atmosphere compared to open air conditions on surface.	No appreciable difference was identified between alternatives because with application of mitigation measures and monitoring, all options would protect worker health and maintain radiation exposure within limits for nuclear workers. Lowest dose of the four mining options evaluated in terms of dose associated with drill cuttings. The main contributor to worker dose would be radon associated with drilling the ISR wells. Surface piping of UBS, pumphouses, and well maintenance will also be a source of dose during pipeline repairs and inspection of equipment.
	Land and Resource Use	Indigenous Land and Resource Use	Less preferred compared to options 3 and 5 because of larger potential changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	More preferred compared to options 2 and 4 because of smaller potential changes in resource availability linked to: 1. smaller footprint (and changes to terrestrial environment) and 2. lower volume of treated effluent (and changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	Less preferred compared to options 3 and 5 because of larger potential changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	More preferred compared to options 2 and 4 because of smaller potential changes in resource availability linked to: 1. smaller footprint (changes to terrestrial environment) and 2. lower volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.

Table Criteria	Section	Valued Component	Option 2: Jet Boring	Option 3: Surface Boring	Option 4: Micro Tunnel Boring	Option 5: ISR
		Other Land and Resource Use	Less preferred compared to options 3 and 5 because of larger potential changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	More preferred compared to options 2 and 4 because of smaller potential changes in resource availability linked to: 1. smaller footprint (and changes to terrestrial environment) and 2. lower volume of treated effluent (and changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	Less preferred compared to options 3 and 5 because of larger potential changes in resource availability linked to: 1. Larger footprint (changes to terrestrial environment) and 2. Higher volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.	More preferred compared to options 2 and 4 because of smaller potential changes in resource availability linked to: 1. smaller footprint (changes to terrestrial environment) and 2. lower volume of treated effluent (changes to aquatic environment). For all options, the area immediately around the mining activity would not be available for Indigenous land and resource use activities during operations for safety reasons. Perceived suitability of land and resources for safe use expected to be similar for all options.
		Heritage Resources	Less preferred compared to options 3 and 5. Larger area of surface disturbance increases potential interaction with archaeological resources.	More preferred compared to options 2 and 4. Smaller area of surface disturbance reduces potential interaction with archaeological resources.	Less preferred compared to options 3 and 5. Larger area of surface disturbance increases potential interaction with archaeological resources.	More preferred compared to options 2 and 4. Smaller area of surface disturbance reduces potential interaction with archaeological resources.
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.			
		Community Well-being	No appreciable difference was identified between alternatives for change in income of local workers and community cohesion.			
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.			
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.			

Other Evaluation Factors					
Criteria		**Option 2: Jet Boring**	**Option 3: Surface Boring**	**Option 4: Micro Tunnel Boring**	**Option 5: ISR**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Potential advantages: technology currently in use in Canadian uranium industry; mine layouts do not require	Potential advantages: technology in widespread use in oil and gas industry; reduced safety and	Potential advantages: technology in widespread use in civil / municipal applications; remote system – safe for	Potential advantages: technology in widespread use in international uranium operations (USA,

Other Evaluation Factors					
Criteria		**Option 2: Jet Boring**	**Option 3: Surface Boring**	**Option 4: Micro Tunnel Boring**	**Option 5: ISR**
		development at or above the unconformity; remote system – safe for radiological risks. Potential technical weaknesses: Long duration development timeline; low production rate with limited ability to increase; currently used at only one mine with limited experience outside of that operation; may require extensive research and development; high technical risk including underground operating risks, inflow risk, design and operating risk; may require bulk freezing approach versus perimeter freeze design as assumed in the PEA. This would increase freeze cost and time significantly.	environmental risks with elimination of underground excavations; completely remote system – safe for radiological risks; reduced number of employees on site; short timeframe to production (weeks); good production rate with scalability; similar technique under evaluation in Canadian uranium industry (Orano's SABRE mining method). Potential technical weaknesses: Drilling accuracy is paramount and needs additional testing; not currently in use in Canadian uranium industry.	radiological risks under normal operating conditions; self-supported tunnels, thus risk of ground failure or inflow in tunnels reduced; simple concept and operation, variety of knowledgeable contractors/personnel; moderate production rate (approximately 4M lbs/yr per machine); ability to apply multiple units (scalability). Potential technical weaknesses: Recovery of ore may be limited to 90% at best due to configuration of the tunnels; congested working space in the launch stations; not currently in use in Canadian uranium industry.	Kazakhstan, Australia); reduced safety and environmental risks with elimination of underground excavations; completely remote system – safe for radiological risks; reduced number of employees on site; short timeframe to production (months); reduced technical risk with majority of remaining risks tested during feasibility stage; toll milling not required. Potential technical weaknesses: Not currently in use in Canadian uranium industry; mining solution permeability requires additional testing to increase confidence; low production rate – based on production rate at US operations (future testing may allow for higher production rates).
Cost Factors	Capital, operating, and decommissioning costs	Option 2 has high operating cost relative to the grade of the ore body, high capital costs and long duration development timeline, although the technology is in use at an existing uranium operation in Canada.	Option 3 has low capital and operating costs compared to jet boring.	Option 4 has the lowest ore recovery and high capital costs and long duration development timeline. Technology is commonly used in civil engineering.	Option 5 has low capital and operating costs. The technology is in widespread use at international uranium operations. ISR mining operations often have comparatively low capital and operating costs, as well as shorter timelines to first production and greater flexibility to allow production to be scaled to meet market demands.
Input received from Interested Parties:					

Other Evaluation Factors				
Criteria	**Option 2: Jet Boring**	**Option 3: Surface Boring**	**Option 4: Micro Tunnel Boring**	**Option 5: ISR**
Denison discussed potential mining methods early in the engagement process. As part of the engagement program for the Project, Denison organized a series of in-person workshops with Indigenous and non-Indigenous communities of interest (COI) and other Interested Parties in 2018. The workshops gathered community and student input in relation to potential mining methods for the Phoenix deposit. Given the history of uranium mining in the Athabasca Basin, there is a wealth of knowledge on various mining methods, and Denison sought input for which method would be best suited to efficiently and safety mining the Phoenix deposit. The following mining methods were evaluated for effectiveness in mining the Phoenix deposit at the Project: Jet Boring, Surface Boring, Micro Tunnel Boring and In Situ Recovery. There was no specific engagement data collected related to surface boring or micro tunnel boring. Workshop participants noted that while jet boring was a relatively well-known method of mining, the high economic costs may make it undesirable for the Phoenix deposit (18-EN-VPL-2.38) (18-EN-ERFN-5.44). ISR mining is new to northern Saskatchewan and Canada. Some workshop participants were unsure how to evaluate the potential benefits and/or drawbacks of this mining method (18-EN-VILX-3.69), however other participants were confident in the method, saying they know it works in other locations, there are minimal waste streams, and method is more economically feasible than other methods (18-EN-VILX-3.68). A participant in the Village of Beauval workshop preferred the small footprint and lesser environmental impacts of ISR and viewed this method as a new opportunity for northern Saskatchewan (18-EN-VB-4.51). New opportunities are welcomed in the area, as they can support local businesses, provide training and learning opportunities, and keep money within the local economy (16-EN-MLA-109.26).				
Selected alternative for mining method = Option 5: ISR				
Rationale: Mining methods were evaluated through an increasingly rigorous process and considered factors such as: safety, environment, production rates, capital costs, operating costs, schedule, operational flexibility, and risk. The top four mining methods considered for the Phoenix deposit were: jet boring, surface boring, micro tunnel boring, and ISR. Independent preliminary economic assessment or class 5 level assessments were completed on each of these four options in 2017. The parameters evaluated included safety, environmental impacts, radiological safety, capital cost, operating cost, development timeframe, production rate, economic results (net present value, internal rate of return), regulatory risk, technology risk, equipment and contractor availability, and operating flexibility; this information has been summarized above in the alternatives means assessment cells. In addition, workshops were held in local Indigenous and non-Indigenous communities to capture community input into the selection of a preferred mining method once the options were narrowed down. Ultimately, based on the alternatives evaluated and feedback from Communities of Interest, Denison included the ISR method in the prefeasibility study (PFS; Denison 2018) and this mining method was selected as the basis for the EA.				

Less Preferred	Neutral	More preferred

Table 7: Mining – Freeze Design for Tertiary Containment of Mining Solution - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Freeze dome	Option 2: Freeze Wall
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. No difference in potential effects on air quality would be expected for the freeze design for tertiary containment of mining solution alternatives.	
		Noise	No appreciable difference was identified between the alternatives. No difference in potential effects on sound levels would be expected for the freeze design for tertiary containment of mining solution alternatives.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the freeze containment alternatives.	
		Groundwater quantity	No appreciable difference was identified between alternatives. During operations, groundwater above the freeze dome would continue to move freely. During operation, groundwater within the vertical extent of the freeze walls will be contained. Based on understanding of the groundwater flow in the Project Area, the options would have similar, negligible effects on the at the regional groundwater regime, including shallow groundwater flow to surface waterbodies.	
		Groundwater quality	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quality would be expected for the freeze containment alternatives. Both options would provide protection of groundwater from mining solution in combination with the primary and secondary protection.	
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified between the alternatives. No difference in potential effects on the aquatic environment would be expected for the freeze design for tertiary containment of mining solution alternatives.	
		Surface Water Quality		
		Fish and Fish Habitat		
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives. No difference in potential effects on the terrestrial environment would be expected for the freeze design for tertiary containment of mining solution alternatives. The surface footprints for Option 2 would be slightly smaller than Option 1 due to the location and reduction from two freeze plant locations at either end of the wellfield (Option 1) to one freeze plant located adjacent to the wellfield (Option 2), but the relative footprint size differences are not material within the context of the Project footprint.	
		Soil		
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates		
		Furbearers		

Criteria	Section	Valued Component	Option 1: Freeze dome	Option 2: Freeze Wall
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between alternatives for changes in worker health from conventional health and safety and radiation exposure.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified between the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the freeze design for tertiary containment of mining solution alternatives. The surface footprints and activities would be similar for Options 1 and 2.	
		Other Land and Resource Use	No appreciable difference was identified between the alternatives. No difference in potential effects on other land and resource use would be expected for the freeze design for tertiary containment of mining solution alternatives. The surface footprints and activities would be similar for Options 1 and 2.	
		Heritage Resources	No appreciable difference was identified between alternatives. The surface footprints for Options 1 and 2 underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet	
		Community Well-being	No appreciable difference was identified between alternatives for changes in income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in economy and participation in traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Freeze dome**	**Option 2: Freeze Wall**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The freeze dome with directional drilling is a more complex option. Weaving the injection and recovery wells between the horizontal freeze holes poses a technical challenge for design, construction, and operation. The design also increases the risk of breaching tertiary containment due to the drilling complexity with the freeze holes perpendicular to the	The freeze wall design is less complex than Option 1 in terms of design, construction, and operation. The reliability of the freeze wall is expected to be higher than Option 1 because the design has the freeze holes adjacent to the injection and recovery wells. Decommissioning would be similar to Option 1.

Other Evaluation Factors			
Criteria		**Option 1: Freeze dome**	**Option 2: Freeze Wall**
		injection and recovery wells. Decommissioning would be similar to Option 2.	
Cost Factors	Capital, operating, and decommissioning costs	The capital costs are higher because the freeze holes would be created with the directional drilling technique. Operating and decommissioning costs would be similar to Option 2.	The capital costs are lower because the freeze holes can be created with the diamond drilling technique. Operating and decommissioning costs would be similar to Option 1.

Input received from Interested Parties:

Substantial efforts were made to ensure Interested Parties were given adequate information on Denison's plan to construct a freeze containment around the Phoenix deposit (19-EN-YNLR-83.3) (21-EN-SUR-446.10) (22-EN-VPL/ML9-620.15). ISR is new to Canadian mining and although ground freezing technology is associated with mining at Cigar Lake and McArthur River operations (e.g., there is knowledge and familiarity on this technique), the combination of ISR and ground freezing technology is unique and Denison dedicated substantial engagement efforts to share information on this topic. Denison had initially proposed a freeze dome to surround the deposit but changed the design plan to a freeze wall after determining that approach would be more appropriate for the Project (21-EN-ERFN-458.11). The freeze wall will be constructed to provide complete containment of the mining solution and support environmental commitments (22-EN-VPL/ML9-620.19), including protection of groundwater sources. Denison understands the ongoing protection of groundwater is a top priority for COI's and other Interested Parties (21-EN-VILX-443.19). During the extensive engagement process Denison used workshops and meetings as opportunities to answer questions about the freeze wall timeline, the freeze solution, the reliability of the freezing technology, and how the freeze wall may interact with groundwater (19-EN-CNSC-1.23) (21-EN-SUR-446.10) (19-EN-CNSC-1.26) (22-EN-EQC-648.1).

Selected alternative for freeze design for tertiary containment of mining solution = Option 2: Freeze wall

Rationale: There were essentially no appreciable differences for biophysical and human environment criteria for the two options evaluated. The freeze dome was the more complex and higher cost option, with higher risk. As such, the freeze wall option was selected as the preferred alternative and evaluated in the EA.

Less Preferred	Neutral	More preferred

Table 8: Mining – Permeability Enhancement - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Hydraulics	Option 2: Propellant	Option 3: Mechanical
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among the alternatives. No difference in potential effects on air quality would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground and surface footprints would be within the ISR wellfield footprint.		
		Noise	No appreciable difference was identified among the alternatives. No difference in potential effects on sound levels would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground.		
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology and groundwater would be expected for the permeability enhancement alternatives because these activities would be conducted within the established mining area.		
		Groundwater quantity			
		Groundwater quality			
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on aquatic environment Valued Components (VCs) would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground and surface footprints would be within the ISR wellfield footprint.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	No appreciable difference was identified among the alternatives. No difference in potential effects on terrestrial environment VCs would be expected for the permeability enhancement alternatives because these activities would be conducted 400 m underground and surface footprints would be within the ISR wellfield footprint.		
		Soil			
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			
		Ungulates			
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			

Criteria	Section	Valued Component	Option 1: Hydraulics	Option 2: Propellant	Option 3: Mechanical
		Bird species at risk			
Human Environment	Human Health	Human Health	No appreciable difference was identified among alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.		
		Worker Health	No appreciable difference was identified among alternatives for changes in worker health from conventional health and safety and radiation exposure.		
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the permeability enhancement alternatives. The surface footprints would be within the ISR wellfield footprint, which is not available for land and resource use activities during operations for safety reasons.		
		Other Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on other land and resource use would be expected for the permeability enhancement alternatives. The surface footprints would be within the ISR wellfield footprint, which is not available for land and resource use activities during operations for safety reasons.		
		Heritage Resources	No appreciable difference was identified among alternatives. No additional clearing for the permeability enhancement alternatives is needed. The clearing would have been done for the development for the ISR wellfield (which underwent heritage resource impact assessment surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch).		
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes in income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in traffic, community infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in economy and participation in traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Hydraulics**	**Option 2: Propellant**	**Option 3: Mechanical**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The technical factors for these options are similar in terms of providing the required permeability enhancement. Site-specific testing would be done and the options may be used at different locations in the deposit or at different times in the ISR process.		
Cost Factors	Capital, operating, and decommissioning costs	Cost factors for these factors are similar for capital, operation, and decommissioning.		
Input received from Interested Parties: During engagement activities it was critical for Denison to clearly explain the difference between permeability enhancement and fracking (21-EN-LLRIB-392.4) and communicate that the Wheeler River Project is not using any fracking methods. Part of the 2019 field work involved testing permeability enhancement techniques. Through meetings and workshops Denison kept COIs informed of field work, field tests and other activities happening at the Project site (21-EN-LLRIB-392.4) (21-EN-LLRIB-392.3). When mining options were presented at workshops in 2018, some members of the communities had reservations regarding the fact that ISR reminded them of fracking since fracking carried a negative connotation (18-EN-VB-4.54).				

Other Evaluation Factors			
Criteria	**Option 1: Hydraulics**	**Option 2: Propellant**	**Option 3: Mechanical**
Selected alternative for Permeability Enhancement = Option 1: Hydraulics, Option 2: Propellant, and Option 3: Mechanical			
Rationale: All three options were carried forward for evaluation in the EA. The evaluation of the performance of permeability enhancement options will be ongoing as the Project advances through the engineering process and into operation.			

Less Preferred	Neutral	More preferred

Table 9: Processing – Location of Processing - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Off-site processing at an existing mill	Option 2: On-site processing in purpose built processing plant
Biophysical	Atmospheric and Acoustic Environment	Air quality	Potential air quality changes would be lower than that expected for Option 2, since processing would occur off site and within the constraints of the licensing constraints of an existing third-party. Air quality changes associated with this option would be from wind dispersion of metals, radionuclides, particulate matter on stockpiles or from Uranium Bearing Solution (UBS) storage areas prior to transport off site.	The processing plant circuits in general, and drying/calcining in particular, increase concentrations of radionuclides, radon, metals in air, despite mitigation with scrubbers, and best management practises (BMPs). greenhouse gas (GHG) emissions associated with this option would be higher than Option 1, as the processing is fairly energy and heat intensive.
		Noise	Potential changes in sound levels would be lower than that expected for option 2.	Anticipate larger changes in sound level for this option compared to option 1.
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the processing location alternatives.	
		Groundwater quantity	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quantity would be expected for the processing location alternatives.	
		Groundwater quality	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quality would be expected for the processing location alternatives.	
	Aquatic Environment	Surface Water Quantity	In consideration of treated effluent discharge that would be associated with processing plant operations, the water management and treatment volumes would be expected to be lower for Option 1 compared to Option 2, making this option more preferred from that perspective.	In consideration of treated effluent discharge that would be associated with processing plant operations, the water management and treatment volumes would be expected to be higher for Option 2 compared to Option 1, making this option less preferred from that perspective.
		Surface Water Quality		
		Fish and Fish Habitat		
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	There would be no construction-related effects (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands for this option. Operation of the surface handling and load out facilities would have a relatively small footprint and would generate emissions to air that may have indirect effects on terrestrial VCs.	Construction of a processing plant would result potentially result in direct effect (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands. Operation of the plant will generate emissions to air that may have indirect effects on terrestrial VCs.
		Soil		
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		

Criteria	Section	Valued Component	Option 1: Off-site processing at an existing mill	Option 2: On-site processing in purpose built processing plant
		Ungulates	Habitat loss (direct loss of habitat) associated with clearing for an area/building for ore, ore slurry, or UBS storage and a container loading facility, and also indirect effect on habitat use from noises, lights, or odors from processing plant activities. Increased direct effects on mortality from increased road traffic.	Habitat loss (direct loss of habitat) associated with clearing for construction of processing plant, and associated project components (e.g., radon purge tanks, UBS holding area), and also indirect effect on habitat use from noises, lights, or odors from processing plant activities.
		Furbearers		
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	Changes in local air quality from surface handling and load out facility and lower volume of treated effluent discharge would make this option more preferred for exposure to non-radiological and radiological constituents in air, water, and food.	Changes in local air quality from processing plant emissions and higher volume of treated effluent discharge would make this option less preferred by increased exposure to non-radiological and radiological constituents in air, water, and food.
		Worker Health	No appreciable difference was identified between alternatives for worker health. These options would have similar conventional health and safety risks and radiation exposure.	
	Land and Resource Use	Indigenous Land and Resource Use	The surface handling and load out facilities would be adjacent to (within 1 km) the mine, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.	The processing plant location would be adjacent to (within 1 km) the ISR wellfield, which is not available for Indigenous land and resource use activities during operations for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.
		Other Land and Resource Use	The surface handling and load out facilities would be adjacent to (within 1 km) the mine, which would not be available for other land and resource use activities during operations for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.	The processing plant location would be adjacent to (within 1 km) the ISR wellfield, which is not available for other land and resource use activities during operations for safety reasons. Potential indirect changes in availability of land and resources due to noise, emissions, lights, and smell associated with this option.
		Heritage Resources	No appreciable difference was identified between alternatives. The surface footprints for Options 1 and 2 are assumed to be in the areas that underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet	
		Community Well-being	No appreciable difference was identified between alternatives for changes to income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in infrastructure and services	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in economy and participation in traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Off-site processing at an existing mill**	**Option 2: On-site processing in purpose built processing plant**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The main technical challenge with this option was the need for a toll-milling agreement with an existing mill. If this was not possible, the Project would be at risk. This technical risk was greater than the technical challenges associated with construction, operating, and decommissioning an on-site processing plant, associated with ISR mining.	Technical factors associated with building and operating an on-site processing plant are comparatively more complex than what would be needed for the surface handling and load out facilities. However, such technical factors are, but not complex enough to create feasibility concerns – similar processing operations are conducted in the region in an effective and safe manner. This option reduces the risks to the Project by not requiring a toll-milling arrangement with a third-party.
Cost Factors	Capital, operating, and decommissioning costs	The cost factors of focus here include the toll-milling fees that effectively lower profit for Denison, compared to Option 2. Option 1 would have a lower net present value as the ore, ore slurry, or UBS would be sold as it leaves site.	The direct capital, operating, and decommissioning costs to Denison would be higher than Option 1 for construction, operation, and decommissioning of an on-site processing plant, but the potential profit would be greater.
Input received from Interested Parties: ISR doesn't require materials to go through a crushing phase. The uranium bearing solution will be processed on site – not trucked to a mill at another facility (21-EN-YOUTH-445.2) (21-EN-ERFN-447.28). Having a processing facility located on site will help to reduce transportation costs, emissions from transportation vehicles, and road degradation (21-EN-SUR-446.75) (21-EN-SUR-446.74). A reduction in road traffic, thereby minimizing noise and dust pollution, would be appreciated by cabin and lodge lease holders that may also use highways and roads in the general area (20-LK-LEASESUR-267.99 to 20-LK-LEASESUR-267.108).			
Selected alternative for location of processing = Option 2: On-site processing in purpose-built processing plant **Rationale:** Processing location options were closely associated with assessment of alternative means for mining methods. With the decision to advance the Project as an ISR mine, the option for on-site processing (Option 2) is preferred to off-site processing (Option 1) as it conveys several advantages to the Project as a whole.			

Less Preferred	Neutral	More preferred

Table 10: Processing – On-site Processing Methods - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Ion Exchange	Option 2: Solvent Extraction	Option 3: Direct Precipitation
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among alternatives. With application of mitigation measures (e.g., scrubbers), the residual effects are expected to be similar for these options.		
		Noise	No appreciable difference was identified among alternatives. With application of mitigation measures, the residual effects are expected to be similar for these options.		
	Geology and Groundwater	Geology	No appreciable difference was identified among alternatives for geology, groundwater quantity and groundwater quality.		
		Groundwater quantity			
		Groundwater quality			
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among alternatives. With application of mitigation measures, the residual effects are expected to be similar for these options. Although solvent extraction increases the use of ammonia in the process, the water treatment methods are assumed to be sufficient to generate effluent of comparable quality, regardless of the processing method.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	No appreciable difference was identified among the alternatives for changes to terrestrial VCs. For the alternative means assessment for on-site processing method, it was assumed that the footprints of the plant would be similar among the methods evaluated. As indicated above, processing plant emissions would be similar for each option and therefore potential residual effects to terrestrial receptors through the air exposure pathway would be similar.		
		Soil			
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			
		Ungulates			
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			

Criteria	Section	Valued Component	Option 1: Ion Exchange	Option 2: Solvent Extraction	Option 3: Direct Precipitation
		Bird species at risk			
Human Environment	Human Health	Human Health	No appreciable difference was identified among alternatives. With application of mitigation measures (e.g., scrubbers, water treatment), the residual effects on worker health are expected to be similar for these options.		
		Worker Health	No appreciable difference was identified among alternatives. With application of mitigation measures (e.g., scrubbers), the residual effects on worker health are expected to be similar for these options.		
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the processing method. The surface footprint for the processing plant was assumed to be similar for all three options and would be beside the wellfield footprint, which is not available for land and resource use activities during Operation for safety reasons.		
		Other Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the processing method. The surface footprint for the processing plant was assumed to be similar for all three options and would be beside the wellfield footprint, which is not available for land and resource use activities during Operation for safety reasons.		
		Heritage Resources	No appreciable difference was identified among alternatives on a change in known archaeological resources. For the alternative means assessment for on-site processing method, it was assumed that the footprints of the plant would be similar between the methods evaluated. This assessment is at the process level, with no consideration of the physical footprint.		
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes to income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in economy and participation in traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Ion Exchange**	**Option 2: Solvent Extraction**	**Option 3: Direct Precipitation**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Potential concerns associated with this option are linked to the elevated uranium concentrations in the UBS. Typical ion exchange application handles high volumes of low uranium concentration levels whereas for this Project, it is expected production from the wellfield will be the opposite: low	Solvent extraction is proven technology in similar applications, so no potential material concerns are raised here. Ammonium sulphate is commonly used for stripping the uranium and waste water requires additional equipment to prior to release in the environment. It has been assumed that sodium chloride	The main technical risk in direct precipitation is the concentration of contaminants in the product, especially with recirculation. The addition of a process precipitate circuit before the uranium extraction circuit could address this technical risk. Little to no industrial history exists for ISR

Other Evaluation Factors				
Criteria		**Option 1: Ion Exchange**	**Option 2: Solvent Extraction**	**Option 3: Direct Precipitation**
		flow with high uranium concentration. This creates the need for very small ion exchange vessels and a multitude number of ion exchange trains, which would require additional testing and a very complicated process control system with attendant piping and instrumentation to manage the frequent loading, unloading and stripping of solutions.	will be used for commonality with the ion exchange circuit. Solvent extraction carries a risk of fire associated with the use of low flash point hydrocarbons. Should this be considered a separate building for the solvent extraction circuit with a robust fire suppression system would be required in the design.	operations using direct precipitation. One of the benefits of this option is that this is a very simple plant with fewer processes and failure points, simplified piping systems, fewer reagents, reduced staffing, and low pressure process compared to Options 1 and 2. Based on the above, this option is more preferred from a technical factor perspective.
Cost Factors	Capital, operating, and decommissioning costs	A capital cost estimate was done at a scoping study level, or class 5 at best for the plant, and is estimated at $36 MM USD, which includes a 30% contingency. For the alternative means assessment, the operating and decommissioning costs are assumed to be similar to Options 2 and 3.	The capital estimate was $43.5 MM USD for the complete plant, which includes a 30% contingency. The mechanical equipment cost of the solvent extraction portion was estimated at $3.6 MM USD, (excluding clarifying circuit and fire protection system). For the alternative means assessment, the operating and decommissioning costs are assumed to be similar to Options 1 and 3.	The capital estimate for the plant was $30.5MM USD, this includes a 30% contingency. For the alternative means assessment, the operating and decommissioning costs are assumed to be similar to Options 1 and 2.
Input received from Interested Parties: While there is considerable experience and expertise when it comes to mining in northern Saskatchewan, there was no engagement specific data collected relating to on site processing methods. Processing materials on site will require a resourceful workforce, a workforce that Denison is looking to source locally (16-EN-VB-107.17). Meaningful employment is highly value amongst COI's and is a frequent topic of discussion. Processing materials on site will help employees develop their skills and bring dollars to local economies (21-EN-SUR-446.21) (19-EN-PBN-135.5).				
Selected Alternative for on-site processing method = Option 3: direct precipitation **Rationale:** Direct precipitation was selected as the on-site processing method for the Project and carried through the EA. This selection was primarily based on the technical factors from the screening level alternative means assessment. The on-site processing method selected to support the EIS will be reviewed and adapted as needed through the completion of additional metallurgical test work and as the Project proceeds through licensing and permitting.				

Less Preferred	Neutral	More preferred

Table 11: Water Management – Freshwater Supply - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Groundwater	Option 2: Surface water
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. No difference in potential effects on air quality would be expected for the freshwater supply alternatives.	
		Noise	No appreciable difference was identified between the alternatives. No difference in potential effects on sound levels would be expected for the freshwater supply alternatives.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the freshwater supply alternatives.	
		Groundwater quantity	Less preferred. Withdrawing groundwater could have a very localized influence on groundwater quantity.	More preferred. Option 2 would not interact with groundwater quantity.
		Groundwater quality	No appreciable difference was identified between the alternatives. Withdrawal of water under Option 1 or 2 is not expected to change the quality of groundwater.	
	Aquatic Environment	Surface Water Quantity	Although groundwater recharge to surface waterbodies does account for some flow contribution, the change in surface waterbody flows or levels would be more influenced by direct withdrawal, making this option more preferred on the surface water quantity VC.	Less preferred option. The use of a waterbody as a freshwater intake source could lead to drawdown.
		Surface Water Quality	No appreciable difference was identified between the alternatives. Withdrawal of water under Option 1 or 2 is not expected to change the quality of surface water.	
		Fish and Fish Habitat	Although groundwater recharge to surface waterbodies does account for some flow contribution, the change in surface waterbody flows or levels would be more influenced by direct, surface water withdrawal, making this option more preferred for these aquatic environment VCs.	Installation of a water intake in a nearby lake, depending on the design, may overprint a small spatial area of the lake bottom, thereby interacting with sediment, benthic invertebrates and fish and fish habitat. Fisheries and Oceans Canada (2013) identifies that cumulative flow alterations (e.g., water withdrawal) of less than 10% of the magnitude of the actual (instantaneous) flow in a river relative to a natural flow regime would result in a low probability of detectable impacts to ecosystems that support commercial, recreational, or Indigenous fisheries. Assuming the water withdrawal location meets these requirements (i.e., withdrawal volumes are <10% of instantaneous flow), would expect no detectable effects to aquatic environment components such as fish and fish habitat, sediment quality, benthic invertebrates, and fish health as it relates to flow/water level alteration.
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives. Changes in terrain, soil, and organic matter/peat would not be anticipated in a discernable way for either option	
		Soil		

Criteria	Section	Valued Component	Option 1: Groundwater	Option 2: Surface water
		Organic matter/peat		
		Vegetation and Ecosystems	Less preferred. Shallow-groundwater withdrawal would have a greater potential to influence on terrestrial moisture regimes, and areal extent of vegetation and ecosystems, listed plant species, and wetlands	More preferred. Surface water withdrawal would have a lower potential to influence on areal extent of vegetation and ecosystems, listed plant species, and wetlands
		Listed Plant Species		
		Wetlands		
		Ungulates	No appreciable difference was identified between the alternatives. Habitat changes associated with Option 1 changing terrestrial moisture regimes and Option 2 changing surface water flows or water levels, would be similar and more importantly, both would be very unlikely to interact with the vertebrate terrestrial VCs. The presence of a small diameter pipeline from the well (Option 1) or the surface waterbody (Option 2) to the main Project Area would be similar in length and designed to facilitate wildlife crossing.	
		Furbearers		
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between the alternatives. Neither option would change non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between the alternatives. Any drinking water at site, regardless of the source, will need to meet potable water requirements. There are no conventional health and safety risks, or radiation exposure differences associated with these options.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable differences were identified for changes in the area of land available for Indigenous and non-Indigenous or other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	
		Other Land and Resource Use		
		Heritage Resources	No appreciable difference was identified between these options for heritage resources. The main project area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed both options (well and pipeline for Option 1, pipeline for Option 2) are located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during construction	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives for changes to knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.	
		Community Well-being	No appreciable difference was identified between alternatives for changes to income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in economy and participation in traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Groundwater**	**Option 2: Surface water**
Technical Factors	Complexity of design, construction, operation, and decommissioning	A shallow groundwater well would be straightforward in terms of design, construction, operation, and decommissioning. Denison uses a shallow groundwater well at its existing exploration camp and drilling equipment is readily available on site for a proposed ISR operation.	A surface water withdrawal would be slightly more complex compared to Option 1. Installing and maintaining a surface water intake in a nearby lake would require more careful planning for in-water works, interaction with fish and fish habitat, and seasonal issues with ice influencing the intake pipe and pump.
Cost Factors	Capital, operating, and decommissioning costs	Costs would be similar for withdrawal components. The water treatment design on the potable side may be lower cost for this option, but that was considered outside of this assessment of alternative means.	The capital, operating, and decommissioning costs of a surface water intake would be similar between Options 1 and 2.
Input received from Interested Parties: Hydrology information from baseline programs were used together with engagement information gathered from workshops and meetings to evaluate surface water locations (22-EN-VPL/ML9-620.8). Freshwater supply was an important aspect for Denison to consider when designing the Project as it supports components of both the mining method and camp operations. While the area surrounding the Project hosts a multitude of freshwater supply sources (e.g., lakes, rivers, ponds, streams), it was important for Denison to listen to the perspectives of Indigenous groups regarding which freshwater sources they believed would best align with the plans and requirements for the Project. This included conversations about which surface water bodies could effectively provide the amount of water needed, without affecting the surrounding aquatic and terrestrial ecosystems (18-EN-VPL-2.11).			
Selected alternative for freshwater supply = Option 1: Groundwater and Option 2: Surface water **Rationale:** The two options evaluated were determined to be viable options based on the screening. Both groundwater and surface water withdrawals were carried forward as freshwater supply alternative means and evaluated in the EA. Additionally, the freshwater needs have been scoped in the EA to allow for one source to be used exclusively. This will allow for a combination of the two water sources to be used, if needed. Assessing both options in the EIS provides operational flexibility for Denison and meets the aim of having a conservative assessment basis.			

Less Preferred	Neutral	More preferred

Table 12: Water Management – Drinking Water - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Truck drinking water to site	Option 2: Generate drinking water on-site with a potable water treatment plant
Biophysical	Atmospheric and Acoustic Environment	Air quality	Transport would generate dust along roads.	No appreciable changes in air quality is anticipated for operation of a potable water treatment plant.
		Noise	No appreciable difference was identified between the alternatives. Option 1 would generate vehicular noise along roads; Option 2 would generate very low, localized levels of noise within the plant.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the drinking water alternatives.	
		Groundwater quantity	No appreciable difference was identified between the alternatives. Groundwater source of freshwater for Option 2 was evaluated separately.	
		Groundwater quality	No appreciable difference was identified between the alternatives. No difference in potential effects on groundwater quality would be expected for the drinking water alternatives.	
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified between the alternatives. Surface water source of freshwater for Option 2 was evaluated separately.	
		Surface Water Quality	No appreciable difference was identified between the aquatic environment VCs for these alternatives.	
		Fish and Fish Habitat		
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives. No difference in potential effects on terrain would be expected for the drinking water alternatives.	
		Soil	Transport would generate dust along roads, which could lead to indirect effects on soil and vegetation.	No appreciable changes in these terrestrial VCs would be anticipated for construction, operation, and decommissioning of a potable water treatment plant.
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates	Transport would generate dust along roads, which could lead to indirect effects on habitat use. Potential increase in direct mortality from increased traffic.	

Criteria	Section	Valued Component	Option 1: Truck drinking water to site	Option 2: Generate drinking water on-site with a potable water treatment plant
		Furbearers	Transport would generate dust along roads, which could lead to indirect effects on habitat use. Potential increase in direct mortality from increased traffic.	
		Woodland caribou	Transport would generate dust along roads, which could lead to indirect effects on habitat use. Potential increase in direct mortality from increased traffic.	
		Raptors	Transport would generate dust along roads, which could lead to indirect effects on habitat use.	
		Migratory breeding birds	Transport would generate dust along roads, which could lead to indirect effects on habitat use.	
		Bird species at risk	Transport would generate dust along roads, which could lead to indirect effects on habitat use.	
Human Environment	Human Health	Human Health	No appreciable difference was identified between the alternatives. Neither option would change non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between the alternatives. Any drinking water at site, regardless of the source, will need to meet potable water requirements. There are no differences in conventional health and safety risks or radiation exposure associated with these options.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable differences were identified for changes in the area of land available for Indigenous and non-Indigenous or other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use	
		Other Land and Resource Use		
		Heritage Resources	For this option, existing facilities (roads) would be used and, therefore, it is presumed no archaeological and cultural heritage features would be affected.	The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the potable plant is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.
	Quality of Life	Cultural Expression	Less preferred option for cultural expressions due to increased traffic close to culture camp locations.	This option is not expected to effect a change in cultural expression.
		Community Well-being	Business opportunities for supplying bottled water and transporting to site may provide a potential positive effect on the income of local workers.	Having an on-site potable water treatment plant would increase the responsibility of Denison staff and contractors (for construction,

Criteria	Section	Valued Component	Option 1: Truck drinking water to site	Option 2: Generate drinking water on-site with a potable water treatment plant
				collection, disposal, maintenance, decommissioning), which may generate a positive effect on income of local workers.
		Infrastructure and Services	Less preferred option due to increase in traffic on local roads.	This option is not expected to effect a change to infrastructure and services.
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors		
Criteria		**Metric**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Complexity of design, construction, operation, and decommissioning were assumed to be similarly low for both options.
Cost Factors	Capital, operating, and decommissioning costs	Capital, operating, and decommissioning costs were assumed to be similarly low for both options.
Input received from Interested Parties: Water has been the topic of many conversations during the past seven years of engagement activities for the Project. The COIs and other Interested Parties are curious how drinking water will be provided for the Project (22-EN-VPL/ML9-620.8). Two options were considered for providing potable water to the Project. Potable water could be sourced off site and then truck into the Project, or potable water could be generated on site through nearby groundwater wells and associated potable water treatment plant infrastructure. The transport of additional materials by truck would increase traffic, which may have a potential effect on traditional land use, infrastructure and services, and wildlife. There were concerns that an increase in noise and vibrations because of truck traffic could potentially disrupt wildlife (19-LKERFNTrap-134.173) and increase greenhouse gas emissions.		
Selected alternative for drinking water = Option 2: Generate drinking water on site with a potable water treatment plant **Rationale:** The ability to generate drinking water on site was more preferred compared to trucking drinking water to site. Assessing this option allows Denison to have operational flexibility and the ability to provide for workers, with less logistical coordination and traffic associated with transport of potable water to site.		

Less Preferred	Neutral	More preferred

Table 13: Water Management – Treated Effluent Discharge Location - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: To groundwater	Option 2: To surface water
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. No difference in potential effects on air quality would be expected for the treated effluent discharge location alternatives.	
		Noise	No appreciable difference was identified between the alternatives. No difference in potential effects on sound levels would be expected for the treated effluent discharge location alternatives.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the treated effluent discharge location alternatives.	
		Groundwater quantity	Less preferred. Local groundwater quantity could be changed; effects would be determined at a receptor location	More preferred. This option would not interact with groundwater quantity.
		Groundwater quality	Less preferred. Local groundwater quality would be changed; effects would be determined at a receptor location	More preferred. This option would not interact with groundwater quality.
	Aquatic Environment	Surface Water Quantity	More preferred. Release to groundwater would contribute to smaller change in these aquatic VCs, via groundwater contribution to surface water	Less preferred. Releasing treated effluent will have more direct effects on these aquatic VCs, through changes in water flow and water quality.
		Surface Water Quality		
		Fish and Fish Habitat		
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives. No difference in potential effects on terrain would be expected for the treated effluent discharge location alternatives	
		Soil	Less preferred. Groundwater discharge would have a greater potential to influence terrestrial moisture regimes, and areal extent of vegetation and ecosystems, listed plant species, and wetlands.	More preferred. Surface water discharge would have a lower potential to influence areal extent of vegetation and ecosystems, listed plant species, and wetlands.
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates	More preferred. Release to groundwater will contribute smaller change in surface water quality (via groundwater contribution to surface water) and eventual uptake by wildlife VCs.	Less preferred. These wildlife VCs could experience an increased exposure to non-radiological and radiological constituents through intake of surface water that has received treated effluent.
		Furbearers		
		Woodland caribou		

Criteria	Section	Valued Component	Option 1: To groundwater	Option 2: To surface water
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	More preferred. Groundwater is not typically used as a drinking water source in the area by recreational and traditional users.	Less preferred. Surface water is more typically used as a drinking water source by recreational and traditional users.
		Worker Health	No appreciable difference was identified between the alternatives. No difference was found in conventional health and safety risks, or radiation exposure associated with these options.	
	Land and Resource Use	Indigenous Land and Resource Use	More preferred. A change in the perceived suitability of land and resources for safe use may be smaller for this option, compared to Option 2.	Less preferred. A change in the perceived suitability of land and resources for safe use may be bigger for this option, compared to Option 1.
		Other Land and Resource Use		
		Heritage Resources	No appreciable difference was identified between these options for heritage resources.	
	Quality of Life	Cultural Expression	More preferred. A change in the perceived suitability of land and resources for safe use may be smaller for this option, compared to Option 2.	Less preferred. A change in the perceived suitability of land and resources for safe use may be bigger for this option, compared to Option 1.
		Community Well-being	No appreciable difference was identified between alternatives for changes in income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: To groundwater**	**Option 2: To surface water**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The regulatory framework and permitting/approval process for releasing treated effluent to groundwater is less clear than the release to surface water. With the selection of ISR, the option to release treated effluent to groundwater became less preferred as it could complicate interactions of the Project with groundwater. Because a portion of the treated effluent released to groundwater would report to lakes, the prediction and monitoring of the movement of effluent in groundwater was a technical/regulatory risk.	Release of treated effluent to surface water is standard approach for other uranium operations in Saskatchewan. Although it will trigger the Metal and Diamond Mine Effluent Regulations (MDMER), and there are associated costs and responsibilities (monitoring, reporting), this is a more preferred option from a technical standpoint.

Other Evaluation Factors			
Criteria		**Option 1: To groundwater**	**Option 2: To surface water**
Cost Factors	Capital, operating, and decommissioning costs	No appreciable difference was identified between the alternatives. For the screening, the costs were assumed to be comparable for option 1 and 2.	

Input received from Interested Parties:

As part of the engagement program for the Project, Denison organized a series of workshops with COIs and Interested Parties. The workshops gathered community and student input in relation to potential mining methods, and other components of the Project, for the Phoenix deposit. Potential locations for treated effluent discharge locations were discussed with COIs and other Interested Parties on multiple occasions. During a meeting with the Village of Beauval, participants voiced their confidence that all waterbodies in proximity to the Project had sufficient capacity to accept treated effluent from the Project. There was a general preference to discharge the treated effluent into a water system that was flowing, allowing for a more effective dilution of the treated effluent (18-EN-VB-4.34) (18-EN-VB-4.35). No specific engagement data were available relevant to discharging the treated effluent into a groundwater source, although there was sufficient material to determine that COIs preferred the option to discharge to a surface water source that experiences flow or movement.

Selected alternative for treated effluent discharge location = Option 2: to surface water

Rationale: The option to release treated effluent to surface water was selected and evaluated in the EA. Releasing treated effluent to surface water may be less preferred in terms of changes to surface water quality and the aquatic, terrestrial, and human VCs that may drink water or otherwise use aquatic resources (e.g., eat fish). However, the option to release treated effluent to surface water is industry-standard and the regulatory process is clearer. The option to discharge treated effluent to groundwater would complicate the Project's monitoring and permitting process.

Less Preferred	Neutral	More preferred

Table 14: Water Management – Treated effluent discharge locations for surface water - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among the alternatives. No difference in potential changes in air quality would be expected for the treated effluent discharge location to surface water alternatives.				
		Noise	No appreciable difference was identified among the alternatives. No difference in potential effects on sound levels would be expected for the treated effluent discharge location to surface water alternatives.				
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the treated effluent discharge location to surface water alternatives.				
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the treated effluent discharge location to surface water alternatives				
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the treated effluent discharge location to surface water alternatives				
	Aquatic Environment	Surface Water Quantity	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, Kratchkowsky Lake (LA-7) was identified as less preferred.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, LA-6 was identified as one of the preferred discharge locations.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, LA-5 was identified as one of the preferred discharge locations.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, LA-1 was identified as one of the preferred discharge locations.	Step 1 in a preliminary evaluation of discharge location: A preliminary water quality assessment was completed using available hydrology, expected effluent quality, and effluent discharge at 200 m^3/hour. Based on the assessment of potential effects on water quantity and quality, Russell Lake was identified as one of the preferred discharge locations.
		Surface Water Quality					
		Fish and Fish Habitat	In Step 2 of the preliminary evaluation of discharge location, consideration was given to fish and fish habitat. All options could be suitable if the discharge location is sited away from spawning areas. Because spawning habitat is present at all locations, but could be avoided, all locations were given a neutral rating. No waterbodies were eliminated from further consideration as potential intake and discharge locations based on the review of fish and fish habitat in this stage.				
		Sediment Quality	In Step 3 of the preliminary evaluation of discharge location, the potential effects on surface water, sediment, and other aquatic VCs associated with the discharge of treated mine water were evaluated using the environmental pathways model IMPACT. The IMPACT model has supported a number of				
		Benthic Invertebrates					

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
		Fish Health	successful environmental assessments in the region and continues to be a key tool for demonstrating the high level of environmental performance of these operations. The IMPACT model was set up for the Icelander River drainage using site-specific baseline and hydrologic information. The IMPACT model includes flow and mass balance in lakes and streams. The constituents of potential concern (COPCs) enter the aquatic environment at the discharge location and travel downstream through a series of waterbodies. As the COPCs travel downstream, concentrations in water can decrease as a result of mixing with natural inflows from the surrounding watershed and interactions with lake sediment. The exchange of constituents is estimated using chemical-specific partitioning coefficients. The model was populated with sensitive aquatic (northern pike, lake whitefish, white sucker, spottail shiner, aquatic invertebrates, zooplankton, aquatic plants, phytoplankton) and terrestrial (loon, scaup, mink) biota to assess potential ecological effects of the discharge of COPCs in treated mine water during the life of the mine. Potential effects on the receiving environment were evaluated by comparing predicted water and sediment quality to water and sediment quality guidelines, and predicted the exposure of sensitive valued ecosystem components to toxicological and radiological benchmarks. Results flagged that molybdenum in sediment in LA-7 was anticipated to exceed a guideline (Kratchkowsky Lake = less preferred). No other guidelines for water/sediment or toxicity reference values for aquatic and terrestrial biota were predicted to be exceeded.				
	Terrestrial Environment	Terrain	No appreciable difference was identified among the alternatives. No difference in potential changes in terrain would be expected for the treated effluent discharge location to surface water alternatives.				
		Soil	Interaction of options with these terrestrial VCs would be through surface clearing for installation of a pipeline and adjacent trail or road for maintenance. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake.				
		Organic matter/peat					
		Vegetation and Ecosystems					
		Listed Plant Species					
		Wetlands					
		Ungulates	Interaction of options with these terrestrial VCs would be through surface clearing for installation of a pipeline and adjacent trail or road for maintenance. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake. In Step 3 of the preliminary evaluation of discharge location, the potential effects on surface water, sediment and valued ecosystem components from the discharge of treated mine water were evaluated using the environmental pathways model IMPACT. The IMPACT model has supported a number of successful environmental assessments in the region and continues to be a key tool for demonstrating the high level of environmental performance of these operations. The IMPACT model was set up for the Icelander River drainage using site-specific baseline and hydrologic information. The IMPACT model includes flow and mass balance in lakes and streams. The COPCs enter the aquatic environment at the discharge location and travel downstream through a series of waterbodies. As the COPCs travel downstream, concentrations in water can decrease as a result of mixing with natural inflows from the surrounding watershed and interactions with lake sediment. The exchange of constituents is estimated using chemical-specific partitioning coefficients. The model was populated with sensitive aquatic (northern pike, lake whitefish, white sucker, spottail shiner, aquatic invertebrates, zooplankton, aquatic plants, phytoplankton) and terrestrial (loon, scaup, mink) biota to assess potential ecological effects of the discharge of COPCs in treated mine water during the life of the mine. Potential effects on the receiving environment were evaluated by comparing predicted water and sediment quality to water and sediment quality guidelines, and predicted the exposure of sensitive valued ecosystem components to toxicological and radiological benchmarks. Results flagged that				
		Furbearers					
		Woodland caribou					
		Raptors					
		Migratory breeding birds					
		Bird species at risk					

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
			molybdenum in sediment in LA-7 was anticipated to exceed a guideline. No other guidelines for water/sediment or TRVs for aquatic and terrestrial biota were predicted to be exceeded.				
Human Environment	Human Health	Human Health	Neutral as this would be less preferred than Options 2 and 3, but more preferred than Options 4 and 5, considering historical commercial fishing at this lake, but no current leases (receptors).	More preferred as there are no leases/cabins or known land use at this lake.	More preferred as there are no leases/cabins or known land use at this lake.	Less preferred because of the land use at this lake (receptor location). Release of effluent here could increase non-radiological and radiological constituents in water and fish. Perceived changes are also considered here.	Less preferred because of the land use at this lake (receptor location). Release of effluent here could increase non-radiological and radiological constituents in water and fish. Perceived changes are also considered here.
		Worker Health	No appreciable difference was identified among the alternatives. No difference was identified in conventional health and safety risks, or radiation exposure associated with these options.				
	Land and Resource Use	Indigenous Land and Resource Use	More preferred as these lakes would have a smaller influence in the change in area of land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use, based on Indigenous land use information available.				Less preferred. One traditional land use lease on Russell Lake. Fishing on Russell Lake could be affected by a change in the perceived suitability of the lake for safe use.
		Other Land and Resource Use	Less preferred as this lake has, in previous years, been fished commercially.	More preferred as there are no recreational leases, and no known land use.	More preferred as there are no recreational leases, and no known land use.	A recreational lease (cabin) occurs on McGowan Lake. Water taking and fishing on McGowan Lake could be affected by a change in the perceived suitability of the lake for safe use.	Less preferred. Several recreational leases and outfitters are found on Russell Lake. This lake has, in previous years, been fished commercially. Recreational and commercial fishing on Russell Lake could be affected by a change in the perceived suitability of the lake for safe use.

Criteria	Section	Valued Component	Option 1: Kratchkowsky Lake (LA-7)	Option 2: Whitefish Lake north (LA-6)	Option 3: Whitefish Lake south (LA-5)	Option 4: McGowan Lake (LA-1)	Option 5: Russell Lake
		Heritage Resources	No appreciable differences were identified among these options. If not within the bounds of a previous heritage resources impact assessment, the land corridor for the effluent pipeline will be examined. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.				
	Quality of Life	Cultural Expression	Less preferred. As this is a larger lake, and has previously been commercially fished, there may be potential for a larger perceived change in the suitability and safety of resources that support a traditional diet with effluent release at this location.	More preferred as, based on land use information, there may be potential for a smaller perceived change in the suitability and safety of resources that support a traditional diet with effluent release at these locations.			Less preferred. As this is a larger lake, and has previously been commercially fished, there may be potential for a larger perceived change in the suitability and safety of resources that support a traditional diet with effluent release at this location.
		Community Well-being	No appreciable differences was identified among these options. No difference in potential changes in income of local workers and community cohesion would be expected for the treated effluent discharge locations for surface water.				
		Infrastructure and Services	No appreciable differences was identified among these options. No difference in potential changes to traffic, or community infrastructure and services would be expected for the treated effluent discharge locations for surface water.				
	Economics	Economy	Less preferred. Commercial fishing on Kratchkowsky Lake could be affected by a change in the perceived suitability of the lake for safe use.	More preferred with smaller potential change in participation in traditional economy.			Less preferred. Commercial fishing on Russell Lake could be affected by a change in the perceived suitability of the lake for safe use.

Other Evaluation Factors						
Criteria		**Option 1: Kratchkowsky Lake (LA-7)**	**Option 2: Whitefish Lake north (LA-6)**	**Option 3: Whitefish Lake south (LA-5)**	**Option 4: McGowan Lake (LA-1)**	**Option 5: Russell Lake**
Technical Factors	Complexity of design, construction, operation, and decommissioning	The general design of the treated effluent pipeline and diffuser would be the same for all options. The parameter that would vary is the length of the pipeline. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake. A line to Russell Lake would also have to cross Highway 914.				
Cost Factors	Capital, operating, and decommissioning costs	The main driver of cost would be related to the length of the pipeline. Going from closest (more preferred) to farthest (less preferred): LA-5, LA-6, LA-1, LA-7, and Russell Lake. A line to Russell Lake would also have to cross Highway 914.				

Other Evaluation Factors					
Criteria	**Option 1: Kratchkowsky Lake (LA-7)**	**Option 2: Whitefish Lake north (LA-6)**	**Option 3: Whitefish Lake south (LA-5)**	**Option 4: McGowan Lake (LA-1)**	**Option 5: Russell Lake**
Input received from Interested Parties: As part of the engagement program for the Project, Denison organized a series of workshops with COIs and Interested Parties. The workshop gathered community and student input in relation to potential mining methods, and other components of the Project, for the Phoenix deposit. Treated effluent discharge locations for surface water received substantial feedback during engagement workshops with COIs. Surface waterbodies considered for receiving treated effluent discharge included Russell Lake, McGowan Lake, Kratchkowsky Lake, and Whitefish Lake. Denison looked to local land users for guidance on how to select an appropriate location for the discharge of any treated effluent. It was important to avoid areas within the identified surface waterbodies that may be spawning habitat or popular locations for fishing and other recreational activities (18-EN-VPL-2.13) (18-EN-VB-4.23). Common reasons provided for why a waterbody was unsuitable to receive treated effluent was the location of the waterbody was too far from the Project site, meaning additional infrastructure would have to be constructed to get the treated effluent to the discharge point. Secondly, the presence of recreational cabins and popular fishing locations (referring to Russell Lake) where present on or around the lake in question. Finally, the presence of potentially sensitive habitat and aquatic species (18-EN-VILX-3.43), which should be avoided to prevent any potential disruption. A consensus was given that any lake, other than Russell Lake, was acceptable to receive the treated effluent discharge, as Russell Lake is frequently used for fishing (18-EN-VPL-2.15).					
Selected alternative for treated effluent discharge locations for surface water = Option 3: Whitefish Lake south (LA-5) **Rationale:** Whitefish Lake south (LA-5) was selected as the treated effluent discharge location and was advanced to the EA for more detailed assessment. Based on the alternative means assessment screening, Whitefish Lake south has the required characteristics (e.g., depth, flow) and assimilative capacity to receive effluent without inducing effects on aquatic and terrestrial biota, as evaluated with the IMPACT model. This location is the closest lake to the Project Area, resulting in the shortest discharge line and associated trail out of the options evaluated, thereby reducing interaction with various terrestrial VCs and optimizing technical factors associated with construction, operation, and decommissioning. No known land use occurs on the lake and although all the lakes evaluated are in the same drainage, the largest changes in surface water quality and sediment quality would be expected in the receiving lake, with decreases moving downstream, reflecting increasing natural flows with increasing catchment areas and distance from the Project.					

Less Preferred	Neutral	More preferred

Table 15: Waste Management – Organic Waste Disposal - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: On-site disposal using an incinerator	Option 2: On-site disposal in domestic landfill	Option 3: On-site composting
Biophysical	Atmospheric and Acoustic Environment	Air quality	Less preferred. Using an incinerator will generate emissions to air, which may include nitrogen oxides, sulfur dioxides, and particulate matter.	Odor from organic waste in the domestic landfill could serve as an attractant to wildlife.	More preferred. The finished product from the composting system is not expected to have odor.
		Noise	No appreciable difference was identified among the alternatives. No difference in potential effects on sound levels would be expected for organic waste disposal alternatives.		
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No effects on geology associated with this option.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. The option more likely to interact with groundwater quantity is Option 2; however, with implementation of mitigation measures, no discernable changes in groundwater quantity are expected with these options.		
		Groundwater quality	No appreciable difference was identified among the alternatives. The option more likely int interact with groundwater quality is Option 2; however, with implementation of mitigation measures, no discernable changes in groundwater quality are expected with these options.		
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among the alternatives. No difference in potential changes in these aquatic environment VCs would be expected for the organic waste disposal options.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	No anticipated effects on terrain associated with this option.	The domestic waste landfill design and size may be increased slightly to receive organic waste, thereby increasing a local (landfill footprint) change in terrain.	No anticipated effects on terrain associated with this option.
		Soil	Air dispersion from the incinerator to nearby soil could influence soil quality.	The domestic waste landfill design and size may be increased slightly to receive organic waste, thereby increasing a local (landfill footprint) change in soil.	More preferred. Potential positive effect on soils if compost can be used in reclamation activities.
		Organic matter/peat	Less preferred. Air emissions from the incinerator to nearby areas could influence organic matter/peat quality.	Less preferred. The domestic waste landfill design and size may be increased slightly to receive organic waste, thereby increasing a local (landfill footprint) change in the extent of organic matter/peat.	More preferred. Potential positive effect on organic matter/peat if compost can be used in reclamation activities.
		Vegetation and Ecosystems			

Criteria	Section	Valued Component	Option 1: On-site disposal using an incinerator	Option 2: On-site disposal in domestic landfill	Option 3: On-site composting
		Listed Plant Species	Less preferred. Air emissions from the incinerator to nearby areas could influence quality of vegetation and ecosystems, listed plant species, and wetlands.	Less preferred due to direct loss of terrestrial ecosystems from landfill footprint.	More preferred. Potential positive effect on these terrestrial VCs if compost can be used in reclamation activities.
		Wetlands			
		Ungulates	Less preferred. Air emissions could alter how wildlife use habitat near the incinerator.	Less preferred. Landfill footprint results in direct loss of habitat and odor from organic waste in the domestic landfill could serve as an attractant to wildlife.	More preferred. Fewer potential interactions with these terrestrial VCs compared to Options 1 and 2.
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			
		Bird species at risk			
Human Environment	Human Health	Human Health	Less preferred. Using an incinerator will generate emissions to air, which may include nitrogen oxides, sulfur dioxides, and particulate matter.	More preferred than Option 1 for effects on human health.	
		Worker Health	Less preferred. Using an incinerator will generate emissions to air, which may include nitrogen oxides, sulfur dioxides, and particulate matter.	More preferred than Option 1 for effects on worker health.	
	Land and Resource Use	Indigenous Land and Resource Use	The incinerator would be adjacent to the main Project infrastructure, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to emissions associated with this option.	The domestic landfill would be adjacent to the main Project infrastructure, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to odors associated with this option.	The composting system would be adjacent to the main Project infrastructure, which would not be available for Indigenous land and resource use activities during Operation for safety reasons. No appreciable indirect effects of this option expected on Indigenous land and resource use.
		Other Land and Resource Use	The incinerator would be adjacent to the main Project infrastructure, which would not be available for other land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to emissions associated with this option.	The domestic landfill would be adjacent to the main Project infrastructure, which would not be available for other land and resource use activities during Operation for safety reasons. Potential indirect changes in availability of land and resources due to odors associated with this option.	The composting system would be adjacent to the main Project infrastructure, which would not be available for other land and resource use activities during Operation for safety reasons. No appreciable indirect effects of this option on other land and resource use.
		Heritage Resources	No appreciable difference was identified among alternatives. The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the area required for all three options is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.		

Criteria	Section	Valued Component	Option 1: On-site disposal using an incinerator	Option 2: On-site disposal in domestic landfill	Option 3: On-site composting
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes in knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes in income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in traffic, community infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in participation in the traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: On-site disposal using an incinerator**	**Option 2: On-site disposal in domestic landfill**	**Option 3: On-site composting**
Technical Factors	Complexity of design, construction, operation, and decommissioning	For the alternative means assessment, technical factors for each of these options were assumed to be similar. Design, construction, and decommissioning would be similar for all three options. Operation of Option 2 would be the simplest; operation of the incinerator (Option 1) and composter (Option 3) would be relatively more active/complex, but not unduly complicated.		
Cost Factors	Capital, operating, and decommissioning costs	For the alternative means assessment, total Project costs for each of these options was assumed to be similar.		

Input received from Interested Parties:

As part of the federal EA process, there was a public review period of Denison's Project Description and Technical Proposal (Denison 2019). In the 2019 Project Description and Technical Proposal (Denison 2019), Denison proposed incineration for disposal of food and other organic wastes. Comments received from the Ya'thi Néné Land and Resource Office on the Project Description and Technical Proposal (Canadian Nuclear Safety Commission 2019) recommended Denison consider composting food scraps and other organic material instead of the proposed incineration option. This comment has greatly influenced Denison's evaluation of alternatives and the selection of the on-site composting option for the EA.

Organic waste generated in the camp and other facilities would be managed on site. The options considered for managing organic waste include composting, placing organic material in the domestic landfill, or separating the organic material from other waste streams and using an incinerator. No specific information related to organic waste disposal was collected during engagement activities; however, Denison understands the importance of minimizing all potential waste and keeping the Project site clean (22-EN-SUR-652.21) (22-EN-SUR-652.23).

Organic materials have the possibility of attracting wildlife. Proactive management of organic waste materials will reduce the possibility of wildlife interactions at site and minimize any form of disturbance to wildlife (21-EN-ERFN-473.2).

Selected alternative for organic waste disposal = Option 3: on-site composting

Rationale: Based on current understanding of the composting systems available, Denison selected the use of on-site composting for organic waste disposal for additional evaluation in the EA. This option provided many environmental benefits and also met a specific recommendation received from the Ya'thi Néné Land and Resource Office in 2019 on the Project Description and Technical Proposal (Canadian Nuclear Safety Commission 2019).

Less Preferred	Neutral	More preferred

Table 16: Waste Management – Process Precipitate Management - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: On-site permanent	Option 2: Off-site reprocessing and permanent disposal
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between the alternatives. With both options, potential exists for changes in air quality from wind dispersion of metals, radionuclides, and particulate matter from process precipitates. These changes are expected to be similar for the two options.	No appreciable difference was identified between the alternatives. With both options, potential exists for changes in air quality from wind dispersion of metals, radionuclides, and particulate matter from process precipitates. These changes are expected to be similar for the two options. This option requires transportation and increased traffic along public roads increases road dust and combustion emissions from mobile equipment.
		Noise	More preferred as this option avoids transportation and associated change in sound levels.	Less preferred because the transportation activity would increase changes in sound levels.
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the process precipitate management alternatives.	
		Groundwater quantity	Less preferred. Decommissioning of the process precipitates on site is effectively adding 50,000 m^3 of material which could slightly alter groundwater flow or levels.	More preferred. Decommissioning an empty temporary storage area would reverse any changes to groundwater flow or levels.
		Groundwater quality	Less preferred. Even with implementation of design mitigations such as cover design to limit water infiltration into and liner design to limit release out of the disposal area, a slow release of material is anticipated over the long-term into the local groundwater environment. Evaluation of the appropriateness of designs will focus on long-term contaminant release from the precipitates and eventual discharge of groundwater to local surface water bodies and reducing effects at these receptor locations.	More preferred. This alternative would have less potential interaction with groundwater quality, because the precipitate storage would be temporary in nature and have less of an effect on changes to groundwater quality in the post-decommissioning period
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified between the alternatives. No difference in potential effects on surface water quantity would be expected for the process precipitate management alternatives.	
		Surface Water Quality	Less preferred. Even with implementation of design mitigations such as cover design to limit water infiltration into and liner design to limit release out of the disposal area, a slow release of material is anticipated over the long-term into the local groundwater environment. Evaluation of the appropriateness of designs will focus on discharge of groundwater to local surface water bodies and reducing effects at these aquatic environment receptor locations. Collection, treatment, and release of process precipitate contact water during operation would be similar for both options.	More preferred. This alternative would have less potential interaction with changes to surface water quality via groundwater discharge to local lakes, because the precipitate storage would be temporary in nature (e.g., no source term remaining on site). Collection, treatment, and release of process precipitate contact water during operation would be similar for both options.
		Fish and Fish Habitat		
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		

Criteria	Section	Valued Component	Option 1: On-site permanent	Option 2: Off-site reprocessing and permanent disposal
	Terrestrial Environment	Terrain	Less preferred. Decommissioning of the process precipitates on site is effectively adding 50,000 m^3 of material, which could slightly change local terrain.	More preferred. Decommissioning an empty temporary storage area would reverse any changes to minor operational changes to terrain.
		Soil	More preferred. Both options would have similar footprints, and as such, similar changes in areal extent of ecosystems and loss and/or alteration of wildlife habitat.	Less preferred. Increased likelihood of interaction with the terrestrial environment associated with transport of material off site (e.g., wildlife collisions, alteration or loss of vegetation, soil, and potential wildlife habitat from dust, noise, smells associated with traffic). Both options would have similar footprints, and as such, similar changes in areal extent of ecosystems and loss and/or alteration of wildlife habitat.
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates		
		Furbearers		
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between alternatives. Options would have similar contribution to changes in non-radiological and radiological constituents in air, water, and food. The Post-Decommissioning exposure for Option 1 is assumed to pose no additional risk to human health in consideration of the disposal area designs and slow transport out of the facility.	
		Worker Health	No appreciable difference was identified between alternatives for worker health. These options would have similar conventional health and safety risks and radiation exposure.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified between alternatives. A change in the perceived suitability of Indigenous land and resources for safe use may be bigger for this option, compared to Option 2 (e.g., temporary storage preferred to permanent disposal). The process precipitate management area would be adjacent to adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for Indigenous land and resource use activities during operations for safety reasons.	No appreciable difference was identified between alternatives. A change in the perceived suitability of Indigenous land and resources for safe use may be smaller for this option, compared to Option 1 (e.g., temporary storage preferred to permanent disposal). The process precipitate management area would be adjacent to adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for Indigenous land and resource use activities during operations for safety reasons. Changes in resource availability may be associated with traffic needed to transport the material off site.
		Other Land and Resource Use	No appreciable difference was identified between alternatives. A change in the perceived suitability of land and resources for safe use may be bigger for this option, compared to Option 2	No appreciable difference was identified between alternatives. A change in the perceived suitability of land and resources for safe use may be smaller for this option, compared to Option 1 (e.g., temporary storage preferred to

Criteria	Section	Valued Component	Option 1: On-site permanent	Option 2: Off-site reprocessing and permanent disposal
			(e.g., temporary storage preferred to permanent disposal). The process precipitate management area would be adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for other land and resource use activities during operations for safety reasons.	permanent disposal). The process precipitate management area would be adjacent to adjacent to (within approximately 1 km) the main Project infrastructure, which would not be available for other land and resource use activities during operations for safety reasons. Changes in resource availability may be associated with traffic needed to transport the material off site.
		Heritage Resources	No appreciable difference was identified between alternatives. The surface footprints for Options 1 and 2 are assumed to be in the areas that underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified between alternatives. There is potential for a larger perceived change in the suitability and safety of resources that support a traditional diet, with on-site permanent disposal generally being less preferred to temporary storage.	No appreciable difference was identified between alternatives. With perceived change in the suitability and safety of resources that support a traditional diet, temporary storage would be preferred to permanent storage. However, the potential changes in cultural expression related to traffic would be less preferred compared to option 1.
		Community Well-being	No appreciable difference was identified between alternatives for changes in income of local workers and community cohesion.	
		Infrastructure and Services	No appreciable difference was identified between alternatives for changes in traffic, community infrastructure and services.	
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: On-site permanent**	**Option 2: Off-site reprocessing and permanent disposal**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Less preferred. Design, construction, and decommissioning would be more complex in terms of planning for long-term environmental protection with precipitates permanently on site. Operation would be similar for both options.	More preferred. Design, construction, and decommissioning would be more straightforward compared to option 1. Operation would be similar for both options.
Cost factors	Capital, operating, and decommissioning costs	Less preferred. This would be a higher cost option.	More preferred. This option has an overall lower cost. Denison would benefit from the sale/processing of the precipitates and not incur decommissioning costs for permanent disposal.
Input received from Interested Parties: The small footprint of the Project helps to reduce any potential effects to the surrounding environment (21-EN-VILX-443.35) but limits the amount of space available for storage of materials and waste. This means operating efficiently within the footprint and removing materials off site for proper disposal, when available. During engagement activities, some members shared their experience at other mining and milling operations where materials are buried on site, and their general disapproval of this practice (22-EN-ERFN-618.26). No engagement material was available for the option of on-site precipitate disposal; however, the proactive removal of waste material from site and minimizing potential disturbances to the land, aligns with feedback collected during other Project engagement sessions (22-EN-SUR-652.87).			

Selected alternative for process precipitate management = Option 2: Off-site reprocessing and permanent disposal:

Rationale: From a biophysical environment, human environment, technical and cost perspective, off-site reprocessing and permanent disposal was preferred to on-site permanent disposal. The off-site reprocessing and permanent disposal alternative was advanced through the EA for additional evaluation.

Less Preferred	Neutral	More preferred

Table 17: Waste Management – Domestic Waste Disposal - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Collection and disposal off-site by a third-party contractor	Option 2: Collection and disposal in an on-site domestic landfill
Biophysical	Atmospheric and Acoustic Environment	Air quality	Dust generation along on and off-site gravel roads from transportation. Scope 3 GHG emissions from off-site transportation.	Changes in air quality at the landfill are assumed to be mitigated by best practice for landfill management.
		Noise	No appreciable difference was identified between the alternatives. Trucks used for transportation under Option 1 and machinery used in landfill construction and management under Option 2 would likely both change sound levels.	
	Geology and Groundwater	Geology	No appreciable difference was identified between the alternatives. No difference in potential effects on geology would be expected for the domestic waste disposal alternatives.	
		Groundwater quantity	No appreciable difference was identified between the alternatives. No effects on groundwater quantity and quality would be expected for either of the domestic waste disposal alternatives. It is assumed that both on-site and approved off-site alternatives would have similar / equivalent environmental protection measures.	
		Groundwater quality		
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified between the alternatives. No difference in potential effects on surface water quality and quantity would be expected for either of the domestic waste disposal alternatives. Drainage from an on-site domestic waste landfill would be diverted around the landfill as much as possible. Leachate collected from the landfill would be treated. An approved off-site facility would have similar effects on local surface water quantity and quality; and water management controls would be in place.	
		Surface Water Quality		
		Fish and Fish Habitat	No appreciable difference was identified between the alternatives. No difference in potential effects on these aquatic VCs would be expected for the domestic waste disposal alternatives.	
		Sediment Quality		
		Benthic Invertebrates		
		Fish Health		
	Terrestrial Environment	Terrain	Road dust from transportation would have indirect effects on these terrestrial VCs. Option 1 uses existing, off-site facilities – no new land clearing is required.	Construction of a domestic landfill may result in direct effect (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands.
		Soil		
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates	Potential increased direct effects on mortality from increased road traffic.	Expected habitat loss associated with clearing for landfill construction and operation (direct loss of habitat), and also indirect effect on habitat use from noises or odors at the landfill.
		Furbearers		
		Woodland caribou		
		Raptors		

Criteria	Section	Valued Component	Option 1: Collection and disposal off-site by a third-party contractor	Option 2: Collection and disposal in an on-site domestic landfill
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.	
		Worker Health	No appreciable difference was identified between alternatives for changes in worker conventional health and safety and radiation exposure	
	Land and Resource Use	Indigenous Land and Resource Use	This option is not expected to interact with Indigenous land and resources use in the Project local study area.	This option is less preferred in terms of requiring construction of an on-site landfill, resulting in anticipated direct effects on vegetation and soil and indirect effect on wildlife (i.e., resource availability).
		Other Land and Resource Use	This option is not expected to interact with other land and resources use in the Project local study area.	This option is less preferred in terms of requiring construction of an on-site landfill, resulting in anticipated direct effects on vegetation and soil and indirect effect on wildlife (i.e., resource availability).
		Heritage Resources	No appreciable difference was identified between alternatives. A new on-site landfill footprint underwent heritage resource surveys in 2017 and 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction. For options 1, an existing facility would be used and therefore it is presumed no archaeological and cultural heritage features would be affected.	
	Quality of Life	Cultural Expression	Change in traffic volume (increase) on public roads for regular transport of domestic waste off site. Less preferred option for cultural expressions due to likely increased traffic in proximity to a culture camp.	No appreciable effects of this option on cultural expression were identified.
		Community Well-being	The transportation component could generate an economic or business opportunity for a local operator, thereby generating a positive effect on income of local workers.	Having an on-site domestic waste landfill would increase the responsibility of Denison staff and contractors (for construction, collection, disposal, maintenance, decommissioning), which may generate a positive effect on income of local workers.
		Infrastructure and Services	Less preferred option with increased traffic. Also, waste disposal capacity that would otherwise be dedicated to serve local or regional communities would be consumed by Project-related waste, which may not be viewed favorably.	No appreciable effects of this option on infrastructure and services.
	Economics	Economy	No appreciable difference was identified between alternatives for changes in participation in the traditional economy.	

Other Evaluation Factors			
Criteria		**Option 1: Collection and disposal off-site by a third-party contractor**	**Option 2: Collection and disposal in an on-site domestic landfill**
Technical Factors	Complexity of design, construction, operation, and decommissioning	This is simple option in terms of design, construction, operation, and decommissioning – the main on-site components would be temporary storage containers for domestic waste. The off-site landfill design, construction, operation and decommissioning are considered separately from the Project. This option would result in increases to Denison's scope 3 GHG emissions associated with transportation.	While design, construction, operation, and decommissioning of an on-site domestic waste landfill is more complex than the transport of domestic waste off sites, the domestic waste landfill is not complex compared to other Project components.
Cost Factors	Capital, operating, and decommissioning costs	Capital costs and decommissioning costs would be minimal – mainly for on-site temporary storage containers for domestic waste. The operational costs would be higher than Option 2 with transport and disposal of material off site.	Capital costs and decommissioning costs would be higher compared to Option 1; operating costs would be lower compared to Option 1. For context, the incremental capital and decommissioning costs associated with this alternative are small in comparison to the Project as a whole, and not material in comparison.

Input received from Interested Parties:

During seven years of engagement activities for the Project, Denison has understood the importance of designing a project that minimizes interactions with the biophysical environment and the importance of continued land use by Indigenous groups. Looking at domestic waste disposal options, the option to transport domestic waste off site to a nearby licensed facility may generate a local economic opportunity (16-EN-DesNd-101.1, 19-EN-VB-132.5, 21-EN-SUR-446.48). However, the transport of material off site would increase traffic, which may have a negative effect on traditional land use, infrastructure and services, and wildlife (16-EN-ERFN-100.15) (21-EN-SUR-446.68). Increased traffic would also increase greenhouse gas emissions. Concerns related to climate change were raised during engagement and consultation activities completed by Denison (e.g., 22-EN-ERFN-621.15, 22-EN-SUR-652.57). It should be noted that these concerns pertain to climate change rather than GHG emissions specifically. The concerns included observations of climate-related changes that have been noticed by the English River First Nation (e.g., depth of permafrost; 16-EN-ERFN-100.17) and observations by the English River First Nation Trapper who provided local knowledge in support of the EIS (19-LK-ERFNTrap-134.232). While no specific feedback was received on the domestic waste disposal options, the above provides context on how Denison's fulsome engagement activities have influenced the selection of a preferred alternative for domestic waste disposal.

Preferred alternative for domestic waste disposal: Option 2: Collection and disposal in an on-site domestic landfill

Rationale: The on-site domestic landfill option was selected for the EA as it provides operational flexibility for Denison to construct, operate, and decommission the landfill to manage non-recyclable, non-hazardous material without radionuclide contamination. Collection and disposal off site by a third-party contractor emerged as a less preferred option due to the associated increased traffic and scope 3 GHG emissions. Also this option can become a burden to local communities if regional landfill availability is limited and placing Project's waste in a regional landfill would lessen the landfill's life.

Less Preferred	Neutral	More preferred

Table 18: Access and Transportation – Access Road Alignment - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Direct route	Option 2: Direct route to reduce cut volumes	Option 3: Follows part of the existing exploration access road
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified among the alternatives. No difference in potential effects on air quality would be expected for the access road alignment alternatives. All options would have equivalent environmental protection measures to minimize changes in air quality.		
		Noise	Distance to the closest recreational lease (cabin) is >500 m.	Distance to the closest recreational lease (cabin) is 240 m.	Distance to the closest recreational lease (cabin) is >1,000 m.
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology would be expected for the access road alignment alternatives.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quantity would be expected for the access road alignment alternatives		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quality would be expected for the access road alignment alternatives		
	Aquatic Environment	Surface Water Quantity	No stream crossings are associated with this option and this route was not within 200 m of a waterbody. No interaction with aquatic environment is expected.	No stream crossings are associated with this option. This route was the closest (140 m) to a waterbody (McGowan Lake, LA-1)	No stream crossings are associated with this option and this route was not within 200 m of a waterbody. No interaction with aquatic environment is expected.
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	This option has the potentially greatest effect on terrain, as a result of the large cut volumes.	No appreciable difference was identified between these alternatives. Effects on terrain would be similar for these two access road alignment alternatives based on cut and fill estimates.	
		Soil	Option-specific clearing of undisturbed vegetation estimated at 6 ha (3 km long, 20 m wide road segment unique to this option). The remainder of the access road has the same alignment for all three options.	Option-specific clearing of undisturbed vegetation estimated at 7 ha (3.5 km long, 20 m wide road segment unique to this option). The remainder of the access road has the same alignment for all three options.	Option-specific clearing of undisturbed vegetation estimated at 2 ha (1 km long, 20 m wide road segment unique to this option). The remainder of the access road has the same alignment for all three options.
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			
		Ungulates			

Criteria	Section	Valued Component	Option 1: Direct route	Option 2: Direct route to reduce cut volumes	Option 3: Follows part of the existing exploration access road
		Furbearers	Option-specific clearing of undisturbed vegetation estimated at 6 ha (3 km long, 20 m wide road segment unique to this option). The balance of the road would be the same for all three options. Cut and fill volumes are highest for this option. Theoretically, because this is the shortest road (5.31 km), there may be less potential for direct wildlife mortality from collisions.	Option-specific clearing of undisturbed vegetation estimated at 7 ha (3.5 km long, 20 m wide road segment unique to this option). The balance of the road would be the same for all three options Cut and fill volumes are between those for Options 1 and 3. Slightly longer road (5.77 km) compared to Option 1.	Option-specific clearing of undisturbed vegetation estimated at 2 ha (1 km long, 20 m wide road segment unique to this option). The balance of the road would be the same for all three options. For construction costs, this options has the lowest cut and fill volumes. Theoretically, because this is the longest road (6.77 km), there may be higher potential for direct wildlife mortality from collisions, but this would not be quantifiable.
		Woodland caribou			
		Raptors			
		Migratory breeding birds			
		Bird species at risk			
Human Environment	Human Health	Human Health	No appreciable difference was identified among the alternatives. No difference in potential effects on human health would be expected for the access road alignment alternatives.		
		Worker Health	No appreciable difference was identified among the alternatives. No difference in potential effects on worker health would be expected for the access road alignment alternatives. All options would have equivalent safety measures to minimize risk to workers.		
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among the alternatives. No difference in potential effects on Indigenous land and resource use would be expected for the access road alignment alternatives.		
		Other Land and Resource Use	Distance to the closest recreational lease (cabin) is >500 m.	Distance to the closest recreational lease (cabin) is 240 m.	Distance to the closest recreational lease (cabin) is >1,000 m.
		Heritage Resources	This option had a heritage resource impact assessment completed in 2017. No artifacts were discovered in the footprint of Option 1. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.	This option had a heritage resource impact assessment completed in 2017. The assessment resulted in the identification of HiNi-6, an artifact find of an unknown precontact cultural affiliation that was identified on the western terrace of McGowan Lake, adjacent to access road Option 2. The site has limited interpretive potential and no additional concerns were attached to the site in the context of the study. The assessment received approval from the Heritage Conservation Branch. The	This option had a heritage resource impact assessment completed in 2017. No artifacts were discovered in the footprint of Option 3. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.

Criteria	Section	Valued Component	Option 1: Direct route	Option 2: Direct route to reduce cut volumes	Option 3: Follows part of the existing exploration access road
				implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during clearing and construction.	
	Quality of Life	Cultural Expression	No appreciable difference was identified among the alternatives. No difference in potential effects on cultural expression would be expected for the access road alignment alternatives.		
		Community Well-being	No appreciable difference was identified among the alternatives. No difference in potential effects on community well-being would be expected for the access road alignment alternatives.		
		Infrastructure and Services	No appreciable difference was identified among the alternatives. No difference in potential effects on infrastructure and services would be expected for the access road alignment alternatives.		
	Economics	Economy	No appreciable difference was identified among the alternatives. No difference in potential effects on economy would be expected for the access road alignment alternatives.		

Other Evaluation Factors				
Criteria		**Option 1: Direct route**	**Option 2: Direct route to reduce cut volumes**	**Option 3: Follows part of the existing exploration access road**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Cut and fill volumes are highest, making the construction more complex. Shortest road (5.31 km).	Cut and fill volumes are between those for options 1 and 3. Slightly longer road (5.77 km) compared to option 1.	For construction costs, this option has the lowest cut and fill volumes. Longest road (6.47 km).
Cost Factors	Capital, operating, and decommissioning costs	Cut and fill volumes are highest, feeding into higher capital costs on this metric. However, a shorter road brings down the capital, operating and decommissioning cost based on total road length.	For cut-fill volumes and total length, this option was intermediate to options 1 and 3.	Cut and fill volumes are lowest, feeding into lower capital costs on this metric. However, this is the longest road which increases the capital, operating, and decommissioning cost based on total road length.

Other Evaluation Factors			
Criteria	**Option 1: Direct route**	**Option 2: Direct route to reduce cut volumes**	**Option 3: Follows part of the existing exploration access road**
Input received from Indigenous groups **and Interested Parties** As part of the engagement program for the Project, Denison organized a series of workshops with COIs and Interested Parties. The workshop gathered community and student input in relation to potential mining methods, and other components of the Project, for the Phoenix deposit. While the most direct access route is generally optimal (18-EN-VPL-2.1), where possible, Denison will consider using existing routes that may have been previously used for exploration and other activities. A focus on minimizing terrestrial disturbance and keeping access roads a respectable distance away from the identified cabin in the area, to reduce noise, dust, and deter the general public from accessing private cabins, was important to COIs and Interested Parties (18-EN-VPL-2.2) (18-EN-VPL-2.3, 18-EN-VPL-2.9, 18-EN-VPL-2.10) (18-EN-VB-4.6). The Denison engagement team also received comments that local land users did not want access roads constructed near waterbodies, again as it may potentially increase disturbance (18-EN-VPL-2.6) (18-EN-VB-4.7). It is important for rights holders to have confidence that they can still access their traditional areas and activities like hunting and berry picking (16-EN-ERFN-100.15, 21-EN-ERFN-473.6). Restrictions on access to the site area would be controlled through two security gates. Security gates are in place to provide for safety in and around the active site. Through engagement efforts Denison has learn that maintaining restricted access to the north (through Cameco's Key Lake gate) is a high priority for local Indigenous groups, to preserve and protect the area. Access road designs that have security gates are preferred and will make sure the Project site is safe and secure (19-LK-ERFNTrap-134.224, 19-LK-ERFNTrap-134.226). Denison has worked hard to make sure plans for access roads have been shared with COIs and feedback collected (18-EN-VPL-2.1) (18-EN-VILX-3.1) (18-EN-VB-4.4).			
Selected alternative for access road alignment = Option 3: Follows part of the existing exploration road **Rationale:** Although this is the longest route, which increases facets of cost considerations, the rationale for selecting this alternative was driven by Denison's commitment to minimize new disturbances to the terrestrial environment. This was achieved by selecting the routing that followed part of the existing exploration access road. This option was supported by Interested Parties, as evidenced by the feedback received from the 2018 workshops.			

Less Preferred	Neutral	More preferred

Table 19: Access and Transportation – Stream Crossing Structures - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Culverts	Option 2: Clear span bridges
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable difference was identified between these options. These options are not expected to interact with or change air quality.	
		Noise	No appreciable difference was identified between these options. These options are not expected to change noise levels.	
	Geology and Groundwater	Geology	No appreciable difference was identified between these options. These options are not expected to interact with or change geology.	
		Groundwater quantity	No appreciable difference was identified between these options. These options are not expected to interact with or change groundwater quantity.	
		Groundwater quality	No appreciable difference was identified between these options. These options are not expected to interact with or change groundwater quality.	
	Aquatic Environment	Surface Water Quantity	Crossing would be installed to withstand a flood event. Culverts may concentrate flows and increase water velocities and potential sediment scour at high flows.	Crossing would be installed to withstand a flood event. Clear span bridges should not limit stream hydraulic capacity.
		Surface Water Quality	Culverts may concentrate flows and increase water velocities and potential scour at high flows.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
		Fish and Fish Habitat	Installation of culverts would likely destroy a small area of fish habitat (substrate beneath culvert) and loss of habitat from infilling around the culvert. Culverts can concentrate flows and increase water velocities. Fish passage would be part of culvert design criteria, although culverts are more likely to interfere with fish passage, compared to clear span structures.	Clear span bridges can be constructed without in-water works and avoid harmful alteration, disruption, or destruction of fish habitat. Can retain existing bottom substrate, bank structure, riparian vegetation, and natural fish passage stream qualities.
		Sediment Quality	Culverts may concentrate flows and increase water velocities and potential sediment scour at high flows.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
		Benthic Invertebrates	Destroy a small area of fish habitat (substrate beneath culvert) and loss of habitat from infilling around the culvert. Culverts can concentrate flows and increase water velocities.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
		Fish Health	Culverts can concentrate flows and velocities. Fish passage would be part of culvert design criteria, although culverts are more likely to interfere with fish passage, compared to clear span structures.	Clear span bridges should not limit stream hydraulic capacity and should not produce scour.
	Terrestrial Environment	Terrain	No appreciable difference was identified between the alternatives for terrestrial environment valued components.	
		Soil		
		Organic matter/peat		
		Vegetation and Ecosystems		
		Listed Plant Species		
		Wetlands		
		Ungulates		

Criteria	Section	Valued Component	Option 1: Culverts	Option 2: Clear span bridges
		Furbearers		
		Woodland caribou		
		Raptors		
		Migratory breeding birds		
		Bird species at risk		
Human Environment	Human Health	Human Health	No appreciable difference was identified between the alternatives. No difference in potential effects on human health would be expected for the stream crossing alternatives.	
		Worker Health	Implementing mitigation measures on culverts (inspected periodically to remove accumulated material and debris that may prevent efficient passage of water and fish through the structures) may pose a relatively higher risk to work health and safety for the culvert option. Would expect to clear more debris more frequently from culverts, requiring more near and in water work for Denison staff and contractors.	Reduced potential effect on worker health and safety for this option compared to culverts.
	Land and Resource Use	Indigenous Land and Resource Use	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing has not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Sourcing culverts of a sufficient diameter to maintain navigability is uncertain. With regard to navigability this option would be less preferred. Looking at local travel by truck or ATV, there would be no appreciable difference in the options: both stream crossings may provide increased ease of access across these steams at these locations.	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing has not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Clear span bridges at both locations could be designed to maintain navigability. With regard to navigability this option would be preferred. Looking at local travel by truck or ATV, there would be no appreciable difference in the options: both stream crossings may provide increased ease of access across these steams at these locations.
		Other Land and Resource Use	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing had not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Sourcing culverts of a sufficient diameter to maintain navigability is uncertain. With regard to navigability, this option would be less preferred. Looking at local travel by truck or ATV, there would be no appreciable difference for the two options: both stream crossings may provide increased ease of access across these steams at these locations.	At the time of alternative means assessment, the navigability of the Kratchkowsky Creek crossing had not been determined; the creek is fast flowing, the water is shallow, and the substrate is rocky in areas. The Hart Creek crossing is likely navigable. Clear span bridges at both locations could be designed to maintain navigability. With regard to navigability, this option would be more preferred. Looking at local travel by truck or ATV, there would be no appreciable difference for the two options: both stream crossings may provide increased ease of access across these steams at these locations.
		Heritage Resources	No appreciable difference was identified between alternatives. The land adjacent to the crossing structures is part of the decommissioned Fox Lake trail, and, therefore, it is presumed no archaeological and cultural heritage features would be affected, because this area was previously disturbed.	

Criteria	Section	Valued Component	Option 1: Culverts	Option 2: Clear span bridges
	Quality of Life	Cultural Expression	No appreciable difference was identified between the alternatives. No difference in potential effects on cultural expression would be expected for the stream crossing alternatives.	
		Community Well-being	No appreciable difference was identified between the alternatives. No difference in potential effects on community well-being would be expected for the stream crossing alternatives.	
		Infrastructure and Services	No appreciable difference was identified between the alternatives. No difference in potential effects on infrastructure and services would be expected for the stream crossing alternatives. Both stream crossings may provide increased ease of access across these streams at these locations.	
	Economics	Economy	No appreciable difference was identified between the alternatives. No difference in potential effects on economy would be expected for the stream crossing alternatives.	

Other Evaluation Factors			
Criteria		Option 1: Culverts	Option 2: Clear span bridges
Technical Factors	Complexity of design, construction, operation, and decommissioning	The design of culverts is fairly simple. However, it would be challenging to find culverts to provide navigability at Hart Creek. The construction and decommissioning would require in-water works and would be technically challenging. The operation phase would require more attention for clearing of debris.	The option of a clear span bridge over the 30 m section of Hart Creek may be a more complex design compared to culverts. But, but the construction, operation and ease of decommissioning would be preferred for this option.
Cost Factors	Capital, operating, and decommissioning costs	Culverts would be a lower cost option for capital considerations. Operational and decommissioning costs are expected to be higher than clear span bridge options.	Capital costs for clear span bridges would be higher than culverts but require less operational costs and be easier to decommission.
Input received from Interested Parties: Denison is intending to use a small portion of road to access the proposed airstrip to the north of the Project site. Stream crossing structures will need to be constructed as the previous crossings were deconstructed by Cameco in 2015. While engagement efforts did not produce any specific information on the preferred stream crossing structure (culverts or clear span bridges), Denison is aware that there is a strong interest from local rights holders to preserve and protect the area and keep the Project site secure. This includes restricting access (using security gates) so the general public cannot use the proposed stream crossing structures or roads as an entry point into English River First Nation (ERFN) territory (19-LK-ERFNTrap-134.224, 19-LK-ERFNTrap-134.226).			
Selected alternative for stream crossing structures = Option 2: Clear span bridge **Rationale:** The clear span bridge option is likely more expensive for Denison to construct, but it is anticipated to provide fewer effects on the aquatic environment and avoid harmful alteration, disruption, and destruction of fish habitat. The option for clear span bridges allows for road crossing without in-water supports or buttresses. This option is also similar to what was previously in place at these locations.			

Less Preferred	Neutral	More preferred

Table 20: Access and Transportation – Worker Transportation - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Ground Transport	Option 2: Air transport to existing airstrip at nearby Cameco operations	Option 3: Air transport to new airstrip constructed and operated by Denison
Biophysical	Atmospheric and Acoustic Environment	Air quality	Includes dust generation along gravel roads and scope 3 GHG emissions from vans and buses. Avoids. This option avoids dust dispersion at an airstrip, but generates scope	Dust dispersion at the airstrip would be similar to Option 3. Dust dispersion along roads during transport to and from the Project Area and Cameco's airstrip would be less preferred compared to Option 3 (longer distance). Aircraft scope 3 GHG emissions would be similar to Option 3.	Dust dispersion at the airstrip would be similar to Option 2. Dust dispersion along roads during transport to and from the Project Area and new airstrip would be more preferred compared to Option 3 (shorter distance). Aircraft scope 3 GHG emissions would be similar to Option 2.
		Noise	Comparatively less noise generation.	Increased sound levels at the airstrip and surrounding area.	Increased sound levels at the airstrip and surrounding area.
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology would be expected for the worker transportation alternatives.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quantity would be expected for the worker transportation alternatives.		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quality would be expected for the worker transportation alternatives.		
	Aquatic Environment	Surface Water Quantity	No new interaction with aquatic environment as the infrastructure needed for options are existing facilities.	No new interaction with aquatic environment as the infrastructure needed for options are existing facilities.	This option requires two stream crossings along the road to the new airstrip. Depending on the crossing structure selected, there is potential for in -water works, loss of fish habitat, changes to riparian vegetation, concentrated flows and increased velocities, and issues with fish passage.
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	No appreciable difference was identified among alternatives for these terrestrial VCs. The infrastructure needed for options are existing facilities – no new land clearing is required.	No appreciable difference was identified among alternatives for these terrestrial VCs. The infrastructure needed for options are existing facilities – no new land clearing is required.	This option is less preferred as it requires construction of a road and airstrip, resulting in greater potential direct effects (loss) of terrain, soil, organic matter/peat, vegetation, listed plant species and wetlands.
		Soil			
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			

Criteria	Section	Valued Component	Option 1: Ground Transport	Option 2: Air transport to existing airstrip at nearby Cameco operations	Option 3: Air transport to new airstrip constructed and operated by Denison
		Ungulates	Potential increased effects on mortality from increased road traffic.	Similar to Option 3 for potential indirect effects on wildlife (altered habitat use) and direct effects on birds from airstrikes.	Similar to Option 2 for potential indirect effects on wildlife (altered habitat use) and direct effects on birds from airstrikes.
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			
		Bird species at risk			
Human Environment	Human Health	Human Health	No appreciable difference was identified among alternatives for changes in human health from exposure to non-radiological and radiological constituents in air, water, and food.		
		Worker Health	Less preferred option for worker health and safety. Ground transport higher risk for accidents and collisions, icy conditions during winter months, and staff sitting in vehicles for up to 10 hours each way, per shift (potentially negative for physical and mental health).	These two options would be similar in terms of worker health.	
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference between these two alternatives regarding land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The infrastructure needed for these options are existing facilities. No changes to access.		This option is less preferred in terms of requiring construction of a road and airstrip, resulting in potential direct effects on vegetation and soil and indirect effect on wildlife. The installation of stream crossings along the road may locally increase ease of access for ATVs or trucks in the immediate vicinity—this is not clearly preferred or less preferred and depends on the perspective as it relates to land and resource use.
		Other Land and Resource Use	No appreciable difference between these two alternatives regarding land available for other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The infrastructure needed for these options are existing facilities. No changes to access.		This option is less preferred in terms of requiring construction of a road and airstrip, resulting in potential direct effects on vegetation and soil and indirect effect on wildlife. The installation of stream crossings along the road may locally increase ease of access for ATVs or trucks in the immediate vicinity—this is not clearly preferred or less preferred and depends on the perspective as it relates to land and resource use.

Criteria	Section	Valued Component	Option 1: Ground Transport	Option 2: Air transport to existing airstrip at nearby Cameco operations	Option 3: Air transport to new airstrip constructed and operated by Denison
		Heritage Resources	No appreciable difference was identified among alternatives. The new on-site airstrip footprint underwent a heritage resource survey in 2019 and have received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for any chance encounters of artifacts during clearing and construction. For Options 1 and 2, existing facilities (e.g., roads, Cameco's airstrips) would be used and, therefore, it is presumed no archaeological and cultural heritage features would be affected.		
	Quality of Life	Cultural Expression	Less preferred option for cultural expressions due to increased traffic close to a culture camp location.	These two options would be similar in terms of cultural expression.	
		Community Well-being	No appreciable difference was identified among alternatives for changes to income of local workers and community cohesion.		
		Infrastructure and Services	Less preferred option for cultural expressions due to increased traffic.	These two options would be similar in terms of infrastructure and services.	
	Economics	Economy	No appreciable difference was identified among alternatives for changes in economy and participation in traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Ground Transport**	**Option 2: Air transport to existing airstrip at nearby Cameco operations**	**Option 3: Air transport to new airstrip constructed and operated by Denison**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Technical issues would be operation of this option (e.g., time driving, logistics for shift changes, weather delays).	The complexity and largest possible constraint for this option is that it relies on an agreement for Denison to use an airstrip owned and operated by a competing company. Otherwise, this option is simple with regard to technical factors.	Road and airstrip are not unduly complex in terms of design, construction, operation, and decommissioning, but more complex than using existing facilities (roads for Option 1, Cameco's airstrips for Option 2).
Cost Factors	Capital, operating, and decommissioning costs	Relatively low capital, operating, and decommissioning costs. Operating costs would be from paying workers during travel time to and from site.	Lowest capital and decommissioning costs. Operating costs would be similar to Option 3.	Highest capital and decommissioning costs. Operating costs would be similar to Option 2.
Input received from Interested Parties: While including an airstrip in the overall Project design will add to the total footprint, having the ability to transport the site workforce by air will greatly reduce the amount of traffic on both highways and Project access roads (21-EN-VILX-443.2). Assessable and convenient worker pick-up points were highlighted in survey responses (21-EN-SUR-446.61). The airstrip may also reduce potential vehicle and wildlife interactions and reduce the frequency of noise and dust disturbances along the roads (18-EN-VB-4.6). Responses on an engagement survey indicated that increases in traffic volumes were a consistent concern (20-LK-LEASESUR-267.99 to 20-LK-LEASESUR-267.108).				

Other Evaluation Factors			
Criteria	**Option 1: Ground Transport**	**Option 2: Air transport to existing airstrip at nearby Cameco operations**	**Option 3: Air transport to new airstrip constructed and operated by Denison**
Selected alternative for worker transportation = Option 3: Air transport to new airstrip constructed and operated by Denison			
Rationale: Based on this assessment, the more preferred option is air transport to an existing airstrip at a nearby Cameco operation (Option 2). It reduces the Project's direct loss of vegetation and soil and reduced indirect effects on wildlife associated with construction, operation, and decommissioning a new airstrip. This option also avoids construction, operation, and decommissioning of a road from the site out to a new airstrip, which includes two stream crossings. This option is also the preferred option in terms of cost. However, there is a risk for Denison to advance the EA without having its own airstrip option assessed. As such, Denison will advance Option 3 through the EA to fully assess the effects associated with constructing, operating, and decommissioning a new, on-site airstrip and associated supporting facilities (e.g., road, stream crossings, airstrip terminal). If Option 2 is secured in the intervening years prior to Denison's construction decision, the EA will have been overly-conservative on many assessments (e.g., air quality, noise, all terrestrial VC assessments). This would be an example of continuous improvement as the Project advances through design stages towards development.			

Less Preferred	Neutral	More preferred

Table 21: Power – Primary Power Supply - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: Liquefied natural gas power plant	Option 2: Diesel generators	Option 3: Provincial power grid
Biophysical	Atmospheric and Acoustic Environment	Air quality	More preferred than Option 2, but less preferred than Option 3 with regard to GHG emissions. Transport would generate dust along roads (similar to Option 2).	Less preferred option with regard to GHG emissions. Transport would generate dust along roads (similar to Option 1).	More preferred option. Electricity would yield scope 2 emissions for the Project but would avoid large scope 1 emissions from fuel combustion. No ground transport component.
		Noise	Less preferred option due to increases in sounds levels.	Less preferred option due to increases in sounds levels.	This option would have the lowest associated increase in sound levels.
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential effects on geology would be expected for the primary power supply alternatives.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quantity would be expected for the primary power supply alternatives.		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential effects on groundwater quality would be expected for the primary power supply alternatives.		
	Aquatic Environment	Surface Water Quantity	No appreciable difference was identified among the alternatives. No difference in potential effects on aquatic environment VCs would be expected for the primary power supply alternatives.		
		Surface Water Quality			
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	Emissions may alter quality of soil and vegetation; potential effects on terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands from clearing associated with construction. Transport would generate dust along roads.	Emissions may alter quality of soil and vegetation; potential effects on terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands from clearing associated with construction. Transport would generate dust along roads.	Construction of the power line into site may result in direct effect (loss) of terrain, soil, organic matter/peat, vegetation and ecosystems, listed plant species and wetlands over a small area.
		Soil			
		Organic matter/peat			
		Vegetation and Ecosystems			
		Listed Plant Species			
		Wetlands			
		Ungulates	Noise and emissions/smells may alter ungulate habitat use. Potential increase in direct mortality from increased traffic.	Noise and emissions/smells may alter ungulate habitat use. Potential increase in direct mortality from increased traffic.	Habitat loss associated with clearing for the overhead power line.

Criteria	Section	Valued Component	Option 1: Liquefied natural gas power plant	Option 2: Diesel generators	Option 3: Provincial power grid
		Furbearers	Noise and emissions/smells may alter furbearer habitat use. Potential increase in direct mortality from increased traffic.	Noise and emissions/smells may alter furbearer habitat use. Potential increase in direct mortality from increased traffic.	Habitat loss associated with clearing for the overhead power line.
		Woodland caribou	Noise and emissions/smells may alter woodland caribou habitat use. Potential increase in direct mortality from increased traffic.	Noise and emissions/smells may alter woodland caribou habitat use. Potential increase in direct mortality from increased traffic.	Habitat loss associated with clearing for the overhead power line. Clearing may create a linear feature for the line into site. Denison will endeavor to have SaskPower align the power line with the access road.
		Raptors	Noise and emissions/smells may alter raptor habitat use.	Noise and emissions/smells may alter raptor habitat use.	Raptors may collide with the power line. Certain species may nest on the power poles. Habitat loss from clearing for overhead power line.
		Migratory breeding birds	Noise and emissions/smells may alter migratory breeding bird habitat use.	Noise and emissions/smells may alter migratory breeding bird habitat use.	Habitat loss associated with clearing for the overhead power line.
		Bird species at risk	Noise and emissions/smells may alter bird species at risk habitat use.	Noise and emissions/smells may alter bird species at risk habitat use.	Habitat loss associated with clearing for the overhead power line.
Human Environment	Human Health	Human Health	Potentially poorer air quality compared to Option 3	Potentially poorer air quality compared to Option 3	No appreciable effects of this option expected on human health.
		Worker Health	Potentially poorer air quality for workers compared to Option 3.	Potentially poorer air quality for workers compared to Option 3.	No appreciable effects of this option on worker health.
	Land and Resource Use	Indigenous Land and Resource Use	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	No appreciable effects of this option on Indigenous land and resource use.
		Other Land and Resource Use	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	Potential change in availability of land and resources due to noise, emissions, and smell associated with this option.	No appreciable effects of this option on other land and resource use.
		Heritage Resources	The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the LNG plant is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding	The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and it is assumed the diesel generators is located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding	This preferred road alignment option (assuming the overhead power line will be within the assessed road + buffer area) had a heritage resource impact assessment completed in 2017. No artifacts were discovered in the footprint of Option 3. The assessment received approval from the Heritage Conservation Branch. The

Criteria	Section	Valued Component	Option 1: Liquefied natural gas power plant	Option 2: Diesel generators	Option 3: Provincial power grid
			to any chance encounters of artifacts during clearing and construction.	to any chance encounters of artifacts during clearing and construction.	implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during line clearing and construction.
	Quality of Life	Cultural Expression	Change in traffic volume (increase) on public roads for regular transport of LNG to site. Less preferred option for cultural expressions due to increased traffic in proximity to a culture camp.	Change in traffic volume (increase) on public roads for regular transport of diesel to site. Less preferred option for cultural expressions due to increased traffic in proximity to a culture camp.	No appreciable effects of this option on cultural expression.
		Community Well-being	Business opportunities for supplying LNG and transporting to site may provide potential positive effect on income of local workers.	Business opportunities for supplying diesel and transporting to site may provide potential positive effect on income of local workers.	Line clearing and construction opportunities through SaskPower may provide potential positive effect on income of local workers.
		Infrastructure and Services	Change in traffic volume (increase) on public roads for regular transport of LNG to site.	Change in traffic volume (increase) on public roads for regular transport of diesel to site.	No appreciable effects of this option on infrastructure and services
	Economics	Economy	No appreciable difference was identified among alternatives for changes in participation in the traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: Liquefied natural gas power plant**	**Option 2: Diesel generators**	**Option 3: Provincial power grid**
Technical Factors	Complexity of design, construction, operation, and decommissioning	More complex option compared to Option 3 as tanks and containment systems are required for fuel storage. Operationally would need more day to day oversight than Option 3. Increases Project's scope 1 GHG emissions compared to Option 3.	More complex option compared to Option 3 as tanks and containment systems are required for fuel storage. Operationally would need more day-to-day oversight than Option 3. Increases Project's scope 1 GHG emissions compared to Option 3.	Not a technically complex option. SaskPower will be responsible for bringing the line into site. Denison will construct a substation. Lowers the Project's scope 1 GHG emissions. Reliability is high.
Cost Factors	Capital, operating, and decommissioning costs	Capital costs similar for all options. Operating costs between options 2 and 3. Decommissioning costs similar for all options.	Capital costs similar for all options. Highest operating costs – purchase of fuel and transport of fuel. Decommissioning costs similar for all options.	Capital costs similar for all options. Lowest operating costs. Decommissioning costs similar for all options.

Input received from Interested Parties:

Multiple methods for powering the Project were discussed during engagement activities. There was interest from workshop participants regarding solar power and wind turbines as a means to power the Project using renewables (18-EN-ERFN-5.48). Ideas for environmentally responsible methods for powering the Project were shared with Denison during a workshop with ERFN members, with preference being given to options that reduced emissions and minimized potential impacts (18-EN-ERFN-5.48). It was suggested that the most cost effective and least environmentally disruptive method for powering the Project would be to connect to the existing provincial grid and run the powerline in a straight line from the connection point to the Project. In a local land user's opinion, the powerline does not necessarily need to follow the proposed access road (19-LK-ERFNTrap-134.248), but would provide a consistent and reliable source of power.

Other Evaluation Factors			
Criteria	**Option 1: Liquefied natural gas power plant**	**Option 2: Diesel generators**	**Option 3: Provincial power grid**
Selected alternative for primary power supply = Option 3: Provincial power grid			
Rationale: Tapping into the provincial power grid is the more preferred option for primary power supply for a number of reasons. Denison is committed to minimizing GHG emissions and this option is preferable to Options 1 and 2 in terms of air emissions in general and scope 1 GHG emissions in particular. The option will result in incrementally more loss of habitat compared to Options 1 and 2, but this will be minimized to the extent practical by aligning the overhead line with the access road. The other two options would require regular transport of fuel to site, which has other potential interactions with the terrestrial environment (e.g., increased frequency of collisions). The increased traffic associated with Options 1 and 2 makes these options less preferred for cultural expression and infrastructure and services VCs.			

Less Preferred	Neutral	More preferred

Table 22: Support Facilities – Camp Location Optimization - Alternative Means Assessment

Criteria	Section	Valued Component	Option 1: First location - Prefeasibility	Option 2: Second location – Reduce fill volumes	Option 3: Third location - Southwest from second location
Biophysical	Atmospheric and Acoustic Environment	Air quality	No appreciable effects of this option on air quality were identified.	This location may experience changes in air quality parameters due to proximity to the wellfield and processing plant areas.	No appreciable effects of this option on air quality were identified.
		Noise	No appreciable difference was identified among the alternatives. No difference in potential changes in sound levels would be expected for the camp location options.		
	Geology and Groundwater	Geology	No appreciable difference was identified among the alternatives. No difference in potential changes in geology would be expected for the camp location options.		
		Groundwater quantity	No appreciable difference was identified among the alternatives. No difference in potential changes in groundwater quantity would be expected for the camp location options.		
		Groundwater quality	No appreciable difference was identified among the alternatives. No difference in potential changes in groundwater quality would be expected for the camp location options.		
	Aquatic Environment	Surface Water Quantity	Less preferred option due to the amount of cut and fill required and the influence on hydrology.	No appreciable difference was identified between these two alternatives. No difference in potential effects on surface water quantity would be expected for these two camp location options.	
		Surface Water Quality	No appreciable difference was identified among the alternatives. No difference in potential changes in these aquatic environment VCs would be expected for the camp location options.		
		Fish and Fish Habitat			
		Sediment Quality			
		Benthic Invertebrates			
		Fish Health			
	Terrestrial Environment	Terrain	Less preferred option due to the amount of cut and fill required.	No appreciable difference was identified between these alternatives. No difference in potential effects on terrain would be expected for these two camp location options	
		Soil	Less preferred option due to the amount of cut and fill required.	No appreciable difference was identified between these alternatives. No difference in potential effects on soil would be expected for these two camp location options	
		Organic matter/peat	No appreciable difference was identified among alternatives for these various terrestrial VCs. The camp locations are the same footprints, simply considered in different locations and the options would not change the total Project footprint.		
		Vegetation and Ecosystems			
		Listed Plant Species			

Criteria	Section	Valued Component	Option 1: First location - Prefeasibility	Option 2: Second location – Reduce fill volumes	Option 3: Third location - Southwest from second location
		Wetlands			
		Ungulates			
		Furbearers			
		Woodland caribou			
		Raptors			
		Migratory breeding birds			
		Bird species at risk			
Human Environment	Human Health	Human Health	More preferred option for human health considerations.	Changes in air quality from other mining activities in proximity to camp may have negative effects on human health, making this option less preferred.	More preferred option for human health considerations.
		Worker Health	More preferred option for worker health considerations.	Changes in air quality may have negative effects on worker health, making this option less preferred.	More preferred option for worker health considerations.
	Land and Resource Use	Indigenous Land and Resource Use	No appreciable difference was identified among alternatives for land available for Indigenous land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The camp locations are the same footprints, simply considered in different locations and the options would not change the total Project footprint. There are no changes to access associated with the camp location options.		
		Other Land and Resource Use	No appreciable difference was identified among alternatives for land available for other land and resource use, as well as resource availability, and perceived suitability of land and resources for safe use. The camp locations are the same footprints, simply considered in different locations and the options would not change the total Project footprint. There are no changes to access associated with the camp location options.		
		Heritage Resources	No appreciable difference was identified among these options for heritage resources. The main Project Area has undergone two heritage resource impact assessments in 2017 and 2019 and all three options are located within the assessed footprint. The assessment received approval from the Heritage Conservation Branch. The implementation of a Heritage Resources Management Plan will provide a process for appropriately responding to any chance encounters of artifacts during line clearing and construction.		
	Quality of Life	Cultural Expression	No appreciable difference was identified among alternatives for changes in knowledge transmission and traditional diet, including perceived changes in the suitability and safety of resources that support a traditional diet.		
		Community Well-being	No appreciable difference was identified among alternatives for changes in income of local workers and community cohesion.		
		Infrastructure and Services	No appreciable difference was identified among alternatives for changes in traffic, community infrastructure and services.		
	Economics	Economy	No appreciable difference was identified among alternatives for changes in participation in the traditional economy.		

Other Evaluation Factors				
Criteria		**Option 1: First location - Prefeasibility**	**Option 2: Second location – Reduce fill volumes**	**Option 3: Third location - Southwest from second location**
Technical Factors	Complexity of design, construction, operation, and decommissioning	Design and construction would be less preferred due to higher cut and fill volumes. Operation and decommissioning would be similar to Options 2 and 3.	No appreciable difference in complexity of design, construction, operation, and decommissioning for this option and Option 3.	No appreciable difference in complexity of design, construction, operation, and decommissioning for this option and Option 2.
Cost Factors	Capital, operating, and decommissioning costs	High capital costs for cut and fill volumes. Otherwise, operating and decommissioning costs would be similar to Options 2 and 3.	No appreciable difference in capital, operating, and decommissioning costs for this option and Option 3.	No appreciable difference in capital, operating, and decommissioning costs for this option and Option 2.

Input received from Interested Parties:

Denison understands the importance of optimizing the location of the Project camp and associated facilities within the footprint of the Project site. The Project will have a small footprint when compared to other, more traditional, mining operations throughout northern Saskatchewan; as such, the Project does not require as much infrastructure and buildings on site. This allows for efficient placement of the critical buildings required for the operation – including the camp facilities. While some specific engagement material was collected on optimizing the location of the camp within the site design, Denison is aware that a footprint, regardless of size, can still have potential effects (21-EN-ERFN-447.38). Therefore, the number of buildings will be as minimal as possible, and as mobile or modular as possible. This will allow for easier installation and removal (21-EN-ERFN-447.29).

Preferred alternative for camp location optimization = Option 3: Third location – southwest from second location

Rationale: The camp location selected remains close the other Project components for the purpose of minimizing Project footprints. It is located in a relatively flat area, which avoids unnecessary costs, construction complexity, and effects on terrain, soil, and surface water quantity associated with moving large volumes of material for cut and fill. The camp location is sufficiently far from emissions based on results from earlier iterations of the air dispersion model. As described earlier, this alternative means assessment was provided as an example of incremental optimization.

Less Preferred	Neutral	More preferred

2 Summary of Selected Alternative(s)

Table 23 provides a summary of the preferred alternative means that were selected for the Project and carried forward to the EA process.

The alternatives means assessment framework incorporated technical, economic, land use, biophysical and human environment considerations, in the context of mitigation measures and residual effects. The evaluation of the Project's performance will be ongoing through the process of continual improvement and adaptive management. The alternatives selected will continue to be reviewed and adapted as needed through the completion of the EA process and as the Project proceeds through licensing and permitting.

Table 23: Summary of Alternative Means Carried Forward into the Environmental Assessment

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
Mining	Method	~~Open pit~~	Jet Boring	Surface Boring	Micro Tunnel Boring	**ISR**		
	Freeze design for tertiary containment of mining solution	Freeze dome	**Freeze wall**					
	Permeability enhancement	**Hydraulics**	**Propellant**	**Mechanical**				
	Mining solution	~~Basic solution~~	**Acidic solution**					
Processing	Location of processing	Off-site processing at an existing mill	**On-site processing in purpose built processing plant**					
	On-site processing method	Ion exchange	Solvent extraction	**Direct precipitation**				
Water management	Freshwater supply	**Groundwater**	**Surface water**					
	Drinking water	Truck drinking water to site	**Generate drinking water on site with a potable water treatment plant**					
	Treated effluent discharge location	To groundwater	**To surface water**					
	Treated effluent discharge locations for surface water	Kratchkowsky Lake (LA-7)	Whitefish Lake north (LA-6)	**Whitefish Lake south (LA-5)**	McGowan Lake (LA-1)	Russell Lake	~~Mardoc Lake (LA-4)~~	~~Williams Lake LB-3~~
Waste management	Organic waste disposal	On-site disposal using an incinerator	On-site disposal in domestic landfill	**On-site composting**				
	Process precipitate management	On-site permanent disposal	**Off-site reprocessing and final disposal**					
	Domestic waste disposal	Collection and disposal off site by a third-	**Collection and disposal in an on-**					

Project Component		Alternative Means						
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
		party contractor	**site domestic landfill**					
Access and transportation	Access road alignment	Direct route	Direct route to reduce cut volumes	**Follows part of the existing exploration access road**				
	Stream crossing structures	Culverts	**Clear span bridges**					
	Worker transportation	Ground transport	**Air transport to existing airstrip at nearby Cameco operations**	**Air transport to new airstrip constructed and operated by Denison**				
Power	Primary power supply	Liquefied natural gas power plant	~~Solar photovoltaic power plant~~	Diesel generators	**Provincial power grid**			
Support facilities	Camp location optimization	First location - Prefeasibility	Second location – Reduce fill volumes	**Third location - Southwest from second location**				

Selected alternative

~~Strikethrough~~ option was eliminated at an earlier step due to technical, economic, or land use factors (see Table 3)

3 References

Note: Refer to EIS Appendix 2-A for a summary of the following engagement database references:

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Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Appendix 3-A

An Exploration of Recorded Athabasca Denesųłiné Traditional Knowledge, Land Use and Occupancy Information in the Vicinity of Denison Mines Wheeler River Project

PREPARED BY
YA'THI NÉNÉ LANDS AND RESOURCES OFFICE

UPDATED
March 2022

For Denison Wheeler River EIS Purposes Only. Any other use requires the permission of YNLR.

This document is an initial exploration of recorded Traditional Knowledge, Land Use and Occupancy (TKLUO) information of the Athabasca Denesųłiné (AD) First Nations and Communities in the Wheeler River area. It does not represent the full extent of historic or current TKLUO in the area. This document was prepared to facilitate participation in the regulatory process. Its use by anyone else or for any other purpose may not be appropriate. Any party wishing to use or disseminate the information contained in this document must first seek approval from Ya'thi Néné Lands and Resources Office.

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1.0 Introduction

Ya'thi Néné Lands and Resources (YNLR) was asked to review materials provided by Denison Mines Corp. and to assist with the identification of Athabasca Denesyłiné Knowledge, Land Use and Occupancy (ADKLUO) information within existing datasets in the vicinity of the Denison Mines' Wheeler River Project. This study is a preliminary exploration of these existing datasets. It is intended that this study will contribute to the development of the Environmental Impact Statement (EIS) for the Wheeler River Project and help to ensure that the Wheeler River Project benefits from the traditional knowledge of the Athabasca Denesyłiné and does not infringe on our rights and interests.

YNLR is a non-profit organization that is owned by, and works on behalf of, the Athabasca Basin communities. Our communities include Hatchet Lake Denesyłiné First Nation, Black Lake Denesyłiné First Nation, Fond du Lac Denesyłiné First Nation and the municipalities of Stony Rapids, Uranium City, Wollaston Lake and Camsell Portage (Figure 1). YNLR was established in June of 2016 to promote and enhance the environmental, social, economic, and cultural well-being of current and future Athabasca Basin residents while working hard to collaborate with government and industry partners to keep their land use in our Traditional Territory sustainable (http://www.yathinene.ca).

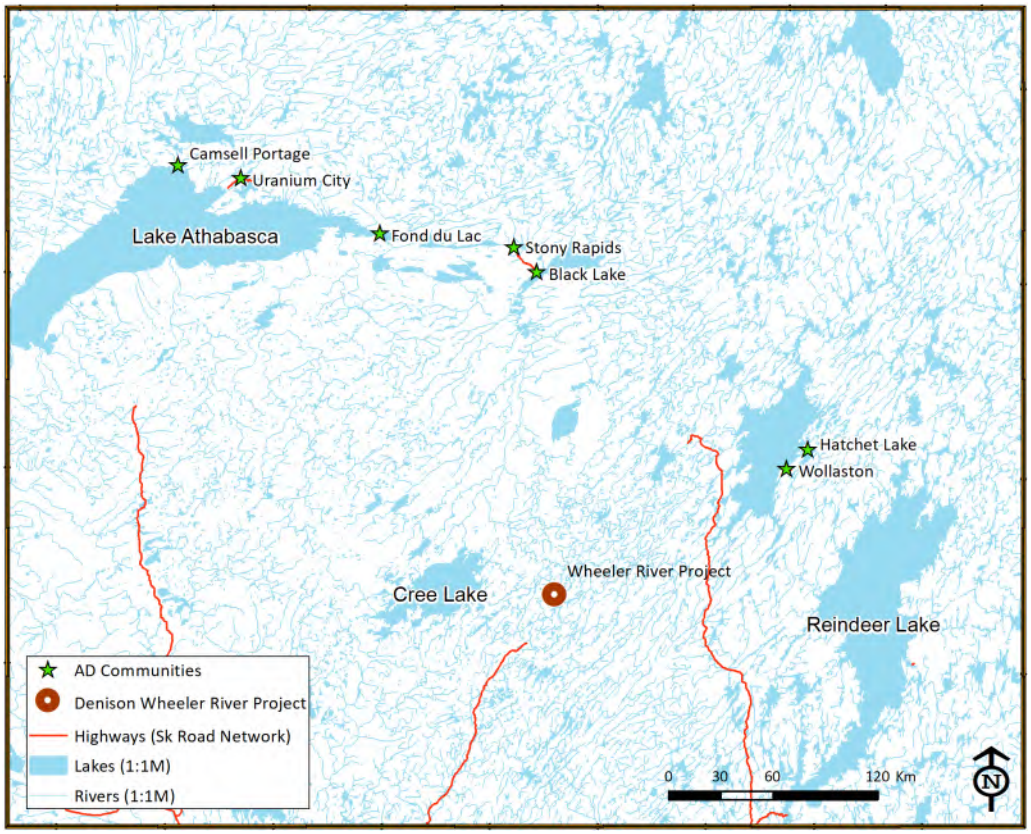

Figure 1. Communities represented by Ya'thi Néné Lands and Resources office.

While all the Athabasca Basin communities are relatively close to the Wheeler River Project area, this report will generally focus on the Athabasca Denesųłiné First Nations including Hatchet Lake, Black Lake and Fond du Lac.

The project is located within Nuhenéné, the traditional territory of the Athabasca Denesųłiné First Nations. Denison is proposing to develop an underground uranium mine at the Gryphon deposit, and an in-situ recovery process for uranium at the Phoenix deposit of the Wheeler River Project site located approximately 35 km northeast of the Key Lake mill and 35 km southwest of the McArthur River uranium mine (https://www.denisonmines.com/projects/core-projects/wheeler-river-project/).

2.0 Background

The Black Lake, Hatchet Lake, and Fond du Lac Denesųłiné First Nations are collectively termed the Athabasca Denesųłiné (AD). Fur traders originally referred to the Denesųłiné as the Northern Indians and later as the Caribou Eaters or Ethen-eldèli (Smith 1981, Elias 2003, Usher 1990, Bone *et al*. 1973). We have also been called Chipewyan; a name we found offensive since it was given to us by our traditional enemies, the Cree. In recent times, we have moved away from both terminologies, preferring the term Denesųłiné, meaning “the Real or Genuine People”. This is the term our ancestors used to define themselves. Apart from the specific references cited, the following works offer additional insight into the Athabasca Denesųłiné way of life: Birkett-Smith 1930, Sharp 1975 and 1977, Gillespie 1976, Irimoto 1981, Usher 2003, Gordon 1996, and Kasstan 2016.

2.1 Nuhenéné

Athabasca Denesųłiné culture, history and way of life are interwoven with the movements and health of the Beverly, Ahiak, Bathurst and Qamanirjuaq barren-ground caribou herds. We are so intrinsically tied that it is often stated that Caribou are Dene; Dene are Caribou. Our ancient legends and stories explain and reinforce this belief (Kasstan 2016, Elias 2003, and Smith 1981).

Every year, the barren-ground caribou migrate south into the forests of Nuhenéné for shelter and food. During this time, the communities begin their yearly harvest. The communities start harvesting caribou in December when they enter the boreal forest, and the hunt continues until the caribou migrate back north to the calving grounds in the barren lands above the treeline. The migration north begins in March and continues until mid-May.

Where there are, or have been, barren-ground caribou there are Athabasca Denesųłiné. This has been true for at least 2600 years. The attached map produced by the Beverly-Qamanirjuaq Caribou Management Board (BQCMB) (Figure 2) shows the range of the barren-ground caribou. Archeological records of the Denesųłiné and our closest ancestors, the Taltheilei, correspond very closely to the caribou range (Figure 3). Since the range is large, portions of our traditional territory are shared with other Indigenous Peoples. The range of the barren-ground caribou

fluctuates due to natural cycles and is impacted by climate changes, forest fires, industrial development, and other factors.

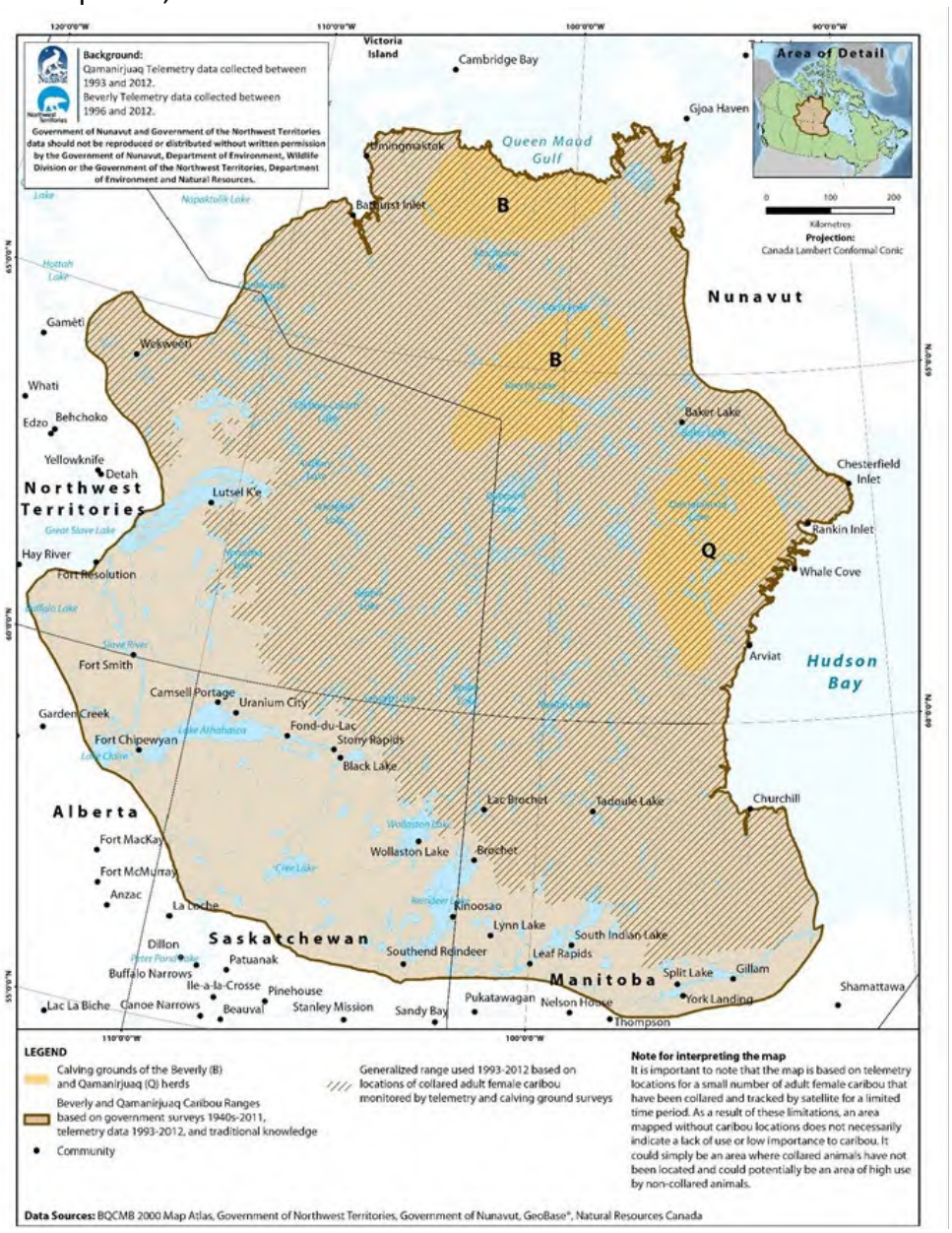

Figure 2. Beverly and Qamanirjuaq caribou ranges based on government surveys, tracking collared cow by telemetry and traditional and local knowledge of caribou harvesters (BQCMB, 2000).

Note: The map authors indicate that a small number of collared female caribou were tracked for a limited time period. Areas that may appear to lack caribou do not indicate a lack of use or importance, only that the collared animals may not have been located there. These areas could be of high use by non-collared animals. (BQCMB, 2000).

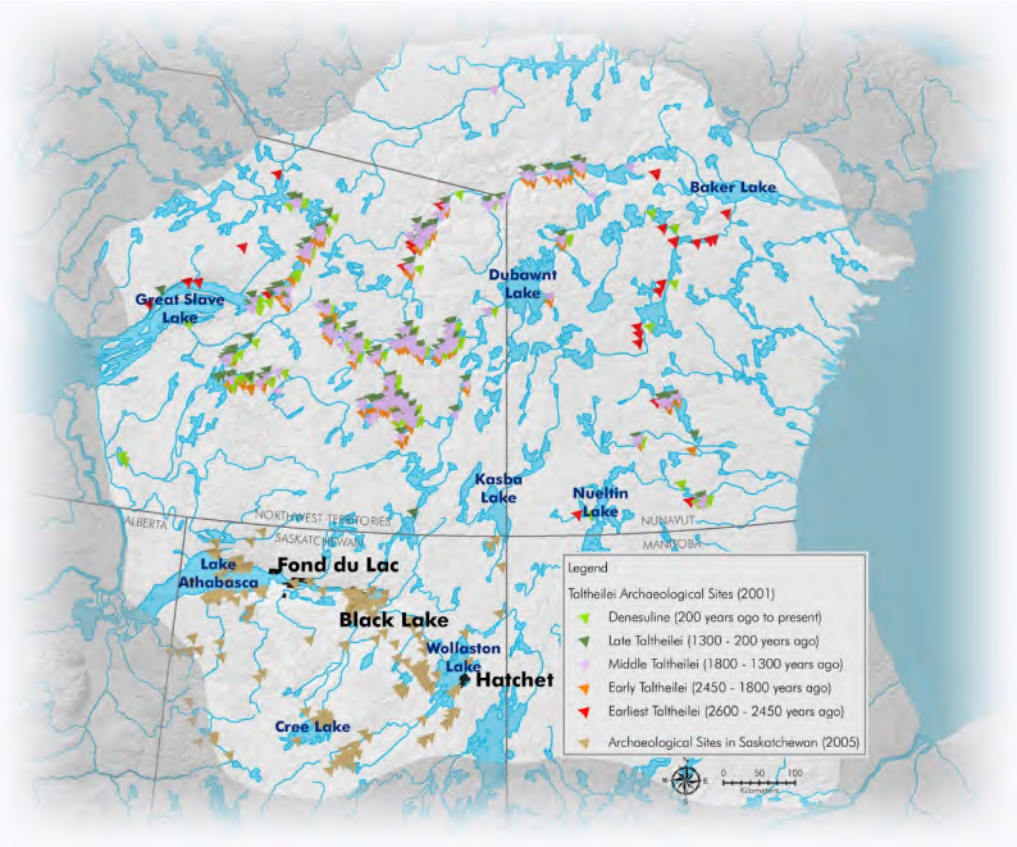

Figure 3. Denesųłiné and related Archeology sites within Nuhenéné (Athabasca Denesųłiné Negotiations Team. 2009. Denesųłiné Atlas. Unpublished Contract Report).

While we talk about caribou being the lifeblood of the Athabasca Denesųłiné, it must be remembered that the range of the caribou defines the extent of our territory, and it is within this territory that our members have or assert Aboriginal or Treaty Rights and conduct many on-the land activities beyond the harvesting of caribou. These activities include, but are not limited to, the hunting of small and other large game animals, fishing, trapping, and the gathering of foods, materials, and medicines.

2.2 Treaty 8 and Treaty 10

The Athabasca Denesųłiné signed Treaties #8 and # 10 with the Crown in the late 19th and early 20th century (Figure 4). Hatchet Lake Denesųłiné First Nation is the only Athabasca Denesųłiné First Nation within Treaty 10, whereas, the Black Lake and Fond du Lac Denesųłiné First Nations are within Treaty 8. The proposed Denison Mines Corp. Wheeler River Project is within Treaty 10 territory and is close to the boundaries of Treaty 8.

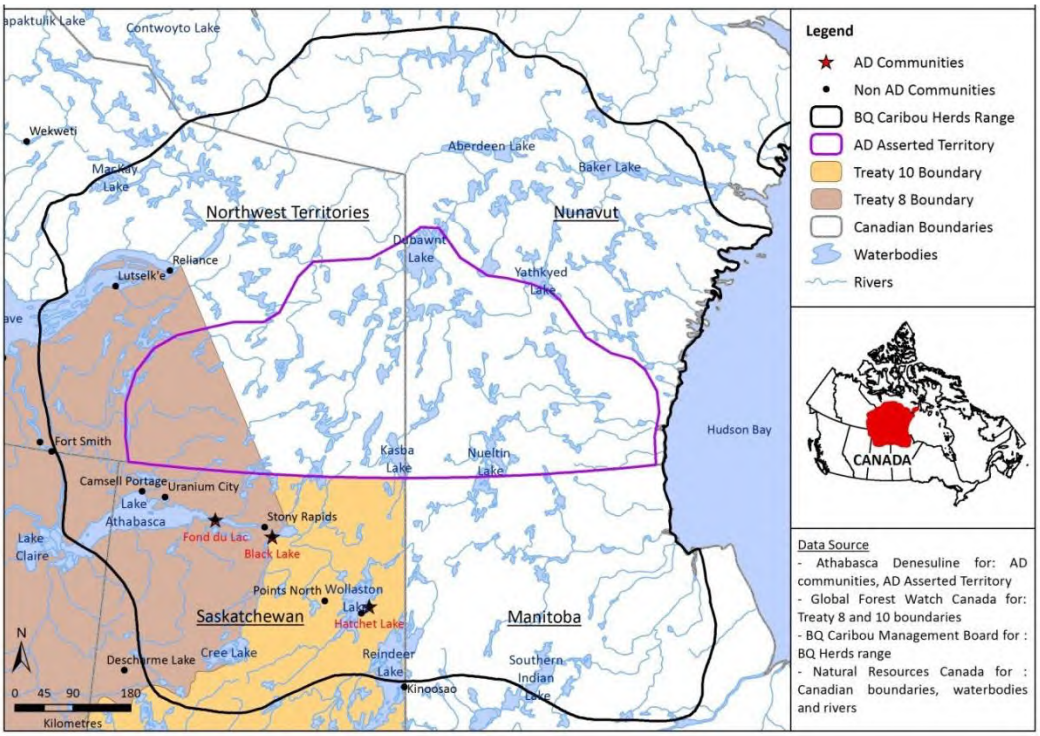

Figure 4. Caribou Range, Treaty 8, Treaty 10 and Athabasca Denesyłiné (AD) Asserted Territory North of 60 (Athabasca Denesyłiné Negotiations Team. 2009. Denesyłiné Atlas. Unpublished Contract Report).

2.3 Land Use Planning

From 2003-2007, the Athabasca Denesyłiné and non-aboriginal community partners (and at times in conjunction with government, industry, and NGOs) developed a regional land use plan that covers approximately 116, 000 km^2 (Figure 5) of our territory. The Multiple Use Zone of this plan includes the Denison Mines Wheeler River Project area.

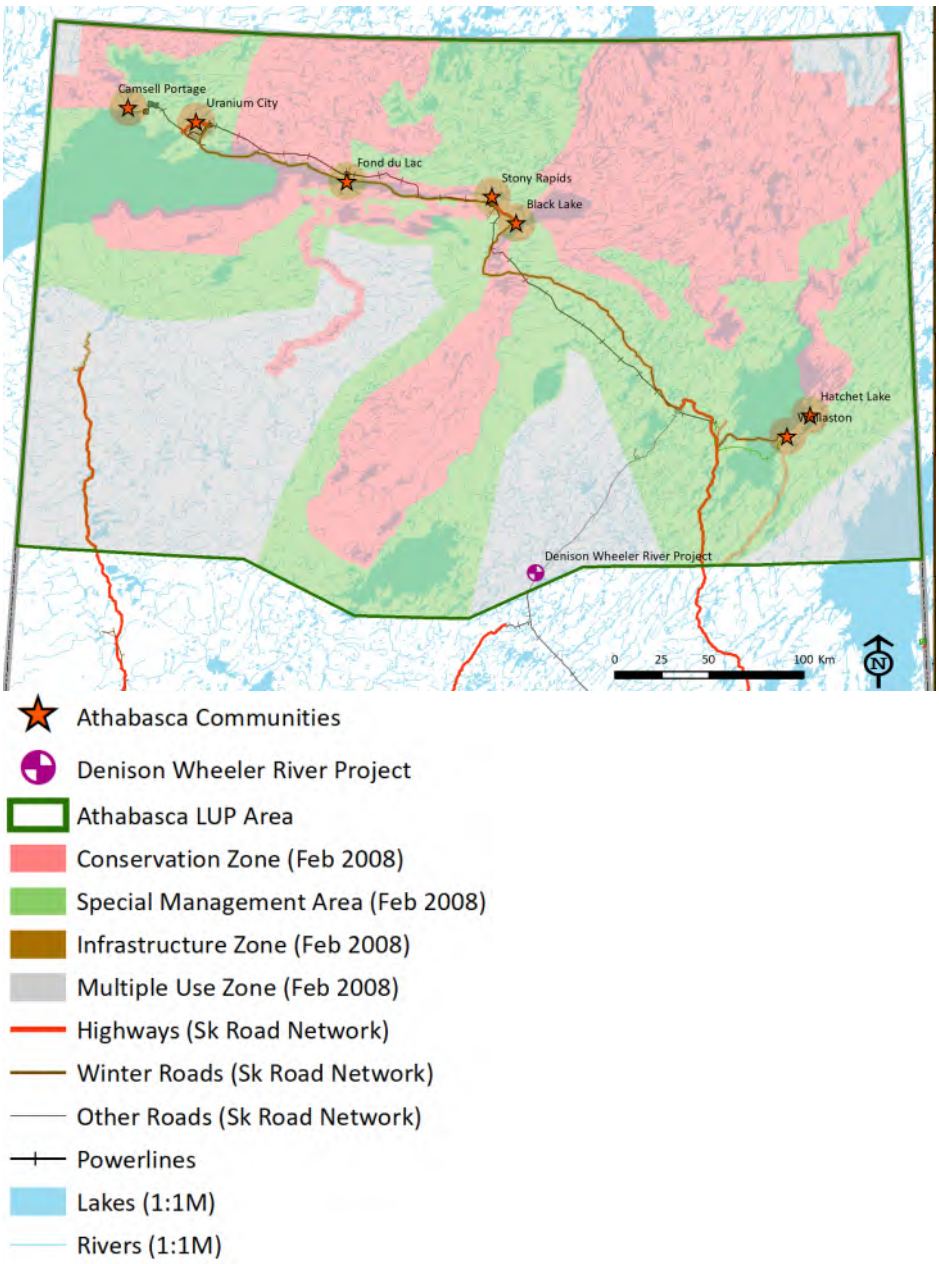

Figure 5. Traditional Territory (Nuhenéné) of the Athabasca Denesyłiné and Land Use Plan in Saskatchewan.

3.0 Recorded Traditional Knowledge, Land Use, and Occupancy Information

On behalf of the Athabasca Denesyłiné, YNLR holds datasets of recorded ADKLUO information for portions of Nuhenéné within Saskatchewan. Some of this data shows land use in proximity

to the project area. The data YNLR currently holds only shows part of a larger picture of land use as the existing datasets are not comprehensive and do not include all users and all areas.

3.1 Territorial Athabasca Denesyłiné Traditional Knowledge, Land Use and Occupancy Studies

Since the 1970s over 500 Denesyłiné have participated in traditional knowledge/oral history/land use and occupancy studies that recorded their lives, history and resource use (e.g. Holland 2001; Elias 2003; Usher 1990 and 2003). These studies have covered various areas within Nuhenéné, but certainly do not cover all of the territory. Many of these studies have been undertaken to elicit information specific to a given area or project. Data from these studies is aggregated in Figure 6, which shows the general pattern of known travel routes, burial sites, and overnight sites around which hunting, fishing, trapping, gathering, and cultural activities occur throughout all of Nuhenéné . This area is synonymous with the range of the Barren-ground caribou herds. It is important to note that this is not a complete description of Athabasca Denesyłiné land use. This is especially true as one nears the boundaries of Nuhenéné. It reflects the uses and values of the individuals who participated in these studies within the associated study areas. Naturally, reports, and maps created with such data, are but a sample of the actual knowledge and land use of the Athabasca Denesyłiné.

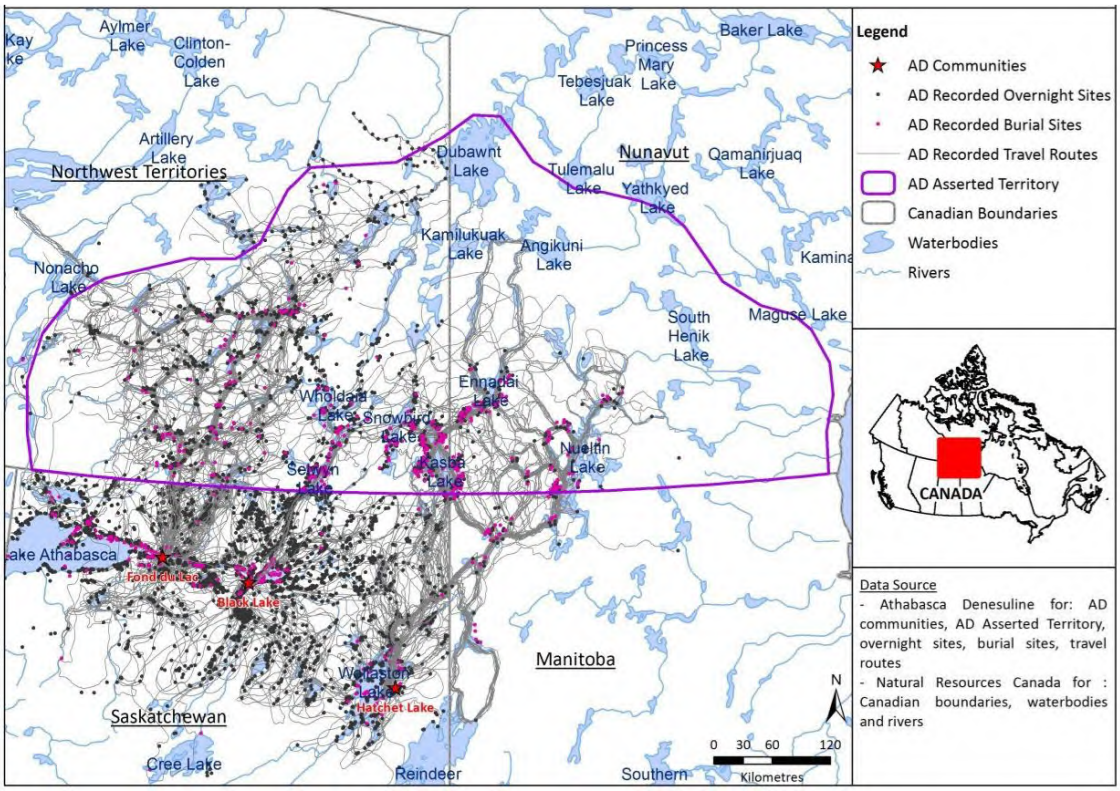

Figure 6. Overview of Traditional Land Use in the Athabasca Denesyłiné (AD) Asserted Territory North of 60 and in Saskatchewan (Hunter, B.W. Forthcoming. Between a Rock and a Hard Place:

Athabasca Denesyłiné and Land Use Planning in Northern Canada. Unpublished PhD. University of Sheffield).

3.2 Regional / Local Athabasca Denesyłiné Traditional Knowledge, Land Use and Occupancy Studies

We have extracted relevant and available information from these existing datasets in order to produce more focused regional and local maps of known TKLUO data in relation to the Wheeler River Project (Figure 7, Figure 8). These figures also indicate areas where "Duty to Consult (DTC)" interviews were undertaken.

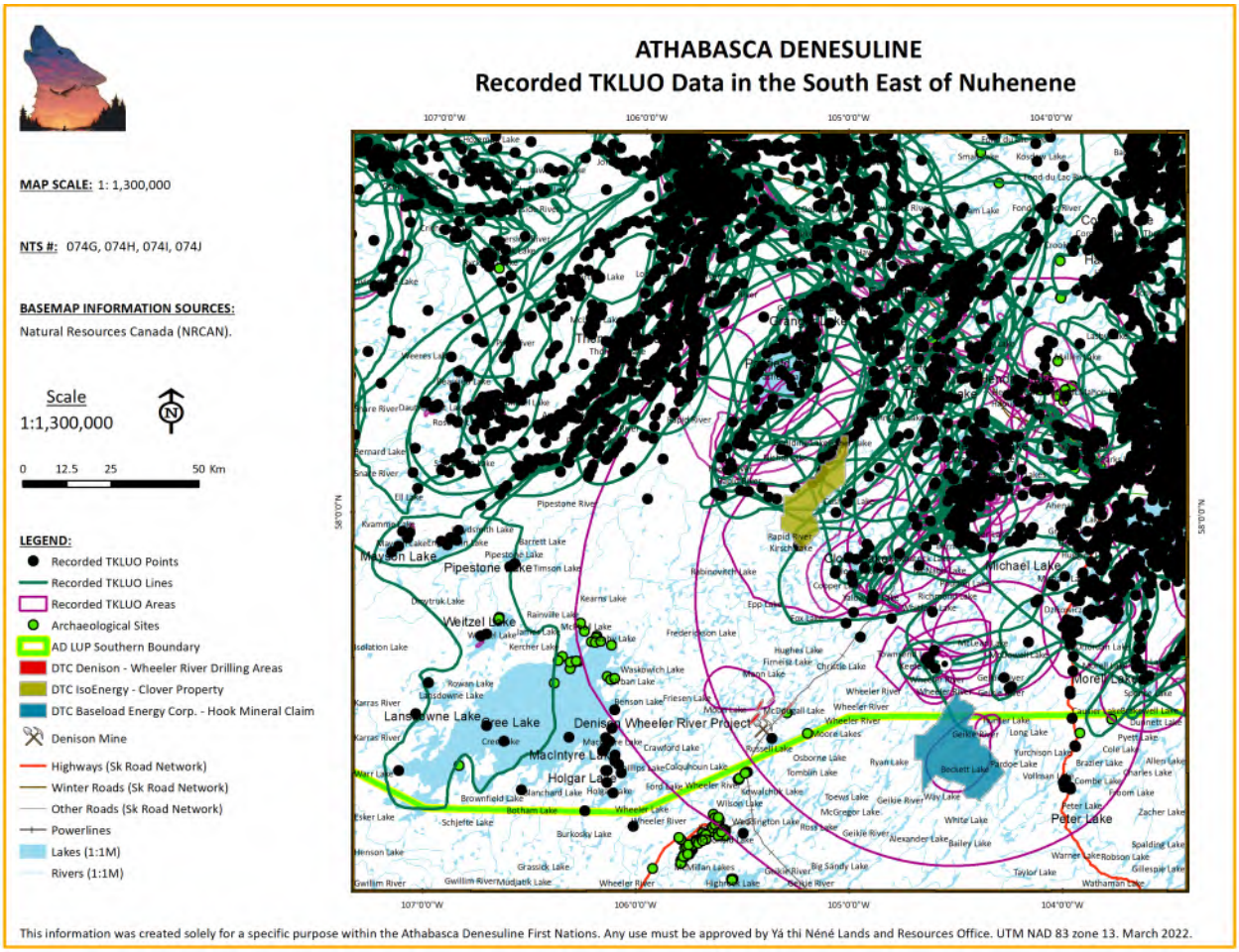

Figure 7. Athabasca Denesyłiné recorded ADKLUO data in the southeast part of Nuhenéné.

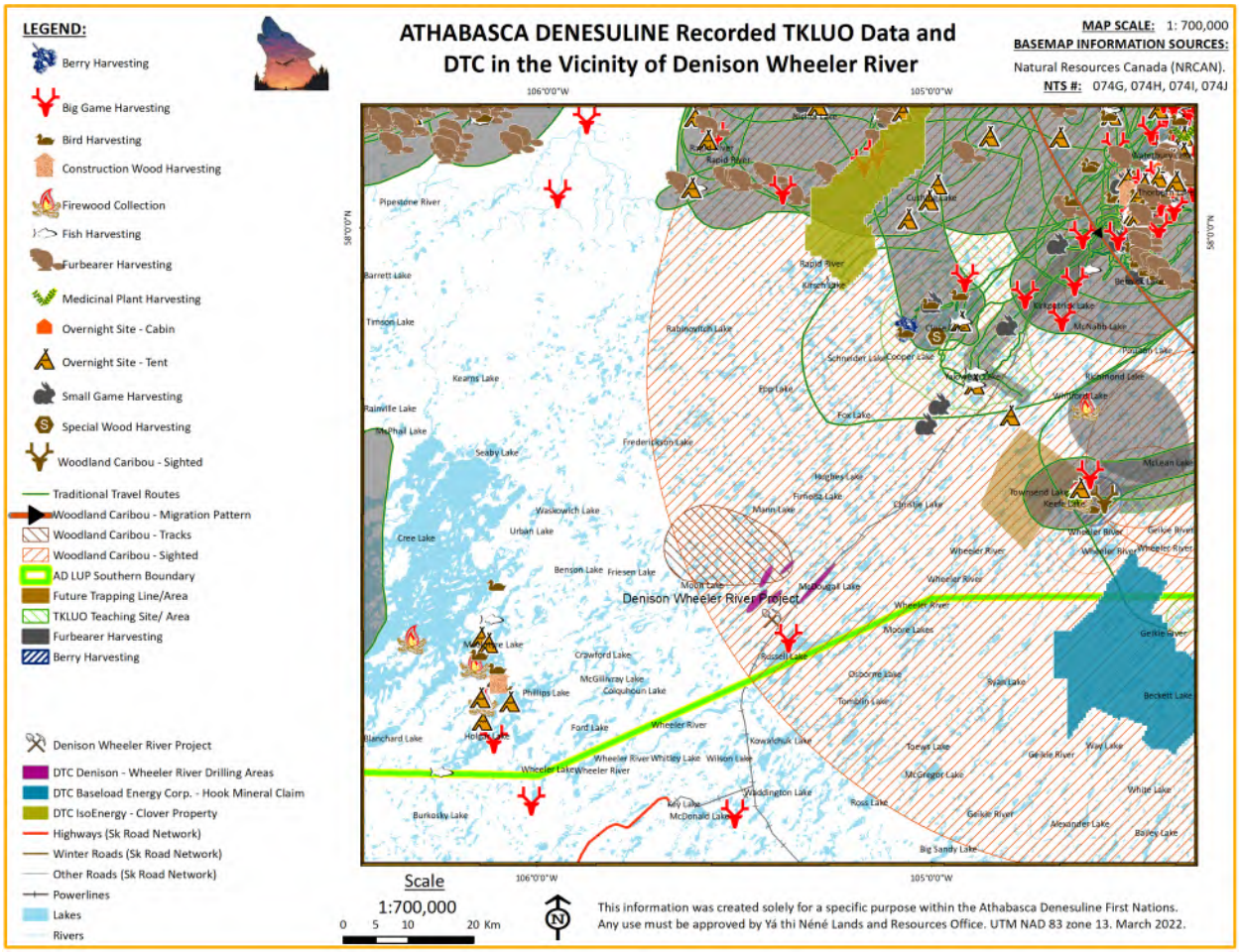

Figure 8. Local map of recorded ADKLUO information in the vicinity of Denison Mines Wheeler River Project.

The represented studies have collected data over a period of approximately twenty years. Figure 8 clearly shows AD traditional knowledge, land use, and occupancy in the vicinity of the Denison Wheeler River Project. This map excludes archaeology sites.

General categories of information recorded by these points, lines and areas are activities such as hunting, fishing, trapping, gathering, teaching of traditional activities, travel routes, occupancy, and local knowledge of woodland caribou.

Hunting activities include:

- Large game harvesting – barren-ground caribou, woodland caribou, black bear, and moose;
- Small game animals harvesting - porcupine and rabbit; and,
- Bird harvesting - wild chicken, ducks, geese and any of their eggs that were found.

Fishing activities represented include:

- gill net;
- hook & line;
- fish weir captures;
- commercial fishing sites;
- fish harvested include northern pike, suckers and burbot.

Animals trapped or shot for fur include:

- beaver, muskrat, marten, fisher, mink, and otter.

Gathering activities noted in these data includes:

- berry picking sites;
- timber for construction or firewood;
- medicinal plants;

Several overnight sites were indicated including tent and cabin sites.

One Athabasca Denesyłiné member with a registered trapping block near Keefe Lake has plans to extend his block further in the area, while another member has considered the possibility of extension but is unsure if there would be conflicts from southern users who also may have trapping interests in the area.

3.3 Other Land Use Information – Duty to Consult Responses

Other information held by YNLR includes the duty to consult interview responses for proposed projects in AD traditional territory. While these are not complete TKLUO studies, nor are the activities geo-located, the duty to consult responses provide insight into land use and any concerns regarding these projects in the area being considered. Figures 7 and 8 show the aggregate ADKLUO data in addition to the duty to consult areas. These DTC areas include the Baseload Heli Drill Exploration, Iso Energy, and the Denison Wheeler River projects.

The areas considered in the duty to consult responses indicate that the surrounding land is used for activities such as hunting, fishing (including commercial) and the gathering of berries and medicines. The land is also used for therapeutic purposes, youth gatherings, fish camps and general camping. Accessible areas were utilized year-round for hunting, trapping and fishing, with activities such as berry picking occurring in summer.

Concerns raised by the interviewees include damage to the lands and water, how wildlife will be affected, disruption to traditional activities and accessibility to the areas while projects are ongoing. Line cutting was raised as an issue that affects both land and wildlife. One interviewee suggested that if trees are being cut down more should be planted. Even when the interviewee

was not a direct user of the area in question, there were desires to protect the areas for future generations and current youth.

> *"Fishing, hunting, trapping….we the Dene people live off the land"* (Athabasca Denesųłiné member)

3.4 Other Land Use Information – Oral history Conveyed to Denison

In October of 2019, a YNLR-led meeting took place that included several leaders from the Athabasca Denesųłiné First Nations and communities. Denison was invited to this meeting and has acknowledged the importance of historical information that was shared. Some notable participant quotations from this meeting include:

"An Elder [described] travelling from Hatchet Lake to Russell Lake, Highrock River and the Geikie River. The area along the Treaty 10/Treaty 8 boundary towards Cree Lake and Geikie River are areas Dene travelled around." (Hatchet Lake Denesųłiné member)

"The whole area of the Athabasca Basin was historically used by the Dene Nation. There were no boundaries to where we travelled. Although there may not be anyone active in the Wheeler area now, it is part of our historical land use area." (Fond du Lac Denesųłiné member)

"We have Black Lake members in Île a la Crosse, Beauval etc. There was always interaction between the west side communities and the northern communities. We would travel through Cree Lake." (Fond du Lac Denesųłiné member)

3.5 Cautions

Information collected during the various studies and duty to consult interviews are limited to the responses of those who participated and should not be taken as a complete picture of collective Denesųłiné knowledge, use or value. The identification of some knowledge holders and resource users indicates that there is broader importance and use of the region likely not captured in the available data. **This study does not represent all Denesųłiné knowledge, uses, values, and interests in the project study area, and an absence of data does not signify an absence of use or value.**

4.0 Summary/Conclusion

The Denison Mines Wheeler River Project is located within Nuhenéné, the traditional territory of the Athabasca Denesųłiné. Further, the project site is situated within the bounds of Treaty 10, to which some Athabasca Denesųłiné are signatories. The Wheeler River site is within the range of the caribou herds that are the key cultural species for the Athabasca Denesųłiné that defines the lands, waters, and resources that have underpinned Athabasca Denesųłiné culture for more than 2600 years. Existing ADKLUO information demonstrates continued traditional and contemporary land use in the vicinity of the Denison Mines Wheeler River Project. The Athabasca Denesųłiné are concerned about the project and its potential adverse impacts on their Aboriginal and Treaty rights to hunt, fish, trap and gather.

Safeguarding the ability of the Athabasca Denesųłiné to practice our Aboriginal and Treaty Rights to hunt, fish, trap, and gather is critical. The Athabasca Denesųłiné must be considered and directly involved during all stages of the Wheeler River project. The Athabasca Denesųłiné expect further consultation and engagement with Denison Mines about project activities, potential impacts to the environment, and how these impacts can be mitigated. Our ongoing relationship with Denison Mines should be outlined in an impact and benefits agreement and any related study agreements.

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Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Appendix 4-B: Interests, Issues and Concerns Tables: Indigenous Communities of Interest, Other Indigenous Communities, Indigenous Organizations

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
A La Baie Métis Local #21	Other	Questions and clarification about the ISR mining process, including alternative power usage and transportation of acid.	ROC 1 ROC 62 ROC 197	Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface. Section 2.2.1.3 provides information on freeze wall technology. The freeze wall is intended for tertiary containment of mining solution to support a defence in depth strategy as additional, site-specific data is obtained on hydraulic containment. The freeze wall around the mining area will extend from the surface to the basement rock, isolating the mining area from regional groundwater. The freeze wall is expected to be a minimum of 10 m thick, be installed 25m away from the uranium deposit, and extend 30 m into the basement rock. Data from the groundwater monitoring network installed in and around the wellfield and freeze wall will make sure the freeze wall is meeting design specifications. Sections 2.2.6.1 and 2.2.6.2 provide information on primary and back-up power supplies. Electrical service to the Project will be provided via an approximate 5-km extension tap from the existing 138 kV overhead transmission line that runs along Highway 914. To provide electrical service during times of utility outages, diesel generators will be installed to service the site and maintain essential functions.	N/A	Ongoing - A La Baie Métis Local #21 has delegated the duty to consult to the MN-S. Denison is committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.
A La Baie Métis Local #21	Other	A concern was expressed about racism despite a “zero tolerance” policy.	ROC 62	Denison has an established Workplace Violence and Harassment Policy and an Indigenous Peoples Policy, both of which are publicly available on Denison's website. These two policies create the conditions for an inclusive and diverse work environment and a safe work culture for all. Policies will be adapted to the conditions of the Project and Denison. Further, Section 12.2.5 Mitigation Measures for Community Well-being describes the establishment of health and wellness programming on-site, an Employee and Family Assistance Program (EFAP), a no alcohol and drug policy on Project site, the enforcement of Denison's Environment, Health, Safety, and Sustainability Policy, the implementation of culturally sensitive employment policies to support the Indigenous workforce (for example, having an Elder representative at the Project site to provide cultural programming), among others.	Denison has an established Workplace Violence and Harassment Policy and an Indigenous Peoples Policy, both of which are publicly available on Denison's website. Policies will be adapted to the conditions of the Project and Denison. Further, Section 12.2.5 Mitigation Measures for Community Well-being describes the establishment of health and wellness programming on-site, an Employee and Family Assistance Program (EFAP), a no alcohol and drug policy on Project site, the enforcement of Denison's Environment, Health, Safety, and Sustainability Policy, the implementation of culturally sensitive employment policies to support the	Ongoing - A La Baie Métis Local #21 has delegated the duty to consult to the MN-S. Denison is committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
					Indigenous workforce (for example, having an Elder representative at the Project site to provide cultural programming), among others.			
A La Baie Métis Local #21	Other	Interest about discharge testing.	ROC 62	During Construction, no effluent is expected to be released to the aquatic environment. Contact water stored in the Clean Waste Rock Pond during Construction and will be held onsite until the Industrial Wastewater Treatment Plant (IWWTP) is commissioned. At that time the water from the pond would be conveyed to the IWWTP, treated, and released to Whitefish Lake per permit / license requirements. The sequence for Construction activities will occur in a logical manner based on Project execution plans. For example, construction of the wellfield runoff pond will be prioritized during the early part of Construction and it will able to hold 38,200 m3 of water. This will provide contingency and additional water storage capacity if contact water produced exceeds estimates or the volume available in the Clean Waste Rock Pond. Other secondary contingency measures are also available should the volume of water requiring management exceed site infrastructure storage volume. This could include use a hydrovac for offsite disposal. Treated Effluent Monitoring and Release Ponds in Section 2.2.3.9 of the draft EIS outlines Denison's commitment to test effluent prior to discharge to Whitefish Lake, to ensure it meets federal and provincial discharge limits. Any pond not meeting the criteria will be recycled back to the Industrial Wastewater Treatment Plant via the process water pond. Denison expects the Provincial Approval to Operate a Pollutant Control Facility will contain specific effluent quality limits and monitoring to confirm effluent quality meets the approved limits. Denison will also be required to meet conditions in CNSC licensing documentation, as well as MDMER effluent discharge criteria.	The Project will adhere to treated effluent discharge limits as stipulated in operating approvals and by regulations and for protection of aquatic life and receptors associate with the water exposure pathway.	Ongoing - A La Baie Métis Local #21 has delegated the duty to consult to the MN-S. Denison is committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.
A La Baie Métis Local #21	Other	Questions were asked regarding the quality and number of lakes tested.	ROC 62	Surface water quality was sampled during 2016, 2018, and 2019 at lakes and watercourses within the LSA and RSA (Figure 8.2-4 and Appendix 8-D). Sampling at lakes and ponds included the measurement of both physical and chemical parameters obtained in situ during field surveys and by laboratory analysis. Locations of interest for this assessment nodes that are coincident with baseline monitoring stations and/or watersheds of interest to the assessment. Surface water quality along with other study components were sampled at stations SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SB-3, SB-5, LAB, LB-2, LA-1, LA-5, and LA-6. These stations are located on the Icelander River, McGowan Lake, Whitefish Lake North, Whitefish Lake South, Russell Lake Inlet, near the outlet of Williams Lake as shown in Figure 8.2-4. As detailed in descriptions of existing surface water quality (Section 8.2.3.3), parameters where water quality guidelines were available, most	N/A	Ongoing - A La Baie Métis Local #21 has delegated the duty to consult to the MN-S. Denison is committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				were below their respective guidelines at all sampling locations. Cases where constituent concentrations exceeded guidelines are detailed in Table 8.2-2. Generally, at least one sample from each waterbody within the LSA contained aluminum concentrations that exceeded the SEQG. In some cases, such as waterbodies LB-2 and SB-3, all water samples exhibited aluminum concentrations higher than the SEQG. There were also several instances where water pH was below the lower threshold of the CCME CWQG for the Protection of Aquatic Life, such as samples from Whitefish Lake North, SA-1, SA-3, SA-5, SA-6, SB-3, and SB-5 (Table 8.2-4). Other metals that had higher concentrations than their guidelines included lead, iron, and cadmium, though in these cases, the maximum concentration was only marginally above the guideline value.				
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes	Interest in sharing IK and history and integration of this information in EIS.	ROC 479	Denison's engagement with BNDN is consistent with the identification of BNDN as an Indigenous Community who has expressed an interest in the Project. However, Denison understands this information from BNDN. As such, over the past year(s), Denison has met with BNDN and has respectfully requested further information from BNDN in respect to the land use activities to occurring in and around the Project, in order to more meaningfully understand the potential for adverse impacts to BNDN and therefore consider the potential for further studies and / or integration into the EIS of such information. Denison remains of the perspective that receipt of this information from BNDN is a necessary first step in this process, and has not received information in this regard to date.	Section 3 provides information on IK and LK and how this information was integrated throughout the EIS. Indigenous Knowledge has been integrated throughout the EIS, for example 11.1.2 and Section 11.2.2, provides further details on the influence of Indigenous Knowledge, Local Knowledge, and Engagement on Land and Resource Use.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes	Concerns about adequate consideration of BNDN IK and Traditional Ecological Knowledge.	ROC 479	Denison's engagement with BNDN is consistent with the identification of BNDN as an Indigenous Community who has expressed an interest in the Project. However, Denison understands this information from BNDN. As such, over the past year(s), Denison has met with BNDN and has respectfully requested further information from BNDN in respect to the land use activities to occurring in and around the Project, in order to more meaningfully understand the potential for adverse impacts to BNDN and therefore consider the potential for further studies and / or integration into the EIS of such information. Denison remains of the perspective that receipt of this information from BNDN is a necessary first step in this process, and has not received information in this regard to date.	Section 3 provides information on IK and LK and how this information was integrated throughout the EIS. Indigenous Knowledge has been integrated throughout the EIS, for example 11.1.2 and Section 11.2.2, provides further details on the influence of Indigenous Knowledge, Local Knowledge, and Engagement on Land and Resource Use.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes	Concerns about the Project site and the ability for BNDN members to access the site.	ROC 479	Section 11 provides information about site access and current use of the area for undertaking Indigenous and/or Treaty Rights. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, including fishing. Denison has	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				determined that there will be no significant impacts as a result of Project activities.				
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes	Concern with effects to hunting, trapping, gathering, and availability of traditionally important species.	ROC 479	Section 11 of the draft EIS provides the assessment of potential Project effects on Indigenous Land and Resource Use (Section 11.1) and Other Land and Resource Use (Section 11.2). The mitigation measures proposed in the aquatic and terrestrial assessments translated into undetectable changes in resource availability to existing and future users and rightsholders. The assessment does not take a distinctions based approach (i.e., the potential impact on each Indigenous community is not evaluated separately), but rather on the key indicators and associated measurable parameters. Mitigation to eliminate, reduce, or control potential adverse effects of the Project on Indigenous Land and Resource Use would apply to any uses proximal to the Project. Given proven mitigation is to be applied to traffic disturbances, noise, air quality, and increased competition for resources, the effects are expected to be minimal.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes	Concern with effects to wildlife and wildlife habitat from Construction and Operation. Caribou, in particular, are at risk from loss of habitat and disturbance.	ROC 479	The Project Area was delineated to capture all direct, and most indirect, likely adverse effects on caribou; as this is the zone of influence most likely to affect caribou in the vicinity of the Project (i.e., in the vicinity of human activity, equipment use and vehicle use). The Project Area (169.6 ha) is the direct footprint of proposed Project infrastructure (74.8 ha) with a buffer applied, thereby representing the area of maximum physical disturbance. The Project Area is not VC-specific, but consistent throughout the EIS. The Wildlife LSA was designed to capture the majority of the Project effects. The LSA extends beyond Project Area of the site to include a reasonable estimation of where sensory disturbance from Project-related activities would extend and where effects on wildlife including caribou are most likely to occur. Section 9 describes how consideration of potential effects to wildlife and wildlife habitat are considered within the EIS. In regard to caribou, Denison has developed a Conceptual Caribou Mitigation Plan based on discussions between Denison and Saskatchewan Ministry of Environment.	Denison has developed a Conceptual Caribou Mitigation Plan based on discussions between Denison and Saskatchewan Ministry of Environment.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes	Concern with effects to Indigenous fisheries associated with changes to the existing aquatic ecosystem including potential disruption of spawning sites and fish habitat.	ROC 479	Section 11 of the draft EIS provides the assessment of potential Project effects on Indigenous Land and Resource Use (Section 11.1) and Other Land and Resource Use (Section 11.2). The mitigation measures proposed in the aquatic and terrestrial assessments translated into undetectable changes in resource availability to existing and future users and rightsholders. The assessment does not take a distinctions based approach (i.e., the potential impact on each Indigenous community is not evaluated separately), but rather on the key indicators and associated measurable parameters. Mitigation to eliminate, reduce, or control potential adverse effects of the Project on Indigenous Land and Resource Use would apply to any uses proximal to the Project. Given proven mitigation is to be applied to traffic disturbances, noise, air quality, and increased competition for resources, the effects are expected to be minimal.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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Birch Narrows Dene Nation	Health and socio-economic conditions	Concern about adequate consideration of socioeconomic effects related to the Project that may affect BNDN (e.g., work camp, temporary workers, increased traffic).	ROC 479	Both the construction and operation camps will operate on a fly-in/out basis, meaning the opportunities for interactions between the workforce and Indigenous communities are limited as workers will be transported by air directly to the site. Section 12.2.4.2.1 provides the actions to minimize the extent the Project contributes to in- and out- migration in the LSA, including: • Denison will initially prioritize the COI in terms of employment opportunities and will work with the leadership of these communities to assist in determining hiring practices during all phases of the Project. Priority for hiring will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA. • Employees will not be permitted to commute to the site by any means other than the fly-in/fly-out worker rotation systems (i.e., they cannot drive to the site). • Pick-up and drop-off points are being planned at two locally central points in communities within the LSA, at one additional site in Saskatchewan (i.e., Saskatoon), and potentially at other locations. • Housing for workers will be provided at the camps with free accommodations and meals. Although difficult to predict, communities in the LSA are not expected to experience any substantial population growth or change in demographics as a result of the Project, particularly with mitigation measures identified. Although the potential exists for some individuals to return to the COI, it is anticipated that this would be difficult to discern from existing in-/out-migration rates. As population and demographics are not expected to experience any change as a result of the Project, this pathway will not be carried forward to the residual effects assessment.	Mitigations related to project employment are provided in Section 13.2.5 and to work camps and temporary workers are provided n Section 12.2.5 and 12.3.5 include: • Denison will initially prioritize the COI in terms of employment opportunities and will work with the leadership of these communities to assist in determining hiring practices during all phases of the Project. Priority for hiring will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA. • Employees will not be permitted to commute to the site by any means other than the fly-in/fly-out worker rotation systems (i.e., they cannot drive to the site). • Pick-up and drop-off points are being planned at two locally central points in communities within the LSA, at one additional site in Saskatchewan (i.e., Saskatoon), and potentially at other locations. • Housing for workers will be provided at the camps with free accommodations and meals.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Health and socio-economic conditions	Make sure that training and employment opportunities for BNDN members are available and accessible.	ROC 479	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in Section 13.3.2.1 of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.	items). With respect to employment, as noted in Section 13.3.2.1 of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.			the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Health and socio-economic conditions	Make sure that Denison provides business and procurement opportunities to BNDN members and businesses.	ROC 479	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in Section 13.3.2.1 of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in Section 13.3.2.1 of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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					the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.			
Birch Narrows Dene Nation	Other	Interest to make sure BNDN is meaningfully consulted with and accommodated by the Crown and Denison.	ROC 479	Denison's engagement with BNDN is consistent with the identification of BNDN as an Indigenous Community who has expressed an interest in the Project. However, Denison understands this information from BNDN. As such, over the past year(s), Denison has met with BNDN and has respectfully requested further information from BNDN, for example in respect to the land use activities to occurring in and around the Project, in order to more meaningfully understand the potential for adverse impacts to BNDN and therefore consider the potential for further studies and / or integration into the EIS of such information. Denison remains of the perspective that receipt of this information from BNDN is a necessary first step in this process, and has not received information in this regard to date.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Interest in understanding cumulative effects associated with the construction of the processing facility and the potential to accept material from other deposits or companies.	ROC 479	Refer to Section 2 for information on Project development. The cumulative effects assessment considers whether residual adverse effects of the Project on a given VC will overlap spatially and/or temporally with the same residual adverse effects on the VC resulting from other past, present, and reasonably foreseeable projects or activities. Refer to Section 16 on the summaries for project cumulative and residual effects.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Effects to surface water quality and quantity from effluent release and water taking, including groundwater.	ROC 479	Potential effects from the Project on water quality were assessed in Section 8.2 of the EIS and the assessment directly evaluated discharge of effluent from the site using predictive modeling. Water treatment will occur; testing will occur prior to release; and no release will occur if water quality des not meet objectives. The predictive modeling showed that constituent concentrations including radionuclides would be below water quality objectives for the protection of aquatic life (i.e., no effects would be expected) at the outlet of White Lake well upstream of the outflow of the Icelander River to Russel Lake. The specific activity of water taking from White Lake to support the mining operation was assessed in Section 8.1.4.2.2 of the EIS. Based on a conservative (i.e., high) estimate of water taking it was estimated that the taking would result in a reduction of flow of about 3% at times of low flow and the lake level could change by about 1 cm. These small incremental changes would be beyond the ability of monitoring techniques to practically measure and are much less than the natural variability seen. For these reasons the EIS concluded that these minor incremental changes did not represent a significant adverse effect. Denison recognizes that geology and groundwater are of particular	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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				importance within the context of the EIS given the proposed mining method and believes that the assessment presented in the EIS and its supporting documentation is comprehensive. Denison is committed to developing / implementing appropriate mitigations to avoid or limit identified adverse effects resulting from the Project, whether direct or indirect. Proposed mitigation measures specific to geology and groundwater and presented in the draft EIS, Section 7.5, Mitigation Measures, and Table 7.5-1 therein provides a summary of mitigation measures based on Project phases for the geology and groundwater VC.				
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes; Other	The Project is located within the treaty and ancestral lands of BNDN and maintains both current and historical significance to the community. BNDN Indigenous Knowledge, Land Use and Occupancy are not currently considered within the EIS. Should the Project proceed without the consideration of BNDN's Knowledge, Land Use and Occupancy, it may cause irreparable loss of culturally significant sites and access to resources that the community depends upon. It may also contribute to a loss in cultural transmission. Request/recommendation: a) Denison should provide BNDN with funds to conduct a community-led Indigenous Knowledge, Land Use and Occupancy Study for consideration within the EIS process. At minimum, the Study should consider BNDN's Indigenous Ecological Knowledge, commercial and non-commercial harvesting practices, and cultural occupation of the region (including historical sites). The Study should also consider cultural transmission, information about the history of the area and BNDN community members' perspectives on the Project. b) The community-led Indigenous Knowledge, Land Use and Occupancy Study should be a component of a broader process agreement between BNDN and Denison that serves as a pathway for obtaining BNDN's consent for the Project. c) Denison should work with BNDN to consider the appropriate integration of the results into all aspects of the EIS and management/monitoring plans, as well as any additional appropriate mitigation and/or accommodation measures.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #2)	Denison's engagement with BNDN is consistent with the identification of BNDN as an Indigenous Community who has expressed an interest in the Project. However, Denison acknowledges and understands this information from BNDN. As such, over the past year(s), Denison has met with BNDN and has respectfully requested further information from BNDN in respect to the land use activities occurring in and around the Project in order to more meaningfully understand the potential for adverse impacts to BNDN and therefore consider the potential for further studies and/or integration into the EIS of such information. Denison remains of the perspective that receipt of this information from BNDN is a necessary first step in this process, and has not received information in this regard to date. Project effects have been mitigated for the most intensive resource user(s), irrespective of affiliation. Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project. Therefore, Denison does not anticipate separate funding for BNDN at this time. Further, the assessment has been completed based on Valued Components (VCs), including the VC of Indigenous Land and Resource Use. Key indicators for Indigenous Land and Resource Use include: • resource availability for harvesting subsistence resources (distribution and abundance of animals, plants, and wildlife for harvest and suitability of animals, plants, and wildlife for consumption); • land/water availability to practice traditional land use (TLU); and • perceived suitability of lands and resources therein. Measurable parameters are identified for each of the key indicators, as presented in Table 11.1-1 of the EIS. The assessment does not take a distinctions based approach (i.e., the potential impact on each Indigenous community is not evaluated	Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project. Therefore, Denison does not anticipate separate funding for BNDN at this time. Measurable parameters are identified for each of the key indicators, as presented in Table 11.1-1 of the EIS. As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				separately), but rather on the key indicators and associated measurable parameters. Mitigation to eliminate, reduce, or control potential adverse effects of the Project on Indigenous Land and Resource Use would apply to any BNDN uses proximal to the Project. Given proven mitigation is to be applied to traffic disturbances, noise, air quality, and increased competition for resources, the effects are expected to be minimal. As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects, wherever possible.	regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects, wherever possible.			
Birch Narrows Dene Nation	Physical and cultural heritage; Current use of lands and resources for traditional purposes; Other	Archaeology as a profession has been dominated in North America by non- Indigenous researchers, despite most sites being Indigenous in origin. It is positive that Golder Associates made efforts to engage and involve Indigenous communities (by including an ERFN representative in fieldwork and by considering ERFN and Pinehouse Kineepik Métis land use maps) in their 2017 heritage baseline study and 2020 heritage resource impact assessment. Notwithstanding, the proposed Project area is within BNDN's treaty and ancestral lands and there may be heritage sites that the community is aware of. BNDN was not involved in either of these studies and BNDN may have Indigenous Knowledge of important heritage sites within the Study Area that should be considered. The archaeological context provided is very Western/Scientific. Denison must also include historical/pre-historical accounts of Indigenous communities to provide an appropriate and comprehensive assessment of the archaeological context of the region. Given the Ancestral and Treaty ties our members have to the project area, our members have valuable knowledge and context to inform the Heritage Resource Impact Assessment (HRIA) for the Project that must be considered prior to being reviewed or approved by any regulatory body. Request/recommendation: a) Denison should provide BNDN with funds to conduct a community-led Indigenous Knowledge, Land Use and Occupancy Study for consideration within the EIS process. b) The Heritage Resources Management Plan should be updated following the consideration of Indigenous Knowledge, Land Use and Occupancy provided by BNDN. This may result in the requirement for further assessment and/or mitigation measures, which should be developed in consultation with BNDN. c) Denison should facilitate BNDN involvement in any additional archaeological fieldwork that takes place, including providing BNDN with capacity funding for members who participate. Terms to facilitate BNDN involvement in future archaeological work should be a component of a broader process agreement between BNDN and Denison. d) Denison must include a write-up of Indigenous historical and prehistorical accounts in consultation with relevant Indigenous communities. This write up must include historic context provided	BNDN Public Comment February 28, 2023 (BNDN Public Comment #3, #7, #9)	Denison's engagement with BNDN is consistent with the identification of BNDN as an Indigenous Community who has expressed an interest in the Project. However, Denison understands this information from BNDN. As such, over the past year(s), Denison has met with BNDN and has respectfully requested further information from BNDN in respect to the land use activities to occurring in and around the Project, in order to more meaningfully understand the potential for adverse impacts to BNDN and therefore consider the potential for further studies and / or integration into the EIS of such information. Denison remains of the perspective that receipt of this information from BNDN is a necessary first step in this process, and has not received information in this regard to date. Project effects have been mitigated for the most intensive resource user(s), irrespective of affiliation. Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project. Therefore, Denison does not anticipate separate funding for BNDN at this time. Following the implementation of the mitigation measures outlined in the Heritage Resource Management Plan (HRMP), the likelihood of residual effects is considered low and residual effects on Heritage Resources will occur infrequently and can be mitigated with the HRMP. Known archaeological resources identified in the Project Area were deemed to have low potential for archaeological interpretation and additional work or mitigation measures were not required for the sites; the Heritage Conservation Branch had no further concerns with these sites and work could proceed as planned. Should unknown archaeological and cultural resources be identified during the Project, effects will be mitigated using the HRMP. While effects to archaeological resources are irreversible, they can be mitigated by following the HRMP, by either avoiding additional	Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project. Therefore, Denison does not anticipate separate funding for BNDN at this time. As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		through oral history interviews as part of BNDN's community-led Indigenous Knowledge, Land Use and Occupancy Study for the Project. e) The draft HRIA should be reviewed by BNDN and other impacted Indigenous Nations prior to being submitted for regulatory approval.		damage to the resource by creating a buffer zone around the site, or by assessing the resource according to The Heritage Property Act to enable the full interpretation of the site before continuing with work. Furthermore, based on the low occurrence of known Heritage Resources in the Project Area (two), and the location of the Heritage Resources (near waterbodies, along an existing trail and away from the main developments), there is a low potential for the identification or disturbance of previously unknown archaeological sites throughout the life of the Project. Therefore, any residual effects (i.e., destruction of Heritage Resources) is considered to be negligible. Further, HRMP includes feedback from Indigenous nations with demonstrated significant land use activities in and around the Project. As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects, wherever possible. Please see Section 11.3.2 Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment for Heritage Resources. The Section describes how field assistants from local Indigenous communities were involved with the HRIA baseline studies, allowing for in-field consultation during the assessment to make sure that areas deemed to have potential by the land users were surveyed.	peoples' connection to the land, and to minimize potential effects, wherever possible.			
Birch Narrows Dene Nation	Physical and cultural heritage; Other	The methodology within both the 2017 and 2020 heritage studies included 'judgmental' shovel probing and initial troweling through soil to identify cultural heritage material. While the discretion of a professional archaeologist needs to be taken into account, relying subjectively on which areas to shovel test and not employing a systematic approach is not reproduceable and may result in sites being missed; this is of particular concern given that large sections of the areas retaining potential were not subject to shovel testing. Further, troweling through soil rather than subjecting all excavated soil to sifting through 6mm mesh means that artifacts/ecofacts may easily be overlooked. Given that the north of Saskatchewan has not been thoroughly investigated archaeologically, and given that 76 sites and nine find areas were recorded just 35 km south of the Project area as part of Dr. David Meyer's multi-year archaeological investigation, the results of these assessments do not seem rigorous. Request/recommendation: a) BNDN recommends that Denison undertake further archaeological investigations based on the results of the BNDN TKLU study prior to construction of the project. b) Future archaeological assessment programs should be designed collaboratively with BNDN and other Impacted Indigenous Nations.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #4)	The 2017 and 2020 heritage studies were reviewed by the Heritage Conservation Branch. The HRIA was completed using standard pedestrian reconnaissance and visual inspection field techniques, complimented by the excavation of shovel probes and shovel tests and it was determined the site has limited interpretive potential. Please see Section 11.3.2 Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment for Heritage Resources. The Section describes how field assistants from local Indigenous communities were involved with the HRIA baseline studies, allowing for in-field consultation during the assessment to make sure that areas deemed to have potential by the land users were surveyed. The details of monitoring and follow-up plans are being developed to support the separate process of Project licensing and permitting. The specific means by which provincial and federal authorities, and Indigenous Nations and communities will be engaged in developing the follow-up and monitoring program, including the information-sharing program, are currently under consideration with the Denison project team. It is noted that Section 4.2.1 of the draft EIS provides the variety of ways in which Denison has engaged with Interested Parties to date and it is assumed it would continue to use these means and others that may be identified to fulfill its key corporate principals for developing positive relationships (see draft EIS Section 4.2). Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime,	Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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				suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project. Therefore, Denison does not anticipate separate funding for BNDN at this time. Please see Section 11.3.2 Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment for Heritage Resources. The Section describes how field assistants from local Indigenous communities were involved with the HRIA baseline studies, allowing for in-field consultation during the assessment to make sure that areas deemed to have potential by the land users were surveyed.	Project. Therefore, Denison does not anticipate separate funding for BNDN at this time.			
Birch Narrows Dene Nation	Physical and cultural heritage; Other	The presence of strandlines are noted as being an indicator of archaeological potential; however, it is unclear within the reports whether any strandlines are present within the Study Area. Most of the investigations and shovel probes that took place were around existing waterbodies. Request/recommendation: Please indicate whether strandlines are present anywhere in the Study Area.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #5)	Strandlines, like other linear landforms, do increase archaeological potential, however heritage resources are only directly effected by Project activities and there are no strandlines located in the Phoenix Site area (Government of Saskatchewan. N.d. 250K Surficial Geology Linear Landforms. Available at: https://geohub.saskatchewan.ca/datasets/saskatchewan::250k-surficial-geology-linear-landforms/explore?location=57.247957%2C-106.370278%2C6.33 [Accessed November 29, 2023]).	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Physical and cultural heritage; Other	It is unclear whether the locations identified by other Indigenous communities in their Land Use maps were investigated archaeologically and subject where appropriate to shovel testing. Knowing this will give confidence to BNDN that areas they may identify as retaining potential may undergo further assessment if necessary. BNDN notes that there has been limited engagement of our Nation as part of the archaeological baseline studies undertaken at the site. The Wheeler River Project is within our Treaty and Ancestral Lands where our members have deep ancestral ties and continue to exercise our rights to this day. As stewards of the land since time immemorial and holders of both Treaty and Aboriginal rights in the Project area, Denison must engage with us as partners on their activities on our lands. This includes their planning and decision-making related to archaeological materials to which our members have ancestral and spiritual ties. Request/recommendation: - Please indicate whether the areas identified by other Indigenous communities in their Land Use maps were investigated archaeologically. - Indigenous communities should be consulted and engaged in decision making rather than merely informed if the archaeological material is expected to be Indigenous in origin.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #6, #8)	Please see Section 11.3.2 Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment for Heritage Resources. The Section describes how field assistants from local Indigenous communities were involved with the HRIA baseline studies, allowing for in-field consultation during the assessment to make sure that areas deemed to have potential by the land users were surveyed. Even the most thorough investigations may not identify all archaeological materials that may be present. Denison advises that if unanticipated archaeological materials or features are encountered as a result of construction or reclamation activities, all work in the immediate area should cease and the Heritage Conservation Branch and local authorities (if applicable) contacted.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Physical and cultural heritage; Other	Discerning archaeological artifacts/ecofacts is difficult at times even to the trained eye; consequently, it is important to undergo training to understand what you could be looking for. Request/recommendation:	BNDN Public Comment February 28, 2023 (BNDN Public	Section 5.1.1 describes how all staff working on the Project should be informed of the possibility that they could encounter archaeological resources during their work or leisure time, which will include the proper procedure to follow in the case of a chance find. This could be facilitated by a short archaeological education section in the employee orientation,	Section 11.3.5 Mitigation Measures describes the management of archaeological resources and includes the assessment of	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		a) Staff should undergo training regarding the cultural material they may encounter while on site b) BNDN and other Indigenous communities should be invited to attend this training	Comment #10)	outlining the types of sites and artifacts that could be encountered in the area, as well as what to do when a potential artifact or site is found. If the chance find is deemed to be an archaeological site, then an HRIA is required and a qualified archaeologist must complete the assessment. Section 11.3.5 Mitigation Measures describes the management of archaeological resources and includes the assessment of the discovery by a qualified archaeologist and mitigation measures including avoidance of the site, shovel testing, systematic and intensive shovel testing, excavation, and/or construction monitoring. The HRMP outlines mechanisms for Indigenous engagement including the communities and implementation of appropriate cultural protocols.	the discovery by a qualified archaeologist and mitigation measures including avoidance of the site, shovel testing, systematic and intensive shovel testing, excavation, and/or construction monitoring. The HRMP outlines mechanisms for Indigenous engagement including the communities and implementation of appropriate cultural protocols.			the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Physical and cultural heritage; Other	In numerous instances the Heritage Resources Management Plan (HRMP), Denison has used noncommittal language to describe future Indigenous engagement related to heritage resources. BNDN notes that engagement of impacted Nations is essential for proper heritage resource management and as such the language in the HRMP should reflect the necessity of this engagement. Request/recommendation: Throughout the HRMP, Denison must change the language of "should" to "will" where appropriate. For example: management options will be presented to the applicable Indigenous communities for feedback and will include consultation.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #11)	The Heritage Resources Management Plan will be revisited for use of language 'should' to 'will' where appropriate.	The HRMP was revisited for language of "should" to "will" where appropriate.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Health and socio-economic conditions ; Physical and cultural heritage; Current use of lands and resources for traditional purposes; Other	BNDN notes that no specific management or monitoring plan has been included in the EIS documentation related to the verification of residual socio-economic impacts, both positive and negative, for the local economy. Denison documents their conceptual level environmental protection program, including several proposed management and monitoring plans which they will develop to manage operations on site. The environmental protection measures which Denison undertakes at the Project site are highly consequential to BNDN, and BNDN requires the opportunity to provide our knowledge and input into environmental protection measures developed for activities within our Ancestral Lands. There is no discussion on how Indigenous communities, such as BNDN, will be included in environmental management, emergency management, monitoring, and remediation. This includes issues related to ongoing permitting or specific remediation such as in the case of an accident or malfunction. Unfortunately, due to the nature of planning and licensing for complex projects such as the Wheeler River mine, there are many documents, plans, licenses and approvals which may not be available for review during the environmental assessment process or which will take place subsequent to completion of the assessment. For example, Denison will be preparing important documentation governing environmental management of the Project following the Environmental Assessment.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #12, #16, #17, #36, #51, #53, #68, #79)	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate separate funding for BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions. The details of monitoring and follow-up plans are being developed to support the separate process of Project licensing and permitting. The specific means by which provincial and federal authorities, and Indigenous Nations and communities will be engaged in developing the follow-up and monitoring program, including the information-sharing	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate separate funding for BNDN at	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		While these are not currently available, there is a need to engage with BNDN to obtain input on these documents as planning progresses. Denison's proposed terrestrial ecology mitigations described are generalized and conceptual in the EIS. With the level of detail provided in the EIS, it is not possible for BNDN to comment on the adequacy or effectiveness of the proposed mitigation measures or whether proposed mitigations will meaningfully diminish Project impacts on BNDN rights and interests. BNDN notes that Section 5.3.1 does not confirm that impacted Indigenous Nations will have the opportunity to participate in future archaeological fieldwork. While BNDN understands that many impacted Nations will have arrangements directly with Denison to facilitate member participation, this should additionally be made available to all impacted Indigenous Nations as part of best practices at the Project. Request/recommendation: - In addition to any provisions developed in a Project Agreement between BNDN and Denison for the Wheeler River Project, Denison should include a clause that confirms that all impacted Indigenous communities will be invited to have monitors participate in any additional fieldwork and that Denison will provide capacity funding for Nations that wish to participate. - Denison must develop a Socio-Economic Monitoring Plan for the life of the Project to verify the effects assessment included in the EIS and to be included in the Project's approach to adaptive management. This Plan would include an approach, co- developed with Indigenous groups in the LSA (including BNDN), to monitoring the realization of the benefits and impacts of the Project (e.g., employment and procurement targets, training and capacity building, community investments, etc.) as mitigation and enhancement measures are implemented. Monitoring and subsequent regular evaluation would allow for the real-time adjustment of targets and/or an approach to adjusting enhancement measures or identifying offsetting benefits where targets are not met. - The Crown must include the development of a Socio-Economic Monitoring Plan as a condition of approval for the Project. - BNDN requests that Denison commit to involving BNDN in the development, review and approval of all environmental monitoring plans developed for the Project. Details of BNDN involvement in the development of environmental monitoring plans should be undertaken within an Environmental Committee, with specific terms defined within a BNDN-Denison Project Agreement for the Wheeler River Project - BNDN requests that the CNSC impose a condition of approval on the project which states the requirement for Denison to consult with BNDN on all environmental management and monitoring plans for the project. - To support BNDN's ongoing participation in monitoring and oversight of the Project, BNDN request the establishment of an Environmental Committee or similar oversight mechanism. The purpose of the committee will be to review monitoring data and monitoring reports produced during the life-of-mine to ensure that the environmental protection is sufficient for all VCs. The committee can also participate in		program, are currently under consideration with the Denison project team. It is noted that Section 4.2.1 of the draft EIS provides the variety of ways in which Denison has engaged with Interested Parties to date and it is assumed it would continue to use these means and others that may be identified to fulfil its key corporate principals for developing positive relationships (see draft EIS Section 4.2).	this time. BNDN will be informed throughout the monitoring program design and implementation process. The details of monitoring and follow-up plans are being developed to support the separate process of Project licensing and permitting.			

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		permitting throughout the life-of-mine for all relevant applications (e.g. Fisheries Act Authorizations, water permits, Closure Plan updates etc.) and provide input to management plans (e.g. EPPs, Surface Water Management Plan, Environmental Monitoring Plans, etc.). The specific details of such a committee can be developed through consultation with BNDN and must be formalized through a BNDN-Denison project agreement. - BNDN requests that Denison consult with our staff members and advisors on important environmental documentation/plans/licenses that are not available as part of the EA process. Engagement with BNDN on these plans should occur through an Environmental Committee or similar oversight mechanism. The specific details of such a committee can be developed through consultation with BNDN and must be formalized through a BNDN- Denison project agreement for the Wheeler River Project. - BNDN holds invaluable indigenous knowledge related to terrestrial ecology topics including traditional and medicinal plants, ungulates, furbearers, game birds etc. within the RSA. BNDN must be meaningfully involved in the development and implementation of the various management and monitoring plans mentioned throughout Chapter 9 of the EIS to ensure that proposed impacts are sufficiently reduced. These plans include but are not limited to the wildlife monitoring plan, avian monitoring, and Woodland Caribou Management Plan. The role that BNDN will have in developing management and monitoring plans should be defined within a project agreement between BNDN and Denison. - BNDN requests the implementation of robust and long-term environmental monitoring to verify protection of the environment, including community-led monitoring during Construction and Operations of the Project. Denison must develop specific roles and responsibilities to BNDN members in relation to air quality monitoring and site wide environmental monitoring. This should include, at a minimum, one environmental monitor position for BNDN. This would provide increased transparency and confidence to Denison's environmental management practices and performance.						
Birch Narrows Dene Nation	Health and socio-economic conditions	BNDN is not included as a Local Study Area (LSA) Community despite being closer to the Project than other LSA Communities. The Project is situated on BNDN's ancestral lands. BNDN members currently and historically use the LSA for harvesting (commercial and personal) and ceremonial purposes. Without the LSA Community designation, BNDN members are less likely to be employed or trained through the Project. BNDN members are not entitled to priority training and employment provisions from Denison on the Project. Further, BNDN businesses and partnerships are not entitled to priority procurement provisions from Denison on the Project. Request/recommendation: · BNDN must be identified as a LSA Community. BNDN members and businesses must be eligible for LSA priority status for employment, training, and contracting opportunities. The EIS should be revised	BNDN Public Comment February 28, 2023 (BNDN Public Comment #13)	Spatial boundaries for the Economy VC were selected to reflect the geographic areas where economic impacts from the Project are likely to be detectable and measurable. These impacts are expected to be driven primarily by the relationship and interactions between the Project and the COI. Economic benefits surrounding Project employment (including income and training) are likely to be targeted toward the communities identified within the spatial boundaries. Economic impacts extending beyond the LSA are likely to be diffused and undetectable within the broader economy. The spatial boundaries were selected based on the consideration of communities where Project recruitment is likely to be prioritized, consideration of previous EAs conducted in the region, and consideration of information shared through key persons in the interview program. The LSA for the assessment of the economy includes the following communities: ERFN (including Indian Reserve Wapachewunak 192D and Indian Reserve La Plonge 192) and Patuanak, Northern Hamlet (Patuanak); Pinehouse Lake, Northern Village; and Beauval, Northern	Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project (Section 13).	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		accordingly. · A formal agreement between BNDN and Denison is required to outline socioeconomic offsetting measures and benefits should the Project move forward. This must include ways for BNDN businesses and member owned businesses to participate in the Project. Denison references a Human Resource Development Plan (HRDP) as a mitigation measure to ensure local and regional community members are hired in priority. However, Denison does not provide sufficient details to allow Birch to assess the adequacy of the HRDP. Request/recommendation: · BNDN requests the ability to review and comment on Denison's Human Resource Development Plan to provide input and recommendations to encourage community participation and employment in the Project.		Village. Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment and training will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA.				
Birch Narrows Dene Nation	Health and socio-economic conditions	There is no BNDN specific Indigenous Knowledge or socioeconomic data presented in the EIS. Request/recommendation: - Denison must conduct Indigenous Knowledge and Community well-being Study (or similar) to gather BNDN specific information. These studies will allow for a more fulsome assessment of the Project on BNDN rights and interests. Additionally, BNDN specific data will enhance Denison's baseline data and help to inform mitigation and monitoring measures.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #14)	Denison's engagement with BNDN is consistent with the identification of BNDN as an Indigenous Community who has expressed an interest in the Project. However, Denison understands this information from BNDN. As such, over the past year(s), Denison has met with BNDN and has respectfully requested further information from BNDN in respect to the land use activities to occurring in and around the Project, in order to more meaningfully understand the potential for adverse impacts to BNDN and therefore consider the potential for further studies and / or integration into the EIS of such information. Denison remains of the perspective that receipt of this information from BNDN is a necessary first step in this process, and has not received information in this regard to date. Spatial boundaries for the Economy VC were selected to reflect the geographic areas where economic impacts from the Project are likely to be detectable and measurable. These impacts are expected to be driven primarily by the relationship and interactions between the Project and the COI. Economic benefits surrounding Project employment (including income and training) are likely to be targeted toward the communities identified within the spatial boundaries. Economic impacts extending beyond the LSA are likely to be diffused and undetectable within the broader economy. The spatial boundaries were selected based on the consideration of communities where Project recruitment is likely to be prioritized, consideration of previous EAs conducted in the region, and consideration of information shared through key persons in the interview program. The LSA for the assessment of the economy includes the following communities: ERFN (including Indian Reserve Wapachewunak 192D and Indian Reserve La Plonge 192) and Patuanak, Northern Hamlet (Patuanak); Pinehouse Lake, Northern Village; and Beauval, Northern Village. The spatial boundaries selected for Community Well-being were chosen because they permit baseline characterization in sufficient detail to enable potential interactions between the Project and the well-being of the community. These boundaries were developed in consideration of where interactions are likely to occur. The spatial boundaries were	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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				derived based on the consideration of communities where Project recruitment is likely to be prioritized, consideration of previous EAs conducted in the region, and consideration of information shared through key persons in the interview program. The LSA for the Community Well-being VC includes ERFN (including Indian Reserves Wapachewunak 192D and La Plonge 192) and Patuanak, Northern Hamlet; Pinehouse Lake, Northern Village; and Beauval, Northern Village.				
Birch Narrows Dene Nation	Health and socio-economic conditions	While EIS does consider the effects of population changes related to the Project on social adaptability, demand for services and housing, it does not address the full range of potential impacts associated with a transient workforce. Significant research has been conducted to demonstrate the negative impacts of remote workers and work camps on Indigenous women and girls. This must be considered in the EIS. The EIS must include an assessment of all potential effects of a transient workforce and changes to population dynamics, including those disproportionately experienced by Indigenous women and girls, and other segments of the population. This must incorporate findings of research like the 2017 study completed by Lake Babine Nation and Nak'azdli Whut'en (Indigenous Communities and Industrial Camps), and/or related research in the context of the LSA.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #15)	Both the construction and operation camps will operate on a fly-in/out basis, meaning the opportunities for interactions between the workforce and Indigenous communities are limited as workers will be transported by air directly to the site. Section 12.2.4.2.1 provides the actions to minimize the extent the Project contributes to in- and out- migration in the LSA, including: • Denison will initially prioritize the COI in terms of employment opportunities and will work with the leadership of these communities to assist in determining hiring practices during all phases of the Project. Priority for hiring will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA. • Employees will not be permitted to commute to the site by any means other than the fly-in/fly-out worker rotation systems (i.e., they cannot drive to the site). • Pick-up and drop-off points are being planned at two locally central points in communities within the LSA, at one additional site in Saskatchewan (i.e., Saskatoon), and potentially at other locations. • Housing for workers will be provided at the camps with free accommodations and meals. Although difficult to predict, communities in the LSA are not expected to experience any substantial population growth or change in demographics as a result of the Project, particularly with mitigation measures identified. Although the potential exists for some individuals to return to the COI, it is anticipated that this would be difficult to discern from existing in-/out-migration rates. As population and demographics are not expected to experience any change as a result of the Project, this pathway will not be carried forward to the residual effects assessment.	Section 12.2.4.2.1 provides the actions to minimize the extent the Project contributes to in- and out-migration in the LSA.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In several instances in the draft EIS Denison has noted that Indigenous Nations are concerned with the possibility of mercury contamination from mining operations. BNDN shares these concerns with other Indigenous Nations. Due to the very low concentrations of mercury present in the Phoenix deposit, Denison has not meaningfully studied the potential impacts the Project may have on altering mercury biogeochemistry in the downstream environment. BNDN notes that background mercury concentrations can be elevated in many unexpected and remote locations due to atmospheric deposition (often due to coal plants) (Jackson, 1997). BNDN is very concerned that Denison has not analyzed for mercury as part of their baseline soil geochemistry assessments for the Project, especially in wetlands downstream of the Project. Mercury concentrations in wetland soils are	BNDN Public Comment February 28, 2023 (BNDN Public Comment #18)	Although baseline concentrations of total mercury in sediment were not collected during the baseline program, Denison will collect background information pertaining to sediment total and methyl mercury from LSA lakes and rivers prior to site development. As indicated in draft EIS Section 8.4.6.1, Residual Effects Characterization, mercury is not associated with the local geology and is not expected to be released in the effluent at measurable levels and was therefore not identified as a COPC. Denison notes that there is potential for increased methylmercury production in the receiving environment under a certain combination of factors to which the Project may contribute; however, prediction of methylmercury production is not practical. Denison commits to monitoring mercury and methylmercury in the aquatic environment over the life of the Project to determine the potential changes in mercury concentrations in fish tissue over time. As the Project advances and	Engagement on licensing requirements, such as the development of the environmental monitoring program and the associated monitoring regime will occur to support Project permitting and licensing efforts.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		sensitive to changes in water chemistry that can lead to increased mercury methylation. This is especially acute from increases in nutrients and sulphates which can active sulfate reducing microorganisms that methylate mercury (Liu, Li, & Cai, 2012). Table 4 of Appendix 8e shows that the effluent discharged to Whitefish Lake will have mercury concentrations almost 5,700 times background concentrations. This dramatic increase in sulfate loading to Whitefish Lake may not exceed water quality objectives unto itself but may be sufficient to meaningfully change mercury biogeochemistry in downstream wetlands. BNDN is very concerned with the complete lack of assessment and analysis of baseline mercury concentrations and the potential changes to mercury cycling that could be induced by the Project. Request/recommendation: a) BNDN requests that Denison undertake baseline studies of mercury concentrations in soils, with a focus on baseline concentrations of mercury in organic wetland soils downstream of the project. Note that mercury sampling should sample total mercury and methylmercury in all analyses, as well as porewater total mercury and methylmercury. The study design and implementation should be undertaken collaboratively with BNDN. b) BNDN recommends that the CNSC requires Denison to undertake a baseline assessment of mercury in soils (with a focus on wetlands) prior to construction of the Project. This may be established as a condition of approval for the Project. c) Depending on the findings of the baseline mercury in soils and wetlands studies, the CNSC should include a condition of approval on the Project that requires Denison to monitor mercury biogeochemistry in the receiving environment over the life of mine.		operational monitoring is underway, Denison will assess health risks from fish consumption by comparing fish tissue data collected during operation from the monitoring program against Health Canada's mercury guideline of 0.5 ug/g wet weight. This is a human health risk-based maximum permissible concentration. Mercury data presented throughout the draft EIS represents total mercury. Denison agrees to include methylmercury as part of the constituents monitored in fish throughout all project phases. Engagement on licensing requirements, such as the development of the environmental monitoring program and the associated monitoring regime will occur to support Project permitting and licensing efforts.				
Birch Narrows Dene Nation	Other	Figure 7.6-10 and 7.6-11 of the draft EIS show the results of Denison's modelling of uranium mobility and adsorption from the ore body following the decommissioning of the mine. The figures show that the model indicates that all dissolved uranium will be effectively removed from solution within a short distance of the orebody via adsorption to clays present in the bedrock. In Section 3.5.6.2.1 of Appendix 7c of the draft EIS Denison notes that there is very limited literature available on uranium fate and transport, especially in similar environments to the Wheeler River Project. Denison's uranium speciation model relies almost entirely on a single academic article studying the partitioning of uranium in the alteration halo surrounding the Cigar Lake uranium deposit. Of very important note is that this paper is focused on the pre-mining	BNDN Public Comment February 28, 2023 (BNDN Public Comment #19)	Denison's engagement with BNDN is consistent with the identification of BNDN as an Indigenous Community who has expressed an interest in the Project. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation (ERFN) and Kineepik Métis Local (KML) on details and updates to the decommissioning plan which includes mining area remediation plans and associated post-decommissioning modelling of groundwater from the remediated mining area, suited to each of their interests and needs. As part of these updates, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that updates to the decommissioning plan and groundwater	Denison has committed to collaborating with English River First Nation (ERFN) and Kineepik Métis Local (KML) on details and updates to the decommissioning plan which includes mining area remediation plans and associated post-decommissioning modelling of groundwater from the remediated mining area,	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		environment at Cigar Lake and does not examine how uranium partitioning may be dramatically altered by ISR mining. Health Canada published a document on uranium in drinking water in 2017 literature review of uranium mobility, complexation and chemistry in groundwater which documents the widely varying behaviour of uranium in groundwater depending on redox conditions, pH, pressure, and other ions available for complexation which may increase or decrease uranium mobility (Health Canada, 2017). Uranium will be present in extremely high concentrations (100 mg/l) in the restoration solution. Many other anions and cations which uranium is known to form complexes with will also be present in the solution at very high concentrations. The limited literature upon which Denison has developed their models to predict uranium mobility post-decommissioning is insufficient to confidently assert that the very concentrated restoration solution will behave as predicted. Uranium is a common groundwater contaminant around the world and is known to be stable in dissolved forms in groundwater in many locations. Furthermore, some studies have indicated that the effectiveness of adsorption as a mechanism for attenuation of uranium in solution is significantly overstated, especially in environments where there is competition from other ions, as there will be in the restoration solution (Gandhi, Sampath, & Maliyekkal, 2022). BNDN is very concerned that Denison has portrayed their groundwater contamination model in Appendix 7c with an inappropriate level of confidence given the level of uncertainty reasonably inferred from the lack of foundational literature relevant to the circumstances at Wheeler River and the well- understood complexity of uranium fate and transport in groundwater. It is not impossible to imagine that surface water contamination could eventually occur, especially given the exceptionally high concentrations of uranium in the restoration solution. By consenting to the Wheeler River Project, BNDN is supporting a process that will be irreversible once it commences and may be very difficult to manage should the underlying modeling assumption prove to be inaccurate by a significant margin. As a Nation whose members put a very high emphasis on the protection of groundwater resources, BNDN requires substantially greater reassurance through dialogue with Denison and further studies to have confidence that the Project will not irreparably degrade the natural environment in our Ancestral Lands. Request/recommendation: - Denison must develop a process agreement with BNDN to work through our concerns related to long-term groundwater contamination from the Project. This process agreement would lay out the pathway to obtaining BNDN consent for the Project through providing our Nation with confidence that the groundwater and surface water near to the project will not be irreparably contaminated. The process agreement will include additional studies and consultation activities with BNDN that Denison		modelling would also be relevant to other Indigenous nations who may have an interest in the Project. As such, Denison will not be developing a process agreement with the BNDN to address concerns raised about pertaining to long-term groundwater quality for the Wheeler River Project. This comment is also applicable to other comments where the same request was made by the BNDN. The balance of this response pertains to groundwater quality and the numerical groundwater model presented in draft EIS will focus on the technical content of the concerns raised. Denison's groundwater SME and author of the modelling report (Appendix 7C) acknowledges that the modelling report did not include a lengthy discussion of uranium speciation and mobility. However, the reactive transport modelling done using the PHREEC geochemical code was carefully informed by relevant literature, and was certainly not restricted to consideration of one study (Cigar Lake). In Section 3.5.3 of Appendix 7C we reference important studies pertaining to uranium complexation in solution by carbonate species (Guillaumont et al. 2003; Gorman-Lewis et al., 2008; Grenthe et al., 2020) and ternary complexes of uranium with calcium and magnesium and carbonates in solution (Dong and Brooks, 2006). These complexation reactions were added into the Project-specific PHREEQC database developed as part of the work presented in Appendix 7C. The database was updated to include solution-phase complexes of uranium in Guillaumont, 2003, which is a comprehensive summary of known reaction constants for uranium with dissolved-phase ligands. Further, the consideration of sorption of uranium-carbonate complexes to quartz, geothite and illite is shown in Appendix E of Appendix 7C, and relies on information from multiple publications. The reactive transport modelling was done using piChem (FELOW + PHREEQC) because of the ability of that approach to carefully consider speciation of uranium, and the potential interactions of uranium with other species in solution. The comment to which the BNDN refer in Section 3.5.6.2.1 of Appendix 7C is: "[t]o the best of our knowledge, there is very little information published about the solid-phase speciation of uranium and other constituents associated with ore bodies and the overlying and underlying rocks in the Athabasca basin". This is not speaking specifically to the speciation of uranium in the solid phase. Experimental work that provide information on solid-phase speciation include sequential extraction schemes and spectroscopic studies, such as recent work by Bayle et al., 2023 (https://pubmed.ncbi.nlm.nih.gov/37417589/). Research on the solid-phase speciation of uranium is not addressed in Health Canada (2017). As indicated, we were not able to find research pertaining to sequential extractions of spectroscopic studies of uranium in the solid phase for relevant materials/conditions. It is for this reason that we presented results of solid-phase uranium speciation in the available study by Percival 1989. It is acknowledged that this study was for Cigar Lake. The relevance of the work for the Wheeler River Project is high.	suited to each of their interests and needs. As part of these updates, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that updates to the decommissioning plan and groundwater modelling would also be relevant to other Indigenous nations who may have an interest in the Project. As such, Denison will not be developing a process agreement with the BNDN to address concerns raised about pertaining to long-term groundwater quality for the Wheeler River Project.			

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		must undertake. The satisfaction of all terms in the process agreement would be defined by the signing of a Project Agreement between Denison and BNDN. - BNDN recommends that Denison commit to funding bench-scale studies to validate the outputs from their FEFLOW and PHREEQC modelling. The bench-scale studies should be undertaken by an independent academic.						
Birch Narrows Dene Nation	Other	In Section 7.6.2.1 of the draft EIS, Denison mentions that they anticipate the outward migration of lixiviant as is observed at other ISR operations globally, and has incorporated their assumed concentrations of metals and the extent of area affected by flare from the ISR operations. Section 4.6 of Appendix 7c states that the flare zone is expected to extend 11 to 13 m but have modelled with a "conservative 50 m flare zone. It is not clear how Denison derived their assessment that the flare zone would extend 11 to 13 m and that a 50 m flare zone is considered conservative for the purposes of modelling. BNDN requires further information to have confidence that the design is as conservative as the Proponent has suggested. Request/recommendation: - BNDN requests that Denison provide further information on how the size of the area above the deposit affected by flare was calculated and how they determined that 50% restoration solution was determined as the appropriate concentration to base water quality modelling. This item would be best addressed and resolved with BNDN through the process agreement to address BNDN's concerns related to long term groundwater contamination from the Project.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #20)	Groundwater modelling and flow path analysis calibrated to field conditions have evaluated upward solution migration and demonstrated that the maximum height that injected fluids will migrate upwards from the ore zone during active mining is likely between 11 to 13 m (Section 2 of the draft EIS). For conservatism, a 50-m vertical zone above the deposit was assumed to be potentially disturbed by mining activities. Denison specified 50m flare threshold based on their commitment to maintain inward hydraulic gradients, and or adding extraction wells as necessary to limit the migration of the flare. With the engineered controls described above, flare is not anticipated above 11-13 m. However, the decision was made to assume 50% of the restored solution uniformly between 15 and 50 m above the mineralized zone because there will be a natural gradient from 100% restored solution to 0% restored solution (i.e., baseline conditions) over this distance. The uncertainty associated with this decision was addressed in the uncertainty analysis presented in Section 4.7 of Appendix 7C, where 100% restored solution was assumed to be present over the entire 50 m height above the ore zone. The results of the model under both scenarios was consistent: no water quality effects above groundwater screening criteria, apart from those that reflect natural conditions, in Whitefish Lake. Over the life of the Project, groundwater quantity and quality monitoring activities will be completed to assess the performance of various components of the Project associated with engineering mining designs and performance and infrastructure designs to protect groundwater. A detailed Groundwater Monitoring Plan (GWMP) will be prepared to support licensing. The GWMP will include an Excursion Contingency Plan, and measures for adaptive management. The GWMP will be informed by the understanding of existing groundwater conditions at the Project Area (Appendix 7-A), the reactive transport modelling of groundwater COPCs associated with the restored mining area (Appendix 7-C), and the commitments made within the Geology and Groundwater section of the EIS. Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Section 3.2.2.1 of Appendix 7C of the draft EIS describes the natural redox conditions in the ore zone as naturally reducing. The operation of the wellfield will result in the groundwater in the ore zone becoming oxidizing. Post decommissioning, the groundwater in the ore zone can be reasonably anticipated to return to baseline (reducing) redox conditions. BNDN notes that as redox conditions becoming increasingly reducing post	BNDN Public Comment February 28, 2023 (BNDN Public Comment #21)	Solution-phase concentrations of metals and uranium are what influence the desorption of these elements from clays over time; but the BNDN is correct that there may be hysteresis, or a kinetic component to desorption to equilibrium conditions. Re-establishment of reducing redox conditions - primarily through scavenging of residual oxidant with pyrite - with progressive movement of natural groundwater through the mining area in the Decommissioning period is anticipated to result in	Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive

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		closure, adsorption kinetics of contaminants adsorbed to clays could shift so that contaminants desorb from clays and are remobilized into solution. It is not clear to BNDN that the evolution of redox geochemistry and its implication on adsorption kinetics has been adequately considered by Denison. Request/recommendation: - BNDN requests further information on how increasingly reducing groundwater conditions post decommissioning may impact adsorption kinetics of contaminants expected to adsorb to clays. This item would be best addressed and resolved with BNDN through the process agreement to address BNDN's concerns related to long term groundwater contamination from the Project.		concentrations of metals and uranium at baseline conditions because the same mineral phases as are present now are expected to control the solubility of those elements. Secondary minerals may influence concentrations for a small number of constituents. In all cases. concentrations of these elements will not exceed those assumed in the model. In the model as presented, desorption from clays was taken into account for protons that had sorbed to chlorite in the mining area as a sensitivity analysis. The desorption of protons did not have an adverse effect on the water quality in Whitefish Lake. See draft EIS Appendix 7-C Sections 3.5.6.4 and 4.7. Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.				to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Section 3.4 of Appendix 7C Denison reports that they have excluded colloids from their post- decommissioning geochemical modelling. Denison has also noted that colloids would serve to enhance mobility of contaminants and they could precipitate out of solution. BNDN is concerned that by excluding the precipitation of colloids with adsorbed contaminants as a pathway for contaminant transport, Denison has significantly underestimated the mobility of contaminants and the consequent risks to the receiving environment. Request/recommendation: - BNDN requests that Denison prepare an additional geochemical model that considers the roles that colloids could potentially contribute to contaminant transport. The findings of this additional model (along with the other models) should be reviewed with BNDN. This item would be best addressed and resolved with BNDN through the process agreement to address BNDN's concerns related to long term groundwater contamination from the Project.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #22)	The authors acknowledged in Appendix 7C the potential for transport of COPCs in association with colloids was possible, and used previous research in a highly relevant system (Cigar Lake) to make the professional judgement that this process would not significantly alter the results of the numerical model. Colloid transport is not included routinely in reactive transport modelling because of the difficulty in a) accurately measuring the colloidal fraction in groundwater under existing conditions as the basis for the numerous assumptions that would need to made to include them in numerical modelling and b) the challenges with applying modelling approaches that have been developed at the scale of regional models (e.g., Molnar et al., https://www.pure.ed.ac.uk/ws/portalfiles/portal/109261315/109261203._Molnar._PFV.pdf). Refinement of the mining area decommissioning objectives and associated modelling will be done as the Project progresses through updates to the Decommissioning Plan; nevertheless, the objectives as they may evolve will be bound by the objectives evaluated in the EIS, which as shown are protective of aquatic biota in Whitefish Lake. The final acceptable mining area decommissioning objectives will be developed prior to initiation of groundwater remediation, as part of the Detailed Decommissioning Plan (DDP). Prior to executing decommissioning activities, Denison shall prepare and submit the DDP to regulators for acceptance. In this case the DDP would reflect input that will be solicited from Indigenous Nations and communities and others prior to its submission and would also be informed by conditions on the ground at the site at that time, operational experience that has been gained and the regulatory landscape at that time. As is highlighted above, the decommissioning plan will evolve over time and the plan will become more refined as the Project advances. Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Section 4.0 of Appendix 7c of the draft EIS, Denison reports that the composition of restoration solution 1 and restoration solution 2 were derived from metallurgical testing. While this is likely the best, BNDN notes that the initial solution used in	BNDN Public Comment February 28, 2023 (BNDN	Further information on how the chemistry in restoration solutions #1 and #2 were derived and evidence providing confidence that the reflect conditions that are expected in the mining area with remediation of the mining area is provided in the Denison Feasibility Report (2023) and a	Please refer to the first part of Denison's response to BNDN comment #19 in	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about

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		the geochemical modelling is enormously consequential in the accuracy of the modelling and require further confirmation and confidence that the restoration solutions are accurate to within a reasonable margin of error for the geochemical modelling. Request/recommendation: BNDN requests that Denison provide further information on how the chemistry in restoration solution 1 and restoration solution 2 were derived and any evidence they can provide that gives them confidence that these solutions are an accurate reflection of what will be observed in the wellfield. This item would be best addressed and resolved with BNDN through the process agreement to address BNDN's concerns related to long term groundwater contamination from the Project.	Public Comment #23)	summary is attached as part of Denison's response to Federal Indigenous Review Team (FIRT) information requirement #67. Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	regard to BNDN's suggestion of a process agreement.			the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	BNDN notes that Denison has not provided any discussion on the extent to which the lixiviant and the solution used to flush the wellfield at the end of operations will interact with the underlying paleo weathered bedrock. BNDN notes that is it possible that there are mineral phases within the paleo weathered bedrock that are also readily soluble when exposed to the lixiviant. While BNDN recognizes that the paleo weathered bedrock has a low permeability, it is unclear to BNDN as to whether the lixiviant will contribute to mobilization of contaminants from the paleo weathered bedrock that requires consideration in the post-decommissioning groundwater model. Request/recommendation: BNDN requests that Denison provide any available information on how the bedrock may be altered (through dissolution of soluble mineral phases) by the lixiviant and the flushing of the wellfield during decommissioning, and whether this has been factored into their post- decommissioning groundwater model. This item would be best addressed and resolved with BNDN through the process agreement to address BNDN's concerns related to long term groundwater contamination from the Project.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #24)	In the modelling presented in Appendix 7-C, the mining area is assumed to span the entirety of the depth of the paleoweathered zone within the area of the freeze wall, as described in Section 4.6. Thus, in the Decommissioning period, the water quality in that entire portion of the paleoweathered zone was assumed to be equivalent to that of the "restored solution". This reflects, as the BNDN notes, the dissolution of soluble minerals associated with the paleoweathered zone due to interaction with the mining solutions. This assumption is conservative because the whole of the paleoweathered zone does not have the uranium mineralization of the ore zone, nor the concentrations of other COPC-containing mineral phases. Some alteration of the clays is expected, as is some bleaching (loss of iron-rich minerals); however, there is uncertainty with respect to the specific changes in the nature of the paleoweathered zone that have continued to be explored by Denison through experimental/metallurgical work. The decision was made in the numeric modelling to treat the portion of the paleoweathered zone within the freeze as geochemically unreactive - meaning that no sorption to clays or desorption from clays (with the exception of chlorite in the "pH tail" scenario (Section 3.5.6.4) was assumed for this zone. Thus, sorption of COPCs to clays in the paleoweathered zone within the numeric model occurred only outside of the freeze wall footprint, where the minerals will not have been exposed to mining solutions and will not have been altered. Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In section 5.2.2 of Appendix 7c of the draft EIS Denison reports the assumptions built into their post- decommissioning groundwater modelling. BNDN notes that Denison has assumed that adsorption reaction sites are assumed to be available uniformly throughout the subsurface parameter zones. The presence of sufficient adsorption sites is a primary variable which determines the outcomes of the groundwater modelling, as adsorption of ions out of solution is the primary means by which contaminant transport is attenuated in Denison's modelling. BNDN is concerned that the presence of a variable that is so consequential to the findings of the model is based primarily on assumptions with limited information to base the assumptions upon.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #25)	We note the uncertainty assessment in the draft EIS tests conditions where less sorption sites are available (1/10th of the characterized amount). Further, refinement of the mining area decommissioning objectives and associated modelling will be done as the Project progresses through updates to the Decommissioning Plan; nevertheless, the objectives as they may evolve will be bound by the objectives evaluated in the EIS, which as shown are protective of aquatic biota in Whitefish Lake. The final acceptable mining area decommissioning objectives will be developed prior to initiation of groundwater remediation, as part of the Detailed Decommissioning Plan (DDP). Prior to executing decommissioning activities, Denison shall prepare and submit	Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		Request/recommendation: BNDN requests that Denison provide justification for the assumption that adsorption sites will be uniformly available throughout the sub-surface parameter zones. BNDN requests that Denison provide information on how they estimated the extent to which adsorption sites are already saturated prior to mining. This item would be best addressed and resolved with BNDN through the process agreement to address BNDN's concerns related to long term groundwater contamination from the Project.		the DDP to regulators for acceptance. In this case the DDP would reflect input that will be solicited from Indigenous Nations and communities and others prior to its submission and would also be informed by conditions on the ground at the site at that time, operational experience that has been gained and the regulatory landscape at that time. As is highlighted above, the decommissioning plan will evolve over time and the plan will become more refined as the Project advances. Denison is committed to continue to engage with Indigenous Nations and communities to solicit input. Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.				
Birch Narrows Dene Nation	Other	Table 3-10 of Appendix 7c of the draft EIS shows the expected adsorbing mineral properties of the mineral phases to which contaminants are expected to adsorb out of solution. BNDN notes that the lixiviant and restoration solution could affect the ability of adsorption. In particular, the clays immediately surrounding the orebody are within the freeze wall and will be directly exposed to the lixiviant during operations, which may impact the clays ability to adsorb contaminants out of solution. BNDN notes that the clays immediately surrounding the orebody may be soluble in the presence of the lixiviant or may be altered to have a lower capacity to adsorb metals. BNDN requires further information from Denison to have confidence that the clay phases which play a crucial role in contaminant attenuation will not have their adsorptive capacity impacted by the operation of the wellfield. Request/recommendation: BNDN requests that Denison provide available information on whether clay mineral phases are anticipated to dissolve through the ISR mining process, and whether the restoration solution will impact the ability of clays to effectively adsorb contaminants. This item would be best addressed and resolved with BNDN through the process agreement to address BNDN's concerns related to long term groundwater contamination from the Project.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #26)	Please see Denison's response above to BNDN Comment #24. Sorbing phases including clays were excluded from the mining area in the numeric model. Sorption occurs only to materials outside of the mining area that are not exposed to, and thus no altered by interaction with the mining solutions. Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Section 1.1.1 of the Draft EIS, Denison notes that "the Gryphon deposit is not amenable to ISR mining and, accordingly, is not included in the EIS". Denison has previously reported that the Gryphon deposit has nearly as much uranium as the Phoenix deposit. While the Gryphon deposit is not amenable to ISR, it is potentially still an economic resource which Denison may wish to mine. While the Gryphon deposit is not in scope for this environmental assessment, BNDN expects to be kept informed of future potential mining activities on the Wheeler River Project which Denison may be considering, including additional exploration on the Property, as future activities on the Property will also have impacts on our Treaty and aboriginal rights and interests. Request/recommendation: Given the potential longer term mining activities at the Wheeler River project beyond the Phoenix deposit, BNDN requests that any project agreement between BNDN and Denison include terms for ongoing dialogue related to future exploration and project development activities at the Wheeler River Project and at all Denison Projects on BNDN Ancestral Lands.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #27)	Denison acknowledges that, if development of the Gryphon deposit as an underground mine is proposed in the future, this would require additional regulatory review and approval as well as engagement with Indigenous Communities of Interest. Please also refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Please refer to the first part of Denison's response to BNDN comment #19 in regard to BNDN's suggestion of a process agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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Birch Narrows Dene Nation	Other	In Section 2.3.3.1.3 of the draft EIS Denison describes the proposed decontamination, demolition and disposal activities at the Project. BNDN notes that Denison has described a detailed process for decommissioning the injection and recovery wells but has not described how the freeze wells will be decommissioned. BNDN notes that the freeze well holes may serve as preferential pathways for contaminated groundwater movement. Given the proximity of freeze wells to the orebody and the number of freeze wells proposed to be drilled, proper closure of freeze wells is also important for protection water quality long term. Request/recommendation: a) BNDN request that Denison clarify the process by which they will decommission the freeze wells. b) BNDN requests that Denison decommission the freeze wells using the same process as is proposed for the decommissioning of the injection and recovery wells.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #28)	The freeze holes will be decommissioned in the same manner as the ISR wellfield injection and recovery wells. All wells once decommissioned will undergo a mechanical integrity and leak off test prior to being grouted and sealed internally preventing interaction of surface water from the underlying aquifer at the mineralized depth. The freeze pipes, which will be located inside the freeze holes, will simply be unthreaded and removed from site after the freeze wall is no longer required.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Denison describes the thawing of the freeze wall as part of the decommissioning of the mine. BNDN notes that water expands when frozen and could potentially be capable of expanding pre-existing joints and fractures within the host rock. BNDN is concerned that the thawing of the freeze wall could lead to expanded joints and fractures which would allow for far more rapid contaminant transport away from the ore body and restoration solution than is modelled in the post-decommissioning groundwater model. Request/recommendation: BNDN request that Denison provide evidence from academic literature or other mine sites employing freeze wall technology to determine the extent the freeze wall could expands joints and fractures within the rock once thawed, including at unconformities or other pre-existing structural weaknesses within the host rock.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #29)	Please refer to the Attachment to IR-10 for information on the freeze wall integrity and basis for the design, which relies on site field data and lived experience from several existing Saskatchewan mining operations.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Denison notes that they have made the conservative assumption that no water would be recycled as mining solution as part of their water balance calculations. BNDN agrees that this conservative assumption is appropriate for assessment of potential impacts of the Project. While this assumption is appropriate for the environmental assessment, BNDN wishes to understand the proportion of industrial wastewater that may be recycled on site and any commitments Denison is willing to make regarding continual refinement of the water treatment process to increase the proportion of water that is recycled. Request/recommendation: a) BNDN requests that Denison commit to continual refinement of the Industrial Waste Water Treatment Plant (IWWTP) treatment process to maximize the amount of water that is recycled to the deposit. b) BNDN recommends that the Crown include a condition of approval for the project regarding continual improvement of water treatment to maximize recycling. c) BNDN requests that Denison share available information on the proportion of water that they currently anticipate being able to recycle.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #30)	The EIS carried forward two options for the source of freshwater: 1) surface water and 2) groundwater. This freshwater will meet all Project needs for potable water, drilling, and process water and allow Denison to obtain the water from groundwater wells or from the surface water (Whitefish lake). The effluent quality and volume predictions in the EIS provide a bounding scenario of the basis of the assessment of Project effects. Denison is undertaking a sequential EA and licensing process under the Nuclear Safety and Control Act. For context, the EA process for a Project under CEAA 2012 and the Saskatchewan Environmental Assessment Act is long and complex. As such, the inputs and outputs (including IWWTP water recycle volumes and effluent quality) developed for the IWWTP were necessary and determined by Denison's Project engineers early in the EA process to allow for the EIS biophysical and human assessments to advance. Detailed design information on the IWWTP, including recycle volumes, were not available, which is standard for engineering and EA sequencing for major projects. Denison intends to continue to refine effluent quality and volume predictions as part of the BATEA assessment and licensing phase of the Project. The predictions provided in the EIS will continue to bound the assessment, and provide a conservative representation of risk to human health and the environment. Further, more detailed information regarding the design and operation of the IWWTP and water management infrastructure	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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				(including discharge rates, recycle rates among many other things), as informed in part by the BATEA assessment, will be included with Denison's application for the license to operate which will provide opportunity for review and comment by Interested Parties. For reference, the IWWTP would be commissioned prior to the Operation phase as no discharge of treated effluent would occur until that time.				
Birch Narrows Dene Nation	Other	In Section 2.2.3.2 and Figure 2.2-15 of the draft EIS, Denison describes their water balance for the project and anticipated water needs to operate the ISR wellfield. BNDN notes that the EIS does not describe how Denison derived their estimate for the quantity of water required to operate the ISR wellfield. BNDN is concerned that the volume of water required to operate the wellfield may be substantially greater than is estimated in the draft EIS. Utilizing greater volumes of water in the wellfield would have cascading effects throughout the water balance, including greater demand on the IWWTP, greater storage volumes required in the process water storage pond, greater UBS holding pond capacity and greater volumes of effluent discharge to Whitefish Lake. BNDN is concerned with the potential cascading risks associated with an inaccurate assessment of the volume of water required to operate the ISR wellfield. BNDN also wishes to understand whether it is possible that Denison will be required to operate the wellfields at a higher pressure, even if only temporarily. BNDN notes that operating wells at higher pressure come with additional workplace and environmental hazards, especially when dealing with a strongly acidic lixiviant. Request/recommendation: a) To demonstrate that Denison has not significantly underestimated the volume of water required to operate the wellfield, BNDN requests that Denison provide evidence that the volume of water required to operate the wellfield is accurate. This should include an assessment of their level of confidence they have in their estimated water consumption. b) BNDN requests that Denison provide BNDN with information on potential contingency measures (such as constructing additional process water pond capacity) should their estimated water consumption be underestimated c) Denison must commit to updating their mixing zone assessment should they find it necessary to discharge greater quantities of effluent to Whitefish Lake than is estimated in the draft EIS. d) Denison must document the implications of operating the wellfield at a substantially higher pressure than currently expected.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #31)	a) Based on Denison's site-specific drilling, development, and pumping requirements over several years of exploration activities, the wellfield drilling water estimates presented in the EIS water balances are achievable. Denison's recently released feasibility study reaffirms the EIS assumptions related to water use and water recycle abilities. b) A key aspect of Denison's management system will be ongoing evaluation of the Project's performance compared to EIS predictions as well as continual improvement and adaptive management, as required. Should water consumption needs fall below those outlined in the EIS, Denison will follow all required permitting, licensing, and engagement with Indigenous nations and communities to describe and assess what those continency measures would be. c) The near-field analysis (Section 8.2.4.2.3) identified that under all flow regime scenarios (i.e., 7Q10, monthly low, and monthly average), constituents are expected to be well mixed within Whitefish Lake (LA-5) and below the most restrictive criteria for the protection of aquatic life (Table 8.2-10; Appendix 8-C and Appendix 8-D). Additionally, the extent of the mixing zone in Whitefish Lake is estimated to be less than 5 m under all flow scenarios assessed (Table 8.2-11). Denison will comply with the Water Security Agency's Guidelines for Effluent Mixing Zones and Denison would update modeling if the base assumptions associated with the discharge of treated effluent to Whitefish Lake were changed, as needed. d) Wellfield pressures were described in the draft EIS, Sections 2.2.1.4.2 and 2.2.1.4.3. In terms of pressures, ISR mining is planned at nominal pressures of 100 psi and intermittent pressures of up 250 psi.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Table 2.3-3 of the draft EIS shows Denison's proposed mining area decommissioning objectives, which are the groundwater quality objectives for the residual water in the ore zone following the flushing of the system during mine decommissioning. BNDN is surprised to see that relatively high concentrations of metals are expected to remain in the restoration solution as a final objective, such as 100 mg/l uranium and 2 mg/l cobalt, amongst many other metals.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #32)	Groundwater remediation targets provided in the draft EIS were from derived from metallurgical test results completed from 2017 to 2021 with over 125 kg of material recovered from Phoenix deposit that underwent leaching and neutralization test work (see response to IR-67). In 2022 and 2023, metallurgical test work continued to further optimize remediation and strategies and confirm test work results presented in the draft EIS. It is expected that metallurgical test work will continue in the future to	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive

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		BNDN notes that potential risks to groundwater and surface water could be dramatically reduced through more stringent mining area decommissioning objectives. It is also feasible that processing efficiencies and high uranium prices may allow for substantially lower concentrations of uranium to be mined economically. The long-term contamination of groundwater from the high concentration of metals in the restoration solution is one of BNDN's primary concerns with the Wheeler River Project, and BNDN would strongly prefer that Denison strive to minimize the residual contamination remaining in groundwater following decommissioning to the greatest extent possible. Request/recommendation: a) BNDN requests that Denison provide documentation that estimates the time, efforts and costs associated with reducing concentrations of metals in the restoration solution by 1 order of magnitude and 2 orders of magnitude. Note that these calculations should include costs that could be recovered by processing subeconomic UBS. b) BNDN requests that Denison work with BNDN through terms defined in a BNDN project agreement to establish achievable decommissioning objectives that would be satisfactory to BNDN. c) BNDN requests that the Crown place a condition of approval upon the Wheeler River Project that Denison is required to work with BNDN to establish mutually agreeable mining area decommissioning objectives. d) BNDN requests that Denison undertake a study of ISR operations elsewhere in the world to determine the lowest concentrations of UBS that could be processed economically utilizing industry best practices and commit to exceeding global standards.		further optimize remediation targets, and this will be advanced through updates to the Decommissioning Plan. The Feasibility Field Test (FFT) provided additional confirmation that pH target and remediation targets could be met. Data gathered during the neutralization phase of the FFT provide confidence that groundwater targets proposed in the draft EIS can be met technically and economically. Based on laboratory testing and the results of the 2022 field testing, subsurface remediation is planned to consist of rinsing the ore zone with 35 pore volumes of fresh water, slowly raising the pH and then pumping about 75 pore volumes of basic solution through the same portion of the ore zone. This basic solution will in effect further raise the pH to a level that impedes further leaching of the deposit and reduces aqueous concentrations of contaminants of concern to below their environmental target levels. Refinement of the mining area decommissioning objectives and associated modelling will be done as the Project progresses through updates to the Decommissioning Plan; nevertheless, the objectives as they may evolve will be bound by the objectives evaluated in the EIS, which as shown are protective of aquatic biota in Whitefish Lake. The final mining area decommissioning objectives will be developed prior to initiation of groundwater remediation as part of the Detailed Decommissioning Plan (DDP). Prior to executing decommissioning activities, Denison shall prepare and submit the DDP to regulators for approval. The DDP would reflect input that will be solicited from Indigenous Nations and communities and others prior to its submission and would also be informed by conditions on the ground at the site at that time, operational experience that has been gained and the regulatory landscape at that time. As is highlighted above, the decommissioning plan will evolve over time and the plan will become more refined as the Project advances. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate separate funding for BNDN at this time.	Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate separate funding for BNDN at this time.			to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Figure 2.2-18 of the draft EIS, Denison shows the proposed design of the double composite liner system for the ponds on site and the uranium bearing solution (UBS) holding area. BNDN notes that the risks associated with temporary storage of UBS is much greater than other contact water on site which is proposed to be stored in a similar means. As such, BNDN is concerned that the proposed UBS holding area does not have adequate leak detection given the additional risk associated with the UBS relative to contact water on site. BNDN also notes that open air storage of UBS presents the risk of incidental interactions with wildlife near to the	BNDN Public Comment February 28, 2023 (BNDN Public Comment #33, #82)	As outlined in draft EIS Section 2.2.2.2.2, Denison will evaluate options to use tanks instead of holding area as engineering advances. It is also important to note that Denison is completing a sequential EA and licensing process for the Project (see draft EIS Section 1). Denison considers the EA to be a planning and decision-making tool that assesses the potential effects of the Project in a careful and precautionary manner and integrates results of engagement with Indigenous nations and communities. The details requested by BNDN will be developed to support licensing and will be included in Management System programs /	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future

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		project (such as birds), which would potentially be acutely toxic. BNDN is also concerned that there is no leak detection system below the secondary HDPE geomembrane and geosynthetic clay liner. Should the secondary containment layers also become compromised, Denison does not have a system planned to detect this. Request/recommendation: a) BNDN requests that Denison commit to storing UBS in appropriate tanks as opposed to open air storage. b) BNDN requests that Denison include a leak detection pipe in the prepared subgrade below the secondary containment as well as between the primary and secondary containment layers. BNDN also requests that the prepared subgrade be engineered to facilitate maximum utility of the leak detection below the secondary containment. c) BNDN requests that Denison undertake a risk assessment for the design of the UBS holding area. BNDN recommends the safer, less environmentally risky option be selected and that BNDN can review and provide input into the decision that Denison makes.		plans including for example the Groundwater Monitoring Plan and the Emergency Response and Preparedness Plan.				interests in the Project.
Birch Narrows Dene Nation	Other	Denison shows an additional ore body to the Southwest of Phase 5. Denison has not included this additional ore body in the mine plan in the draft EIS and has not discussed whether they have intentions to mine this ore body or undertaking a project change at a later date to include this additional ore body. It is unclear whether this additional ore body has any implications for the long term groundwater quality modelling either through the additional orebody altering anticipated groundwater chemistry, or the restoration solution dissolving metals in the additional orebody increasing overall metal loading. Given the probable difference in groundwater and mineral geochemistry in the additional orebody relative to the overlying sandstone and underlying basement rock, there is likely to be interaction between the restored solution and the additional orebody post-closure. Request/recommendation: a) BNDN requests that Denison clarify whether they are considering adding the additional orebody to the southwest of Phase 5 into the mine plan, including clarifying whether the additional ore body is amenable to ISR mining. b) BNDN requests that Denison clarify what the anticipated permitting associated with the additional ore body would be. c) BNDN requests that the post- decommissioning groundwater modelling for the Project include interactions between the additional ore body and the restoration solution to understand if the ore body poses a risk of additional metal loading to groundwater.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #34)	a) and b) The small deposit to the SW of Phase 5 is amendable to ISR, but is of lower grade than the areas targeted in mining phases 1 through 5 and mining of that low grade areas is not being considered at this time. It is noted that The Project mining and milling capacity will be bound by the assumptions in the EIS, which includes a production rate higher than the current reserves. The Project would be reviewed to determine what if any changes to the design basis would be anticipated and then what permitting would be required, should additional mining beyond what is contemplate by the EA be considered in the future. c) The additional modelling recommended by the review comment is unnecessary at this time. The low grade area is not considered in the mine plan at this time. Should that change, as noted above, the Project would be reviewed to determine what if any changes to the design basis would be anticipated and then what permitting would be required. Such modeling as envisioned by the review comment would be done that time as may be required. Hydrogeological investigations have been ongoing in the field and in laboratories since 2014. Packer, open hole, and cross hole tests have been completed in conjunction with exploration drilling programs. As well, permeability tests have been completed on sections of available competent core within the Phoenix deposit. Open hole water level surveys have been completed across the site in 2015, 2017, 2021 and 2022. Data gathered during the field tests have been utilized for both the EA groundwater model as well as the mining model. The primary direction of groundwater flow at depth is to the north east, which means restored solutions will move away from the small deposit to the SW. Additionally, as noted in the response to BNDN Comment #32, the restored solution will be basic and will further raise the pH to a level that impedes further leaching of the deposit and reduces aqueous concentrations of contaminants of concern to below their environmental target levels.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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Birch Narrows Dene Nation	Other	Denison intends to use a freeze wall as tertiary containment for the operation of the wellfield during operations. In general BNDN is supportive of this containment measure but requires further information to have confidence that the freeze walls will operate as designed. In particular, BNDN notes that while the freeze wall will be continuous from the ground surface all the way into the basement rocks underlying the orebody, the freeze wall is by far the most consequential immediately around the ore body itself. The orebody is approximately 400 m below the ground surface (where the earth would be significantly warmer) and the lixiviant is expected to be at least 10 degrees warmer than the surrounding groundwater would be. Considering that the cold brine will need to be injected nearly half a kilometer into the earth where warm lixiviant will be injected into the wellfield, BNDN is concerned that the freeze wall may be ineffective in and around the ore body where it is required. Furthermore BNDN is concerned that the monitoring system for assessing the stability of the freeze wall may not adequately detect the continuity of the freeze wall at depth. As such, BNDN is concerned that the freeze wall may be ineffective and in fact obscure our ability to recognize contamination of the surrounding groundwater from the freeze wall operating ineffectively. Request/recommendation: a) BNDN requests that Denison provide information to demonstrate that the freeze wall will in fact be frozen in and around the ore body. If there is any doubt that the freeze wall will indeed be frozen around the ore body, Denison should describe further measures they can undertake to ensure that the freeze wall is frozen as intended around the ore body. b) Denison must provide BNDN with further information on how they will monitor the performance and continuity of the freeze wall. c) BNDN requests further information on the proposed groundwater monitoring program around the wellfield. d) BNDN requests the opportunity to review the groundwater monitoring plan and to review groundwater monitoring data as part of a BNDN-Denison environmental committee developed through a BNDN-Denison project agreement.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #35)	a) Please refer to the Attachment to IR-10 for information on the freeze wall integrity and basis for the design, which relies on site field data and lived experience from several existing Saskatchewan mining operations. b) The following explains how the continuous freeze wall will be monitored. The alignment of the freeze wall is located 25 m offset from the lateral extent of the recoverable ore and the freeze wall will grow in thickness both towards the ore and away from the ore. The freeze wall will solidify all liquid porewater and develop into a contiguous impermeable barrier many metres thick. Ground temperature monitoring will be installed through a series of continuous fiberoptic temperature and pressure wells from surface to the depth of impermeable basement rock below the unconformity. Such monitoring wells/systems will be installed on both the ore (inside) and non-ore (outside) sides of the freeze wall to confirm the thickness of frozen ground. There will be sufficient operational controls in place to verify that the freeze plant is operating, to measure the temperature in the ore zone, and to measure the temperature on opposite sides (inside and outside) of the freeze wall so that early detection of any upset conditions can be identified and addressed. Options for addressing issues include: lowering the temperature of the freeze system to draw more heat out; increasing the freeze coolant flow rates in freeze wells nearer to active ISR cells; and/or to adaptively manage the lixiviant injection and recovery rates in cells located nearest to the freeze wall. c) Regarding the monitoring program: A framework for the groundwater monitoring plan was provided in Section 7.8.2 of the draft EIS and is commensurate with the level of development of the Project. Further details regarding the Environmental Management Program and its associated plans (of which the groundwater monitoring plan is one) will be developed later in 2023 and 2024 as part of the licensing process. Engagement on licensing requirements, including on program and plan documentation will occur at that time. d) As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on monitoring regimes, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project, such as BNDN. Denison does not anticipate separate funding for BNDN at this time.	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate separate funding for BNDN at this time.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Section 7.6.2.3 of the draft EIS and the geology and groundwater summary table in Appendix 16A, Denison states that they expect no residual effects to groundwater quality during the operations, decommissioning or future centuries period of the Project. Denison has also not placed a significance determination on the impacts to groundwater quality based on the findings of the draft EIS due to	BNDN Public Comment February 28, 2023 (BNDN Public	The Groundwater Quality VC was carried through the EIS as an intermediate VC. The shallow and deeper groundwaters are not considered to be a potable water source currently nor in the future within the LSA (defined in Section 7.1.3.1), as detailed in Section 7.1.1.1. Within the LSA, the Groundwater VC was considered an intermediate VC as it is a pathway to the aquatic environment and considered in the future	Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and

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		groundwater being considered an intermediate VC. BNDN disagrees with both the residual effects assessment and the fact that groundwater quality has been assessed solely as an intermediate VC. The protection of groundwater resources is highly important to BNDN. Our members place immense value on clean spring water and the protection of groundwater more generally. The advancement of the Wheeler River Project will permanently impair groundwater resources in and around the Wheeler River Project. The contamination of groundwater at the Project will have a significant impact on our members' connection to the land and ability to exercise our Treaty and Aboriginal rights. BNDN see the limited interpretation of residual effects and the lack of inclusion of groundwater quality as a receptor VC as a significant oversight in the assessment of impacts of the Project on the environment and BNDN Treaty and Aboriginal rights. This must be corrected to properly assess the Project and thus ensure that project impacts are appropriately mitigated and accommodated. Request/recommendation: a) Denison must apply a significant determination to groundwater quality and quantity for all projects phases, including the future centuries period. The significance determination must be developed following consultation and engagement with BNDN. b) Denison must re-evaluate the residual effects of the project on groundwater quality including the future centuries period. This re-evaluation must be following consultation and engagement with BNDN. c) BNDN requests that the CNSC work with our Nation to understand the significant impacts that the permanent contamination of groundwater caused by the project will have on our Treaty and Aboriginal rights.	Comment #37)	centuries period in Section 8. It is also important to note that the mining area is 400 m below surface and the existing/baseline groundwater quality in the ore zone area is poor (e.g., high in iron and uranium compared to shallower groundwater; Figure 7.3-11). Section 7.6 describes the residual effects evaluation for geology and groundwater, including for the life of mine (0 to 38 years) and the future centuries period. It is Denison's opinion that the approach associated with evaluating Project effects to groundwater quality is appropriate and reasonable for the reasons presented in the draft EIS. Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. One of the key goals of such collaboration with each Indigenous nation will be to provide the information necessary to the communities such that it provides confidence to community members regarding the impacts from the Project to the aspects of the environment which matter the most to them. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous First Nations who may have interest in the Project. The details of monitoring and follow-up plans are being developed to support the separate process of Project licensing and permitting. The specific means by which provincial and federal authorities, and Indigenous Nations and communities will be engaged in developing the follow-up and monitoring program, including the information-sharing program, are currently under consideration with the Denison project team. It is noted that Section 4.2.1 of the draft EIS provides the variety of ways in which Denison has engaged with Interested Parties to date and it is assumed it would continue to use these means and others that may be identified to fulfil its key corporate principals for developing positive relationships (see draft EIS Section 4.2).	each of their interests and needs, in an agreed-upon fashion. One of the key goals of such collaboration with each Indigenous nation will be to provide the information necessary to the communities such that it provides confidence to community members regarding the impacts from the Project to the aspects of the environment which matter the most to them. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous First Nations who may have interest in the Project.			will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Section 7.8.2 of the draft EIS documents the groundwater monitoring proposed for the surface facilities and the ISR recovery area. It also describes a conceptual excursion contingency plan wherein Denison has proposed their plans to manage situations where groundwater contamination occurs beyond what is predicted in the EIS. BNDN notes that Section 7.8.2 lacks information on the involvement of Indigenous Nations related to groundwater monitoring. As stated previously, BNDN is highly concerned with the level of impact the Project will have on groundwater resources. As such BNDN requires Denison to communicate excursions of groundwater and the consequent management of excursions to our Nation. Request/recommendation: a) BNDN requests that Denison revise Section 7.8.2 to include	BNDN Public Comment February 28, 2023 (BNDN Public Comment #38)	Denison agrees with BNDN's comment that groundwater monitoring will be an important component of the Project as it advances. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet	Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. One of the key goals of such collaboration with each Indigenous nation will be to provide the information necessary to the communities such that it	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		Indigenous engagement and input for groundwater monitoring results and the management of observed groundwater excursions. The manner in which Denison engages BNDN on groundwater monitoring and management will likely occur through an Environmental Committee, which should be defined in a BNDN-Denison Project Agreement. b) BNDN requests that the CNSC impose a condition of approval on the Project that clarifies that Denison is required to engage with impacted Indigenous Nations such as BNDN on groundwater monitoring and management.\		regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions. The details of monitoring and follow-up plans are being developed to support the separate process of Project licensing and permitting. The specific means by which provincial and federal authorities, and Indigenous Nations and communities will be engaged in developing the follow-up and monitoring program, including the information-sharing program, are currently under consideration with the Denison project team. It is noted that Section 4.2.1 of the draft EIS provides the variety of ways in which Denison has engaged with Interested Parties to date and it is assumed it would continue to use these means and others that may be identified to fulfil its key corporate principals for developing positive relationships (see draft EIS Section 4.2).	provides confidence to community members regarding the impacts from the Project to the aspects of the environment which matter the most to them. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous First Nations who may have interest in the Project.			
Birch Narrows Dene Nation	Other	In Appendix 8d, Denison documents their baseline aquatics studies undertaken for the Wheeler River EIS. Denison has included some lakes and rivers upstream of the Project as background sites for understanding project impacts to the aquatic environment. BNDN notes that there are many additional sites throughout our Ancestral Lands which would benefit from ongoing aquatic monitoring and would be potentially suitable for the Project as background sampling sites. Request/recommendation: BNDN requests that Denison work with our Nation to identify potential additional background sampling sites within our Ancestral Lands for aquatic monitoring for the life of Project. The details of such should be defined in the BNDN-Denison project agreement.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #39)	Denison appreciates and acknowledges the recommendation. At this time Denison believes suitable candidate references areas are available upstream of the Project site in areas located in the same drainage system / watershed. While proximity to the Project is only one of many considerations for suitable reference area selection in this case the ability to be able to compare relevant measurement endpoints between "reference" vs "potentially influence" sampling locations where the primary difference between locations is the point source discharge is compelling rationale. Additionally, data that have been collected from upstream areas as part of baseline programs provides the opportunity to implement aquatic monitoring according to a BACI design which is a powerful means by which to assess and isolate potential mine related effects from natural environmental change. Given the above, Denison does not see that there is rationale for investigating lakes over a regional extent to establish reference areas for aquatic monitoring as is suggested.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Section 2.2.1.4.2 of the Draft EIS Denison discusses the operation of the wellfield during the operations phase of the mine. BNDN notes that many of the details in this section are conceptual in nature and thus could require significant refinements in design to achieve the desired recovery consistently throughout the life of mine. Amongst other concerns related to operations of the ISR wellfield, BNDN is concerned that Denison may alter the chemical composition of the lixiviant used in the ISR wellfield which could cause inadequately understood changes in potential effects of the Project to the environment. These effects could include significant changes to the final restorative solution at the end of mine life or significant changes in the treatment requirements for the IWWTP that impact the ability of Denison to achieve effluent quality criteria for significant periods of time. Request/recommendation:	BNDN Public Comment February 28, 2023 (BNDN Public Comment #40)	a) It is important to note that Denison is completing a sequential EA and licensing process for the Project (see draft EIS Section 1). Detailed ISR mining-related information needed to support licensing and permitting has not been included in the EIS; it will be provided to regulators as part of permitting and licensing. For the EIS, an initial understanding of the mine plan and mining area remediation was needed to initiate the assessment of migration of constituents of potential concern in groundwater out of this area in the post-decommissioning period. The findings and conclusions of the EIS were also used, in turn, to inform and bound the engineering and feasibility work. As part of the metallurgical test program, over 125kg of core from the Phoenix deposit has been leached in a variety of settings, including bottle rolls, column tests, and intact core tests. This has helped to predict concentrations of both the lixiviant as well as the production solutions. The lixiviant (mining solution) concentrations will vary depending on each individual well production profile. To ensure reagent consumption is effective and efficient it will be	Please see response to Comment #19 for Denison's response on a Project agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		a) BNDN requests that Denison provide information on: (i) the likelihood of the chemical composition of the lixiviant changing throughout the life of project, (ii) potential changes to the lixiviant composition, and (iii) the implications for long term groundwater quality and effluent treatment from changes in lixiviant chemistry b) BNDN requests that Denison commit to ongoing communications and engagement with BNDN regarding changes to the wellfield operation throughout the life of mine. The terms of engagement should be defined in a BNDN-Denison project Agreement.		varied during the life of each well dependent on its characteristics. The initial acidification of the well requires a lower acid content to ensure the formation does not plug due to precipitation, whereas during periods of high production the well can accept a higher acid concentration. Towards the end of the recovery curve, the uranium is more difficult to access and therefore the strength of the acid or the flow rate to the well need to be optimized to ensure efficient use of reagents. It is expected that the lixiviant concentrations will vary between 0-60 g/L H2SO4, and 0-20g/L H2O2 and will be situationally dependent. There is also the capability to add Fe2(SO4)3, however it is not expected that this will be required in significant concentration due to the natural abundance of iron in the deposit. b) Please see response to Comment #19 for Denison's response on a Project agreement.				
Birch Narrows Dene Nation	Other	Table 4 of Appendix 8e of the draft EIS shows the predicted site discharge concentrations of the contaminants of potential concern (COPCs). BNDN notes that the concentrations of a number of COPCs do not achieve water quality objectives that is the best available technology economically achievable (BATEA). Example COPCs include copper, molybdenum, selenium, uranium, vanadium, zinc and ammonia. BNDN requires proponents operating on our Ancestral Lands to, at a minimum, achieve BATEA standards for effluent treatment and discharge. This takes reasonable and appropriate precaution without imposing unreasonable costs on the operation. Request/recommendation: a) BNDN requests that Denison commit to achieving BATEA criteria for all COPCs in their effluent. b) Denison must work with BNDN to identify mutually agreeable and appropriate effluent discharge criteria for their effluent. BNDN expects that identifying suitable effluent discharge criteria will be undertaken through an Environmental Committee with a terms of reference defined in a BNDN-Denison project agreement c) BNDN requests that the CNSC impose a condition of approval on the Project that BNDN is engaged.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #41)	a) Denison is undertaking a sequential EA and licensing process under the NSCA. For context, the EA process for a Project under CEAA 2012 and the Saskatchewan Environmental Assessment Act is long and complex. As such, the inputs and outputs (e.g., effluent quality) needed for the EIS were developed by Denison's Project engineers early in the EA process to allow for the biophysical and human assessments to advance. An example of one of these outputs is the IWWTP effluent quality. The effluent quality predictions in the EIS provide a bounding scenario of the basis of the assessment of Project effects. As stated in the Draft REGDOC 2.9.2 Denison understands that a BATEA assessment be conducted to determine the predicted design release characteristics as part of the licence application for a new facility or activity. Outside of the EIS process, the Project detailed engineering is progressing, including the design of the IWWTP and associated refinement of effluent quality predictions. Denison is following Draft REGDOC 2.9.2 to arrive at a treatment option that remains within the bounds of the EA, which ultimately predicts no significant impacts to the receiving environment. The maximum design release characteristics for the IWWTP will be provided as part of Denison's licence application to the CNSC. b) As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to engagement with English River First Nation and Kineepik Métis Local as it relates to effluent discharge criteria, suited to each of their interests and needs. Denison does not anticipate working closely with BNDN on this topic.	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to engagement with English River First Nation and Kineepik Métis Local as it relates to effluent discharge criteria, suited to each of their interests and needs. Denison does not anticipate working closely with BNDN on this topic.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Table 7 of draft EIS Appendix 8e shows the anticipated size of the mixing zone under 3 different flow conditions, including the calculated 7Q10 flow. While BNDN understands that Denison expects to discharge relatively small volumes of effluent to Whitefish Lake compared to a conventional open pit or underground mining operation, BNDN is concerned that the mixing zone assessment underestimates the magnitude of impact that the project will have on Whitefish Lake. Request/recommendation: BNDN requests that Denison undertake a plume delineation study and provide BNDN the opportunity to review the	BNDN Public Comment February 28, 2023 (BNDN Public Comment #42)	The prediction uncertainty analysis (i.e., "sensitivity analysis") presented in Appendix 7-C included an evaluation of the change in the model prediction (i.e., plume migration) with respect to changes in the conductivity of materials along the flow path to the receptor, Whitefish Lake (i.e., Scenarios 4, 5, and 6) as well as regarding the hydraulic conductivity of the mined-out ore zone. As such we feel that the work requested by the reviewer has already been completed and reported upon within the draft EIS. In addition, the uncertainty of the Intermediate Sandstone Aquifer was evaluated (see IR55), where higher hydraulic	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future

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		findings of the study through the BNDN-Denison Environmental Committee for the Wheeler River Project.		conductivity within the Intermediate Sandstone Aquifer were found to reduce the proportion of water from the ore zone reaching Whitefish Lake, which would have the effect of further reducing (i.e., diluting) concentrations simulated and presented in the EIS documentation. As such, the conditions documented in the draft EIS are already conservative with respect to the uncertainty in these parameters. The near-field analysis (Section 8.2.4.2.3) identified that under all flow regime scenarios (i.e., 7Q10, monthly low, and monthly average), constituents are expected to be well mixed within Whitefish Lake (LA-5) and below the most restrictive criteria for the protection of aquatic life (Table 8.2-10; Appendix 8-C and Appendix 8-D). Additionally, the extent of the mixing zone in Whitefish Lake is estimated to be less than 5 m under all flow scenarios assessed (Table 8.2-11). Denison will comply with the Water Security Agency's Guidelines for Effluent Mixing Zones. The above notwithstanding in-field confirmation of the extent of the effluent mixing zone is anticipated following commissioning of the IWWTP and effluent discharge system during the Operation phase of the Project.				interests in the Project.
Birch Narrows Dene Nation	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes	BNDN notes that the environmental risk assessment (draft EIS Appendix 10a) makes no mention of potential impacts the project may have on mercury biogeochemical cycling and the consequent risks to the environment and human health. This is unsurprising given the lack of baseline sampling of mercury in sediments and soils, especially wetland soils. The lack of baseline mercury sampling is a significant oversight given the significant impact that mining operations can have on mercury biogeochemistry, including mercury methylation, and mobility of mercury species within the environment. BNDN is very concerned with the complete lack of assessment of this important consideration for the project and the consequent inability for our members to adequately understand the potential risks to our Treaty and Aboriginal rights from these risks. Note that the absence of baseline information gathered can be reasonably considered an impact on our Treaty and Aboriginal rights as our members will avoid exercising our rights if BNDN lack the information to have confidence that it is safe to do so.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #43)	Although baseline concentrations of total mercury in sediment have not been collected during baseline sampling to date, Denison will collect background information pertaining to sediment total and methyl mercury from LSA lakes and rivers prior to site development. As indicated in EIS Section 8.4.6.1, Residual Effects Characterization, mercury is not associated with the local geology and is not expected to be released in the effluent at measurable levels and was therefore not identified as a COPC. Denison notes that there is potential for increased methylmercury production in the receiving environment under a certain combination of factors to which the Project may contribute; however, prediction of methylmercury production is not practical. Denison commits to monitoring mercury and methylmercury in the aquatic environment over the life of the Project to determine the potential changes in mercury concentrations in fish tissue over time. As the Project advances and operational monitoring is underway, Denison will assess health risks from fish consumption by comparing fish tissue data collected during operation from the monitoring program against Health Canada's mercury guideline of 0.5 ug/g wet weight. This is a human health risk-based maximum permissible concentration. Mercury data presented throughout the draft EIS represents total mercury. Denison agrees to included methylmercury as part of the constituents monitored in fish throughout all project phases.	Denison commits to monitoring mercury and methylmercury in the aquatic environment over the life of the Project to determine the potential changes in mercury concentrations in fish tissue over time (Section 8).	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Table 2.2-4 of the Draft EIS, Denison documents their planned chemical used for the project. BNDN notes that Denison intends to use zero-valent iron (ZVI) in the IWWTP, but not as part of the remediation solution for the mine. BNDN notes that ZVI is used to treat contaminants in groundwater around the world. Denison has not discussed whether they have investigated the possibility of utilizing ZVI to remediate the wellfield during decommissioning.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #44)	Refinement of the mining area decommissioning objectives and associated modelling will be done through updates to the Decommissioning Plan, and will be bounded by the objectives evaluated in the EIS. The use of zero-valent iron will be evaluated, as applicable.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future

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		Protection of groundwater is of exceptional importance to BNDN. BNDN is concerned that Denison has not made a complete or comprehensive effort to understand how to minimize negative impacts to groundwater from the project using proven technologies that may be suitable for remediating the restoration solution in the wellfield during the decommissioning phase of the mine. Request/recommendation: BNDN requests that Denison investigate the suitability of using zero-valent iron to remediate the groundwater within the wellfield as part of the decommissioning process.						interests in the Project.
Birch Narrows Dene Nation	Other	BNDN is concerned that the small volume of Effluent Monitoring and Release Ponds may create a lack of operational flexibility. For example, in the EIS, it is stated that: "Treated water from the IWWTP will be pumped to the three Effluent Monitoring and Release Ponds (each 3,300 m3). These ponds will be designed to hold effluent for 72 hours for testing before discharge to the environment." – EIS, pp 723 If water quality in these ponds exceeds discharge criteria then there may be a need to store water so that additional treatment and monitoring can occur prior to discharge. However, only having capacity for three days of storage means it is unlikely the Proponent would be able to adequately treat water prior to reaching storage capacity, resulting in a need for emergency release of poor- quality water. Request/recommendation: a) BNDN requests that additional storage capacity be included as part of the design for water management system. This must include adequate storage capacity to ensure Denison has the ability to retain water for sufficient time to allow treatment, in the event that exceedances of water quality discharge criteria occur. Alternatively, Denison can commit to halting discharge (and operations if required) should water quality exceed discharge criteria. Discharge into Whitefish Lake would resume once water quality in the Effluent Monitoring and Release Ponds has been returned to below discharge criteria. b) BNDN requests that the CNSC impose a condition of approval for the Project that requires Denison to must meet effluent discharge criteria prior to discharge and must halt operations if treated effluent in the monitoring and release ponds does not meet effluent discharge criteria.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #45)	a) During Construction, no effluent is expected to be released to the aquatic environment. Contact water stored in the Clean Waste Rock Pond during Construction will be held onsite until the Industrial Wastewater Treatment Plant (IWWTP) is commissioned. At that time the water from the pond would be conveyed to the IWWTP, treated, and released to Whitefish Lake per permit / license requirements. The sequence for Construction activities will occur in a logical manner based on Project execution plans. For example, construction of the wellfield runoff pond will be prioritized during the early part of Construction and it will able to hold 38,200 m3 of water. This will provide contingency and additional water storage capacity if contact water produced exceeds estimates or the volume available in the Clean Waste Rock Pond. Other secondary contingency measures are also available should the volume of water requiring management exceed site infrastructure storage volume. This could include use a hydrovac for offsite disposal. Section 2 Project Description, Section 2.2.3.9 Treated Effluent Monitoring and Release Ponds of the draft EIS outlines Denison's commitment to test effluent prior to discharge to Whitefish Lake, to ensure it meets federal and provincial discharge limits. Any pond not meeting the criteria will be recycled back to the Industrial Wastewater Treatment Plant via the process water pond. b) Denison expects the Provincial Approval to Operate a Pollutant Control Facility will contain specific effluent quality limits and monitoring to confirm effluent quality meets the approved limits. Denison will also be required to meet conditions in CNSC licensing documentation, as well as MDMER effluent discharge criteria.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Fish community sampling is an important component of baseline studies for many reasons, including identifying species present (including any species at risk) and evaluating relative abundance (e.g. CPUE). A robust program should include multi- season and multi-year approach. This allows improved characterization of seasonal habitat use and accounts for natural variability. In the baseline aquatic assessments, the Proponent has focused fish community sampling in fall 2016, with some limited additional sampling of in spring 2017. This low level of effort will make it difficult to draw meaningful comparisons with monitoring work that will occur during the life of mine.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #46)	It is Denison's and their aquatic SME's opinion that the baseline fish community sampling efforts, including information provide from Indigenous and local resource users, provide a sufficient basis for conducting an effects assessment (draft EIS Section 8.3 Fish and Fish Habitat). Based on the information collected there is a good understanding of fish species presence / absence, relative abundance, fish habitat characteristics including areas that contribute to important life history stages (e.g., spawning areas) and fish habitat use. Denison does not believe further extensive baseline collection are needed to support the environmental assessment process but will implement targeted aquatic surveys prior to site development (see below).	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		Furthermore, CPUE has only been reported for electrofishing effort. As a result, there is very limited information available for relative abundance of fish in important waterbodies, including Whitefish Lake, McGowan Lake, and Russell Lake. Request/recommendation: a) BNDN requests that the Proponent build on the existing data for fish community sampling by collecting an additional round of spring and fall sampling. b) BNDN requests that an assessment of total effort, total catch, and CPUE be provided for each capture method/location where fish sampling has occurred.		With respect to inclusion of the additional information requested the following is noted. Both detailed and summary data are presented in the Baseline Aquatic Environment Report that was provided as an appendix to the draft EIS. Effort and catch by sampling gear type by sampling location are shown for example in Table A-13 of the Baseline Aquatic Environment Report and metrics such as CPUE and total catches can be derived from these data if desired. Denison does not see the need to derive these metrics for presentation in the final version of the EIS (and supporting documents). This is in part related to the fact that the aquatic effects assessment did use abundance / relative abundance metrics such as CPUE as measurable parameters (MPs; a parameter or metric associated with a key indicator that can be used to detect and measure Project-related changes) to represent the fish and fish habitat VC, nor would it have been practical to use them for this purpose. There would be no practical or reliable way to derive such a prediction of change relative to Protect-aquatic habitat interactions. While abundance / relative abundance metrics may be reported during future monitoring they would not likely be seen as a key measurable parameters for fish monitoring. More subtle measures of fish health would be used for this purpose - it is reasonable to assume that fish health measures will be more sensitive to change than abundance measures and provide an earlier indication of potential Project-related effects. This is what is envisioned and required by the MDMER EEM program, whereby measures of fish health (e.g., growth, reproduction, condition) are used to assess potential effects. As noted above, Denison will implement targeted aquatic surveys prior to site development. At this time it is envisioned that a pre-development EEM program survey following guidance provided in the Metal Mining Technical Guidance Document will be implemented at the site, with sampling at future effluent exposed and reference areas. Best practice is to undertake an analysis of candidate reference areas using the existing baseline information and investigate their utility as controls prior to project development. Execution of the pre-development EEM represents a Before-After-Control-Impact (BACI) design for aquatic monitoring, that will provide the ability to monitor change temporally (among sampling periods) and spatially (among sampling areas), thereby providing a more robust means by which to assess potential mine related effects.				
Birch Narrows Dene Nation	Other	The Proponent has identified one mitigation measure that includes sharing of monitoring results to assess performance of water management system (EIS, pp 8-90, 8.2.5 Mitigation Measures). BNDN is supportive of this type of information sharing and believes that it can be an important component of transparency and trust- building between the Proponent and other parties. However, it is important that information sharing be done in a way that is accessible to community members. Request/recommendation: - BNDN requests involvement in discussions with Denison about sharing of information related to water quality monitoring (and environmental monitoring more broadly). Some methods of communication that may	BNDN Public Comment February 28, 2023 (BNDN Public Comment #47)	Denison agrees with BNDN that water quality monitoring will be interest to Indigenous nations and communities. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project. BNDN will be informed throughout the monitoring program design and implementation process. Further details on the Public Information Program and Public Disclosure	Please see response to Comment #19 for Denison's response on a Project agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		support accessibility of data include: o Public-facing summary reports on a regular schedule (e.g. quarterly or annually) o Real-time access to environmental monitoring data through online database portals. o Semi-regular community meetings hosted in Turnor Lake (e.g. every 12-18 months, as decided in conjunction with BNDN leadership within a Project Agreement with BNDN). o Presentations to BNDN staff, leadership, and/or community members by BNDN Environmental Monitors. The specific methods used for information sharing and appropriate levels of support from Denison can be determined through consultation with BNDN.		will form part of the documentation submitted in support of the CNSC licensing for the Project. It is also noted for further reference that there are existing, non-Denison monitoring programs such as the CNSC's Independent Environmental Monitoring Program (https://nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/index.cfm), and the Eastern Athabasca Regional Monitoring Program (www.earmp.ca/). Results from these programs provide relevant information and can complement Denison's Project-specific monitoring program. One forum for discussion of monitoring results is the Northern Saskatchewan Environmental Quality Committee(https://www.saskatchewan.ca/residents/first-nations-citizens/saskatchewan-first-nationsmetis-and-northern-initiatives/northern-saskatchewan-environmental-quality-committee). Please see response to Comment #19 for Denison's response on a Project agreement.				
Birch Narrows Dene Nation	Other	he Proponent has completed predictive modelling for concentrations of contaminants in fish tissue. For example, results of modeling for selenium indicate that concentrations will fluctuate throughout operations but remain below the recommended criterion of 2.83 mg/kg wet weight (from the US EPA). Should the Project proceed, information on contaminants in fish tissues will be highly relevant for BNDN and land users who eat fish from the area. Request/recommendation: BNDN requests that results of fish tissue monitoring (e.g. EEM studies) be shared in a publicly available and accessible way. This must include comparisons with guidelines and information on other contaminants of importance (e.g. mercury). Discussions regarding how this information can be shared with BNDN should occur alongside the discussions related to water quality monitoring results.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #48)	Denison agrees with BNDN that results of fish tissue monitoring will be interest to Indigenous nations and communities. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project. BNDN will be informed throughout the monitoring program design and implementation process. Further details on the Public Information Program and Public Disclosure will form part of the documentation submitted in support of the CNSC licensing for the Project. It is also noted for further reference that there are existing, non-Denison monitoring programs such as the CNSC's Independent Environmental Monitoring Program (https://nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/index.cfm), and the Eastern Athabasca Regional Monitoring Program (www.earmp.ca/). Results from these programs provide relevant information and can complement Denison's Project-specific monitoring program. One forum for discussion of monitoring results is the Northern Saskatchewan Environmental Quality Committee(https://www.saskatchewan.ca/residents/first-nations-citizens/saskatchewan-first-nationsmetis-and-northern-initiatives/northern-saskatchewan-environmental-quality-committee). Please see response to Comment #19 for Denison's response on a Project agreement.	Please see response to Comment #19 for Denison's response on a Project agreement.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Increased fishing pressure in Whitefish Lake from employees working at the Project site and increased ability for visitors due to improved access could negatively impact fish populations. Preferred species, large-bodied fish, and older individuals are most likely	BNDN Public Comment February 28, 2023 (BNDN Public	Please note that the Project will not change public access to the area. The existing gate on Highway 914 near Cameco's Key Lake Operation will remain in place and no changes to the gate and the process for controlling access to Highway 914 north of the Key Lake Operation are proposed as part of the Wheeler River Project. As described in the draft EIS, workforce	Detailed Project plans and programs related to staff and contractor fishing will be developed to support Project	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		to be targeted. This may have negative consequences on the population structure of fish in the lake as well as the ability of BNDN members to exercise fishing rights. Request/recommendation: BNDN recommends that the policies Denison sets related to staff and contractors fishing while on site are determined collaboratively with BNDN through the Environmental Committee defined in a BNDN-Denison project agreement.	Comment #49)	members will be transported to/from site via a fly-in/fly-out rotation and will, therefore, not use ground travel options during shift changes, which will eliminate fishing on local lakes during commutes to/from the site and during time off work. Denison site vehicles will not be available for recreational purposes. While at the Project site and off duty, workers may opt to fish local waterbodies. To protect sustainable use of resources, only catch and release of fish will be encouraged, and fish storage or cooking facilities will not be provided. To prevent entry of land users from entering the Project Area, Denison will control access to the property with both a north and south security gate. Overall, given a lack of resources to access fishing locations and store fish harvests, workforce fishing is expected to cause minimal disturbances to local users. Section 11 of the draft EIS provides the assessment of potential Project effects on Indigenous Land and Resource Use (Section 11.1) and Other Land and Resource Use (Section 11.2). The mitigation measures proposed in the aquatic and terrestrial assessments translated into undetectable changes in resource availability to existing and future users and rightsholders. The assessment does not take a distinctions based approach (i.e., the potential impact on each Indigenous community is not evaluated separately), but rather on the key indicators and associated measurable parameters. Mitigation to eliminate, reduce, or control potential adverse effects of the Project on Indigenous Land and Resource Use would apply to any uses proximal to the Project. Given proven mitigation is to be applied to traffic disturbances, noise, air quality, and increased competition for resources, the effects are expected to be minimal. As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects, wherever possible. Detailed Project plans and programs related to staff and contractor fishing will be developed to support Project permitting and licensing efforts.	permitting and licensing efforts.			the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The EIS provides very few details regarding how spills, leaks, and other accidents and malfunctions will be managed to mitigate the impacts on fish and fish habitat. Over the life of the mine there will inevitably be accidents and malfunctions. One of the most common environmental issues that will be encountered is leaks and spills. These can typically be managed through good monitoring and preparedness, though if they occur near water, the ability to clean them quickly is difficult and can result in harm to aquatic communities. Request/recommendation: BNDN request additional information regarding the development of spill prevention programs, emergency management procedures, and monitoring and remediation programs for accidents and malfunctions. Representatives from BNDN need to be included in the planning and execution of monitoring and remediation activities to provide community perspectives in Project activities. One method through which BNDN can be involved in these discussions is through the development of an Environmental Committee.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #50)	A standalone Accidents and Malfunctions (A&M) assessment was completed and is summarized in Section 14 of the EIS (full report is Appendix 14-A of the EIS). The A&M assessment considered almost 70 accident scenarios including many that would relate to the unplanned release of chemicals and radiation to the environment with potential to effect country foods. Specific scenarios including the release of chemicals and radiation to the aquatic environment and to the terrestrial environment adjacent to the ERFN and KML culture camps located along Hwy 914. The overall risks in consideration of likelihood and consequence were characterized as low. The assessment concluded that with planned engineering / environmental design features, mitigation measures, and emergency response, as well as implementing industry best practices that the risks to the environment from accidents and malfunctions can be reduced to levels that are as low as reasonably practical. Section 2.9.1.3 of the draft EIS provides Denison's commitment to develop an Environmental Management System, which includes an	Section 2.9.1.3 of the draft EIS provides Denison's commitment to develop an Environmental Management System. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				Emergency Preparedness and Response Program (EPRP) and an Environmental Protection Program (EPP; including an Environmental Monitoring Plan). The EPRP would be established to identify how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property. The EPRP would be developed in a manner that aligns with guidance provided by CNSC in REGDOC-2.10.1. The EPP would be established to provide an overarching framework for key environmental monitoring and management plans and to ensure a means to demonstrate compliance with applicable environmental regulatory requirements and other performance targets that Denison may set. As noted on the draft EIS, Denison has opted to execute the overall Project approvals process - that is, the environmental assessment and licensing / permitting processes - in series and not simultaneously. A such, the details of these programs and plans will be developed during the licensing / permitting phase and will be available for review at that time rather than as part of the final EIS. The level of information provided in the draft EIS is appropriate for the current stage of the Project approvals process. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and program spatial boundaries will be sufficiently extensive to measure EIS predictions.	community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process.			
Birch Narrows Dene Nation	Other	Mitigation measures are an important component of Project management which are critical for environmental protection. Upon review of the suggested mitigation measures, BNDN has identified some opportunities for additional mitigation. Request/recommendation: BNDN request that the following standard mitigation measures be included as part of the list described in Section 8.3.5: o Maintain vegetated buffers of at least 100m with all waterbodies wherever practical; o All equipment must be inspected prior to use on-site to ensure that they are clean and free of soil or other contaminants; o Maintain spill kits on all vehicles used on-site;	BNDN Public Comment February 28, 2023 (BNDN Public Comment #52)	Denison acknowledges the input and will consider the suggestions as the project moves forward. The draft EIS contains a number of mitigations referenced in different biophysical and human environment assessments; these mitigations together form Denison's fulsome commitment list of Project mitigation measures moving forward. Many of the proposed additional mitigation measures are already included in the draft EIS. A few examples are provided here: - Section 2.2.7.6: No fuels, oils, or other hazardous substances will be stored within 100 m of any water body. No equipment maintenance or re-fuelling will be conducted within 100 m of a water body. - Section 2.8: Fuel storage and distribution infrastructure will be constructed in accordance with applicable legislation requirements; Fuels	Section 2.9.1.3 of the draft EIS provides Denison's commitment to develop an Environmental Management System. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime,	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		o All machinery will be kept in good working order and inspected regularly for drips, leaks, and spills; o In the event of a spill, Denison will take all necessary actions, where it is safe to do so, to immediately stop the spill, contain contaminants, clean up and dispose of contaminated materials; o Denison will maintain a record of all spills and report upon each spill within 48 hours, including information on spill response, cleanup, and remediation; o Vehicle refueling will occur at a distance of at least 100m; o Fuel tanks will be located in areas that are lined and contained; o Fuel tanks will be located at least 500m from known waterbodies.		will be stored in approved, above-ground, double-walled storage tank(s) equipped with secondary containment in accordance with provincial regulations and standards; Stationary and mobile equipment will be fueled with a fuel-dispensing truck. - Section 9.2.5.2.7: Standard operating procedures will be employed, and regular inspections of equipment and machinery will be completed to verify they are in good working order; Vehicles and equipment will be maintained in good working condition (e.g., no leaks) and furnished with industry-standard spill response kits. Denison also notes that Section 2.9.1.3 of the draft EIS provides Denison's commitment to develop an Environmental Management System, which includes an Emergency Preparedness and Response Program (EPRP) and an Environmental Protection Program (EPP; including an Environmental Monitoring Plan). The EPRP would be established to identify how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property. The EPRP would be developed in a manner that aligns with guidance provided by CNSC in REGDOC-2.10.1. The EPP would be established to provide an overarching framework for key environmental monitoring and management plans and to ensure a means to demonstrate compliance with applicable environmental regulatory requirements and other performance targets that Denison may set. As noted on the draft EIS, Denison has opted to execute the overall Project approvals process - that is, the environmental assessment and licensing / permitting processes - in series and not simultaneously. A such, the details of these programs and plans will be developed during the licensing / permitting phase and will be available for review at that time rather than as part of the final EIS. The level of information provided in the draft EIS is appropriate for the current stage of the Project approvals process. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.	suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process.			
Birch Narrows Dene Nation	Other	The collection of sediment samples was completed using cores and grab petit Ponar in three upstream reference locations (LA-7A, LA-8, and LA-9), Whitefish Lake (LA-5 and LA-6), McGowan Lake (LA-1), and Russell Lake	BNDN Public Comment February 28,	Baseline sediment chemistry was conducted on the 0-2cm horizon as this is the area in contact with surface water and the zone inhabited by benthic invertebrates. It is also the sediment layer in which changes in	As the Indigenous Communities of Interest with reserves and residential	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is

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		(LAB-1 and LAB-2). Sediment quality testing was conducted to characterize COPC including nutrients, metals, and radionuclides. Only the top 2 cm of cores of grab samples were analyzed in the lab. It is not clear in the methodology why laboratory analysis was limited to the top 2 cm. Request/recommendation: BNDN requests additional information on the rational for only analyzing COPC within the top 2 cm of sediment samples. This should include information on whether this limited data will negatively affect the ability to evaluate potential impacts of groundwater contamination entering Whitefish Lake from below during operations, decommissioning, and future centuries.	2023 (BNDN Public Comment #54)	sediment chemistry would be expected to change in response to Project-related inputs and thus provides the most appropriate data for comparison to follow-up monitoring. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions. The details of monitoring and follow-up plans are being developed to support the separate process of Project licensing and permitting. The specific means by which provincial and federal authorities, and Indigenous Nations and communities will be engaged in developing the follow-up and monitoring program, including the information-sharing program, are currently under consideration with the Denison project team. It is noted that Section 4.2.1 of the draft EIS provides the variety of ways in which Denison has engaged with Interested Parties to date and it is assumed it would continue to use these means and others that may be identified to fulfil its key corporate principals for developing positive relationships (see draft EIS Section 4.2).	communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process.			informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Despite significant concerns regarding the presence of mercury in water and sediment, the Proponent has elected not to test sediments for it. BNDN acknowledges that the mining process does not use mercury and it is present in low levels in the background environment. However, for the purposes of good stewardship, communications, and trust, having an assessment of the background levels of mercury is important to BNDN. Request/recommendation: BNDN requests that the proponent sample sediments for mercury to establish background levels. This is information that is culturally important given the potential harm and the psychological toll of mercury in aquatic ecosystems. Background levels can then be compared with ongoing monitoring throughout the life of mine.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #55)	Denison will collect background information pertaining to sediment total and methyl mercury from LSA lakes and rivers prior to site development.	Denison will collect background information pertaining to sediment total and methyl mercury from LSA lakes and rivers prior to site development (Section 8).	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	In Section 8.5 Fish Health, the Proponent has included a summary table with information on contaminants in fish tissue and bone tissue. The information provided does not include total number of samples.	BNDN Public Comment February 28,	The requested information is presented in Appendix 8-D in the draft EIS.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is

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		Request/recommendation: BNDN requests table 8.5-2 be updated with information on total number of fish (n) samples for each location.	2023 (BNDN Public Comment #56)					informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes; Other	The Proponent has committed to using seed that is certified weed-free, with a valid "Certificate of Seed Analysis" for the revegetation process. Request/recommendation: BNDN recommends that, in addition to using weed-free certified seeds, consultation occur with Indigenous communities, including BNDN, to select an appropriate seed mix that closely mimics the pre- construction plant community and includes plants of medicinal and traditional importance. This could be done by either sourcing seed mix from a local seed distributor, or using wild seed propagated from plants collected from the Project Area. In addition, the seed mix should contain native plant species only.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #57)	Specific details of the seed mixture and overall reclamation plan will be developed through updates to the Decommissioning Plan, on which Interested Parties will be provided opportunity for review and input. The decommission plan in the EIS is a conceptual plan. A preliminary decommissioning plan will be included with licence application and reviewed and updated during operations. Prior to executing Decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan to regulators for acceptance, which builds on the preliminary decommissioning plan. Additionally, Denison has partnered with the University of Saskatchewan and Northwest Communities Environmental Services (an Indigenous-owned environmental company) under the Developing Eco-Restoration Together (DERT) program. This unique project aims to co-create ecological restoration practices that centre Indigenous peoples, worldviews, and values while also braiding knowledge from the land, Indigenous knowledge, and western science. The project is supported by the three partners but is ultimately guided by the Indigenous Project Advisory Board, and the Community Liaison/Education Coordinator. Through restoration trials, community engagement, and various planting techniques, Denison, with their partners are seeking to return ecosystem functions in areas where they have been previously disturbed (e.g., exploration cutlines). Through collaboration with community members, University of Saskatchewan, industry partners, two graduate students, and local youth, this project is expected to ultimately inform the creation of a framework for effective restoration practices in northern Saskatchewan that centre on caribou and Indigenous communities.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes; Other	The EIS uses a 500 m buffer around the Project Area to define indirect habitat alteration for moose (Figure 9.3-9). This includes habitat alteration from sensory disturbance such as anthropogenic noises, vehicle traffic, aircraft traffic, and increased predator access. However, the EIS references scientific research that states that roads and vehicle traffic can affect moose habitat selection, resulting in habitat avoidance up to 1 km from roads (Shanley and Pyare 2011). Furthermore, the EIS acknowledges uncertainty concerning the available background and baseline information used to identify available moose habitat in this assessment. Without considering a larger avoidance buffer (as demonstrated in various research) around proposed anthropogenic disturbances, BNDN believe that the EIS underestimates the potential extent of moose habitat alteration. To be more conservative, a 1000 m buffer should be used surrounding the Project area.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #58)	It is Denison's and their terrestrial SME's opinion that the approach used to characterize moose habitat alteration provided a sufficient basis for conducting the ungulate (VC) moose (KI) effects assessment (draft EIS Section 9.3). The Project Area had a 500 m buffer applied to account for indirect effects/habitat alteration; this area is within the wildlife LSA. Availability of habitat is not a key limiting factor for moose populations.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		Request/recommendation: BNDN recommends using a 1000 m buffer surrounding the Project Area to measure the extent of moose habitat alteration. BNDN believe this analysis will provide a more accurate and conservative outcome with respect to potential project impacts to moose.						
Birch Narrows Dene Nation	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes; Other	One of the mitigation measures implemented to protect ungulates, furbearers, and Woodland Caribou includes de-icing the Project roads for winter traction, which will result in fewer wildlife collisions. Salt used for de-icing is likely to attract ungulates, including moose, to roadways to satisfy their mineral requirements (Rea et al 2021). Request/recommendation: BNDN requests that the Proponent revise this mitigation measure to explicitly state that salt will not be used for de-icing Project roads to avoid attracting ungulates to the Project Area. This mitigation measure can be found in section 9.3.5.2.7 Road and Traffic Management.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #59)	Denison has committed to using alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) whenever practicable (Section 12.0).	Denison has committed to using alternative measures on Project roads for de-icing and winter traction (e.g., sand, gravel) or dust suppression (e.g., water) whenever practicable.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Current use of lands and resources for traditional purposes; Other	The EIS uses a 500 m buffer around the Project Area to define Woodland Caribou habitat alteration from sensory disturbance. However, scientific research expects up to 5 km (or greater) of Caribou avoidance around mining Projects, and that related semi- permeable barriers, such as roads, likely exacerbate this effective habitat loss [(Smith et al. 2000; Dyer et al. 2001; Courtois et al. 2008; Vistnes and Nellemann 2008; Nagy 2011; Polfus et al. 2011; Leblond et al. 2011, 2013; CPAWS Wildlands League 2013; Johnson et al. 2015)]. Without considering a larger avoidance buffer (as demonstrated in various research) around proposed anthropogenic disturbances, we believe that the EIS underestimates the potential extent of Caribou habitat alteration. Request/recommendation: BNDN requests that the Proponent present the extent of caribou habitat alteration/loss from the proposed Project within a range of uncertainty informed by scientific research. Specifically, the percent alteration of habitats must be presented using a 500 m (low end) up to a 5,000 m (high end) buffer. BNDN believe this analysis will provide a more accurate range of outcomes with respect to potential project impacts to caribou.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #60)	It is Denison's and their terrestrial SME's opinion that the approach used to characterize caribou habitat alteration provided a sufficient basis for conducting the caribou effects assessment (draft EIS Section 9.3).The Project Area had a 500 m buffer applied to account for indirect effects/habitat alteration; this area is within the wildlife LSA (refer to Figure 9.3-9 for a map showing the spatial areas). The 500 m buffer for habitat alteration was selected in accordance with ECCC's assessment of disturbed areas, which buffered (500 m) anthropogenic disturbances to evaluate the habitat. The alteration of available habitat is quantified in this EIS by applying a buffer of 500 m around the Project Area in which Project effects in the form of sensory disturbance are likely to affect available the habitat and make it functionally unavailable for use. Following submission of the draft EIS in October 2022, Denison has met with Saskatchewan Ministry of Environment (SK ENV) staff to develop a framework for future woodland caribou offset. This information has been presented to the provincial and federal review teams as part of the response to federal information requirements in August 2023 as the Conceptual Caribou Mitigation Plan. The Conceptual Caribou Mitigation Plan (the Plan), developed proactively by Denison, has a different objective than the draft EIS. The Plan builds on the assessment of potential Project effects and commitments to consider additional mitigation (offset) to account for non-significant residual effects highlighted in the draft EIS. The Plan is expected to be advanced with ongoing consultation with the SK ENV, as SK ENV finalize the caribou range plan for SK1. The EIS is a conservative planning tool, whereas the Plan is a practical, living document designed to define management works associated with caribou. The Plan is not a requirement for EA determination per se, but is provided as a guidance document to help Denison proactively describe and inform the development and implementation of appropriate mitigation measures related to caribou and their habitat. The Plan is an evergreen document. It will be consistent with the management goals of SK ENV for the SK-1 caribou conservation	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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				unit (once available) and will be developed/refined in consultation with local communities including English River First Nation and Kineepik Métis Local in Pinehouse and SK ENV. Denison is continuing to work with SK ENV to estimate habitat offset scenarios based on the current Project design which will be refined as the Project advances. A boreal caribou habitat offset calculator is under development by SK ENV and Denison is collaborating with SK ENV to define key scenario attributes.				
Birch Narrows Dene Nation	Other	Incidental observations of Barn Swallow (Hirundo rustica) occurred during baseline studies (Appendix 9- B). This bird SAR was not included as a Key Indicator for this Valued Component. Instead, the EIS represents the Barn Swallow using two other SAR birds including the Olive-sided Flycatcher (Contopus cooperi), and Common Nighthawk (Chordeiles minor). This does not make ecological sense because Barn Swallows use distinct habitat and exhibit distinct breeding behaviour from these other SAR. Therefore, the barn swallow should be its own key indicator because it will have unique levels of habitat alteration/loss and levels of mortality than the other species. In addition, Barn Swallows have a higher likelihood of being impacted by project activities than the other representative SAR, because they nest directly on artificial structures. The EIS states that species that nest on buildings are more susceptible to entrapment in Project components. This species is listed as Threatened on SARA Schedule 1. In Canada, the Migratory Birds Convention Act, 1994 protects Barn Swallow, its nests, and eggs. Request/recommendation: a) BNDN requests that the Barn Swallow is included as its own key indicator for the VC Bird SAR within the EIS. b) Additional surveys should be conducted to confirm the presence of any Barn Swallow nests on all buildings in the Project Area prior to commencement of construction. c) If Barn Swallow nests are located, contact the SK MOE for regulatory advice on the appropriate actions given the specific situation. d) The Proponent should monitor all barn swallow nests found within the Project Area to confirm their continued usage throughout the lifecycle of the mine. If avoidance of nests is observed near Project activities, the Proponent should adopt an adaptive management approach and provide additional nesting sites elsewhere. Specifically, the Proponent could consider installing nesting structures in suitable areas to provide alternative nesting options for Barn Swallows. e) Staff should be trained to identify and report barn swallows and their nests. f) Future monitoring programs during the life of the project must include the barn swallow.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #61)	The process and rationale for selection of VCs and establishment of KIs and associated MPs is described in Section 5.3 in Section 5. Raptors, Migratory Breeding Birds, and Bird Species at Risk VCs were selected based on their likelihood of interaction with the Project, as well as their contributing roles to biodiversity and ecosystem function. The methodology for the habitat-based assessment appropriately evaluated potential adverse effects on avian species using the accepted VC and KI approach for focus of the assessment. As described in the EIS, the Common Nighthawk (similar to the Barn Swallow) is an aerial insectivore that uses a variety of habitats, including anthropogenically disturbed and cleared areas (Section 9.4.3.3.1). As such, effects on these anthropogenically disturbed areas were appropriately assessed in the habitat-based EA methodology. Since Barn Swallows nest almost exclusively on human-made structures, specific Barn Swallow exclusion methods will be added as mitigation measures to the EIS (Section 9.4.5). If Barn Swallow nests should be encountered, any subsequent activities would be conducted in accordance with the 2022 Migratory Birds Regulations. The habitat-based approach for the assessment supports the use of surrogates that are known to utilize the same habitat types. Habitat loss and alteration were assessed for the Key Indicator species included in this Valued Component. A conservative approach of identifying available habitat for these species was chosen to include habitat for those species not directly assessed (i.e., Barn Swallow through Common Nighthawk habitat). Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D). It has been included as to Attachment IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS. The new appendix also includes a summary of the life history requirements, the expected Project effects, proposed mitigation measures, and anticipated residual effects on barn swallow.	Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D) will be added to Section 9 of the final EIS. It has been included as to Attachment IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Incidental observations of Horned Grebe (Podiceps auratus) occurred during baseline studies (Appendix 9- B). This species is listed as Special Concern on SARA Schedule 1. The Horned Grebe was not included as a Key Indicator for this Valued Component. Instead, the EIS represents this species with two other bird SAR, Yellow Rail (Coturnicops	BNDN Public Comment February 28, 2023 (BNDN Public	The process and rationale for selection of VCs and establishment of KIs and associated MPs is described in Section 5.3 in Section 5. Raptors, Migratory Breeding Birds, and Bird Species at Risk VCs were selected based on their likelihood of interaction with the Project, as well as their contributing roles to biodiversity and ecosystem function. While Horned	Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of

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		noveboracensis), and Rusty Blackbird (Euphagus carolinus). The Horned Grebe uses distinct habitat from these other species. Therefore, the Horned Grebe should be its own key indicator because it will have different levels of habitat alteration/loss and levels of mortality. Request/recommendation: a) BNDN requests that the Horned Grebe is included as its own Key Indicator for the VC Bird SAR within the EIS. b) Future monitoring programs during the life of the Project must include the Horned Grebe.	Comment #62)	Grebe was not included as a avian SAR in the draft EIS, the EIS identified Yellow Rail and Rusty Blackbird as a surrogate species. To focus the effects assessment on key species, it was decided to use the provincially listed Yellow Rail (and Rusty Blackbird) as surrogates for Horned Grebe. Horned Grebe use similar wetland habitat types for nesting, foraging and protective cover as Yellow Rail. The habitat-based approach for the assessment supports the use of surrogates that are known to utilize the same habitat types. Habitat loss and alteration were assessed for the Key Indicator species included in this Valued Component. A conservative approach of identifying available habitat for these species was chosen to include habitat for those species not directly assessed (i.e., Horned Grebe through Yellow Rail and Rusty Blackbird habitat). As such, potential effects on these habitat types were assessed appropriately in the draft EIS. Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D). It has been included as Attachment to IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS. The new appendix also includes a summary of the life history requirements, the expected Project effects, proposed mitigation measures, and anticipated residual effects on Horned Grebe. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project.	new SAR appendix (new Appendix 9-D) will be added to Section 9 of the final EIS. It has been included as to Attachment IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project.			the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Bank Swallow (Riparia riparia), a bird SAR may be present within the terrestrial RSA. This species was not included in the EIS as a key indicator for bird SAR. This species is listed as Threatened on SARA Schedule 1. The breeding range of the Bank Swallow (Riparia riparia) overlaps with the terrestrial RSA. Bank swallows breed in varying natural and artificial habitat with sand-silt substrates including vertical banks, riverbanks, bluffs, stockpiles, aggregate pits, and roadcuts (COSEWIC 2013). Suitable habitat may be present because soil surface textures across the RSA are predominantly sand textured (sand, loam sand/sandy loam and silty	BNDN Public Comment February 28, 2023 (BNDN Public Comment #63)	The process and rationale for selection of VCs and establishment of KIs and associated MPs is described in Section 5.3 in Section 5. Raptors, Migratory Breeding Birds, and Bird Species at Risk VCs were selected based on their likelihood of interaction with the Project, as well as their contributing roles to biodiversity and ecosystem function. Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D). It has been included as Attachment to IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures	Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D) will be added to Section 9 of the final EIS. It has been included as to Attachment IR-131. This new	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		sand). The creation of soil stockpiles during construction may create suitable breeding habitat for this species. Request/recommendation: a) BNDN requests a justification for excluding the Bank Swallow from the EIS. b) If a valid justification does not exist, BNDN requests this species be added as a Key Indicator for bird SAR unless it can be proven not present in the RSA. c) All soil stockpiles should be monitored for Bank Swallow nesting activity before the stockpiles are disturbed when needed for site reclamation. d) If Bank Swallow nests are located, contact the SK MOE for regulatory advice on the appropriate actions given the specific situation.		described in the draft EIS. The new appendix also includes a summary of the life history requirements, the expected Project effects, proposed mitigation measures, and anticipated residual effects on bank swallow.	EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS.			
Birch Narrows Dene Nation	Other	The EIS states that knowledge providers reported that multiple Whooping Cranes (Grus americana) have been observed along the Wheeler River, Moore River, and along the Cree River (outside of the terrestrial RSA) (19-LK-ERFNTrap- 134.169) (19-LK- ERFNTrap-134.170). Whooping Cranes are listed as Endangered on SARA Schedule 1. The EIS does not include this species as a key indicator for SAR birds, nor does it include an explanation why this species was omitted despite being reported by a knowledge provider from English River First Nation. Request/recommendation: a) BNDN requests an explanation for excluding this species despite being reported by a Trapper from English River First Nation. If a valid justification does not exist, the species Whooping Crane (Grus americana), should be included as a key indicator for SAR birds. b) Future monitoring programs during the life of the Project must include surveys for the Whooping Crane.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #64)	The process and rationale for selection of VCs and establishment of KIs and associated MPs is described in Section 5.3 in Section 5. Raptors, Migratory Breeding Birds, and Bird Species at Risk VCs were selected based on their likelihood of interaction with the Project, as well as their contributing roles to biodiversity and ecosystem function. The local trapper's observation of Whooping Crane was outside of the avian RSA. The rationale for the selection of the SAR Key Indicators was provided in draft EIS Section 9.4.1. For these reasons, Whooping Crane was not included as a SAR Key Indicator in the draft EIS. for further reference as noted above subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D). It has been included as Attachment to IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS. The new appendix also includes a summary of the life history requirements, the expected Project effects, proposed mitigation measures, and anticipated residual effects on bank swallow As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project.	Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D) will be added to Section 9 of the final EIS. It has been included as to Attachment IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
					will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project.			
Birch Narrows Dene Nation	Other	Short-eared Owls (Asio flammeus) were not observed during the baseline surveys (Appendix 9-B). This is likely because targeted surveys for this species were not conducted. The detection probability of Short-eared Owls is very low at sunrise when the breeding songbird point count surveys were conducted. Short-eared Owls are most detectable from one hour before sunset to half an hour after sunset. Request/recommendation: a) BNDN requests that short-eared Owls continue to be assumed present within suitable habitat, unless proven otherwise by a qualified biologist using the Short-Eared Owl Survey Protocol (Saskatchewan Ministry of Environment 2015). b) Future monitoring programs should utilize the protocol developed by the Saskatchewan Ministry of Environment to better (2015) understand whether this species is present.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #65)	The process and rationale for selection of VCs and establishment of KIs and associated MPs is described in Section 5.3 in Section 5. Raptors, Migratory Breeding Birds, and Bird Species at Risk VCs were selected based on their likelihood of interaction with the Project, as well as their contributing roles to biodiversity and ecosystem function. Short-eared Owl were included as a KI of the Bird SAR VC in the EIS. A review of life history requirements and discussion on effects assessment are included in the EIS (Section 9.3). In the EIS, Short-eared Owl were assumed to be present and breeding in the Project study areas. As described in the EIS, pre-construction surveys will be conducted prior to the commencement of any vegetation clearing or soil disturbance. Avian species will also be routinely monitored throughout the life of the Project. Results from the surveys and monitoring activities are expected to inform the adaptive management process to update Project design and identify the need for additional mitigation measures, if required.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Yellow Rail (Coturnicops noveboracensis) were not observed during the baseline surveys (Appendix 9-B). This is likely because targeted surveys for this species were not conducted. The Yellow Rail is nocturnal; therefore, survey effort must take place between 23:00-3:00. Therefore, this species would not have been observed when the breeding songbird point count surveys were conducted. Request/recommendation: a) BNDN requests that Yellow Rail should continue to be assumed present within suitable habitat, unless proven otherwise by a qualified biologist using the Yellow Rail Survey Protocol (Saskatchewan Ministry of Environment 2014). b) Future monitoring programs should utilize the protocol developed by the Saskatchewan Ministry of Environment (2014) to better understand whether this species is present.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #66)	The process and rationale for selection of VCs and establishment of KIs and associated MPs is described in Section 5.3 in Section 5. Raptors, Migratory Breeding Birds, and Bird Species at Risk VCs were selected based on their likelihood of interaction with the Project, as well as their contributing roles to biodiversity and ecosystem function. Yellow Rail were included as a KI of the Bird SAR VC in the EIS. A review of life history requirements and discussion on effects assessment are included in the EIS (Section 9.3). In the EIS, Yellow Rail were assumed to be present and breeding in the Project study areas. As described in the EIS, pre-construction surveys will be conducted prior to the commencement of any vegetation clearing or soil disturbance. Avian species will also be routinely monitored throughout the life of the Project. Results from the surveys and monitoring activities are expected to inform the adaptive management process to update Project design and identify the need for additional mitigation measures, if required.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Two bat species, Little Brown Bat (Myotis lucifugus) and Northern Myotis (Myotis septentrionalis) were detected during passive acoustic surveys in 2019 (Appendix 9- b). These species are listed as Endangered by COSEWIC and SARA schedule. Despite being present, bats were completely excluded from the EIS. Areas that will be cleared for mine development and operations could contain maternity roost trees. Based on Appendix 9-b, this habitat was not adequately evaluated through field surveys. Request/recommendation: a) BNDN requests justification for excluding bat species from the EIS despite two Endangered species confirmed present.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #67)	Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS and has been included in the response to YNLR (a new SAR appendix (new Appendix 9-D) will be added to Section 9 of the final EIS. It has been included here as Attachment IR-131. This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS. The new appendix also includes a summary of the life history requirements, the expected Project effects, proposed mitigation measures, and anticipated residual effects on bats.	Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS (a new SAR appendix (new Appendix 9-D) will be added to Section 9 of the final EIS. It has been included as to Attachment IR-131. This new	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		b) BNDN also request the Proponent put protocols in place to identify and assess bat maternity roost trees prior to clearing and employ mitigation measures such as retaining maternity roost trees, modifying the timing of clearing, and offsetting for the destruction of habitat for endangered species.			EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS.			
Birch Narrows Dene Nation	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes; Other	Denison's air dispersion model does not include any receptor locations related to BNDN traditional land and resources use (TLRU) and Indigenous Knowledge (IK) sites. BNDN members use the lands and waters in the Project area for TLRU and ceremonial purposes. Request/recommendation: BNDN TLRU and IK sites should be considered in Denison's air quality assessment. The geographic locations for TLRU and IK should be inputted into the air dispersion model as special receptors. This will provide site specific data for BNDN land users who use the LSA so they can effectively assess the Project's impact on land use and rights.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #69)	Scoping of the air quality assessment followed a conservative approach and described where modelled concentrations returned to background levels. The air quality assessment included human receptors in the Project Area and Local Study Area (refer to draft EIS, Figure 6.1-3). These receptor locations are consistent with what was presented in the ERA (Section 10.1 and Appendix 10-A).	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Health and socio-economic conditions ; Other	Denison states in the EIS "the Cameco McArthur River Operation and Key Lake sites are currently in Care and Maintenance mode; therefore, there is currently no truck traffic between the sites on Highway 914. When these sites are to become operational again, there is potential for a cumulative effect at sensitive locations near the highway." On November 28th, 2022, operations resumed at Cameco's McArthur River Uranium Mine and Key Lake Mill. Denison did not model Cameco related air emissions in their air dispersion model. The EIS model does not account for any of Cameco's air emissions from the mill, mine, and associated truck traffic between sites. Without this data included in the model, the EIS does not adequately account for the cumulative effects of Cameco's McArthur River Mine and Key Lake Mill on the atmospheric environment. Request/recommendation: Denison must redo air dispersion modeling to account for the Cameco McArthur River Uranium Mine and Key Lake Mill which have resumed operations since the EIS was released. Without this data included in the model the EIS does not accurately capture baseline conditions or cumulative effects on the atmospheric environment. Fugitive dust and uranium emissions (and potentially other contaminants) have increased potential for exceedances with the resumption of Cameco's operations, as exceedances are already predicted with the Wheeler River Project alone.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #70)	Please refer to Section 6.1.3.2 and 6.1.7. The regional SK MOE data presented in Table 6.1-12 were conservatively used to represent background concentrations of TSP, PM10, PM2.5, CO, SO2, and NO2 for the Wheeler River Project air quality assessment. While traffic associated with Cameco Operations was not modelled, conservative regional background concentrations from the Saskatchewan Air Quality Modelling Guideline (SK MOE 2012a) and the La Loche monitoring station were used for particulate matter, NO2, SO2, and CO (see Section 6.1.3.2.5 and Appendix 6-A). The La Loche monitoring station is located near anthropogenic sources, while the Project is in a remote area removed from anthropogenic sources. Accordingly, emissions to air from traffic associated with Cameco's operations are captured by the regional background concentrations used in the air dispersion model and are considered in the assessment of Project-related effects discussed in Section 6.1.4. Model predictions of COPC concentrations and depositions were added to background levels and compared to the available standards summarized in Table 6.1-5 at receptors located outside the property boundary. To confirm the residual effects of the Project on Air Quality and demonstrate compliance with provincial ambient air quality standards, an adaptive air quality management program will be implemented. The air quality management program will contain various plans which will be finalized during permitting and licensing. The plans within the air quality management program will incorporate monitoring requirements directed by provincial and federal regulators and by Indigenous groups and other Interested Parties as requested.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Project is predicted to produce exceedances for TSP of 313% over the regulatory limit. 24-hour TSP concentrations exceed the criterion 28% of the time during Construction, 21% of the time during Operations.	BNDN Public Comment February 28,	a) A change in a measurable parameter is not a significant effect, per the EA methodology outlined in Section 5. This threshold approach is both transparent and reasonable with the context of the assessment, though it	As the Indigenous Communities of Interest with reserves and residential	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is

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		These exceedance conditions do not include TSP emissions from Cameco's McArthur River Mine and Key Lake Mill which have now resumed operations. There is also the potential for wildfire smoke to further exacerbate dust emissions. TSP exceedances represent a potential health risk for land users and workers near the Project site. Especially for at-risk groups such as elders, youth, and people with existing respiratory conditions. Request/recommendation: a) Denison must employ additional mitigation measures to reduce TSP emissions on site including enhanced dust suppression efforts. b) Denison must remodel TSP to include emissions from Cameco's McArthur River Mine and Key Lake Mill. c) Please provide information on how TSP will be monitored during the Project and how Denison will know when exceedance conditions are occurring. d) Please provide information on how adaptive management will be used when a TSP exceedance is discovered. Including discussion on how the Project will be managed during poor air quality events caused by wildfire smoke. e) Please provide information on how exceedances conditions near the Project site will be communicated to the public.	2023 (BNDN Public Comment #71)	is acknowledged that some level of change in the VC (or more precisely its measurable parameter) is deemed acceptable on condition that the change is not of a magnitude from which negative effects could accrue. Denison directs BNDN to Table 6.1-19 to 6.1-21 for the complete residual effect characterization for TSP exceedances. This includes a consideration of the residual effect related to TSP in the full context of direction, magnitude, geographic extent, duration, frequency, reversibility, context, and likelihood. In Section 10.1 of the draft EIS, the SMEs concluded that while there were predicted exceedances of air quality criteria for particulate matter, they were not identified for further assessment in the HHRA—these COPCs are unlikely to be associated with a human health or environmental risk, and any exposures to people at elevated concentrations would be infrequent, short-term, and highly localized. b) Please refer to Section 6.1.3.2. The regional SK MOE data presented in Table 6.1-12 were conservatively used to represent background concentrations of TSP, PM10, PM2.5, CO, SO2, and NO2 for the Wheeler River Project air quality assessment. While traffic associated with Cameco Operations was not modelled, conservative regional background concentrations from the Saskatchewan Air Quality Modelling Guideline (SK MOE 2012a) and the La Loche monitoring station were used for particulate matter, NO2, SO2, and CO (see Section 6.1.3.2.5 and Appendix 6-A). The La Loche monitoring station is located near anthropogenic sources, while the Project is in a remote area removed from anthropogenic sources. Accordingly, emissions to air from traffic associated with Cameco's operations are captured by the regional background concentrations used in the air dispersion model and are considered in the assessment of Project-related effects discussed in Section 6.1.4. Model predictions of COPC concentrations and depositions were added to background levels and compared to the available standards summarized in Table 6.1-5 at receptors located outside the property boundary. c) and d) To confirm the residual effects of the Project on Air Quality and demonstrate compliance with provincial ambient air quality standards, an adaptive air quality management program will be implemented. The air quality management program will contain various plans which will be finalized during permitting and licensing. The plans within the air quality management program will incorporate monitoring requirements directed by provincial and federal regulators and by Indigenous groups and other Interested Parties as requested. In terms of worker health and safety while forest fire smoke is present, Denison will consider this through the Occupational Health and Safety Program. Information on how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property related to forest fires will be included in the Emergency Preparedness and Response Program. e) As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik	communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process.			informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.				
Birch Narrows Dene Nation	Other	The Project is predicted to produce exceedances for PM10 of 232% over the regulatory limit. 24- hour PM10 concentrations exceed the criterion 17% of the time during Construction, 12% of the time during Operations. These exceedance conditions do not include PM10 emissions from Cameco's McArthur River Mine and Key Lake Mill which have now resumed operations. There is also the potential for wildfire smoke to further exacerbate dust emissions. PM10 exceedances represent a potential health risk for land users and workers near the Project site. Especially for at-risk groups such as elders, youth, and people with existing respiratory conditions. Request/recommendation: a) Denison must employ additional mitigation measures to reduce PM10 emissions on site including enhanced dust suppression efforts. b) Denison must remodel PM10 to include emissions from Cameco's McArthur River Mine and Key Lake Mill. c) Please provide information on how PM10 will be monitored during the Project and how Denison will know when exceedance conditions are occurring. d) Please provide information on how adaptive management will be used when a PM10 exceedance is discovered. Including discussion on how the Project will be managed during poor air quality events caused by wildfire smoke. e) Please provide information on how exceedances conditions near the Project site will be communicated to the public.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #72)	a) A change in a measurable parameter is not a significant effect, per the EA methodology outlined in Section 5. This threshold approach is both transparent and reasonable with the context of the assessment, though it is acknowledged that some level of change in the VC (or more precisely its measurable parameter) is deemed acceptable on condition that the change is not of a magnitude from which negative effects could accrue. Denison directs BNDN to Table 6.1-22 and 6.1-23 for the complete residual effect characterization for PM10 exceedances. This includes a consideration of the residual effect related to PM10 in the full context of direction, magnitude, geographic extent, duration, frequency, reversibility, context, and likelihood. In Section 10.1 of the draft EIS, the SMEs concluded that while there were predicted exceedances of air quality criteria for particulate matter, they were not identified for further assessment in the HHRA—these COPCs are unlikely to be associated with a human health or environmental risk, and any exposures to people at elevated concentrations would be infrequent, short-term, and highly localized. b) Please refer to Section 6.1.3.2. The regional SK MOE data presented in Table 6.1-12 were conservatively used to represent background concentrations of TSP, PM10, PM2.5, CO, SO2, and NO2 for the Wheeler River Project air quality assessment. While traffic associated with Cameco Operations was not modelled, conservative regional background concentrations from the Saskatchewan Air Quality Modelling Guideline (SK MOE 2012a) and the La Loche monitoring station were used for particulate matter, NO2, SO2, and CO (see Section 6.1.3.2.5 and Appendix 6-A). The La Loche monitoring station is located near anthropogenic sources, while the Project is in a remote area removed from anthropogenic sources. Accordingly, emissions to air from traffic associated with Cameco's operations are captured by the regional background concentrations used in the air dispersion model and are considered in the assessment of Project-related effects discussed in Section 6.1.4. Model predictions of COPC concentrations and depositions were added to background levels and compared to the available standards summarized in Table 6.1-5 at receptors located outside the property boundary.	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process.	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				c) and d) To confirm the residual effects of the Project on Air Quality and demonstrate compliance with provincial ambient air quality standards, an adaptive air quality management program will be implemented. The air quality management program will contain various plans which will be finalized during permitting and licensing. The plans within the air quality management program will incorporate monitoring requirements directed by provincial and federal regulators and by Indigenous groups and other Interested Parties as requested. In terms of worker health and safety while forest fire smoke is present, Denison will consider this through the Occupational Health and Safety Program. Information on how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property related to forest fires will be included in the Emergency Preparedness and Response Program. e) As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.				
Birch Narrows Dene Nation	Other	The Project is predicted to produce exceedances for uranium of 148% over of the regulatory limit. These exceedance conditions do not include uranium emissions from Cameco's McArthur River Mine and Key Lake Mill which have now resumed operations. Uranium exceedances represent a potential health risk for land users and workers near the Project site. Additionally, uranium deposition in the aquatic and terrestrial environment can cause effect pathways to humans through the food chain through the consumption of edible/medicinal plants, berries, fish, and wildlife. Request/recommendation: a) Denison must employ additional mitigation measures to reduce uranium emissions on site including enhanced scrubber systems and containment measures.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #73)	a) A change in a measurable parameter is not a significant effect, per the EA methodology outlined in Section 5. This threshold approach is both transparent and reasonable with the context of the assessment, though it is acknowledged that some level of change in the VC (or more precisely its measurable parameter) is deemed acceptable on condition that the change is not of a magnitude from which negative effects could accrue. Denison directs BNDN to Table 6.1-27: Air Quality – Summary of the Characteristics Ratings for Residual Effect 9 (Operation, 24-hour Uranium Exceedances) for the complete residual effect characterization. This includes a consideration of the residual effect (24-hour U exceedance during operation) in the full context of direction, magnitude, geographic extent, duration, frequency, reversibility, context, and likelihood. Further, in Section 10.1 of the draft EIS, all relevant radionuclides were assessed in the HHRA in terms of their contribution to the total radiological dose to human and ecological receptors and COPCs identified for air were radionuclides (U-238, U-234 and radon); refer to Table 10.1-7 for a summary of human health exposure pathways. The HHRA estimated dose	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		b) Denison must remodel uranium to include emissions from Cameco's McArthur River Mine and Key Lake Mill. c) Please provide information on how uranium emissions will be monitored during the Project and how Denison will know when exceedance conditions are occurring. d) Please provide information on how adaptive management will be used when a uranium exceedance is discovered. e) Please provide information on how exceedance conditions near the Project site will be communicated to the public.		and risk during all Project phases to the following receptors: camp worker, seasonal resident, recreational fisher/hunter, fisher/trapper. The incremental radiation dose to all human receptors during all Project phases is predicted to be below the regulatory public dose limit of 1 mSv/yr and the dose constraint of 0.3 mSv/yr during all Project phases. Overall, since the radiation dose estimates would be below the public dose limit, no discernable health effects are anticipated due to exposure of these receptors to radioactive releases from the Project. b) Please refer to Section 6.1.3.2. The Key Lake data from camp high volume air samplers from 2009 to 2018 (Table 6.1-13) were selected to represent background concentrations of uranium, arsenic, and nickel for the Wheeler River Project air quality assessment. Model predictions of COPC concentrations and depositions were added to background levels and compared to ambient air quality standards and criteria. c) and d) To confirm the residual effects of the Project on Air Quality and demonstrate compliance with provincial ambient air quality standards, an adaptive air quality management program will be implemented. The air quality management program will contain various plans which will be finalized during permitting and licensing. The plans within the air quality management program will incorporate monitoring requirements directed by provincial and federal regulators and by Indigenous groups and other Interested Parties as requested. e) As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.	collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. Denison does not anticipate any funding to BNDN at this time. BNDN will be informed throughout the monitoring program design and implementation process.			
Birch Narrows Dene Nation	Other	The Saskatchewan MOE Air Quality Modelling Guidelines specifies that the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) should be used for assessments in Saskatchewan. Denison opted to use the CLAMET/CALPUFF dispersion model for the EIS. Request/recommendation: Please provide additional rationale for the selection of the CALPUFF model over the provincially recommended AERMOD.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #74)	As described in Section B.1 of Appendix 6-A, staff at the Saskatchewan Ministry of Environment (Air Quality Branch) were consulted on the selection of CALPUFF and development of the CALMET meteorological data set, beginning in 2019. The CALMET consultation included an initial discussion about the general approach, and once the CALMET runs were completed, two technical memos were produced and reviewed by Ministry staff including: 1) a memo completed in March 2020 summarizing the general CALMET approach and results (e.g., wind roses,	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future

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				temperature data, precipitation data); and 2) a follow-up memo completed in May 2021, which answered specific questions posed by Ministry staff. Ministry staff also completed a review and provided feedback on the CALPUFF model setup in August 2021. The specific rationale for the use of CALPUFF in lieu of AEROMOD as documented in the March 2020 memo was as follows: the domain size needed to generate inputs for the human health and ecological risk assessment (HHERA) is estimated to be 60 km by 60 km. The Saskatchewan Air Modelling Guide recommends CALPUFF for long-range transport (i.e., > 50 km); CALPUFF includes wet and dry removal processes and chemical transformation algorithms that are needed to generate inputs for the HHERA and the terrestrial and aquatic assessments; and, the approach is consistent with other uranium mines in the area.				interests in the Project.
Birch Narrows Dene Nation	Other	Carbon dioxide emissions related to air travel for Project personnel were not included in the GHG emissions calculations. Project related emissions from air travel would be significant source due to the remote nature of the site. The GHG emission estimate included in EIS Appendix 6-C does not provide a fulsome representation of Project related GHG emissions. Request/recommendation: Denison must include emissions from air travel for project personnel in the GHG emissions calculations. This will provide a more accurate representation of project- related GHG emissions.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #75)	Assessment of upstream or Scope 3 GHGs under Environment and Climate Change Canada's Strategic Assessment of Climate Change guide are only required for projects that are likely to exceed the upstream threshold of 500 kt of CO2e per year. The upstream GHG emissions for the Project are expected to be well below this threshold (draft EIS Section 2.5) and in the range of 25 to 31 kt of CO2e.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	Denison acknowledges the Project's contribution to climate change through GHG emissions but does not outline a plan to offset GHG emissions. Other mines in Canada, including the Canadian Malartic Mine in Quebec have GHG offset plans in which carbon emissions are tracked and offsetting activities are developed in collaboration with local First Nations (Canadian Malartic, 2014). Request/recommendation: Denison must develop a GHG/Carbon offsetting plan to mitigate potential impacts of the Project to climate change. Denison could work with BNDN and other local First Nations on initiatives that help to offset the Project's GHG emissions (e.g. tree planting, wetland restoration, carbon offsets). This would demonstrate a commitment to corporate social responsibility, climate stewardship and reconciliation on Denison's behalf.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #76)	Denison anticipates being subject to ECCC's reporting requirements for emitters over 10,000 tonnes CO2e and the information is collected under section 26 of the Canadian Environmental Protection Act. In order to meet these reporting requirement, Denison will be tracking Scope 1 and 2 GHG emissions. Options to offset the Project's GHG emissions will be considered as the Project advances. In draft EIS Section 2.5 Greenhouse Gas Emissions Denison has committed to looking for opportunities to optimize energy management and improve the energy intensity of the Project where practical.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Project is reliant on burning diesel for construction, supplementary power generation, mine processing activities, and mine equipment. The GHG intensive nature of the Project's construction and operation phases are a concern for BNDN and not consistent with federal or provincial directives to reduce GHGs. Cleaner technology and fuel sources are available to reduce the Project's GHG emissions. For a project based around supplying fuel for the energy transition, a more progressive approach that utilizes Best Available Technology is required in order to reduce GHG emissions. Request/recommendation: Where feasible Denison must implement the use of low carbon technology and fuels in the final Project design to	BNDN Public Comment February 28, 2023 (BNDN Public Comment #77)	Thank you for the comment. The EIS is a planning tool and the details of Project design including use of fuels will be evaluated by Denison as the Project advances. However, we note that in Section 2.5 Greenhouse Gas Emissions of the draft EIS that Denison will look for opportunities to optimize energy management and improve the energy intensity of the Project where practical. In terms of EIS scoping for the basis of effects assessments, Denison took a conservative approach to estimating combustion products use by assuming back-up diesel generators were running continually (worst-case scenario). This is expected to bound actual Project fuel use.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		reduce GHG emissions. Specifically, Denison should redesign the Project to: o Replace all diesel electricity generation with LNG/CNG generators (and add in renewables where feasible) for construction phase o Replace all diesel powered mine equipment and vehicles with electric or LNG/CNG models o Use renewable energy sources for electricity generation (e.g. wind, solar) as early in the project lifecycle as possible						
Birch Narrows Dene Nation	Other	Denison does not specify how it will monitor air contaminant concentrations during all phases of the Project. Continuous on-site ambient air monitoring for all COPCs (including particulates, metals, and radon) is the only way to truly assess the Project's impact on air quality and compliance with government standards. Request/recommendation: Denison must conduct continuous on-site monitoring for all contaminants of concern (including particulates, metals, and radon) in order to assure regulatory compliance and verify the accuracy of air dispersion models and EIS predictions.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #78)	To confirm the residual effects of the Project on Air Quality and demonstrate compliance with provincial ambient air quality standards, an adaptive air quality management program will be implemented. The air quality management program will contain various plans which will be finalized during permitting and licensing. The plans within the air quality management program will incorporate monitoring requirements directed by provincial and federal regulators and by Indigenous groups and other Interested Parties as requested.	The plans within the air quality management program will incorporate monitoring requirements directed by provincial and federal regulators and by Indigenous groups and other Interested Parties as requested (Section 6.0)	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Proponent states that the UBS holding area will have leak detection (Figure 2.2-18). The system is shown as a pipe running under the pond. The Proponent states that the UBS holding area will have leak detection (Figure 2.2-18). The system is shown as a pipe running under the pond. Request/recommendation: a) BNDN requests more details on the leak detection system used for all ponds shown in Figure 2.2-18. b) BNDN requests that Denison respond to all the following questions in writing: • Is the pipe connected to an automated sensing system? • If not, how frequently is the system monitored? • What chemical or physical indicator(s) are used to detect a leak? • What are the detection limits/thresholds for each indicator? • What is the precision of each indicator? • Who is notified, and how quickly would a response be mobilized? c) BNDN requests to know what specific containment/restoration methods will be used in the event that a leak is detected, and how quickly they would be implemented. This applies to both the UBS holding area and process precipitate pond.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #80, #81)	It is important to note that Denison is completing a sequential EA and licensing process for the Project (see draft EIS Section 1).Denison considers the EA to be a planning and decision-making tool that assesses the potential effects of the Project in a careful and precautionary manner and integrates results of engagement with Indigenous nations and communities. The details requested by BNDN will be developed to support licensing and will be included in Management System programs / plans including for example the Groundwater Monitoring Plan and the Emergency Response and Preparedness Plan.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Proponent states that the wellfield pipelines will be designed to have secondary containment or catchment and have leak detection systems in place at key locations. BNDN requests more details on the leak detection system used for wellfield lines. Specifically, BNDN requests that Denison respond to the following questions: - Is an automated sensing system used? - Will automated controls shut off pressure in the event of a significant leak? - If no automation is used, how frequently is the system monitored?	BNDN Public Comment February 28, 2023 (BNDN Public Comment #83)	Wellfield piping system will transport the mining solution to and from the processing plant. The flow rates and pressures of the individual well lines will be monitored in the pumphouses. This data will be transmitted to the processing plant for remote monitoring through a master control system. Through the master control system, operators will be capable of controlling pumphouse production lines remotely. The specific details requested by BNDN in this comment are not available at this time and will be developed as part of detailed design to support Project licensing and permitting. Denison considers the EA to be a planning and decision-making tool that assesses the potential effects of	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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		- What chemical or physical indicator(s) are used to detect a leak? - What are the detection limits/thresholds for each indicator? - What is the precision of each indicator? - Who is notified, and how quickly would a response be mobilized?		the Project in a careful and precautionary manner and integrates results of engagement with Indigenous nations and communities. Denison views the EIS as an important planning tool that will be used to support future activities and represents one stage in the rigorous overall approvals process for a uranium mining facility in Canada. Denison completed feasibility designs for the Project in 2023. The engineering design of the wellfield pipelines including control measures to monitor and respond to leaks will be included in the detailed design information provided to the CNSC during Project licensing.				
Birch Narrows Dene Nation	Other	The Proponent states that the well designs and operational monitoring of the wellfield will mitigate accidental release of mining solution or UBS in the sandstone above the mining area Request/recommendation: BNDN requests to know how Denison will monitor the integrity of wells once in production. Will tests be conducted at regular intervals?	BNDN Public Comment February 28, 2023 (BNDN Public Comment #84)	The well designs and operational monitoring of the wellfield will mitigate accidental release of mining solution or UBS in the sandstone above the mining area. Each well will have double containment: mining solution will travel inside an inner casing with the outer casing acting as secondary containment for the mining fluids. Wells will be continually monitored for operational parameters such as injection pressures, injection flow rates, and recovery flow rates. This data will be transmitted to the processing plant for remote monitoring through a master control system. Through the master control system, operators will be capable of controlling pumphouse production lines remotely. Wellfield monitoring will facilitate detection of any issues with the injection and recovery wells. A network of monitoring wells installed within the freeze wall area will be equipped with pressure instrumentation for the determination of the vertical strain/stresses placed on the formation to do mining zone space creation. This monitoring network is designed to detect if these strains may be approaching their acceptable levels prior to failure. The injection and recovery wells will also be equipped with devices for pressure and temperature that can detect a breach in the well casing if one were to occur. As a preventative measure, annual mechanical integrity testing is conducted on the wells to ensure their containment and compliancy. Active monitoring will allow for operational shutdown if a scenario is approaching a failure mode.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Proponent states that fuels will be stored in approved, above-ground, 25,000 L double-walled storage tank(s) equipped with secondary containment in accordance with provincial regulations and standards. Request/recommendation: BNDN requests to confirm when the permanent fuel storage facility will be constructed. If temporary fuel storage for construction is required, indicate how much, how it will be stored and dispensed, and show on a sketch where it will be located. Construction fuel requirements for site development may be significant.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #85)	Details on when Denison will construct the permanent fuel storage facility or precisely where temporary fuel storage tanks will be located are not available at this phase of the Project and these details are not required to support EIS review. However, at the EIS stage it is important to note that Denison is committed to construction and operating all fuel storage and distribution infrastructure in accordance with applicable legislative requirements. Fuels will be stored in approved, above-ground, double-walled storage tank(s) equipped with secondary containment in accordance with provincial regulations and standards. In Saskatchewan, the permitting process for hazardous substances including above ground storage tanks for diesel, propane, gas, and jet fuel are governed by The Hazardous Substances and Waste Dangerous Goods Regulations; Environmental Code Chapter E-10.2 Reg 3 (HSWDG). Denison will need to apply for an Approval to Construct, Install, Alter and Expand a Storage Facility and Store Hazardous Substances and/or Waste Dangerous Goods and secure an approval from the Ministry of Environment pursuant to The Environmental Management and Protection Act, 2010, and The	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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				Hazardous Substances and Waste Dangerous Goods Regulations. Denison will have to adhere to the Terms and Conditions of the approval, complete regular inspections of the facilities, and maintain an Emergency Response Contingency Plan. The Ministry of Environment staff also conduct regular inspections to ensure the conditions of the approval are being followed.				
Birch Narrows Dene Nation	Other	The Proponent states that process precipitates may be stored in totes inside the process precipitate pond. Request/recommendation: BNDN requests details on the procedures for placement and handling of precipitate totes within the pond. Care should be taken to ensure that equipment and totes do not compromise the pond lining. Totes should be sealed and transport of totes from the plant to the pond should be carefully planned to minimize the risk of a spill, and in the event of a spill ensure that runoff is captured on the site.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #86)	The precipitate pond is proposed as a lined area with berms (as shown in Section 2, Figure 2.2-18) and may be more clearly described as being a lined pad. As such, process precipitates can be placed into totes, which can be placed on the lined area ('pond') for containment during storage. Details on the plans for precipitate management, placement and handling will be developed to support Project licensing and permitting. Denison agrees the integrity of the liner and totes are important considerations which will be factors in the plans. We also refer BNDN to the following draft EIS sections and comments responses: - Waste Management: Waste management is described in Section 2.2.4 of the draft EIS and includes discussion of all waste types that will be generated by Project-related activities. The following is noted in Section 2.2.4 for reference, "Conventional waste, radiologically contaminated waste, and hazardous waste will be managed at the Project. Denison is committed to conducting stringent waste characterization throughout the life of the Project. This includes physical, radiological, and chemical characterization to maintain accurate waste inventories and determine how wastes will be dispositioned through either re-use, recycling, temporary storage, or permanent disposal (on or off site). This includes clearance of material that meets unconditional release requirements and can be safely removed from site. A waste management program will be developed for the Project to support licensing and permitting. The waste management program and associated plans developed to support licensing will be based on the 4 R's: Reduce, Reuse, Recycle, and Recover, and will detail how each type of waste generated on site will be managed. Resources used to develop the waste management program will include, but are not limited to, the CNSC's REGDOC-2.11 series, related Canadian Standards Association (CSA) standards, and the Hazardous Substances and Waste Dangerous Goods Regulations (Government of Saskatchewan 2000)." - Water Management: Water management is described in Section 2.2.3 of the draft EIS and includes Denison's commitment to capturing any contact water. Clean, non-contact runoff will be diverted around Project components where possible. Contact water, including, for example, runoff from the wellfield and around the processing plant, will be collected in various ponds and eventually routed through the IWWTP for treatment prior to release to Whitefish Lake. Refer to Figure 2.2-17 for runoff collection assumptions. - Emergency Preparedness and Response Program: Please also see Denison's response to BNDN comment 87 below for information on the Emergency Preparedness and Response Program.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.

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Birch Narrows Dene Nation	Other	Denison states that they will maintain an up-to-date record of the various hazardous substances on site and will maintain Safety Data Sheets and appropriate procedures for spill management, handling, and clean up in an accessible location Request/recommendation: - BNDN requests a description of the safety and spill response training programs that employees will undergo. What is the duration of each training program and how often will retraining be conducted? - BNDN requests to know what resources will be kept on site for management and clean- up of spills, for example spill kits, absorbents, neutralization agents, vacuum trucks, PPE, hand tools, etc.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #87)	The details requested related to the Emergency Preparedness and Response Program are being developed to support licensing efforts. The EIS is a planning tool to provide an assessment of the potential Project effects on the human and biophysical environment; at the EIS stage a detailed Management System is not required. A brief description of the Emergency Preparedness and Response Plan is provided in the draft EIS, Section 2.9.1.3.5: and included below for reference. Please also refer to draft EIS, Section 14 Accidents and Malfunctions for an assessment of the potential accidents and malfunctions that could occur in association with the Project and a description of the potential effects on human health or the biophysical environment, considering environmental design features and mitigation measures that would be implemented to reduce such effects. 2.9.1.3.5 Emergency Preparedness and Response Program The Emergency Preparedness and Response Program would identify how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property. The objectives of the program would include the following: • identification of accidents and emergencies and the actions and responsibilities in the event of an emergency; • Project requirements for emergency response equipment and personnel; • internal incident command structure to effectively manage complex, lengthy, and large scale emergencies; • required communications with external emergency services, statutory bodies, and public, Indigenous groups, and regulatory agencies; • development of appropriate emergency procedures; and • assurance of availability of vital information during an emergency. Emergency Preparedness and Response Program would be developed consistent with guidance provided by CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Proponent describes various measures used to mitigate yellowcake dust emissions: the yellowcake drying and packaging area will be outfitted with hygiene systems to capture dust generated during the material handling of the yellowcake product and sent to either the dryer or calciner venturi scrubbers. All equipment located after the dewatering of the yellowcake will be selected to provide minimal dust generation and outfitted with dust collection systems where required. The ventilation system in this area of the processing plant will also be adequately designed to provide safety of workers and control fugitive dust emissions. Request/recommendation: BNDN recommends redundant hygiene systems be installed (n+1 units) to ensure continuity of air filtration in the event of equipment failure.	BNDN Public Comment February 28, 2023 (BNDN Public Comment #88)	Should dust collection systems in the yellowcake drying and packaging area fail and generate a hazard for the workers, the plant will be shut down until repairs are completed. A redundant hygiene system is not economical to implement. Hygiene scrubbers are typically very reliable and can be repaired in short time frames.	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about the progression of the Project, and will be responsive to BNDN's future interests in the Project.
Birch Narrows Dene Nation	Other	The Proponent states that all contaminated areas will be fenced to avoid contact with workers and wildlife. Fences will be monitored and maintained.	BNDN Public Comment February 28, 2023 (BNDN	Access to the property will be controlled by both a north and south security gate. In the draft EIS, Denison has committed to fencing the domestic landfill (Section 2.2.4.3.1) and having a fenced storage area near the operations centre. Details on the size and type of fencing are not	N/A	Resolved - agreement reached by both parties	As per letter received January 18, 2024	Denison will continue to ensure BNDN is informed about

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		Request/recommendation: - BNDN requests to know the size and type of fence considered for each project area. - Confirm if the wellfields will be fenced. Show all fences on a site layout drawing like Figure 2.2-1.	Public Comment #89)	defined at this stage of the Project, but will meet the criteria outlined in the EIS. The wellfield is not proposed to be fenced. For the wildlife-specific mitigation measures, refer to Section 9.3.5.2.5 Wildlife Deterrence and Prevention of Wildlife Entrapment and Section 9.3.5.2.8 Waste and Hazardous Materials Management.				the progression of the Project, and will be responsive to BNDN's future interests in the Project.
English River First Nation	Current use of lands and resources for traditional purposes	Interest in sharing IK and history, and integration of this information in EIS.	ROC 5 ROC 100 ROC 103 ROC 104 ROC 134 ROC 137 ROC 140 ROC 310 ROC 473 ROC 618 Draft EIS Comments	As detailed in Section 3.4.2.1, English River First Nation provided a land use map dated 2017 for Denison to gain an understanding of the extent and distribution of land use in the Project area. This map is published in the Project Terms of Reference (TOR; Denison 2019). To supplement the mapping information, funding was provided to ERFN to write their own independent contribution to the EIS, with assistance from Shared Value Solutions. English River First Nation produced a draft Traditional Knowledge Study and Health and Socio-Economic Study Results document that was split and finalized into two summary reports: 1) Wheeler River Project – Summary of Health and Socio-Economic Study Results (ERFN and SVS 2022a); and 2) Wheeler River Project - Summary of Traditional Knowledge Study Results (ERFN and SVS 2022b). The studies collectively documented baseline land use and socio- economic conditions and identified Project-related concerns and opportunities. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	Denison has previously compensated a trapper potentially affected by exploration activities in and around the Project based on the potential for commercial loss, who has since passed away. This will be assessed going forward based on the potential for the Project to negatively effect commercial loss, and where appropriate, Denison will compensate accordingly.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Current use of lands and resources for traditional purposes	Concerns were shared about the potential effects of Project construction on wildlife, including possible effects on game for hunting. Noted desire to document pocket (location) for caribou calving as well as an ongoing role in the mitigation of any possible effects.	ROC 5 ROC 100 ROC 134 ROC 447 ROC 456 ROC 473 ROC 506 ROC 516 Draft EIS Comments	Section 9.3.3.3.2 discusses the referenced calving habitat, which is along Fox Lake Road, well outside the Terrestrial RSA and mitigation measures for the Project (Section 9.3.5) consider the elimination and reduction of the direct and indirect disturbance of caribou in sensitive habitat and during sensitive time periods (such as calving). Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	Denison has developed a Conceptual Caribou Mitigation Plan based on discussions between Denison and Saskatchewan Ministry of Environment.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Interest in understanding existing water flows and existing fish species composition, size, and quality.	ROC 5 ROC 134 Draft EIS Comments	Section 8.3.3.2 indicates that presence or absence of fish in the subwatersheds of the LSA is summarized in Table 8.3-5 and Figure 8.3-6 and Figure 8.3-7. These include a number of large-bodied species (i.e., Northern Pike, White Sucker. Longnose Sucker, Artic Graying, Walleye, Lake Trout, Lake Whitefish, and Burbot), as well as small-bodied forage fish species (i.e., Ninespine Stickleback, Slimy Sculpin, Spottail Shiner, and Yellow Perch). As barriers to fish movement were not identified, the absence of a species in lake or river habitats does not necessarily confirm that the species does not inhabit that area; rather, that the species was not actively captured, or the area is not characteristic of preferred habitat for the species. Fish spawning habitat for several species was confirmed in the LSA, both through LK and confirmatory field reconnaissance. This	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				habitat is summarized in Table 8.3-3 and Table 8.3-4 and Figure 8.3-8, Figure 8.3-9, and Figure 8.3-10. Known spawning habitat occurs for Northern Pike, White Sucker, Longnose Sucker, Artic Graying, Walleye, Lake Trout, and Lake Whitefish in the LSA and Russell Lake, as well as upstream of the Project in the Icelander River system. The Baseline Hydrology Report included as Appendix 8-B indicates that the Project area lies within the Wheeler River watershed, which is part of the Churchill River Basin. Surface water from the Project site is drained by two sub-basins of the Wheeler River, the Icelander River drainage and the Williams Lake drainage. Both drainages flow generally south into the northwest portion of Russell Lake. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.				
English River First Nation	Current use of lands and resources for traditional purposes	ERFN provided information about Furblocks N-18 and N-16 being amalgamated into single management by ERFN a while back, under a co-management regime.	ROC 5 ROC 134 ROC 137 ROC 140 ROC 456 ROC 618 Draft EIS Comments	The EIS notes in Section 11.1.4.4.1 that Furblock N-18 and N-16 have been amalgamated under a co-management regime between the province and ERFN. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Questions and clarifications on ISR mining methodology, including freeze wall technology and Project power requirements.	ROC 5 ROC 134 ROC 137 ROC 140 ROC 456 ROC 618 ROC 621 Draft EIS Comments	Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface. Section 2.2.1.3 provides information on freeze wall technology. The freeze wall is intended for tertiary containment of mining solution to support a defence in depth strategy as additional, site-specific data is obtained on hydraulic containment. The freeze wall around the mining area will extend from the surface to the basement rock, isolating the mining area from regional groundwater. The freeze wall is expected to be a minimum of 10 m thick, be installed 25m away from the uranium deposit, and extend 30 m into the basement rock. Data from the groundwater monitoring network installed in and around the wellfield and freeze wall will make sure the freeze wall is meeting design specifications. Sections 2.2.6.1 and 2.2.6.2 provide information on primary and back-up power supplies. Electrical service to the Project will be provided via an approximate 5-km extension tap from the existing 138 kV overhead transmission line that runs along Highway 914. To provide electrical service during times of utility outages, diesel generators will be installed to service the site and maintain essential functions. Through the draft EIS review process, Denison has worked directly with	General discussions to continue as part of ongoing dialogue.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.				
English River First Nation	Current use of lands and resources for traditional purposes	Concern about safety of mine shaft and groundwater, specifically determination of the Project being in vicinity of underground rivers.	ROC 5 ROC 134 ROC 140 ROC 447 ROC 618 Draft EIS Comments	Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface. Groundwater flow is influenced by a number of factors and, as such, varies within the LSA. Baseline information on groundwater flow rates can be found in the Geology and Groundwater section of the EIS. Groundwater monitoring wells will be installed at various depths and locations in and around the wellfield, as outlined in Section 2.2.1.5. The monitoring wells have a variety of purposes including groundwater sample collection, measurement of groundwater levels, and detection of changes in pressure and temperature in the groundwater environment. A detailed groundwater monitoring program will be developed as component of the environmental management system as part of the licensing and permitting process. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Health and socio-economic conditions	Concern and interest in economic opportunities associated with the Project and education and training to facilitate access	ROC 5 ROC 99 ROC 140 ROC 447 ROC 456 ROC 618 ROC 621 Draft EIS Comments	Sections 13.3.2.1 and 13.4 incorporate the following information: Denison has estimated a workforce of 300 people for the two-year Construction period. Each component of Construction will require workers with different types of skills and training depending on the task (e.g., road construction, wellfield drilling, erection of buildings, connection to services). During Operation, over 180 people are expected to be employed to operate the ISR wellfield and processing plant, as well as provide various supporting activities such as security, camp operations, operation of the water treatment, sewage and potable water plants, environmental monitoring, and maintenance of roads, equipment, and buildings. Total employment level of over 180 people is estimated to include 155 employees and 29 contracted. The anticipated workforce breakdown for Operation of the Project includes the following types of positions: Foundation (82 jobs), Trades (35 jobs) Profession/Technical (46 jobs), Supervisory (21 jobs). Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying	Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.				
English River First Nation	Other	Concerns about climate change were shared, including inquiring about possible changes to permafrost on the Wheeler River.	ROC 100 ROC 134 ROC 621 Draft EIS Comments	Section 9.1.7.1.1 provides information on permafrost. The Project is in a mapped area designated as Sporadic Discontinuous Permafrost. Large and/or expansive areas of continuous cryosolic soil and permafrost terrain do not occur within the RSA. For this reason, the potential effects are not expected to affect terrain stability within the Project Area within the life of the Project. Section 5.9.9 provides detail on the considerations of climate change throughout the EIS. Within the CEA of applicable VC-specific sections, a subsection has been included that provides a brief discussion on how climate change has been considered. Climate change has been included in the cumulative effects section because it is an external force that can influence the potential effects of the Project. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Health and socio-economic conditions	Concern with process for business interactions with all communities and reflecting Indigenous perspective in business transactions	ROC 100 ROC 172 ROC 173 ROC 447 ROC 456 ROC 474 ROC 618 Draft EIS Comments	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in the Economics section of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Interest to make sure Elders are included throughout the process and have a meaningful and accessible role.	ROC 100 ROC 172 ROC 173	Denison has applied a variety of methods to support engagement activities throughout the engagement process and used different methods with various groups depending on requirements and	Commitment to ongoing engagement and adaptation to requests from ERFN	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between

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			ROC 447 ROC 456 ROC 474 ROC 618 Draft EIS Comments	preferences of the process. Examples of this include local radio shows, presentations, and translations in both written and oral format. Determination of methods for ERFN specific engagement processes have been, and will continue to be, based on direct interaction with ERFN. Section 4.3.2 outlines engagement with ERFN to date. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.				Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Concern identified about how waste, such as radium iron material, would be handled.	ROC 100 ROC 618 Draft EIS Comments	Section 2.2.4 provides information on waste management. A waste management program will be developed for the Project to support licensing and permitting. The waste management program and associated plans developed to support licensing will be based on the 4 R's: Reduce, Reuse, Recycle, and Recover, and will detail how each type of waste generated on site will be managed. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	A waste management program will be developed for the Project to support licensing and permitting.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Concern about possible soils and surface disturbances.	ROC 100 ROC 618 ROC 621 ROC 473 Draft EIS Comments	Denison responded to concerns about surface disturbance due to activities in an Advisory Committee Meeting on June 15, 2021, as documented in ROC 473. Section 7.4.2.2 indicated that the assessment predicted maximum vertical displacement in altered sandstone immediately above the mining area (17.5 cm). A very minor change in elevation at ground surface (of less than 7.5 cm) was predicted within a discrete and localized area overlying the ore body. This degree of change may not be measurable as it is likely within the range of ground surface elevation change/disturbance associated with other routine operations at surface. The assessment evaluated what is considered the 'worst-case' scenario from a stability perspective. The model evaluated post-extraction stability as a single mass loss event across the entire active mining area. In reality, the mining area will be mined in phases and the phased approach is anticipated to lessen potential effect(s) on geological stability. In alignment with the modelling approach, the potential Project-related effect of subsidence was assumed to occur, essentially instantaneously, upon termination of mining (i.e., at the end of Operation). The modelling work is considered to provide a worst-case bounding scenario: if subsidence were to occur during the. Project phases or in the years following mining, the extent of vertical displacement is not expected to exceed that predicted in the modelling. Monitoring will be undertaken to evaluate any vertical displacement at ground surface (Section 7.8.1). Mitigation measures include contingency plans for stabilization of the geological environment localized to the mining area (Section 7.5). Therefore, this potential effect is not expected to be a primary contributor to potential residual effects following application of the proposed mitigation measures.	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.				
English River First Nation	Health and socio-economic conditions	ERFN noted a concern that people who have worked in the territory previously coming back to the territory for cabins. Can you integrate Indigenous land use into the economic assessment?	ROC 117 ROC 136 ROC 137 ROC 140 ROC 145 ROC 447 Draft EIS Comments	Section 13.2.3 provides detail on the consideration of the traditional economy as a key indicator as part of the economic valued component. The effect of Project-related activities on the traditional economy is measured as the change in the proportion of LSA residents participating in the traditional economy. See the Economics section of the EIS for more information. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	Indigenous Knowledge has been integrated throughout Section 13 Economics and Section 13.1.4 provides further details on the influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Economic Assessment. Denison notes that the "Traditional Economy" was included as a key indicator in Section 13 and was integrated in a fulsome manner. Of note, Denison has previously compensated a trapper potentially affected by exploration activities in and around the Project based on the potential for commercial loss, who has since passed away. This will be assessed going forward based on the potential for the Project to negatively effect commercial loss, and where appropriate, Denison will compensate accordingly.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Health and socio-economic conditions	A concern was expressed about radiation and water levels exceeding targets.	ROC 447 Draft EIS Comments	Section 2.2.3 outlines Denison's intent to recycle process water to the greatest extent possible, thereby reducing the demand for fresh water supply. In an effort to develop a conservative assessment basis for the EA, the water recycle flows from the industrial wastewater treatment plant back into the processing plant and wellfield have not been incorporated into the estimates for freshwater withdrawal and treated effluent discharge. Section 7.4.2.1 provides information on the site water balance. Water taking at a volume of 35m3/hr is anticipated throughout the construction. Discharge to the environment is not expected during construction. The main source of water taking for operation of the mine and to maintain water balance will be from groundwater sources. However, to supplement these volumes, surface water taking from Whitefish Lake was considered as part of the Surface Water Quantity assessment. Releases to the natural environment of contact water will be directed through the applicable collection ponds, Industrial Waste Water Treatment Plant, and Effluent Monitoring and Release Ponds. Discharge will only occur once it	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				is safe to do so. Denison does not intend to include constant freshwater withdrawal or effluent discharge throughout operation; however, for the purpose of assessing the scenario of greatest potential effects, the Project was assessed as having a continuous freshwater withdrawal rate of 40.5m3/hr and a continuous effluent discharge rate of 81.0m3/hr. Water levels within surface water bodies were monitored over several years. The range of observed water levels at Whitefish Lake (SA-6) during 2016-2018 was 499.5 to 500.2 m ASL, with an average of 500.1 m ASL; as such the value assigned in the model (500.0) is an accurate (and slightly conservative) reflection of the average water level observed. What is important is the hydraulic head difference over the 300-year (or more) transport travel time. Recognizing that future conditions could be different by as much as 2 m (i.e., the depth of Whitefish Lake), this range of water level could be tested. Through the implementation of mitigation measures, outlined in Section 8.2.5, water quality in Whitefish Lake and, by extension, downstream of Whitefish Lake will meet appropriate benchmarks for the protection of aquatic life in consideration of a small mixing zone in the lake. Following Decommissioning and the restoration of drainage patterns that are similar to pre-mining conditions, water quality is expected to meet appropriate benchmarks for the protection of aquatic life in Whitefish Lake and downstream. This includes Russell Lake of which the Icelander River system is associated. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.				
English River First Nation	Current use of lands and resources for traditional purposes	Elders said after natural disasters (i.e., forest fires) it could take 35 years (to regenerate). The Project area is burnt with the exception for some non-burned patches that caribou have used. The moose are coming back slowly.	*Wildlife ROCs above* ROC 134 ROC 473 Draft EIS Comments	As detailed in Section 3.4.2.1, English River First Nation provided a land use map dated 2017 for Denison to gain an understanding of the extent and distribution of land use in the Project area. This map is published in the Project Terms of Reference (TOR; Denison 2019). To supplement the mapping information, funding was provided to ERFN to write their own independent contribution to the EIS, with assistance from Shared Value Solutions. English River First Nation produced a draft Traditional Knowledge Study and Health and Socio-Economic Study Results document that was split and finalized into two summary reports: 1) Wheeler River Project – Summary of Health and Socio-Economic Study Results (ERFN and SVS 2022a); and 2) Wheeler River Project - Summary of Traditional Knowledge Study Results (ERFN and SVS 2022b). The studies collectively documented baseline land use and socio- economic conditions and identified Project-related concerns and opportunities. The information, in addition to other information provided by ERFN through engagement, has been incorporated into Section 11 and throughout the EIS. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding	Indigenous Knowledge has been integrated throughout the EIS, for example Section 9.1.2, Section 9.2.2, Section 9.3.2, Section 9.4.2, 11.1.2, Section 11.2.2, and Section 13.1.4 provides further details on the influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Terrestrial Environment, Land and Resource Use, and Economy. Of note, Denison has previously compensated a trapper potentially affected by exploration activities in and around the Project based on the potential for commercial loss, who has since passed away. This will	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				concerns. Denison and ERFN have come to resolution on this area of interest.	be assessed going forward based on the potential for the Project to negatively effect commercial loss, and where appropriate, Denison will compensate accordingly.			
English River First Nation	Current use of lands and resources for traditional purposes	Concern about responsible authority for restoring the environment, including contaminants when mining concludes. How long will it take to have the environment fully restored and, if Denison is no longer the operator, how will this be completed?	*Project description listed above* ROC 140 ROC 447 ROC 456 ROC 506 ROC 618 ROC 621 Draft EIS Comments	Section 2.3.3 provides information on decommissioning. The conceptual decommissioning plan highlights that remediation of the mining area will continue until water reached and is demonstrated to be stabilized at acceptable mining area decommissioning objectives as set out in regulatory requirements. Additional detail will be provided in the preliminary decommissioning plan (PDP), which will be submitted to regulators as part of Project licensing and permitting. Prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan, that builds upon the PDP, to regulators for acceptance. A Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and licence conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	Additional detail will be provided in the preliminary decommissioning plan (PDP), which will be submitted to regulators as part of Project licensing and permitting. Prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan, that builds upon the PDP, to regulators for acceptance. A Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and licence conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Physical and cultural heritage	Better understanding of the heritage assessment done and the proposed plans for responding to the identification of a heritage artifact.	ROC 591 Draft EIS Comments	Following the implementation of the mitigation measures outlined in the Heritage Resource Management Plan (HRMP), the likelihood of residual effects is considered low and residual effects on Heritage Resources will occur infrequently and can be mitigated with the HRMP. Known archaeological resources identified in the Project Area were deemed to have low potential for archaeological interpretation and additional work or mitigation measures were not required for the sites; the Heritage Conservation Branch had no further concerns with these sites and work could proceed as planned. Should unknown archaeological and cultural resources be identified during the Project, effects will be mitigated using the HRMP. While effects to archaeological resources are irreversible, they can be mitigated by following the HRMP, by either avoiding additional damage to the resource by creating a buffer zone around the site, or by assessing the resource according to The Heritage Property Act to enable the full interpretation of the site before continuing with work. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding	Denison committed to including a consultation element with ERFN in the Heritage Management Plan, should an artifact be found during the development of the Project.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				concerns. Denison and ERFN have come to resolution on this area of interest.				
English River First Nation	Current use of lands and resources for traditional purposes	Concern about how the Project may limit or restrict access to the area for hunters and resource users.	*Listed above in Indigenous Land and Resource Use*	ROC473 contains a discussion pertinent to access, in which ERFN highlights satisfaction with the existing controls in place (i.e., Cameco's Key Lake Operation gate. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	Section 12.3.3.2.1 of the EIS describes how access north of the Key Lake gatehouse for employees of northern mines, Indigenous resource harvesters from select communities, cabin owners, and lease owners provides for controlled access to users. Access beyond the Key Lake gate is currently restricted, although some members of ERFN are provided access to the Key Lake - McArthur River mine haul road if they are on the Ministry of Environment list or have received a gate access pass. Denison has designed the security for the site in accordance with engagement outcomes with ERFN, which are to include a security gate at both the south and north location and to allow ERFN members to access areas beyond the gate.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Interest in making sure copies of the EIS are available to the public before public hearings.	*Listed above in Engagement	Pursuant to CEAA 2012, copies of the final EIS are made available to the public in advance of a Commission Hearing. Through the draft EIS review process, Denison has worked directly with ERFN to understand, consolidate and resolve any of its outstanding concerns. Denison and ERFN have come to resolution on this area of interest.	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Concern was raised for the use of the more sophisticated CALPUFF modelling package rather than Meteorological Society / Environmental Protection Agency Regulatory Model. Has the province accepted this method as appropriate? Concern is in reference to Section 6.1.4.2.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 1)	As described in Section B.1 of Appendix 6-A, staff at the Saskatchewan Ministry of Environment (Air Quality Branch) were consulted on the selection of CALPUFF and development of the CALMET meteorological data set, beginning in 2019. The CALMET consultation included an initial discussion about the general approach, and once the CALMET runs were completed, two technical memos were produced and reviewed by Ministry staff including: 1) a memo completed in March 2020 summarizing the general CALMET approach and results (e.g., wind roses, temperature data, precipitation data); and 2) a follow-up memo completed in May 2021, which answered specific questions posed by Ministry staff. Ministry staff also completed a review and provided feedback on the CALPUFF model setup in August 2021. The specific rationale for the used of CALPUFF in lieu of AEROMOD as documented in	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				the March 2020 memo was as follows: • The domain size needed to generate inputs for the human health and ecological risk assessment (HHERA) is estimated to be 60 km by 60 km. The Saskatchewan Air Modelling Guide recommends CALPUFF for long-range transport (i.e., > 50 km); • CALPUFF includes wet and dry removal processes and chemical transformation algorithms that are needed to generate inputs for the HHERA and the terrestrial and aquatic assessments; and, The approach is consistent with other uranium mines in the area.				
English River First Nation	Other	ERFN would like to further understand the progressive remediation of the mining area proposed, including thawing of the freeze wall in phases; it is believed reasonable for ERFN to request the following: i. Engagement between ERFN and Denison Mines throughout the life of the project, specifically pertaining to the remediated / restored solution targets and associated environmental effects monitoring. ii. The EIS appears to only provide the remediated / restored solution targets and the concentration of COCPs following mixing in Whitefish Lake Middle (the basin where impacted groundwater expected to interact with the receiving environment). ERFN requests clarification on the targets and concentrations in the EIS. iii. Alignment of environmental risk assessment updates and review of updates by ERFN prior to execution of progressive mine area remediation phases. iv. Prior to freeze wall thaw, there should be approved progressive decommissioning objectives that are considered conservatively protective of the receiving environment and contingency planning that would allow for continued remediation following freeze wall thaw, if this is deemed necessary by monitoring results. Further, the progressive decommissioning objectives should be considered living and reviewed regularly, as a finalized decommissioning and closure plan has not been approved. Concern is in reference to Section 2.3.3.1.1.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 2)	With respect to: i. Denison has committed to meeting the mining area decommissioning objectives presented in the draft EIS (Table 2.3-3). These were modelled in draft EIS Section 7 with recharge to Whitefish Lake. Refinement of mining area decommissioning objectives is expected as part of updates to the decommissioning plan, which forms the basis of the decommissioning cost estimate and associated financial assurance. The conceptual decommissioning plan (CDP) included in the draft EIS (Section 2.3.3) contains the appropriate level of detail for this stage of the Project and recognizes that the details of the decommissioning plan and the elements thereof (including remediation and restoration targets and monitoring) will evolve and become more detailed and specific as the Project advances. The subsequent iteration of the plan is the preliminary decommissioning plan (PDP) which will be submitted to regulators as part of Project licensing and permitting. The PDP would reflect input that will be solicited from ERFN and others prior to its submission. Finally, prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan (DDP) to regulators for acceptance, which builds on the PDP. In this case the DDP would reflect input that will be solicited from ERFN and others prior to its submission and would also be informed by conditions on the ground at the Project site at that time, operational experience that has been gained and the regulatory landscape at that time. To reiterate, as highlighted above, the decommissioning plan, including the mining area decommissioning objectives, will evolve over time becoming more detailed and specific as the Project advances. Denison is committed to working with ERFN to solicit input through this process. ii. From Denison's response and EIS contents, Denison is committing to no residual effects to groundwater beyond the mining area during operations and during decommissioning activities; nor effects from changes in groundwater to surface water in the vicinity of the project during the same time period. As such, no potential groundwater effects pathway occurs until restored solution targets are achieved and controls isolating the mining area are removed. As interpreted, this would imply that during operations and early decommissioning activities, there will be no measurable change to groundwater outside of the mining area. iii. As recommended, Denison will work with ERFN to align the ERA updates and reviews of those updates as recommended. iv. The narrative posed by the review comments is consistent with Denison's perspective on how the decommissioning process (and therefore development of the decommissioning plan including	Denison has committed to meeting the mining area decommissioning objectives presented in the draft EIS (Table 2.3-3). Denison has committed to no residual effects to groundwater beyond the mining area during operations and during decommissioning activities; nor effects from changes in groundwater to surface water in the vicinity of the project during the same time period. Denison will work with ERFN to align the ERA updates and reviews of those updates as recommended.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				decommissioning objectives) will be implemented. The reader is further referred to the response to part i provided above that describes the overall progression of the CDP to the DDP. As noted, Denison will engage with ERFN to solicit input during all phases of the process and Project.				
English River First Nation	Other	ERFN would like clarification on whether or not start up of backup generators for the injection and recovery wells and IWWTP will be immediate? Is there a concern of loss of mining solution containment because of a power outage? ERFN understands there will be planned period when the IWWTP will be offline, does this planning also encompass unplanned events? ERFN requests commitment from Denison Mines of ongoing engagement pertaining to the development of the wellfield environmental effects monitoring and Emergency Preparedness and Response Plan. Concern is in reference to Section 2.2.6.2.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 3)	Electrical service to the Project will be provided via an approximate 5-km extension tap from the existing 138 kV overhead transmission line that runs along Highway 914. Denison expects an average of six outages per year based on information provided by SaskPower. An outage would be anticipated to last a few hours for a given event. As noted in the draft EIS, Denison will have back-up power supply available with diesel generators to supply power to essential services and functions. In the event of a power interruption, essential services would include the processing plant HVAC system and ensuring the power to the processing plant was maintained to provide Denison the overall ability to shutdown the processing plant in a safe manner. While this is happening (i.e., processing plant shut down), the majority of the electrical loads from the generators will be directed to these activities. Once the processing plant is shutdown safely, loads can then be redirected on a priority basis. In terms of the wellfield operation, the inwards hydraulic gradient only needs to be maintained when mining solutions are being injected. In the event of a power interruption, no mining solution injection would be occurring, therefore no UBS recovery would be required for vertical containment as the system would become static. Denison may use the "sit and soak" method in the wellfield as part of routine ISR mining (i.e., no injection or recovery) which essentially provides Denison the ability to store or hold solutions underground. In terms of the freeze wall, the design and nature of the freeze wall means that the integrity of the freeze wall will not change during short-term power outages. Even if a longer outage is envisioned, freeze wall integrity is would not be compromised. Once developed, the freeze wall would take months to thaw. It is also noted that the freeze wall provides tertiary containment of the mining solution / UBS. With regard to unplanned events and/or care and maintenance situations, Denison would manage the wellfield as follows: 1. Provided power is still available to site the UBS can be used as make-up in the mining solution and recirculated into the wellfield in a closed loop system. 2. If power is lost to the site, the well pumps can be shut off with existing mining solution and UBS remaining stagnant within the mining zone. As the mining zone is contained within the freeze wall with the combined absence of pumping/injecting, no hydraulic gradient existing (translating to no flow). As per correspondence dated July 26, 2023, Denison is committed to engagement with ERFN where input will be solicited and opportunity for document review will be provided, as necessary, for the Environmental Management Program, including development of the Heritage Resource Management Plan, Emergency Preparedness and Response Plan, and Environmental Effects Monitoring Programs. Denison and ERFN have an agreed upon process for such activities in the future.	Commitment to engagement with ERFN where input will be solicited and opportunity for document review will be provided, as necessary, for the Environmental Management Program, including development of the Heritage Resource Management Plan, Emergency Preparedness and Response Plan, and Environmental Effects Monitoring Programs.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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English River First Nation	Other	It appears that a specific source term for the clean waste rock has not been provided, and that if deemed to need management a liner will be integrated into the pond design and contact water would be sent to the IWWTP. ERFN expects that the material would be non-potential-acid generating and non-potential metal leaching. ERFN is asking for clarification as to what will inform this decision, for example is it that the clean waste rock would not need management if the leachate would meet surface water quality guidelines? Concern in reference to Section 2.2.4.8.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 4)	Conceptually, clean waste rock is defined as non-mineralized and non-potentially acid generating (non-PAG) rock. More precise criteria (numeric and/or narrative), and testing program documentation, will be developed as part of the Waste Management Program that will describe the basis for waste rock segregation based on mineralized content and acid generating potential. For further reference the following is noted. "Clean" waste rock (as described above) is expected to comprise clean sandstone cuttings and core. Waste rock from the sandstone will be characterized during construction and operation per the Waste Management Program prior to placement on the clean waste rock pad. Waste rock characterization will be done primarily based on geological and geochemical characteristics though static and kinetic testing, as appropriate, following standard testing guidance to ensure the rock is both non-mineralized and non-PAG. Any waste rock identified as being mineralized or PAG will be stored on the special waste pad. While the draft EIS did not definitely state that a clean waste rock pond would be constructed, Denison has since committed to constructing a single geomembrane lined pond adjacent to the clean waste rock pad to collect contact water. The contact water in the clean waste rock pond will be routed to the process water pond for eventual treatment in the IWWTP and ultimately released to Whitefish Lake.	Commitment to constructing a single geomembrane lined pond adjacent to the clean waste rock pad to collect contact water.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	In the EIS, there are no details provided in relation to the off-site processing and permanent disposal of the process precipitates. Please clarify whether or not this activity will be encompassed in decommissioning and closure or would this activity potentially occur during operations. As there are processing and disposal options within ERFN Nutsiye-kwi Benéne, ERFN requests commitment from Denison Mines to ongoing engagement pertaining to this component of the operations. Concern in reference to Section 2.2.4.5.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 5)	Denison is committed to continued dialogue with ERFN on the details related to the sale, transport, off-site processing, and final disposal of the process precipitates. At this time it is envisioned that these details will be developed as part of the decommissioning plan updates and will outline the timing for when these assets are removed from the Wheeler River Project site, as well as the regulatory approvals process to which such activities may be subject, including but not necessarily limited to provincial approvals or federal licensing requirements and statutory obligations such as those described in the Transportation of Dangerous Goods Regulations.	Denison is committed to continued dialogue with ERFN on the details related to the sale, transport, off-site processing, and final disposal of the process precipitates	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	It appears to be stated that during construction contact water discharge to the receiving environment from the Clean Water Rock Pond might be required in the case of upset conditions (e.g., extreme precipitation event). As such, ERFN requests commitment from Denison Mines to ongoing engagement pertaining to development of a Construction Environmental Management Plan, including discharge monitoring and trigger action response planning, as well as having a qualified environmental professional design this plan and/or be present during high-risk construction activities. Concern in reference to Section 8.3.4.2.1 and Section 8.3.4.2.3.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 6)	During construction, no effluent is expected to be released to the aquatic environment. As part of both diamond and rotary drilling activities during construction, a centrifuge will be used for separating out solids in order to recycle fluids. Only solid drill cuttings, not wastewater, will be produced and all muds and waters will be recycled as part of the drilling process. Upon completion of a drilling campaign, all remaining mud and water will be stripped of solids, treated with mud zymes to break down polymers, and injected back down into the mineralized horizon. During active drill campaigns clean water will be held in approved tanks. Any contact water stored in the clean waste rock pond during construction will be held onsite until the Industrial Wastewater Treatment Plant (IWWTP) is commissioned. At that time the water from the pond would be conveyed to the IWWTP, treated, and released to Whitefish Lake per permit / licence requirements.	ERFN's engagement and review of the Environmental Management Program, including the Emergency Preparedness and Response Plan, will be completed in the agreed upon process for such future activities. The program and plans will outline commitments for the construction phase. While details on the plans are not available at this time, Denison welcomes ERFN's input and recognizes the importance of having qualified environmental	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				It is also important to note that the sequencing of construction activities will occur in a manner that prioritizes water management based on Project execution plans. For instance, construction of the wellfield runoff pond will be prioritized during the early part of construction and it will be able to hold 38,200 m3 of water. This will provide contingency and additional water storage capacity if contact water produced exceeds estimates or the volume available in the clean waste rock pond during construction. Should the volume of water requiring management exceed site infrastructure storage volumes during construction, contingency measures would be available and could include for example use a hydrovac for offsite disposal. More broadly in terms of Project water management pond designs, ponds will be constructed to maintain a minimum freeboard of at least 1.0 m to allow for continued functioning during a probable maximum precipitation (PMP) event. The PMP event used for feasibility engineering designs is 493 mm. The PMP is very conservative as it effectively assumes a full year of precipitation in one event, under both existing and future climate conditions. For comparison, the PMP is well above both the 24-hour maximum precipitation (e.g., 72 mm recorded at Key Lake in 1998) and 1:100, 24 hour return precipitation events (e.g., 88.6 mm for climate change influenced IDF curves). However, in the event that a pond's design basis is exceeded, emergency spillways will direct excess water away safely as not to compromise the integrity of the water management infrastructure. An unplanned event such as a pond exceeding its design capacity will be reported to ERFN in a timely manner per the commitments in the Public Information Program. ERFN's engagement and review of the Environmental Management Program, including the Emergency Preparedness and Response Plan, will be completed in the agreed upon process for such future activities. The program and plans will outline commitments for the construction phase. While details on the plans are not available at this time, Denison welcomes ERFN's input and recognizes the importance of having qualified environmental professionals onsite during construction activities.	professionals onsite during construction activities.			
English River First Nation	Other	In relation to IWWTP effluent it is stated that discharge will be to a surface waterbody or injected into groundwater via deep well inject. However, the EIS only assesses direct release of 10.1 L/s of effluent to Whitefish Lake during operations and decommissioning. As such, any deviation from this discharge plan would need to be assessed and approved prior to implementation. Concern in reference to Section 8.2.4.1.	ERFN Public Comment February 22, 2023 ((ERFN Main Area of Concern 7)	Reference to effluent discharge via deep well injection was a typo in the draft EIS and will be removed from Section 8 of the final EIS. Effluent release is to Whitefish Lake only and no deep well injection of effluent is planned.	Change made to final EIS (Section 8).	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Can you provide clarification re: Sulphate and sulphate (Hardness) concentrations provided? It would be anticipated that the screening concentration would change because of hardness, but it is unclear as to why the predicted concentration would increase?	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 8)	There was a typographical error in Table 8.2-10 in the draft EIS; the sulphate (hardness) value in column LA-5 Well Mixed (7Q10) should read 63.83 mg/L. Table 8.2-10 is updated in the EIS and also includes the addition of MDMER constituents (these were added to address a comment from the federal review process, IR-114).	Change made to final EIS (Section 8).	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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		Concern in reference to Table 8.2-10.						
English River First Nation	Other	Specifically, the EIS appears to only provide the IWWTP effluent quality and the concentration of COCPs following mixing in Whitefish Lake Middle (the basin where impacted discharge is expected to interact with the receiving environment). As dilution in Whitefish Lake Middle is required to meet guidelines for some COPCs., are chronic toxicity effects possible within the initial dilution zone within the basin including salinity? If yes, what portion of the available habitat would be impacted by elevated levels of COCPs? In relation to the potential for chronic exposure within a dilution zone, ERFN requests engagement as this should be captured within the aquatic effects monitoring. Concern in relation to Section 8.2.4.2.3.	ERFN Public Comment February 22, 2023 ((ERFN Main Area of Concern 9)	An analysis of near-field effluent mixing was undertaken as part of the EIS, based on discharge to Whitefish Lake through an off-shore multiport diffuser. Simulations were carried under different flow scenarios using CORMIX to assess the size of the mixing zone. In this case, the meaning of "mixing zone" can be used synonymously with "regulatory mixing zone" that is defined as an area (or water volume) where numeric water quality thresholds (i.e., chronic effects thresholds) may be exceeded as long as conditions inducing acute toxicity are prevented. Such a situation (i.e., existence of a regulatory mixing zone) is envisioned by the MDMER (and in fact permitted by statute), as well as the provincial water quality policy framework. The results of effluent mixing analysis predicted that the regulatory mixing zone would be very small under each of the modelled scenarios. It was predicted that constituent concentrations would be equal to or less than their respective water quality objectives (i.e., chronic effects thresholds) within a few meters (up to 5 m) of discharge and by definition those constituent concentrations would be protective of the most sensitive life stage of the most sensitive resident aquatic taxa. Both effluent-based and receiver-based monitoring plans will be developed as the Project moves forward and Denison is committed to working with ERFN in that process. For reference, at minimum the programs would be designed consistent with and to meet the requirements of the MDMER, as well as provincial operating permits that will be negotiated subsequent to the EA process. Under MDMER, effluent (end of pipe) monitoring would include laboratory-based chemical and biological (acute and sublethal toxicity) measurement and testing (see MDMER Part 2, Division 2 – Effluent Monitoring Conditions). Under MDMER, receiver-based monitoring, including effluent and water quality monitoring studies and biological studies are completed within the framework of the Environmental Effects Monitoring program (MDMER, Schedule 5).	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	It would appear that a temperature assessment was not completed for the proposed heated treated effluent discharge line. It is assumed if there is the potential for adverse effect to the receiving environment, discharge limits would be stipulated as a licensing condition. ERFN requests engagement regarding the establishment of effluent discharge limits, as well as finalized remediated/restored solution targets. Section 8.2.4.2.5.	ERFN Public Comment February 22, 2023 ((ERFN Main Area of Concern 10)	The EIS does consider the potential thermal effects of effluent in Whitefish Lake; please refer to Appendix 8-E Constituent Concentrations and Mixing Zone Assessment Report. Because the effluent holding ponds are outside, Denison anticipates very minimal differences in the temperature of effluent entering the lake versus the lake water itself. Effluent will be discharged to Whitefish Lake via a pipeline and multiport diffuser that will be situated at depth of 3-4 meters depth. The effluent itself will be held in effluent monitoring ponds prior to discharge and maximum effluent temperature is assumed to be 5 degrees Celsius during the winter. Water temperature in Whitefish Lake during ice-cover is expected to be between 3 and 4 degrees Celsius. As such, the effluent may have a temperature difference of between 1 and 2 degrees Celsius in the immediate zone of the diffuser ports. Mixing of the effluent with the receiving water will be nearly instantaneous and over an area of less than 5 m and generally near its depth of discharge (3 to 4 m). As a result, the thermal change within the highly localized mixing zone will be less than a degree Celsius.	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				We note that Denison will be collecting field temperature in effluent samples as part of the requirements under Schedule 3 of the MDMER. Water quality monitoring will also be conducted to meet the requirements of the MDMER and includes recording temperature of water in both exposure (e.g., Whitefish Lake) and reference areas, per MDMER Section 7(1)(b). It is also assumed that similar monitoring requirements would be included within provincial approvals. The above monitoring will allow Denison to test the assumptions made in the EIS and to understand any potential thermal effects of effluent in Whitefish Lake. This level of monitoring is appropriate as a starting point. If based on monitoring data it was evident that the EIS assumptions were not being met the monitoring program would be adapted accordingly. This approach is consistent with Denison's overall approach to its proposed environmental monitoring programs that will incorporate adaptive management.				
English River First Nation	Other	Can it be clarified as to whether or not the clear span bridges proposed for stream crossings will be temporary or intended for use throughout the life of the project? There is uncertainty as the DFO Interim Code of Practice for Temporary Stream Crossings, but the use of these crossing doesn't seem to be limited to a limited stage of the life of mine? Concern in reference to Section 8.3.5.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 11)	The two clear span bridges proposed at stream crossing locations would be in place for the life of the Project to allow for transportation of staff and contractors between the airstrip and the main Wheeler River Project site. Section 8.3.5 of the draft EIS does list adherence to the Interim Code of Practice for Temporary Stream Crossings as a mitigation measure, as applicable. Denison does not expect this code of practice would apply to the final, constructed clear span bridges, since these are not temporary structures. However, depending on how construction sequencing and logistics proceeds, Denison may use temporary watercourse crossings to access the eastern shores of the streams, as needed. Temporary stream crossings are employed for short term access across a watercourse by construction vehicles when an existing crossing is not available or practical to use. Denison acknowledges that any temporary watercourse crossings, if used, are not intended for prolonged use, per the code of practice.	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	What is the rationale for the timeframe (post-closure) criteria in terms of concluding full reversibility of an effect? Table 3-4 of Appendix 10-A indicates that mass flux (mg/s) rates of molybdenum and selenium persist for 1000 years or more following the end of decommissioning. Further, it is our experience that effects to sediment quality would not decrease for some time following cessation of the water quality effects. Concern in reference to Table 8.3-9.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 12)	The Section 8.3 assessment related to the Fish and Fish Habitat Valued Component's Key Indicator of surface water quality is focused on the release of treated effluent. As such, the timeframe for the fully reversible rating in Table 8.3-9 is the post-decommissioning period and considers whether or not the residual effect on surface water quality can be reversed once the activity causing the residual effect (i.e., treated effluent release) ceases. Refer to draft EIS, Appendix 10-A, Figure 3-2 for modelled concentrations of COPCs in water, which show COPC concentrations returning to baseline concentrations in the post-decommissioning period. The figure shows the first five years of post-decommissioning and the actual post-decommissioning period extends to a total of 15 years. The "future centuries" scenario evaluates the potential effects post-restoration (i.e., beyond the Project timeline of 0-38 years) and reflects the time period over which the highest constituent concentrations in groundwater are predicted to migrate towards and interact with surface	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				water. The period of time between the cessation of discharge of treated effluent to Whitefish Lake and when remediated solution in the decommissioned mining area migrates to Whitefish Lake is hundreds to thousands of years. To be conservative the future centuries modelling in Appendix 10-A assumed the mass flux from groundwater to Whitefish Lake starts 200 years after the post-decommissioning phase. Between the end of post-decommissioning period and the start of the future centuries, any changes to surface water quality from treated effluent release would be fully reversed (refer to Appendix 10-A, Figure 3-4). The EIS considered the post-decommissioning changes through the future centuries assessment which was completed in Appendix 10-A. The predicted maximum concentrations of COPCs in water and sediment during future centuries are shown in Appendix 10-A, Table 3-5. There are no predicted exceedances of water and sediment quality guidelines for any of the COPCs and as such, the future centuries evaluations were not carried through the residual effect characterizations in Section 8.				
English River First Nation	Other	There appears to be some uncertainty regarding the benthic invertebrate community and tissue chemistry data provided. Regarding the tissue chemistry, it is understood that baseline data would have been used to evaluate the baseline predicted by the environmental effects assessment, and as such questions regarding the ERA sampling program may not affect the outcome of the assessment. However, having a robust baseline in terms of benthic invertebrate community composition and abundance would be required to complete a before-and-control-impact assessment (pre and post operations). It is our experience that benthic invertebrate community composition and relative abundance are sensitive end point to changes in aqueous and sediment metal concentrations. If changes are observed above those predicted in the EIS, the first area of investigation would be metal speciation and contaminant bioaccumulation in the organisms. Concern in reference to Section 8.4.3.2.5 and Table 8.4-4.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 13)	For clarity, in the ERA model (Appendix 10-A) the benthic invertebrate tissue chemistry predictions shown are modelled values based on exposure to surface water and sediment in consideration of Project-related releases to the aquatic environment and appropriate bioaccumulation factors. The measured baseline benthic invertebrate chemistry was not used specifically within the ERA, but the ERA was informed by the measured data in that the baseline data were used to validate the model predictions. Generally, there was reasonable agreement for many parameters though some constituent concentrations were either over- or underestimated by the model. The model predictions will be updated as part of routine ERA updates throughout the life of the Project. Additionally, the model predictions will be compared to measured benthic invertebrate tissue chemistry collected as part of monitoring programs. The overall objective of this process is to continue to gain a better understanding of potential risks associated with the Project as more operational data are generated and reduce the uncertainty related to estimating such risks. A very brief overview of the benthic invertebrate data collected as part of the environment baseline characterization is shared below for reference. Benthic invertebrate samples were collected in 2016 at ten lake locations and a total of 78 benthic invertebrate taxa from 38 major taxonomic groups (Families) were identified within the study area (Appendix 8-D). Chironomids were prevalent across the study area and were the most numerically dominant taxon at most locations. Other taxonomic groups that represented more than 10% of the total benthic invertebrate density at a sampling location were detritus worms (Naididae), pill clams (Pisidiidae), water fleas from the families Holopedidae and Macrothricidae, and phantom midges (Chaoboridae). From a feeding group perspective, predatory taxa and those that feed on fine particulate organic matter (collector-gatherers) were generally the most abundant groups in lakes within the study area. As alluded to in the review comment, benthic invertebrates will be	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.

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				utilized to assess potential effects related to the Project, and in particular those that may be associated with the discharge of effluent. As such, and also as noted in the review comment a "robust" baseline data set is needed to evaluate such effects. The baseline benthic invertebrate collections made in areas relevant to assessing the potential effects of effluent discharge were sampled with rigour (i.e., sample replication and processing methodology) consistent with the federal EEM program requirements, and therefore in that regard meet the robustness test and can be used to help define the before condition in the BACI framework. Moving forward (that is in the operations phase of the Project), benthic invertebrate community sampling will be implement though the site's EEM program and, at minimum, would be completed in a manner consistent with MDMER requirements. Sampling would focus on upstream reference areas and downstream effluent exposed areas and would be statistically based to ensure an appropriate level of statistical power is provided to determine whether there are mine-related effects, or not. Endpoints that would be measured include density, richness, evenness and community composition (via the B-C Index). The above does not preclude the execution of a further before operations benthic invertebrate community sampling program that would further define the before condition in the BACI framework. Such considerations are in the early planning stages and will be considered in the next stage of EMS documentation whereby plans and procedures are developed. As previously indicated Denison is committed to involving ERFN in development of those plans.				
English River First Nation	Other	It is stated that pre-constructed listed plant surveys / breeding bird surveys would be required on the final project footprint with ecosites that were not sampled in 2017; however, it is ERFN's understanding from the June 22nd site tour that almost all of the footprint has already been disturbed. Were preconstruction surveys completed prior to clearing activities? Concern in relation to Section 9.1.1.1 and Section 9.4.3.	ERFN Public Comment February 22, 2023 (ERFN Main Area of Concern 14)	The commitments made in the EIS, including those related to pre-construction surveys, are applicable to the Project as it advances to the Project development phase. Any forest clearing completed by Denison to date was done in accordance with the Saskatchewan mineral exploration guidelines and permitted through Saskatchewan Ministry of Environment, Lands Branch as part of exploration activities. While some limited areas above the Phoenix uranium deposit and trails have been cleared in previous years to access the site as part of exploration activities, the majority of the proposed Project Area has not been cleared. For example, the footprints of the proposed airstrip, camp, processing plant, borrow area, landfills, and portions of the access roads within the Project Area are undisturbed areas consisting primarily of upland jack pine ecosites. Please refer to draft EIS Figure 9.2-6: Vegetation Communities and Ecosystems within the Project Study Areas for a visual representation of the current anthropogenic disturbance within the Project Area. The current anthropogenic disturbance in the Project Area is approximately 24.8 hectares which represents less than 15% of the total Project Area (169.6 ha) (refer to draft EIS table 9.4-20 Summary of Available Common Nighthawk Habitat, Direct Habitat Loss, and Habitat Alteration in the Study Areas).	N/A	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
English River First Nation	Health and socio-	ERFN is looking for commitment later in the permitting phase to discuss the development and monitoring of key indicators (KIs) for community health and wellness that reflect the perspectives of community members	ERFN Public Comment February 22,	As noted in the draft EIS, Section 10.1.8 monitoring will focus on collecting data to verify ERA model predictions as well as provide data to improve model predictions as the Project begins, with the goal of	Commitment to working with ERFN to understand how follow-up programs might be	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between

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	economic conditions	within the region. Firstly, it is recommended that human health evaluation efforts and KIs / measurement endpoints be reviewed and consider expanding to encompass directly the health of Patuanak/Wapachewunak community members and perceived risks. This may not be required to finalize the EIS as we understand the Human Health Conceptual Site Model based on fisher/trapper on Whitefish Lake and post-closure permanent resident on Whitefish Lake, however, it would be valuable to addressing concerns throughout the life of the project. For example, continued engagement with ERFN communities has identified that regardless of historical radiation protection performance, country food monitoring results and mine/mill personnel health monitoring, community member still believe that uranium mining contributes to cancer rates in community members. Perhaps a community specific KI could be developed and monitored (e.g., a limited uranium testing program looking at levels in ERFN residents on reserve versus off reserve). Further, local scale economy and wellness KIs could be proposed that reflect community members perspectives (e.g., local traffic rates / accidents and community quality of life and income disparity). Concern in relation to Section 10.1.1.2, Section 10.1.1.3, Section 10.1.3.2, Section 12.1.1.2, and Section 12.1.6	2023 (ERFN Main Area of Concern 15)	reducing uncertainty over time. It is expected this will be an iterative process, and will be approached in consultation with Indigenous groups, other stakeholders, and relevant federal and provincial agencies with interest. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions. The environmental monitoring program is anticipated to include air emissions, surface water, sediment, soil samples, fish tissue sampling, benthic invertebrate tissue sampling, and country food sampling. Monitoring is currently anticipated on Whitefish Lake, McGowan Lake and Russell Lake, and could be expanded based on the interests of ERFN. Although no specific monitoring is currently anticipated with regards to the Cultural Expression VC (Section 12.1.8) follow-up programs for the EIS are proposed to address any uncertainties identified during the EA process. Denison is committed to working with ERFN to understand how this might be executed at the community level to address community perspectives.	executed at the community level to address community perspectives.			Denison and ERFN as part of ongoing engagement.
English River First Nation	Other	Typo, the Economy VC is comprised of five, not four KIs. Please fix typo. Concern in reference to Section 13.1.2.	ERFN Public Comment February 22, 2023	The typo is corrected in the EIS Section 13.1.2.	The typo is corrected in the EIS Section 13.1.2.	Resolved - agreement reached by both parties.	As per letter dated November 24, 2023	General discussions to continue between Denison and ERFN as part of ongoing engagement.
Lac La Ronge Indian Band	Health and socio-economic conditions	Interest for information regarding employment opportunities.	ROC 392	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in the Economics section of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.	Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement.	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by LLRIB on the draft EIS. Denison has responded to the LLRIB on the draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and/or has outlined a proposed approach forward to the LLRIB.	A meeting was held on August 30, 2023 and resulted in response to LLRIB comments which were submitted on November 06, 2023. An in-person meeting was held on June 12, 2024 and resulted in correspondence submitted to the LLRIB on June 28, 2024.	Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.

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						Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.		
Lac La Ronge Indian Band	Other	Questions and clarifications on ISR mining methodology, and construction schedule	ROC 392	Section 2 provides information about the various Project elements and anticipated Project construction timing. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface (see Section 2 for further information). Section 2 provides a schedule including construction (year 1 to 3), operations (year 3 to 18), decommissioning (year 18 to 23), and post decommissioning (year 23 to 38). See Section 2.3 for a summary of the anticipated key activities for Construction, Operation, Decommissioning and Post-Decommissioning of the Project.	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by LLRIB on the draft EIS. Denison has responded to the LLRIB on the draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and/or has outlined a proposed approach forward to the LLRIB. Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.	A meeting was held on August 30, 2023 and resulted in response to LLRIB comments which were submitted on November 06, 2023. An in-person meeting was held on June 12, 2024 and resulted in correspondence submitted to the LLRIB on June 28, 2024.	Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.
Lac La Ronge Indian Band	Other	Concern about the effects the Project may have on the environment and interest in understanding what was required for construction.	ROC 392	Section 2 provides information about the various Project elements and anticipated Project construction timing. Information on how the Project may affect the environment is included throughout the EIS.	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by LLRIB on the draft EIS. Denison has responded to the LLRIB on the draft	A meeting was held on August 30, 2023 and resulted in response to LLRIB comments which were submitted on November 06, 2023. An in-person meeting was held on June	Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.

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						EIS public comments, by providing background information, clarification on assumptions and approach taken, and/or has outlined a proposed approach forward to the LLRIB. Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.	12, 2024 and resulted in correspondence submitted to the LLRIB on June 28, 2024.	
Lac La Ronge Indian Band	Other	Questions about ISR mining technique, including the potential for any tailings being left behind.	ROC 392	Section 2 provides information about the various Project elements and anticipated Project construction timing. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface (see Section 2 for further information). The proposed ISR mining method for the Project will produce minimal volumes of waste and does not require the development of a conventional tailings management facility. A waste management program will be developed for the Project to support licensing. Denison is proposing to design pond, pad, and landfill liners systems and develop appropriate performance monitoring based on the characteristics of the material being stored.	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by LLRIB on the draft EIS. Denison has responded to the LLRIB on the draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and/or has outlined a proposed approach forward to the LLRIB. Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and	A meeting was held on August 30, 2023 and resulted in response to LLRIB comments which were submitted on November 06, 2023. An in-person meeting was held on June 12, 2024 and resulted in correspondence submitted to the LLRIB on June 28, 2024.	Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.

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						mutually agreeable manner.		
Lac La Ronge Indian Band	Other	Concern expressed for incorporation of chemical and pollutants into the water environment and the effects to water quality and health of aquatic species.	ROC 392	Section 8 provides information on surface water quality and aquatic habitat and how these values overlap with potential effects of the Project.	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by LLRIB on the draft EIS. Denison has responded to the LLRIB on the draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and/or has outlined a proposed approach forward to the LLRIB. Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.	A meeting was held on August 30, 2023 and resulted in response to LLRIB comments which were submitted on November 06, 2023. An in-person meeting was held on June 12, 2024 and resulted in correspondence submitted to the LLRIB on June 28, 2024.	Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.
Lac La Ronge Indian Band	health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	Resource development projects in the Traditional Territory of LLRIB have had significant impact to community members and their traditional way of life. LLRIB is concerned about potential adverse impacts to the ability to hunt, fish and trap for food and/or carry out traditional uses including cultural, spiritual or other important sites near the proposed project area. LLRIB encourages Denison Mines to: (1) Reach out to the LLRIB to engage LLRIB members and impacted land users. (2) Support the LLRIB Heritage Fund which enables community members to practice traditional activities (3) Reach out to LLRIB's economic development company, Kitsaki Management, to ensure local and Indigenous involvement	LLRIB public comments received February 9, 2023	The Lac La Ronge Indian Band ("LLRIB") hosted Denison Mines Corp. ("Denison") at the Lac La Ronge Indian Band ("LLRIB") Traditional Lands & Resources Advisory Committee ("TLRAC") meeting in Missinipe, on August 30, 2023. Denison appreciated the invitation to provide the TLRAC with an update on the Wheeler River Project ("Project"), including responding to the specific concerns raised by LLRIB in its February 9, 2023 letter to the Canadian Nuclear Safety Commission providing comments on Denison's comprehensive Environmental Impact Statement for the Project. As we affirmed during the meeting, the Project is located in the N-18 furblock for registered trappers and is outside the publicly available information regarding the LLRIB Traditionally Occupied Territory. Denison heard the TLRAC's information and perspective shared with us that there are LLRIB land users in the area, irrespective of furblock boundaries, and there remains general concern that land users could be impacted by the Project. As Denison explained during the meeting, we would welcome any specific information about land users in and around the Project area.	Denison is committed to, as described in Section 13, collaborating with Indigenous peoples and communities to build long-term, respectful, trusting, and mutually beneficial relationships. With respect to using Kitsaki-owned businesses to support Denison's activities, Denison is proud of the work we have done to date with Kitsaki Management-owned companies including CanNorth and Northern Resource Trucking, and understand the opportunities	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the LLRIB. Denison will continue to engage with LLRIB on	A meeting was held on August 30, 2023 and resulted in response to LLRIB comments which were submitted on November 06, 2023. An in-person meeting was held on June 12, 2024 and resulted in correspondence submitted to the LLRIB on June 28, 2024.	Denison will continue to engage with LLRIB on remaining issues of concern, in an appropriate and mutually agreeable manner.

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				From the evidence Denison is aware of so far, we are of the view that the outcome of Denison's comprehensive effects assessment in the areas of aquatic and terrestrial environments, and the associated potential impacts to the ability to exercise Indigenous Rights, leads to the conclusion that there will be no significant adverse residual effects to land use activities resulting from the Project. We recognize that this is an evolutionary process, such that if further information arises which indicates a different or more nuanced conclusion, we will review it and consider whether changes to our current direction are appropriate. In accordance with our Indigenous Peoples Policy, Denison is committed to collaborating with Indigenous peoples and communities to build long-term, respectful, trusting, and mutually beneficial relationships. With respect to using Kitsaki-owned businesses to support Denison's activities, Denison is proud of the work we have done to date with Kitsaki Management-owned companies including CanNorth and Northern Resource Trucking, and understand the opportunities for further work in the future as the Project progresses. As mentioned in the meeting, since 2019, Denison has spent more than $1.1M dollars with Kitsaki-owned companies and has intentions to continue this positive trend as much as possible. Denison also understand the interests in general employment opportunities at the Project once approval is received to proceed, and are happy to have already received the contact information for the Community Relations Liaison Officer for Lac La Ronge Indian Band. This helpful contact will ensure that we have a fulsome listing of entities to which employment opportunities can be shared over the next while. Further, we understand as a company working in northern Saskatchewan, Denison wishes to respect and support efforts and initiatives that our neighbours, such as LLRIB and the TLRAC feel are important. As noted in your correspondence dated February 9, 2023 we understand that the Heritage Fund is such an initiative, and as such, Denison is pleased to contribute to the Heritage Fund for the amount of $5,000. We trust that this contribution will continue to support and encourage community members to practice traditional activities.	for further work in the future as the Project progresses. Denison also understand the interests in general employment opportunities at the Project once approval is received to proceed, and are happy to have already received the contact information for the Community Relations Liaison Officer for Lac La Ronge Indian Band. This helpful contact will ensure that we have a fulsome listing of entities to which employment opportunities can be shared over the next while. Further, we understand as a company working in northern Saskatchewan, Denison wishes to respect and support efforts and initiatives that our neighbours, such as LLRIB and the TLRAC feel are important. As noted in your correspondence dated February 9, 2023 we understand that the Heritage Fund is such an initiative, and as such, Denison is pleased to contribute to the Heritage Fund for the amount of $5,000. We trust that this contribution will continue to support and encourage community members to practice traditional activities.	remaining issues of concern, in an appropriate and mutually agreeable manner.		
Métis Nation – Saskatchewan	Other	A question was asked about ponds for waste and waste rock.	ROC 1	The proposed ISR mining method for the Project will produce minimal volumes of waste and does not require the development of a conventional tailings management facility. A waste management program will be developed for the Project to support licensing. Denison is proposing to design pond, pad, and landfill liners systems and develop appropriate performance monitoring based on the characteristics of the material being stored. For more information on waste management Section 2.2.4 for more information.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-	Questions about radiation and how it would be monitored.	ROC 1 ROC 62	As stated in Section 2.9.1.3.2, A Radiation Protection Program would be designed and implemented so that Denison complies with, or exceeds, the level of radiation safety that is required by the relevant regulations	N/A	Ongoing - Denison is committed to working toward	Response to MN-S comments were	Discussions continue with MN-S about

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	economic conditions			pursuant to the Nuclear Safety and Control Act and Denison's Health and Safety Policy. Activities within the program would include implementing a radiation code of practice, measuring and monitoring radiation on an ongoing basis, and reporting radiation testing results to regulators. As summarized in the Worker Health assessment (Section 10.2.3.2.10) potential residual effects to worker health during Construction and Operation are expected to be negligible given that the predicted radiation doses are less than the annual allowable effective dose of 20 mSv/yr, and radon is predicted to be within the range that is manageable under an RPP.		reaching a resolution on these issues.	provided on December 1, 2023	working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Concern expressed about ensuring Denison was following engagement protocols set out by the MN-S.	ROC 1 ROC 442	Section 4 describes the approach for engagement between Denison and MN-S that has occurred. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLR are understood as organizations.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes	Interest and questions asked about IK including how Denison is pursuing this, the process of obtaining IK, and whether money was available for IK studies.	ROC 62	A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study.	Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (including for Sections 4, 11, 12, and 13).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions	Interest was expressed in understanding the number and types of employment that would be created by the Project.	ROC 62	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in the Economics section of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project. Section 13 summarizes local, provincial, and federal Project benefits and Denison's approach to employment, training, and business participation opportunities for communities. Denison has estimated a workforce of 300 people for the two-year Construction period. Each component of Construction will require workers with different types of skills and training depending on the task (e.g., road construction, wellfield drilling, erection of buildings, connection to services). During Operation, over 180 people are expected to be employed to operate the ISR wellfield and processing plant, as well as provide various supporting activities such as security, camp operations, operation of the water treatment, sewage and potable water plants,	Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				environmental monitoring, and maintenance of roads, equipment, and buildings.				
Métis Nation – Saskatchewan	Health and socio-economic conditions	Concern with racism and other factors in the workplace affecting employee retention and the need for the understanding of the Métis identity, their culture, and their values.	ROC 62	Denison has an established Workplace Violence and Harassment Policy and an Indigenous Peoples Policy, both of which are publicly available on Denison's website. These two policies create the conditions for an inclusive and diverse work environment and a safe work culture for all. Policies will be adapted to the conditions of the Project and Denison. Further, Section 12.2.5 Mitigation Measures for Community Well-being describes the establishment of health and wellness programming on-site, an Employee and Family Assistance Program (EFAP), a no alcohol and drug policy on Project site, the enforcement of Denison's Environment, Health, Safety, and Sustainability Policy, the implementation of culturally sensitive employment policies to support the Indigenous workforce (for example, having an Elder representative at the Project site to provide cultural programming), among others.	Denison has an established Workplace Violence and Harassment Policy and an Indigenous Peoples Policy, both of which are publicly available on Denison's website. Policies will be adapted to the conditions of the Project and Denison. Further, Section 12.2.5 Mitigation Measures for Community Well-being describes the establishment of health and wellness programming on-site, an Employee and Family Assistance Program (EFAP), a no alcohol and drug policy on Project site, the enforcement of Denison's Environment, Health, Safety, and Sustainability Policy, the implementation of culturally sensitive employment policies to support the Indigenous workforce (for example, having an Elder representative at the Project site to provide cultural programming), among others.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Interest in understanding about how well Denison was doing (financially) and the effect that has on community investment decisions.	ROC 62	Denison is a publicly traded uranium exploration and development company with interests focused in the Athabasca Basin region of northern Saskatchewan. The company trades on the Toronto Stock Exchange and NYSE American exchange and is headquartered in Toronto, Ontario, with offices in Saskatoon, Saskatchewan, and Elliot Lake, Ontario. Denison strives to achieve the development of the Project through positive partnerships with Communities of Interest, integrating information from Indigenous and non-Indigenous Interested Parties, and maintaining high standards for environmental protection and worker safety. Overall, the world and Canada need uranium to meet the projected future needs of nuclear power generation, and the Project can provide a critical component in the nuclear fuel cycle while making a meaningful contribution to the Canadian economy and Saskatchewan's northern and Indigenous communities.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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Métis Nation – Saskatchewan	Other	Métis Nation-Saskatchewan noted that the land the Project is located within is subject to a land claim.	ROC 62	Denison thanks the MN-S for the comment.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Questions were asked regarding the ISR mining process, transportation, and exploration.	ROC 62 ROC 1	Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface. The proposed operation is fly-in, so Project related traffic to the area would only be related to deliveries of materials to and from the site. Project-related truck traffic during Construction and Operation (such as surface construction equipment, materials, and drill rigs) is expected to originate from Saskatoon or other southern locations. Project-related traffic originating from the west may travel through Beauval via Highway 165, whereas traffic from the south and east may access Highway 165 via Highway 2. Traffic from Saskatoon would likely use Highway 11 to Prince Albert and Highway 55 to Beauval, then travel via Highway 165. Highways are under the authority of the Saskatchewan Ministry of Highways. The Wheeler River property was staked on July 6, 1977. Excluding the years 1990 to 1994, exploration activities, such as airborne and ground geophysical surveys, geochemical surveys, prospecting, and diamond drilling, have been carried out on the property from 1978 to present. As stated in Section 1.1, Denison became the operator of the property in November 2004 and carried out property-wide airborne geophysical surveys in 2005. The Phoenix deposit was discovered by diamond drilling in 2008 with subsequent delineation completed over the next six years from 2008 to 2014.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	To date, Denison's engagement approach has not been collaborative. Denison has not engaged all potentially impacted Métis communities. Denison has focused engagement efforts on Métis communities in NR3. Denison does not acknowledge that the Project falls within the MN-S Homeland. MN-S is listed under Indigenous Organizations instead of Indigenous Communities of Interest. Per Denison's definition, MN-S, NR1 Locals, and NR3 Locals should be considered an Indigenous Community of Interest. Denison notes site visits as the only engagement-associated activities in each Project Phase. Additional involvement opportunities should be provided to MN-S throughout the life of the Project. Further, MNS refers to CNSC correspondence (Appendix A) indicating that consultation and engagement was expected to be with NR1 Locals, NR2 Locals, NR3 Locals, and MN-S. Given NR2's involvement in NexGen and Fission, MN-S limited its engagement and consultation expectations to NR1 Locals, NR3 Locals, and itself. Denison did not engage MN-S on potential Project-related effects to Métis traditional use activities (such as but not limited to: hunting, trapping, and fishing) and therefore may not be aware of potential traditional use activities conducted by Métis peoples in and around the Project. Denison's reliance on reviewing	MN-S Public Comments (March 4, 2023) (Public Comment #439, #440, #442, #444)	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLR are understood as organizations. Denison has updated the revised draft EIS executive summary to acknowledge that the Project falls within the MN-S Homeland, including the unique situation that the MN-S have in the area. A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 as described in Section 4). Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13). The revised draft EIS executive summary has been updated to acknowledge that the Project falls within the MN-S Homeland,	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		traditional resource user leases is not an appropriate way to determine Métis traditional resource use in and around the Project. Recommendations: - Denison needs to engage all potentially impacted Métis communities. Specifically, to see Denison equally engage NR1 Locals and NR3 Locals in addition to Kineepik Metis Local #9 throughout the life of the Project. Denison needs to include MN-S, NR1 Locals, and NR3 Locals under Indigenous Communities of Interest - Denison needs to engage MN-S, NR1 Locals, and NR3 Locals on Project information, Project-related employment, procurement, and cultural opportunities, engagement expectations (e.g., involvement of youth and Elders), and approach for gathering and incorporating Métis Knowledge into Project reports, plans, and processes. - Denison needs to incorporate Métis Knowledge from the Métis Knowledge Study (MKS) into their discipline-specific effects assessment, the Final EIS, and all monitoring plans for the Project, where applicable. - Denison needs to engage MN-S, NR1 Locals, and NR3 Locals to determine the appropriate funding, process, and timeline to conduct the MKS.						
Métis Nation – Saskatchewan	Health and socio-economic conditions	Denison's EIS does not outline where hazardous waste will be taken for proper recycling or disposal. Recommendations: • Denison needs to share where hazardous waste will be taken for proper recycling and disposal with MN-S, NR1 Locals, and NR3 Locals	MN-S Public Comments (March 4, 2023) (Public Comment #441)	Waste management is described in Section 2.2.4 of the Draft EIS and includes discussion of all waste types that will be generated by Project-related activities. The following is noted in Section 2.2.4 for reference, "Conventional waste, radiologically contaminated waste, and hazardous waste will be managed at the Project. Denison is committed to conducting stringent waste characterization throughout the life of the Project. This includes physical, radiological, and chemical characterization to maintain accurate waste inventories and determine how wastes will be dispositioned through either re-use, recycling, temporary storage, or permanent disposal (on or off site). This includes clearance of material that meets unconditional release requirements and can be safely removed from site. A waste management program will be developed for the Project to support licensing and permitting. The waste management program and associated plans developed to support licensing will be based on the 4 R's: Reduce, Reuse, Recycle, and Recover, and will detail how each type of waste generated on site will be managed. Resources used to develop the waste management program will include, but are not limited to, the CNSC's REGDOC-2.11 series, related Canadian Standards Association (CSA) standards, and the Hazardous Substances and Waste Dangerous Goods Regulations (Government of Saskatchewan 2000)." Hazardous waste management in particular discussed in Section 2.2.4.4. of the Draft EIS where the following is noted, "Denison identified a need to have a small (250 m2) pad designated for temporary storage of hazardous waste such as paints, solvents, hydrocarbons, and used oil. The temporary storage pad will have a composite liner system (Figure 2.2 24). Hazardous wastes will be taken off site by waste management service providers for proper recycling as soon as practical."	Section 2.2 describes how Denison is committed to conducting stringent waste characterization throughout the life of the Project. A waste management program will be developed for the Project to support licensing and permitting. Hazardous wastes will be managed consistent with regulatory requirements, using licensed third-party waste management/haulage providers and licensed waste management facilities. Denison will inform the MN-S and relevant locals when such documentation has been prepared through engagement mechanisms in place at that time.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				As referenced in the Draft EIS, the specific details related to hazardous waste management will be documented as part of the overall, waste management program that will be developed as the Project advances from the environmental assessment process into licensing and permitting. Hazardous wastes will be managed consistent with regulatory requirements, using licensed third-party waste management/haulage providers and licensed waste management facilities. Denison will inform the MN-S and relevant locals when such documentation has been prepared through engagement mechanisms in place at that time.				
Métis Nation – Saskatchewan	Other	Denison created "Key Issues and Concerns" tables in their EIS to document responses to issues and concerns identified by Indigenous Groups. Denison marked issues and concerns that they believe have been addressed as "Complete" in "Key Issues and Concerns" tables throughout the Draft EIS. Directing MN-S and Métis Locals to chapters within the EIS is not a sufficient response to an issue or concern identified by MN-S and Métis peoples. One- way information sharing is not an effective means for addressing or mitigating issues and concerns identified by MN-S and Métis people. Responses to issues regarding effects should discuss the presence or absence of effects, rather than responding that effects were studied. MN-S has not had an opportunity to review Denison's engagement plan. Recommendations: - Denison needs to respond to issues and concerns identified through engagement during meetings with and communications to MN-S, MN-S, NR1 Locals, and NR3 Locals. - Denison needs to implement a collaborative engagement approach that allows MN-S, NR1 Locals, and NR3 Locals to provide feedback and inform Project decision-making, plans, and outcomes versus one-way information sharing engagement approach. - Denison needs to share all engagement plans and reports of interest to MN-S, NR1 Locals, and NR3 Locals for review and comment.	MN-S Public Comments (March 4, 2023) (Public Comment #443, #461)	Since being advised by the MN-S in October 2019 that a number of Métis Locals had delegated to the MN-S the Duty to Consult for the Project, Denison has been engaged in extensive ongoing discussions with the MN-S with the goal of reaching agreement regarding the EA process and MN-S' participation in it. Denison continues to engage with the MN-S, inclusive of engagement in NR1 and NR3, at their direction and there is no formal engagement plan, as such Denison does not feel there is a need for MN-S review as continued engagement is informed by and at the direction of the MN-S in an ongoing manner. For example, In recognition of the MN-S potential interests in the Project, Denison and MN-S have negotiated a capacity funding agreement. This agreement outlines a mutually agreeable framework and applicable funding arrangements to facilitate the MN-S' participation and engagement in the EA process for the Project. The parties have specifically agreed to a process between each other that will be funded by Denison and undertaken on behalf of the MN-S in connection with the EA of the Project: a Métis Knowledge Study, meetings to focus on VCs and preliminary effects, and regular meetings and associated costs for hosting such meetings.	Denison continues to engage with the MN-S at their direction and there is no formal engagement plan, as such Denison does not feel there is a need for MN-S to review an engagement plan as continued engagement is informed by and at the direction of the MN-S in an ongoing manner. In recognition of the MN-S potential interests in the Project, Denison and MN-S have negotiated a capacity funding agreement (identified in Section 4).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	Denison did not engage MN-S on potential Project-related effects to Métis traditional use activities such as (but not limited to): hunting, trapping, and fishing. No Métis Knowledge was used to inform the Project's spatial boundaries. Denison has not engaged MN-S to understand Métis knowledge to inform the development of the Project's environmental monitoring and management plans (e.g., Caribou Management Plan). This applies to monitoring air emissions, noise monitoring, geology, groundwater quantity and quality, surface water quality, sediment quality, fish and fish habitat and human health. Information to be gathered during the Métis Knowledge Study will contribute to the development of these plans. Denison does not acknowledge MN-S, NR1, or NR3 involvement in the	MN-S Public Comments (March 4, 2023) (Public Comment #445, #448, #457, #498, #502, #505, #512, #513, #515, #526, #543, #545, #548)	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLR are understood as organizations. A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 as described in Section 4. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13). MN-S will be informed throughout the monitoring program design	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		design and implementation of the post-decommissioning monitoring program. Recommendations: - Denison needs to incorporate Métis Knowledge from the MKS into their discipline- specific effects assessment, the Final EIS, and all monitoring and management plans for the Project, where applicable. - Denison needs to engage MN-S to determine the appropriate funding, process, and timeline to conduct the MKS. - MN-S would like the opportunity to review applicable Project management documents that provide information that is relative to the potential impacts of the Project on traditional land use activities, these include, but are not limited to the following: Preliminary Decommissioning Plan, Status of the Environment reports, Environmental Effects Monitoring reports, annual reports, updated environmental risk assessments and the Final Decommissioning. - Denison needs to provide plain language summaries, posters/handouts, and presentations on monitoring and effects management plans and programs to MN-S, NR1 Locals, and NR3 Locals. Denison needs to share all engagement plans and reports of interest to MN-S, NR1 Locals, and NR3 Locals for review and comment. - Denison needs to engage MN-S, NR1 Locals, and NR3 Locals to better understand how they would like to be informed of monitoring results (e.g., 1-page plain language summaries, annual monitoring report, community meetings etc.). - Denison needs to revise its understanding of Métis, Métis governance and the differences between MN-S and Métis Locals. - Denison needs to include MN-S, NR1 Locals, and NR3 Locals as Communities of Interest, or explain why they limited their selection of Métis communities in their listing. - Denison needs to include in the Final EIS, information provided by Métis Locals in NR1 and NR3 on their input related to cultural expression. - The Final EIS should include detail on how the input provided by Métis Locals in NR1 and NR3 and MN-S will influence the development of the location of pick-up points and commuter transportation options and address concerns related to in-migration and out-migration pressures. - Denison needs to provide additional detail within the Final EIS related to Denison's commitment to developing mitigations that address potential effects to community well-being such as support for community accessible health and wellness programs, community liaisons, community readiness programs, and long-term monitoring opportunities. This includes mitigations that are prepared with MN-S, and NR1 and NR3 Locals involvement and agreement. - Considering the uncertainty identified in the Draft EIS about social effects of the Project on community cohesion, Denison needs to provide additional detail within the Final EIS related to Denison's commitment to developing monitoring and management programs to understand and respond adaptively to potential effects of the Project on community cohesion. This includes monitoring and management programs prepared with MN-S, and NR1 and NR3 Locals involvement and agreement that		Section 12.2.4.2.1 describes that multiple pick-up points for workers will be determined as part of Project design, including additional locations to be determined relative to eligible labour force supply. As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.	and implementation process. Section 12.2.4.2.1 describes that multiple pick-up points for workers will be determined as part of Project design, including additional locations to be determined relative to eligible labour force supply. MN-S will be informed throughout the monitoring program design and implementation process (as described in Section 8)			

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		could support community members dealing with use of alcohol/substances and/or related violence and crime.						
Métis Nation – Saskatchewan	Other	The draft EIS does not clarify the influence of groundwater temperature on Whitefish Lake. Recommendations: - Denison needs to confirm the influence of groundwater temperature on Whitefish Lake in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #446)	There is no expectation of influence of groundwater temperature on Whitefish Lake during any phase of the Project. Groundwater would be expected to enter (discharge) to Whitefish Lake at its typical ambient temperature.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	he removal of the freeze wall may cause increased migration of constituents that could cause environmental release to the receiving environment unintentionally. Recommendations: Denison needs to clarify the following with MN-S, NR1 Locals, and NR3 Locals: a) the freezing effects on the Upper and Lower barrier zones post mining, and b) if the freeze thaw process could cause increased fracturing potential within these zones.	MN-S Public Comments (March 4, 2023) (Public Comment #447)	A separate technical memo including information related to freeze wall integrity and the basis for design of the freeze wall, which relies on site field data and lived experience from several exiting Saskatchewan mining operations, is provided as an attachment to Attachment to IR-10.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Denison's EIS suggests SaskPower's work related to the extension of an existing 138 kV line will be independent from work led by Denison. Recommendations: - Denison needs to clarify whether the additional 138 kV line was factored into the cumulative effects evaluation. - Denison needs to clarify whether the proposed Project can proceed without the 138 kV line construction. - Denison needs to clarify the timing of the construction of the line and Wheeler River Project construction. - Denison needs to confirm that SaskPower will engage with MN-S, NR1 Locals, and NR3 Locals on line routing and design. - Denison needs to confirm if/when the 138 kV line will be decommissioned.	MN-S Public Comments (March 4, 2023) (Public Comment #449)	Denison provides that the SaskPower extension of an existing 138 kV line is part of the Project component. As it is part of the Project undergoing the assessment, it is not a distinct reasonably foreseeable development included separately in the CEA.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions	Denison has not identified Métis-specific considerations to their employment and training program. Denison has indicated that there will in-house training, as well. It is not clear how this will be delivered. Denison notes some jobs will require a Grade 12 education in addition to in- house training programs, but does not offer to support Métis peoples obtain Grade 12 education to access available positions. Terminology like “could” is a vague indicator of commitment to developing strategies to address training and support systems for workers. More detail is needed to understand Denison's approach and commitment to addressing community concerns related to providing appropriate local resources for training and support as access to education and supports systems effects for residents of the LSA.	MN-S Public Comments (March 4, 2023) (Public Comment #450, #509, #536)	Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions (such as Northlands College) to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment and training will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA. All positions at the Project will require a Grade 12 education or	Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		Recommendations: - MN-S would like confirmation on what kind of education and training support Denison will make available to maximize employment from Communities of Interest. - Denison needs to support Métis training opportunities through Northlands College. - MN-S would like additional details on which roles will need Grade 12, and how many roles are available for people without Grade 12. - Denison needs to provide more detail within the Final EIS related to their role in developing and providing culturally appropriate resources for training, education and supports systems as access has already been identified as a barrier to local communities. - Denison needs to support Métis training opportunities through Northlands College. - Denison needs to provide more certainty and detail within the Final EIS related to local training and employment. More detail within the Final EIS related to Denison's role in developing and providing resources for training and employment as access has already been identified as a barrier to local communities. This includes training programs prepared with MN-S/NR1 and NR3 Locals involvement and agreement. - More information is needed to understand Denison's approach and commitment to addressing effects to local employment especially as it relates to Foundational positions and why a Grade 12 education is required. -Denison needs to update the Economics Section to reflect the latest census and the effects that Covid has had on employment in the LSA and RSA. - Denison needs to engage MN-S, NR1 Locals, and NR3 Locals to discuss employment and training opportunities for Métis (e.g., discussing Métis-specific recruitment strategies). Opportunities to discuss include (but are not limited to): hiring and training practices during all phases of the Project, on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs.		equivalent. Section 13.3.2.1 describes how foundational positions (i.e. entry level) require Grade 12 education and in-house training programs, although a combination of skills and experience may be considered. These positions would include process plant operators, site services, drillers, and catering/janitorial staff. Denison will update the Economics Section to reflect the latest census and the effects that Covid has had on employment in the LSA and RSA. Further, Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS.	(described in Section 13). Section 13 was updated to reflect the 2021 Census. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 as described in Section 4.			
Métis Nation – Saskatchewan	Health and socio-economic conditions	Denison does not specify the goods and services during Construction, Operation, and Decommissioning. MN-S is interested in sharing potential goods and services opportunities for Métis peoples (e.g., chefs and artisans). Denison has not specified how it is transmitting knowledge nor provided an explanation of the procurement approach. Recommendations: - Denison needs to provide specific information on the goods and services opportunity available to Métis as per labour force and business analysis. - Denison needs to clarify how it has made MN-S, NR1, and NR3 Locals aware of the procurement approach and opportunities, and how it will keep them informed through the life of the Project.	MN-S Public Comments (March 4, 2023) (Public Comment #451)	Denison will establish a procurement approach throughout all phases of the Project, prioritizing the procurement of goods and services for the Project toward businesses based within the LSA communities prior to looking elsewhere in northern Saskatchewan, southern Saskatchewan, and/or outside of Saskatchewan. This procurement approach may consider advance sharing of purchasing requirements of goods and services throughout all phases of the Project, efforts to increase the capacity and capabilities of businesses to increase successful bidding outcomes, and the development of a business registry.	Denison will establish a procurement approach throughout all phases of the Project, prioritizing the procurement of goods and services for the Project toward businesses based within the LSA communities prior to looking elsewhere in northern Saskatchewan, southern Saskatchewan, and/or outside of	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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					Saskatchewan (as describe in Section 13).			
Métis Nation – Saskatchewan	Other	The Draft EIS does not include a draft Environmental Protection Plan (EPP) or a summary of how the EPP will be developed. The Métis Knowledge Study is yet to be completed and these plans should not be completed without considering the Métis Knowledge Study. Draft monitoring plans were not available for review to confirm how Denison plans to inform plans with existing local and traditional knowledge. Recommendations: - Denison needs to provide an Environmental Protection Plan with the Final EIS. - Denison needs to involve MN-S, NR1 Locals, and NR3 Locals in the development and implementation of the Environmental Protection Program so that Métis can ensure their interests and Métis Knowledge are included. Additionally involvement in the development of monitoring plans and review of MN-S knowledge usage and how it informed the plan should also be undertaken. - Denison needs to share all engagement plans and reports of interest to MN-S, NR1 Locals, and NR3 Locals for input, review and comment. - Denison needs to include an implementation and reporting plan with the monitoring plans.	MN-S Public Comments (March 4, 2023) (Public Comment #452)	With respect to Part i) of the comment the following is noted. The MN-S review comments accurately indicates that a draft Environmental Protection Plan was not included in the EIS submission; rather, Section 2.9.1.3.1 of the draft EIS provides the commitment to develop an Environmental Protection Program (EPP) and associated plans. The EPP would be established to provide an overarching framework for key environmental monitoring and management plans and to ensure a means to demonstrate compliance with applicable environmental regulatory requirements and other performance targets. The EPP would be developed in a manner that aligns with the ISO 14001 EMS Standard. As noted on the draft EIS, Denison has opted to execute the overall Project approvals process - that is, the environmental assessment and licensing / permitting processes - in series and not simultaneously. As such, the documentation referenced in the MN-S review comment will be developed during the licensing / permitting phase and will be available for review at that time rather than as part of the final EIS. The level of information provided in the draft EIS is appropriate for the stage at which the overall Project approvals process currently sits, and as noted, MN-S, and others, will have an opportunity to review documentation that is developed at later stages of the overall approvals process as appropriate. With respect to Parts ii), iii) and iv) of the comment the following is noted. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLRO are understood as organizations. A study agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. Denison is now in receipt of this study and is in the process of reviewing the information contained therein to identify how the information will be incorporated into the final EIS. It is important to note that Denison has incorporated Métis land use information and perspectives into the draft EIS, through the funding of the Kineepik Métis Land and Occupancy information along with the KML VEC statement, of which relevant information has been incorporated directly into the draft EIS to determine effects to the human environment. Additionally, and as noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other stakeholders, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13). MN-S will be informed throughout the monitoring program design and implementation process (as described in Section 8).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				applicable) to reduce effects during the lifetime of the Project, and programs will have spatial boundaries that are sufficiently extensive to measure EIS predictions.				
Métis Nation – Saskatchewan	Health and socio-economic conditions	No Emergency Preparedness and Response Program was available for review. Recommendations: - Denison needs to include an Emergency Preparedness and Response Program in the Final EIS for review. - Denison to include information on transportation accidents within the Emergency Preparedness and Response Program.	MN-S Public Comments (March 4, 2023) (Public Comment #453)	With respect to Part i) of the comment the following is noted. The MN-S review comments accurately indicates that a draft Emergency Preparedness and Response Program was not included in the EIS submission; rather, Section 2.9.1.3.5 of the draft EIS provides the commitment to develop an Emergency Preparedness and Response Program (EPRP). The EPRP would be established to identify how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property. The EPRP would be developed in a manner that aligns with guidance provided by CNSC in REGDOC-2.10.1. As noted on the draft EIS, Denison has opted to execute the overall Project approvals process - that is, the environmental assessment and licensing / permitting processes - in series and not simultaneously. A such, the documentation referenced in the MN-S review comment will be developed during the licensing / permitting phase and will be available for review at that time rather than as part of the final EIS. The level of information provided in the draft EIS is appropriate for the stage at which the overall Project approvals process currently sits, and as noted, MN-S, and others, will have an opportunity to review documentation that is developed at later stages of the overall approvals process as appropriate. With respect to Part ii) of the comment the following is noted. The EPRP will include information relevant to transportation accidents and responses thereof. Further, information regarding aspects of emergency response with respect to transportation accidents was provided in the draft EIS and direction to that information is highlighted as follows for reference. Postulated traffic accident scenarios were considered in the Accidents and Malfunctions Technical Supporting Document (TSD; Appendix 14-A) as summarized in Section 14 of the draft EIS. As mitigation for such scenarios the accidents and malfunctions assessment highlighted commitments to develop the EPRP and several plan and procedure level documents (e.g., spill response plan; an emergency response plan; a traffic and transportation plan; a travel management plan; personnel training procedures). Additionally, Section 12.3 of the draft EIS discusses mitigation measures that will be implemented to reduce adverse traffic effects, as well as mitigation measures to be implemented to reduce adverse effects on emergency services capacity such as: • All drivers serving the Project will receive appropriate training related to the nature of materials being transported, including driver training to the highest standards based on the transportation of nuclear substances. • Vehicles transporting dangerous goods and/or hazardous products will display required placards and labels in accordance with provincial legislation and will follow designated highway corridors. • All materials transported by truck will be compliant with any weight restrictions or permits, spring road restrictions, or geometric constraints set out by the Saskatchewan MOHI. • Denison will maintain Project roads and the main access road to the	Section 2.9.1.3.5 of the draft EIS provides the commitment to develop an Emergency Preparedness and Response Program (EPRP).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				site. First aid facilities will be supplied during construction. • A primary care paramedic will be contracted to provide care on site through all phases of the Project. Denison will provide the appropriate amount of First Aid and CPR training to make sure employees have adequate coverage. • Mandatory safety orientations will be held for contractors and workers. • First aid personnel will provide transport to a hospital by air when required or by Saskatchewan's air ambulances; • Health and safety management programs will be developed for Construction, Operation, and Decommissioning. • Workers will be trained in fuel handling, equipment maintenance, and fire prevention and response measures. • Denison's Environment, Health, Safety, and Sustainability Policy will be enforced. • Continued liaison with LSA communities and relevant authorities (e.g., RCMP, health and service providers) will be undertaken to provide updates, discuss any Project-related concerns, and make sure that the required resources are in place. • Project-specific contingency, emergency response, and spill prevention plans will be developed to reduce the likelihood and severity of accidents and potential fires. • Based on the outcomes of discussions with COI, Denison may provide support and/or training to local emergency services to make sure that staff are adequately prepared in the unlikely event of an accident, malfunction, or spill on Highways 914 or 165. This may include the provision of specialty materials or equipment to deal with an emergency response.				
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes	The Draft EIS does not yet include Métis Knowledge from NR1 and NR 3 other than Kineepik. The Draft EIS does not include information on how Denison intends to include the outcome of the Métis Knowledge Study. Perspectives on cumulative impacts have only been considered for English River First Nation and Kineepik Metis. This has resulted in an absence of MN-S perspective regarding cumulative impacts within the Project and surrounding areas. Recommendations: - Denison needs to provide a clear indication of how the MKS findings were included in the Final EIS (e.g., effects analysis, cumulative effects analysis, mitigation measures, etc.) including confirming use with MN-S. - The Assessment should not be considered complete until the Métis Knowledge Study is finished and factored in.	MN-S Public Comments (March 4, 2023) (Public Comment #454)	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLRO are understood as organizations. A study agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. Denison is now in receipt of this study and is in the process of reviewing the information contained therein to identify how the information will be incorporated into the final EIS. It is important to note that Denison has incorporated Métis land use information and perspectives into the draft EIS, through the funding of the Kineepik Métis Land and Occupancy information along with the KML VEC statement, of which relevant information has been incorporated directly into the draft EIS to determine effects to the human environment.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Current use of lands and	Details are not provided regarding how these programs and plans will be developed and implemented, or how they will integrate the needs of all the Indigenous and Métis communities. Recommendations: - Denison needs to clarify whether discrepancies will only be addressed by follow-up and monitoring.	MN-S Public Comments (March 4, 2023) (Public Comment #455, #492, #501, #510,	As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following	MN-S will be informed throughout the monitoring program design and implementation process.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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	resources for traditional purposes	- Denison needs to involve MN-S, NR1 and NR3 in determining other means for examining divergences and informing follow-up and monitoring (e.g., collaborative field studies). - Denison needs to include in the Final EIS, management and monitoring plans that were prepared with MN-S and NR1 and NR3 Locals involvement and agreement. - Denison needs to include in the Final EIS, health risk assessment management and monitoring plans that are prepared with MN-S involvement and agreement to address suitability of land and resources for Indigenous land users. - Denison should confirm this assertion through a monitoring program that will focus on providing data to verify the predictions and include communication planning to convey health risk assessment results. This may also address assumptions about perceived suitability of lands and resources. - Denison needs to provide more detail within the Final EIS related to the health and wellness programs and their role in developing and providing resources of this type. This should include the provision of services more broadly within communities, not just to individuals on-site. - Denison to confirm how Métis input is considered in mitigation development. - Denison needs to provide more detail within the Final EIS related to a commitment to developing and key components of life skills programs. It is appropriate to address the issues as they are identified as an effect of the project in the proceeding section regardless of the certainty of these effects. - Denison should clarify their commitment to providing provide community social services to the families of local employees to address issue identified in relation to the shift rotation (e.g., childcare services) - Denison to provide additional information of on-site health services that will alleviate community-based health services in NR1 and NR3. - Denison needs to confirm how social responsibility guidelines will support community infrastructure and services in NR1 and NR3 to help offset some of the interactions and effects to local communities and timelines for the action. - MN-S requests that in the Final EIS, Denison include the addition of interactions and effects analysis for Post- Decommissioning impacts to economics that may stem from Employment Income within the LSA communities related to monitoring and the implementation of management programs to respond adaptively to potential effects of the Project. This includes monitoring and management programs prepared with MN-S, NR1 Locals, and NR3 Locals involvement and agreement.	#511, #521, #523, #527)	principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions. As the Project site will be self-sufficient in terms of meeting the needs of the Project and its workforce, the effects related to local communities are associated with the effects of participation in employment and the associated commuter rotation system. With the application of mitigation measures described in Section 12.3.5, and given the distance between communities in the LSA and the Project site, the residual adverse effects are expected to be low in magnitude The overall conclusion relative to changes to Infrastructure and Services is not significant.				
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The EIS notes that "In 2021, Denison announced the adoption of an Indigenous Peoples Policy (IPP). The IPP reflects Denison's recognition of the important role of Canadian business in the process of reconciliation with Indigenous peoples in Canada and outlines Denison's commitment to take action towards advancing reconciliation. The IPP was developed based on Denison's experiences with, as well as feedback and guidance received from, Indigenous communities with whom Denison is actively engaged. This approach was designed to make sure the IPP appropriately	MN-S Public Comments (March 4, 2023) (Public Comment #456)	Denison's IPP is a principles based policy and addresses its vision for reconcile-action in all of Denison's activities. How the policy will be executed will vary on a project to project and community to community basis. The process includes a continually evolving Reconciliation Action Plan, that Denison will seek periodic input on from its Indigenous partners to ensure that it remains relevant to in the ongoing evolving landscape of reconciliation.	Denison will seek periodic input on from its Indigenous partners to ensure that it remains relevant to in the ongoing evolving landscape of reconciliation	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		captures a mutual vision for reconciliation. The IPP identifies five key areas of action that will support the ongoing development of a continuously evolving Reconciliation Action Plan (RAP): Engagement; Empowerment; Environment; Employment; and Education. Through the RAP, Denison is striving to interweave the principles of reconciliation throughout all areas of the company's operations (Denison 2021a)." Denison does not explain how it will accomplish free, prior, and informed consent (FPIC) as per the IPP and RAP [2]. Recommendations: - Denison needs to clarify how it intends to consider free, prior, and informed consent (FPIC). [2] Engagement – We are committed to building long-term and mutually respectful relationships through proactive engagement and consultation with Indigenous people. Our aim is to work to achieve the free, prior, and informed consent, where the potential for impacts to rights may occur, before proceeding with economic development projects and during ongoing activities and operations						
Métis Nation – Saskatchewan	Other	MN-S appreciates Denison's willingness to evolve engagement activities in response to feedback from MN-S over time. Recommendations: - Denison to continue engaging and involving MN-S, NR1 Locals, and NR3 Locals during the revisions of the Draft EIS and completion of outstanding plans.	MN-S Public Comments (March 4, 2023) (Public Comment #458)	Noted, throughout the engagement, Denison has consistently affirmed its interest in MN-S participation and the incorporation of Métis knowledge into the EIS, in addition to the information and input that has already been gathered with KML.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Denison is taking engagement direction from MN-S to not lump public engagement efforts with Métis engagement is appreciated. Recommendations: - Denison needs to engage Beauval/Sipishik Métis Local #37 throughout the life of the Project.	MN-S Public Comments (March 4, 2023) (Public Comment #459)	Noted, Denison will continue to engage with MN-S, including Beauval/Sipishik Métis Local #37, at their direction for the life for relevant stages of the Project.	Denison will continue to engage with MN-S, including Beauval/Sipishik Métis Local #37, at their direction for the life for relevant stages of the Project.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions	The safety of all Métis peoples that will be engaged or employed by the Project is of utmost importance. Racism towards Métis peoples will not be tolerated. Denison's policies need to support a safe work culture for all. Recommendations: - Denison needs to share all policies related to creating a safe workplace with MN-S, NR1 Locals, and NR3 Locals for review and comment (e.g., health and safety policies and the Workplace Violence & Harassment Policy). - Denison needs to create a culturally safe workplace for Métis peoples. - Denison needs to clarify its policies to prevent incidents of workplace violence and harassment and identify clear actions to address potential incidents of workplace violence and harassment. - Denison needs to mandate cultural awareness training for all employees to help with one the Project's established principles: "approaching	MN-S Public Comments (March 4, 2023) (Public Comment #460)	Denison has an established Workplace Violence and Harassment Policy and an Indigenous Peoples Policy, both of which are publicly available on Denison's website. These two policies create the conditions for an inclusive and diverse work environment and a safe work culture for all. Policies will be adapted to the conditions of the Project and Denison welcomes specific feedback on Métis interests and concerns. Further, Section 12.2.5 Mitigation Measures for Community Well-being describes the establishment of health and wellness programming on-site, an Employee and Family Assistance Program (EFAP), a no alcohol and drug policy on Project site, the enforcement of Denison's Environment, Health, Safety, and Sustainability Policy, the implementation of culturally sensitive employment policies to support the Indigenous workforce (for example, having an Elder representative at the Project site to provide cultural programming), among others.	Section 12.2.5 Mitigation Measures for Community Well-being describes the establishment of health and wellness programming on-site, an Employee and Family Assistance Program (EFAP), a no alcohol and drug policy on Project site, the enforcement of Denison's Environment, Health, Safety, and Sustainability Policy, the implementation of culturally sensitive employment policies to support the Indigenous workforce (for	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		sustainability and engagement activities with the utmost respect for Indigenous communities, Indigenous Rights, and Indigenous Knowledge".			example, having an Elder representative at the Project site to provide cultural programming), among others.			
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Denison's Draft EIS notes that Denison and MN-S were in the process of developing a capacity funding agreement. Since the Draft EIS was published, Denison and MN-S reached an agreement. Recommendations: - Denison needs to revise the Final EIS to note that a capacity funding agreement was reached with MN-S.	MN-S Public Comments (March 4, 2023) (Public Comment #462)	The EIS will be updated to reflect the capacity funding agreement reached with the MN-S.	Section 4 of the EIS is updated to reflect the capacity funding agreement reached with the MN-S.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Métis input to VC selection was limited to NR3 communities. Recommendations: - Denison needs to confirm the selected valued components with Métis Locals in NR1 and NR3 and revise the Final EIS as required to reflect their input. - Denison needs to include in the Final EIS input from the Métis Knowledge Study and any changes in the selection of VCs and their characterization.	MN-S Public Comments (March 4, 2023) (Public Comment #463, #487)	At the direction of the MN-S, Denison participated in meetings on February 12, 2023 with NR1 and on February 13, 2023 with NR3. The participants at these sessions were identified and invited by the MN-S. During these meetings, Denison shared information about the Project and the associated VCs assessed as part of the environmental assessment. No new VCs were identified as part of that discussion, and should new ones emerge through process, we would consider them at that time. A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The use of "complimentary and influential" does not reflect current best practices that acknowledge Indigenous Knowledge as an equal but different way of knowing (than western science). This terminology implies that Indigenous Knowledge can be absorbed into a scientific approach. Recommendations: - Denison needs to confirm use of the wording "complimentary and influential" and how the use of Indigenous Knowledge is treated as equal to western science in the Final EIS. - Denison needs to confirm if it intends the use of "complimentary" or "complementary". Best practices will differ depending on intention.	MN-S Public Comments (March 4, 2023) (Public Comment #464)	Section 5.1 of the EIS explains that the project is assessment under the Canadian Environmental Assessment Act, 2012, along with the Saskatchewan Environmental Assessment Act. As such, the Canadian Environmental Assessment Agency's reference guidance (CEAA 2015) on considering Aboriginal traditional knowledge for EAs under the Canadian Environmental Assessment Act 2012 is considered as relevant guidance. Further to this (see Section 3.3.1 of the EIS) Denison has committed to working with Indigenous communities in a spirit of mutual respect and cooperation. Denison's Indigenous Peoples Policy reflects the company's belief that reconciliation is advanced through collaboration with Indigenous peoples and communities to build long-lasting, respectful, trusting, and mutually beneficial relationships. Section 3.2.2 of the EIS notes that access to Indigenous Knowledge is a privilege and must be respected. Prior to sharing and collecting IK, local protocols and procedures developed by the Indigenous COIs for the management of IK were requested and applied. For some communities, this meant Indigenous Knowledge was shared with Denison and its consultants for use in the EIS with measures in place to protect the privacy of the IK, and in others communities consented to reports being shared and appended to the EIS itself. Denison will continue to work with the Indigenous COIs to ensure this information is shared and protected in manner consistent with community protocols.	Section 5 was updated (re: complimentary vs complementary)	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				Noted, the use of 'complimentary' and 'complementary' will be revisited throughout the EIS.				
Métis Nation – Saskatchewan	Health and socio-economic conditions	Interactions with the Human Environment Valued Components should be consistent with interaction table in related technical VC assessment sections. Comments have been made for revision to some of the interaction table in related VCs. Recommendations: - Denison needs to update Table 5.6-2 be to be consistent with revised interaction tables for related VCs.	MN-S Public Comments (March 4, 2023) (Public Comment #465)	Acknowledged. Table 5.6-2, Summary Interaction Matrix for Valued Components in the Human Environment, will be cross-checked against the VC interactions tables related to the biophysical environment and updated for consistency in the final EIS, and in consideration of the comments provided by the reviewer on the individual biophysical environment VC interaction tables as noted.	Table 5.6-2 has been updated.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	It's best practice in environmental assessments to acknowledge limitations on data and analysis used for the assessment. This identifies constraints imposed on the assessment due to limitations in data or analysis that can influence or limit the ability to predict potential effects of the Project. This may be provided as a "technical boundary" or in some other transparent way as a part of the assessment reporting. Recommendations: - Denison needs to provide details in the Final EIS on data and analysis limitations.	MN-S Public Comments (March 4, 2023) (Public Comment #466)	Data and analysis limitations are described within the relevant VCs existing environment, where applicable. As an example, See Section 12.2.3 Existing Environment for Community Well-Being which describes the limitations of Statistics Canada Census of Population Data, the limitations of Statistics Canada incident-based crime statistics, limitations associated to key person interviews, and others.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Details should be provided on what level of residual effects are carried forward for residual effects evaluation. This would help provide a consistent method for bringing measurable effects for a full residual effect assessment. This ensures that measurable (even minor) are not overlooked in residual effects characterization and consideration of significance. From review of the Draft EIS, there are instances where effects that remain after the implementation of all mitigation measures and management plans are characterized as minor and not carried forward for evaluation. Recommendations: - Denison needs to provide details on the development and choice of thresholds used to describe residual effects including how LK and IK were considered in threshold development. - Denison needs to provide further explanation as to why minor effects will have no or negligible effects and should not be considered further.	MN-S Public Comments (March 4, 2023) (Public Comment #467)	Section 5 of the draft EIS provides an overview of the assessment methodology, including how residual effects were characterized (i.e., those effects that were measurable after consideration of proposed mitigation. Each technical section of the draft EIS where effects are considered (draft EIS Sections 6 through 13) uses this assessment framework in consideration of the specific VCs / KIs that have bee defined to represent that environmental component. Effects thresholds that define the presence / or absence of a residual effect have been described for each VC / KI. In some cases the thresholds are narrative in nature and in some cases, where available, numeric thresholds are used. The former tended to be based on SME knowledge and experience in like assessments and situations and in the latter the thresholds tended to be derived from published environmental quality objectives and guidelines. As an example, the manner by which residual effects were characterized for the Fish and Fish Habitat VC is given. Section 8.3.6.1 of the draft EIS provides the definition for a residual effect as follows, "A residual adverse effect on the Fish and Fish Habitat VC is defined as a measurable change in the concentrations of a surface water quality parameter(s) that exceed relevant water quality assessment benchmarks that represent concentrations that are protective of aquatic biota and water uses in watercourse and waterbodies that receive mine-affected drainage. " In this example a numeric threshold is used (i.e., a relevant water quality assessment benchmark) and rationale is provided for its use (i.e., represent concentrations that are protective of aquatic biota and water uses in watercourse and waterbodies that receive mine-affected drainage). The threshold is both transparent and reasonable with the context of the assessment, though it is acknowledged that some level of change in the VC (or more precisely its measurable parameter) is deemed	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				acceptable on condition that the change is not of a magnitude from which negative effects could accrue. Each technical section of the draft EIS where effects are considered (draft EIS Sections 6 through 13) notes how Indigenous Knowledge (IK), Local Knowledge (LK) and Engagement influenced the assessment. Whether generic or specific in nature the information was considered and woven into the assessment where possible. For example, water and the protection of water was generally noted as a key consideration to Indigenous peoples and LK holders. Accordingly, informs the framework of the assessment to ensure that water quality related VCs are included to provide a comprehensive evaluation related to water quality and affirms the need to assess water quality and sediment quality as they inform assessments for benthic invertebrates, fish and fish habitat, human health, and Indigenous land and resource use components.				
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Denison acknowledges that cumulative effects are important to Indigenous communities in section 5.9.3. For many Indigenous communities and governments, cumulative effects analysis requires an assessment this includes pre-development conditions to understand the impacts of past and existing activities that continue to affect the context for environmental and social systems. Considering the fuller context of historic change during an EA is an evolving best practice and is recognized through numerous Canadian cumulative effects assessment initiatives and management frameworks (e.g., Indigenous Centre for Cumulative Effects) and recent Indigenous led environmental assessment (e.g., Squamish Nation Assessment Process). Recommendations: - Denison needs to provide further detail on what projects and activities were considered in the cumulative effects i.e., table listing projects. - Denison needs to provide further detail on how it considers cumulative effects important to Indigenous communities and whether it includes an evaluation of changes to pre- development conditions as is being done as practice in other environmental assessments. This would allow Indigenous communities to better understand the ongoing impacts of past and existing activities that continue to affect Indigenous cultural use of lands and resources.	MN-S Public Comments (March 4, 2023) (Public Comment #468)	With respect to review comment i) the following is noted. Section 5.9.2 of the draft EIS provides an overview of other Projects and activities that were considered present and reasonably foreseeable and could be a source of residual effects that could interact with the Project-specific residual effects. A preliminary list of projects and activities for potential consideration in the VC-specific cumulative effects assessment for the Project was provided in Table 5.9-1 of the draft EIS and their locations were shown relative to the Project site in Figure 5.9-1. Per Section 5.9.2.1 of the draft EIS, the original (or "preliminary") list of Projects and activities was scrutinized relative to various screening criteria to identify those present and reasonably foreseeable Projects and activities that were likely to interact with the Project VC in cumulative manner. It was this subset of Projects and activities that was carried forward into the cumulative effects assessment as described in Section 5.9.2.1.1 of the draft EIS. With respect to comment ii) the following is noted. The Wheeler River Project EIS is subject the Canadian Environmental Assessment Act, 2012. In this assessment framework, the Project-specific cumulative effects assessment (CEA) considers whether residual adverse effects of the Project on a given VC will overlap spatially and/or temporally with residual adverse effects on the VC resulting from other past, present, and reasonably foreseeable projects or activities. The CEA follows standard methodology as per provincial (e.g., Guidelines for an Environmental Assessment [Government of Saskatchewan 2022]) and federal guidance (e.g., Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012 [Government of Canada 2019]). As noted in the IR, Section 5.9.3 of the draft EIS describes how Denison considers the cumulative effects assessment to be important to Indigenous peoples. As noted, the cumulative effects assessment is important to Indigenous communities because incremental effects to the environment can weaken resource economies, affect important resources such as plants, fish, and wildlife, affect rights-based and cultural activities, and affect both the health of wildlife and humans. Denison also noted and acknowledged the important relationship of the Indigenous Communities of Interest to the lands and waters in the Project study areas and sought	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				out information from Indigenous Communities of Interest (ERFN and the Kineepik Métis Local #9 at Pinehouse (KML)) with respect to their Indigenous Knowledge on past, present, and predicted cumulative effects. Denison believes that the cumulative effects assessment does appropriately consider changes to pre- development conditions. References Government of Canada. 2019. Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012. https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/assessing-cumulative-environmental-effects-ceaa2012.html. Government of Saskatchewan. 2022. Guidelines for an Environmental Assessment. https://www.saskatchewan.ca/business/environmental-protection-and-sustainability/environmental-assessment/does-my-project-need-an-environmental-assessment.				
Métis Nation – Saskatchewan	Other	Clarity is required that this includes existing ongoing activities that may not be certain but are highly likely to occur such as forestry and mine exploration activity. Denison did not include the new powerline that SaskPower is building in Table 5.9-1: Projects and Activities for Consideration in the Cumulative Effects Assessment for the Valued Components. See Section 2.3.1.9 for more details on the powerline to be constructed by SaskPower. Recommendations: · Denison needs to provide further detail on the projects and activities that were considered for cumulative effects and why certain projects and activities were not included. For example, Denison needs to explain how reasonably foreseeable projects and activities that may not be certain but are highly likely in the RSA, such as mining exploration or infrastructure use and maintenance, are not included in Table 5.9-1.	MN-S Public Comments (March 4, 2023) (Public Comment #469)	Section 5.9.2 of the draft EIS provides an overview of other Projects and activities that were considered present and reasonably foreseeable and could be a source of residual effects that could interact with the Project-specific residual effects. A preliminary list of projects and activities for potential consideration in the VC-specific cumulative effects assessment for the Project was provided in Table 5.9-1 of the draft EIS and their locations were shown relative to the Project site in Figure 5.9-1. Per Section 5.9.2.1 of the draft EIS, the original (or "preliminary") list of Projects and activities was scrutinized relative to various screening criteria to identify those present and reasonably foreseeable Projects and activities that were likely to interact with the Project VC in cumulative manner. Also show in Section 5.9.2.1 are the criteria by which the Present or Reasonably Foreseeable Projects and Activities were assessed. These criteria are consistent with CEAA's interim technical guidance on a future project (or physical activity) and how it could be considered reasonably foreseeable and areas as follows: • The intent to proceed is officially announced by a proponent. • The project or activity is under regulatory review (i.e., the application is in process). • The submission for regulatory review is imminent. • The project or activity is identified in a publicly available development plan that is approved or for which approval is anticipated (e.g., a wastewater treatment plant in a city's long term development plan). • The physical activity supports—or is consistent with—the long-term economic or financial assumptions and engineering assumptions made for the project's planning purposes. • A physical activity is required in order for the project to proceed (e.g., rail or port transportation facilities, or a transmission line). • The economic feasibility of the project is contingent upon the future development. • The completion of the project would facilitate or enable the future development. Further information with respect to present and reasonably foreseeable projects and activities pertaining to exploration and mining activities,	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				infrastructure use and maintenance, lodges/outfitters and tourist/ recreational activities and Indigenous and other land use activities are described in draft EIS Sections 5.9.2.1.1 through 5.9.2.1.4, respectively. Rationale for not carrying forward projects / activities that were part of initial screening is described in Section 5.9.2.2. The review comments has specifically references the power line development associated with the implementation of the Project. In response the following is offered. While it is true the power line to service the Project will be constructed by Sask Power the power line has been considered a Project activity for the purpose of the effects assessment and has been assessed in that context. With that there is no rationale nor need for assessing it as a separate project / activity within the CEA.				
Métis Nation – Saskatchewan	Other	There is lack of geotechnical information in the Draft EIS that would expand explanation of Project interactions with geology and groundwater. Recommendations: - The Final EIS needs to demonstrate Denison's commitment to developing appropriate mitigations to avoid or limit identified adverse effects resulting from the Project, whether direct or indirect.	MN-S Public Comments (March 4, 2023) (Public Comment #470)	Denison recognizes that geology and groundwater are of particular importance within the context of the EIS given the proposed mining method and believes that the assessment presented in the EIS and its supporting documentation is comprehensive. Denison is committed to developing / implementing appropriate mitigations to avoid or limit identified adverse effects resulting from the Project, whether direct or indirect. Proposed mitigation measures specific to geology and groundwater and presented in the draft EIS, Section 7.5, Mitigation Measures, and Table 7.5-1 therein provides a summary of mitigation measures based on Project phases for the geology and groundwater VC.	Proposed mitigation measures specific to geology and groundwater and presented in the draft EIS, Section 7.5, Mitigation Measures, and Table 7.5-1 therein provides a summary of mitigation measures based on Project phases for the geology and groundwater VC.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	There is lack of information, details and modelling related to potential subsidence. Recommendations: - Denison needs to provide additional detail in the Final EIS about mitigation measures related to operations affecting subsidence at ground surface including managing for different subsidence areas, different subsidence sizes, and whether subsidence will propagate further ground surface disturbances that will require further and continuous action. - Denison needs to prepare a management and monitoring plan for subsidence.	MN-S Public Comments (March 4, 2023) (Public Comment #471)	To clarify with respect to the potential for subsidence, it is noted that the portion of the deposit being mined is never truly a void and what remains after mining will be a honeycomb texture with water-filled interstices. The mined area is filled with a fluid at all times, whether it be a mining solution, groundwater, or the neutralizing solution. This is different from a more traditional underground operation such as Cigar Lake, where there is physical excavation of the orebody, leaving a temporary air-filled space. Although the uranium ore is high-grade by global standards it is not entirely massive in nature. As such, the uranium will be leached in a 'honeycomb' texture leaving behind a structure of partial intact rock mass with the remaining area being filled by fluid. This retains the pressure balance of the mining zone with the adjacent water-saturated rock masses. Although the above provides context on the absence of true, air-filled voids remaining post-mining, the risk of subsidence has been assessed appropriately in the draft EIS and its supporting documents (see draft EIS as Appendix K to Appendix 7-C; see also draft EIS Section 7 Geology Valued Component - Terrain Morphology and Stability Key Indicator and draft EIS Section 9 Terrain Valued Component - Terrain Morphology Key Indicator and Terrain Stability Key Indicator). The analysis presented in the draft EIS shows there is negligible risk of subsistence and the magnitude of subsistence, if it were to occur, is the range of 7.5 cm at surface. Subsequent to the filing of the draft EIS, Denison has undertaken additional modelling with refined, more granular inputs including consideration of subunits within the altered zone. With this more refined	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				analysis, the potential surface subsidence has been reduced from 7.5 cm to 2.4 to 2.8 mm. Further, this potential subsidence, if it were to occur, would be limited to the footprint directly above the deposit. Given the low levels of risk that has been determined, Denison believes the monitoring and contingency plans as envisioned in the draft EIS are commensurate with this low level of risk and appropriate.				
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Key waterbodies are inconsistently named on the maps/figures throughout Section 8.0 Aquatic Environment. Key waterbodies include those considered as reference or exposure waterbodies, and any others of importance to NR2 and NR3 Locals. Recommendations: - Denison needs to revise maps/figures to include labels for key waterbodies referenced in the EIS, particularly for figures included in section 8. - Denison needs to ensure waterbodies are named consistently throughout section 8.0 Aquatic Environment.	MN-S Public Comments (March 4, 2023) (Public Comment #472)	Acknowledged. Denison will update all maps/figures throughout Section 8 in the final EIS to more consistently include lake names.	Denison will update all maps/figures throughout Section 8 in the final EIS to more consistently include lake names.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Not all fishing and hunting activities are documented. Currently, the MKS has not been completed and therefore this assumption may be incorrect. Recommendations: - Denison needs to revise the fish and fish habitat section as part of the inclusion and consideration of the MKS in the Final EIS. - Denison needs to include additional information in the Final EIS that describes data limitations. A conservative approach would consider all waterbodies in the area to be potential fishing waterbodies for current and future use purposes.	MN-S Public Comments (March 4, 2023) (Public Comment #473)	The draft EIS was prepared in consideration of the information available to Denison at that time. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLR are understood as organizations. A study agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. Denison is now in receipt of this study and is in the process of reviewing the information contained therein to identify how the information will be incorporated into the final EIS. It is important to note that Denison has incorporated Métis land use information and perspectives into the draft EIS, through the funding of the Kineepik Métis Land and Occupancy information along with the KML VEC statement, of which relevant information has been incorporated directly into the draft EIS to determine effects to the human environment. While Denison acknowledges the comment regarding what it perceives as a desire to include more regional data regarding fishing waterbodies of interest to MN-S within the context of cumulative effects, it believes the draft EIS and supporting documentation (including the aquatic environment baseline report, Appendix 8-D) provide a spatially extensive and appropriate description of fish habitat and fish resources in water bodies and water courses to assess potential cumulative effects given the spatial extent of Project interactions with the environment. For the purpose of a Project-specific CEA a cumulative effect can only exist when a residual Project effect overlaps in time and space with other current or reasonably foreseeable projects / activities. Where no such overlap exists, it is beyond the scope of a Project-specific CEA.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Russell Lake is not identified as a location to monitor fish health. Recommendations: - Denison needs to include Russell Lake in the aquatic monitoring program as cumulative effects from the Key Lake operation will be detected in this waterbody and this is an important local fisheries resource waterbody. - Denison should commit to involving MN-S, NR1 and NR3 in the development of management and monitoring plans for the aquatic environment in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #474)	As indicated in the review comment, Russell Lake was not specifically referenced as a location to monitor fish health. This would be based on the draft EIS conclusion that environmental change that might affect fish health (e.g., water quality) would not extend beyond the LSA and into Russell Lake. This however does not preclude incorporating Russell Lake into follow up monitoring based on alternative rationale. Specific details for follow up monitoring program design have yet to be developed and the appropriateness / suitability of sampling areas (including Russell Lake) will be evaluated through that process. Such determinations as to the appropriateness of sampling areas to be utilized for follow up monitoring for the aquatic environment will be made when that monitoring program / plan documentation is developed and would be subject to discussion with Interested Parties. As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other stakeholders, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and programs will have spatial boundaries that are sufficiently extensive to measure EIS predictions. For further reference the following provides an overview of the information presented in the draft EIS and its supporting documentation regarding Russel Lake. Aquatic baseline surveys were conducted at two stations (LAB-1 and LAB-2) in Russell Lake and were considered 'far-field' stations in relation to the proposed mining plan for the Wheeler River Project. Data collection methods and results are presented in the draft EIS throughout the applicable subsections of Section 8. • Section 8.2 details the Surface Water Quality methods and results, • Sections 8.3 and 8.5 detail fish habitat, community, and health methods and results; and • Section 8.4 details sediment quality and benthic invertebrate community and chemistry methods and results. A breakdown of where specific processes and results are located for each of these components is presented below: Surface Water Quality/Chemistry: Surface Water Quality was sampled in Russell Lake. Methods and metrics are presented in Section 8.2.3.1. Water was sampled in Russell Lake and presented in Table 8.2-2 (Pages 8-60 to 8-62) of Section 8.2.3.3 of the EIS report, and summarized in Table 8.2-4. Surface Water predicted maximum Constituents of Potential Concern for the Russell Lake Inlet (LAB-1) are presented in Table 8.2-13 of Section 8.2.4.2.4. Cumulative effects are also assessed in Section 8.2.7. Detailed baseline summary data is presented in Appendix 8-D of the report in Table 3-3.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				Sediment Quality/Chemistry: Sediment was sampled in Russell Lake, and the sample methodology is presented in Section 8.4.3.1. Sediment grain size results are summarized in Table 8.4-2 in Section 8.4.3.2.1, and full data is presented in Appendix 8-D, Table 3-4. Sediment chemistry was summarized in Table 8.4-3, and full data is in Appendix 8-D, Table 3-5. Fish Habitat, Tissue Chemistry, and Community: Russell lake is not clearly indicated in the initial list of sample areas presented in Section 8.3.3 or Section 8.5.3; however, habitat information is presented in the Fish Habitat table (Table 8.3-4) of Section 8.3.3.2, and both Russell Lake sample locations (LAB-1 and LAB-2) and their associated fish community data are presented in the fish community map (Figure 8.3-6). Fish community and information is also presented in Table 8.3-4. Baseline fish community information is presented in Appendix 8-D of the report in Table 3-9. Fish chemistry summary data (Mean, Max, Min) for Northern Pike and White Sucker bone and tissue samples is presented in Table 8.5-2 of Section 8.5.3 of the Draft EIS. Detailed fish tissue data summary is presented in Appendix 8-D of the report in Table 3-10. Benthic Invertebrate Chemistry and Community: Benthic invertebrates were sampled in Russell Lake, and the sample methodology is presented in Section 8.4.3.1. Benthic invertebrate endpoints are summarized in Table 8.4-4 of Section 8.4.3.2.4, and benthic invertebrate chemistry is summarized in Table 8.4-5. Detailed baseline benthic invertebrate community and chemistry data is presented in Appendix 8-D of the report in Table 3-8, and community data in Tables 3-7A to 3-7D. Also, refer to Cumulative Effects sections within each part of the Aquatic Environment assessment in the draft EIS for a discussion of potential cumulative effects in Russell Lake. (i.e., Section 8.2.7 for surface water quality; Section 8.3.7 for fish and fish habitat, 8.4.7 for sediment quality and benthic invertebrates, and 8.5.7 for fish health).				
Métis Nation – Saskatchewan	Other	"Fish Health VC are primarily related to c the controlled" – there is a typo in the report. Recommendations: - Denison needs to address the typo and replace "c" with the complete word.	MN-S Public Comments (March 4, 2023) (Public Comment #475)	Acknowledged. The typo will be corrected in the final version of the EIS as follows, "Potential Project residual effects on the Fish Health VC are primarily related to controlled discharge of site water into local receiving environments during all Project phases."	The typo was corrected in Section 8.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	It is unclear whether there is a physical barrier between Whitefish Lake North and Whitefish Lake South that would allow Whitefish Lake North to be considered as an appropriate reference area for monitoring fish health. Recommendations: - Denison needs to clarify in the Final EIS on an appropriate reference area for monitoring fish health. - Denison needs to confirm fish movements between Whitefish Lake North and Whitefish Lake South and that Whitefish Lake North will be an appropriate reference lake. If it is not appropriate, then another	MN-S Public Comments (March 4, 2023) (Public Comment #476)	To clarify, there is no physical barrier between the north and south portions of Whitefish Lake. As indicated in the review comment the north basin of Whitefish Lake was suggested in the EIS as a potential upstream or reference monitoring for aquatic environment endpoints, including those related to fish health. Specific details for follow up monitoring program design have yet to be developed and the appropriateness / suitability of sampling areas will be evaluated through that process. The north basin of Whitefish Lake is the most proximal aquatic feature upstream of where treated effluent would be discharged and in that regard is a good candidate as a reference or non-influenced area. It is understood that proximity is not the only	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		reference lake such as Kochichowsky Lake may need to be considered for monitoring fish health.		consideration as to the suitability of an area to be utilized as a reference area - as indicated in the review comment fish movement and mobility between sampling areas is also an important consideration since it is necessary to make comparisons, in the case of fish health, between / among independent fish populations. Such determinations as to the appropriateness of sampling areas to be utilized for follow up monitoring for the aquatic environment will be made when that monitoring program / plan documentation is developed and would be subject to discussion with Interested Parties.				
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The terrestrial RSA seems small in consideration of woodland caribou and determining the impacts of the Project in association with the SK1 caribou population. Recommendations: - Denison needs to evaluate the terrestrial RSA as it relates to the SK1 caribou population and Environment Canada's woodland caribou management plan. Provide a detailed explanation in the Final EIS as to how the terrestrial RSA was determined.	MN-S Public Comments (March 4, 2023) (Public Comment #477)	The Project Area was delineated to capture all direct, and most indirect, likely adverse effects on caribou; as this is the zone of influence most likely to affect caribou in the vicinity of the Project (i.e., in the vicinity of human activity, equipment use and vehicle use). The Project Area (169.6 ha) is the direct footprint of proposed Project infrastructure (74.8 ha) with a buffer applied, thereby representing the area of maximum physical disturbance. The Project Area is not VC-specific, but consistent throughout the EIS. The Wildlife LSA was designed to capture the majority of the Project effects. The LSA extends beyond Project Area of the site to include a reasonable estimation of where sensory disturbance from Project-related activities would extend and where effects on wildlife including caribou are most likely to occur. That is the primary rationale for selection of the spatial extent of the LSA – Denison believes this is an appropriate spatial scale that applies broadly to the wildlife VCs as a whole given the perceived mechanism of VC-Project interaction. Importantly, as noted in draft EIS Section 9.3.6.4, in the caribou assessment, the Project Area had a 500 m buffer applied to account for indirect effects/habitat alteration; this area is within the wildlife LSA (refer to Figure 9.3-14 for a map showing the spatial areas). The 500 m buffer for habitat alteration for caribou was selected in accordance with ECCC's (2020) assessment of disturbed areas, which buffered (500 m) anthropogenic disturbances to evaluate woodland caribou habitat. The alteration of available woodland caribou habitat is quantified in this EIS by applying a buffer of 500 m around the Project Area in which Project effects in the form of sensory disturbance are likely to affect available woodland caribou habitat and make it functionally unavailable for use. Boreal caribou occur as one continuous population across the SK1 range, including within the Terrestrial RSA. It was decided to not use the entire SK1 range as an assessment area (e.g., due to the dilution factor) and instead use the Terrestrial RSA to appropriately and adequately assess residual and cumulative effects in proportion to the Project. It was deemed to be not feasible to use a large area like the SK1 range to assess residual Project effects because this would provide inappropriate context or "dilute" the adverse effects of the Project on the caribou that have a home range that overlaps with the RSA. The reviewer is also referred to the response provided to Information	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				Requirement (IR) No. 137 from the Federal Indigenous Review Team (FIRT).				
Métis Nation – Saskatchewan	Other	Figure 9.2-8 identifies lakes and waterbodies separately. There is a lack of clarity between a lake and a waterbody and its treatment in the EIS. Recommendations: - Denison needs to clarify and distinguish in the Final EIS if and why lakes and waterbodies are treated differently.	MN-S Public Comments (March 4, 2023) (Public Comment #478)	Footnote 4 of Table 9.2-5 of the draft EIS describes "lakes" and "waterbodies" the difference within the context of the assessment as follows: “Lakes have been defined as either named lakes or waterbodies observed to exhibit an average depth of ≥2 m (Ecometrix Incorporated 2020). Waterbodies are defined as areas of open water observed to exhibit an average depth of <2 m (Ecometrix Incorporated 2020), or unnamed areas of open water without any existing bathymetric information." For further reference it is noted that lakes were not considered wetlands and not carried forward in our assessment, but waterbodies (identified as either <2m deep or without bathymetric information) were conservatively considered to be shallow open water wetlands and assessed in the wetland assessment.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	There is inadequate evaluation of the combined impact of all of these changes in vegetation on the terrestrial ecosystem. It is unclear whether there will be any short-term or long-term impacts on the overall health of the terrestrial ecosystem due to the individual changes to the terrestrial components. Recommendations: - Denison needs to provide in the Final EIS an assessment of the cumulative impacts of all of the individual changes to the vegetation (e.g., change in vegetation types, a change in the COPC levels in vegetation and a change in wetland composition) on the entire terrestrial ecosystem.	MN-S Public Comments (March 4, 2023) (Public Comment #479)	The assessment of potential Project related effects on the vegetation VCs followed standard assessment methodology using specific KIs and associated MPs. There is no practical, reliable way to combine all of the various KIs and associated MPs into a single, combined expression of potential effects as suggested by the review comment. The standard approach and practice is that each VC is evaluated independently using the KIs and associated MPs, setting appropriately conservative effects thresholds. As outlined in draft EIS Section 9.2.7.4, the residual effects of the Project, in conjunction with the comparable residual effects from past, present, and reasonably foreseeable future projects on the vegetation abundance and constituent concentrations in vegetation KIs were predicted to be not significant. Thus, the cumulative effects are not expected to alter the integrity of the Vegetation and Ecosystems VC (i.e., it remains sustainable and available to contribute to ecological functions) and is predicted to be not significant. Similarly, the residual effects of the Project, in conjunction with the comparable residual effects from past, present, and reasonably foreseeable future projects on the listed plant species and wetlands KIs were predicted to be not significant. Thus, the cumulative effects are not expected to alter the integrity of the Listed Plant Species VC and Wetlands VC (i.e., they remain sustainable and available to contribute to ecological functions) and are predicted to be not significant.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The EA assumptions for moose harvest numbers and success are based on the SK database information which includes information for hunters in the southern portion of the province and for non-Indigenous peoples. Reliance on draw licences to support Project models does not capture Métis harvesting and traditional use activities in the Northern Administrative District of Saskatchewan. Métis do not participate in the draw system as they are recognized rights holders. Indigenous and non-Indigenous hunters have different hunting patterns. Although the data used in the EA is accurate for non- Indigenous hunters,	MN-S Public Comments (March 4, 2023) (Public Comment #480)	With respect to bullet #1 the following is noted. Denison can confirm that the information provided in Section 9.3 (as well as 11.1) of the Draft EIS related to moose harvest data is based on the information that was publicly available from the Saskatchewan Ministry of Environment to contextualize moose harvest in the province and did not include specific harvest information from Indigenous sources as this was not available at the time. The final version of the EIS will provide further clarification as to the source of the moose harvest data, and that specifically it was obtained via the publicly available data regarding draw licenses.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		this data should be used cautiously when assessing a project that is in an area where there is mostly (if not all) Indigenous hunters for moose and other ungulates. Recommendations: - Denison needs to provide confirmation that the assumption that moose harvest information used in the Draft EIS is based on the SK database which includes information for hunters in the southern portion of the province and for non- Indigenous peoples. If yes: o Denison to acknowledge in the Final EIS that the Terrestrial Ecosystem Effects Assessment relied on draw licences to support assessment conclusions and these conclusions do not capture Métis harvesting and traditional use activities in the Northern Administrative District of Saskatchewan. In addition, Denison to note Métis do not participate in the draw system as they are recognized rights holders in the Final EIS. - Denison needs to incorporate Métis Knowledge from the MKS to the Project's Terrestrial Ecosystems Effects Assessment. - Denison to co-develop and implement a moose-specific monitoring and management plan with the Métis. - Denison needs to include Métis harvesting patterns in the Final EIS (e.g., rabbit, moose, caribou, fox etc.).		With respect to bullet #2 the following is noted. The draft EIS was prepared in consideration of the information available to Denison at that time. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLR are understood as organizations. A study agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. Denison is now in receipt of this study and is in the process of reviewing the information contained therein to identify how the information will be incorporated into the final EIS. It is important to note that Denison has incorporated Métis land use information and perspectives into the draft EIS, through the funding of the Kineepik Métis Land and Occupancy information along with the KML VEC statement, of which relevant information has been incorporated directly into the draft EIS to determine effects to the human environment. With respect to bullet #3 the following is noted. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3, is committed to such engagement with respect to monitoring. As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other stakeholders, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and programs will have spatial boundaries that are sufficiently extensive to measure EIS predictions. With respect to bullet #4 the following is noted. The draft EIS was prepared in consideration of the information available to Denison at that time. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. For the purposes of the organization of the EIS, such organizations as the MN-S and YNLR are understood as organizations. A study agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. Denison is now in receipt of this study and is in the process of reviewing the information contained therein to identify how the information will be incorporated into the final EIS. It is important to note that Denison has incorporated Métis land use information and perspectives (including harvesting) into the draft EIS, through the funding of the Kineepik Métis Land and	to Sections 3, 4, 9, 11, 12, and 13).			

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				Occupancy information along with the KML VEC statement, of which relevant information has been incorporated directly into the draft EIS to determine effects to the human environment.				
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The nature of vegetation regeneration on an altered landscape can have continuing effects on woodland caribou. This conclusion is sufficiently vague and assume regeneration will be suitable for woodland caribou. Denison does not provide information on the removal and decommissioning of the roads built for the Project or the extension of the transmission line in the Draft EIS. Linear disturbances like these are incredibly impactful to Métis traditional land use in and around the Project. Recommendations: - Denison needs to identify how it will be determined that post-decommissioning revegetated habitat will be suitable for woodland caribou including any risk assessments completed to confirm the predictions. - Denison needs to involve MN-S as well as NR1 and NR3 Locals in decommissioning planning, mitigation, and monitoring. - Denison to provide further information on the removal and decommissioning of roads built for the Project and the extension of the transmission line built by SaskPower in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #481)	With respect to bullet #1 the following is noted. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS, and are presented at a relatively high level commensurate with the stage of Project development, including consideration of site restoration. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. As the decommissioning plan becomes more specific and granular it is expected that the design basis will become more detailed. Consistent with this approach / process, the expectation is that restoration goals will be defined, the activities to be implemented to meet these goals will be defined and performance criteria to confirm that the goals are being / have been reached will also be defined. It is also noted that Denison has developed a Conceptual Caribou Mitigation Plan (the Plan) during discussions between Denison and Saskatchewan Ministry of Environment (ENV) in May and June 2023. As noted at this time the Plan is conceptual in nature but will go hand in hand with, and evolve with the decommissioning plan over time. Since the boreal caribou range plan for SK-1 is under development, it is understood that this Plan will be updated as more information becomes available. The conceptual nature of the Plan at this time is in part due to the absence of range plan priorities and reflects Denison's commitment to continue to work with ENV to meet the management objectives and management strategies for the SK1 range. With respect to bullet #2 the following is noted. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 and is committed to such engagement with respect to decommissioning planning, mitigation, and monitoring. With respect to bullet #3 the following is noted. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS, and are presented at a relatively high level commensurate with the stage of Project development, including consideration of site restoration. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. As the decommissioning plan becomes more specific and granular it is expected that the design basis will become more detailed. With the context of the evolution of the decommissioning plan for the site, the plans for removal and decommissioning of roads built for the Project and the transmission line will de developed as part of that process.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Changes in the numbers of prey and/or predators during the post-decommissioning period could impact what animals are available for harvesting by the MN- S in the long-term. Recommendations: - Denison needs to clarify and confirm the duration of the habitat changes that may interfere with predator/prey densities including any risk assessments completed to confirm the predictions. - Denison needs to involve MN-S, as well as NR1 and NR3 Locals in decommissioning planning, mitigation, and monitoring.	MN-S Public Comments (March 4, 2023) (Public Comment #482)	With respect to bullet #1 the following is noted. Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. Plans for the post-decommissioning phase, including land restoration are at the conceptual stage and will evolve over time. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS, and are presented at a relatively high level commensurate with the stage of Project development, including consideration of site restoration. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. As the decommissioning plan becomes more specific and granular it is expected that the design basis will become more detailed and specifics as to what the post-decommissioning landscape will entail and the wildlife it would support as referenced in the review question will be developed. It is also noted that Denison has developed a Conceptual Caribou Mitigation Plan (the Plan) based on discussions between Denison and Saskatchewan Ministry of Environment (ENV) in May and June 2023. The Plan is conceptual in nature but will go hand in hand with, and evolve with the decommissioning plan over time. Since the boreal caribou range plan for SK-1 is under development, it is understood that this Plan will be updated as more information becomes available. The conceptual nature of the Plan at this time is in part due to the absence of range plan priorities and reflects Denison's commitment to continue to work with ENV to meet the management objectives and management strategies for the SK1 range. With respect to bullet #2 the following is noted. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 and is committed to such engagement with respect to decommissioning planning, mitigation, and monitoring.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 and is committed to such engagement with respect to decommissioning planning, mitigation, and monitoring.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	A wildlife monitoring plan and a Woodland Caribou Management Plan are important tools for managing caribou in the short and long-term. Recommendations: - Denison needs to involve MN-S as well as NR1 and NR3 Locals in the creation of the Woodland Caribou Management Plan, and include the plan in the Final EIS	MN-S Public Comments (March 4, 2023) (Public Comment #483)	Denison has developed a Conceptual Caribou Mitigation Plan (the Plan) based on discussions between Denison and Saskatchewan Ministry of Environment (ENV) in May and June 2023. As noted the Plan is conceptual in nature at this time, largely because of the absence of range plan priorities. Denison is committed to continue to work with ENV to meet the management objectives and management strategies for the SK1 range as the boreal caribou range plan for SK-1 is developed. The Plan is a living document and will evolve over time as more information becomes available. In this regard, Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 and is committed to such engagement with respect to decommissioning planning, mitigation, and monitoring.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 and is committed to such engagement with respect to decommissioning planning, mitigation, and monitoring.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for	The woodland caribou may not return to the Project area for up to 20 years following post-decommissioning due to available food resources. This may have an impact on long-term harvesting of woodland caribou by the MN-S.	MN-S Public Comments (March 4, 2023) (Public	Denison acknowledges the comment and notes the following. Following submission of the draft EIS in October 2022, Denison has met with Saskatchewan Ministry of Environment (SK ENV) staff to develop a framework for future woodland caribou offset. This information has been presented to the provincial and federal review teams as part of the	N/A	Ongoing - Denison is committed to working toward reaching a	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a

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	traditional purposes; Other	Recommendations: - Denison needs to clarify and confirm the duration of the habitat changes that may interfere with predator/prey densities including any risk assessments completed to confirm the predictions.	Comment #484)	response to federal information requirements in August 2023 as the Conceptual Caribou Mitigation Plan. The Conceptual Caribou Mitigation Plan (the Plan), developed proactively by Denison, has a different objective than the draft EIS. The Plan builds on the assessment of potential Project effects and commitments to consider additional mitigation (offset) to account for non-significant residual effects highlighted in the draft EIS. The Plan is expected to be advanced with ongoing consultation with the SK ENV, as SK ENV finalize the caribou range plan for SK1. The EIS is a conservative planning tool, whereas the Plan is a practical, living document designed to define management works associated with caribou. The Plan is not a requirement for EA determination per se, but is provided as a guidance document to help Denison proactively describe and inform the development and implementation of appropriate mitigation measures related to caribou and their habitat. The Plan is an evergreen document. It will be consistent with the management goals of SK ENV for the SK-1 caribou conservation unit and will be developed/refined in consultation with local communities including English River First Nation and Kineepik Métis Local in Pinehouse and regulators. As noted above, the boreal caribou range plan for SK-1 is under development and it is understood that this Plan will be updated as more information becomes available. The conceptual nature of the Plan is in part due to the absence of range plan priorities and reflects Denison's commitment to continue to work with the province to meet the management objectives and management strategies for the SK1 range. Denison is continuing to work with SK ENV to estimate habitat offset scenarios based on the current Project design which will be refined as the Project advances. A boreal caribou habitat offset calculator is under development by SK ENV and Denison is collaborating with SK ENV to define key scenario attributes. SK ENV will engage with Indigenous communities and nations as the province develops and refines the range management plan for SK1.		resolution on these issues.		resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The 5% threshold disturbance is for a viable population which is the SK1 population. Recommendations: - Denison needs to provide confirmation that the Final EIS appropriately used the Environment Canada threshold values on the woodland caribou population as they relate to the SK1 population. - Denison needs to confirm that the RSA and threshold is suitable in areal extent. See comment 9-001. - Denison needs to commit to re-evaluating their woodland caribou information in the Final EIS. Specifically, to ensure the woodland caribou information used by Denison is in alignment with the SK1 Range Plan being developed by the Province.	MN-S Public Comments (March 4, 2023) (Public Comment #485)	In terms of the woodland caribou population in SK1, the likelihood of self-sustainability for the Boreal Shield range (SK1) has been updated from "unknown" (EC 2012) to "likely" in the amended recovery strategy (ECCC 2020). The SK1 range comprises more than 18,000,000 ha and is characterized by high fire disturbance and low anthropogenic disturbance (ECCC 2020). For SK1, the amended recovery strategy (ECCC 2020) identifies 40% undisturbed habitat in the range as the disturbance management threshold, which provides a measurable probability (71%) for the local population to be self-sustaining. This threshold is considered a minimum threshold because at 40% undisturbed habitat there remains a risk (29%) that the SK1 local population cannot be self-sustaining. According to ECCC (2020) disturbed habitat is habitat showing: i) anthropogenic disturbance visible on Landsat at a scale of 1:50,000, including habitat within a 500 m buffer of the anthropogenic disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				each provincial and territorial jurisdiction (without buffer). In contrast, according to ECCC (2020) undisturbed habitat is habitat not showing any: i) anthropogenic disturbance visible on Landsat at a scale of 1:50,000, including habitat within a 500 m buffer of the anthropogenic disturbance; and/or ii) fire disturbance in the last 40 years, as identified in data from each provincial and territorial jurisdiction (without buffer). The cumulative effects assessment in the draft EIS showed that the Project is expected to add 0.001% of anthropogenic disturbance at the scale of the SK1 Boreal Shield Woodland Caribou Management Unit (Section 9.3.7.3.3 of the EIS). Specific to woodland caribou, the draft EIS evaluated and assessed potential Project-related effects on the boreal population of woodland caribou following standard environmental assessment (EA) methodology. The assessment of potential effects considered both direct (i.e., habitat loss) and indirect effects (i.e., habitat alteration) on caribou and their habitat, while assuming that caribou were present year-round and during all of their life stages (i.e., calving, rearing, mating, over wintering). The rationale for the definition of study areas for the purpose of the assessment of the Terrestrial Environment valued components (VCs) is described in Section 9.1.1 of the draft EIS. The Project Area (169 ha or 1.69 km2) and LSA were delineated based on the expected extent of potential direct (footprint) and indirect (sensory disturbance) Project effects; whereas, the RSA considered an 8 km buffer around the Project Area to provide an appropriate spatial scale upon which potential Project effects could be evaluated at the landscape scale where key Terrestrial Environment VCs reside and move within and upon which cumulative effects could be assessed. Boreal caribou occur as one continuous population across the SK1 range (18,034,870 ha), including within the Terrestrial RSA. After consideration, it was decided by Denison and its Subject Matter Experts at EDI Environmental Dynamics Inc. to use the Terrestrial RSA for the cumulative effects assessment for caribou rather than the entire SK1 range. This decision was made largely on the basis that it would not be feasible / appropriate to use a such large area like the SK1 range to assess cumulative effects since consideration of such a large spatial extent would likely "dilute" the contribution of the Project to potential effects at that scale. In support of this decision, comparison of the Project-specific habitat effects (i.e., the Project Area plus a 500 m buffer to account for sensory disturbance) relative to the scale of the SK1 range (as the applicable management unit for portion of the woodland caribou population that uses the Terrestrial RSA) was made. The comparison indicated that the Project is expected to add 0.001% of anthropogenic disturbance at the scale of the SK1 Boreal Shield Woodland Caribou Management Unit (Section 9.3.7.3.3 of the EIS). As can be seen, the default conclusion at the range scale could only be that the Project does not contribute to cumulative effects at a practical measurable level. Denison and its SMEs believe the EIS took a precautionary or conservative approach to understanding/addressing the likely residual effects (i.e., effects remaining after mitigation measures were considered) of the				

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				Project on caribou and their habitat. This approach provides is appropriate as a planning tool to inform/support future Project-related regulatory approvals processes and to guide the scope and nature of follow-up monitoring. After consideration of measures to avoid and mitigate the potential for effects on caribou and their habitat it was concluded that the likely residual effects of the Project on caribou and their habitat were not significant. While the EIS did not consider specific additional opportunities to offset the non-significant effects, Denison has been working to develop a Conceptual Caribou Mitigation Plan. The plan was submitted to the provincial and federal review teams as part of the response to federal information requirements in August 2023 as the Conceptual Caribou Mitigation Plan and Denison has been in close contact with the Saskatchewan Ministry of Environment (SK ENV), as stewards of woodland caribou from a regulatory perspective. References: Environment and Climate Change Canada (ECCC). 2020. Amended Recovery Strategy for the Woodland Caribou (Rangifer tarandus caribou), Boreal Population, in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. xiii + 143pp.				
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Previous sections of the Draft EIS identified the development of the Woodland Caribou Management Plan. Recommendations: - Denison needs to confirm the preparation and inclusion of a Woodland Caribou Management Plan within this section of the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #486)	Denison acknowledges the comment and notes the following. Following submission of the draft EIS in October 2022, Denison has met with Saskatchewan Ministry of Environment (SK ENV) staff to develop a framework for future woodland caribou offset. This information has been presented to the provincial and federal review teams as part of the response to federal information requirements in August 2023 as the Conceptual Caribou Mitigation Plan. The Conceptual Caribou Mitigation Plan (the Plan), developed proactively by Denison, has a different objective than the draft EIS. The Plan builds on the assessment of potential Project effects and commitments to consider additional mitigation (offset) to account for non-significant residual effects highlighted in the draft EIS. The Plan is expected to be advanced with ongoing consultation with the SK ENV, as SK ENV finalize the caribou range plan for SK1. The EIS is a conservative planning tool, whereas the Plan is a practical, living document designed to define management works associated with caribou. The Plan is not a requirement for EA determination per se, but is provided as a guidance document to help Denison proactively describe and inform the development and implementation of appropriate mitigation measures related to caribou and their habitat. The Plan is an evergreen document. It will be consistent with the management goals of SK ENV for the SK-1 caribou conservation unit and will be developed/refined in consultation with local communities including English River First Nation and Kineepik Métis Local in Pinehouse and regulators. As noted above, the boreal caribou range plan for SK-1 is under development and it is understood that this Plan will be updated as	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				more information becomes available. The conceptual nature of the Plan is in part due to the absence of range plan priorities and reflects Denison's commitment to continue to work with the province to meet the management objectives and management strategies for the SK1 range. Denison is continuing to work with SK ENV to estimate habitat offset scenarios based on the current Project design which will be refined as the Project advances. A boreal caribou habitat offset calculator is under development by SK ENV and Denison is collaborating with SK ENV to define key scenario attributes. SK ENV will engage with Indigenous communities and nations as the province develops and refines the range management plan for SK1.				
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The EIS states: "The parties have specifically agreed to a process between each other that will be funded by Denison and undertaken on behalf of the MN-S in connection with the EA of the Project: a Métis Knowledge Study, meetings to focus on VCs and preliminary effects, and regular meetings and associated costs for hosting such meetings." The correct name is "Métis Nation-Saskatchewan" (no "of"). Recommendations: - Denison needs to correctly reference Métis Nation- Saskatchewan throughout the Final EIS. - Denison needs to include in the Final EIS input from the Métis Knowledge Study and any changes in the selection of VCs and their characterization.	MN-S Public Comments (March 4, 2023) (Public Comment #488)	The EIS will be updated throughout to the correct name "Métis Nation-Saskatchewan" (no "of"). At the direction of the MN-S, Denison participated in meetings on February 12, 2023 with NR1 and on February 13, 2023 with NR3. The participants at these sessions were identified and invited by the MN-S. During these meetings, Denison shared information about the Project and the associated VCs assessed as part of the environmental assessment. No new VCs were identified as part of that discussion, and should new ones emerge through process, we would consider them at that time. A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13). Section 11 has been updated to reflect "MN-S."	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	Many of the Project Phase/Activities listed would contribute to a change in the environmental setting for Indigenous land and resource users within the LSA. Interactions should be considered for temporary or longer-lasting aesthetics impact related to Project-related dust, lighting, noise, and visual disturbance. Recommendations: - Denison needs to revise Table 11.1-7 in the Final EIS to include the addition of interactions and effects analysis for "Perceived suitability of lands and resources therein" that considers Project-related construction and decommission impacts to Indigenous Land and Resource Use. For example, the development of access roads and site preparation during construction, and demolition and disposal of surface infrastructure during decommission, would likely result in some interaction with ILRU related to noise, dust, or traffic.	MN-S Public Comments (March 4, 2023) (Public Comment #489)	Table 11.1-7 will be revisited to include to the development of access roads and site preparation during construction, and demolition and disposal of surface infrastructure during decommission.	Table 11.1-7 has been updated.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for	Missing information to support the claim that other large terrestrial mammals, such as elk and white-tailed deer species, are not found in sufficient abundance in the LSA to be assessed as part the Project. Recommendations:	MN-S Public Comments (March 4, 2023) (Public	Section 11.2.3.1.2 describes how other big game species, such as white-tailed deer or elk, are not hunted in WMZ 75 due to the absence or low abundance of these species.	N/A	Ongoing - Denison is committed to working toward reaching a	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a

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	traditional purposes; Other	- Denison needs to include additional information in the Final EIS on why large terrestrial mammals that are harvested in the LSA (such as elk and white-tailed deer) are not found in sufficient abundance in the LSA to support this conclusion.	Comment #490)			resolution on these issues.		resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	The characterization of the EIS does not yet reflect MN-S and NR1 and NR3 Locals values or interests as this has not yet been provided. It is expected that when made available, this information will be reflected in the Final EIS. In the Draft EIS, Denison has proposed to develop mitigation measures and management planning, but has not begun engaging with Métis Community of Interest and MN-S on contents of mitigation measures or management plans. It is good practice for Communities of Interest, including Métis, to have the opportunity to contribute to the scoping, development, and implementation of mitigation measures and management plans (and monitoring programs), including effectiveness reviews and the application of an adaptive management approach. Arrangements and applicable funding for a Métis Knowledge study is underway but not yet incorporated in the assessment. Recommendations: - Denison needs to include in the Final EIS, information provided by Métis Locals in NR1 and NR3 on their perspectives on other land and resource use. - Denison needs to engage all potentially impacted Métis communities. Specifically, Denison should equally engage all NR1 and NR3 Locals in addition to Kineepik Metis Local #9 on potential Project-related effects to Métis traditional economy throughout the life of the Project. - Denison needs to include in the Final EIS, effects mitigation, and management and monitoring plans that were prepared with MN-S and NR1 and NR3 Locals involvement and agreement. - Denison, in the Final EIS, needs to incorporate the outcome of the Métis Knowledge Study.	MN-S Public Comments (March 4, 2023) (Public Comment #491, #496, #503, #522, #531, #538)	A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study. As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13). MN-S will be informed throughout the monitoring program design and implementation process (as described in Section 8).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	For many Indigenous communities and governments, cumulative effects analysis requires an assessment that includes pre-development conditions to understand the impacts of past and existing activities that continue to affect the context for environmental and social systems. An evolving best practice during an EA is to consider the fuller context of historic change. This practice is recognized through numerous Canadian cumulative effects assessment initiatives and management frameworks (e.g., Indigenous Centre for Cumulative Effects) and recent Indigenous led environmental assessment (e.g., Squamish Nation Assessment Process).	MN-S Public Comments (March 4, 2023) (Public Comment #493)	Noted.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for	The EA assumptions for big game numbers and success are based on the SK database information which includes information for hunters in the southern portion of the province and for non-Indigenous peoples. Reliance on draw licences to support Project models does not capture Métis harvesting and traditional use activities in the Northern	MN-S Public Comments (March 4, 2023) (Public	Section 9.3.3.1.1 describes how the Project is located in WMZ 75, while WMZ 73, 74, and 76 are adjoining WMZ 75 (Figure 9.3 6). Between 2014 and 2020 (the years for which data are available), no draw licences were sold for any of these WMZ and, therefore, no associated harvest was reported to have occurred in the area based on draw licenses. While this	Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable	Ongoing - Denison is committed to working toward reaching a	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a

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	traditional purposes; Other	Administrative District of Saskatchewan. Métis do not participate in the draw system as they are recognized rights holders. Recommendations: - Denison to acknowledge in the Final EIS that the Terrestrial Ecosystem Effects Assessment relied on draw licences to support assessment conclusions and these conclusions do not capture Métis harvesting and traditional use activities in the Northern Administrative District of Saskatchewan. In addition, Denison to note Métis do not participate in the draw system as they are recognized rights holders in the Final EIS. - Denison needs to incorporate Métis Knowledge from the MKS to the Project's Terrestrial Ecosystems Effects Assessment.	Comment #494)	breakdown to WMZ harvest numbers is not available for resident regular licences, it is assumed that most of the annual harvest through resident regular licences occurred in the southern part of the province. A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study.	to Sections 3, 4, 9, 11, 12, and 13).	resolution on these issues.		resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	To characterize trends in wildlife harvesting it would be more appropriate to show a period longer than 1 year; at least 5 years where available. Recommendations: - Following best practices, Denison should include at least 5 years of data in the Final EIS for upland game bird harvest and harvest effort in Game Bird Management.	MN-S Public Comments (March 4, 2023) (Public Comment #495)	Temporal boundaries for characterizing components of the OLRU existing environment varied by topic. Commercial trapping and fishing data were presented based on the data available from the Province of Saskatchewan, and with multiple years of data presented where available. Other topics such as recreational fishing and hunting considered data where available, but in some instances is based on licensing quotas which do not always vary from year to year, or are based on self-reported outcomes. Specific to game bird harvesting, over 5 years of data is provided on annual grouse harvest (2014 to 2020) in Section 9.4.3, Table 9.4-3.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Current use of lands and resources for traditional purposes; Other	This conclusion is not consistent with the methods detailed on page 5-30 in section 5.8 as the Draft EIS identifies noticeable residual effects related to traffic (increased traffic volume) and noise (low to moderate impact). These effects should be taken to residual effects assessment. Recommendations: - To be consistent with the methods detailed in section 5.8, Denison should include all noticeable Project-related effects for residual effects assessment. For example, effects were identified related to traffic (increased traffic volume) and noise (low to moderate impact) but were not taken to residual effects assessment for Other Land and Resource Use in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #497)	Potential Project disturbances considered under this pathway included increases in traffic, noise, air quality, modification of the wilderness experience, and increases in competition for resources. These disturbances will be most detectible in locations proximal to the Project site. Effects have the most potential to affect cabin leaseholders due to their use of ground travel, hunting and fishing activities, and general proximity to the Project. With the exception of dust which has proven mitigation strategies, the overall disturbances are negligible and there are a limited number of resource users who will experience them to any detectible degree. Therefore, this pathway is not carried forward for residual effects assessment. Section 11.2.5 describes the mitigation measures to reduce the impacts of traffic, noise, and others. Further mitigations for traffic are described in Section 12.3.5 in Section 12 and for noise are described in Section 6.2.5 in Section 6.	Section 11.2.5 describes the mitigation measures to reduce the impacts of traffic, noise, and others. Further mitigations for traffic are described in Section 12.3.5 in Section 12 and for noise are described in Section 6.2.5 in Section 6.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes; Other	Need some clarification on this statement as it's reasonable to assume that both parents (mother and father), aunts' and uncles, and other relatives who are members of the community/family would potentially be employed and be away from home. Transmission of knowledge has the potential to be disturbed if multiple family and community members are away on working rotation. Recommendations: - Denison needs to provide clarity in the Final EIS on the statement that "knowledge transmission is likely to continue because the entire family and community are involved'" considering the potential that with local hiring practices in place, multiple family and community members may be	MN-S Public Comments (March 4, 2023) (Public Comment #499)	Denison acknowledges that both parents (mother and father), aunts' and uncles, and other relatives who are members of the community/family could potentially be employed by the Project. Mitigation measures associated with potential effects to cultural continuity and the commuter-rotation system are described in Section 12.1.5 and include: - Working with Indigenous COIs to understand culturally important periods relative to harvest times and cultural camps to facilitate Indigenous employees taking time off to participate in such activities, where practicable; - Implementation of Denison's Indigenous Peoples Policy and advancement of reconciliation - Using a commuter rotation system has also shown to be effective in allowing Indigenous employees continued opportunities to spend time on	As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		away on working rotation and not able to adequately facilitate knowledge transfer.		the land, and important factor in the transmission of knowledge and language (see Section 11 for a description of potential effects to land use). Denison remains committed to maintain positive working relationships with all Indigenous COIs and will be open to discussion on any issues or concerns that arise. As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.	the monitoring program design and implementation process.			
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes; Other	The Draft EIS points to follow-up programs as a way to address any uncertainties identified during the EA process. Insufficient detail is provided to reflect how avoidance of areas near the Project may occur; monitoring (and adaptive management) is needed. More clarity on how monitoring will be developed (in section 12.1.8, p. 12-34) to address this uncertainty. Recommendations: - Denison needs to provide more detail in the Final EIS on monitoring (and adaptive management) for areas of uncertainty such as displacement of cultural activities. This includes management and monitoring plans that were prepared with MN-S involvement and agreement.	MN-S Public Comments (March 4, 2023) (Public Comment #500)	Changes to knowledge transmission as described in Section 12.1.4.2.1 stem from two factors: changes to Indigenous Land and Resource Use, and individual participation in the commuter rotation system - both of which have the potential to affect the ways in which individuals spend time participating in cultural activities. Although there is some uncertainty as to the extent to which individuals will continue to participate in activities that support knowledge transmission, experience from other uranium operations in northern Saskatchewan, the shared and communal nature of cultural expression (i.e., occurs within entire extended families and communities) combined with the Project's minimal effects to land and resource use are not expected to alter the ways in which cultural expression currently occurs (or might vary under regular circumstances). As such, no specific monitoring related to changes to cultural expression are planned. Denison acknowledges the concern raised regarding cultural activities related to working at an industrial operation. Mitigation measures associated with potential effects to cultural continuity (including knowledge transfer and language) are described in Section 12.1.5 and include: - working with Indigenous COIs to understand culturally important periods relative to harvest times and cultural camps to facilitate Indigenous employees taking time off to participate in such activities; and - implementation of Denison's Indigenous Peoples Policy and advancement of reconciliation; Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 and is committed to such engagement with respect to decommissioning planning, mitigation, and monitoring. Denison remains committed to maintaining positing relationships with	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				Indigenous communities and will be open to discussion on any issues or concerns that arise over the course of the Project.				
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	The interaction table (12.2-5) identifies "Employment and Expenditures" as the only project component that would influence community well-being. This is inconsistent with previous interactions tables and information in the Draft EIS that identified potential interactions with the physical components and activities of the project that could affect aspects of community identity and cohesion (e.g., section 12.1 Cultural Expression). Comments were raised in the Draft EIS that community health and well- being is related to the relationship with the environment including issues such as changes in water quality or quantity, and mental health being affected by industrial development. Furthermore, section 12.2.3.3 (p. 12-66 to 12-73) identifies the natural environment as a component of community cohesion. This should be better reflected in the analysis of Community Well-being. Recommendations: - In the Final EIS, Table 12.2-5: Potential Project Interactions for Community Well-being (p. 12-74 to 12-77) should include the addition of interactions and effects analysis for "Change in Community Cohesion" that considers Project- related construction, operations, and decommission impacts to mental, physical, and cultural health that stem from a relationship with the environment. This analysis does not address the concerns expressed in the existing conditions reporting (section 12.2.3, p. 12-47 to 12-50) related to mental and physical health being affected by quality of water and land is being affected by industrial developments. This should be better reflected in the analysis of Community Cohesion. Recommendations: - Denison needs to provide additional effects analysis of "Change in Community Cohesion" that considers Project- related construction, operations, and decommission impacts to mental, physical, and cultural health that stem from a relationship with the environment. For example, concerns were expressed in the Draft EIS reporting (section 12.2.3) related to mental and physical health being affected by quality of water and land is being affected by industrial developments.	MN-S Public Comments (March 4, 2023) (Public Comment #504, #514)	Denison acknowledges that there is an interrelationship between the two and for the purposes of the EIS ha been organized into separate sections. Section 11.1 provides an assessment on perceived suitability of lands and resources therein, along with human health. See Section 11.1.4, 11.1.5, and 11.1.6 for further information.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	The EIS states: "Best efforts will be made to make sure employment is maximized, including within the LSA communities and to encourage business participation within the LSA." (p. 12-80) "Best efforts will be made . . ." is a vague statement about project-related plans to maximize local training, employment, and procurement opportunities that would beneficially impact income levels for residents. More detail is needed to understand Denison's approach and commitment to increased personal income for residents of the LSA. "Community concerns" are identified related to broader spatial (having to	MN-S Public Comments (March 4, 2023) (Public Comment #506, #507)	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. Spatial boundaries for the Economy VC were selected to reflect the geographic areas where economic impacts from the Project are likely to be detectable and measurable. These impacts are expected to be driven primarily by the relationship and interactions between the Project and the COI. The LSA for the assessment of the economy includes ERFN (including	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		move away to work) and temporal ("crash" after project) uncertainty for increased income. More detail is needed to understand Denison's approach and commitment to addressing community concerns related to income for residents of the LSA. Recommendations: - Denison needs to provide more certainty and detail within the Final EIS related to local employment and procurement mitigation as well as supports for employee retention. More information is needed to understand Denison's approach and commitment to increased personal income for residents of the LSA - Denison to expand the LSA communities to include all potentially impacted NR1 and NR3 Locals. - Denison needs to provide more certainty and detail within the Final EIS related to local employment and procurement mitigation as well as supports for employee retention. More information is needed to understand Denison's approach and commitment to addressing community concerns related to increased personal income for residents of the LSA. - Decommissioning planning needs to consider employment transition in addition to site clean-up to avoid boom and bust scenarios.		Indian Reserve Wapachewunak 192D and Indian Reserve La Plonge 192) and Patuanak, Pinehouse Lake, and Beauval. The RSA for the Economy VC is the Northern Saskatchewan Administrative District (Census Division 18), which is defined in The Northern Municipalities Act, 2010 (Government of Saskatchewan 2010). This area shares many economic and demographic characteristics with the LSA and is a relevant reference point. Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions (such as Northlands College) to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment and training will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA. Denison will establish a procurement approach throughout all phases of the Project, prioritizing the procurement of goods and services for the Project toward businesses based within the LSA communities prior to looking elsewhere in northern Saskatchewan, southern Saskatchewan, and/or outside of Saskatchewan. This procurement approach may consider advance sharing of purchasing requirements of goods and services throughout all phases of the Project, efforts to increase the capacity and capabilities of businesses to increase successful bidding outcomes, and the development of a business registry.	opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project (as described in Section 13).			
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	"Community concerns" are identified related to impact to family and community cohesion due to working away from home for long periods. More detail is needed to understand Denison's approach and commitment to addressing community concerns related to community and family cohesion effects for residents of the LSA. Recommendations: - Denison needs to provide more detail within the Final EIS related to worker rotation system mitigation. Particularly considering the identification of reported difficulty in balancing the demands of a worker rotation system with domestic commitments, and many local community members concern of being unable to achieve a work-life balance.	MN-S Public Comments (March 4, 2023) (Public Comment #508)	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. Denison recognizes that both parents and members of the community/family could potentially be employed by the Project. Mitigation measures associated with potential effects to community cohesion and the commuter-rotation system are described in Section 12.1.5 and include: - Working with Indigenous COIs to understand culturally important periods relative to harvest times and cultural camps to facilitate Indigenous employees taking time off to participate in such activities, where practicable; - Implementation of Denison's Indigenous Peoples Policy and advancement of reconciliation - Using a commuter rotation system has also shown to be effective in allowing Indigenous employees continued opportunities to spend time on the land, and important factor in the transmission of knowledge and	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				language (see Section 11 for a description of potential effects to land use). As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions.				
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	This statement is vague about who will monitor community cohesion and whether Government departments and private- sector companies are committed to provide those services for the life of the Project. It also ignores previous statements in the Draft EIS that identify direct and indirect effects of uncertainty related to changes to community well-being that would be related to the Project. Denison's earlier statements indicate that monitoring and follow-up will be an aspect of mitigation. The statements seem contradictory. Recommendations: - Denison, in the Final EIS, needs to demonstrate that whether Government departments and private-sector companies are committed to provide community cohesion- related services for the life of the Project. - Denison needs to distinguish and clarify earlier statements of monitoring and follow- up with the assertion here.	MN-S Public Comments (March 4, 2023) (Public Comment #516)	Denison is committed to implementing measures within its control and responsibilities (for example the EFAP and other measures). As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: meet regulatory requirements, confirm the effectiveness of mitigation measures and predictions made in the assessment, implementing adaptive management (if/where applicable) to reduce effects during the lifetime of the Project, and will ensure that spatial boundaries are sufficiently extensive to measure EIS predictions. Monitoring of community cohesion at the community level is something Denison understands is for the Government to consider.	As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." MN-S will be informed throughout the monitoring program design and implementation process.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Contrary to the text describing the Traffic Study Area, Highway 914 and Highway 165 are not labelled on Figure 12.3-3. Recommendations: - MN-S request the revision of Figure 12.3-3 to include labelling of Highway 914 and Highway 165 in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #517)	Please refer to Figure 12.3-4 which describes the location of the Project in relation to Highway 914 and 165.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	The 31% or 51% increase in truck traffic on Highway 914 seems to represent a more than slight increase in traffic volume. It is acknowledged that this is related to 18 additional trucks per day. Clarification is required to determine if there would be a similar % increase in potential collisions. Recommendations: - Denison needs to clarify and provide analysis of the impact of traffic volume and what is a suitable threshold.	MN-S Public Comments (March 4, 2023) (Public Comment #518)	Denison believes it has fulfilled its information requirements for the EIS and supporting documentation as outlined in the EA guidance provided by the province and federal government. Notwithstanding that, Denison recognizes that further information will be required as the project moves through the EA and licensing / permitting processes. Denison will work with the province to identify and scope additional information requirements.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic	Clarity is required to explain why collisions can not be predicted with accuracy given the availability of existing predictive modelling for traffic management planning.	MN-S Public Comments (March 4,	To clarify, the text in Section 12.3.4.2.1. should have more specifically referenced accident rates as part the discussion of an increase in the number of collisions due to the Project. Overall, it is expected that	N/A	Ongoing - Denison is committed to working toward	Response to MN-S comments were	Discussions continue with MN-S about

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	conditions ; Other	Recommendations: - Denison should provide further clarification in the Final EIS of why collisions can not be predicted with accuracy given the availability of existing predictive modelling for traffic management planning.	2023) (Public Comment #519)	accident rates will not be affects by the incremental increase in traffic associated with the Project. Traffic volume is a poor predictor of accident rates on relatively well traveled roads - that is, the accident rate does not show a direct relationship with traffic volume and is relatively consistent in this case. Extrapolating existing accident rates and specifically applying them to the Projects related traffic would can provide some insight but it is understood that such extrapolation would be very conservative and overestimate the actual level of risk. Accident statistics are inclusive of all manner of accidents, the majority if which are single vehicle accidents that do not result in significant harm to people or property. Moreover, it would be expected that the likelihood of Project-related traffic accidents would occur at lower rates than those attributed to the general public based on the mitigations described in the draft EIS (Section 12.3.5) including: all drivers serving the Project will receive appropriate training related to the nature of materials being transported, including driver training to the highest standards based on the transportation of nuclear substances; vehicles transporting dangerous goods and/or hazardous products will display required placards and labels in accordance with provincial legislation and will follow designated highway corridors; an Emergency Response Plan will be developed in case there is a spill during the transportation of dangerous goods and/or hazardous products; and all, materials transported by truck will be compliant with any weight restrictions or permits, spring road restrictions, or geometric constraints set out by the Saskatchewan MOHI. The above notwithstanding, Denison recognizes the level of concern regarding Project related transportation it has received through engagement activities to date and will continue to solicit input on transportation concerns as the Project moves forward and as the Program / Plan / Procedure documentation is developed during licensing since elements of this documentation directly align with management of the aforementioned concerns (e.g., emergency response planning, transportation management planning).		reaching a resolution on these issues.	provided on December 1, 2023	working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Clarification is required to explain how Denison intends to provide employee maintenance support services that address the indirect effect to the community members (e.g., childcare, etc.) identified in this statement. Recommendations: - Denison to provide in the Final EIS additional detail on commitments to support employee families while on rotation.	MN-S Public Comments (March 4, 2023) (Public Comment #520)	Section 12.3.5 describes the mitigation measures applicable to community infrastructure and services within the LSA communities, the following mitigation measures will be implemented to reduce adverse effects: (1) Services and programs will be provided on-site and will be accessible to workers. These services and programs may alleviate pressures on social and health services within LSA communities. (2) An EFAP will be part of each worker's benefits package and will provide supports to individuals and their families that may not be readily available in the communities. Employee and family assistance programs typically provide free assessments, short-term counselling, referrals, and follow-ups to employees and their family members who are having personal or work-related problems. Generally, EFAPs can be accessed remotely by workers and their immediate family. Denison will aim to educate their staff on the offerings of their EFAPs, as well as making that information shareable with individuals' families.	Section 12.3.5 describes the mitigation measures applicable to community infrastructure and services within the LSA communities.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Most of the mitigations provided are standard worker health and safety and materials handling measures required for worker and environmental safety and don't address potential effects to traffic within the LSA. Detail is required to demonstrate how measures will address potential hazards from increased traffic volumes, and potential risk for conflict between road users and mining traffic. Recommendations: - Denison needs to provide additional information in the Final EIS on how the mitigation will alleviate traffic related impacts. - Denison needs to engage all potentially impacted Métis, including: MN-S, NR1 Locals, and NR3 Locals, in addition to Kineepik Metis Local #9, as an Indigenous Community of Interest throughout the life of the Project. - Denison needs to revise their Indigenous Community of Interest definition in the Final EIS to reflect the uniqueness of Métis governance structures. Specifically, a definition that recognizes Métis Locals proximate to the Project, MN-S, and MN-S regional leadership. - Denison needs to engage MN-S, NR1 Locals, and NR3 Locals, to understand their preferred level of involvement throughout the life of the Project. - Denison needs to acknowledge MN-S, NR1 Locals, and NR3 Locals as an Indigenous Community of Interest in the Final EIS. - Denison needs to revise the Final EIS Executive Summary to note that the Project falls within the Homeland of MN-S, NR1 Locals, and NR3 Locals. Denison needs to apply this change throughout the EIS, where applicable. - Denison to acknowledge that lease review data is not an appropriate way to determine Métis traditional resource use in and around the Project in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #524)	Denison believes the mitigations it has outlined for transportation management (and associated risks thereof) as detailed in the draft EIS (Section 12.3.5, Section 14, Appendix 14-A) are reasonable and practical measures it can take to manage it's Project activities. It is acknowledged that the information provided in the EIS and its supporting documentation is presented at a planning level; however, this level of detail is appropriate at this stage of Project development. Further details as to how these mitigations will be implemented will be developed during the licensing / permitting phase and will be available for review at that time, rather than as part of the final EIS. Further to this, and as noted elsewhere, Denison recognizes the level of concern regarding Project related transportation it has received through engagement activities to date and will continue to solicit input on transportation concerns as the Project moves forward and as the Program / Plan / Procedure documentation is developed during licensing since elements of this documentation directly align with management of the aforementioned concerns (e.g., emergency response planning, transportation management planning). Mitigations in Section 12.3.5 also require Denison truck traffic to slow to 40 km/hr for a minimum of 2.5 km on either side of the culture camp(s) in which are understood to occur in September and October (dates may be adjusted at the communities' direction). Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3 and is committed to such engagement with respect to mitigation measures and monitoring plans.	See mitigations in Section 12.3.5	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	This section of the draft EIS states: "Residents in the LSA and Regional Study Area (RSA) have expressed interest and concern about the Project's effect on the local economy, through income, training and employment opportunities, and business opportunities. Denison has not sufficiently engaged MN-S, NR1 communities, and NR3 communities on the assessment of the Economics VC. Initial direction and input into VC selection was obtained from: • discussions with Indigenous and non-Indigenous Communities of Interest (COI); • discussions with LK holders; • discussions with government agencies and the public; • results of Denison's baseline studies; • regional data from other EAs; • results from engagement and consultation activity; and • similar or recent projects in the region." (p. 13-5 to 13-6) Recommendations: • In the Final EIS, Denison needs to include the input from MN-S, NR1 Locals, NR3 Locals and indicate if VCs were altered. • Denison needs to meet with MN-S, NR1 Locals, and NR3 Locals to	MN-S Public Comments (March 4, 2023) (Public Comment #525, #528)	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. At the direction of the MN-S, Denison participated in meetings on February 12, 2023 with NR1 and on February 13, 2023 with NR3. The participants at these sessions were identified and invited by the MN-S. During these meetings, Denison shared information about the Project and the associated VCs assessed as part of the environmental assessment. No new VCs were identified as part of that discussion, and should new ones emerge through process, we would consider them at that time.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		discuss Project- related economic issues and interests. • MN-S request additional detail is included within the Final EIS, on how the input provided by MN-S, NR1 Locals, and NR3 Locals will influence the assessment of the Economics VC.						
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Denison does not include MN-S or NR1 communities within the LSA in the assessment on the economy and therefore employment, training, and business opportunities will not be prioritized for all potentially impacted Métis. Potential Project interactions for the Economy VC do not reflect feedback shared by MN-S/NR1 and NR3 Locals. Denison has not assessed the participation rate, employment rate, or unemployment rate of MN-S or NR1 and NR3 communities. Recommendations: - Denison to include MN-S and all NR1 communities in the LSA for the economy VC in the Final EIS. - Denison needs to discuss potential Project interactions for economy to Métis peoples and update Table 13.3-1 to reflect feedback shared by MN-S/NR1 and NR3 Locals. - In the Final EIS, Denison needs to expand the description of the existing environment to include NR1 communities and NR3 communities.	MN-S Public Comments (March 4, 2023) (Public Comment #529, #533, #534)	Spatial boundaries for the Economy VC were selected to reflect the geographic areas where economic impacts from the Project are likely to be detectable and measurable. These impacts are expected to be driven primarily by the relationship and interactions between the Project and the COI. Further, Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes; Other	As identified in section 11.1.6 (p. 11-66 to 11-68), Indigenous land use may be affected by the Project despite mitigations. It is reported that Project-related effects such as noise and dust can cause avoidance of the area by some resource harvesters while others may be undeterred. Denison acknowledges that several barriers to employment in northern Saskatchewan exist without providing solutions to address and/or mitigate such barriers. Recommendations: - Denison needs to include in the Final EIS, information provided by Métis in NR1 and NR3 once the MKS is completed. - Denison needs to support Métis training opportunities through Northlands College. - Denison needs to provide more detail within the Final EIS related to their role in developing and providing resources for training and employment as access has already been identified as a barrier to local communities.	MN-S Public Comments (March 4, 2023) (Public Comment #530, #541)	Section 13.4 Mitigation and Enhancement Measures provides details on Denison's Human Resource Development Plan, which will initially prioritize Indigenous and non-Indigenous communities in the Local Study Area in terms of employment and training opportunities and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project - such as on the job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions, including Northlands College, to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment and training will then focus on Indigenous and non-Indigenous residents of the Regional Study Area and then beyond the Regional Study Area. A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study.	Section 13.4 Mitigation and Enhancement Measures provides details on Denison's Human Resource Development Plan, which will initially prioritize Indigenous and non-Indigenous communities in the Local Study Area in terms of employment and training opportunities and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project. Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (applicable to Sections 3, 4, 9, 11, 12, and 13).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Initiating efforts with LSA communities excludes most of the Métis communities and keeps them from benefiting. "Economic leakage (i.e., money leaving the local economy) is a relevant concern, particularly for small, concentrated economies. Economic leakage can occur at various points through the cascade of spending in an economy, but the closer that leakage occurs to the point source of investment, the more potential	MN-S Public Comments (March 4, 2023) (Public Comment	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in Section 13.3.2.1 of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services	Section 13.4 Mitigation and Enhancement Measures also provides details on Denison's Human Resource Development Plan, which will initially prioritize Indigenous	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		economic benefit that is lost." Recommendations: - The Final EIS needs to include additional evaluation of non- LSA communities potential for income benefits. - Denison needs to provide more certainty and detail within the Final EIS related to local employment and procurement mitigation to manage for and reduce 'economic leakage'. - It is unclear from the description of Mitigation and Enhancement Measures whether Impact and Benefit Agreements (IBAs) will be included. Impact and Benefit Agreements are a normal vehicle for extending economic benefits to Indigenous communities. - In the Final EIS, confirm whether IBAs are also a mitigation and enhancement measure.	#532, #537, #542)	to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project. Section 13.4 Mitigation and Enhancement Measures also provides details on Denison's Human Resource Development Plan, which will initially prioritize Indigenous and non-Indigenous communities in the Local Study Area in terms of employment and training opportunities and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, priority for employment and training will then focus on Indigenous and non-Indigenous residents of the Regional Study Area and then beyond the Regional Study Area.	and non-Indigenous communities in the Local Study Area in terms of employment and training opportunities and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project.			
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Denison has not included MN-S or NR1 and NR3 Métis communities in the LSA for the assessment of the economy. Denison also has not engaged MN-S or all potentially impacted NR1 and NR3 communities to understand Métis concerns and/or interests related to employment and training opportunities. Recommendations: - Denison needs to engage all potentially impacted Métis communities. Specifically, Denison should equally engage all NR1 and NR3 Locals in addition to Kineepik Metis Local #9 on interests and concerns related to employment and training opportunities throughout the life of the Project. - Denison needs to provide more detail within the Final EIS related to their role in developing and providing resources for training and employment as access has already been identified as a barrier to local communities. This includes training programs prepared with MN-S/NR1 and NR3 Locals involvement and agreement.	MN-S Public Comments (March 4, 2023) (Public Comment #535)	Spatial boundaries for the Economy VC were selected to reflect the geographic areas where economic impacts from the Project are likely to be detectable and measurable. These impacts are expected to be driven primarily by the relationship and interactions between the Project and the COI. Further, Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. Section 13.4 Mitigation and Enhancement Measures provides details on Denison's Human Resource Development Plan, which will initially prioritize Indigenous and non-Indigenous communities in the Local Study Area in terms of employment and training opportunities and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project - such as on the job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions (such as Northlands College) to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment and training will then focus on Indigenous and non-Indigenous residents of the Regional Study Area and then beyond the Regional Study Area.	Section 13.4 Mitigation and Enhancement Measures provides details on Denison's Human Resource Development Plan, which will initially prioritize Indigenous and non-Indigenous communities in the Local Study Area in terms of employment and training opportunities and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Denison has not included details on closure planning including traditional economic activities that can be expected upon decommissioning. Recommendations: In the Final EIS, Denison needs to provide additional information on closure planning and what traditional economic activities can be expected upon decommissioning.	MN-S Public Comments (March 4, 2023) (Public Comment #539)	The draft EIS includes the Project's Conceptual Decommissioning Plan (CDP) (see Section 2.2.3). As the name implies the decommissioning plan for the site is presented at a relatively high level commensurate with the stage of Project development, including consideration of physical decommissioning activities and reclamation (or restoration) activities. With specific reference to reclamation / restoration the draft EIS notes that disturbed areas would be returned to become a self-sustaining and viable wildlife habitat, but little further detail is provided at this early stage. That detail will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed	Denison is committed to continued engagement with the MN-S at their direction, inclusive of engagement in NR1 and NR3.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. As the decommissioning plan becomes more specific and granular it is expected that the design basis will become more detailed. Denison noted the MN-S interest in how traditional economic activities can be integrated into the decommissioning plan and such considerations can be made as the plan evolves. Denison is committed to continued engagement with the MN-S at their direction, inclusive of engagement in NR1 and NR3, and within that context expects that integration of traditional economic activities within the context of site decommissioning will be part of those discussions.				
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Denison has not engaged MN-S, NR1, and NR3 to understand Métis-specific effects of the Project's proposed commuter-rotation schedule. Recommendations: (1) In the Final EIS, Denison needs to provide more detail related to worker rotation system mitigation. Particularly considering the identification of reported difficulty in balancing the demands of a worker rotation system with traditional economy activities.	MN-S Public Comments (March 4, 2023) (Public Comment #540)	Denison acknowledges the concern raised regarding participation in the traditional economy related to working at an industrial operation. Participation in the worker rotation system would present similar challenges as those described in the Métis Knowledge Study Report which describes how people's ability to go out on the land is challenged by work schedules generally and the busyness of the modern world. Mitigation offered for other VCs would equally apply to an individual's ability to continue to participate in culturally important activities, such as: - working with Indigenous COIs to understand culturally important periods relative to harvest times and cultural camps to facilitate Indigenous employees taking time off to participate in such activities; and - implementation of Denison's Indigenous Peoples Policy and advancement of reconciliation; Other uranium operations in northern Saskatchewan have shown that using a commuter rotation system has been effective in allowing Indigenous employees continued opportunities to spend time on the land, which similarly supports the traditional economy. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3, and within that context expects that the concerns raised by the review comment will be part of those discussions.	Mitigations are described in Section 12 and 13.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Denison has not identified mitigation and enhancement measures to support their conclusion that employment and training residual effects are expected to be low to moderate in magnitude. Recommendations: (1) Denison needs to expand its description of mitigation and enhancement measures to better support their conclusion that employment and training residual effects that are low to moderate in magnitude in Section 13.5.	MN-S Public Comments (March 4, 2023) (Public Comment #544)	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS. Denison recognizes that there is a need for and will be an annual evaluation of outcomes. The residual effect on employment and training during Construction, Operation, and Decommissioning is expected to be positive. Positive effects are expected to occur primarily in the LSA and RSA but are also expected to extend beyond the RSA as the labour demands of the Project are unlikely to be met with local resources only. Effects associated with employment are expected to occur continuously through each Project phase, while it is anticipated that training efforts will be focused largely during the operational phase (although some initiatives may be in place prior to the onset of Operation to maximize opportunities). Effects will be reversed after Decommissioning is completed; however, individuals who benefits from employment and training will have skills to carry forward to future opportunities.	Section 13.5 describes the mitigation and enhancement measures for economy, including those specific to education and training	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				Section 13.5 describes the mitigation and enhancement measures for economy, including those specific to education and training: • Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions (such as Northlands College) to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment and training will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA. • Denison will plan a workforce transition plan prior to Decommissioning of the mine. • Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.				
Métis Nation – Saskatchewan	Other	Meeting current regulations and building codes may not be sufficient for short-term or long-term environmental effects as they are characterized in the Draft EIS (e.g., forest fires, flooding). Please provide detail on how the Project will be designed to exceed current regulations in anticipation of changing to environmental conditions. Recommendations: - Denison needs to provide additional detail in the Final EIS describing how the Project will be designed beyond current regulations and building codes in anticipation of changes to environmental conditions.	MN-S Public Comments (March 4, 2023) (Public Comment #546)	From an operations perspective the current mine design is sufficiently robust such that changes in environmental conditions that may be expected, such as increased precipitation event intensity, over the operational life of the mine can be accommodated. For example, the design basis for water management infrastructure far exceeds standard design basis. The following is noted regarding the design basis for water management infrastructure for reference. The probable maximum precipitation (PMP) value of 493 mm selected for design of water management infrastructure, such as ponds, is similar to total annual precipitation (456 mm from Key Lake station, and 483 mm from 1981-2020 climate normals). The selected PMP is well above (>5 times higher): 1) current/measured 24-hour maximum precipitation, 2) modelled 1 in 100 year 24-hour return for current conditions, 3) modelled 1:100 year 24 hour return for a future (2020-2050) period, 4) the predicted maximum 1-day precipitation under different emissions scenarios for the future (including RCP8.5 in the 2021-2050 period). Design basis to accommodate environmental change over the longer term is a factor that will be considered as it pertains to decommissioning. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS, and are presented at a relatively high level commensurate with the stage of Project development. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. As the decommissioning plan	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				becomes more specific and granular it is expected that the design basis will become more detailed. Denison is committed to and will factor in longer term considerations of environment and climate within the evolution of the decommissioning plan, and in particular as it concerns how changes in environment and climate could affect decommissioning and restoration goals.				
Métis Nation – Saskatchewan	Health and socio-economic conditions ; Other	Further details are required on how emergency preparedness and response plans will adaptively respond to changing climatic conditions and potential unforeseen effects to the Project. Recommendations: - Denison needs to provide additional detail in the Final EIS about their commitment to developed adaptive emergency preparedness and response plans to address unforeseen effects to the Project resulting from climate change.	MN-S Public Comments (March 4, 2023) (Public Comment #547)	Section 2.9.1.3.5 of the draft EIS provides the commitment to develop an Emergency Preparedness and Response Program (EPRP). The EPRP would be established to identify how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property. The EPRP would be developed in a manner that aligns with guidance provided by CNSC in REGDOC-2.10.1. As noted on the draft EIS, Denison has opted to execute the overall Project approvals process - that is, the environmental assessment and licensing / permitting processes - in series and not simultaneously. As such, the documentation will be developed during the licensing / permitting phase and will be available for review at that time rather than as part of the final EIS. The level of information provided in the draft EIS is appropriate for the stage at which the overall Project approvals process currently sits, and as noted, MN-S and others, will have an opportunity to review documentation that is developed at later stages of the overall approvals process as appropriate. It is confirmed that the EPRP will include provision for change management and an explanation as to how change management will occur. The EPRP will be a living document that will be reviewed regularly and updated as needed - such updates may be required for a myriad of reasons including those related to climate change as noted by the review comment.	Section 2.9 of the draft EIS provides the commitment to develop an Emergency Preparedness and Response Program (EPRP).	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	These meetings had representation from Métis Local #39 (La Loche) and no other Métis. It is unclear who asked, "What are the concerns with groundwater monitoring…". MN-S does not consider Denison's engagement with the EQC as engagement with MN-S or Métis communities. MN-S prefers Denison specify feedback shared at join workshops by Indigenous Nation. Recommendations: - Denison engagement with Métis communities has been limited. In the Final EIS, MN-S expects to see more informed engagement and responses to concerns raised.	MN-S Public Comments (March 4, 2023) (Public Comment #549)	Thanks and noted. Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3. Denison understands the MN-S is a governing body of the Métis Citizens in Saskatchewan and recognizes that communities the MN-S governs may be included as a COI and are recognized as such in the EIS.	Denison continues to engage with the MN-S at their direction, inclusive of engagement in NR1 and NR3.	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Page ii of this document states: ""By accounting for these reactions, the simulated dissolved constituent plumes emanating from the ore zone reach their maximum extents within the deeper units (i.e., Lower Sandstone Aquifer and deeper parts of the Desilicified Zone) after approximately 10,000 years. Consequently, concentrations at Whitefish Lake throughout the future centuries are simulated to be similar to background concentrations. Under the base case scenario, which represents a conservative estimate of the conditions present, there are no exceedances of the groundwater quality screening criteria protective of freshwater aquatic life in the receiving environment." Whether conditions are "conservative" or not, is dependent on perspective.	MN-S Public Comments (March 4, 2023) (Public Comment #550)	It is acknowledged that additional details could have been added to the Appendix 7-C Executive Summary to provide more fulsome context for the comment that the "base case scenario" is conservative. The basis for this statement was the robust data set of subsurface geochemistry that supported the assumptions in the model with respect to concentrations of sorbing mineral phases and the uncertainty analysis that was performed. The uncertainty analysis evaluated the potential that conditions at the base case were not adequately conservative. The uncertainty analysis is detailed in Section 4.7 of the report. This included increasing the mass of chemical constituents of potential concern (COPCs) within the source (mining area), increasing the hydraulic conductivity of	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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		Recommendations: - Denison needs to provide further rationale detailing how the "base case scenario" represents a conservative estimate of the conditions present.		key zone and/or hydrostratigraphic units, decreasing the number of reactive sites for sorption of COPCs, removing some sorbent phases altogether from key hydrostratigraphic units, and other scenarios focused on geochemical and hydrolaugic uncertainties. Altogether, there were 15 uncertainty scenarios tested in addition to the base case. For the base case, and all uncertainty scenarios, no exceedances of ground water quality screening criteria were generated at Whitefish Lake into the future (i.e. over the "future centuries" period), apart from those that reflect natural conditions. The results are provided in detail in Sections 4.6.6 and 4.7.1 of Appendix 7-C and the consistency of the uncertainty results with the base case affirms that the base case simulation is appropriate for decision-making.				
Métis Nation – Saskatchewan	Other	Denison provides no rationale for "conservative dispersivity values" in the Draft EIS. Recommendations: - Denison needs to provide site-specific research to confirm literature dispersivity values are conservative in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #551)	Site-specific research, as understood from the comment, would require a natural gradient tracer test over the distances of interest (> 1 km). Such testing would take centuries, and therefore is not practical. For this reason, use of literature dispersivities is standard practice.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Additional modelling will be needed to confirm at the time of decommissioning the assumption that there is "large assimilative capacity" of the groundwater system, in order to manage risk in Whitefish Lake. Recommendations: - Denison to complete simulations that increase focus on maintaining containment of the contaminant source for a greater period of time (i.e., a higher level of focus on source term control and flushing), and less reliance on management of contaminant along the pathway, prior to the contaminant reaching the receptor. In other words, simulations that focus, to a greater extent, on evaluating the benefit of additional effort and time on source term control (the first step in the risk hierarchy of source, pathway, receptor).	MN-S Public Comments (March 4, 2023) (Public Comment #552)	The comment is noted and it is Denison's intent to continue to evaluate what is reasonably achievable with respect to remediation of the mining zone water quality prior to discontinuation of containment measures. After 30+ years of monitoring we will be in a better position to update predictions and have enhanced confidence in the assimilative capacity. Flushing of the source zone is part of the planned remedy and would only be stopped once the target level of remediation has been achieved. Beyond that flushing period (which may take years), if conditions indicate additional long-term source control is required, then Denison may have to do that, but our current understanding suggests long-term source control is not needed so long as the flushing is able to reduce source concentrations to the target amounts. Lab testing suggests the proposed flushing will be effective at reducing concentrations to the target values. Additionally, we note that refinement of the mining area decommissioning objectives and associated modelling will be done as the Project progresses through updates to the Decommissioning Plan; nevertheless, the objectives as they may evolve will be bound by the objectives evaluated in the EIS, which as shown are protective of aquatic biota in Whitefish Lake. The final acceptable mining area decommissioning objectives will be developed prior to initiation of groundwater remediation, as part of the Detailed Decommissioning Plan (DDP). Prior to executing decommissioning activities, Denison shall prepare and submit the DDP to regulators for acceptance. In this case the DDP would reflect input that will be solicited from Indigenous Nations and communities and others prior to its submission and would also be informed by conditions on the ground at the site at that time, operational experience that has been gained and the regulatory landscape at that	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				time. As is highlighted above, the decommissioning plan will evolve over time and the plan will become more refined as the Project advances.				
Métis Nation – Saskatchewan	Other	Denison assumes non-surface reaching groundwater will not extracted or accessed by future generations. Recommendations: - Denison to study and provide further understanding of deep groundwater characteristics with MN-S, NR1 Locals, and NR3 Locals prior to commencement of mining operations. This information may affect final closure options. - Denison to consider modelling for surface receptors of deep groundwater beyond the boundaries identified in Section 1.1.	MN-S Public Comments (March 4, 2023) (Public Comment #553)	Denison did complete engagement with Interested Parties, including Indigenous Communities of Interest and it is based on that engagement that it is understood deep groundwater use does not presently occur, nor is expected to in the future. Further, impacted groundwater is 100's of meters below ground surface, which is far below what would be needed for a future water supply as the flow through the shallower aquifer is far greater than through the deep aquifer. During operations, Denison will continue and expand groundwater monitoring to ensure that current study findings are realistic. Modelling simulations report the highest levels of predicted discharge to surface water - any discharge to more distant surface water bodies would be at even further reduced concentrations. Prior to executing decommissioning activities, Denison shall prepare and submit the DDP to regulators for acceptance. In this case the DDP would reflect input that will be solicited from Indigenous Nations and communities and others prior to its submission and would also be informed by conditions on the ground at the site at that time, operational experience that has been gained and the regulatory landscape at that time.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Denison's Draft EIS does not confirm if the groundwater recharge rates were adjusted for potential changes to recharge as a result of climate change. Recommendations: - Denison should develop a Project-specific climate change model database, which clearly articulates the shared socioeconomic pathway (SSP) the Project is choosing from IPCC AR6, and show how that scenario has been down- scaled for use within Project modelling predictions, and present the results in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #554)	A qualitative and quantitative assessment of climate change and groundwater and surface water is provided: The experience of the Project team regarding studies of climate change and the impacts on groundwater at other sites generally shows a range of potential positive and offsetting negative impacts. While warmer temperatures will lead to extended periods of summer drought conditions extending into early fall, warmer winters are predicted as well, resulting in less snowpack accumulation, more frequent snowmelt events, and more frequent rainfall during periods when evapotranspiration is negligible. These warmer winter conditions are often simulated to produce enhanced groundwater recharge during late fall, winter, and early spring conditions. In particular, the lack of enhanced snowpack is simulated to result in less severe spring run-off conditions, indicating that more of the winter precipitation that falls will infiltrate. Overall, this is anticipated to result in enhanced groundwater recharge in the mid- to late-century periods. If, however, lower groundwater recharge was to result from climate change, it would reduce the groundwater driving force for mass transport of mining related fluids, and reduce mass loading to receiving water bodies such as Whitefish Lake. In other words, lower groundwater recharge resulting from higher evapotranspiration would result in slower mass transport to the receiving water bodies, reducing the risk of exposure. Section 8.1.3.4 (and Appendix 8-C) provides a quantitative assessment of the potential changes in surface water quantity due to climate change. The 1:100 year, 24-hour return period rainfall events for the baseline and climate change influenced IDF curves are 79.9 mm and 88.6 mm,	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				respectively. The PMP for the Project is estimated to be 493 mm (refer to IR-15 and AD-15) which is well above both 24-hour maximum precipitation and 1:100, 24 hour return precipitation events. The PMP is very conservative (e.g., assumes effectively a full year of precipitation in one event) under both existing and future conditions (climate change). The potential impacts of climate change to precipitation and therefore flows was summarized in Appendix 6-C, Table 10 with the total annual precipitation and the maximum 1-day events being variable over the next four decades (Table 1). Regardless, the climate change scenario indicates a potential increase in event based assimilative capacity in the receiving environment. TABLE 1- Existing and Predicted Precipitation Data for Key Lake (provided in EIS, Appendix 6- C, Table 10). To mitigate the potential for unplanned release of deleterious substances into the surface water environment even during the next 40 years of climate change, the PMP of 493 mm was used for water management engineering designs. During a PMP, water requiring management will report to the wellfield runoff pond which will be sized to accommodate a PMP event at the site. This pond has been sized to 38,200 m3 (excluding a freeboard of 1 meter). From the wellfield runoff pond, water will then be sent to the process water pond for treatment if required. In Section 2.8 Project Design Features, Denison notes that "Ponds will be designed to maintain a minimum freeboard of at least 1.0 m to allow for continued functioning during a probable maximum precipitation (PMP) event." As such, the project has been designed to manage water during PMP and greater, and therefore mitigation of potential impacts to water quality due to climate change has been initially included as part of the EIS. As a result, it is Denison's opinion that a quantitative assessment of potential impacts to surface water quality is not warranted as it is likely to indicate improved results from the conservative assessment of potential water quality changes during operation and decommissioning phases. Continued monitoring of background, effluent and receiver water quality will be undertaken and provide the ability for adaptive management throughout the life of the mine in association with potential climatic changes to the local and regional area.				
Métis Nation – Saskatchewan	Other	Water levels in surface water features are not static; they change in response to regional climate and flow conditions. This would influence the interaction between groundwater and surface water, as the assumption by the model developer is that water levels are input as static head boundary conditions. Recommendations: - Denison needs to explain in the Final EIS why static head boundary conditions are used for the modelling beyond a need to simplify the modelling.	MN-S Public Comments (March 4, 2023) (Public Comment #555)	Water levels within surface water bodies were monitored over several years. The range of observed water levels at Whitefish Lake (SA-6) during 2016-2018 was 499.5 to 500.2 m ASL, with an average of 500.1 m ASL; as such the value assigned in the model (500.0) is an accurate (and slightly conservative) reflection of the average water level observed. What is important is the hydraulic head difference over the 300-year (or more) transport travel time. Recognizing that future conditions could be different by as much as 2 m (i.e., the depth of Whitefish Lake), this range of water level could be tested.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Denison does not provide the basis, explanation, or literature to state that a calibrated model to observe water levels is sufficient with a deviation of +/- 2m.	MN-S Public Comments (March 4,	The mean residual is 0.23 m, not 2 m as inferred. The 2 m guidelines are merely presented for reference. The literature is quoted regarding the goodness of fit parameter NRMS, which is normalized so that it can be	N/A	Ongoing - Denison is committed to working toward	Response to MN-S comments were	Discussions continue with MN-S about

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		Recommendations: - Denison needs to provide an explanation, basis, and/or literature to state that a calibrated model to observe water levels is sufficient with a deviation of +/- 2m in the Final EIS. Denison provides no rationale/basis for considering a mean error of 0.23 considered to be an "excellent match" to the observed water levels. Recommendations: - Denison should provide an explanation, basis, and/or literature for why a mean error of 0.23 is considered to be an "excellent match" to the observed water levels in the Final EIS.	2023) (Public Comment #556, #557)	applied to any model. The NRMS achieved within the Denison model is 4.1%, whereas the literature (Spitz and Moreno) recommend 10% or less. As such the model is considered calibrated by literature standards. The qualitative term "excellent match" is based on 30-years of experience in developing 100's of similar numerical groundwater flow models.		reaching a resolution on these issues.	provided on December 1, 2023	working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	Ecological receptors could potentially be exposed to groundwater flows. Recommendations: - Denison should provide an understanding of deep groundwater as a contaminant pathway to ecological receptors within immediate vicinity in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #558)	Denison and its SMEs believe that this (i.e., what is referenced in the review comments) is what has been done (and presented in the report) by evaluating groundwater flow to a small portion of Whitefish Lake. At other locations (e.g., the edges of the Lake), shallow groundwater will be discharging, which has not come into contact with the deeper groundwater.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	The Project has assumed that it is "conservative" to supply all water for the Project from outside the ore zone, and assume minimal influent from re-cycled / treated water. This statement supports that position. Recommendations: - Denison should provide simulations that maximize recycling treated water, rather than minimize using recycled water for the Project. - Denison to confirm how groundwater quality predictions differ when recycled and treated water is used to supply water to the Project, as compared to assuming conditions as noted in this statement.	MN-S Public Comments (March 4, 2023) (Public Comment #559)	With respect to the first bullet: It is believed that the analysis completed is appropriate given that it represents a conservative (i.e., protective) means by which to assess the activities potential effects. The scenarios / simulations referenced in the review comment therefore are bounded by the conservative water supply assessment as it concerns potential Project effects to groundwater quantity. Denison concurs with the idea that it would be beneficial to maximize recycling of water and will strive to do so; however, this is more of an operational consideration. As outlines in draft EIS Section 2.2.3, Denison intends to recycle process water to the greatest extent possible, thereby reducing the demand for fresh water supply and volume of treated effluent. In an effort to develop a conservative assessment basis for the EA, the water recycle flows from the industrial wastewater treatment plant back into the processing plant and wellfield have not been incorporated into the estimates for freshwater withdrawal and treated effluent discharge. An overview of the site water balance during Construction, Operation, and Decommissioning are provided in draft EIS Figure 2.2-14, Figure 2.2-15, and Figure 2.2-16, respectively. These figures provide a summary of the water needs for certain Project activities, plans for water treatment (both potable and wastewater), and the general flow of managed water at the site. The estimated flows in the site water balances do not account for water recycle back into the processing plant and wellfield. This results in a conservative estimate of both freshwater withdrawal needs and treated effluent discharge rates. With respect to the second bullet point: Under the modelled scenarios, in which water is withdrawn from three water supply wells, the shallow groundwater system is simulated to recover very quickly following the cessation of decommissioning. Thus, the taking of shallow groundwater during Operations and Decommissioning will not influence the overall	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				transport of potential contaminants in Post-Decommissioning after the containment (including the freeze wall) is removed. In addition, it should be recognized that if less water is withdrawn from the shallow bedrock for Operation, that additional groundwater left in the flow system will naturally act to further dilute any concentrations reaching the shallow aquifer and surface water receptors. That is why we feel the simulations presented are conservative.				
Métis Nation – Saskatchewan	Other	The interaction of increase drought or increased precipitation (i.e., climate change) could potentially affect the length of time for full recovery of groundwater recharge due to potential changes in climate conditions. Recommendations: - MN-S requests that interaction between climate change scenarios and groundwater modelling should be included in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #560)	The experience of the Project team regarding studies of climate change and the impacts on groundwater at other sites generally shows a range of potential positive and offsetting negative impacts. While warmer temperatures will lead to extended periods of summer drought conditions extending into early all, warmer winters are predicted as well, resulting in less snowpack accumulation, more frequent snowmelt events, and more frequent rainfall during periods when evapotranspiration is negligible. These warmer winter conditions are often simulated to produce enhanced groundwater recharge during late all, winter, and early spring conditions. In particular, the lack of enhanced snowpack is simulated to result in less severe spring run-off conditions, indicating that more of the winter precipitation that falls will infiltrate. Overall, this is anticipated to result in enhanced groundwater recharge in the mid- to late- century periods. If, however, lower groundwater recharge was to result from climate change, it would reduce the groundwater driving force for mass transport of mining related fluids, and reduce mass loading to receiving water bodies such as Whitefish Lake. In other words, lower groundwater recharge resulting from higher evapotranspiration would result in slower mass transport to the receiving water bodies, reducing the risk of exposure. The groundwater model will be updated over the course of mine life to among other things support the decommissioning plan that will consider recovery in the mining zone. Such model scenarios would incorporate up to date information with respect to climate change and the potential effects of climate change on the groundwater environment.	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.
Métis Nation – Saskatchewan	Other	It is unclear if the statements made about full recovery and 90% recovery are defendable given that calibrated hydraulic conductivity values, as shown in Table 2-2 (p. 2.7), for the lower sandstone aquifer ranges over 2 orders of magnitude, and the ore zone calibrated hydraulic conductivity over nearly 5 orders of magnitude, and that no range in hydraulic conductivity is reported for the desilicified sandstone aquifer (i.e., a single calibration value is reported). Recommendations: - Denison should provide simulations that consider the full range of calibrated hydraulic conductivity values in the Final EIS.	MN-S Public Comments (March 4, 2023) (Public Comment #561)	The calibrated hydraulic conductivity values are consistent with observed data. The calibrated K value for the intermediate aquitard was 1x10-8 m/s, which is in the middle of the range of values reported from point testing within this unit (Range: 10-10 to 3.8x10-6 m/s), and similar to the geomean value (8.4 x10-9 m/s). Thus, the calibrated K value is within a factor of 1.2 of, and higher than, the geomean value. The hydraulic conductivity value for the Intermediate Aquitard is similar to that applied by AECL at Cigar Lake (5x10-8 m/s). Similarly, the K values applied for the Upper and Lower Sandstone Aquifer units are consistent with the field measured values, particularly for this fractured rock environment. The high end of the packer tested range of K values varied by 2 orders of magnitude between the aquifer and aquitard units, which is consistent with the definition of aquifer / aquitard differentiation. The interpretation of an aquifer-aquitard-aquifer sequence is consistent with the AECL interpretation of the Athabasca Sandstone at the Cigar Lake mine. When packer testing in fractured rock, the hydraulic conductivity	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				associated with any test depends on whether the packed zone contains a continuous fracture set. However, for the unit as a whole, it is important that the model represent the hydraulic conductivity (or transmissivity) representative of the interconnected fracture network. Thus, it is appropriate that the applied hydraulic conductivity values within the aquifers are consistent with the higher end of tested conductivity values within those units. Within aquitard units, having singular higher conductivity fracture values from packer tests that test local fractures only, does not necessarily indicate large-scale transmissivity. A fault feature is suspected along the western perimeter of the Lower Sandstone Aquifer near Kratchkowsky and Williams Lake, located 1.5 km west of the mine site (also as depicted on the Hydrogeological Conceptual Site Model). This feature was interpreted to exist based on the similarity in groundwater levels between deep and shallow aquifers in that particular area (c.f., water levels along the creek south of Williams Lake and within GWR-029, as well as water levels recorded in open boreholes near Kratchkowsky Lake), as well as geochemistry in GWR-029. The geochemistry and water levels show in the vicinity of GWR-029 are different, however, than conditions within the Lower Sandstone aquifer further east of this area, above and east of the Phoenix deposit. The effect of the fault feature along the western edge of the Lower Sandstone aquifer was incorporated within the numerical model both through enhanced hydraulic conductivity parameters, as required to match observed water levels, and boundary conditions applied to introduce as much inflowing water to the Lower Sandstone Aquifer as the water level data suggest is reasonable.				
Métis Nation – Saskatchewan	Other	No time period is provided to reach acceptable levels of remaining contaminants or effective remediation accomplished in order to leave the area in a pre- mining condition. Recommendations: - Denison needs to provide more clarity on what the expected time period to reach acceptable levels of remaining contaminants or effective remediation in order to leave the area in a pre-mining condition. This unknown time frame may play into the viability of remediation and final closure costing.	MN-S Public Comments (March 4, 2023) (Public Comment #562)	Groundwater remediation targets provided in the draft EIS were from derived from metallurgical test results completed from 2017 to 2021 with over 125 kg of material recovered from Phoenix deposit that underwent leaching and neutralization test work (see response to IR-67). In 2022 and 2023, metallurgical test work continued to further optimize remediation and strategies and confirm test work results presented in the draft EIS. It is expected that metallurgical test work will continue in the future to further optimize remediation targets, and this will be advanced through updates to the Decommissioning Plan. The Feasibility Field Test (FFT) provided additional confirmation that pH target and remediation targets could be met. Data gathered during the neutralization phase of the FFT provide confidence that groundwater targets proposed in the draft EIS can be met technically and economically. Based on laboratory testing and the results of the 2022 field testing, subsurface remediation is planned to consist of rinsing the ore zone with 35 pore volumes of fresh water, slowly raising the pH and then pumping about 75 pore volumes of basic solution through the same portion of the ore zone. This basic solution will in effect further raise the pH to a level that impedes further leaching of the deposit and reduces aqueous concentrations of contaminants of concern to below their environmental target levels. Refinement of the mining area decommissioning objectives and	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				associated modelling will be done as the Project progresses through updates to the Decommissioning Plan; nevertheless, the objectives as they may evolve will be bound by the objectives evaluated in the EIS, which as shown are protective of aquatic biota in Whitefish Lake. The final acceptable mining area decommissioning objectives will be developed prior to initiation of groundwater remediation, as part of the Detailed Decommissioning Plan (DDP). Prior to executing decommissioning activities, Denison shall prepare and submit the DDP to regulators for acceptance. In this case the DDP would reflect input that will be solicited from Indigenous Nations and communities and others prior to its submission and would also be informed by conditions on the ground at the site at that time, operational experience that has been gained and the regulatory landscape at that time. As is highlighted above, the decommissioning plan will evolve over time and the plan will become more refined as the Project advances. As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project.	Indigenous nations who may have interest in the Project.			
Métis Nation – Saskatchewan	Other	Climate change as a variable does not appear to have been incorporated into the modelling. Recommendations: - Denison needs to provide more clarity in the Final EIS on how climate change as a variable has been incorporated into the ground water modelling as climate changes scenarios and effects on the groundwater could affect the closure pathway.	MN-S Public Comments (March 4, 2023) (Public Comment #563)	The experience of the Project team regarding studies of climate change and the impacts on groundwater at other sites generally shows a range of potential positive and offsetting negative impacts. While warmer temperatures will lead to extended periods of summer drought conditions extending into early all, warmer winters are predicted as well, resulting in less snowpack accumulation, more frequent snowmelt events, and more frequent rainfall during periods when evapotranspiration is negligible. These warmer winter conditions are often simulated to produce enhanced groundwater recharge during late all, winter, and early spring conditions. In particular, the lack of enhanced snowpack is simulated to result in less severe spring run-off conditions, indicating that more of the winter precipitation that falls will infiltrate. Overall, this is anticipated to result in enhanced groundwater recharge in the mid- to late- century periods. If, however, lower groundwater recharge was to result from climate change, it would reduce the groundwater driving force for mass transport of mining related fluids, and reduce mass loading to receiving water bodies such as Whitefish Lake. In other words, lower groundwater recharge resulting from higher evapotranspiration would result in slower mass transport to the receiving water bodies, reducing the risk of exposure. The groundwater model will be updated over the course of mine life to among other things support the decommissioning plan that will consider recovery in the mining zone. Such model scenarios would incorporate up	N/A	Ongoing - Denison is committed to working toward reaching a resolution on these issues.	Response to MN-S comments were provided on December 1, 2023	Discussions continue with MN-S about working toward a resolution on these issues.

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				to date information with respect to climate change and the potential effects of climate change on the groundwater environment.				
Northern Village of Pinehouse and Kineepik Métis Local	Other	Feedback on mining options and technical questions were asked on the different methods of mining. The community provided comments on the different on-site road options.	ROC 2	Project components include: ISR, Drilling, Freeze Wall, Wellfield, Processing, Water Management, Waste Management, Access and Transportation, Power, Support Facilities, Project Area, Project Activities, Ancillary Projects, GHG Emissions, Project Schedule, Project Benefits, Project Design Features, Management System, and Project Alternatives. Through an alternative means assessment, Denison considered options in relation to access and transportation. The access road alignment will follow part of the existing exploration access road, stream crossing structures will use clear span bridges, and worker transportation will be air transport to a) nearby Cameco operations or, b) a new airstrip constructed and operated by Denison. Denison incorporated the feedback provided on road options select the current road alignment for the Project. See Section 2 for information and technical detail pertaining to Project Components and Project alternatives.	N/A	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Other	Interest in information and direct participation in monitoring baseline and effects. Concern that project should have independent monitoring for the Project and that information from this be shared with communities.	ROC 2 ROC 105 ROC 444	An Environmental Protection Program will be established to provide an overarching framework for key environmental monitoring and management plans and to ensure a means to demonstrate compliance with applicable environmental regulatory requirements and other performance targets that Denison may set. The program would be developed in a manner that aligns with the ISO 14001 EMS Standard. Aspects of the Environmental Protection Plan will include: -Management and Monitoring of Emissions -Liquid Effluent Monitoring Plan - Air Emissions Monitoring Plan - Groundwater Monitoring Plan - Environmental Monitoring Plan - Woodland Caribou Management Plan As the Indigenous Community of Interest with a residential community most proximal to the Project, Denison has committed to collaborating with Kineepik Metis Local on a community specific monitoring regime, suited to their interests and needs in order to provide transparent information to discourage avoidance of the area and alleviate perceived concerns about potential impacts. As part of this program, Denison and KML will be sharing information in an agreed-upon fashion, about agreed-upon species of interest. Denison expects that important country foods harvested for food and cultural purposes (i.e., moose, fish species, etc.), surface water quality, and other areas of interest will form part of this monitoring program, including the potential to report on wildlife-vehicle mortality or other such areas of potential concern as they evolve over time. See Section 16 for a summary of monitoring and follow-up programs.	As the Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, Denison has committed to collaborating with English River First Nation and Kineepik Métis Local on a monitoring regime, suited to each of their interests and needs. As part of these programs, Denison and the Indigenous community of ERFN and KML will be sharing information in an agreed-upon fashion.	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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Northern Village of Pinehouse and Kineepik Métis Local	Current use of lands and resources for traditional purposes	Russell Lake was noted of particular importance for recreational/ commercial fishing.	ROC 2 ROC 620	Denison noted the importance of Russell Lake and considered Russell Lake in the LSA in terms of recreational/commercial fishing. Negligible aquatic habitat loss is predicted in LA-5 (also known as Whitefish Lake) due to the installation of a discharge pipeline and diffuser configuration. The total area of the lake substrate that would be overprinted by the pipeline is expected to be approximately 135 m2, which will constitute less than 0.05% of the lake's surface area. No other alteration, disruption, or destruction of aquatic habitat in the aquatic environment LSA is expected. Project-induced changes to the abundance and distribution of fish is, therefore, not expected. The effect, if any, is expected to undetectable to fishers. The Agreement currently being negotiated between Denison and KML outlines specific commitments for KML participation in environmental monitoring associated with the Project, including the potential for monitoring fish species harvested by and important to, KML. See Section 11 for information on how the Project will interact with land and resources including how potential effects will be mitigated.	The Agreement currently being negotiated between Denison and KML outlines specific commitments for KML participation in environmental monitoring associated with the Project, including the potential for monitoring fish species harvested by and important to, KML.	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	Concern and interest in economic opportunities associated with Project and education and training to facilitate access and participation by community members.	ROC 62 ROC 105 ROC 388 ROC 444 ROC 620 ROC 623	Denison has estimated a workforce of 300 during the two-year Construction phase and 180 during the Operation phase. Mineral sector positions are typically considered to be higher paying than many other industrial positions. Residents and communities in the LSA (ERFN (including Indian Reserve Wapachewunak 192D and Indian Reserve La Plonge 192) and Patuanak, Northern Hamlet (Patuanak); Pinehouse Lake, Northern Village; and Beauval, Northern Village) will be given first priority for employment, training, and business opportunities, followed by residents and communities in the RSA (Northern Saskatchewan Administrative District). Mitigation and enhancement measures will be implemented by Denison to enhance the positive effects of the Project on employment and training, income, traditional economy, and business opportunities and minimize adverse effects including: -A Human Resource Development Plan to initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities; -Establishment of a procurement approach through all phases of the Project, focusing on businesses based within the LSA communities, followed by Indigenous and / or businesses in the RSA; -Negotiation with the Province of Saskatchewan to develop the Project's Surface Lease Agreement and Human Resource Development Agreement. The Agreement currently being negotiated between Denison and KML outlines specific commitments for KML participation in economic opportunities associated with the Project, including in relation to ongoing education and training as deemed appropriate by KML. See Section 13 for a summary on local, provincial, and federal Project	Denison is committed to, as described in Section 13, providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities. General discussions to continue as part of ongoing dialogue.	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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				benefits and Denison's approach to employment, training, and business participation opportunities for communities. See Section 13 for information regarding employment, employment opportunities, and career growth for community members.				
Northern Village of Pinehouse and Kineepik Métis Local	Other	Questions and clarifications on ISR mining methodology, including freeze wall technology and Project power requirements.	ROC 62 ROC 604 ROC 620 ROC 623	Project components include: ISR, Drilling, Freeze Wall, Wellfield, Processing, Water Management, Waste Management, Access and Transportation, Power, Support Facilities, Project Area, Project Activities, Ancillary Projects, GHG Emissions, Project Schedule, Project Benefits, Project Design Features, Management System, and Project Alternatives. See Section 2 for information and technical detail pertaining to Project Components and Project alternatives. Engagement activities for the Project can and will evolve over time, as information is gathered that is pertinent to Denison's understanding of the Interested Parties and their relationship to, and interest in, the Project. At present, Denison has an Exploration Agreement with KML and continues to engage with KML and NVP with respect to the Wheeler River Project. See Section 4 for additional information on the consultation process.	N/A	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Other	Interest in information about current market conditions and overall viability of the Project.	ROC 105	Denison has identified that there is current and future market demand for uranium, the primary raw material for nuclear fuel generation. The Project can address gaps in annual global uranium supply and the use of uranium in nuclear power plants can contribute to net-zero goals, and this can be achieved while making a meaningful contribution to the Canadian economy. The Project was considered in relation to technical feasibility, economic feasibility, and l and use criteria to determine viability of the Project. See Section 2 for information about Project components and purpose.	N/A	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Current use of lands and resources for traditional purposes	Concern was expressed over cumulative effects in the region.	ROC 105	Denison conducted a cumulative effects assessment, which included the Highway 914 extension project, on categories: -The Atmospheric and Acoustic Environment. -Geology and Groundwater. -The Aquatic Environment. -The Terrestrial Environment. -Human Health. -Land and Resource Use. -Quality of Life. -Economics. Denison respects and understands KML's concern about the cumulative effects in the region, particularly in relation to access to traditional lands and resources in correlation with industrial and mining developments. The residual effects of the Project are expected to interact with the residual effects of other projects and activities in the ILRU RSA, resulting in potential cumulative effects to Indigenous land use activity in the area. This is largely due to the proposed Highway 914 extension project.	N/A	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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				See Section 16 for a summary of the cumulative effects assessments for each category above.				
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	Interest with potential contracts and business opportunities for northern Indigenous companies.	ROC 105 ROC 114 ROC 118 ROC 444	The Project will create employment and business opportunities and increase income for workers and businesses in the LSA, RSA, and beyond the RSA during all phases of the Project. Denison has estimated a workforce during the two-year Construction period of 300 people and during the Operation phase 180 people are expected to be employed to operate the ISR wellfield and processing plant, including supporting activities. Mineral sector positions are typically considered to be higher paying than many other industrial positions. Residents and communities in the LSA will be given first priority for employment and training and business opportunities, followed by Indigenous and / or other communities in the RSA. The Agreement currently being negotiated between Denison and KML outlines specific commitments for KML participation in economic opportunities associated with the Project, including business opportunities as deemed appropriate by KML. See Section 13 for a summary of local, provincial, and federal Project benefits and Denison's approach to employment, training, and business participation opportunities for communities.	Denison is committed to, as described in Section 13, providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities.	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Current use of lands and resources for traditional purposes	The community has pre-existing Indigenous Knowledge and will work with Denison on this.	ROC 106	In 2018, KML approached Denison to support a land use mapping initiative in the Project area. The 2018 study builds on existing land use maps, completed in 2011. A verification meeting was held in late 2018 to make sure no geographic data gaps existed and that the results speak for the whole community. In 2022, KML prepared a document to voice their perspectives on Project VCs and to provide a record for EIS development. Based on 12 community engagement sessions and review of the land use maps, KML explained their unique social, cultural, and historical context, expressed a general consensus of support for the Project, and described issues and concerns. See Section 3 for information on IK and LK and how this information was integrated throughout the EIS.	Section 3 provides information on IK and LK and how this information was integrated throughout the EIS. Indigenous Knowledge has been integrated throughout the EIS and a section on the Influence of Indigenous Knowledge, Local Knowledge, and Engagement is provided in the methodology for sections. For example see Section 11.1.2 and Section 11.2.2 for further details on how Indigenous Knowledge, Local Knowledge, and Engagement influences Land and Resource Use.	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Other	Interest in implementation of appropriate engagement process activities. Concern was raised over the approach to consultation with others (other communities) and questions raised on whether a Collaborative Agreement was possible during operations.	ROC 106 ROC 114 ROC 118 ROC 135 ROC 388 ROC 444	Denison has identified key objectives respecting Indigenous engagement associated with the Project: -Build and maintain authentic relationships based on a foundation of trust, good faith, and transparency. -Create a respectful dialogue process that promotes communication and collaboration among Denison and Indigenous communities, in a timely	N/A	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				and accurate fashion. -Understand how the proposed development of the Project may affect the interests of Indigenous peoples (including Indigenous and/or Treaty Rights), and work with Indigenous peoples to avoid, mitigate, or otherwise address effects, while also collaborating to maximize potential positive effects. Engagement activities for the Project can and will evolve over time, as information is gathered that is pertinent to Denison's understanding of the Interested Parties and their relationship to, and interest in, the Project. At present, Denison has an Exploration Agreement with KML and continues to engage with KML and NVP with respect to the Wheeler River Project. The Agreement currently being negotiated between Denison and KML is demonstrative of Denison's responsiveness to the request from KML for such an agreement. See Section 4 for additional information on the consultation process.				Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Other	Interest for information about type and how chemicals and other hazardous products would be transported, and whether an emergency response team would be ready to respond.	ROC 444	Denison will establish a Transportation of Dangerous Good Program, intended to provide for the safe transport of goods by conforming to all applicable laws, regulations, company policies, and procedures. The Transportation of Dangerous Goods Program applies to all modes of transport and all locations where Denison assumes care and control of the materials. Denison will establish an Emergency Preparedness and Response Program to identify how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property. Emergency Preparedness and Response Program would be developed consistent with guidance provided by CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016). Increased pressure on emergency services is most likely to stem from an accident or malfunction on Highways 914 or 165. The extent to which these changes could affect any given community would depend on the nature of the accident or malfunction. Accidents and malfunctions for the Project were determined to (generally) have a highly unlikely to unlikely probability of occurrence, with an overall risk rating of low to moderate; however, the severity of accidents and malfunctions was determined to be minor to major. If such an event were to occur, local resources may be called upon to provide support, which may result in a call to fire, RCMP, or ambulance services depending on the nature of the event. Denison will provide any necessary training and/or equipment to local first responders to make sure they are sufficiently prepared to deal with an unlikely accident or malfunction. Denison's objective is to utilize existing emergency response teams from other operations prior to drawing on community-based resources. In the	N/A	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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				unlikely event that this were to occur, and KML resources were drawn upon, the Agreement currently being negotiated between provides the foundation for discussions in respect of such incidents. See Section 2 for information pertaining to the above programs.				
Northern Village of Pinehouse and Kineepik Métis Local	Other	Expressed a need for industrial grade improvements between Highway 2 and the Key Lake Gate to support the increase in heavy traffic.	ROC 444	Highway improvements are not within Denison's jurisdiction and are not considered in the EIS for the Wheeler River Project. However, Denison notes KML's perspective of increased traffic volumes and subsequent desire for highway improvements. On Highway 914 between Key Lake and Pinehouse, Denison anticipated that road users would see an increase between 16% and 40% over the life of the mine. Trucks travelling on this section of highway will increase from 35 to 53 at peak operational times. Denison's vision in respect of this concern is that Denison and KML work together as partners in discussions about highways with the Provincial Government. However, in respect of actions Denison can undertake regarding traffic along the road at times important for the undertaking of cultural activities, Denison commits to: 1) Assisting KML with the clear identification of the forthcoming culture camp along highway 914 (clear signage 2) Having Project vehicle slow down to 40km/hr from mid-August to mid-October, during the times when KML members may be using the portion of the road near the culture camp. To be specific, this includes 2.5km before the entry into the culture camp, and 2.5km after the entry into the culture camp. See Section 2, Appendix 2-B for more detail pertaining to traffic volumes.	Denison's vision in respect of this concern is that Denison and KML work together as partners in discussions about highways with the Provincial Government. However, in respect of actions Denison can undertake regarding traffic along the road at times important for the undertaking of cultural activities, Denison commits to (Section 12): 1) Assisting KML with the clear identification of the forthcoming culture camp along highway 914 (providing clear signage) 2) Having Project vehicle slow down to 40km/hr from mid-August to mid-October, during the times when KML members may be using the portion of the road near the culture camp. To be specific, this includes 2.5km before the entry into the culture camp, and 2.5km after the entry into the culture camp.	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	Expressed a need for building capacity locally in terms of training and education, emergency response, waste management, and additionally expressed a want of local procurement and industry supporting infrastructure.	ROC 444	As outlined in Denison's Indigenous Peoples Policy, Denison recognizes the critical necessity of advancing reconciliation with Indigenous peoples in Canada and the important role of Canadian business in the reconciliation process. Denison is committed to providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities. The Agreement currently being negotiated between Denison and KML	Denison is committed to, as described in Section 13, providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities.	Resolved - agreement reached by both parties.	Email dated June 10, 2023 and acceptance of response	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of

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				outlines specific commitments for KML participation in economic opportunities associated with the Project, including commitments for ongoing education and training as deemed appropriate by KML, support to the vision of local industry supporting infrastructure. In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible. The Agreement provides a framework for future possibilities such as these.	In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible. General discussions to continue as part of ongoing dialogue.			ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	As noted in the KML's summary of Primary Concerns: 1) There is a need for funding for education and training to reach a standard of knowledge in mining, science and math required to understand the impacts of uranium mining industry that is expected for an Indigenous community to be able to make free and prior informed decision on impact and expectation of that industry. 2) Development of a centre of Excellence in Pinehouse to organically develop the knowledge transference required for Indigenous community to understand the uranium mining industry including regulations, materials used, transportation, end use of products, education required mitigation efforts etc. 3) Support for training and education to support KML and Pinehouse on uses of artificial intelligence in the mining projects and to what level this activity can be managed by and in the community. A strategy to build capacity for matriculation graduates with the following classes English 30A 30B Chemistry 30, Physics 30, Math 30. KML wants to increase the community western education levels so that they are knowledgeable and have the capacity to protect themselves and the environment.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #93)	Denison has estimated a workforce of 300 during the two-year Construction phase and 180 during the Operation phase. Mineral sector positions are typically considered to be higher paying than many other industrial positions. Residents and communities in the LSA (ERFN (including Indian Reserve Wapachewunak 192D and Indian Reserve La Plonge 192) and Patuanak, Northern Hamlet (Patuanak); Pinehouse Lake, Northern Village; and Beauval, Northern Village) will be given first priority for employment, training, and business opportunities, followed by residents and communities in the RSA (Northern Saskatchewan Administrative District). Mitigation and enhancement measures will be implemented by Denison to enhance the positive effects of the Project on employment and training, income, traditional economy, and business opportunities and minimize adverse effects including: • A Human Resource Development Plan to initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities; • Establishment of a procurement approach through all phases of the Project, focusing on businesses based within the LSA communities, followed by Indigenous and / or businesses in the RSA; • Negotiation with the Province of Saskatchewan to develop the Project's Surface Lease Agreement and Human Resource Development Agreement. See Section 13 for a summary on local, provincial, and federal Project benefits and Denison's approach to employment, training, and business participation opportunities for communities. See Section 13 for information regarding employment, employment opportunities, and career growth for community members. As outlined in Denison's Indigenous Peoples Policy, Denison recognizes the critical necessity of advancing reconciliation with Indigenous peoples in Canada and the important role of Canadian business in the reconciliation process. Denison is committed to providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business	Residents and communities in the LSA (ERFN (including Indian Reserve Wapachewunak 192D and Indian Reserve La Plonge 192) and Patuanak, Northern Hamlet (Patuanak); Pinehouse Lake, Northern Village; and Beauval, Northern Village) will be given first priority for employment, training, and business opportunities, followed by residents and communities in the RSA (Northern Saskatchewan Administrative District). Mitigation and enhancement measures related to employment and training, income, traditional economy, and business opportunities and minimize adverse effects include a Human Resource Development Plan (outlining the above employment commitments), an establishment of a procurement approach through all phases of the Project, focusing on	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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				activities. In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible and will continue with ongoing discussions in this regard.	businesses based within the LSA communities, followed by Indigenous and / or businesses in the RSA, and negotiation with the Province of Saskatchewan to develop the Project's Surface Lease Agreement and Human Resource Development Agreement. In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible and will continue with ongoing discussions in this regard. Commitments and mitigations are described in Section 13.			
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions ; Physical and cultural heritage	KML note that loss of language can be correlated to the introduction of the Saskatchewan Uranium Industry. Prior to the industry development, Pinehouse was among the most fluent speaking communities in northern Saskatchewan. All children in Pinehouse spoke Cree with limited English and French capacity. Since the collateral effect of industry became the prominent community discourse the support for Cree language was diminished and marginalized by industry as English is the primary language used by industry. KML and NVP are actively working to determine how to stop the current language extinction process with strategies around creating more resources for culture and language. KML is leading the process for recovering from this loss. KML are using our own source revenue and resources to bring pride in the language and culture for community members of KML. KML will continue to bring this attention to all proponent activities that occur on the KML territory for KML are all are responsible to remove the effects of colonisation and institutional racism.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #94)	Denison respects the concern raised by KML regarding language and culture related to working at an industrial operation. Denison and KML will be working on specific items of interest to mitigate these types of concerns through private contractual arrangements, which may include specific mitigation and accommodation measures in this respect. Mitigation measures associated with potential effects to cultural continuity (including knowledge transfer and language) are described in Section 12.1.5 and include: • working with Indigenous COIs to understand culturally important periods relative to harvest times and cultural camps to facilitate Indigenous employees taking time off to participate in such activities; • implementation of Denison's Indigenous Peoples Policy and advancement of reconciliation • Using a commuter rotation system has also shown to be effective in allowing Indigenous employees continued opportunities to spend time on the land, and important factor in the transmission of knowledge and language (see Section 11 for a description of potential effects to land use). In discussions with Indigenous Communities of Interest since the filing of the draft EIS, it has become apparent that Denison should add additional commitment / mitigation measure in relation to this area of interest, as follows: • Encouragement to speak languages of choice while at site, except during safety sensitive situations. Section 12.1.5 of the final EIS will be updated to include the additional commitment / mitigation measure in relation to culture and language, as	Mitigation measures associated with potential effects to cultural continuity (including knowledge transfer and language) are described in Section 12.1.5 and include: • working with Indigenous COIs to understand culturally important periods relative to harvest times and cultural camps to facilitate Indigenous employees taking time off to participate in such activities; • implementation of Denison's Indigenous Peoples Policy and advancement of reconciliation • Using a commuter rotation system has also shown to be	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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				follows: • Encouragement to speak languages of choice while at site, except during safety sensitive situations.	effective in allowing Indigenous employees continued opportunities to spend time on the land, and important factor in the transmission of knowledge and language. Encouragement to speak languages of choice while at the site, except during safety sensitive situations, will be made.			
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	KML and NVP must be educated on all aspects of the Denison project to remove limited understanding of the processes that occurred within our traditional territories. They note that they cannot learn how to protect the land if they cannot understand the math and science involved in mining and environmental protection. KML people require higher education levels because of the collateral effect, on their population, caused by industry [which the proposed Wheeler River project adds to]. They further assert that they must understand the technological advantages being employed in the Denison Wheeler River Project. This transference of knowledge can occur through a sustained and supported education program. The community will also require confidence that any environmental incidents are managed in a way that is fully understood by the community. A long-term plan would be to develop and build that capacity in the community to manage the incidents and monitor any environmental cleanup processes. They want assurance that the standards being followed and that as a community, KML are able to action a response to mitigate potential environmental impact. This knowledge must become an integral part of the community knowledge and capacity for this project and for uranium exploration and mining in general. As noted in their summary of Primary Concerns, this includes: • Begin training and education support for community to prepare for employment at the mining operations with a focus on females, youth, and previously marginalized land users. Effort to increase employment in trades and drilling related work.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #95)	See responses to KML and NVP Public Comment #93	See responses to KML and NVP Public Comment #93	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	When determining community safety with respect to need for increased transportation for a new operation, the Indigenous people of KML have the following concerns: • The state of the existing road from 165 to 914: The road has received upgrades up to the kilometer 75 on highway 165. From Kilometer 75 to Kilometer 112 where Highway 165 ends and Highway 914 begins, Highway 914 needs an upgrade in width all the way to Pinehouse to create a more industrialized road. KML are not looking forward to the spring road conditions with just the current industry activity.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #96)	Project components include: ISR, Drilling, Freeze Wall, Wellfield, Processing, Water Management, Waste Management, Access and Transportation, Power, Support Facilities, Project Area, Project Activities, Ancillary Projects, GHG Emissions, Project Schedule, Project Benefits, Project Design Features, Management System, and Project Alternatives. Through an alternative means assessment, Denison considered options in relation to access and transportation. The access road alignment will follow part of the existing exploration access road, stream crossing structures will use clear span bridges, and worker transportation will be	Denison's vision in respect of this concern is that Denison and KML work together as partners in discussions about highways with the Provincial Government. However, in respect of actions Denison can undertake regarding traffic	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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		• Every community member has reported near miss incidents with the increased traffic caused by the general resurgence of the Uranium Industry using semi truck and heavy hauls to transport material to the operations and project sites. With the increase in incidents and near misses the opportunity for a major incident is inevitable, with the current road conditions. Adding the development of a new Denison mining operation will only increase this potential for incidents for people using this road. • When you add the rough road conditions, visibility reduction in the winter and summer with dust and snow flurry from large vehicles. This causes unsafe conditions and increases the potential for incidents. • The current capacity for road maintenance from the community members of Pinehouse are not prepared for the additional maintenance requirements for the road becoming a connected road. The road must be developed to an industrial rating to allow for the increase in industrial use so that members of KML do not experience safety issues. KML is requesting that the Transport Canada, Ministry of Highways respond to the concerns of Pinehouse and inform the community of the plans for road infrastructure development. KML would request the road be developed to the standard that the Key Lake and McArthur River Road is managed all the way to Junction of Highway 165 and Highway 2. KML and NVP request further capacity to develop road management capacity so KML can provide the support necessary to manage the integrity of the road. As also noted in their summary of Primary Concerns, this includes a requirement for: • Immediate efforts to build and increase emergency response capacity with community people from KML and NVP to support capacity for road incidents. • Significant improvements to the road to an industrial grade from Highway 2 to the Key Lake gatehouse to support the massive increase in heavy traffic from Industry.		air transport to a) nearby Cameco operations or, b) a new airstrip constructed and operated by Denison. Denison incorporated the feedback provided on road options select the current road alignment for the Project. See Section 2 for information and technical detail pertaining to Project Components and Project alternatives; see also Appendix 2-C for Alternative Means Assessment. Highway improvements are not within Denison's jurisdiction and are not considered in the EIS for the Wheeler River Project. However, Denison notes KML's perspective of increased traffic volumes and subsequent desire for highway improvements. On Highway 914 between Key Lake and Pinehouse, Denison anticipated that road users would see an increase between 16% and 40% over the life of the mine. Trucks travelling on this section of highway will increase from 35 to 53 at peak operational times. Denison's vision in respect of this concern is that Denison and KML work together as partners in discussions about highways with the Provincial Government. However, in respect of actions Denison can undertake regarding traffic along the road at times important for the undertaking of cultural activities, Denison commits to: 1) Assisting KML with the clear identification of the forthcoming culture camp along highway 914 (providing clear signage) 2) Having Project vehicle slow down to 40km/hr from mid-August to mid-October, during the times when KML members may be using the portion of the road near the culture camp. To be specific, this includes 2.5km before the entry into the culture camp, and 2.5km after the entry into the culture camp. See Section 2, Appendix 2-B for more detail pertaining to traffic volumes.	along the road at times important for the undertaking of cultural activities, Denison commits to (Section 12): 1) Assisting KML with the clear identification of the forthcoming culture camp along highway 914 (providing clear signage) 2) Having Project vehicle slow down to 40 km/hr from mid-August to mid-October, during the times when KML members may be using the portion of the road near the culture camp. To be specific, this includes 2.5km before the entry into the culture camp, and 2.5km after the entry into the culture camp.			
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	Pinehouse will inherit significant impacts from the transportation of goods and services to the mining operations. Safety of our community member is a paramount concern for the community. KML will be impacted from increased heavy haul traffic, and this will impede our ability to hunt for food. KML will also bear the effects of needed emergency services from our community first from the increased need for emergency response, which could dilute the limited emergency response services KML currently are provided. KML will also inherit any future security emergency requirement and expanded exploration and developmental impacts. The expectation is that within the life of the mine the community and industry will co- develop capacity to engage in emergency response including environmental spills, traffic incidents, air traffic incidents,	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #97)	Denison will establish a Transportation of Dangerous Good Program, intended to provide for the safe transport of goods by conforming to all applicable laws, regulations, company policies, and procedures. The Transportation of Dangerous Goods Program applies to all modes of transport and all locations where Denison assumes care and control of the materials. Denison will establish an Emergency Preparedness and Response Program to identify how the Project will prepare for and addresses emergencies that may affect the health and safety of persons, the environment, and the protection of property. Emergency Preparedness and Response Program would be developed consistent with guidance provided by CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).	Denison will, as described in Section 12, establish a Transportation of Dangerous Good Program, intended to provide for the safe transport of goods by conforming to all applicable laws, regulations, company policies, and procedures. Denison will establish an Emergency Preparedness and Response Program to identify how the Project will prepare for and addresses emergencies that	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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		emergency road security, search and rescue, fire fighting, and water rescue.		Increased pressure on emergency services is most likely to stem from an accident or malfunction on Highways 914 or 165. The extent to which these changes could affect any given community would depend on the nature of the accident or malfunction. Accidents and malfunctions for the Project were determined to (generally) have a highly unlikely to unlikely probability of occurrence, with an overall risk rating of low to moderate; however, the severity of accidents and malfunctions was determined to be minor to major. If such an event were to occur, local resources may be called upon to provide support, which may result in a call to fire, RCMP, or ambulance services depending on the nature of the event. Denison will provide any necessary training and/or equipment to local first responders to make sure they are sufficiently prepared to deal with an unlikely accident or malfunction. Denison's objective is to utilize existing emergency response teams from other operations prior to drawing on community-based resources. In the unlikely event that this were to occur, and KML resources were drawn upon, the Agreement negotiated between provides the foundation for discussions in respect of such incidents. See Section 2 for information pertaining to the above programs.	may affect the health and safety of persons, the environment, and the protection of property.			
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions ; current use of lands and resources for traditional purposes	KML is concerned with cumulative impacts from historical legacy exploration and mining practices. Not specific to Denison, Cameco or Orano, KML notes that land users have often found remnants of past poor exploration practices which are now affecting our continued land use. The abandoned camps and industrial and domestic waste left with no known program for clean up are the most significant of these remnants. They would like the EIS to host in partnership with provincial government regulators to host a conversation on progressive reclamation of these legacy sites. This conversation should prioritise the community capacity and an environmental agent for process that occur on our traditional territories. This conversation could include changing the policies of waste (future waste) being brough into the NAD. KML's contention is that waste that is brought into the region should be removed entirely from the region. The need for a regional waste management facility or a transfer station must be developed in partnership with KML. As noted in their summary of Primary Concerns, this includes a requirement for: • Immediate efforts to build capacity in a regional waste management operation within or near the community. To build current and future expertise in domestic waste, special waste, recycling, and the development of a transfer station in Pinehouse to support all mining activity including current operation and exploration.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #98)	Denison conducted a cumulative effects assessment, which included the Highway 914 extension project, on categories the Atmospheric and Acoustic Environment; Geology and Groundwater; the Aquatic Environment; the Terrestrial Environment; Human Health; Land and Resource Use; Quality of Life; and Economics. Denison respects and understands KML's concern about the cumulative effects in the region, particularly in relation to access to traditional lands and resources in correlation with industrial and mining developments. The residual effects of the Project are expected to interact with the residual effects of other projects and activities in the ILRU RSA, resulting in potential cumulative effects to Indigenous land use activity in the area. This is largely due to the proposed Highway 914 extension project. See Section 16 for a summary of the cumulative effects assessments for each category above. As outlined in Denison's Indigenous Peoples Policy, Denison recognizes the critical necessity of advancing reconciliation with Indigenous peoples in Canada and the important role of Canadian business in the reconciliation process. Denison is committed to providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities. In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible.	Denison is committed to, as described in Section 13, providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities. In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible. General discussions to continue as part of ongoing dialogue.	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.

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				General discussions to continue as part of ongoing dialogue.				
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions ; current use of lands and resources for traditional purposes	While one project or mining operation does not materially affect KML's land use practices, the substantial and growing projects and mineral exploration activity severely limits their ability to practice land use for the region north of Haultain River. KML land users are now experiencing loss of use with some areas leading to complete exclusion for food sovereignty and traditional activities. As an example of this, hunting practices currently use high powered rifles to engage with big game including moose, bear, deer, and caribou in the area. How will Denison ensure the community can continue to practice this method of food gathering in a safe method?	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #99)	In 2018, KML approached Denison to support a land use mapping initiative in the Project area. The 2018 study builds on existing land use maps, completed in 2011. A verification meeting was held in late 2018 to make sure no geographic data gaps existed and that the results speak for the whole community. In 2022, KML prepared a document to voice their perspectives on Project VCs and to provide a record for EIS development. Based on 12 community engagement sessions and review of the land use maps, KML explained their unique social, cultural, and historical context, expressed a general consensus of support for the Project, and described issues and concerns. See Section 3 for information on IK and LK and how this information was integrated throughout the EIS. See Section 11 for information on how the Project will interact with land and resources including how potential effects will be mitigated.	N/A	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions	KML sees limited mention that this project has respected the intent of the United Nations Declaration on the Rights of Indigenous People or the Recommendations of the Truth and Reconciliation Commission. There is limited opportunity for this project to review the implications of UNDRIP and TRC and how this project will cause to effect for the Indigenous rights bearing members of Pinehouse. This is not case for other agencies providing information for this project. KML request advocacy to increase education for external agencies on the need to develop greater understanding of UNDRIP and TRC calls to actions. These agencies can be contractors, regulators, and managers within the companies. This process could be developed if the agencies co develop a centre of excellence in Pinehouse.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #100)	Denison respects KMLs perspectives on the matter and understands this is not an industry only prerogative. As outlined in Denison's Indigenous Peoples Policy, Denison recognizes the critical necessity of advancing reconciliation with Indigenous peoples in Canada and the important role of Canadian business in the reconciliation process. Denison is committed to providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities.	Denison is committed to, as described in Section 13, providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities.	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Health and socio-economic conditions ; current use of lands and resources for traditional purposes	Potential impacts to KML are from increased development and access to their territory. Current provincial regulation of hunting, fishing, tourism, resources development and increase human traffic will affect and limit our ability to practice our protected rights. Western business with greater acumen may displace economic activity as they note that they are still evolving their understanding of the industry business practices. KML request further study on how current provincial regulations including opportunity for co-management so lessen the impacts from this project and from increased encroachment.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #101)	See response to KML and NVP Public Comment #99. The Agreement negotiated between Denison and KML outlines specific commitments for KML participation in environmental monitoring associated with the Project.	General discussions to continue as part of ongoing dialogue. The Agreement negotiated between Denison and KML outlines specific commitments for KML participation in environmental monitoring associated with the Project.	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Other	Waste generated from the operation, construction and maintenance of mines and exploration projects need to be better understood by the community. KML is of the view that waste management may represent the greatest source of environmental liability arising from this project and the mining industry in northern Saskatchewan in general. KML request that planning for waste management including capacity for	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public	As outlined in Denison's Indigenous Peoples Policy, Denison recognizes the critical necessity of advancing reconciliation with Indigenous peoples in Canada and the important role of Canadian business in the reconciliation process. Denison is committed to providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities.	Denison is committed to, as described in Section 13, providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis

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		Pinehouse to host a waste management company and a transfer station in Pinehouse to be considered. As a community that uses this land for food, shelter and culture KML want the capacity and responsibility to manage waste for this project and the industry in general and prepare for future development.	Comment #102)	In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible. General discussions to continue as part of ongoing dialogue.	benefits of Denison's business activities. In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible. General discussions to continue as part of ongoing dialogue.			Locals as part of ongoing engagement.
Northern Village of Pinehouse and Kineepik Métis Local	Other	KML describes Indigenous Economic Leakage and Triggered Response Capacity as concerns: • Indigenous Economic Leakage: the lack of capacity within Indigenous communities like Pinehouse prior to massive development projects like uranium mining operations. No ability in existing community development to capitalize on industrial activity in their areas because of historic colonization and racism. There are limited businesses, stores, materials and infrastructure within community to support and build upon. • Triggered Response Capacity: the respond required by the Indigenous people of KML to meet the need of industry. The community is required to change focus away from Indigenous community needs to focus on the needs of Industry. This includes time to respond to the industrial education, safety protocols, regulatory responses. The need as a community to participate in the Duty to Consult on exploration requests, feasibility studies, Environmental impact studies, negotiate agreements, industry training requirements. All of this removes the community ability for practicing Indigenous cultural activities, less time of Cree language retention. This response increases as the Collateral Effect increase. It is acknowledged by KML that these are factors are exacerbated by an additional mine. As noted in their summary of Primary Concerns, this necessitates: • Systemic increases in the use of services in Pinehouse including COOP store and PBNLP, Pinehouse Housing Corporation, Pinehouse Fishing COOP and Wild Rice, and KML Métis Local to prevent the continuation of Indigenous economic leakage. • Consideration to build industry supporting infrastructure such as warehousing, hotels, bulk fuels parts and mining necessities in Pinehouse to support community development and to stop the Indigenous economic leakage which has occurred over the last 50 years of development.	KML and NVP Public Comments (February 17, 2023) (KML and NVP Public Comment #103)	See response to KML and NVP Public Comment #102.	Denison is committed to, as described in Section 13, providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities. In terms of building capacity locally for emergency response and waste management, Denison supports KML's vision on these items where it makes sense and is possible. General discussions to continue as part of ongoing dialogue.	Resolved - agreement reached by both parties	As per letter dated December 5, 2023	General discussions to continue between Denison and the Northern Village of Pinehouse and Kineepik Métis Locals as part of ongoing engagement.
Patuanak Métis Local #82	Other	Questions were asked regarding if the wastewater would be treated.	ROC 1	Wastewater will be treated as part of water management for the Project. Treated Effluent Monitoring and Release Ponds in Section 2.2.3.9 of the draft EIS outlines Denison's commitment to test effluent prior to discharge to Whitefish Lake, to ensure it meets federal and provincial discharge limits. Any pond not meeting the criteria will be recycled back to the Industrial Wastewater Treatment Plant via the process water pond.	Wastewater will be treated as part of water management for the Project. Treated Effluent Monitoring and Release Ponds in Section 2.2.3.9 of the draft EIS	Ongoing - Patuanak Métis Local #82 has delegated the duty to consult to the MN-S. Denison and MN-S are	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.

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				Denison expects the Provincial Approval to Operate a Pollutant Control Facility will contain specific effluent quality limits and monitoring to confirm effluent quality meets the approved limits. Denison will also be required to meet conditions in CNSC licensing documentation, as well as MDMER effluent discharge criteria.	outlines Denison's commitment to test effluent prior to discharge to Whitefish Lake, to ensure it meets federal and provincial discharge limits. Any pond not meeting the criteria will be recycled back to the Industrial Wastewater Treatment Plant via the process water pond. Denison will also be required to meet conditions in CNSC licensing documentation, as well as MDMER effluent discharge criteria.	committed to working toward a resolution on these issues.		
Patuanak Métis Local #82	Other	Questions were asked regarding malfunctions during the process.	ROC 62	A standalone Accidents and Malfunctions (A&M) assessment was completed and is summarized in Section 14 of the EIS (full report is Appendix 14-A of the EIS). The A&M assessment considered almost 70 accident scenarios including many that would relate to the unplanned release of chemicals and radiation to the environment with potential to effect country foods. Specific scenarios including the release of chemicals and radiation to the aquatic environment and to the terrestrial environment adjacent to the ERFN and KML culture camps located along Hwy 914. The overall risks in consideration of likelihood and consequence were characterized as low. The assessment concluded that with planned engineering / environmental design features, mitigation measures, and emergency response, as well as implementing industry best practices that the risks to the environment from accidents and malfunctions can be reduced to levels that are as low as reasonably practical.	N/A	Ongoing - Patuanak Métis Local #82 has delegated the duty to consult to the MN-S. Denison and MN-S are committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.
Patuanak Métis Local #82	Other	Questions and clarifications on ISR mining methodology, including freeze wall technology.	ROC 62	Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface. Section 2.2.1.3 provides information on freeze wall technology. The freeze wall is intended for tertiary containment of mining solution to support a defence in depth strategy as additional, site-specific data is obtained on hydraulic containment. The freeze wall around the mining area will extend from the surface to the basement rock, isolating the mining area from regional groundwater. The freeze wall is expected to be a minimum of 10 m thick, be installed 25m away from the uranium deposit, and extend 30 m into the basement rock. Data from the groundwater monitoring network installed in and around the wellfield and freeze wall will make sure the freeze wall is meeting design specifications.	N/A	Ongoing - Patuanak Métis Local #82 has delegated the duty to consult to the MN-S. Denison and MN-S are committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.
Patuanak Métis Local #82	Other	Patuanak Métis expressed interest in pursuing a relationship with Denison as this had not been previously pursued with companies prior.	ROC 142	Before 2019, Denison undertook engagement activities in the Patuanak area (including with PML more broadly through work done in relation to the ERFN Wapachewunak reserve, consistent with the strong	Patuanak Métis Local #82 has delegated the duty to consult to the MN-S.	Ongoing - Patuanak Métis Local #82 has delegated the duty	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about

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				interconnections in the area. In mid-2019, Denison was advised by the Province of Saskatchewan of the interest of PML in relation to the Project. As a result, beginning June 2019, Denison began engaging directly with PML. This included sending correspondence to PML about the Project description, having informal discussions pertaining to their interests in the Project, and hosting a site visit (2019) and a meeting jointly coordinated by the MN-S (2019). See Section 4.3.2.4 for more information. In 2019, the PML delegated their Duty to Consult for the Project to the MN-S. From 2019, the MN-S has been representing PML in respect of engagement with Denison for the Project. Since then, Denison has been engaging with MN-S on behalf of PML and other Métis Locals. For details of this engagement, see Section 4.3.4.1. For engagement that occurred with PML in 2019. These key engagement activities were supported by ongoing engagement methods including, but not limited to, those outlined in Section 4.2.1.		to consult to the MN-S. Denison and MN-S are committed to working toward a resolution on these issues.		working toward a resolution on these issues.
PBCN	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	PBCN is concerned that the Project has potential adverse environmental, cultural and socio- economic impacts to PBCN members, lands and uses, including hunting, fishing and gathering in all seasons. Both Denison and CNSC indicate that they have fulsome aboriginal engagement policies and guidelines and appear to be undertaking their delegated Crown duty to consult in good faith, as informed by those policies, principles, legal and regulatory requirements. However, there has been an initial error in the assessment, both by Denison and CNSC, as PBCN was erroneously excluded from indigenous engagement, ostensibly due to distance from Wheeler and a lack of understanding of PBCN lands and Indigenous activities potentially impacted by the project. PBCN wishes to participate fully in the regulatory review of the Wheeler River project. PBCN requests that the CNSC ensure that it's review timelines be adjusted, as required, to ensure fulsome participation by PBCN with the proponent and the regulator, going forward. PBCN's goals are to: • Meet with CNSC to share PBCN knowledge of its land, and Indigenous uses, and how these may be impacted by the Project and methods to address any adverse impacts. • Establish a shared understanding of how PBCCN would like to be engaged in the regulatory review, including, but not restricted to, timely project updates, information and an opportunity to discuss concerns throughout the EA process, including the review of the EIS, CNSC's staff's EA Report, and other project-related documentation.	PBCN Public Comment March 3, 2023 (PBCN Public Comment #90)	Denison followed the criteria identified in CNSC's REGDOC 3.2.2 v 1.2 in determining the Project's Indigenous Communities of Interest. By way of background, Denison has been the operator of the Wheeler River property since 2004, and its predecessors have been in the area since the 1980s. Denison followed a systematic and comprehensive process to identify Indigenous communities who may be impacted by the Project, informed by a wide variety of information, such as the wildlife and fur block management administration areas, existing traditional land use information (particularly information made available through the Key Lake and McArthur River public review processes), access restrictions on Highway 914 north of Key Lake, anticipated impacts to water, anticipated transportation routes, and publicly available descriptions of Indigenous Nations' traditional territories, including that of PBCN. Our approach was further informed by our discussions with those Indigenous Nations with the potential to be adversely effected by Project activities, as well as Indigenous organizations in the region, and supported by information from and interactions with representatives of the Saskatchewan Ministry of Environment (MOE) and Canadian Nuclear Safety Commission (CNSC). Denison has been discussing the interests and concerned identified by PCBN on an on-going basis since March of 2023, and will continue to share information regarding the Project.	Denison has listed PBCN as an Other Indigenous Community in Section 4, and has updated figures in Section 1 (Figure 4-1) and Section 4 (Figure 4.3-1 and Figure 4.3-2) accordingly.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.
PBCN	Health and socio-economic conditions ; Current use of lands and resources	PBCN is concerned that the Project has potential adverse environmental, cultural and socio- economic impacts to PBCN members, lands and uses, including hunting, fishing and gathering in all seasons. Both Denison and CNSC indicate that they have fulsome aboriginal engagement policies and guidelines and appear to be undertaking their delegated Crown duty to consult in good faith, as informed by those policies, principles, legal and regulatory requirements. However, there	PBCN Public Comment March 3, 2023 (PBCN Public Comment #91)	Denison remains committed to conducting meaningful engagement with Indigenous communities potentially affected by the Project and to understanding how the proposed development of the Project may affect the ability of Indigenous peoples to exercise collective Indigenous and Treaty Rights. Denison has been corresponding with PBCN on these issues and concerns since March of 2023, including written correspondence and an in-person meeting with PBCN on September 20, 2023. We believe that consultation and engagement is an iterative, two-way process, such that	Denison remains committed to conducting meaningful engagement with Indigenous communities potentially affected by the Project and to understanding how the proposed development of the Project may affect the	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually

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	for traditional purposes;	has been an initial error in the assessment, both by Denison and CNSC, as PBCN was erroneously excluded from indigenous engagement, ostensibly due to distance from Wheeler and a lack of understanding of PBCN lands and Indigenous activities potentially impacted by the project. PBCN meets nearly all of Denison's stated criteria to evaluate Indigenous communities located within the Saskatchewan Northern Administration District that would be engaged by Denison. A full and accurate description of PBCN's rights and interests is an essential part of the Wheeler dEIS and is necessary to ensure a fulsome environmental assessment. PBCN is interested in the opportunity to collaborate with Denison mines to comprehensively identify PBCN's rights and interests that may be impacted by the project. PBCN's goals are to: • Work together with Denison in a spirit of mutual respect to cooperate to collectively identify means to avoid, mitigate or otherwise address potential negative impacts of the project on PBCN's territory and the exercise of its Indigenous rights and interests. • Participate in a funding agreement with Denison to facilitate and support PBCN participation and meaningful engagement in the EA process. • Meet with Denison to share PBCN knowledge of its land, and Indigenous uses, and how these may be impacted by the Project and methods to address any adverse impacts. • Explore employment and job opportunities related to the Project.		as we learn about the Project, its potential impacts, and the interests of Indigenous peoples in the region, we will continue to tailor our approach to engagement. It is in this spirit that we have continued to engage with PBCN to better understand the Nation's interests and land uses in the vicinity of the Project.	ability of Indigenous peoples to exercise collective Indigenous and Treaty Rights. Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.		agreeable manner.
PBCN	Current use of lands and resources for traditional purposes	PBCN concern: what are the potential impacts to the landscape, including aquatic and terrestrial environments?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	The potential effects of the Wheeler River Project on the aquatic and terrestrial environments have been comprehensively assessed in the EIS and related supporting documentation. The spatial scale is very small (resulting from ISR mining method) of 160 hectares (for reference, the McIlvenna Bay Project is 1,029 hectares [8 times bigger than Denison's Project]). A conservative approach was taken in the assessment and the overall conclusion was made that there would be no significant adverse residual effects in consideration of proposed mitigations.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.

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PBCN	Current use of lands and resources for traditional purposes	PBCN concern: what are the effects on the growing/carrying capacity of both aquatic and terrestrial environments for Country Foods due to potential changes to the landscape and risk of contaminants?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	See above answer regarding the scale of the Project in the landscape. While it is acknowledged that the footprint is not "zero" it is a small footprint on the landscape scale and the assessment of the potential effects of the Project has concluded that the Project will not that will cause a change in any component of the environment that would alter its status or integrity beyond an acceptable level. Specifically, as it concerns the risk of introduction of contaminants to the environment the following is noted. A Human Health risk Assessment (HHRA) was undertaken for the Project in Section 10. The HHRA evaluated direct exposure to constituents of potential concern (or contaminants) released to air and water, and through indirect exposure to the constituents associated with soil, sediment, and food, such as fish, wildlife, and plants. The assessment was inclusive of information based on use of traditional foods and a specific traditional food diet from ERFN. The overall conclusion of the HHRA was that there would be no significant adverse effects to human health from the Project.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.
PBCN	Current use of lands and resources for traditional purposes	PBCN concern: what are potential accident or spill impacts on the harvesting of plant specific country foods?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	A standalone Accidents and Malfunctions (A&M) assessment was completed and is summarized in Section 14 of the EIS (full report is Appendix 14-A of the EIS). The A&M assessment considered almost 70 accident scenarios including many that would relate to the unplanned release of chemicals and radiation to the environment with potential to effect country foods. Specific scenarios including the release of chemicals and radiation to the aquatic environment and to the terrestrial environment adjacent to the ERFN and KML culture camps located along Hwy 914. The overall risks in consideration of likelihood and consequence were characterized as low. The assessment concluded that with planned engineering / environmental design features, mitigation measures, and emergency response, as well as implementing industry best practices that the risks to the environment from accidents and malfunctions can be reduced to levels that are as low as reasonably practical.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.
PBCN	Current use of lands and resources for	PBCN concern: will there be limitations to access lands for country food harvesting due to mining traffic or operation of the mines?	PBCN Public Comment March 3, 2023 (PBCN Public	Access limitations will be limited to the 169 hectare footprint of the site (for reference, the McIlvenna Bay Project is 1,029 hectares [8 times bigger than Denison's Project]). Access north of the Key Lake Road is already limited to a select number of individuals/resource harvesters, and will remain in place until such a time that the access is changed by other parties. Limitation to Indigenous Land and Resource Use beyond the	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will	Based on Denison's understanding of the concern or comment, Denison has provided background	As per Denison letter to PBCN dated January 10, 2024. No response has been received to	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate

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	traditional purposes		Comment #92)	Project footprint and along Highway 914 are expected to result from Project related traffic. Denison is sensitive to areas of high value to ERFN and KML along Highway 914, and is working with these communities to ensure that appropriate mitigations and restrictions are in place during periods of intensive use, such as community-hosted cultural camps proximal to Highway 914. These, and any other mitigations could be applicable to all users of Highway 914, inclusive of PBCN. Although the known trapper in the Project area is recently deceased, it is understood that similar uses are expected from future ERFN members. When the trapline is transferred, a trapper's compensation agreement with inclusions for loss of commercial income and/or any in-kind support related to access and continued use will be contemplated with the future user (irrespective of their home community).	continue to share information regarding the Project with PBCN.	information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	date (as of June 30, 2024)	and mutually agreeable manner.
PBCN	Current use of lands and resources for traditional purposes	PBCN concern: how will Denison use freshwater from Whitefish Lake?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	The specific activity of water taking from White Lake to support the mining operation was assessed in Section 8.1.4.2.2 of the EIS. Based on a conservative (i.e., high) estimate of water taking it was estimated that the taking would result in a reduction of flow of about 3% at times of low flow and the lake level could change by about 1 cm. These small incremental changes would be beyond the ability of monitoring techniques to practically measure and are much less than the natural variability seen. For these reasons the EIS concluded that these minor incremental changes did not represent a significant adverse effect.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.
PBCN	Current use of lands and resources for traditional purposes	PBCN concern: what are the potential impacts to boreal shield woodland caribou?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	The Caribou in SK1 are stable. Potential effects on Woodland Caribou were considered in Section 9.3 of the EIS and it was concluded that there would be no significant adverse effects. The full reasoning for that conclusion can be found in the EIS but the conclusion was based on several factors including the small spatial scale of the Project relative to the SK1 range (0.001%), risk of Project-related mortality being below natural variation, and the various mitigations that will be implemented. An initial Draft Caribou Management Plan has been developed, provided to regulators, and this document will be used as a framework to further reduce or mitigate potential Project-related effects. The plan is a living document that will evolve over time in response to the eventual Provincial overall management plan for the SK1 range.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.

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						proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.		
PBCN	Current use of lands and resources for traditional purposes	PBCN concern: how will Denison contain effluent from the mine and manage anticipated downstream impacts? In particularly interconnected waterbodies?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	Potential effects from the Project on water quality were assessed in Section 8.2 of the EIS and the assessment directly evaluated discharge of effluent from the site using predictive modeling. Water treatment will occur; testing will occur prior to release; and no release will occur if water quality does not meet objectives. The predictive modeling showed that constituent concentrations including radionuclides would be below water quality objectives for the protection of aquatic life (i.e., no effects would be expected) at the outlet of White Lake well upstream of the outflow of the Icelander River to Russel Lake. Since no impact are expected to occur in these areas close to the Project, it can also be concluded that no effects would accrue in areas further downstream in the watershed where contributing sub watersheds are many, many-times the size of the sub watersheds near the Project site. In addition, the HHRA concluded that there would be no human health risks related to the Project for traditional food users in consideration of traditional food uses in relatively close proximity to the Project site. As above, if Project effects are not found in relatively close proximity to the site, there is no risk of Project effects in more downstream areas. Finally, the A&M assessment (see response to Question #8; Section 14 of the EIS) did evaluate unplanned releases of chemicals and radioactivity to the environment. As noted, the assessment concluded that with planned engineering / environmental design features, mitigation measures, and emergency response, as well as implementing industry best practices that the risks to the environment from accidents and malfunctions can be reduced to levels that are as low as reasonably practical.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.
PBCN	Health and socio-economic conditions	PBCN concern: what are the socio-economic impacts of the Project, including vulnerable populations, from construction through operation?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	Both the construction and operation camps will operate on a fly-in/out basis, limiting the opportunities for interactions between the workforce and Indigenous communities, as workers will be transported by air directly to the site. Other measures to protect community well-being of people employed on the site include health and wellness programming, life skills programming, employee and family assistance programming, implementing a no drug and alcohol policy on site, and offering culturally sensitive employment policies available to all employees, inclusive of any PBCN members.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.

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						continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.		
PBCN	Health and socio-economic conditions	PBCN concern: what is the proposed means and haul route of yellowcake product to the market?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	The yellowcake will be transported in industrial containers, in accordance with the Transportation of Dangerous Goods Act. Project-related truck traffic during Construction and Operation (such as surface construction equipment, materials, and drill rigs) is expected to originate from Saskatoon or other southern locations. Project-related traffic originating from the west may travel through Beauval via Highway 165, whereas traffic from the south and east may access Highway 165 via Highway 2. Traffic from Saskatoon would likely use Highway 11 to Prince Albert and Highway 55 to Beauval, then travel via Highway 165. Highways are under the authority of the Saskatchewan Ministry of Highways.	Denison has been discussing and engaging with PBCN regarding the interests and concerns identified by PBCN on an on-going basis since March of 2023, and will continue to share information regarding the Project with PBCN.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.
PBCN	Health and socio-economic conditions	PBCN concern: are there employment or procurement opportunities for PBCN members or Group of Companies?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in Section 13.3.2.1 of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan, inclusive of PBCN communities) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project. PBCN businesses would fall in the category of northern Saskatchewan businesses, which would place them in line for second preference if project needs cannot be met within the local study area.	Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan, inclusive of PBCN communities) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.

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					looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project. PBCN businesses would fall in the category of northern Saskatchewan businesses, which would place them in line for second preference if project needs cannot be met within the local study area. Further details are described in Section 13.	mutually agreeable manner.		
PBCN	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes	PBCN concern: how will PBCN be included in the development and execution of long-term environmental effects monitoring and follow-up programs?	PBCN Public Comment March 3, 2023 (PBCN Public Comment #92)	Denison acknowledges PBCN interests in respect of the Project. Detailed monitoring programs to be developed through licensing and this will include how data is going to be reported and shared. The regulators have developed third party monitoring programs and undertake data review on an ongoing basis.	Detailed monitoring programs to be developed through licensing and this will include how data is going to be reported and shared. Denison has been discussing the interests and concerned identified by PCBN on an on-going basis since March of 2023, and will continue to share information regarding the Project.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to PBCN. Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.	As per Denison letter to PBCN dated January 10, 2024. No response has been received to date (as of June 30, 2024)	Denison will continue to engage with PBCN on remaining issues of concern, in an appropriate and mutually agreeable manner.
Prince Albert Grand Council	Other	Overall Comments from the PAGC submission: The EIS does not address multiple issues related to ecosystems, human health, and the long-term sustainability of the Wheeler River project, particularly Indigenous concerns regarding the loss of caribou, wolverine and other culturally significant animals. There are no details on economic benefits from the mines through Indigenous partnerships, including equity-based participation in the workforce with training opportunities for Indigenous personnel to operate in management roles. [Additional questions on this topic directed to regulators or government entities are included in the CNSC table]	Prince Albert Grand Council (March 6, 2023) (PAGC public comment #564)	The potential effects of the Wheeler River Project on the aquatic and terrestrial environments have been comprehensively assessed in the EIS and related supporting documentation. The spatial scale is very small (resulting from ISR mining method) of 160 hectares. A conservative approach was taken in the assessment and the overall conclusion was made that there would be no significant adverse residual effects in consideration of proposed mitigations. The Wildlife LSA was designed to capture the majority of the Project effects. The Wildlife LSA extends beyond the Project Area of the site to include a reasonable estimation of where sensory disturbance from Project-related activities would extend and where effects on wildlife including caribou are most likely to occur. Further the Local Study Area for Indigenous Land and Resource Use (Section 11.1) is defined as the Project footprint plus the maximum combined extents of the supporting Valued Components for the Regional Study Area for aquatic, terrestrial, noise,	Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP.	Based on Denison's understanding of the concern or comment, Denison has provided background information and clarification on the assumptions and/or approach undertaken to PAGC.	Response to PAGC comments were submitted on June 06, 2024.	Denison considers the concern resolved.

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				and health as these components can affect the Indigenous resource use environment to ensure that all possible effects to resources were considered. Section 9 describes how consideration of potential effects to wildlife and wildlife habitat are considered within the EIS. In regard to caribou, Denison has developed a Conceptual Caribou Mitigation Plan based on discussions between Denison and Saskatchewan Ministry of Environment. Denison utilized Traditional Knowledge provided by Indigenous communities in the assessment and in the development of the Plan. A Human Health Risk Assessment (HHRA) was undertaken for the Project in Section 10. The HHRA evaluated direct exposure to constituents of potential concern (or contaminants) released to air and water, and through indirect exposure to the constituents associated with soil, sediment, and food, such as fish, wildlife, and plants. The assessment was inclusive of information based on use of traditional foods. The overall conclusion of the HHRA was that there would be no significant adverse effects to human health from the Project. Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be with institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment and training will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA.				
Prince Albert Grand Council	Current use of lands and resources for traditional purposes; Other	The EIS does not capture Indigenous Elders' understanding of the human impact, climate change and cumulative effects on wildlife including caribou or other species at risk and the resulting impacts on Indigenous livelihoods. Denison's EIS states that existing disturbances in the area are from exploration activities with a general description of how disturbances from these activities will be managed. PAGC does not find sufficient evidence that the affected areas can be restored to their former state and will impact woodland caribou habitats. PAGC Elders prioritize the removal or reduction of human disturbances to the landscape for caribou recovery and wish to avoid projects which have	Prince Albert Grand Council (March 6, 2023) (PAGC public comment #565)	Denison remains committed to conducting meaningful engagement with Indigenous communities potentially affected by the Project and to understanding how the proposed development of the Project may affect the ability of Indigenous peoples to exercise collective Indigenous and Treaty Rights. The potential effects of the Wheeler River Project on the aquatic and terrestrial environments have been comprehensively assessed in the EIS and related supporting documentation. The spatial scale is very small (resulting from ISR mining method) of 160 hectares. A conservative approach was taken in the assessment and the overall conclusion was	Denison remains committed to conducting meaningful engagement with Indigenous communities potentially affected by the Project and to understanding how the proposed development of the Project may affect the ability of Indigenous peoples to exercise collective	Based on Denison's understanding of the concern or comment, Denison has provided background information and clarification on the assumptions and/or approach	Response to PAGC comments were submitted on June 06, 2024.	Denison considers the concern resolved.

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		a significant environmental impact. PAGC elders do not want to see any animals or plants disappear from the landscapes they use based on their traditional understanding of the relationship between humans and nature. This impacts the ability to practice treaty rights and entitlements to the lands which impact physical and mental health and mixed economy connected to hunting and gathering. PAGC urges Denison to understand and take an eco-cultural approach to preserve wildlife and landscape health when planning mining operations and decommissioning processes. This should include use of Indigenous Knowledge in delineating caribou habitats despite the data and woodland caribou traditional ecological knowledge available in the report published by Mamun and Brook (2017).		made that there would be no significant adverse residual effects in consideration of proposed mitigations. The Wildlife LSA was designed to capture the majority of the Project effects. The LSA extends beyond Project Area of the site to include a reasonable estimation of where sensory disturbance from Project-related activities would extend and where effects on wildlife including caribou are most likely to occur. Section 9 describes how consideration of potential effects to wildlife and wildlife habitat are considered within the EIS. In regard to caribou, Denison has developed a Caribou Management Framework based on discussions between Denison and Saskatchewan Ministry of Environment. Denison utilized Indigenous Knowledge provided by Indigenous communities in the assessment and in the development of the Framework. Denison notes that the objective of Mamun and Brook (2017) was to support the provincial range planning process for conservation of woodland caribou. The range planning process for SK1 is currently underway. As needed, Denison's Framework will be updated to be consistent with the management goals defined by ENV for SK1. Additionally, as part of its boreal caribou management efforts, the province is working with industry to develop effective and practice approaches to mitigate potential effects of activities on woodland caribou through offsetting. Denison is committed to continue to work with the province to finalize the habitat offset requirement using the province's habitat offset calculator. Section 11 of the draft EIS provides the assessment of potential Project effects on Indigenous Land and Resource Use (Section 11.1) and Other Land and Resource Use (Section 11.2). The mitigation measures proposed in the aquatic and terrestrial assessments translated into undetectable changes in resource availability to existing and future users and rightsholders. The assessment does not take an eco-cultural approach but rather one focused on VCs, key indicators and associated measurable parameters, which are standard in impact assessment. Mitigation to eliminate, reduce, or control potential adverse effects of the Project on Indigenous Land and Resource Use would apply to any uses proximal to the Project. Given proven mitigation is to be applied to traffic disturbances, noise, air quality, and increased competition for resources, the effects are expected to be minimal. Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP.	Indigenous and Treaty Rights. Denison is committed to continue to work with the province to finalize the habitat offset requirement using the province's habitat offset calculator. Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure.	undertaken to PAGC.		
Prince Albert Grand Council	Current use of lands and resources for	Additional traffic and associated noise from the proposed project are a concern and PAGC requests that Denison puts a speed limit of about 70km/hour for trucks in the boreal forest where woodland caribou reside and are used by barren land caribou in winter.	Prince Albert Grand Council (March 6, 2023) (PAGC public	The proposed operation is fly-in, so Project related traffic, and associated noise, to the area would only be related to deliveries of materials to and from the site. On-site staff will not have access to personal (or company) vehicles. The Project will not change public access to the area. The existing gate on Highway 914 near Cameco's Key Lake Operation will	On-site staff will not have access to personal (or company) vehicles. As outlined in Denison's	Based on Denison's understanding of the concern or comment, Denison has provided	Response to PAGC comments were submitted on June 06, 2024.	Denison considers the concern resolved.

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	traditional purposes; Other		comment #566)	remain in place and no changes to the gate and the process for controlling access to Highway 914 north of the Key Lake Operation are proposed as part of the Wheeler River Project. Section 12.3.4.2.1 of the draft EIS describes change in traffic as a result of the Project, including truck average annual daily traffic and average annual daily traffic. Given proven mitigation, as described in Section 12.3.5, to be applied to traffic disturbances and associated noise the effects are expected to be minimal. Section 11.1.5 also describes the mitigation measures to reduce the impacts of traffic and noise, among others. For example, air transportation will be used to transport most workers between the Project site and designated pick-up and drop-off points in communities and noise generating equipment will be situated behind on-site obstructions. In regard to caribou, Denison has developed a Conceptual Caribou Mitigation Plan based on discussions between Denison and Saskatchewan Ministry of Environment. Denison recognizes the level of concern regarding Project related transportation it has received through engagement activities to date and will continue to solicit input on transportation concerns as the Project moves forward. As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects where possible. As an example, Section 11.1.5.3 describes that Denison will require truck traffic to slow down to 40 km/hr for a minimum of 2.5 km o either side of the ERFN and KML (Pinehouse #9) cultural camps, which are understood to occur in September and October (but may be adjusted at the communities direction).	Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects where possible. As an example, Section 11.1.5.3 describes that Denison will require truck traffic to slow down to 40 km/hr for a minimum of 2.5 km o either side of the ERFN and KML (Pinehouse #9) cultural camps, which are understood to occur in September and October (but may be adjusted at the communities direction).	background information and clarification on the assumptions and/or approach undertaken to PAGC.		
Prince Albert Grand Council	Other	PAGC finds that science-based models used for EIA reports put Indigenous people at a disadvantage as Indigenous communities are not involved in the collection, analysis and interpretation of data for models. Indigenous culture does not make use of models, rather, they follow natural changes and patterns which sometimes are not reflected in scientific findings. Requesting feedback from Indigenous communities on a report full of models prepared without Indigenous involvement has limited value as PAGC members are not fully engaged throughout the process. This approach is somewhat disrespectful to Indigenous communities as they are not part of the development process and PAGC reserves the right to reject the EIA or EIS. PAGC requests a commitment from Denison to get Indigenous communities involved in each stage of the documentation and report preparation process.	Prince Albert Grand Council (March 6, 2023) (PAGC public comment #567)	Denison acknowledges that Indigenous ways of knowing are distinct from western science, and have included Indigenous knowledge shared by communities in the impact assessment process. For example, Section 10.1.2 describes that Indigenous Knowledge and Local Knowledge were used to inform assumptions used in the human health risk assessment which helped identify human health receptors (i.e., people) who consume traditional foods, specifically in terms of their locations, residency times, and components of the traditional foods diet. In this instance, Indigenous knowledge was used to complement western science. Denison remains committed to conducting meaningful engagement with Indigenous communities potentially affected by the Project and to understanding how the proposed development of the Project may affect the ability of Indigenous peoples to exercise collective Indigenous and Treaty Rights. Through the environmental assessment process ERFN and other Indigenous communities have opted to utilize third party supports to complement their review of the EIS. Third party reviews were supported by both agreements executed between Denison and Indigenous communities, along with participant funding offered by the CNSC. Section 4 of the EIS describes the engagement undertaken with Indigenous communities and organizations. Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project,	Denison remains committed to conducting meaningful engagement with Indigenous communities potentially affected by the Project and to understanding how the proposed development of the Project may affect the ability of Indigenous peoples to exercise collective Indigenous and Treaty Rights. Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project, and an example of their continued involvement from the outset to end of a process includes the commitment to collaborating with English	Based on Denison's understanding of the concern or comment, Denison has provided background information and clarification on the assumptions and/or approach undertaken to PAGC.	Response to PAGC comments were submitted on June 06, 2024.	Denison considers the concern resolved.

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				and an example of their continued involvement from the outset to end of a process includes the commitment to collaborating with English River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project.	River First Nation and Kineepik Métis Local on a community specific monitoring regime, suited to each of their interests and needs, in an agreed-upon fashion. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. It is expected that the data collected through such monitoring regimes would also be relevant to other Indigenous nations who may have interest in the Project.			
Prince Albert Grand Council	Health and socio-economic conditions	PAGC request additional details from Denison regarding plans to incorporate Indigenous partnership in the economic benefit of the mines, equity-based participation in the workforce and training opportunities for Indigenous personnel to operate in management roles. PACG suggest arranging long-term funding for youth education in science that would prepare them for careers in biology and environmental science, which is very uncommon among Indigenous communities. Increasing Indigenous representation in science and technology, and participation in development planning is therefore a valuable long-term goal.	Prince Albert Grand Council (March 6, 2023) (PAGC public comment #568)	As outlined in Denison's Indigenous Peoples Policy, Denison recognizes the critical necessity of advancing reconciliation with Indigenous peoples in Canada and the important role of Canadian business in the reconciliation process. Denison is committed to providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities. Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in the Economics section of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project. Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project. This may include initiatives associated with youth education in science if that is the interest and priority of the communities. Training could also include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Priority for employment	As outlined in Denison's Indigenous Peoples Policy, Denison recognizes the critical necessity of advancing reconciliation with Indigenous peoples in Canada and the important role of Canadian business in the reconciliation process. Denison is committed to providing Indigenous people and businesses with sustainable economic opportunities and benefits and sharing the economic benefits of Denison's business activities. Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items).	Based on Denison's understanding of the concern or comment, Denison has provided background information and clarification on the assumptions and/or approach undertaken to PAGC.	Response to PAGC comments were submitted on June 06, 2024.	Denison considers the concern resolved.

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				and training will then focus on Indigenous and non-Indigenous residents of the RSA and then beyond the RSA.				
Sipishik Métis Local #37	Current use of lands and resources for traditional purposes	Interest in understanding how IK and history is integrated in EIS.	ROC 62	Denison has supported several processes to aid community-led collection of IK. Section 3.4.2 provides detail on these processes and outcomes. Studies and reports incorporated throughout the Draft EIS include those provided by ERFN, KML, and YNLR on behalf of the Athabasca Denesųłiné. A Capacity Funding Agreement was signed with the MN-S to complete a Métis Knowledge Study by the end of October 2023. As part of this study agreement, Denison agreed to fully fund the Métis Knowledge Study. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison has updated the revised draft EIS to include relevant information in the assessment from the Métis Knowledge Study. Denison will continue to consider and integrate results from and forthcoming materials provided by communities as it advances the EIS process. Denison has recorded and stored information regarding IK, LK and engagement activities in an Engagement Database. Within the database, records are given unique identification numbers. These numbers are referenced throughout the EIS, but particularly in Parts II and III, to indicate where specific information from the database has been integrated into the assessment Within each section of Part II and Part III are subsections titled "Influence of Indigenous Knowledge, Local Knowledge and Engagement on the Assessment". Within these subsections are summary tables that provide additional details related to each one of the unique identification numbers referred to in that section.	Section 3 provides information on IK and LK and how this information was integrated throughout the EIS. Indigenous Knowledge has been integrated throughout the EIS and a section on the Influence of Indigenous Knowledge, Local Knowledge, and Engagement is provided in the methodology for sections. For example see Section 11.1.2 and Section 11.2.2 for further details on how Indigenous Knowledge, Local Knowledge, and Engagement influences Land and Resource Use.	Ongoing - Sipishik Métis Local #37 has delegated the duty to consult to the MN-S. Denison and MN-S are committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.
Sipishik Métis Local #37	Health and socio-economic conditions	Concern with racism and other factors in workplace affecting employee retention.	ROC 62	Denison has an established Workplace Violence and Harassment Policy and an Indigenous Peoples Policy, both of which are publicly available on Denison's website. These two policies create the conditions for an inclusive and diverse work environment and a safe work culture for all. Policies will be adapted to the conditions of the Project and Denison. Further, Section 12.2.5 Mitigation Measures for Community Well-being describes the establishment of health and wellness programming on-site, an Employee and Family Assistance Program (EFAP), a no alcohol and drug policy on Project site, the enforcement of Denison's Environment, Health, Safety, and Sustainability Policy, the implementation of culturally sensitive employment policies to support the Indigenous workforce (for example, having an Elder representative at the Project site to provide cultural programming), among others.	Denison has an established Workplace Violence and Harassment Policy and an Indigenous Peoples Policy, both of which are publicly available on Denison's website.	Ongoing - Sipishik Métis Local #37 has delegated the duty to consult to the MN-S. Denison and MN-S are committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.
Sipishik Métis Local #37	Other	Question about credentials required to undertake environmental monitoring. Interest in having transparency of environmental monitoring data for operating mines.	ROC 62	Public Information and Disclosure (CNSC 2018) sets out requirements and guidance for public information and disclosure for licensees and applicants of Class I and Class II nuclear facilities, and uranium mines and mills, for all lifecycle phases. The primary goal of the public information program, as it relates to the licensed activities, is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities are effectively communicated to the public. Denison would meet all requirements set out in this REGDOC, including the development of an appropriate public information program and disclosure protocol.	N/A	Ongoing - Sipishik Métis Local #37 has delegated the duty to consult to the MN-S. Denison and MN-S are committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
Sipishik Métis Local #37	Current use of lands and resources for traditional purposes	It was noted that development of a TK map for the community had not been undertaken due to funding pressures, but that the traditional territory of the people of Beauval was typically described to reach from Tippo Lake east of Beauval to the Primrose Air Weapons range to the west and north to the Patterson Lake area.	ROC 116	Denison understands that the Métis Knowledge Study, undertaken by MN-S on behalf of the Locals who have delegated the Duty to Consult to it, would be representative of the Sipishik Métis Local #37. As a result, please see information pertaining to Interests, Issues and Concerns in relation to the MN-S and the associated Métis Knowledge Study.	N/A	Ongoing - Sipishik Métis Local #37 has delegated the duty to consult to the MN-S. Denison and MN-S are committed to working toward a resolution on these issues.	Delegated the duty to consult to the MN-S.	Discussions continue with MN-S about working toward a resolution on these issues.
Ya'thi Néné Lands and Resources Office	Other	Questions were asked about ISR mining and on what would take place on site, and whether processing would occur at McClean.	ROC 77 ROC 83 ROC 457 ROC 570	Project components include: ISR, Drilling, Freeze Wall, Wellfield, Processing, Water Management, Waste Management, Access and Transportation, Power, Support Facilities, Project Area, Project Activities, Ancillary Projects, GHG Emissions, Project Schedule, Project Benefits, Project Design Features, Management System, and Project Alternatives. See Section 2 for information and technical detail pertaining to Project Components and Project alternatives. Engagement activities for the Project can and will evolve over time, as information is gathered that is pertinent to Denison's understanding of the Interested Parties and their relationship to, and interest in, the Project. At present, Denison has an Exploration Agreement with KML and continues to engage with KML and NVP with respect to the Wheeler River Project. See Section 4 for additional information on the consultation process.	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by YNLR on the draft EIS. Denison has responded to the YNLR on all draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	Interest in information regarding radiation scanning.	ROC 77	As stated in Section 2.9.1.3.2, A Radiation Protection Program would be designed and implemented so that Denison complies with, or exceeds, the level of radiation safety that is required by the relevant regulations pursuant to the Nuclear Safety and Control Act and Denison's Health and Safety Policy. Activities within the program would include implementing a radiation code of practice, measuring and monitoring radiation on an ongoing basis, and reporting radiation testing results to regulators. As summarized in the Worker Health assessment (Section 10.2.3.2.10) potential residual effects to worker health during Construction and Operation are expected to be negligible given that the predicted radiation doses are less than the annual allowable effective dose of 20 mSv/yr, and	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by YNLR on the draft EIS. Denison has responded to the YNLR on all draft EIS public comments,	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				radon is predicted to be within the range that is manageable under an RPP.		by providing background information, clarification on assumptions and approach taken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Other	Interest in sharing IK and history and integration of this information in the EIS, including Traditional Land Use information.	ROC 78 ROC 83	Section 3 provides information on IK and LK and how this information was integrated throughout the EIS. Indigenous Knowledge has been integrated throughout the EIS and a section on the Influence of Indigenous Knowledge, Local Knowledge, and Engagement is provided in the methodology for sections. For example see Section 11.1.2 and Section 11.2.2 for further details on how Indigenous Knowledge, Local Knowledge, and Engagement influences Land and Resource Use.	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by YNLR on the draft EIS. Denison has responded to the YNLR on all draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for	Historically, there has always been interaction between northern Saskatchewan and western Saskatchewan communities.	ROC 78 ROC 83	Thank you, noted.	N/A	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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	traditional purposes					comments made by YNLR on the draft EIS. Denison has responded to the YNLR on all draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions	Interest in procurement and employment and training.	ROC 570	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in the Economics section of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project.	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in the Economics section of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by YNLR on the draft EIS. Denison has responded to the YNLR on all draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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					of Saskatchewan) throughout all phases of the Project.			
Ya'thi Néné Lands and Resources Office	Other	A question was asked if Denison was aware of the Collaboration Agreement with Orano and Cameco, and whether the Project would be a part of that.	ROC 570	Denison will negotiate with the Province of Saskatchewan to develop the Project's Surface Lease Agreement and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.	Denison will negotiate with the Province of Saskatchewan to develop the Project's Surface Lease Agreement and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.	Based on Denison's understanding of the comment, the comment made has a relationship to similar-type public comments made by YNLR on the draft EIS. Denison has responded to the YNLR on all draft EIS public comments, by providing background information, clarification on assumptions and approach taken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR sees a potential benefit of the in-situ approach as it is designed to reduce the surface disturbance of the Project, and the potential leakage of contaminants from excavated rock and tailings. However: • YNLR is concerned that the extraction of source water for the Project may have a negative effect on stream flows both below- and aboveground. • YNLR is concerned with the potential effects of contaminants released during and after the Project. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #375)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison acknowledges these concerns and notes the comment from YNLR references the Executive Summary. Both of the areas of interest raised by the comment are addressed in the main part of the draft EIS and supporting appendices. Denison refers YNLR to the following sections for comprehensive evaluation of these aspects of the Project: • Potential changes in surface water quantity as the result of the Project, including consideration of water taking activities, are presented in the hydrology assessment (draft EIS, Section 8.1). • Potential changes to groundwater quantity and quality as the result of the Project, including consideration of the long-term implications of the mining method, are presented in the groundwater assessment (draft EIS, Section 7). Specifically, the 'future centuries' temporal scope of the assessment for Groundwater considers the period for which the highest COPC concentrations in groundwater are predicted to interact with surface water based on groundwater modeling described in Appendix 7-C. Due to the relatively long travel time (relatively low groundwater velocities) between the mining area (Section 7.6.2.2.3) and the surface water environment where groundwater/surface water interactions are	Follow-up and monitoring programs will be employed to confirm mitigation measures are functioning as planned and to confirm EA predictions. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				expected, as well as the potential for chemical reactions along the groundwater flow pathway, a 'future centuries' scenario was deemed appropriate to fully assess potential future effects beyond the Project timeline (i.e., 0 to 38 years). The 'future centuries' temporal scope was also developed in recognition of the concerns raised by Interested Parties through the engagement process around the potential for the Project to influence water quality into the future. These assessments, completed in a transparent and rigorous manner, concluded that residual effects of the Project would not be significant. Follow-up and monitoring programs will be employed to confirm mitigation measures are functioning as planned and to confirm EA predictions. For example. a groundwater monitoring plan, including an excursion contingency plan and measures for adaptive management will be implemented for the Project. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 375. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions	**YNLR Comment March 4, 2023** Based on the information from p. 2 of the Project Overview: YNLR assumes no permanent work camp will be constructed YNLR expects that a sizeable proportion of the Project workers will be hired from the local and regional area. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #376)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). With respect to employment, as noted in Section 13.3.2.1 of the EIS, Residents of Saskatchewan's North (i.e., those resident in the northern administration district of Saskatchewan, inclusive of YNLR) are prioritized for employment as an expected condition of the Surface Lease Agreement, similarly for goods and services to service the Project. With respect to procurement, Denison has established an internal procurement policy approach. The approach requires that Denison consider businesses within the local study area first and the Northern Administrative District second, prior to looking elsewhere (southern Saskatchewan and/or outside of Saskatchewan) throughout all phases of the Project. YNLR businesses would fall in the category of northern Saskatchewan businesses, which	Denison's Indigenous Peoples Policy sets out priority for Indigenous employment and procurement (among other items). Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		would place them in line for second preference if project needs cannot be met within the local study area. Details on the Project components are provided in EIS Section 2. The Project will be operated as a fly-in/fly-out mine, meaning the opportunities for interactions between the workforce and Indigenous communities are limited as workers will be transported by air directly to the site. The proposed camp or accommodations facility is anticipated to be a turnkey building manufactured off site and assembled and commissioned on site. The building's design will be sized to accommodate a peak load of about 190 individuals during Operation; however, due to its modularized design, additional modules can be easily installed should additional beds be required in the future. Section 13 provides the assessment for the key indicator of employment and training, which is a component of the Economy Valued Component. A summary of residual environmental effects on employment and training is found in Table 13.5-2. Employment opportunities represent direct and indirect benefits associated with construction and operation of projects, particularly in the vicinity of communities where unemployment is typically high. Additionally, because the property is located on Crown Land, a mineral surface lease agreement will be negotiated with the Province, specifically the Ministries of Environment and Government Relations. The agreement grants surface rights for the purpose of accessing the land to extract minerals under the Crown Resources Land Regulations. The mineral surface lease agreement provides long term rental of Crown land for mining and milling in Saskatchewan. The agreement also contain specific commitments for environmental protections for the life of the project, OH&S protocols, reporting requirements, and socio-economic benefits for residents of northern Saskatchewan. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 376. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further		YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		

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				comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** YNLR is concerned with the potential increase in road and off- road traffic affecting wildlife and fisheries sustainability. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #377)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Please note that the Project will not change public access to the area. The existing gate on Highway 914 near Cameco's Key Lake Operation will remain in place and no changes to the gate and the process for controlling access to Highway 914 north of the Key Lake Operation are proposed as part of the Wheeler River Project. The proposed operation is fly-in, so Project related traffic to the area would only be related to deliveries of materials to and from the site. On-site staff will not have access to personal (or company) vehicles and will largely be "confined" to the camp and work areas during their shifts. Refer to draft EIS, Section 12 Quality of Life for the assessment of potential Project effects on the Key Indicator of Infrastructure and services (traffic) and the associated measurable parameter of change in traffic volumes and types and risk of accident. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 377. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** YNLR supports this built-in precautionary approach to the Project's risk assessment. However, given the lengthy timeline of the Project, YNLR would like to see that lost (i.e., unmitigated) wildlife and fisheries habitat be offset in some manner. A response to this should be approached through an anticipated impact benefit agreement. YNLR is interested in creating more formal processes to achieve this, such as the signing of an impact benefit agreement. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #378)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Through the EA process to date, Denison believes it has identified areas where offset may be required based on Project-Environment interactions. To this end, Denison has made a specific commitment to develop a Caribou Mitigation Plan (submitted in response to provincial and federal EIS review comments) that includes provision for potential habitat offset. Details of the habitat offset will be developed in collaboration with Saskatchewan Ministry of Environment. It is also important to consider the site decommissioning plan within this context, though such restoration activities are not typically discussed as	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		YNLR Comment June 19, 2024 (Response to Denison Comment April 05, 2024) YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		"offsets". Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. No other specific needs for "offset" have been identified based on the effects assessment. Denison will continue to engage with YNLR on topics of interest. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 378. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** The EIS Executive Summary outlines mitigation measures, monitoring requirements, and commitments needed for Denison to have confidence that Project is operating as planned and that the actual effects resulting from Project Construction, Operation, and Decommissioning are at or below predicted effects. Despite these reassuring statements, YNLR is aware that predictions may fall short, hence the need for close collaboration with Indigenous Peoples, communities, and organizations, including their input into the design and implementation of transparent and statistically-robust project monitoring programs. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)**	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #379)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison acknowledges the comment and is committed to ongoing engagement and dialogue with interested parties with respect to monitoring. Details of follow-up and monitoring plans will be prepared in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies. YNLR will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and programs will have spatial	Details of follow-up and monitoring plans will be prepared in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies. Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		Denison states that they will inform YNLR of the development of their monitoring plan. This does not meet the YNLR request for input and collaboration into the design of monitoring programs. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.		boundaries that are sufficiently extensive to measure EIS predictions. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a	Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		

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				starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.				
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Physical and cultural heritage; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** YNLR remains concerned about the nature and disposition of project contaminants during and after the mining process. • YNLR supports the Project outcome of lower aboveground disturbance, it retains concerns about the management inputs and outputs of the ISR method, particularly project water sources, quantity, and release along with its associated contaminants. • The release of contaminants before and after the Project's completion worries YNLR, which sets a high priority on clean and abundant groundwater and surface water. The Indigenous People, communities, and organizations YNLR represents will be here long after mine decommissioning, so minimizing this risk with statements regarding the length of time it takes is not helpful. • As with groundwater, YNLR places a high value on the quantity and quality of surface waters. Monitoring of water will be critical, and YNLR expects to be consulted and heavily involved with respect to this activity. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No timeline for consultation has been offered. The response simply restates Denison's original comments in the EIS. Denison promises dialogue. YNLR wants to see the predecommisioning monitoring plan for contaminant releases so that mitigation can be applied long before decommissioning. YNLR wants to be involved with all monitoring plans and programs from conception to implementation. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development. YNLR has provided its responses on caribou offsets and other aspects of caribou restoration and mitigation planning in the responses contained in	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #380)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison acknowledges the comment and concerns raised by YNLR. Denison believes the assessment of potential effects, such as those highlighted in the review comment, have been considered in a robust manner in the EIS and appropriate mitigations have been proposed. Denison is committed to ongoing engagement and dialogue with interested parties on key Project aspects such as that referenced in the review comment. With specific reference to site decommissioning the following is noted. Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. YNLR has shared comments with respect to Woodland Caribou offsets, including those related to the definition of offsets, timing, and mitigation measures as part of present-day mitigation measures for the Project, and should be applied in advance of decommissioning. YNLR has also requested to see the predecommissioning monitoring plan for containment releases. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided a document titled Summary	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework, which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		their letters of 02 February 2024 and 13 March 2024. The concerns expressed in those responses remain valid and unaddressed. YNLR did request from Denison, in their meeting of 22 Feb 2024, specific information as to where their caribou offsets are located and what was the information and methodology used to determine these offsets, however, Denison declined to provide this information. Additionally, YNLR is also on record with CNSC and Denison (see attached letters at appendix 3) that there is a divergence of opinion of the results of the YNLR and Denison Cumulative Effects analysis. Given that the results of the CE analysis is the basis for how much land, suitable for caribou, is required for offsetting: YNLR's interest in the details of Denison's caribou offset plan is a valid concern (see Appendix 3 for a review of YNLR's GIS based Method for Assessing Cumulative Environmental Effects). Respecting preliminary decommissioning plans: decommissioning plans are based on the extent to which restoration and offsetting are carried out prior to decommissioning, therefore while their receipt from Denison is appreciated any conclusions that can be determined from this plan is incomplete without the former requested information on offset plans. Therefore, YNLR concerns stated in their comments remain valid and unaddressed.		of Monitoring, which outlines the Project's commitments for monitoring programs for all phases of the Project from preconstruction to post decommissioning. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework, which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances. Denison is committed to the development of a caribou mitigation and				

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				offsetting plan for the Project. This plan will be developed ahead of construction and independent of the development of the Project's detailed decommissioning plan. Denison provided the YNLR with a draft Caribou Management Framework which outlines mitigation and restorative measures within the Provincial Government framework. Denison continues to remain open to feedback from the YNLR on the draft Caribou Management Framework. Further, Denison's previous offer to involve the YNLR in discussions with respect to the development of the decommissioning plans still stands. Decommissioning plans at this stage are conceptual as outlined in the EIS and will continue to be refined through each phase of the Project as it progresses.				
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes; Other	**YNLR Comment March 4, 2023** Containment of the mining solution and uranium bearing solution within the mining area will be achieved through a defence-in-depth approach with three levels of containment. • YNLR assumes that information and data exist with respect to the environmental safety of freeze wall technology in uranium mining operations within Saskatchewan. Has Denison reviewed these data and are they considered/presented as part of this EIS? If not, why not? • What happens to the freeze wall and its retained contaminants at the end of the Project's life? – despite safeguards and remediation, it has potential to release contaminants after mining is completed. • Monitoring and adaptive management are important components of sustainable uranium mining. YNLR expects to be consulted/included in the design and implementation of the Project's environmental monitoring programs. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** This statement is misleading because ground freezing to contain contaminants in a uranium mining extraction project has never been done in Canada before. Independent assessment comments are needed here. It is unclear that groundwater contaminates monitoring outside of the freeze wall is unnecessary to monitor this risk of leakage and confirm the conclusions of the predictive modeling. It is good that Denison later alludes that monitoring is necessary; however, prior comments as to the extent of YNLR involvement in planning and execution of monitoring is reiterated. It is noted that Denison has committed to ground water monitoring; however, prior comments as to the extent of YNLR involvement in planning and execution of monitoring is reiterated. TK will have no input into ground water contamination until health risks are noted decades or centuries later. Therefore, the relevance of this statement from Denison saying that TK will inform the ground water monitoring plan is questionable. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #381)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison notes this comment is on the Executive Summary and that more detailed information is available in the main part of the draft EIS e.g., Section 2 Project Description and Section 7 Geology and Groundwater (and associated appendices). Ground freezing technology is well established and used widely throughout the world. Its use in a mining environment was pioneered in Saskatchewan's potash mining industry for shaft sinking activities, and later adapted for use in Saskatchewan's uranium industry. Ground freezing to control and eliminate groundwater from entering mining areas is a fundamental component of two existing Athabasca Basin underground uranium mines: Cameco Corporation's McArthur River Operation and Cigar Lake Operation. Freeze walls, when fully developed, are capable of withstanding significant external pressures because the ice in the pore voids greatly improves the bulk strength of the soil. For example, in the province of Saskatchewan, ground freezing is used to support the sinking of deep potash mine shafts, which must penetrate through the Mannville formation at a depth between 400 and 500 m below surface. The Mannville formation is often described as saturated, unconsolidated beach sand and it would not support shaft excavation in a thawed state. Freezing is used to create a structural and impermeable wall up to 5 m thick, which can resist a stress gradient driven by full hydrostatic and/or lithostatic pressures on the outside of the wall, and an open to atmosphere excavation within the shaft. This loading condition is much more extreme than any condition the freeze walls at the Phoenix deposit will experience because the interior side of the freeze wall where active ISR mining is occurring is not open to atmosphere and is fluid filled in the same way that the regional groundwater system is on the exterior side of the freeze wall, creating a balanced pressure system, where loading is equal on both the interior and exterior sides.. While freeze walls are very strong when fully developed, they are also plastic in nature. This means that they can slowly deform without failing in response to localized ground deformations. As the freeze wall deforms towards a lower stress zone, it maintains its thickness and integrity. While the above example referred to potash shafts, other examples can be drawn from the experience at the McArthur River or Cigar Lake uranium mines. At McArthur River, open stopes are generated directly adjacent to a freeze	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances. Denison respects the YNLR's desire to seek other expertise. In any event, should the YNLR wish to meet with the qualified professional utilized to design the freeze wall, Denison would be happy to facilitate.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development. YNLR appreciates the offer of Denison's Technical expert to brief YNLR on their concerns with freeze-wall technology. Unfortunately, Denison's freeze-wall technical expert is no more independent that Denison's Cumulative Effects technical expert, that YNLR staff spoke to on 22 Feb 2024. Hence, YNLR's concerns as stated in their response remains. Going forward on this item, YNLR will engage with CNSC for access to an independent technical expert on freeze-wall technology. Denison's above statement is a reassertion of their comment addressed by YNLR in their letters of 02 February 2024 and 13 March 2024. Therefore, YNLR's concerns as to their involvement in monitoring, remain valid and unaddressed.		wall that is a nominal 4 m thick. At Cigar Lake, open mine cavities 10 m high and several metres in diameter commonly exist within the frozen ground. Neither site has had a breach of the freeze wall during mining activity. Given that the freeze wall at Denison will be much thicker than at McArthur River and that it will be located up to 25 m from the ore zone, it is not anticipated that it will be exposed to a stress environment that will put it at risk. Since the mine design includes the freeze wall as a tertiary management strategy, movement of mining solution is restricted and contained horizontally during operations. Wellfield pumping is the primary form of containment and provides the hydraulic containment to keep mining solution within the 50 m mining area (see Section 2.2.1.4.2). During the operation phase, and under normal operational conditions there is no interaction between the mining zone and surface water or down gradient groundwater environments, and the groundwater assessment (Section 7) focuses on the post-decommissioning period following removal of the freeze wall, once the groundwater flow paths return to pre-mining conditions. During mining area remediation (see Section 2.3.3.1.1), the freeze wall will remain in place until decommissioning objectives are achieved. Refinement of the mining area decommissioning objectives and associated modelling will be done through updates to the Decommissioning Plan, and will be bounded by the objectives evaluated in the EIS. To carefully evaluate how constituents dissolved in the remediated groundwater within the mining area may migrate away from and interact with the environment, a rigorous numerical model of groundwater flow and chemical constituent behaviour along the groundwater flow path was used as a predictive tool. The model is based on proven scientific principles and processes (e.g., groundwater flow, contaminant transport, and geochemical reaction processes) and allowed future conditions to be evaluated. Migration of dissolved constituent concentrations along the groundwater flow path from the mining area to Whitefish Lake (the local surface water receptor) is predicted to take hundreds to thousands of years, with concentrations remaining below values that would result in an environmental risk. Given the nature of the ISR mining method that will be employed by the Project groundwater monitoring is an important consideration. The groundwater monitoring plan would be developed in consideration of how Project facilities and activities could interact with the groundwater environment and groundwater users to define monitoring needs (locations, frequencies and constituents). Data generated from the groundwater monitoring plan would serve various purposes, such as to assess performance and the controls associated with the ISR process, demonstrate compliance with internal action levels, assess performance of emissions control systems, and contribute to the understanding of the potential influence of the Project on the groundwater environment. The groundwater monitoring program would demonstrate, during each Project phase, that: • excursions are not occurring; if excursions do occur, an early warning/timely signal will be provided of when and where they are occurring such that appropriate further evaluation and actions can be undertaken;				

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				• commitments made in the EA are being achieved; and • protection of groundwater end use/receiving environment is being achieved. The groundwater monitoring plan would be informed by existing local and traditional knowledge, ongoing engagement activities with interested parties, information generated by development of EIS and its supporting documents, relevant guidance, such as CSA Standard N288.7-15, Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mine and Mills as well as any applicable licenses, approvals, and permits. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison would be pleased to coordinate a meeting between YNLR and the technical expert Denison utilized, Greg Newman from Newman's Geotechnique, to design the freeze wall and confirm its effectiveness for the geological and hydrogeological conditions for an ISR mine at Wheeler River. A meeting could be the most effective means for YNLR to seek information about the areas of concern with respect to the freezing technology. Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted that detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. Denison would like to clarify that the current rigorous groundwater modelling does not indicate there will be groundwater contamination nor health risks from the Project. The groundwater monitoring program will be robust and meet all regulatory standards for the type of mining proposed for the Project. Further, Denison would like to note that consideration of local and Traditional Knowledge in all facets of the Wheeler River Project will be guided by local and Traditional Knowledge Holders to the extent they wish to share information. As an example, Traditional Knowledge may or may not be relevant to groundwater monitoring results, but may have relevance to the considerations in the planning for such monitoring. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that,				

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				"YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances. Denison respects the YNLR's desire to seek other expertise. In any event, should the YNLR wish to meet with the qualified professional utilized to design the freeze wall, Denison would be happy to facilitate. Denison has offered to involve the YNLR in groundwater monitoring plans and notes that the timeline and detail for the development of these plans extends beyond the environmental assessment process. Denison remains open to the YNLR's involvement in groundwater monitoring plans now and in the future. Further, Denison reiterates that it will continue to consider local and Traditional Knowledge in all facets of the Project to the extent holders of such knowledge wish to share information with us.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Will the released radon gas be of any concern to natural resources, such as fish and wildlife? **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)**	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19,	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Inhalation pathway to terrestrial wildlife and birds was included in the Ecological Risk Assessment (EcoRA). Please refer to the draft EIS Appendix 10-A Section 5 and an excerpt is provided below for reference: Exposure pathways consider the various routes by which radionuclides	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	2024) (Public Comment #382)	and/or chemicals may enter the body of the receptor, or for radionuclides, may exert effects from outside the body. Exposures to environmental media may be direct (i.e., by contact) or indirect (i.e., via constituent transport through the food chain). For each type of ecological receptor, draft EIS Appendix 10-A Table 5-5 summarizes the relevant exposure pathways to various environmental media including air, surface water, soil, and sediment. Airborne COPCs partition to soil and plants. For most COPCs, ingestion pathways dominate over inhalation and air immersion. The latter pathways are considered minor pathways in the EcoRA, but inhalation was included in the IMPACT model and is thus included in draft EIS Appendix 10-A Table 5-5. Exposure to constituents that may deposit from air to surface water was not considered, as that pathway is considered negligible according to CSA N288.1-20. As such, a pathway of radon in air to aquatic receptors such as fish was not evaluated. Radiological dose to aquatic receptors is evaluated through water and sediment exposure, as appropriate based on the receptor's characteristics. For fish, aquatic plants, and aquatic invertebrates, contact with water and constituent uptake from water via bioaccumulation represents the main exposure pathway. Direct contact or uptake from sediment are also considered for benthic invertebrates and bottom-feeding fish. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 382. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes; Other	**YNLR Comment March 4, 2023** While Project water reuse is laudable, its overall conservation and management are significant concerns for YNLR, particularly the quantities removed from the ecosystem and the fate of contaminated water released back into the ecosystem from the Project that end up in Wollaston Lake. YNLR expects to be consulted/included in the design and implementation of the Project's environmental monitoring programs.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** The specific activity of water withdrawal from Whitefish Lake was assessed in the draft EIS, Section 8.1. The conservative estimate of water withdrawal would result in a reduction of flow of about 3% at times of low flow and the lake level could change by 1cm; this minor change is beyond the ability of monitoring techniques to practically measure, and the assessment concluded that the Project would not result in a significant	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		YNLR remains concerned with the potential effects of Project contamination on culturally important natural resources. These concerns stem from the nature of the materials being mined, and the novel method (ISR) by which they are being extracted. Northern residents and Indigenous Peoples will be living here long after the mine is exhausted, thus effective monitoring is critical, as is the inclusion of impacted Aboriginal and Treaty rights holders in the design and implementation of arm's length, transparent, and statistically-robust monitoring programs. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** The monitoring plans are not yet drafted and therefore this is an unacceptable. response. The request is reiterated for Denison to support a collaborative approach at the concept and methodology development stage. "Monitoring plans when drafted" makes this an unacceptable response to the YNLR concern, this does not go beyond the statement in the EIS and therefore the further response here continues to be unacceptable; prior comments as to the extent of YNLR involvement in planning and execution of monitoring is reiterated. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.	Comment #383)	effect on surface water quantity (hydrology). It is noted that there will be a separate permitting process that will consider water withdrawal for Project support that will occur following the EIS. Monitoring, including of water withdrawal rates and of potential effects (e.g., change in water flow, change in lake levels) will be implemented as the Project moves forward. Denison is committed to sharing information with Indigenous Communities of Interest (COIs) in a mutually agreed-upon fashion. Overall, the approach that will be utilized with respect to Indigenous community engagement will be aligned with Denison's Indigenous Peoples Policy. Denison's Indigenous Peoples Policy commits the company to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land. The relevant monitoring plans for the species/resources that support a traditional diet will reflect and incorporate these values and will be reflective of the Indigenous COIs priorities. The monitoring plans when drafted will include more detail about communication methods and their effectiveness would be assessed through ongoing engagement with Indigenous communities. As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects, wherever possible. Through continued and focussed engagement with the YNLR since the YNLR identified its interest in the Project in 2019, Denison has come to better understand the Athabasca Denesyłiné communities' relationship to the Project site and current use of the areas for traditional purposes. Denison acknowledges that the Hatchet Lake Denesyłiné First Nation has the potential for established Indigenous and Treaty Rights proximal to the Project. The Hatchet Lake Denesyłiné First Nation, as represented by the YNLR will be identified as an Indigenous COI in the revised draft EIS. Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. YNRL will be informed throughout the monitoring program design and implementation process. A list of commitments, including specific commitment or mitigation measures related to Project effects as an outcome of engagement, made in the draft EIS, throughout the Federal information request period and the Provincial comment response period, will be included with the submission of the final EIS. For clarity, this would not include any private, confidential accommodations made under contractual agreements. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate	Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		

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				interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.				

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Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions; Physical and cultural heritage; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** YNLR supports Denison's corporate Indigenous Peoples Policy (IPP) and looks forward to collaborating with Denison to ensure that the Project's socioeconomic benefits reach local Indigenous People. YNLR acknowledges that Denison incorporated the YNLR report into the EIS and looks forward to further working with the company collaboratively regarding the rights of Indigenous People. YNLR is interested in an impact benefit agreement with Denison ensuring mutual benefits from the Project and co-management of environmental monitoring and mitigation. The EIS minimizes effects of Lands and Waters availability and access on northern residents and Indigenous Peoples. Any impairment to the ability of Indigenous Peoples to utilize their Aboriginal and Treaty rights to the use of natural resources for their traditional activities constitutes an infringement of those constitutionally protected rights and must be justified. Rigorous examination of these impacts and negotiated compensation for these impacts should therefore be seriously considered. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** "YNRL will be informed throughout the monitoring program design and implementation process." Once again this is an unacceptable delay and does not go beyond the original statements in the EIS. Prior comments made, as to the extent of YNLR collaborative involvement, in planning and execution of monitoring is reiterated. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #384)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** As outlined in Denison's Indigenous Peoples Policy, Denison is committed to respecting Indigenous knowledge and values regarding environmental stewardship and Indigenous peoples' connection to the land, and to minimize potential effects, wherever possible. Through continued and focussed engagement with the YNLR since the YNLR identified its interest in the Project in 2019, Denison has come to better understand the Athabasca Denesyłiné communities' relationship to the Project site and current use of the areas for traditional purposes. Denison acknowledges that the Hatchet Lake Denesyłiné First Nation has the potential for established Indigenous and Treaty Rights proximal to the Project. The Hatchet Lake Denesyłiné First Nation, as represented by the YNLR will be identified as an Indigenous COI in the revised draft EIS. Denison continues to work with its Indigenous Communities of Interest with reserves and residential communities most proximal to the Project. Denison is committed to continual improvement in relation to such collaborative monitoring programs, in order to adapt to areas of interest which can change over time. YNRL will be informed throughout the monitoring program design and implementation process. A list of commitments, including specific commitment or mitigation measures related to Project effects as an outcome of engagement, made in the draft EIS, throughout the Federal information request period and the Provincial comment response period, will be included with the submission of the final EIS. For clarity, this would not include any private, confidential accommodations made under contractual agreements. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that,	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				"YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.				
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** YNLR concerns: • Indigenous People, communities, and organizations YNLR represents are rights holders, and are not to be arbitrarily grouped and treated as non-rights holders. This is an important distinction, as the rights they hold are constitutionally protected. This must be respected and recognized in the ongoing dialogue between the company and Indigenous Peoples through their chosen representatives, like YNLR. • The Athabasca Denesųłiné people are rights holders and not stakeholders with respect to the Project. These rights include full access and use of the natural resources of the area. Any proposed infringement on these rights by the Project will need to be discussed well ahead of the Project's start date. The EIS minimizes effects of Lands and Waters availability and access on northern residents and Indigenous Peoples. Any impairment to the ability of Indigenous Peoples to utilize their Aboriginal and Treaty rights to the use of natural resources for their traditional activities constitutes an infringement of those constitutionally	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #385)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison acknowledges the comment. In March 2019, Denison was notified by the YNLR that the Indigenous communities within the local Athabasca communities identified were interested in the Project and that YNLR held the Duty to Consult from these communities. Since receiving correspondence from the YNLR office in 2019 Denison has been collaboratively working with the YNLR office in a mutually agreed upon manner and will continue to do so. Denison's approach to identifying Indigenous COIs considered several factors as identified in Section 4.3.1 of the EIS. Being signatories of Treaty 10 was among, but not the sole applicable criteria, and not all Treaty 10 communities are considered as Indigenous COIs for the Project. Through continued and focused engagement with the YNLR since the YNLR identified its interest in the Project in 2019, Denison has come to better understand the Athabasca Denesųłiné communities' relationship to the Project site and current use of the areas for traditional purposes. Denison acknowledges that the Hatchet Lake Denesųłiné First Nation has the potential for established Indigenous and Treaty Rights proximal to the	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		protected rights and must be justified. Rigorous examination of these impacts and negotiated compensation for these impacts should therefore be seriously considered. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		Project. The Hatchet Lake Denesyłiné First Nation, as represented by the YNLR will be identified as an Indigenous COI in the revised draft EIS. With respect to Denison's consideration of Indigenous Knowledge shared by the Athabasca Denesyłiné knowledge sources, Denison notes that Tables 3.5-1 will be updated to better reflect where the YNLR's An Exploration of Recorded Athabasca Denesyłiné Traditional Knowledge, Land Use and Occupancy Information in the Vicinity of the Denison Mines Wheeler River Project, which was included as an Appendix to the EIS, was considered and included as Table 3.5-1 does not reflect all instances the report was utilized. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 385. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR respondedindicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** Fish, fish habitat, and fish health are all extremely important to northern people of Saskatchewan, and especially Indigenous People. Wild fish are a culturally important source of protein and provide economic opportunities in the form of commercial fishing and recreational angling. • YNLR will be eager to and expects to be involved in collaborating with Denison in the future monitoring of these vital natural resources. • Based on existing federal fishers legal and policy requirements, YNLR expects that all fish habitat destroyed or altered by the Project will be more than offset. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** There is no monitoring plan developed yet to substantiate Denison's determination here. YNLR continues to state its desire for collaboration in the development of monitoring analysis and assessment plans. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)**	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #386)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison has committed to collaborating with Indigenous Communities of Interest with reserves and residential communities most proximal to the Project on specifics of environmental monitoring regimes, suited to each of their interests and needs. As part of these programs, Denison and the Communities of Interest will be sharing information in an agreed-upon fashion. Denison expects that important country foods harvested for food and cultural purposes (e.g., moose, fish, etc.), surface water quality, and other areas of interest will form parts of these monitoring programs, including other areas of potential concern as they evolve over time. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. The specific potential for need for approval(s) under the Fisheries Act related to effects on fish and fish habitat (i.e., harmful alteration, disruption and destruction) resulting from Project activities has been assessed and presented in the draft EIS. Based on the assessment, Denison has determined that effects can be avoided and mitigated and	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.		therefore there will be no need for fish habitat offsets under the Fisheries Act. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the		YNLR to come to resolution.		

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				YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.				
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** YNLR places a high priority on wildlife and wildlife habitat, from both ecological and sociocultural perspectives. Given the long-time frame of the Project, YNLR are concerned about the lack of significance associated with the residual and cumulative effects assessments of all ecological VCs. YNLR believes that the addition of this mine with its associated disturbances will have a cumulative effect on wildlife, especially for woodland caribou, as the area is already crisscrossed with many kilometres of seismic cut lines through the LSA, RSA and beyond (Figure 9.2-6, page 9-83, EIS and Appendix 9B). YNLR maintains that in order for the Project to meaningfully attempt to mitigate this concern, the company must work with Indigenous partners to create an effective habitat offset plan for this species. This should form part of any project approval. Such a plan should, for instance, include steps to restore the considerable caribou habitat degraded by past mineral exploration activities. Additional YNLR concerns on this matter include: - YNLR is concerned about the potential residual and cumulative effects of the extensive seismic network on the soils of the RSA and LSA. Were these and other potential network effects considered in the analyses? - Appendix 9B of the EIS states that 100% of the LSA and 82% of the RSA are already disturbed by buffered anthropogenic disturbances in the form of exploration lines, exploration trails, and seasonal roads. During the consultation process, residents raised the issue of the high degree of human disturbance and highlighted concerns about the broad network of linear disruptions in numerous places across the EIS. As with the Project soils, YNLR is concerned about the potential residual and cumulative effects of the extensive seismic network on the vegetation and wetlands of the RSA and LSA, particularly from edge effects. Were these and other possible effects of the network considered? If so, how were they included? - Wilson et al. (2018) recently summarized the home ranges of 25 woodland caribou populations in Canada. The average home range varied 28-fold, from 312 to 8,838 sq. km. The RSA delineated for assessing cumulative effects on caribou (40,174 ha ~ 402 sq.km.) is thus inadequate for this purpose, and the conclusions of project residual and cumulative effects non-significance are highly suspect. The same could be said for other wide-ranging species such as wolverine. - Was the current RSA anthropogenic disturbance estimate (599 ha) inclusive of the many kilometres of existing seismic cut lines? Did the estimate include consideration of the compounding 'edge effects' from these linear disturbances? If not, why not? See previous comments on the very high level of existing human disturbance in the LSA and RSA	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #387, #401 to #411)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Through the EA process to date, Denison believes it has identified areas where offset may be required based on Project-Environment interactions. To this end, Denison has made a specific commitment to develop a Caribou Mitigation Plan (a preliminary draft of which has been submitted in response to provincial and federal EIS review comments) that includes provision for potential habitat offset. Details of the habitat offset will be developed in collaboration with Saskatchewan Ministry of Environment. It is also important to consider the site decommissioning plan within this context, though such restoration activities are not typically discussed as "offsets". Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. Denison will continue to engage with YNLR on topics of interest. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Public comment #387: Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. YNLR has shared comments with respect to Woodland Caribou offsets, including those related to the definition of offsets, timing, and mitigation measures as part of present-day mitigation measures for the Project, and	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework, which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		highlighted in Appendix 9B. - Again, the direct and indirect effects of the existing seismic disturbance seem not to have been considered in this assessment, particularly because wolverines 'avoid linear infrastructure.' In fact, one can also see that woodland caribou avoid areas of historic seismic disturbance by directly comparing the figures on page 9-139, EIS (vegetation) and 9-202, EIS (caribou sightings). Appendix 9B gives a summary of the impacts of linear disturbances on boreal forest wildlife. - Buffered disturbance is included in Appendix 9B but appears to have been ignored in the effects assessment. Was the 500m buffering of anthropogenic disturbances also applied to the network of seismic cut lines to account for edge effects? If not, why not? - Is the amount of initial 'available woodland caribou habitat' inclusive of the direct and indirect seismic cutline network effects? If not, why not? Irrespective of this, it appears that the LSA is being written off for woodland caribou for decades to come. See above comments with respect to Appendix 9B. - The EIS correctly highlights the cultural importance of moose and woodland caribou to Indigenous People, which underscores YNLR's concerns regarding the conclusions of the residual and cumulative effects assessments of these species, particularly for caribou. YNLR questions the optimistic conclusions drawn by Denison regarding the ongoing availability of woodland caribou for traditional use. - Past and future direct and indirect effects of seismic line clearing appear to have been ignored in this assessment (Appendix 9B). The fact that most caribou sightings occurred away from seismically disturbed areas independent of habitat type supports this observation. YNLR disagrees with this overall residual effects conclusion for these wildlife VCs, especially in regard to woodland caribou (Appendix 9B) - YNLR strongly believes that, at a minimum, an aggressive Caribou Habitat Offset Plan should be co-developed before Project work begins, and regular monitoring of the caribou population be conducted throughout the life of the Project. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** Public comment #387: The consideration of offsets in the decommissioning plan is not appropriate as a substitute for considerations of offsets in a present-day mitigation plan. Offsets are a method to address current habitat damage from the impacts of development while mitigation is underway. Offsets augment habitat requirements now and into the future. Consideration of offsets in a decommissioning plan is primarily for the damage that could not be mitigated in a preceding mitigation and management plan. YNLR reiterates its stated desire to collaborate, now, with Denison in the development of all plans for monitoring and mitigation. Notification to YNLR by Denison for plans and processes after their development is complete is not acceptable. Restoration of the area to pre disturbance conditions could be considered as an 'offset'. As long the DDP is done well in advance, it doesn't matter. However, the discussion for offsets should really be considered during the		should be applied in advance of decommissioning. YNLR has also requested to see the predecommissioning monitoring plan for containment releases. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided a document titled Summary of Monitoring, which outlines the Project's commitments for monitoring programs for all phases of the Project from preconstruction to post decommissioning. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework, which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. Public comment #401 to 411: No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** Public comment #387: YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a				

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		life of the mine, not afterwards. No further response provided by YNLR for public comment #401 to #411 **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** Public comment #387: While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development. YNLR has provided its responses on caribou offsets and other aspects of caribou restoration and mitigation planning in the responses contained in their letters of 02 February 2024 and 13 March 2024. The concerns expressed in those responses remain valid and unaddressed. YNLR did request from Denison, in their meeting of 22 Feb 2024, specific information as to where their caribou offsets are located and what was the information and methodology used to determine these offsets, however, Denison declined to provide this information. Additionally, YNLR is also on record with CNSC and Denison (see attached letters at appendix 3) that there is a divergence of opinion of the results of the YNLR and Denison Cumulative Effects analysis. Given that the results of the CE analysis is the basis for how much land, suitable for caribou, is required for offsetting: YNLR's interest in the details of Denison's caribou offset plan is a valid concern (see Appendix 3 for a review of YNLR's GIS based Method for Assessing Cumulative Environmental Effects). Respecting preliminary decommissioning plans: decommissioning plans are based on the extent to which restoration and offsetting are carried out prior to decommissioning, therefore while their receipt from Denison is appreciated any conclusions that can be determined from this plan is incomplete without the former requested information on offset plans. Therefore, YNLR concerns stated in their comments remain valid and unaddressed. Public comment #401 to #411: YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances. Denison is committed to the development of a caribou mitigation and offsetting plan for the Project. This plan will be developed ahead of construction and independent of the development of the Project's detailed decommissioning plan. Denison provided the YNLR with a draft Caribou Management Framework which outlines mitigation and restorative measures within the Provincial Government framework. Denison continues to remain open to feedback from the YNLR on the draft Caribou Management Framework. Further, Denison's previous offer to involve the YNLR in discussions with respect to the development of the decommissioning plans still stands. Decommissioning plans at this stage are conceptual as outlined in the EIS and will continue to be refined through each phase of the Project as it progresses. Public comment #401 to 411: There have been no further comments from the YNLR on EIS reference no. 401 to 411. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Indigenous People have brought forward concerns with the extensive network of seismic cut lines at several places in the EIS.	YNLR Public Comments (March 4, 2023, March	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Through the EA process to date, Denison believes it has identified areas where offset may be required based on Project-Environment interactions.	Denison is committed to working with YNLR to share information about monitoring plans as they are	Based on Denison's understanding of the concern or comment, Denison	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the

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		YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023) YNLR has not been privy to any caribou mitigation and offset discussions to date and would like to be as soon as possible. Consideration of offsets in a site decommissioning plan must be based on the results and analysis of an ongoing mitigation/offset plan that is in-place and functioning from the point of inception. Further to this, the ongoing results of the in-place mitigation/offset plan are obtained for analysis from an active and comprehensive monitoring plan that is also in place from the point of inception. Both of these issues reinforce the YNLR position that they need to be involved in the collaborative development and implementation of monitoring and other plans. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development. YNLR has provided its responses on caribou offsets and other aspects of caribou restoration and mitigation planning in the responses contained in their letters of 02 February 2024 and 13 March 2024. The concerns expressed in those responses remain valid and unaddressed. YNLR did request from Denison, in their meeting of 22 Feb 2024, specific information as to where their caribou offsets are located and what was the information and methodology used to determine these offsets, however, Denison declined to provide this information. Additionally, YNLR is also on record with CNSC and Denison (see attached letters at appendix 3) that there is a divergence of opinion of the results of the YNLR and Denison Cumulative Effects analysis. Given that the results of the CE analysis is the basis for how much land, suitable for caribou, is required for offsetting: YNLR's interest in the details of Denison's caribou offset plan is a valid concern (see Appendix 3 for a review of YNLR's GIS based Method for Assessing Cumulative Environmental Effects). Respecting preliminary decommissioning plans: decommissioning plans are based on the extent to which restoration and offsetting are carried out prior to decommissioning, therefore while their receipt from Denison is appreciated any conclusions that can be determined from this plan is incomplete without the former requested information on offset plans. Therefore, YNLR concerns stated in their comments remain valid and unaddressed.	13, 2024, and June 19, 2024) (Public Comment #388)	To this end, Denison has made a specific commitment to develop a Caribou Mitigation Plan (a preliminary draft of which has been submitted in response to provincial and federal EIS review comments) that includes provision for potential habitat offset. Details of the habitat offset will be developed in collaboration with Saskatchewan Ministry of Environment. It is also important to consider the site decommissioning plan within this context, though such restoration activities are not typically discussed as "offsets". Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. Denison will continue to engage with YNLR on topics of interest. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. YNLR has shared comments with respect to Woodland Caribou offsets, including those related to the definition of offsets, timing, and mitigation measures as part of present-day mitigation measures for the Project, and should be applied in advance of decommissioning. YNLR has also requested to see the predecommissioning monitoring plan for containment releases. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided a document titled Summary of Monitoring, which outlines the Project's commitments for monitoring programs for all phases of the Project from preconstruction to post decommissioning. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework,	developed through the permitting and licencing process. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework, which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		YNLR to come to resolution.

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				which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances. Denison is committed to the development of a caribou mitigation and offsetting plan for the Project. This plan will be developed ahead of construction and independent of the development of the Project's detailed decommissioning plan. Denison provided the YNLR with a draft Caribou Management Framework which outlines mitigation and restorative measures within the Provincial Government framework. Denison continues to remain open to feedback from the YNLR on the draft Caribou Management Framework. Further, Denison's previous offer to involve the YNLR in discussions with respect to the development of the decommissioning plans still stands.				

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				Decommissioning plans at this stage are conceptual as outlined in the EIS and will continue to be refined through each phase of the Project as it progresses.				
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** While the overall direct footprint of the Project is relatively small, YNLR maintains that any wildlife habitat destroyed or altered by the Project should be more than offset or compensated for in some fashion. One example would be the additional disturbance created by the proposed Highway 914 extension. This needs to be accounted for by Denison. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** See above stated comments on CE, WLC and offsets. **YNLR Comment June 19, 2024 (Response to Denison Comment April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development. YNLR has provided its responses on caribou offsets and other aspects of caribou restoration and mitigation planning in the responses contained in their letters of 02 February 2024 and 13 March 2024. The concerns expressed in those responses remain valid and unaddressed. YNLR did request from Denison, in their meeting of 22 Feb 2024, specific information as to where their caribou offsets are located and what was the information and methodology used to determine these offsets, however, Denison declined to provide this information. Additionally, YNLR is also on record with CNSC and Denison (see attached letters at appendix 3) that there is a divergence of opinion of the results of the YNLR and Denison Cumulative Effects analysis. Given that the results of the CE analysis is the basis for how much land, suitable for caribou, is required for offsetting: YNLR's interest in the details of Denison's caribou offset plan is a valid concern (see Appendix 3 for a review of YNLR's GIS based Method for Assessing Cumulative Environmental Effects). Respecting preliminary decommissioning plans: decommissioning plans are based on the extent to which restoration and offsetting are carried out prior to decommissioning, therefore while their receipt from Denison is appreciated any conclusions that can be determined from this plan is incomplete without the former requested information on offset plans. Therefore, YNLR concerns stated in their comments remain valid and unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #389)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** To be clear, Denison's proposed Project does not require any extension to the existing Highway 914. There is a Highway 914 extension project under evaluation by the Ministry of Highways, but this project is not related to or ancillary to the Wheeler River Project. As noted in response to other comments, through the EA process to date, Denison believes it has identified areas where offset may be required based on Project-Environment interactions. To this end, Denison has made a specific commitment to develop a Caribou Mitigation Plan (a preliminary draft of which has been submitted in response to provincial and federal EIS review comments) that includes provision for potential habitat offset. Details of the habitat offset will be developed in collaboration with Saskatchewan Ministry of Environment. It is also important to consider the site decommissioning plan within this context, though such restoration activities are not typically discussed as "offsets". Denison's decommissioning commitment is to return the land back to the Province of Saskatchewan for unrestricted surface land use post-closure. The Project's Conceptual Decommissioning Plan (CDP) is included in the draft EIS. The details of decommissioning and restoration will be refined over time as the Project proceeds. A Preliminary Decommissioning Plan (PDP) will be developed by Denison to support licensing and permitting applications. Prior to executing decommissioning activities, Denison will prepare and submit a Detailed Decommissioning Plan (DDP) to regulators for their review and acceptance, which builds on the PDP. No other specific needs for "offset" have been identified based on the effects assessment. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. YNLR has shared comments with respect to Woodland Caribou offsets,	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. The detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework, which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				including those related to the definition of offsets, timing, and mitigation measures as part of present-day mitigation measures for the Project, and should be applied in advance of decommissioning. YNLR has also requested to see the predecommissioning monitoring plan for containment releases. As an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided a document titled Summary of Monitoring, which outlines the Project's commitments for monitoring programs for all phases of the Project from preconstruction to post decommissioning. Details of monitoring will be developed prior to, and applicable for each phase of the Project, including decommissioning. Denison has also provided YNLR with the Preliminary Decommissioning Plan, of which Denison offers to include YNLR in discussions as more details are developed for the Preliminary Decommissioning Plan. Denison has also provided YNLR with the Draft Caribou Management Framework, which outlines mitigation and restorative measures within the Provincial government framework. Denison welcomed feedback on the Draft Caribou Management Framework and remains open and willing to receive additional feedback. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the				

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				conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances. Denison is committed to the development of a caribou mitigation and offsetting plan for the Project. This plan will be developed ahead of construction and independent of the development of the Project's detailed decommissioning plan. Denison provided the YNLR with a draft Caribou Management Framework which outlines mitigation and restorative measures within the Provincial Government framework. Denison continues to remain open to feedback from the YNLR on the draft Caribou Management Framework. Further, Denison's previous offer to involve the YNLR in discussions with respect to the development of the decommissioning plans still stands. Decommissioning plans at this stage are conceptual as outlined in the EIS and will continue to be refined through each phase of the Project as it progresses.				
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** YNLR expects to be included as part of the design and implementation of all monitoring programs. All such programs should be transparent, arm's length, include significant involvement and participation of Indigenous People, communities, and organizations and be statistically robust. While appreciating current water quality standards, YNLR suggests that monitoring programs be designed to more than meet regulatory requirements of the license conditions. The EIS recognizes that the Project area lies primarily within an undisturbed area of the boreal forest (aside from the extent of seismic activity carried out within this area). YNLR would like to be involved in specific follow-up and monitoring plans as identified in the EIS. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** See comments above on YNLR collaboration in the development and implementation of monitoring plans. YNLR needs a general statement concerning requested collaboration in management and monitoring plans. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing'	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #390, #396)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison has committed to collaborating with Indigenous Communities of Interest with reserves and residential communities most proximal to the Project on specifics of environmental monitoring regimes, suited to each of their interests and needs. As part of these programs, Denison and the Communities of Interest will be sharing information in an agreed-upon fashion. Denison expects that important country foods harvested for food and cultural purposes (e.g., moose, fish, etc.), surface water quality, and other areas of interest will form parts of these monitoring programs, including other areas of potential concern as they evolve over time. It is expected that the data collected through such monitoring regimes as described above would also be relevant to other Indigenous nations who may have interest in the Project. As noted in the draft EIS, Section 8.2.9 "Specific follow-up and monitoring plans will be prepared to refine and finalize approach in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC specific program." The monitoring and follow-up program will include measurement of water quality parameters to meet regulatory criteria (i.e., provincial discharge permits, Metal and Diamond Mining Effluent Regulations [MDMER; Government of Canada 2022] and CSA N288.4-19 (CSA Group 2019). At a minimum, this will include collection of non-radiological parameters (e.g., metals, nutrients, hardness, temperature, pH, TDS, TSS, and sulphate) and radiological parameters. Denison has committed to collaborating with Indigenous Communities of Interest with reserves and residential communities most proximal to the Project on specifics of environmental monitoring regimes, suited to each of their interests and needs. As part of these programs, Denison and the Communities of Interest will be sharing information in an agreed-upon fashion. YNLR will be informed throughout the monitoring program design and implementation process. Monitoring program design and	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.		implementation will be guided by the following principles: programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and programs will have spatial boundaries that are sufficiently extensive to measure EIS predictions. Additionally, regulators will be involved with setting specific requirements for follow-up and monitoring, as well as reporting, through licence conditions (CNSC) and provincial approvals. A number of monitoring and reporting requirements will be generated through the completion of the environmental assessment process. Denison and its lifecycle regulators will be in regular communication throughout the life of the Project as part of routine reporting, site inspections, licence and permit renewals. Denison is committed to ongoing engagement with regulators and recognizes that this will include information sharing related to follow-up and monitoring results and any needed adaptive management plans. It is also noted for further reference that there are existing, non-Denison monitoring programs such as the CNSC's Independent Environmental Monitoring Program (https://nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/index.cfm), and the Eastern Athabasca Regional Monitoring Program (www.earmp.ca/). Results from these programs provide relevant information and can complement Denison's Project-specific monitoring program. One forum for discussion of monitoring results is the Northern Saskatchewan Environmental Quality Committee (https://www.saskatchewan.ca/residents/first-nations-citizens/saskatchewan-first-nationsmetis- and-northern-initiatives/northern-Saskatchewan-environmental-quality-committee). **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when				

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				experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** The EIS states: "On the basis of the Project information and related evaluation and assessment of effects, Denison believes that the Project can be constructed, operated, and decommissioned in a manner that is not likely to cause significant adverse effects to the biophysical or human environments." This is perhaps an overly optimistic conclusion. However, YNLR is willing to discuss how the company moves forward and is interested in creating more formal processes to achieve this, such as the signing of an impact benefit agreement. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** This is not an open comment or invitation by Denison to address this concern with any process, commitment, or funding. Further to this; there is no indication in the response that Denison even accepts the YNLR comment hence this issue, raised in the original comments to Denison's EIS remains unresolved.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #391)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison notes YNLR's perspective on this. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison and YNLR have collaborated on an appropriate process in relation to the identified comment made by YNLR and both parties are actively working together in this respect. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** No further response from YNLR as per in letter dated June 19, 2024. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised.	Denison and YNLR have collaborated on an appropriate process in relation to the identified comment made by YNLR and both parties are actively working together in this respect. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024) No further response provided by YNLR as per letter dated June 19, 2024.				engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** The Project is located within Nuhenéné and of principal concern to YNLR is that the Project be fully sustainable with respect to cultural rights and traditions, socioeconomic equity, and environmental protection. To achieve this end, YNLR expects Denison to work collaboratively with the people of Nuhenéné through the YNLR office. YNLR supports the sustainable mining of uranium within Nuhenéné. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #392)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison notes YNLR's perspective on this. In March 2019, Denison was notified by the YNLR that the Indigenous communities within the local Athabasca communities identified were interested in the Project and that YNLR held the Duty to Consult from these communities. Since receiving correspondence from the YNLR office in 2019 Denison has been collaboratively working with the Nuhenéné through the YNLR office in a mutually agreed upon manner and will continue to do so. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 392. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** The EIS recognized that the utilization of water will result in an adverse impact on the drainage but dismissed the issue given that a reduction in the stream flow rate is expected to be less than 3%. It would therefore be prudent to closely monitor the flow regime to identify possible adverse effects throughout the life of the Project. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** This comment by Denison is encouraging in that it accepts YNLR's concern for a monitoring requirement. However, it does nothing to address YNLR's position that is must be collaboratively involved in all plans' development and implementation. **YNLR Comment June 19, 2024 (Response to Denison Comment on April**	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #393)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** In the draft EIS, conservative estimate of water taking would result in a reduction of flow of about 3% at times of low flow and the lake level could change by 1cm. While this incrementally small change in water quantity is beyond the ability of monitoring techniques to practically measure, Denison will conduct hydrological monitoring. Monitoring will likely include streamflow and lake level monitoring as well as continuous monitoring with stage dataloggers with details of monitoring plans to be finalized to support Project permitting and licensing. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		05, 2024) While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.		licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	collaboration as the Project advances.	YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		

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Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Utilizing the extent of the LSA and the fact that it does not overlap with projects located within the same drainage system seems to be quite arbitrary and convenient. By this criterion, each mine does not trigger a cumulative effect according to the EIS, although they are all additive to the water flow regime. This methodology then arbitrarily and conveniently determines that "mitigation measures" for each of the mines is not warranted since there was a determination of no cumulative effects in sections 8.1.7.1, 8.1.7.2, 8.1.7.3 and 8.1.7.4. The determination of Cumulative Effects Characterization and the resultant Determination of Significance is highly subjective, therefore a much more extensive monitoring program is required. Such a program should start prior to the construction phase and carry on at least several years into the operation portion of the Project to at least demonstrate local and cumulative effects of mining projects within the watershed. YNLR agrees that the hydrological monitoring program remain throughout the life of the Project but as per the above, the study should have a much broader mandate in order to measure local and regional effects on VCs. YNLR is concerned that the conclusion that the residual effects from Project operations will not have an adverse effect on surface water is highly speculative. Again, this indicates the need for a comprehensive monitoring program to validate the speculation on water quality with rigorous statistical evidence. YNLR questions the logic track that states, "additional mitigation measures not warranted" because of the determination of no cumulative effects, then "a determination of significance is not warranted" as no cumulative effects were identified for water quality because surface water impacts are expected to remain localized…for all the mining operations in the region. Impacts on water quality and mitigation measures "not warranted" should be demonstrated through field studies and research rather than relying on a theoretical modelling approach. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** These comments do not address the YNLR's original concern (the residual effects from Project operations will not have an adverse effect on surface water is highly speculative) and the above stated requests for collaboration at the conceptual and methodological stages of monitoring development are reiterated. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #394)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** In terms of watersheds and nearby uranium operations, only Key Lake Operation's drainage area interacts with the Wheeler River Project. Drainages from both operations would combine at Russell Lake. As such, the Key Lake Operation was included as an existing project in the CEA sections of the aquatic environment. The drainages associated with McArthur River Operation and Cigar Lake Operation are separate from the Project. The RSA is the area that surrounds and includes the LSA, and was established to assess the potential, largely indirect effects of the Project, as well as other activities, in a regional context. The RSA is large enough to capture the extent of potential effects (i.e., zone of influence) on a VC and defines the area within which cumulative effects may occur (i.e., cumulative effects assessment boundary). The RSA for the Surface Water Quality VC is bounded by the regional watershed area in which the Project Area is located. The RSA for this assessment is based on the whole watershed within which the Project is located and extends downstream to include Russell Lake (refer to draft EIS Figure 8.2-3). Given the very low magnitude of predicted changes in water quantity in the LSA (in the draft EIS, conservative estimate of water taking would result in a reduction of flow of about 3% at times of low flow and the lake level could change by 1cm), it would not be measurable further downstream into the RSA. The CEA considers whether residual adverse effects of the Project on a given VC will overlap spatially and/or temporally with the same residual adverse effects on the VC resulting from other past, present, and reasonably foreseeable projects or activities. The CEA follows standard methodology as per provincial (e.g., Guidelines for an Environmental Assessment) and federal guidance (e.g., Assessing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012). Cumulative effects assessment is important to Indigenous communities in general because incremental effects to the environment can weaken resource economies, affect important resources such as plants, fish, and wildlife, affect rights-based and cultural activities, and affect both the health of wildlife and humans. Indigenous perspectives can be complementary to the CEA for the Project, and Denison acknowledges the important relationship of the Indigenous Communities of Interest to the lands and waters. The Indigenous Communities of Interest of ERFN and the Kineepik Métis Local #9 at Pinehouse (KML) have shared their Indigenous Knowledge on past, present, and predicted cumulative effects through the following: • Wheeler River Project – Summary of Health and Socio-Economic Study Results (ERFN and SVS 2022a); • Wheeler River Project - Summary of Traditional Knowledge Study Results (ERFN and SVS 2022b); • Kineepik Valued Ecosystem Components – KML Pre-statement for Denison EIS (KML and NVP 2022); and • Response to the Environment Impact Assessment For the proposed Ministry of Highways 914 Extension Project (KML and Limnos Environmental 2022).	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.		These perspectives on cumulative effects have been summarized in Section 3.4.8 of Section 3. Denison and the Communities of Interest agreed on the high value of this contribution being part of the EIS. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it				

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				is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** There are several comments in the EIS that recognize the potential for a negative effect on water quality from the site water management system into Whitefish Lake. Statements taken from residents have identified concerns about the release of elements such as "mercury" because of the mining activity. While the report recognized that detectable concentrations of mercury will not be produced, the local comment should be considered as a proxy for a variety of contaminants such as selenium, arsenic, cobalt, zinc, etc., as well as the concern expressed by residents, rather than being taken literally as mercury as the only contaminant of concern. YNLR reiterates that concerns about water quality are warranted given that the EIS indicates that there will be a continuous (year-round) average discharge of water from the mine site of more than 36,000 litres/hour for the entire life of the Project. This discharge will be especially evident during low flow periods. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #395)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** The comment from YNLR references text in Section 8.2 of the draft EIS which is the water quality assessment. Please refer to draft EIS Section 8.1 for the water quantity assessment and information on potential changes in water flow. Denison acknowledges the concern raised by YNLR and believes the water quality assessment, including the assessment of potential water quality effects on ecological and human health, presented in the EIS and supporting documentation is robust and supports the conclusions drawn. With regard to YNLR's concerns around contaminants in treated effluent, we refer YNLR to Appendix 10-A Environmental Risk Assessment (ERA) for Wheeler River. The ERA predicts and assesses the risk to representative human and ecological receptors resulting from exposure to radiological and non-radiological substances expected to be released throughout the Project Phases. The ERA encompasses a human health risk assessment (HHRA) and an ecological risk assessment (EcoRA), which have been prepared to be compliant with Canadian Standards Association Group (CSA) N288.6-12 Environmental Risk Assessments for Class I Nuclear Facilities and Uranium Mines and Mills (CSA, 2012). It also meets the requirements for an ERA outlined in Section 4.1 of Regulatory Document 2.9.1, Environmental Principles, Assessments and Protection Measures (CNSC, 2020). The ERA has been developed with current science and current regulatory attitudes in mind. The predicted radiological and non-radiological to human and ecological receptors demonstrate that the Project can be conducted in a manner that is protective of human and ecological health. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 395. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's	Denison has committed to collaborating with Indigenous Communities of Interest with reserves and residential communities most proximal to the Project on specifics of environmental monitoring regimes, suited to each of their interests and needs. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes; Other	**YNLR Comment March 4, 2023** It is noted that the aquatic survey and fish sampling were carried out in 2016, which is now somewhat dated. It is also noted that work that would affect fish and fish habitat could/should only be carried out between July 16 and September 30th, as both spring and fall spawning species were collected in the fish sample. YNLR acknowledges that the amount of fish habitat directly affected by the Project is small. However, a much bigger concern is the indirect effects of increased human activity in the area over several decades and beyond, particularly with respect to the consequent increase in fish harvest. This will directly affect the ability of Indigenous Peoples to exercise their Aboriginal and Treaty rights. Related comments: • YNLR would be eager to see how "a fish salvage plan to relocate fish prior to in-water works" might be carried out? Such an approach may not be practicable or effective. • While the sentiment of the above fish management strategy is laudable, it is not practical in terms of preserving fish numbers given the increased human access to the lakes that the mining activity will create. • The EIS does recognize the value of sucker species to residents, which is a positive step, as these fish species are netted for a variety of purposes. Increased local traffic will also undoubtedly provide more access for both subsistence and recreational fishing. As part of the mitigation measures YNLR proposes working with authorities to regulate recreational fishing prior to the onset of the construction phase of the Project and revisiting these regulations at intervals throughout the mine's operation and decommissioning. • YNLR disagrees with the assumptions used (Section 8.3.7.2 to 8.3.7.5), which "assume" specific monitoring and follow-up for Fish and Fish Habitat related to cumulative effects is not warranted. • YNLR would like to be involved in designing and carrying out of a monitoring program, which would test the "no cumulative effect" assumption. • YNLR would like to be involved in a monitoring program for fish health. Further, this monitoring program should continue for the life of the Project or until it is demonstrated that the current filtering programs are effective. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** YNLR looks forward to the details on how this collaboration will be conducted. **YNLR Comment June 19, 2024 (Response to Denison Comment on April**	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #397)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** The response to the review comment are organized by theme, consistent with the comment. Fish salvage: Details of a fish salvage program, if required, will be developed to support Project permitting and licensing. Briefly, for any in-water work, the work area would be isolated from rest of the waterbody. Any fish remaining inside the isolated work area would be captured and relocated outside of the work area. Based on the experience of Denison and its SME team it is noted that such programs are implemented successfully on a routine basis with effective and site-specific planning. Indirect effects related to increased human activity in the area: Please note that the Project will not change public access to the area. The existing gate on Highway 914 near Cameco's Key Lake Operation will remain in place and no changes to the gate and the process for controlling access to Highway 914 north of the Key Lake Operation are proposed as part of the Wheeler River Project. The proposed operation is fly-in, so Project related traffic to the area would only be related to deliveries of materials to and from the site. On-site staff will not have access to personal (or company) vehicles and will largely be "confined" to the camp and work areas during their shifts. Section 11 of the draft EIS provides the assessment of potential Project effects on Indigenous Land and Resource Use (Section 11.1) and Other Land and Resource Use (Section 11.2). The mitigation measures proposed in the aquatic and terrestrial assessments translated into undetectable changes in resource availability to existing and future users and rightsholders. Recreational fishing: As described in the draft EIS and as noted above, workforce members will be transported to/from site via a fly-in/fly-out rotation and will, therefore, not use ground travel options during shift changes, which will eliminate fishing on local lakes during commutes to/from the site and during time off work. Denison site vehicles will not be available for recreational purposes. While at the Project site and off duty, workers may opt to fish local waterbodies. To protect sustainable use of resources, only catch and release of fish will be encouraged, and fish storage or cooking facilities will not be provided. To prevent entry of land users from entering the Project Area, Denison will control access to the property with both a north and south security gate. Overall, given a lack of resources to access fishing locations and store fish harvests, workforce fishing is expected to cause minimal disturbances to local users. Monitoring: In the draft EIS, Denison outlines its plans to conduct fish health monitoring in tandem with surface water quality, sediment quality, benthic invertebrate and fish and fish habitat sampling. Sampling locations will be co-located to facilitate comparison to water quality and	Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		05, 2024) While encouraging, this still does not address YNLR's concerns as stated in their responses in their letters of 02 February 2024 and 13 March 2024. From the beginning, of their review of Denison's EIS and revised EIS YNLR, has been consistent in their request to be "involved in all monitoring and other plans at a conceptual level when experimental design and methodologies are being developed". Denison has been consistent in their responses "to share further information about plans as they are developed". The Denison response, explicitly, does not address YNLR's concerns stated in YNLR's letters of 02 February 2024 and 13 March 2024. Hence these concerns remain. YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development.		sediment quality characteristics. Denison has committed to collaborating with Indigenous Communities of Interest with reserves and residential communities most proximal to the Project on specifics of environmental monitoring regimes, suited to each of their interests and needs. As part of these programs, Denison and the Communities of Interest will be sharing information in an agreed-upon fashion. YNLR will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and programs will have spatial boundaries are sufficiently extensive to measure EIS predictions. Denison is committed to maintaining positive relations with all local interested parties and will be open to discussions on any issues or concerns that arise. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** Denison is committed to working with YNLR to share information about monitoring plans as they are developed through the permitting and licencing process. In a meeting between YNLR and Denison on February 22, 2024, it was noted by YNLR's consultants that the areas of immediate interest to YNLR are surface and groundwater, aquatics, wildlife, and Woodland Caribou monitoring. As noted in the meeting, the detailed monitoring plans are not yet developed given the stage of the Project in the regulatory process. Given the number of plans and procedures to be developed it would be helpful for Denison and YNLR to work together to establish a process for next steps. Further, as an outcome of a meeting between Denison and YNLR on February 22, 2024, Denison provided YNLR a document from the draft Wheeler River Environmental Impact Statement (EIS) titled Summary of Monitoring. The document outlines the conceptual monitoring program for all stages of the Project and how they tie to each Valued Component assessed in the EIS. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** YNLR expressed the desire to be involved in the program design and development of all monitoring and other plans at a conceptual level when experimental design and methodologies are being deployed, stating that, "YNLR interprets the notion of 'sharing' information after its been developed as being non-collaborative and we prefer being 'involved' in the program/plan design and development." Denison feels it is important to clarify the processes related to the development of various monitoring programs for the Project and the manner in which involvement can occur with interested Indigenous nations, such as those represented by the YNLR. As a starting point, the EIS contains conceptual level information for various monitoring plans associated with the Project, commensurate with the requirements for an environmental assessment, the primary basis of which is informed by				

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				regulatory guidance and requirements. The conceptual monitoring plans also take into account any input received through engagement activities, where appropriate. As the Project advances into permitting and licensing, the conceptual monitoring plans evolve into detailed monitoring plans, the designs of which must adhere to Provincial and Federal regulatory requirements but can be further enhanced by the involvement of the YNLR and other Indigenous communities. Denison provided the summary of monitoring and follow-up programs (Section 16 of the EIS) to the YNLR as an outcome of the February 22, 2024 meeting, with the request to identify those items of further interest to the YNLR to enable the co-development of a path forward. It is Denison's perspective that, in order to advance a meaningful process to further involve the YNLR in the development of the monitoring plans, it is necessary for Denison to understand the key areas of interest to the YNLR. This was the basis of Denison's request whereby the YNLR identify a starting point for this exchange, based on the conceptual monitoring programs provided in the EIS. In the absence of specific feedback on the conceptual monitoring plans/programs, Denison re-iterates its commitment to providing the YNLR with the detailed monitoring plans, as developed through the permitting and licensing process, for input and collaboration as the Project advances.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** The statement on page 8-151 recognizes that the discharge of treated effluent during the Operation and Decommissioning phase may interact with Cameco's current releases contributing to cumulative effects. It is recommended that a study be undertaken to assess the basin effect of water discharges. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #398)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** The requested information is presented in draft EIS Section 8.2.7 Cumulative Effects (surface water quality). The summary referenced in the YNLR comment is made in Section 8.3 Fish and Fish Habitat. Specific monitoring and follow-up plans for the Surface Water Quality VC will be prepared to refine and finalize the approach and specific metrics following consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies with interest in the development and implementation of this VC-specific program. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 398. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further	Denison has committed to collaborating with Indigenous Communities of Interest with reserves and residential communities most proximal to the Project on specifics of environmental monitoring regimes, suited to each of their interests and needs. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Sediment quality of Whitefish Lake and downstream is not "anticipated" to overlap with the Key Lake Operation. It would be prudent to test this hypothesis to ensure that water quality in the flowage is maintained given the high value placed on these waters by residents. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #399)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Any changes in sediment quality would be preceded by changes in surface water quality. Should the surface water quality monitoring program identify changes beyond those predicted in the EIS, adaptive management measures would be implemented and may include monitoring of sediment quality further downstream in the watershed. In addition, the Environmental Effects Monitoring (EEM) program under the Diamond Mining and Effluent Regulations will provide a framework for monitoring changes in the aquatic environment. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 399. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Water management during construction indicates that there is to be no planned discharge to Whitefish Lake. If a release of water from the mine site becomes necessary, in addition to monitoring suspended solid levels, there should be a communication plan to inform area residents of the pending release and its duration. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #400)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** During Construction, no effluent is expected to be released to the aquatic environment. Contact water stored in the Clean Waste Rock Pond during Construction will be held onsite until the Industrial Wastewater Treatment Plant (IWWTP) is commissioned. At that time the water from the pond would be conveyed to the IWWTP, treated, and released to Whitefish Lake per permit / license requirements. The sequencing of Construction activities will occur in a logical manner based on Project execution plans. For example, construction of the wellfield runoff pond will be prioritized during the early part of Construction, and it will be able to hold 38,200 m3 of water. This will provide contingency and additional water storage capacity if contact water produced exceeds estimates or the volume available in the Clean Waste Rock Pond. Other secondary contingency measures are also available should the volume of water requiring management exceed site infrastructure storage volume. Depending on the situation and volume of water needing management,	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				this could include for example use a hydrovac for offsite disposal. Alternatively, in the instance that there is a planned release of water during construction, this would be permitted by Saskatchewan Ministry of Environment. In accordance with our Indigenous Peoples Policy, Denison is committed to collaborating with Indigenous peoples and communities to build long-term, respectful, trusting, and mutually beneficial relationships. Denison has identified key objectives respecting Indigenous engagement associated with the Project: • Build and maintain authentic relationships based on a foundation of trust, good faith, and transparency. • Create a respectful dialogue process that promotes communication and collaboration among Denison and Indigenous communities, in a timely and accurate fashion. • Understand how the proposed development of the Project may affect the interests of Indigenous peoples (including Indigenous and/or Treaty Rights), and work with Indigenous peoples to avoid, mitigate, or otherwise address effects, while also collaborating to maximize potential positive effects. In addition, Denison is required to have a Public Information Disclosure Protocol as set out by the CNSC. This would include any notification to the wider public of unplanned discharges. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 400. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** in Section 9.4 of the EIS lists Raptors, Migratory Breeding Birds and Bird Species at Risk together (p. 9-320). YNLR questions how and why these three avian VCs were selected and grouped. The three VCs include dozens of breeding bird species with hugely varying habitat requirements, so it is difficult to see how it is possible to	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** An EIS requires scoping in order to determine the appropriate content for the assessment and focus the EIS on key areas of concern and relevance. As per standard, accepted EA practice, the EA was organized by and focused on VCs. The VCs are aspects of the biophysical and human environments that will likely be affected (adversely or positively) by the	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		accurately predict Project effects for many of these species, especially when so many are lumped together in only one Migratory Breeding Birds VC. In addition, the scarcity of raptors and avian species at risk makes them poor candidates for effects assessments because of low sample sizes. With only two water-based species selected to represent all forest raptors in the Project area, the results and conclusions of this assessment are extremely limited. For the forest birds in particular, this is compounded by the non-inclusion of the historic network of seismic cut lines across the landscape (Appendix 9B), and the resulting underestimation of direct and edge effects. Species at risk generally make very poor indicators of ecological integrity/biodiversity because of their relative scarcity. In fact, three of the VC bird species at risk selected were not even detected during the Project surveys. This very low quantity and data quality greatly weakens any conclusions regarding the Project residual effects. YNLR cannot find any mention of the extensive seismic line network impacts (Appendix 9B) included in the effects assessment for birds. This was also the case for the caribou and wildlife assessments. The selection of weak indicators and the ad hoc grouping of dissimilar species make these predictions quite unreliable. This potential error is likely compounded by the apparent exclusion of the direct and indirect effects of the existing seismic cutline network (Appendix 9B). Concern about these extensive network of seismic cut lines were also raised by Indigenous People at several places in the EIS. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	Comment #412)	Project. The VCs reflect identified scientific, local knowledge and Indigenous knowledge, and community interests regarding the Project and its potential effects and are typically identified early in the EA process as a result of questions and concerns raised through engagement with government departments and agencies, Indigenous and community groups, and the general public. Key Indicators are an important component or aspect of the VC that is expected to be affected (changed) as a result of the Project. The KIs may comprise subsets or a guild of the VC, certain aspects of the VC that may be affected by the Project and/or which have a particular importance. The three avian VCs (with Key Indicators in brackets) were: Raptors (bald eagle and osprey), Migratory Breeding Birds (waterbirds and waterfowl, upland game birds, and migratory songbirds), and Bird Species at Risk (common nighthawk, short-eared owl, yellow rail, rusty blackbird, and olive-sided flycatcher). The residual effects evaluation was completed on the Key Indicator species. The rationale for selecting these avian Key Indicators is available in Section 9.4.1.2. For instance, the inclusion of Species At Risk birds is a requirement of the Species at Risk Act and the CNSC's REGDOC 2.9.1 also notes that applicants should identify all biological species at risk in the area; the avian Species at Risk were not included in the EIS to be indicators of ecological integrity/biodiversity. The avian effects assessment was habitat based. The assessment methods used a conservative approach with the assumption that, following the implementation of site-specific mitigation measures, the proposed Project activities would have a residual effect on these species' guilds regardless of species presence on site. As described in the EIS, pre-construction surveys will be conducted prior to the commencement of any vegetation clearing or soil disturbance. Avian species will also be routinely monitored throughout the life of the Project. Results from the surveys and monitoring activities are expected to inform the adaptive management process to update Project design and identify the need for additional mitigation measures, if required. Denison is of the professional opinion that the data presented, and analysis provided in the avian assessment of the draft EIS is sufficient given 1) the local / regional environment, 2) the level of interaction of the Project with birds that is expected, and 3) because bird densities are not expected to be limited by habitat regionally. The Wheeler River Project Environmental Impact Statement - Denison's Response to Woodland Caribou Habitat Comments discusses how existing cutlines were considered in avian assessments. All past anthropogenic disturbances (which includes cutlines to support mineral exploration) were considered in the terrestrial environment assessments. These human disturbances were mapped and considered/addressed appropriately in Section 9 including the Existing Environment, Residual Effects Characterization, and Cumulative Effects Assessment sections, as they relate to Terrain, Soil and Organic Matter/Peat (Section 9.1); Vegetation and Ecosystems, Listed Plant Species and Wetlands (Section 9.2); Ungulates, Furbearers and Woodland Caribou (Section 9.3); Raptors, Migratory Breeding Birds, and Bird Species at Risk (Section 9.4). The cutlines were classified as previously disturbed and considered as low-quality habitat or no habitat, depending on the species being assessed		clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		

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				and their habitat requirements. An anthropogenic layer is included on draft EIS, Figure 9.2-6, which includes geophysical cutlines. Please note that anthropogenic features were mapped at IKONOS 1:5,000. This anthropogenic layer is not listed under available habitat types for any of the wildlife or avian VCs in subsequent assessments (e.g., Figures 9.3-9 to 9.3-14, Figures 9.4-8 to 9.4-11, Figures 9.4-13 to 9.4-15) except for Common Nighthawk (Figure 9.4-12), which is a species that is known to use anthropogenic features. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 412. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** In regard to the potential effects of the Project on breeding bird habitats. When wooded landscapes are subjected to widespread seismic activity, the same effects occur: continuous parcels of forest are divided by miles of cut lines, resulting in smaller habitat patches and greater habitat edge. As a result, bird species that prefer contiguous habitats are declining, while birds that prefer habitat edges are increasing. How will the EIS address already existing direct and indirect impacts of these historic seismic linear disturbances across the LSA and RSA (Appendix 9B) that were ignored. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #413)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Please refer to the Wheeler River Project Environmental Impact Statement - Denison's Response to Woodland Caribou Habitat Comments for a discussion of how existing cutlines were considered in avian assessments. All past anthropogenic disturbances (which includes cutlines to support mineral exploration) were considered in the terrestrial environment assessments. These human disturbances were mapped and considered/addressed appropriately in Section 9 including the Existing Environment, Residual Effects Characterization, and Cumulative Effects Assessment sections, as they relate to Terrain, Soil and Organic Matter/Peat (Section 9.1); Vegetation and Ecosystems, Listed Plant Species and Wetlands (Section 9.2); Ungulates, Furbearers and Woodland Caribou (Section 9.3); Raptors, Migratory Breeding Birds, and Bird Species at Risk (Section 9.4). The cutlines were classified as previously disturbed and considered as low-quality habitat or no habitat, depending on the species being assessed and their habitat requirements. An anthropogenic layer is included on draft EIS, Figure 9.2-6, which includes geophysical cutlines. Please note that anthropogenic features were mapped at IKONOS 1:5,000. This anthropogenic layer is not listed under available habitat types for any of the wildlife or avian VCs in subsequent	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				assessments (e.g., Figures 9.3-9 to 9.3-14, Figures 9.4-8 to 9.4-11, Figures 9.4-13 to 9.4-15) except for Common Nighthawk (Figure 9.4-12), which is a species that is known to use anthropogenic features. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 413. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Why were amphibians excluded as a VC/KI? Bats? Both were surveyed (Appendix 9B). **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #414)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Subsequent to filing the draft EIS, Denison has developed a new Species at Risk appendix to Section 9 which will be included in the final EIS and has been included in the response to YNLR (a new SAR appendix (new Appendix 9-D) will be added to Section 9 of the final EIS. It has been included here as Attachment IR-131). This new EIS appendix lists all SAR species potentially occurring in the Project study areas, with links to applicable and appropriate mitigation measures described in the draft EIS. The new appendix also includes a summary of the life history requirements, the expected Project effects, proposed mitigation measures, and anticipated residual effects on bats and amphibians. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 414. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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				Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Project monitoring programs specific to Raptors, Migratory Breeding Bird, and Bird Species at Risk VCs are critical, particularly the ongoing repeated surveys throughout the life of the Project, especially given the weak predictive basis for the effects assessments of the Project on breeding bird species. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #415)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** The framework for avian-related monitoring programs are available in Section 9.4.8 of the draft EIS. This includes a discussion of the anticipated adaptive management process. As described in the draft EIS, a wildlife monitoring plan will be developed to support permitting and licensing and implemented as the Project proceeds. The wildlife monitoring plan will provide details on the monitoring and follow-up programs outlined in Section 9.4.8 of the draft EIS. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 415. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** YNLR would like to emphasize that natural resource use by Indigenous Peoples of northern Saskatchewan is of incalculable value, and the Project must not infringe upon the ability of Indigenous Peoples to exercise those constitutionally protected rights. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #416)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison acknowledges the comment. We believe that the work we have done to date with the YNLR, such as entering into an Exploration Agreement in respect of Denison's exploration activities, demonstrates our strong understanding of this YNLR emphasis. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		**Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 416. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources for traditional purposes;	**YNLR Comment March 4, 2023** The EIS notes that "The presence of the Project workforce will increase the numbers of people in the ILRU LSA by an estimated 300 during Construction and 180 during Operation and Decommissioning." YNRL notes that: • This is a significant increase in the number and persistence of humans in the area, and despite these vague reassurances, YNLR believes that this increase will affect the ability of Indigenous Peoples to exercise their Aboriginal and Treaty rights and increase the pressures on the natural resources of the area. • YNLR believes that Denison provides an overly optimistic conclusion regarding the impacts of the Project on traditional resource use by Indigenous peoples. • One indicator of increased human activity is truck traffic. However, these numbers do not include non-truck traffic. How will Denison address this? As with the impacts on the traditional use of land and natural resources by Aboriginal and Treaty rights holders, the human presence in the region is going to increase, which in turn will put additional pressures on fish and wildlife resources. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #417)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Section 12.3.3.2.1 of the EIS describes how access north of the Key Lake gatehouse for employees of northern mines, Indigenous resource harvesters from select communities, cabin owners, and lease owners provides for controlled access to users. Further, Denison staff will not be allowed to hunt or fish. Denison expects to continue to work with Indigenous COI to share information about the proposed impacts of the Project in relation to the potential to adversely impact the exercise of hunting, fishing, trapping and the carrying out of traditional uses as a result of the Project. Information in this respect will be provided as an update to the EIS. Further mitigations identified in Section 12 include: • Air transportation will be used to transport most workers between the Project site and designated pick-up and drop-off points in communities. Pick-up points will be located at two locally central points in communities within the LSA, one additional site in northern Saskatchewan, and potentially other locations to minimize time spent away from families. • Denison's Environment, Health, Safety, and Sustainability Policy will be enforced. • Liaison with LSA communities and relevant authorities (e.g., RCMP, health and service providers) will continue. • Culturally sensitive employment policies that support the Indigenous workforce will be implemented (e.g., having an Elder representative at the Project site to provide cultural programming) **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 417. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** There are about three dozen Valued Component/Key Indicators that are assessed for the significance of residual effects (effects that remain after mitigation) from the Project. They include sediment quality, benthic invertebrates, fish and fish habitat, fish health, terrain, soil, organic matter, vegetation abundance, listed plant species, wetlands, ungulates (moose), furbearers (wolverine, pine marten, mink, muskrat), woodland caribou, raptors (bald eagle, osprey), migratory breeding birds (water birds and waterfowl, upland game birds, migratory songbirds), avian species at risk (5), human health and safety, Indigenous land and resource use, other land and resource use, heritage resources, traditional diet, community well-being (income and cohesion), traffic, infrastructure & services, and economics. The residual effects of the Project on all of these VCs/Kis are concluded to be non-significant in the EIS. YNLR questions this overly optimistic and statistically unlikely prediction. For example, the sheer number of fish and wildlife species that the few selected VC/Kis represent would suggest that some will be adversely affected, even if by chance alone. The assessment effectively states that the Project is advantageous and/or neutral to all biophysical and human values, which YNLR rejects. If the Project proceeds, YNLR will want to be closely associated with all project monitoring programs. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #418)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** The draft EIS carefully evaluated the residual adverse effects remaining on VCs and KIs following implementation of mitigation measures. The EIS conservatively identifies where change from existing conditions are expected for each VC or KI, and assesses this change (i.e., the residual effect) for significance. For instance, the wildlife and avian assessments concluded that the residual effects of the Project are not expected to result in a change to the viability and persistence of the VCs and associated KIs and were, therefore, predicted to be not significant. As the review comment correctly notes residual effects identified in the EIS were deemed to be not significant - that is, the level of effect (change) did not meet the threshold of significance as defined for the VC. The EIS also discusses the certainty (and uncertainty) of the conclusions drawn by the assessment. Each VC or KI is evaluated independently and based on specific Project-environment interactions and VC-specific mitigations. Denison is confident that the conclusions drawn in the EIS with respect to potential effects and their significance are supported by the analysis presented. Details of follow-up and monitoring plans will be prepared in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies. YNLR will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and programs will have spatial boundaries that are sufficiently extensive to measure EIS predictions. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 418. As such, Denson assumes that its responses provided November	Details of follow-up and monitoring plans will be prepared in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Physical and cultural heritage; Current use of lands and resources for traditional purposes; Other	**YNLR Comment March 4, 2023** There are about three dozen Valued Component/Key Indicators that are assessed for the significance of cumulative effects (effects that remain after mitigation) from the Project. These include air quality, noise, terrain morphology and stability, groundwater quantity and quality, surface water quality and quantity, soil quantity and quality, organic matter, sediment quality, benthic invertebrates, fish and fish habitat, fish health, vegetation abundance, listed plant species, wetlands, moose, furbearers, woodland caribou, raptors, migratory breeding birds, avian species at risk, human health, Indigenous land and resource use, other land and resource use, heritage resources, traditional diet, income of workers, community cohesion, traffic, community infrastructure and services, and economics. As with the summary of the residual effects, the cumulative effects of the Project on all of these VCs/Kis are concluded to be non-significant in the EIS. Again, YNLR believes this to be an overly optimistic and statistically unlikely prediction for the same reasons as given above, for example, inadequate spatial boundaries, poorly chosen and grouped VCs and Kis, the apparent omission of the existing linear disturbance network in the effects assessments, and the largely qualitative nature of the assessments and their resultant 'significance.' **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #419)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Please refer to the response to YNRL comments #418. Additionally, Denison notes that there are a number of review comments that have a similar theme. Rather than repeating the same narrative in this table Denison has developed an inclusive technical memo to provide a more coherent and complete response, the Wheeler River Project Environmental Impact Statement - Denison's Response to Woodland Caribou Habitat Comments. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 419. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Details of follow-up and monitoring plans will be prepared in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies. YNLR will be informed throughout the monitoring program design and implementation process. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Health and socio-economic conditions ; Current use of lands and resources	**YNLR Comment March 4, 2023** YNLR believes there is a lot of uncertainty remaining from this EIS. This stems from several items, including the relatively novel nature of the ISR methodology with its potential effects on water quality and fish health, to the questionable conclusion that the mine will be neutral with respect to the persistence of woodland caribou in the region. If the mine is to be approved, YNLR wants a transparent, independent, statistically robust monitoring program implemented for the life of the	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Details of follow-up and monitoring plans will be prepared in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies. YNLR will be informed throughout the monitoring program design and implementation process. Monitoring program design and implementation will be guided by the following principles: programs will meet regulatory requirements, programs will confirm the	Details of follow-up and monitoring plans will be prepared in consultation with Indigenous groups, other interested parties, and relevant federal and provincial agencies.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
	for traditional purposes; Other	Project and beyond. YNLR expects northern Indigenous Peoples to be involved in the design and implementation of such a program. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	Comment #420)	effectiveness of mitigation measures and predictions made in the assessment, programs will be implemented in an adaptive management framework (if/where applicable) to reduce effects during the lifetime of the Project, and programs will have spatial boundaries are sufficiently extensive to measure EIS predictions. Additionally, Denison has identified key objectives respecting Indigenous engagement associated with the Project: • Build and maintain authentic relationships based on a foundation of trust, good faith, and transparency. • Create a respectful dialogue process that promotes communication and collaboration among Denison and Indigenous communities, in a timely and accurate fashion. • Understand how the proposed development of the Project may affect the interests of Indigenous peoples (including Indigenous and/or Treaty Rights), and work with Indigenous peoples to avoid, mitigate, or otherwise address effects, while also collaborating to maximize potential positive effects. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 420. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison remains committed to engaging with the YNLR on these concerns.	assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** There is inconsistent use of YNLRO and YNLR throughout several sections of the EIS. Specifically, YNLRO in section 3, YNLR in sections 4 and 11. As they are used to represent the same thing, only one format should be used. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)**	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #421)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Editorial issue with inconsistent abbreviations for Ya'thi Néné Land and Resource Office will be corrected in the final EIS and 'YNLR' will be used. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19,**	Edit made throughout EIS. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		**2024)** There have been no further comments from the YNLR on EIS reference no. 421. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** EIS Page 1-1, second paragraph, first sentence states: "The Project falls within the boundaries of Treaty 10, the Nuhtsiye-kwi Benéne (Ancestral Lands) of English River First Nation, the traditional territory of the Kineepik Métis Local #9, the homeland of the Métis, and the Nuhenéné." YNLR notes that this is a misuse of Nuhenéné as the name of the people. This should be "Nuhenéné, the traditional territory of the Athabasca Denesyłiné". In reference to section 3.1 of the EIS (p. 3-1 to 3-2), YNLR also notes that the Wheeler River Project falls within Nuhenéné and Athabasca Denesyłiné perspectives and knowledge should have been sought throughout all stages of the Environmental Assessment (EA). Early inclusion in this project would have been beneficial to both the Athabasca Denesyłine communities and to Denison through increased sharing of knowledge. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #422)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** At first instance of 'Nuhenéné' Denison will recognize: 'Nuhenéné, the traditional territory of the Athabasca Denesyłiné.' **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 422. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Edit made throughout EIS, including in Section 1 and Section 3. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** There YNLR notes that the Hatchet Lake Denesyłiné First Nation, an Athabasca Denesyłiné community, is the closest to the Project. The Wheeler River EIS seems to rely on road distance rather than physical proximity. Road distance should not be utilized to determine community importance or impacts since not all travel methods require continuous roads. Travel to this part of our traditional territory is typically achieved cross country rather than by road. YNLR notes that Hatchet Lake First Nation is located 150 km…Black Lake First Nation is located 180 km…and Fond du Lac First Nation is located 230	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #423)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Thank you for the information. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19,**	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		km away from the Project as recognised on page 4-47 of the draft EIS. Our community members generally access the Project area via overland routes rather than the established Provincial Road network. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		**2024)** There have been no further comments from the YNLR on EIS reference no. 423. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** Athabasca Denesųłiné land uses include, but are not limited to, large and small game harvesting, gathering activities, and fishing, all of which are of key cultural importance. It is important to note that the Hatchet Lake Denesųłiné First Nation and the community of Wollaston Post are situated at Wollaston Lake and given their downstream location there is potential for negative impacts. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #424)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Potential effects from the Project on surface water quality were comprehensively assessed in Section 8.2 of the draft EIS. The assessment evaluated discharge of treated effluent from the site using predictive modeling. Water treatment will be conducted in the onsite Industrial Waste Water Treatment Plant (IWWTP) and treated effluent will be tested prior to release to Whitefish Lake. Treated effluent that does not meet the effluent discharge criteria in the provincial approval to operate or effluent criteria defined in the Metal and Diamond Mining Effluent Regulations will not be released to Whitefish Lake and will be recirculated to the process water pond for eventual re-treatment in the IWWTP. In the draft EIS, Section 8.2 the predictive modeling showed that constituent concentrations including radionuclides would be below water quality objectives for the protection of aquatic life (i.e., no effects would be expected) at the outlet of Whitefish Lake. The outlet of Whitefish Lake is well upstream of the inflow of Icelander River to Russell Lake. Since no effects on surface water quality are expected to occur in the lake closest to the Project, no effects would accrue in areas further downstream in the watershed, where contributing sub watersheds are many, many-times the size of the sub watersheds near the Project site. As such, there will be no effects on surface water quality in Wollaston Lake from the Project activities. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 424. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** YNLR notes that while the wording for EIS Page 3-5, first paragraph, is an improvement from the May 2021 draft, it does not make clear that no Wheeler River site specific Athabasca Denesųłiné knowledge or land use studies were undertaken and that the information presented is from a variety of other projects with differing objectives and study areas. The issue is better captured/described in the EIS on page 11-39. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #425)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Acknowledged, updated language will be included in the EIS. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 425. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Section 3.0 updated to reflect language in Section 11.0. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR notes that there appears to be grammatical errors for page 3-10, last paragraph of the EIS. YNLR requests edits to: "Ya'thi Néné Lands and Resources, the point of contact for and representative of the Athabasca Denesųłiné communities of Black Lake, Fond du Lac, and Hatchet Lake Denesųłiné First Nations, as well as the northern hamlets/settlements of Stony Rapids, Wollaston Lake, Uranium City, and Camsell Portage, provided their report; An Exploration of Recorded Athabasca Denesųłiné Traditional Knowledge, Land Use and Occupancy Information in the Vicinity of Denison Mines Wheeler River Project, that summarized traditional knowledge and land use and occupancy information collected for various other projects and initiatives and partially documented Athabasca Denesųłiné use in the Project area, although it is not considered as a site-specific study." **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #426)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Acknowledged, edit will be made to the EIS. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 426. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's	Section 3.0 has been updated to reflect edit. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024) YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** YNLR notes that as the Athabasca Denesyłiné were not considered to be an Indigenous COI, the opportunities to contribute to our knowledge to this discussion were diminished or lost. The mis-categorization as the Athabasca Denesyłine am Indigenous Community rather than as an Indigenous COI is a step backwards rather than forwards with regards to reconciliation. A letter to Denison dated July 29, 2022, YNLR critiqued the designations of COI and IC as being artificial and marginalizing. Denison responded October 28, 2022, after the submission of Wheeler River EIS with an alternative view. YNLR has other related comments on the issue. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #427)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison's approach to identifying Indigenous COIs considered several factors as identified in Section 4.3.1 of the EIS. Being signatories of Treaty 10 was among, but not the sole applicable criteria, and not all Treaty 10 communities are considered as Indigenous COIs for the Project. Through continued and focused engagement with the YNLR since the YNLR identified its interest in the Project in 2019, Denison has come to better understand the Athabasca Denesyłiné communities' relationship to the Project site and current use of the areas for traditional purposes. Denison acknowledges that the Hatchet Lake Denesyłiné First Nation has the potential for established Indigenous and Treaty Rights proximal to the Project. The Hatchet Lake Denesyłiné First Nation, as represented by the YNLR will be identified as an Indigenous COI in the revised draft EIS. With respect to Denison's consideration of Indigenous Knowledge shared by the Athabasca Denesyłiné knowledge sources, Denison notes that Tables 3.5-1 will be updated to better reflect where the YNLR's An Exploration of Recorded Athabasca Denesyłiné Traditional Knowledge, Land Use and Occupancy Information in the Vicinity of the Denison Mines Wheeler River Project, which was included as an Appendix to the EIS, was considered and included as Table 3.5-1 does not reflect all instances the report was utilized. With respect to Table 3.5-2, only a limited number of data sources were considered and labelled as Local Knowledge - which is representative of information collected outside of a community-led IK process, key person interviews, or engagement events. As such, there may be limited examples in which knowledge shared constituted local knowledge, and may have been considered as either IK or engagement outcomes. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 427. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's	Denison acknowledges that the Hatchet Lake Denesyłiné First Nation has the potential for established Indigenous and Treaty Rights proximal to the Project. The Hatchet Lake Denesyłiné First Nation, as represented by the YNLR will be identified as an Indigenous COI in the revised draft EIS (for example Section 3, Section 4, and Section 11). Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.				
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR note that project is within Nuhenéné. There is no need to state the southern edge. It could be argued that the Project is on the northern edge of other Indigenous groups areas. Such descriptions have been applied inconsistently to the groups. Territories should be described in an unbiased manner. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #428)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Noted, EIS will be updated accordingly. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 428. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Section 4.0 has been updated to reflect the edit. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR notes that the EIS text on page 4-61 should recognise that this report was a compilation of existing YNLR data from a variety of projects with differing objectives and study areas, and that no research was commissioned. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #429)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Noted, EIS will be updated accordingly. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 429. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's	Section 4.0 has been updated to reflect the edit. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
				comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR believes that the EIS section on page 4-65 referring to the letter sent by Denison dated October 28, 2022 rather than in early October as stated in the draft EIS. Given the draft EIS was submitted to the CNSC on October 24, 2022, four days before Denison responded to YNLR concerns, further opportunity to provide clarifications or specific details for inclusion in the EIS were lost. YNLR does not agree that all our concerns have been addressed in the EIS. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #430)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison understands the EIS involves an iterative process and Denison will continue to engage with YNLR at their direction. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 430. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR notes that the Athabasca Denesyłiné had limited opportunity to contribute to VCs. One community virtual meeting was presented to the Athabasca Denesyłine, while there appears to have been approximately 12 events for other First Nation communities (combined) including workshops, school presentations, meetings (in person and virtual) and open houses (draft EIS section 4). While YNLR appreciate the opportunity to participate and recognize the impacts of Covid-19, the difference between Athabasca Denesyłine participation and other groups is stark. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #431)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** In March 2019, Denison was notified by the YNLR that the Indigenous communities within the local Athabasca communities identified were interested in the Project and that YNLR held the Duty to Consult from these communities. Since receiving correspondence from the YNLR office in 2019 Denison has been collaboratively working with the YNLR office in a mutually agreed upon manner and will continue to do so. Denison understands the EIS involves an iterative process and Denison will continue to engage with YNLR at their direction. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)**	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		There have been no further comments from the YNLR on EIS reference no. 431. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** YNLR notes that the Athabasca Denesųłiné have demonstrated land use in both the local and regional land use as per our report (YNLR 2022). YNLR has reported 371 Athabasca Denesųłine Traditional Land Use and Occupancy data entries within the Denison regional study area. These include 18 points for harvesting of big game, such as barrenground caribou, moose, and woodland caribou, 29 overnight sites, 21 points where birds or eggs such as duck and spruce grouse were harvested. Other activities include furbearer harvesting, fishing, including commercial and tourism related activities such as guiding. A map of these activities is reiterated here. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #432)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Thank you, noted. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 432. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Current use of lands and resources for traditional purposes	**YNLR Comment March 4, 2023** YNLR notes that Denison's understanding of the nature of the 2022 YNLR Report is incomplete. As YNLR noted many times, this report is an amalgamation of known information contained within YNLR's database. It comes from a variety of projects each with differing objectives and geographic scope. It is not a Wheeler River-specific Athabasca Denesųłiné Knowledge, Land Use, and Occupancy (ADKLUO) Study. This, in our opinion, leads to misunderstandings and misrepresentations within the draft EIS. Additional clarifications are that our report is not a Wheeler River-specific TLU study, nor were any such specific works undertaken or commissioned. This is important because it sets the tone for comparisons with other Indigenous groups who have met with Denison far more frequently and conducted far more intensive and focused works.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #433)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Section 11.1.2.4 of the EIS will be updated to reflect the fact that the YNLR's report is an amalgamation of known information from YNLR's database and was not collected explicitly for the purposes of the Project, and as such, should be interpreted by the reader with caution. Section 3.3 of the YNLR's report notes that the comments shared are not geo-located. Without having the locations disclosed, information may have been excluded from Section 11.0 as there was no way to confirm whether those activities overlapped with the spatial boundaries under consideration for potential effects to Indigenous Land and Resources Use. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)**	Section 11 of the EIS has been updated to reflect the edits. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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		Additionally, the limited engagement with did not allow for a shared Athabasca Denesųłine – Denison in- depth exploration of Athabasca Denesųłiné experiences. Using the YNLR Report requires an understanding that the amalgamated information comes from a variety of projects and was collected for a variety of purposes. For example, the report mentions woodland caribou values, tracks, and sightings within the EIS study area. This information comes from various caribou studies and our database records project. information. This information clearly demonstrates that Athabasca Denesųłine members were in the EIS area, that harvesting or other values were not recorded is a function of the purpose of the woodland caribou study rather than an indication that Athabasca Denesųłine do not utilize the area for other traditional purposes. Other such interpretations or misrepresentations exist within the report. Additional engagement with the Athabasca Denesųłiné communities and YNLR could have ensured further clarification. Information from the 2022 YNLR Report Section 3.3 appears to have been disregarded in the draft EIS. This information includes references to activities mentioned during duty-to- consult works for other projects with the LSA. This includes hunting, fishing (including commercial) and the gathering of berries and medicines. The responses also indicate that the land is used for therapeutic purposes, youth gatherings, fish camps and general camping. Further the responses note that areas were utilized year-round for hunting, trapping, and fishing, with activities such as berry picking occurring in summer. Impact concerns raised by the interviewees in included damage to the lands and water, how wildlife will be affected, disruption to traditional activities and accessibility to the areas while projects are ongoing. Surely, this information is relevant to the Wheeler River project and should be included with the EIS? YNLR also indicated to Denison in July 2022 that some of the publicly available information is the draft EIS was misleading and of limited relevance to this project. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.		No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 433. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.		YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR notes that the Map of BQ Caribou Range in draft EIS Section 11.1.3.3.26 is misdated, it should be BQCMB 2012. The original source map is dated 2000, but includes telemetry data from 2012 so is more appropriately dated as 2012.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19,	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Noted, the map included in Section 11.1.3.2.6 (Figure 11.1-5) has been updated to reflect the appropriate date. **Denison Response April 05, 2024 (Response to YNLR Comment March**	The note to the map included in Section 11.1.3.2.6 (Figure 11.1-5) has been updated to reflect the appropriate date. Denison remains committed	Based on Denison's understanding of the concern or comment, Denison has provided background	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
		YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023) No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	2024) (Public Comment #434)	**13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 434. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	to engaging with the YNLR on these concerns.	information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.		
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR notes, as they did previously, that they are unclear what the relevance of including these sources is, since neither the CBEMP nor the Tazi Twé project investigated land use in the Wheeler River area. The March 2022 YNLR compilation report provides clear indications that the Athabasca Denesųłine communities utilize the areas in the vicinity of the Project. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #435)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Noted, Denison provided publicly available information on the Community Based Environmental Monitoring Program and the socio-economic baseline assessment for the Tazi Twé Hydroelectric Project EIS to provide context on recorded harvests in locations close to communities and distant from the Project. Section 11.1.3 further provides context from the YNLR 2022 report and their recorded land use in the vicinity of the Project. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 435. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Section 11.1.3 further provides context from the YNLR 2022 report and their recorded land use in the vicinity of the Project. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)	Status	Justification of Status	Ongoing Resolution of Concerns (if required)
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** YNLR notes that the citations on the EIS page 11-40 are listed as YNLR 2020 and should likely be 2022. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #436)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Noted, the EIS will be updated. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 436. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Reference in Section 11.0 has been updated. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.
Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** Pages 11-94 and 11-95 of the EIS uses the term historic. YNLR notes that the use of the term historic is prejudicial and incorrect. YNLR were assured by Denison that they had removed the term historic during earlier discussions. **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #437)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison has verified that the term 'historic' is not included or referenced on pages 11-94 or 11-95 of the EIS. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 437. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Denison has verified that the term 'historic' is not included or referenced on pages 11-94 or 11-95 of the EIS. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

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Ya'thi Néné Lands and Resources Office	Other	**YNLR Comment March 4, 2023** EIS Page 11-100 third- and fourth-lines states "The YNLR described trapping activity by one of its Athabasca Denesųłiné member at Keefe Lake to the east of the RSA but did nor report any trapping in N-14 (YNLR 2022)." YNLR notes that the reference to trapping in N-14 is perplexing as the Saskatchewan Trappers Association map shows that N-14 is south of the Project area. Further there is a typo: "not" instead of "nor" **YNLR Comment March 13, 2024 (Response to Denison Comment November 22, 2023)** No further response provided by YNLR. **YNLR Comment June 19, 2024 (Response to Denison Comment on April 05, 2024)** YNLR Response: YNLR does not know what Denison means by the phrase 'deemed complete.' YNLR's responses in their letters of 02 February 2024 and 13 March 2024 remain unchanged and YNLR's concerns in those responses remains unaddressed.	YNLR Public Comments (March 4, 2023, March 13, 2024, and June 19, 2024) (Public Comment #438)	**Denison Response November 22, 2023 (Response to YNLR Comment March 4, 2023)** Denison will revise the EIS to correct the typo. **Denison Response April 05, 2024 (Response to YNLR Comment March 13, 2024)** No further response from YNLR. Denison will proceed on the basis that the comment is deemed acceptable and complete by YNLR, unless otherwise advised. **Denison Response June 28, 2024 (Response to YNLR Comment June 19, 2024)** There have been no further comments from the YNLR on EIS reference no. 438. As such, Denson assumes that its responses provided November 2023 are satisfactory and are therefore deemed complete. YNLR responded indicating that the YNLR's comments in letter dated February 02, 2024 and March 13, 2024 remain unchanged and unaddressed. Denison has provided a comprehensive response to each of YNLR's comments in kind and has sought to address YNLR's concerns. Denison has stated its commitment to work with the YNLR and to collaboratively develop monitoring plans. Denison remains committed to engaging with the YNLR on these concerns. As the YNLR has provided no further comments to Denison's responses November 2023, Denison is unclear on how to address the comments in a way that is satisfactory for the YNLR.	Section 11.0 has been updated. Denison remains committed to engaging with the YNLR on these concerns.	Based on Denison's understanding of the concern or comment, Denison has provided background information, a clarification on the assumptions and/or approach undertaken, and has outlined a proposed approach forward to the YNLR to reflect the YNLR's interests. Denison remains committed to engaging with the YNLR to come to resolution.	As per Denison letter to YNLR dated June 28, 2024	Denison remains committed to engaging with the YNLR to come to resolution.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Appendix 4-C: Interests, Issues and Concerns Tables: General Public

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)
Cabin/Lease Owners and Commercial Lodge Operators	Other	Concern about the potential for vandalism of buildings north of Key Lake if the controlled access at Key Lake was removed.	ROC 141 ROC 267	Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate.	N/A
Cabin/Lease Owners and Commercial Lodge Operators	Other	Concern over the aesthetics in the area and how this might be changed with the Project.	ROC 267	The potential effects of the Wheeler River Project on the environment have been comprehensively assessed in the EIS and related supporting documentation. The spatial scale is very small (resulting from ISR mining method) of 160 hectares (for reference, the McIlvenna Bay Project is 1,029 hectares [8 times bigger than Denison's Project]). A conservative approach was taken in the assessment and the overall conclusion was made that there would be no significant adverse residual effects in consideration of proposed mitigations. Potential changes in terms of the aesthetics of the area were captured within the scope of the assessment on Land and Resource Use in terms of the perceived suitability of land and resources therein. Outlined in Sections 11.1.4.5.1 and 11.2.4.5.1, changes may occur due to Project-related disturbances to resource harvesters such as traffic, noise, air quality, changes to the relationship to land, and changes in competition for resources. Potential effects are predicted to begin in Construction, continue through Operation, and cease when reclamation activities have been completed in Decommissioning when Project components are removed, and activities cease. While the Project Area will be restricted to resource users for safety reasons, disturbances in areas very local to the Project Area and along roadways such as local access roads and the Key Lake to McArthur River haul road where Project traffic is operating. Disturbances assessed under this pathway include increases in traffic; noise; changes to air quality, and changes to the relationship with the land. These disturbances are likely to be most detectable during Construction when construction activities are at their peak and decline somewhat in Operation due to acclimatization to the Project, except for traffic, which will increase during Operation.	N/A
Cabin/Lease Owners and Commercial Lodge Operators	Health and socio-economic conditions	Concern over effects to traffic.	ROC 267	Please note that the Project will not change public access to the area. The existing gate on Highway 914 near Cameco's Key Lake Operation will remain in place and no changes to the gate and the process for controlling access to Highway 914 north of the Key Lake Operation are proposed as part of the Wheeler River Project. As described in the draft EIS, workforce members will be transported to/from site via a fly-in/fly-out rotation and will, therefore, not use ground travel options during shift changes. As indicated in Section 2.2.5.2, estimates of traffic are provided by Saskatchewan Ministry of Highways by road segments and are broken down by total traffic and truck traffic. Truck traffic, reported as Truck Annual Average Daily Traffic (TAADT), is a subset of all traffic, which is reported as Annual Average Daily Traffic (AADT). Project-related traffic is associated with transportation of required supplies such as equipment, materials, reagents, food, and fuel. Detail can be found in Appendix 2-B. Refer to draft EIS, Section 12 Quality of Life for the assessment of potential Project effects on the Key Indicator of Infrastructure and Services (traffic) and the associated measurable parameter of change in traffic volumes and types and risk of accident.	N/A
Cabin/Lease Owners and Commercial Lodge Operators	Health and socio-economic conditions	Effects of the Project on recreational/commercial fishing and hunting in the area by Project staff. Effects of overall access to resources being potentially opened up and putting pressure on resources and increased resource use (all varieties). Concern over conflicts with outfitter and cabin users due to the Project (also a safety issue).	ROC 267 ROC 328	Please note that the Project will not change public access to the area. The existing gate on Highway 914 near Cameco's Key Lake Operation will remain in place and no changes to the gate and the process for controlling access to Highway 914 north of the Key Lake Operation are proposed as part of the Wheeler River Project. As described in the draft EIS, workforce members will be transported to/from site via a fly-in/fly-out rotation and will, therefore, not use ground travel options during shift changes, which will eliminate fishing on local lakes during commutes to/from the site and during time off work. Denison site vehicles will not be available for recreational purposes. While at the Project site and off duty, workers may opt to fish local waterbodies. To protect sustainable use of resources, only catch and release of fish will be encouraged, and fish storage or cooking facilities will not be provided. To prevent entry of land users from entering the Project Area, Denison will control access to the property with both a north and south security gate. Overall, given a lack of resources to access fishing locations and store fish harvests, workforce fishing is expected to cause minimal disturbances	Workforce members will be transported to/from site via a fly-in/fly-out rotation and will, therefore, not use ground travel options during shift changes, which will eliminate fishing on local lakes during commutes to/from the site and during time off work. Denison site vehicles will not be available for recreational purposes. While at the Project site and off duty, workers may opt to fish local waterbodies. To protect sustainable use of resources, only catch and release of fish will be encouraged, and fish storage or cooking

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				to local users. Section 11 of the draft EIS provides the assessment of potential Project effects on Indigenous Land and Resource Use (Section 11.1) and Other Land and Resource Use (Section 11.2). The mitigation measures proposed in the aquatic and terrestrial assessments translated into undetectable changes in resource availability to existing and future users and rightsholders. The assessment does not take a distinctions-based approach (i.e., the potential impact on each Indigenous community is not evaluated separately), but rather on the key indicators and associated measurable parameters. Mitigation to eliminate, reduce, or control potential adverse effects of the Project on Indigenous Land and Resource Use would apply to any uses proximal to the Project. Given proven mitigation is to be applied to traffic disturbances, noise, air quality, and increased competition for resources, the effects are expected to be minimal.	facilities will not be provided. To prevent entry of land users from entering the Project Area, Denison will control access to the property with both a north and south security gate.
Cabin/Lease Owners and Commercial Lodge Operators	Health and socio-economic conditions	Concern was shared about the noise from drilling activities.	ROC 328	The predicted sound levels were below the threshold values from the federal and provincial guidelines at all receptor locations, indicating that additional mitigation measures would not be required. The closest sensitive location to the Project is a cabin identified as leased property 302506. While the predicted sound levels were less than the guideline values, the increase from baseline was predicted to be noticeable. Therefore, as a conservative approach, this effect was carried forward as a residual effect and mitigation measures and follow-up monitoring were recommended. Given proven mitigation is to be applied to noise, the effects are expected to be minimal. Sound levels will be monitored on a continuous basis using a calibrated Class 1 sound level meter and data logger, calibrated to a National Institute of Standards and Technology traceable standard within one year of its use in the program, and field calibrated using a Class 1 acoustic calibrator. Where possible, the sound level meters will utilize the same monitoring locations as were used in the baseline program for direct comparison and may be expanded to include the location of the nearest sensitive receptor where access is granted.	Sound levels will be monitored on a continuous basis using a calibrated Class 1 sound level meter and data logger, calibrated to a National Institute of Standards and Technology traceable standard within one year of its use in the program, and field calibrated using a Class 1 acoustic calibrator. Where possible, the sound level meters will utilize the same monitoring locations as were used in the baseline program for direct comparison and may be expanded to include the location of the nearest sensitive receptor where access is granted.
Cabin/Lease Owners and Commercial Lodge Operators	Health and socio-economic conditions	Concern shared about radon	ROC 328	As outlined in Section 3.4.2.2, when the UBS comes to surface, radon gas will naturally migrate out of solution and into the atmosphere. To keep radiation exposure of process plant worker as low as reasonably achievable (ALARA,) a radon purge tank will be used to remove an initial volume of radon before the solution enters the processing plant. A holding area for the UBS will be designed to safely store the UBS on surface prior to processing to allow for a controlled flow of UBS into the plant. As stated in Section 2.9.1.3.2, A Radiation Protection Program would be designed and implemented so that Denison complies with, or exceeds, the level of radiation safety that is required by the relevant regulations pursuant to the Nuclear Safety and Control Act and Denison's Health and Safety Policy. Activities within the program would include implementing a radiation code of practice, measuring and monitoring radiation on an ongoing basis, and reporting radiation testing results to regulators. As summarized in the Worker Health assessment (Section 10.2.3.2.10) potential residual effects to worker health during Construction and Operation are expected to be negligible given that the predicted radiation doses are less than the annual allowable effective dose of 20 mSv/yr, and radon is predicted to be within the range that is manageable under an RPP.	To keep radiation exposure of process plant worker as low as reasonably achievable (ALARA,) a radon purge tank will be used to remove an initial volume of radon before the solution enters the processing plant. A holding area for the UBS will be designed to safely store the UBS on surface prior to processing to allow for a controlled flow of UBS into the plant. Activities within the program would include implementing a radiation code of practice, measuring and monitoring radiation on an ongoing basis, and reporting radiation testing results to regulators.
Commercially Licensed Trappers and Fishers	Current use of lands and resources for traditional purposes	Information shared with knowledge of the area regarding various aspects of wildlife, wildlife movement, fishing activities, and traditional food consumption. Concern with overuse of cutlines and corridors by wolves providing better access to caribou.	ROC 134	An interview with the ERFN Trapper is detailed in ROC134. Information provided during this interview has been incorporated into Section 11 and throughout the EIS. As stated in Section 9.3.5.2, a wildlife monitoring plan and a Woodland Caribou Management Plan will be developed to address wildlife-specific mitigation measures based on proven and accepted mitigation following standard industry guidelines and BMPs. The plans will provide guidance to avoid or minimize potential adverse effects of the Project on wildlife and wildlife habitat, including monitoring and follow-up programs, as appropriate. It will be in place during all phases of the Project and will be subject to ongoing review and revision as required. If monitoring identifies a need for additional or revised mitigation measures, a process of adaptive management (as described in the plan) will be triggered. The Project is located in the SK1 Boreal Shield Woodland Caribou Management Unit, which has low levels of anthropogenic disturbance and was exposed to large fire disturbances in the past 40 years (ECCC 2019). A Woodland Caribou Management Plan consistent with the management goals of SK- 1 Management Unit. The Project management plans provide direction on monitoring and adaptive management so that measures are timely and effective. Mitigation measures specific to the Ungulates, Furbearers, and Woodland Caribou VCs are applicable during all Project phases and expected to be effective following implementation.	A Woodland Caribou Management Plan will be developed to address wildlife-specific mitigation measures based on proven and accepted mitigation

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Commercially Licensed Trappers and Fishers	Other	Concern expressed that removal of the access gate at Key Lake could open up the area to a variety of material effects. Feedback provided on on-site road options.	ROC 134	Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate.	N/A
Commercially Licensed Trappers and Fishers	Current use of lands and resources for traditional purposes	Concern about potential overfishing and effects on commercial fishing and water quality.	ROC 134	Please note that the Project will not change public access to the area. The existing gate on Highway 914 near Cameco's Key Lake Operation will remain in place and no changes to the gate and the process for controlling access to Highway 914 north of the Key Lake Operation are proposed as part of the Wheeler River Project. As described in the draft EIS, workforce members will be transported to/from site via a fly-in/fly-out rotation and will, therefore, not use ground travel options during shift changes, which will eliminate fishing on local lakes during commutes to/from the site and during time off work. Denison site vehicles will not be available for recreational purposes. While at the Project site and off duty, workers may opt to fish local waterbodies. To protect sustainable use of resources, only catch and release of fish will be encouraged, and fish storage or cooking facilities will not be provided. To prevent entry of land users from entering the Project Area, Denison will control access to the property with both a north and south security gate. Overall, given a lack of resources to access fishing locations and store fish harvests, workforce fishing is expected to cause minimal disturbances to local users. Section 11 of the draft EIS provides the assessment of potential Project effects on Indigenous Land and Resource Use (Section 11.1) and Other Land and Resource Use (Section 11.2). The mitigation measures proposed in the aquatic and terrestrial assessments translated into undetectable changes in resource availability to existing and future users and rightsholders. The assessment does not take a distinctions-based approach (i.e., the potential impact on each Indigenous community is not evaluated separately), but rather on the key indicators and associated measurable parameters. Mitigation to eliminate, reduce, or control potential adverse effects of the Project on Indigenous Land and Resource Use would apply to any uses proximal to the Project. Given proven mitigation is to be applied to traffic disturbances, noise, air quality, and increased competition for resources, the effects are expected to be minimal. Potential effects from the Project on surface water quality were comprehensively assessed in Section 8.2 of the draft EIS. The assessment evaluated discharge of treated effluent from the site using predictive modeling. Water treatment will be conducted in the onsite Industrial Waste Water Treatment Plant (IWWTP) and treated effluent will be tested prior to release to Whitefish Lake. Treated effluent that does not meet the effluent discharge criteria in the provincial approval to operate or effluent criteria defined in the Metal and Diamond Mining Effluent Regulations will not be released to Whitefish Lake and will be recirculated to the process water pond for eventual re-treatment in the IWWTP. In the draft EIS, Section 8.2 the predictive modeling showed that constituent concentrations including radionuclides would be below water quality objectives for the protection of aquatic life (i.e., no effects would be expected) at the outlet of Whitefish Lake.	Workforce members will be transported to/from site via a fly-in/fly-out rotation and will, therefore, not use ground travel options during shift changes, which will eliminate fishing on local lakes during commutes to/from the site and during time off work. Denison site vehicles will not be available for recreational purposes. While at the Project site and off duty, workers may opt to fish local waterbodies. To protect sustainable use of resources, only catch and release of fish will be encouraged, and fish storage or cooking facilities will not be provided. To prevent entry of land users from entering the Project Area, Denison will control access to the property with both a north and south security gate. Water treatment will be conducted in the onsite Industrial Waste Water Treatment Plant (IWWTP) and treated effluent will be tested prior to release to Whitefish Lake. Treated effluent that does not meet the effluent discharge criteria in the provincial approval to operate or effluent criteria defined in the Metal and Diamond Mining Effluent Regulations will not be released to Whitefish Lake and will be recirculated to the process water pond for eventual re-treatment in the IWWTP.
Commercially Licensed Trappers and Fishers	Other	Concerns and questions about aspects of the mining process.	ROC 140	Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface. Section 2.2.1.3 provides information on freeze wall technology. The freeze wall is intended for tertiary containment of mining solution to support a defence in depth strategy as additional, site-specific data is obtained on hydraulic containment. The freeze wall around the mining area will extend from the surface to the basement rock, isolating the mining area from regional groundwater. The freeze wall is expected to be a minimum of 10 m thick, be installed 25m away from the uranium deposit, and extend 30 m into the basement rock. Data from the groundwater monitoring network installed in and around the wellfield and freeze wall will make sure the freeze wall is meeting design specifications. Section 2 provides a detailed Project Description.	N/A
Northern Village of Beauval	Other	The community participants provided feedback on the various on-site road options for the Project.	ROC 4	Denison incorporated the feedback provided on road options select the current road alignment for the Project. Information from several engagement meetings with local communities informed the selection of the road alignment proposed in the Project EIS, as documented in Appendix 2-C Alternative Means Assessment.	N/A

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Northern Village of Beauval	Current use of lands and resources for traditional purposes	Concern about drinking water quality post mining.	ROC 4	Consideration of Groundwater as a Potable Water Source is presented in Section 7.1.1.1. At present, groundwater is unsuitable for consumption as it interacts with the uranium ore body, resulting in high levels of uranium. When mining is over, the groundwater will remain unsuitable for consumption. Denison will remediate groundwater to meet acceptable regulatory standards.	Denison will remediate groundwater to meet acceptable regulatory standards.
Northern Village of Beauval	Other	Questions and clarifications on ISR mining methodology.	ROC 4 ROC 619	Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface.	N/A
Northern Village of Beauval	Other	Interest in information about surface water sampling programs.	ROC 4 ROC 619	Surface water quality was sampled during 2016, 2018, and 2019 at lakes and watercourses within the LSA and RSA (Figure 8.2-4 and Appendix 8-D). Sampling at lakes and ponds included the measurement of both physical and chemical parameters obtained in situ during field surveys and by laboratory analysis. Locations of interest for this assessment nodes that are coincident with baseline monitoring stations and/or watersheds of interest to the assessment. Surface water quality along with other study components were sampled at stations SA-1, SA-2, SA-3, SA-4, SA-5, SA-6, SB-3, SB-5, LAB, LB-2, LA-1, LA-5, and LA-6. These stations are located on the Icelander River, McGowan Lake, Whitefish Lake North, Whitefish Lake South, Russell Lake Inlet, near the outlet of Williams Lake as shown in Figure 8.2-	N/A
Northern Village of Beauval	Other	Interest in information about current market conditions and overall viability of the Project.	ROC 107	Denison has identified that there is current and future market demand for uranium, the primary raw material for nuclear fuel generation. The Project can address gaps in annual global uranium supply and the use of uranium in nuclear power plants can contribute to net-zero goals, and this can be achieved while making a meaningful contribution to the Canadian economy. The Project was considered in relation to technical feasibility, economic feasibility, and l and use criteria to determine viability of the Project. See Section 2 for information about Project components and purpose.	N/A
Northern Village of Beauval	Other	Interest in opportunities to invest in the Project.	ROC 107 ROC 116 ROC 132	Denison is a publicly traded uranium exploration and development company with interests focused in the Athabasca Basin region of northern Saskatchewan. The company trades on the Toronto Stock Exchange and NYSE American exchange and is headquartered in Toronto, Ontario, with offices in Saskatoon, Saskatchewan, and Elliot Lake, Ontario.	N/A
Northern Village of Beauval	Current use of lands and resources for traditional purposes	It was noted that development of a TK map for the community had not been undertaken due to funding pressures, but that the traditional territory of the people of Beauval was typically described to reach from Tippo Lake east of Beauval to the Primrose Air Weapons range to the west and north to Patterson Lake area.	ROC 116	Although the Northern Village of Beauval is a municipality and not a Rights-bearing entity, this area of Interest is related to the broader efforts in the area to undergo traditional land use mapping. Within the municipality of the Northern Village of Beauval, is the Sipishik Métis Local. Denison understands that the Métis Knowledge Study, undertaken by MN-S on behalf of the Locals who have delegated the Duty to Consult to it, would be representative of the Sipishik Métis Local #37. As a result, please see information pertaining to Interests, Issues and Concerns in relation to the MN-S and the associated Métis Knowledge Study.	N/A
Northern Village of Beauval	Other	Interest in engagement processes that provide opportunities for direct site tour.	ROC 116 ROC 382	Since 2016, Denison has been engaging with the Northern Village of Beauval in a variety of ways. In some instances, the elected members of the municipality are also officials of Métis Locals and, therefore, represent both their municipality as well as their Indigenous community. As a result, during the onset of engagement activities in 2016, the entities of SML and the NVB had some overlap between each other. In 2019, the SML delegated their Duty to Consult for the Project to the MN-S. Clear distinction between the Métis leadership and Citizens, and the NVP leadership and residents was, therefore, necessary to make sure the MN-S was able to appropriately provide the representation of the Métis of KML, per the delegated Duty to Consult. As a result, Denison distinguished its engagement efforts between MN-S, on behalf of SML, and the general public of the NVB, with no intended overlap in relation to Métis interests. During the engagement activities undertaken with the NVB, several key engagement activities took place that have played a meaningful role in the EA process. These key engagement activities were supported by ongoing engagement methods including, but not limited to, those outlined in Section 4.2.1. The main forms of engagement included meetings with leadership, community meetings, a workshop on early infrastructure options (2018), a site visit (2019), two online surveys (2021 and 2022), and a meeting and information session on preliminary effects and mitigation (2022).	N/A

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)
Northern Village of Beauval	Health and socio-economic conditions	Concern and interest in economic opportunities associated with Project and education and training to facilitate access and participation by community members.	ROC 116 ROC 382 ROC 442 ROC 4 ROC 107 ROC 132 ROC 382	Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.	Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.
Northern Village of Île-à-la-Crosse	Other	Concern was expressed about the quality of surface water and effects of the Project.	ROC 3	Potential effects from the Project on water quality were assessed in Section 8.2 of the EIS and the assessment directly evaluated discharge of effluent from the site using predictive modeling. Water treatment will occur; testing will occur prior to release; and no release will occur if water quality does not meet objectives. The predictive modeling showed that constituent concentrations including radionuclides would be below water quality objectives for the protection of aquatic life (i.e., no effects would be expected) at the outlet of White Lake well upstream of the outflow of the Icelander River to Russel Lake.	Potential effects from the Project on water quality were assessed in Section 8.2 of the EIS and the assessment directly evaluated discharge of effluent from the site using predictive modeling. Water treatment will occur; testing will occur prior to release; and no release will occur if water quality does not meet objectives.
Northern Village of Île-à-la-Crosse	Health and socio-economic conditions	Interest in economic opportunities associated with the Project and benefits for the community.	ROC 3 ROC 109 ROC 436 ROC 443	As outlined in Section 13.4, Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.	As outlined in Section 13.4, Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)
Northern Village of Île-à-la-Crosse	Other	Questions and comments were shared about on-site roads, including possible closure of certain roads, wanting an assessment of the road conditions, wildlife crossings and having monitoring be done by local community guardians.	ROC 3 ROC 109 ROC 436 ROC 443	Appendix 2-C describes the alternative means assessment framework employed and the results of the alternatives assessment for key Project components and activities in detail; this section of the EIS provides a summary of Appendix 2-C. The documentation of this systematic alternative assessment provides transparency and traceability with respect to decision making on Project design. It also documents how input received by Indigenous groups and other Interested Parties has been considered in the design/planning process.	N/A
Northern Village of Île-à-la-Crosse	Other	Concerns and questions were asked about groundwater, including sampling, presence of mercury, water quality, presence of aquifers, and the process to monitor the groundwater.	ROC 3 ROC 109 ROC 343	Consideration of Groundwater as a Potable Water Source is presented in Section 7.1.1.1. At present, groundwater is unsuitable for consumption as it interacts with the uranium ore body, resulting in high levels of uranium. When mining is over, the groundwater will remain unsuitable for consumption. Denison will remediate groundwater to meet acceptable regulatory standards. Groundwater monitoring wells will be installed at various depths and locations in and around the wellfield, as outlined in Section 2.2.1.5. The monitoring wells have a variety of purposes including groundwater sample collection, measurement of groundwater levels, and detection of changes in pressure and temperature in the groundwater environment. A detailed groundwater monitoring program will be developed as component of the environmental management system as part of the licensing and permitting process.	Groundwater monitoring wells will be installed at various depths and locations in and around the wellfield, as outlined in Section 2.2.1.5.
Northern Village of Île-à-la-Crosse	Current use of lands and resources for traditional purposes	Information shared about a land use framework that all communities would undergo—including the mapping of traditional land use. It was further noted that the community has one partially completed (in 2018) An interest was expressed in having the cultural side of climate change come together alongside the science.	ROC 3 ROC 115	Although the Northern Village of Ile a la Crosse is a municipality and not a Rights-bearing entity, this area of Interest is related to the broader efforts in the area to undergo traditional land use mapping. Within the municipality of the Northern Village of Ile a la Crosse, is the A La Baie Métis Local. Denison received the Métis Knowledge Study from the MN-S on October 24, 2023. Denison will update the final EIS to include relevant information in the assessment from the Métis Knowledge Study.	Denison has updated the final EIS to include relevant information in the assessment from the Métis Knowledge Study (see Sections 4, 11, 12, and 13).
Northern Village of Île-à-la-Crosse	Health and socio-economic conditions	Interest in having opportunities for capacity building and local training through partnerships with schools and colleges nearby, job opportunities, and business contractor opportunities.	ROC 3 ROC 441 ROC 443 ROC 109 ROC 119 ROC 439 ROC 436	As outlined in Section 13.4, Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.	As outlined in Section 13.4, Denison, through a Human Resource Development Plan, will initially prioritize Indigenous and non-Indigenous communities in the LSA in terms of employment and training opportunities (anticipated to be in institutions in northern Saskatchewan) and will work with the leadership of these communities to assist in determining hiring and training practices during all phases of the Project, which could include such items as on-the-job training and career counselling to help with advancement from foundational positions, advance sharing of job qualification requirements, clearly identifying training requirements and working with various training institutions to make sure such appropriate training is available, and creation of scholarship and support programs. Denison will negotiate with the Province of Saskatchewan to develop the Project's SLA and the Human Resource Development Agreement, which will outline measures in relation to socio-economic parameters related to the Project.
Northern Village of Île-à-la-Crosse	Other	The community provided the pros and cons on longhole stope, directional drilling and ISR mining options.	ROC 3 ROC 443	Appendix 2-C describes the alternative means assessment framework employed and the results of the alternatives assessment for key Project components and activities in detail; this section of the EIS provides a summary of Appendix 2-C. The documentation of this systematic alternative assessment provides transparency and traceability with respect to decision making on Project design. It also documents how input received by Indigenous groups and other Interested Parties has been considered in the design/planning process.	N/A

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)
Northern Village of Île-à-la-Crosse	Health and socio-economic conditions	Questions were asked about hauling of products, what routes would be used and concern over radioactivity.	ROC 3 ROC 443	The yellowcake will be transported in industrial containers, in accordance with the Transportation of Dangerous Goods Act. Project-related truck traffic during Construction and Operation (such as surface construction equipment, materials, and drill rigs) is expected to originate from Saskatoon or other southern locations. Project-related traffic originating from the west may travel through Beauval via Highway 165, whereas traffic from the south and east may access Highway 165 via Highway 2. Traffic from Saskatoon would likely use Highway 11 to Prince Albert and Highway 55 to Beauval, then travel via Highway 165. Highways are under the authority of the Saskatchewan Ministry of Highways. As stated in Section 2.9.1.3.2, A Radiation Protection Program would be designed and implemented so that Denison complies with, or exceeds, the level of radiation safety that is required by the relevant regulations pursuant to the Nuclear Safety and Control Act and Denison's Health and Safety Policy. Activities within the program would include implementing a radiation code of practice, measuring and monitoring radiation on an ongoing basis, and reporting radiation testing results to regulators. As summarized in the Worker Health assessment (Section 10.2.3.2.10) potential residual effects to worker health during Construction and Operation are expected to be negligible given that the predicted radiation doses are less than the annual allowable effective dose of 20 mSv/yr, and radon is predicted to be within the range that is manageable under an RPP.	The yellowcake will be transported in industrial containers, in accordance with the Transportation of Dangerous Goods Act.
Northern Village of Île-à-la-Crosse	Other	Concerns were raised about wildlife transects crossing the road, migration routes, and critical habitat affected by the Project.	ROC 3 ROC 443	Refer to Section 9.3 of the assessment for detail on ungulates, furbearers, and woodland caribou. The main activities considered in the effects assessment include site preparation (i.e., clearing, grading and construction of roads, airstrip, and surface infrastructure), operation (i.e., vehicle movement, material handling), water management (i.e., withdrawal/use of surface and/or groundwater and release of effluent), waste management (i.e., temporary storage, handling, and off-site transportation), and reclamation (i.e., progressive and final reclamation of disturbed areas). Mitigation measures were designed to avoid or minimize potential effects and include Project design measures (Section 9.3.5.2) and additional wildlife-specific mitigation measures (Section 9.3.5.2). As such, the residual effects of alteration and/or loss of available habitat and of change in mortality are not expected to result in a change that will alter habitat integrity to the point where it would not be able to sustain the regional ungulate populations or the integrity of the regional moose, woodland caribou, or furbearer population to the point where it could not be sustained.	Mitigation measures were designed to avoid or minimize potential effects and include Project design measures (Section 9.3.5.2) and additional wildlife-specific mitigation measures (Section 9.3.5.2).
Northern Village of Île-à-la-Crosse	Other	Community feedback was provided on treated effluent discharge options. Concern was expressed over water treatment and effects of ISR mining on water quality.	ROC 3 ROC 443	Appendix 2-C describes the alternative means assessment framework employed and the results of the alternatives assessment for key Project components and activities in detail; this section of the EIS provides a summary of Appendix 2-C. The documentation of this systematic alternative assessment provides transparency and traceability with respect to decision making on Project design. It also documents how input received by Indigenous groups and other Interested Parties has been considered in the design/planning process. Potential effects from the Project on water quality were assessed in Section 8.2 of the EIS and the assessment directly evaluated discharge of effluent from the site using predictive modeling. Water treatment will occur; testing will occur prior to release; and no release will occur if water quality does not meet objectives. The predictive modeling showed that constituent concentrations including radionuclides would be below water quality objectives for the protection of aquatic life (i.e., no effects would be expected) at the outlet of White Lake well upstream of the outflow of the Icelander River to Russel Lake.	Potential effects from the Project on water quality were assessed in Section 8.2 of the EIS and the assessment directly evaluated discharge of effluent from the site using predictive modeling. Water treatment will occur; testing will occur prior to release; and no release will occur if water quality does not meet objectives.
Northern Village of Île-à-la-Crosse	Other	Interest in information on which communities had been consulted and provided feedback on the types of virtual consultation methods the community would prefer.	ROC 109 ROC 115	Denison understands the importance of engaging with local and Indigenous communities, residents, businesses, organizations, land users and the various regulatory authorities. Since 2016, Denison has been engaging with Interested Parties to support the development of positive relationships and a mutual commitment to collaboration. Interested Parties are further categorized into three broad groups: Indigenous Groups, General Public, and Regulatory Agencies, each with several sub-categories (more fully described in Sections 4.3 and 4.4). Denison's engagement activities with Interested Parties have been designed to meet their expectations while	N/A

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)
				complying with both federal and provincial regulatory legislation. Engagement is defined as the sharing and gathering of project-related information from Interested Parties, and the collaboration with Interested Parties in a good faith effort with the goal of developing mutually acceptable resolutions to issues identified. The development of relationships with Interested Parties is a fundamental determinant of the Project's success. Denison has applied a variety of methods to support engagement activities throughout the engagement process and used different methods with various groups depending on requirements and preferences of the process. Engagement methods have included in-person, remote (audio only, virtual, and digital), and print. Engagement activities for the Project can and will evolve over time, as information is gathered that is pertinent to Denison's understanding of the Interested Parties and their relationship to, and interest in, the Project.	
Northern Village of Île-à-la-Crosse	Other	Questions were asked about the sustainability of the Project in view of protection of people's interests, and what would the Project leave as a legacy for the people.	ROC 443	The purpose of the Project is to construct and operate an ISR uranium mine and processing plant to provide a uranium supply necessary to meet existing and increasing global demand for nuclear power generation. Facilitating global growth in nuclear through environmentally sustainable uranium exports positions Canada and the Province of Saskatchewan to not only help Canada meet its climate change objectives, but to support numerous nations around the world to do the same. Denison recognizes the thriving culture and deep-rooted traditions of northern Saskatchewan communities and their aspirations of achieving economic growth and prosperity. Denison strives to achieve the development of the Project through positive partnerships with Communities of Interest, integrating information from Indigenous and non-Indigenous Interested Parties, and maintaining high standards for environmental protection and worker safety.	N/A
Northern Village of Île-à-la-Crosse	Other	Interest in information on consideration of CNSC in the EA and review process and the timeline. Interest in review process of Draft EIS in relation to the regulatory process.	ROC 443 ROC 109	Section 1.7 provides information in relation to the regulatory framework. The provincial and federal EA processes for the Project will be conducted in parallel. The Saskatchewan Ministry of Environment's Environmental Assessment and Stewardship Branch and the CNSC will cooperate in conducting a coordinated provincial-federal EA that will follow the spirit of the Canada-Saskatchewan Agreement on Environmental Assessment Cooperation (2005; Government of Canada 2016) to the extent possible. The agreement allows for cooperation in the assessment of projects that require regulation by both levels of government. The cooperation agreement allows for the production of a single EIS that meets the requirements of both levels of government, such that each level of government can make an independent decision on the approval of the EIS.	N/A
Northern Village of Île-à-la-Crosse	Other	Questions and clarifications on ISR mining methodology, Project components, and construction schedule.	ROC 1 ROC 3 ROC 109 ROC 443 ROC 439	Various components and activities are required to support the ISR mining and processing activities. Details are provided in Section 2.2 and include infrastructure and systems for water management, waste management, site access and transportation, power, heating, and other support features, such as a camp. Section 2.2.1 provides information on the ISR mining method. The ISR mining method uses a water-based solution, fortified with mining reagents, to dissolve naturally occurring uranium from within a host rock, while the host rock remains in place (in situ) below surface. Section 2.3 provides a list of activities that will occur at each Project phase, including the Construction phase between years 1 and 3. The sequence for Construction activities will occur in a logical manner based on Project execution plans. As one example, Denison will prioritize bringing power into the site, allowing the freeze plant operation to start early in the construction process and the Phase 1 freeze wall can be established. More detail can be found in Section 2.3.1.	N/A
Organizations	Other	NSEQC asked about there being a committee choosing the route and length. Concerns were expressed over the highway extensions affecting hunting, fishing, and caribou migration.	ROC 39 ROC 112	Project and activities that were considered reasonably foreseeable and may be a source of residual effects that could interact with residual effects of the Project were identified through a literature review, database review, discussion with Indigenous groups, and discussion with local communities and review by the EIS team and Denison. The Highway 914 extension was considered within the CEA for the Valued Components, as seen in Section 5.9.2. For a summary of cumulative and residual effects on VCs, see Section 16.	N/A
Organizations	Other	Interest and clarification about baseline study guidance and terms of reference.	ROC 112	Section 1 describes the regulatory framework of the Project and Section 5 describes the approach and methodology of the assessment. See Section 1 and Section 5 for further details.	N/A

Indigenous Nation, Métis Local, Community, or Organization	Key Topics	Summary of the Issue, Interest, or Concern	Reference	How Comment was Addressed/Considered by Denison	Changes made to Final EIS / Commitment (Mitigation Measure, Monitoring or Other) (or N/A)
Organizations	Other	Interest and question with consideration for milling at Key Lake.	ROC 112	Refer to Appendix 2-C for the consideration of off-site processing as part of the Alternative Means Assessment.	N/A
Organizations	Other	Groundwater monitoring in relation to post-freeze wall.	ROC 648	The conceptual decommissioning plan, outlined in Section 2.3.3, highlights that remediation of the mining area will continue until water reached and is demonstrated to be stabilized at acceptable mining area decommissioning objectives as set out in regulatory requirements. Additional detail will be provided in the preliminary decommissioning plan (PDP), which will be submitted to regulators as part of Project licensing and permitting. Prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan, that builds upon the PDP, to regulators for acceptance. A Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and licence conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met.	Prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan, that builds upon the preliminary decommissioning plan, to regulators for acceptance. A Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and licence conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met.
Organizations	Other	Interest in grade and nature of uranium in relation to potential for acid-generation.	ROC 648	As stated in Section 2.2.1.1, the Project proposes to use the ISR method to mine uranium from the Phoenix uranium deposit. The deposit is a high-grade (average grade 19% uranium ore concentrate [i.e., triuranium octoxide or U3O8]) with approximately 70.2 million pounds (Mlbs) of U3O8. The recovery of uranium from the UBS obtained in the wellfield will be undertaken in a two-stage precipitation process outlined in Section 2.2.2. The two-stage process creates a low-grade uranium precipitate and a concentrated uranium product known as yellowcake. Denison's processing plans are based on numerous metallurgical tests completed as part of engineering activities. A detailed metallurgical testing program was developed and implemented in collaboration with the Saskatchewan Research Council (SRC) under the supervision of several third- party consultants and Denison. Around 1,000 L of UBS was produced by leaching over 64 kg of core samples recovered from the Phoenix deposit and the UBS produced was tested using variations of several parameters to define the processing plant design and its components.	N/A

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Appendix 6-A
Air Quality Technical Supporting Document
Denison Mines Corp. – Wheeler River Project

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APPENDICES

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1.0 INTRODUCTION

This technical report is supplementary to the discussion of the air quality assessment provided in the main body of the Environmental Impact Statement (EIS) report (Section 6 – Atmospheric and Acoustic Environment). The purpose of this supplemental report is to provide additional technical details on the air quality assessment methodology, including an overview of the assessment scenarios, source identification and emissions calculations, air dispersion modelling methods, and modelling outputs.

2.0 ASSESSMENT SCENARIOS

The Wheeler River Project (the Project) will be completed in four phases: construction, operation, decommissioning, and post-decommissioning. As the nature of operations in each phase differs, the assessment scenarios were developed with consideration to each of these phases to effectively bound the potential effects of the Project over its entire life cycle. As the post-decommissioning phase is effectively a period of monitoring, the air emissions have been assumed to be negligible and bounded by the other phases. The activities to be completed in the construction, operations and decommissioning phases are discussed in general terms below. The methods for characterizing the sources and the emission rates for each identified activities are discussed in Section 3.0 and 4.0, respectively.

2.1 CONSTRUCTION SCENARIO

The Construction scenario was based on the general activities associated with construction, assuming activities occur 24 hours per day. For the purposes of the air quality assessment, the Construction scenario considered the following activities occurring concurrently:

- Site preparation and earthworks occurring at various locations around site,
- Wellfield and freeze hole drilling,
- Deposit of drill cuttings in the clean waste rock pad and special waste pad,
- Surface infrastructure construction (e.g., camp, operations centre, etc.),
- Batch plant operation (i.e., concrete production),
- On-site and off-site operation of vehicles/equipment and transport of materials,
- Comfort heat provided by propane heaters,
- Power supplied by two (2) 1.1 MW generator sets operating near the freeze plant, and four (4) portable generator sets,
- Borrow area development, and
- Waste management (composting, domestic and industrial landfill operation, recycling).

For the purposes of bounding the air quality assessment, it was also assumed that wellfield pump tests may occur toward the end of the construction phase. The above construction activities and wellfield pump tests are not likely occur concurrently, but for the purposes of developing a conservative emissions scenario, it has been assumed it as such. The detailed source inventory for the Construction scenario is discussed in Section 3.0, and the approach to the characterization of each source is discussed in Section 4.1.

2.2 OPERATIONS SCENARIO

The Operations scenario was based on activities being completed in the late stages of the operations phase, with work being completed in Phase 5 of the mine plan with a recovered solution flow rate of 30 cubic metres per hour (m^3/h). During this stage, wellfield drilling is anticipated to continue, and all facilities are assumed to be fully operational. For the purposes of the air quality assessment, the general activities included in the Operations scenario are:

- Full operation of the wellfield and ISR processing plant,
- Full operation of the freeze plant,
- Wellfield and freeze hole drilling,
- Storage and disposal of drill waste rock, process precipitates and industrial wastewater treatment plant precipitates in their designated storage areas,
- Shipping of yellowcake product,
- Batch plant operation, mainly for cement needs,
- On-site and off-site operation of vehicles/equipment and transport of materials,
- Grading/maintenance of roads,
- Comfort heat provided by propane heaters,
- Backup power supplied by two (2) 1.1 MW generators operating near the freeze plant, two (2) 450 kW generator sets operating near the administration building and permanent camp, and two (2) portable generators,
- Water treatment in the industrial wastewater treatment plant, and
- Waste management (composting, domestic and industrial landfill operation, recycling).

During operations, the site will be connected to the provincial power supply but will occasionally require backup power from the installed generator sets. To assess worst-case 1-hour NOx, CO, and SO_2 emissions from the generators, an emissions scenario was assessed whereby all generators operate simultaneously. However, on an average annual basis, one (1) 1.1 MW generator was assumed to operate for two hours a day, while the portable generator sets were assumed to operate for 12 hours a day.

The detailed source inventory for the Operations scenario is discussed in Section 3.0, and approach to the characterization of each source is discussed in Section 4.2.

2.3 DECOMMISSIONING SCENARIO

Activities during the decommissioning period that may impact air quality include remediation works at the contaminated areas (e.g., wellfield, waste pads, processing plant area), and general site activity including use of equipment/vehicles. For the purposes of the air quality assessment, the general activities included in the Decommissioning scenario are:

- Ongoing water treatment in the industrial wastewater treatment plant,
- Wellfield restoration,
- Remediation of contaminated areas (wellfield, pads, ponds),
- On-site and off-site operation of vehicles/equipment and transport of materials,
- Grading/maintenance of roads, and

- Backup power supplied by one (1) 1.1 MW generator operating near the freeze plant, and four (4) portable generators.

It is important to note that the above decommissioning activities may not occur concurrently, but for the purposes of developing a conservative emissions scenario, it has been assumed it as such. The detailed source inventory for the Decommissioning scenario is discussed in Section 3.0, and approach to the characterization of each source are discussed in Section 4.3.

3.0 SOURCES OF AIR EMISSIONS

The sources of contaminants of potential concern (COPC) identified in Section 6.1.1.2 of EIS report are discussed in the following sections. Acrolein emissions from diesel combustion were also evaluated using a quantitative screening analysis but were determined to be negligible and not considered a COPC. The screening analysis is detailed in Appendix D of this report.

3.1 SOURCES OF PARTICULATE MATTER

Fugitive dust is particulate matter (i.e., total suspended particulate [TSP], particulate less than 10 microns [PM_{10}], and particulate less than 2.5 microns [$PM_{2.5}$]) emitted from sources other than point sources (i.e., stacks). A source of fugitive dust at the Project site is unpaved roads. Emissions from unpaved roads were calculated using emission factors from U.S. EPA AP-42 Chapter 13.2.2 [1], based on the anticipated road traffic volumes and traffic fleet, and the silt content of the roads. To control road dust during summer (May to October), water and/or chemical dust suppressant will be applied to all site roads, which was assumed to mitigate these emissions by 70% [2]. In the winter months (November to April), natural mitigation from snow/ice can control unpaved road dust by up to 90% [3]. Additionally, vehicle speeds at the Project site will be limited to 30 kilometres per hour (km/h) along the site haul roads, which will reduce the amount of road dust generated [4]. The roads are also maintained during the summer months using a grader, which is a lesser source of particulate matter along the roads. Particulate emissions for the grader were estimated using emission factors from U.S. EPA AP-42 Chapter 11.9 [5].

During the construction phase, general construction activities, like clearing, grubbing, and building construction will also be a source of fugitive dust. Emissions from general construction activities were based on emission factors from U.S. EPA AP-42 Chapter 13.2.3 [6] and Western Regional Air Partnership (WRAP) guidance [4]. In the summer months, water will be used to control dust emissions from construction activities. Based on guidance from WRAP, watering is assumed to mitigate construction dust by 50% [4]. Note that emissions from the concrete batch plant have been calculated separately from general construction emissions using emission factors from U.S. EPA AP-42 Chapter 11.12 [7] and the expected concrete production rates.

Another source of fugitive dust expected to be present during each phase of the Project is wind erosion. When winds are strong, erodible fines (i.e., small particles) can be picked up and dispersed by the wind. Wind erosion was assessed using WRAP emission factors [4] at locations where there is expected to be exposed, erodible material, including the landfill sites, the borrow area, and the clean and special waste pads. For short-term averaging periods (i.e., 24-hour), the emissions were assumed to be uncontrolled in the summer where no watering is expected (the landfills and the borrow pit), or by 50% where watering is expected (the waste pads).

For the winter periods and the annual averaging periods, natural controls were applied of 90% in winter (per above), and 47% in summer (based on the number of days with rainfall calculated from CALMET).

Fugitive dust from material handling has also been assessed, including the handling of well cuttings from the wellfield, placement of material at the waste pads, and collection and placement of material from the borrow pit to various locations (e.g., construction site, landfill). Handling emissions were estimated based on U.S. EPA AP-42 Chapters 13.2.4 and 11.19.2 [8] [9]. Short-term emissions assumed no controls, while average annual emissions utilized natural controls, as described above.

Other sources of fugitive dust include dozing at the wellfield and waste pads during the decommissioning phase only. Dozing during the construction phase is already accounted for in the general construction emissions and not calculated separately. Drilling in the wellfield will occur during the construction and operations phases, and emissions have been calculated using Environment and Climate Change Canada (ECCC) guidance [10] and the anticipated maximum number of holes to be drilled per year. Filling of the lime silo is expected to occur during the operations and construction phases, and dust emissions have been estimated using U.S. EPA emission factors from AP-42 Chapter 11.19.2 [9].

Additional sources of particulate matter include various combustion sources at the site, such as the diesel generators, the propane heaters, and diesel and gasoline combustion associated with construction equipment and vehicles utilizing the on-site roads. The ISR calciner, dryer, and hygiene scrubber stacks will also emit particulate matter in the form of yellowcake. Emissions for combustion sources were estimated using emission factors from U.S. EPA AP-42 [11] [12] [13] and diesel generator manufacturer data. Emissions of particulate matter from the ISR stacks were based expected emissions from pre-feasibility engineering design documents [14].

3.2 Sources of Metals

Metals were assumed to be emitted as a fraction of TSP. The fraction of metals emitted from a particular source is dependent upon on the composition of the parent material (e.g., special waste, etc.). The compositions of the various sources used in this assessment are discussed in Appendix A. Sources of metal releases for this assessment included emissions from wellfield drilling in mineralized areas, wind erosion from the special waste pad, material handling at the wellfield and special waste pad, and stack emissions from the ISR Plant (the dryer, calciner, and hygiene scrubber stacks).

3.3 Sources of NOx, SO_2 and CO

Combustion of diesel, gasoline, or propane fuel results in emissions of gaseous contaminants including nitrogen oxides (NOx), sulphur dioxide (SO_2) and carbon monoxide (CO). Sources of diesel combustion include the standby diesel generators, off-road mobile equipment (e.g., dozer, grader, drill rigs), and vehicles such as haul trucks, transport, and shipping trucks. Gasoline combustion is from on-site vehicles such as the crew vans and pick-up trucks, while propane is generally combusted for heating of the various on-site facilities. The emissions from these sources were estimated using the same U.S. EPA AP-42 documents as referenced for the calculation of particulate emissions from combustion.

3.4 SOURCES OF RADON

During the Construction and Operations scenarios, radon gas (Rn-222) will be released during wellfield drilling from radium-bearing ore cuttings and when groundwater containing dissolved radon gas is exposed to the atmosphere. During Operations, radon released from the ore body is removed by the mining solution moving through the production wellfield and radon gas will be released to the atmosphere wherever the mining solution is vented. In the case of the Project, a portion of the radon is expected to be released in the wellfield from occasional venting from the wellheads and leaking transport piping. But, majority of the radon gas will be released to air when the uranium rich solution arrives at the recovered solution surge tank, where it will be vented to the atmosphere. Minor amounts of radon gas will also be released at the uranium rich solution holding area, and from the processing plant ventilation. Areas storing radium-bearing materials, such as the special waste and process precipitates storage pads, will passively emit radon gas.

As described in Section 2.1, well field pump tests were assumed to be conducted toward the end of the construction and included in the air emissions inventory. As detailed in Appendix A, six months of pump tests were conservatively assumed for the Construction scenario.

Radon is released during Decommissioning from well field restoration. The mechanisms of restoration are similar to wellfield production, therefore, the radon sources (wellheads, recovered solution surge tank, etc. are the same). In the ISR plant, radon is also expected from contaminated materials that remain in the plant. Radon gas will also be emitted from any radium-bearing materials being reclaimed during Decommissioning. Details are provided in Appendix A.

U.S. NRC and IAEA methods were the primary methods used to estimate radon gas emissions [15] [16] [17].

4.0 SUMMARY OF AIR EMISSION RATES

Emission rates for the COPC were estimated for each of three assessment scenarios described in Section 2.0. In accordance with Saskatchewan Ministry of the Environment (SaskMoE) air quality modelling guidance [18], emission inventories were developed to capture the maximum or worst-case emission rates for each of the scenarios. In addition, each assessment scenario included two emissions scenarios representing different averaging periods so that the model results could be compared to the Project air quality criteria summarized in Section 6.1.1.2.4 of the EIS. These included:

- A short-term emissions scenario (e.g., 24-hour), which considers emissions from all Project sources on a worst-case day. For example, this might be a day when the power supply from the SaskPower grid is unavailable, and all the on-site diesel generators must operate to support the continued operation of the site. The short-term scenario also does not consider natural sources of dust mitigation (e.g., rain).
- An average annual emissions scenario, which considers emissions from all Project sources over an entire year. Although this scenario is still conservative (e.g., based on maximum annual production rates), emission rates are intended to be more reflective of the typical operating case. For example, emissions from the generators are based on the expected number of annual operating hours, and natural sources of dust mitigation such as rainfall are included.

To develop the above emissions inventories, assumptions were made in the calculations that have resulted in conservative emissions estimates. For example, the emission sources were assumed to operate concurrently at their individual maximum rates of production to estimate the worst-case emission rates in each of the scenarios. In reality, production rates will vary on a day-to-day basis and some activities may not actually occur simultaneously. However, this approach provides an upper bound estimate of air emissions for the assessment scenario and helps to ensure that the predicted COPC concentrations reflect the concurrence of maximum emission rates with worst-case meteorological conditions. Other assumptions that resulted in conservative emissions estimates are detailed in the emissions calculations provided in Appendix A.

Summaries of the calculated emission rates for each phase are provided in the following sections. Note that for some sources, like unpaved roads, emissions of particulate matter vary between summer (May to October) and winter (November to April) to account for differences in dust mitigation levels. In general, dust emissions were considered to be 90% controlled in the winter months.

4.1 CONSTRUCTION SCENARIO

A summary of the maximum short-term emission rates for the Construction scenario is provided in Table 1 along with the average annual radon emission rates. The maximum site-wide emission rate of TSP occurs in the summer and is estimated to be 26.4 g/s. This is largely driven by the unpaved road dust emissions, which totals to 19.7 g/s, or 74.6% of the site-wide TSP emissions. The next highest contribution is from general construction activities, which totals 6.2 g/s, or 23.5% of site wide TSP emissions. These sources together therefore account for 98.1% of the TSP emissions from the site during construction. The maximum site-wide emissions of PM_{10} and $PM_{2.5}$ also occur in the summer and are estimated to be 8.13 g/s and 1.06 g/s, respectively. Like TSP, PM_{10} emissions are dominated by unpaved roads and general construction emissions. These two sources combine to make up 95.4% of the total PM_{10} emissions from the site. For $PM_{2.5}$, the unpaved roads and construction activity sources make up 73.1% of the total $PM_{2.5}$ emissions from the site, with the diesel generators contributing an additional 22.8% (i.e., 95.9% of $PM_{2.5}$ emissions from these three sources).

The maximum gaseous emissions are estimated to be 9.4 g/s for NOx, 7.0E-03 g/s for SO_2, and 1.64 g/s for CO. Short-term NOx emissions are dominated by the diesel generators (84.7% of the total site-wide NOx emissions), with off-road mobile equipment contributing an additional 15.1% (i.e., 99.8% of site-wide NOx emissions are from the diesel generators and off-road mobile equipment). The SO_2 emissions from the generators represent 75.4% of the site-wide SO_2 emissions, while emissions of CO from the generators represent 73.8% of the site-wide CO emissions.

Radon was assessed on an annual basis for the Construction scenario. The total annual site-wide radon emissions are estimated to be 1.47E+06 Bq/s. The main contributing sources to site-wide radon emissions is the recovered solution surge tank (8.0E+05 Bq/s, or 54.4%) and the wellfield area (6.61E+05, or 45.0%), which account for 99.4% of the site-wide radon releases. The other sources of radon releases during construction include the special waste storage pad and the core shack.

4.2 OPERATIONS SCENARIO

A summary of the maximum short-term emission rates for the Operations scenario is provided in Table 2 along with the average annual radon emission rates. The maximum site-wide emission rate of TSP during operations

occurs in the summer and is estimated to be 15.4 g/s. As with construction, the TSP emissions are largely dominated by dust from vehicle travel on unpaved roads, which makes up 94.2% of the site-wide TSP emissions. The overall lower TSP emissions (and higher percentage attributable to road dust) is due to the construction source no longer being active. While other sources of TSP are introduced in this scenario (e.g., additional wind erosion sources, process stack emissions), the contributions are not as significant as the construction source with respect to dust emissions. Similarly, site wide emissions of PM_{10} (totalling 4.67 g/s in the summer) are also driven largely by unpaved road sources (4.21 g/s, or 90.1%). With regard to $PM_{2.5}$, the unpaved road dust sources make up only 54.5% of the total site-wide emissions (4.21E-01 g/s out of the total of 7.76E-01 g/s). The operation of the diesel generators makes up an additional 26.8% of the total $PM_{2.5}$ site-wide releases, and another 13.7% is estimated to be from the hygiene scrubber stack at the ISR plant.

Maximum short-term gaseous emission rates during the Operations scenario are estimated to be 10.0 g/s for NOx, 8.23E-03 g/s for SO_2, and 1.70 g/s for CO. As with the construction emissions, these were largely attributable to the diesel generators and fuel combustion in off-road mobile equipment.

The total annual site-wide emissions of radon during the Operations scenario are estimated to be 1.42E+07 Bq/s. The source with the highest radon emission rate is the recovered solution surge tank, which accounts for 70% of the site-wide radon emissions during operations (9.95E+06 Bq/s). Emissions from the special waste pad are estimated to be the next most significant source, with emissions of 3.25E+06 Bq/s or 22.9% of the total site-wide radon emissions. Other sources of radon emissions in the Operations scenario include the wellfield, the recovered mining solution pond, the ISR plant, and the process precipitates storage area.

4.3 DECOMMISSIONING SCENARIO

A summary of the maximum short-term emission rates for the decommissioning phase is provided in Table 3 along with the average annual radon emission rates. The maximum short-term site-wide emission rate of TSP during decommissioning occurs in the summer and is estimated to be 11.9 g/s. As with previous phases, this is dominated by the generation of dust from use of unpaved roads. This source makes up 10.4 g/s of the total site-wide TSP emissions, or 87.4%. This is similar for PM_{10}, for which the unpaved road dust emission rate of 2.95 g/s makes up 82.2% of the total PM10 emission rate (3.59 g/s). The site-wide (short-term) total $PM_{2.5}$ emissions are 6.69E-01 g/s, of which 2.95E-01 g/s, or 44.1% is estimated to be comprised of road dust. Another 36.2% is estimated to be from the diesel generators.

Maximum short-term gaseous emission rates during the decommissioning phase are estimated to be 9.0 g/s for NOx, 6.53E-03 g/s for SO_2, and 1.64 g/s for CO. As with the other phases discussed in previous sections, these were largely attributable to the diesel generators and fuel combustion from off-road mobile equipment.

The total annual site-wide emissions of radon during the operations phase are estimated to be 9.32E+06 Bq/s. The source with the maximum radon emissions is estimated to be the recovered solution surge tank (8.26E+06 Bq/s, or 88.6% of the total), followed by the wellfield (1.00E+6 Bq/s, or 10.7% of the total). Other sources of radon emissions in the decommissioning phase included the process precipitates storage pad, the ISR plant, special waste pad, the recovered solution pond, and the gypsum pond.

Table 1: Construction Emissions Summary (Summer Rates)

Model ID	Description	Maximum Short-Term Emissions (g/s)																		Annual Emissions (Bq/s)
		TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NOx	As	Cd	Co	Cu	Pb	Mo	Ni	Se	U	Vn	Zn	Cr	Rn
HWY914	Highway 914 (5 km)	7.38	2.10	0.21	0.00	2.73E-06	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
ACCESS	Project access road	4.39	1.25	0.13	0.01	1.20E-05	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE1	Project site road 1	1.34	0.38	0.04	0.01	1.13E-05	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE2	Project site road 2	2.73	0.78	0.08	0.04	8.28E-05	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE3	Project site road 3	4.12	1.18	0.12	0.01	1.12E-05	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
BATCH [1]	Batch plant operation (concrete); crusher at borrow area	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONST	Construction (general)	6.27	2.24	0.29	0.54	1.87E-03	2.05	7.97E-07	9.56E-08	4.69E-07	2.34E-05	2.43E-05	9.46E-07	1.26E-06	2.18E-07	5.90E-04	2.47E-06	8.03E-06	7.32E-07	6.70E+05
GEN1	Generator 1 (1.1 MW)	0.10	0.10	0.10	0.53	2.53E-03	3.66	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN2	Generator 2 (1.1 MW)	0.10	0.10	0.10	0.53	2.53E-03	3.66	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN3	Generator 3 (450 kW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN4	Generator 4 (450 kW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFL	Domestic land fill	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFLC	Construction waste laydown area	0.01	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RN_TANK	Recovered solution surge tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.00E+05
	Total	**26.43**	**8.13**	**1.06**	**1.67**	**7.05E-03**	**9.43**	**5.35E-07**	**6.42E-08**	**3.15E-07**	**1.57E-05**	**1.63E-05**	**6.35E-07**	**8.45E-07**	**1.47E-07**	**3.96E-04**	**1.66E-06**	**5.39E-06**	**4.91E-07**	**1.47E+06**

Notes:
[1] Emissions captured in the general construction model source (CONST)

Table 2: Operations Emissions Summary (Summer Rates)

Model ID	Description	Maximum Short-Term Emissions (g/s)																		Annual Emissions (Bq/s)
		TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NOx	As	Cd	Co	Cu	Pb	Mo	Ni	Se	U	Vn	Zn	Cr	Rn
HWY914	Highway 914 (5 km)	6.50	1.85	0.18	1.32E-03	2.27E-07	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
ACCESS	Project access road	3.88	1.11	0.11	2.17E-02	6.94E-05	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE1	Project site road 1	1.05	0.30	0.03	9.49E-03	2.02E-05	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE2	Project site road 2	1.25	0.36	0.04	1.02E-02	2.31E-05	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE3	Project site road 3	2.09	0.60	0.06	3.39E-02	8.39E-05	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0
BATCH	Batch plant	0.00	0.00	0.00	7.18E-04	1.12E-07	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
ISR	ISR general ventilation	0.01	0.01	0.01	1.40E-01	4.79E-05	0.25	0	0	0	0	0	0	0	0	0	0	0	0	2.28E+04
STORAGE	Storage area (propane)	0.00	0.00	0.00	2.13E-02	7.87E-05	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0
PH5	Wellfield Phase 5	0.02	0.02	0.02	1.35E-01	5.53E-04	0.60	8.74E-07	1.05E-07	5.14E-07	2.56E-05	2.66E-05	1.04E-06	1.38E-06	2.39E-07	6.47E-04	2.71E-06	8.80E-06	8.02E-07	9.15E+05
CAMP	Camp (propane)	0.00	0.00	0.00	4.22E-02	1.30E-04	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0
PUMP	Pumphouse (propane)	0.00	0.00	0.00	1.42E-04	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
FREEZE	Freeze plant	0.00	0.00	0.00	2.36E-03	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
OPS	Admin bldg. (propane)	0.00	0.00	0.00	2.43E-03	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBSTN	Substation (propane)	0.00	0.00	0.00	1.58E-04	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
AIRPORT	Airport bldg. (propane)	0.00	0.00	0.00	4.40E-04	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN1	Generator 1 (1.1 MW)	0.10	0.10	0.10	5.33E-01	2.53E-03	3.66	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN2	Generator 2 (1.1 MW)	0.10	0.10	0.10	5.33E-01	2.53E-03	3.66	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN3	Generator 3 (450 kW)	0	0	0	1.01E-01	7.52E-04	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN4	Generator 4 (450 kW)	0	0	0	1.01E-01	7.52E-04	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFL	Domestic landfill	0.02	0.01	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFLC	Construction waste laydown area	0.01	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFLCN	Industrial landfill	0.01	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BORROW	Borrow area	0.13	0.06	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FE_RA	Process precipitates pad	0.04	0.02	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.73E+04
SWPAD	Special waste pad	0.02	0.01	0.00	0	0	0	5.22E-06	6.26E-07	3.07E-06	1.53E-04	1.59E-04	6.20E-06	8.24E-06	1.43E-06	3.87E-03	1.62E-05	5.26E-05	7.97E-06	3.25E+06
CWPAD	Clean waste pad	0.02	0.01	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIME	Lime silo	0.01	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1	Dryer scrubber stack	0.00	0.00	0.00	0	0	0	4.32E-11	1.20E-09	5.88E-09	2.93E-07	3.05E-07	4.32E-11	1.58E-08	2.74E-09	1.84E-05	3.09E-08	1.01E-07	1.53E-08	0
S2	Calciner scrubber stack	0.00	0.00	0.00	0	6.70E-04	0	3.62E-10	1.00E-08	4.92E-08	2.45E-06	2.55E-06	3.62E-10	1.32E-07	2.29E-08	1.54E-04	2.59E-07	8.41E-07	1.28E-07	0
S3	Hygiene scrubber stack	0.11	0.11	0.11	0	0	0	1.50E-07	4.15E-06	2.04E-05	1.02E-03	1.06E-03	1.50E-07	5.46E-05	9.48E-06	6.36E-02	1.07E-04	3.48E-04	5.29E-05	0
S4	Calciner burner stack	0.00	0.00	0.00	8.80E-03	0	0.02	0	0	0	0	0	0	0	0	0	0	0	7.94E-06	0
CORE	Core shack ventilation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.43E+02
UBS	Recovered mining solution pond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.94E+04
RN_TANK	Recovered solution surge tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.95E+06
GYPSUM	Gypsum pad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.05E+03
	Total	**15.36**	**4.67**	**0.78**	**1.70**	**8.23E-03**	**10.05**	**6.25E-06**	**4.89E-06**	**2.40E-05**	**1.20E-03**	**1.24E-03**	**7.38E-06**	**6.44E-05**	**1.12E-05**	**6.83E-02**	**1.26E-04**	**4.11E-04**	**6.98E-05**	**1.42E+07**

Table 3: Decommissioning Emissions Summary (Summer Rates)

Model ID	Description	Maximum Short-Term Emissions (g/s)																		Annual Emissions (Bq/s)
		TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NOx	As	Cd	Co	Cu	Pb	Mo	Ni	Se	U	Vn	Zn	Cr	Rn
HWY914	Highway 914 (5 km)	1.87	0.53	0.05	3.81E-04	6.54E-08	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
ACCESS	Project access road	1.21	0.35	0.04	1.35E-02	4.75E-05	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE1	Project site road 1	0.79	0.22	0.02	8.24E-03	1.63E-05	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE2	Project site road 2	1.87	0.53	0.05	3.51E-02	8.15E-05	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0
SITE3	Project site road 3	4.95	1.41	0.14	2.89E-02	6.45E-05	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0
BATCH	Batch plant	0.00	0.00	0.00	2.15E-03	3.35E-07	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
ISR	ISR general ventilation	0.00	0.00	0.00	6.96E-02	8.86E-05	0.14	0	0	0	0	0	0	0	0	0	0	0	0	1.14E+04
STORAGE	Storage area (propane)	0.00	0.00	0.00	2.64E-02	9.74E-05	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0
PH5	Wellfield Phase 5	0.45	0.16	0.10	2.81E-01	6.95E-04	1.02	0	0	0	0	0	0	0	0	0	0	0	0	1.00E+06
CAMP	Camp (propane)	0.00	0.00	0.00	5.36E-02	1.73E-04	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0
PUMP	Pumphouse (propane)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FREEZE	Freeze plant	0.00	0.00	0.00	2.36E-03	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
OPS	Admin bldg. (propane)	0.00	0.00	0.00	2.43E-03	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBSTN	Substation (propane)	0.00	0.00	0.00	1.58E-04	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
AIRPORT	Airport bldg. (propane)	0.00	0.00	0.00	4.40E-04	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN1	Generator 1 (1.1 MW)	0.10	0.10	0.10	5.33E-01	2.53E-03	3.66	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN2	Generator 2 (1.1 MW)	0.10	0.10	0.10	5.33E-01	2.53E-03	3.66	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN3	Generator 3 (450 kW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GEN4	Generator 4 (450 kW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFL	Domestic landfill	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFLC	Construction waste laydown area	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LNDFLCN	Industrial landfill	0.01	0.00	0.00	0	0	0	7.67E-09	9.19E-10	4.51E-09	2.25E-07	2.34E-07	9.10E-09	1.21E-08	2.10E-09	5.67E-06	2.38E-08	7.72E-08	7.03E-09	0
BORROW	Borrow area	0.13	0.06	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FE_RA	Process precipitates pad	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.66E+03
SWPAD	Special waste pad	0.00	0.00	0.00	0	0	0	5.27E-07	6.32E-08	3.10E-07	1.55E-05	1.61E-05	6.25E-07	8.32E-07	1.44E-07	3.90E-04	1.64E-06	5.30E-06	8.01E-07	8.22E+03
CWPAD	Clean waste pad	0.39	0.10	0.04	4.94E-02	2.08E-04	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0
LIME	Lime silo	0.01	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1	Dryer scrubber stack	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S2	Calciner scrubber stack	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S3	Hygiene scrubber stack	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S4	Calciner burner stack	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CORE	Core shack ventilation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UBS	Recovered mining solution pond	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.94E+04
RN_TANK	Recovered solution surge tank	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.26E+06
GYPSUM	Gypsum pad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.05E+03
	Total	**11.89**	**3.59**	**0.67**	**1.64**	**6.53E-03**	**9.03**	**5.35E-07**	**6.41E-08**	**3.15E-07**	**1.57E-05**	**1.63E-05**	**6.34E-07**	**8.44E-07**	**1.46E-07**	**3.96E-04**	**1.66E-06**	**5.38E-06**	**8.08E-07**	**9.32E+06**

5.0 AIR DISPERSION MODEL

Air dispersion modelling was performed using CALPUFF (version 7), which is an advanced three-dimensional (3-D) dispersion model. While the Saskatchewan Air Quality Modelling Guideline identifies that AERMOD is used for most assessments in Saskatchewan, Section 3.3 of the guideline does allow for the use of more sophisticated models, including CALPUFF, where justified [18]. CALPUFF was selected for this assessment primarily because of its ability to model long range transport in the large Study Area and to maintain consistency with dispersion modelling assessments completed for other nuclear facilities in northern Saskatchewan. CALPUFF also includes wet and dry removal processes and chemical transformation algorithms that are needed to generate inputs for the Terrestrial Environment and Human Health assessments. CALPUFF can also manage multiple emission sources and COPC within a single model run, which creates efficiencies for the assessment and enables detailed study of complex operating scenarios (see Section 2.0). An overview of the modelling approach is described below, while details are provided in Appendix B.

5.1 CALMET

To overcome the limited meteorological observing record in the Project Study Areas, a meteorological data set was generated using the Weather Research Forecast Non-Hydrostatic Mesoscale Model (WRF-NMM), which was run for one year, 2016. The approach was discussed with and agreed to by staff at the SaskMoE [19]. 2016 was selected in conjunction with the SaskMoE so that they could compare the CALMET model results to their AERMOD-ready regional meteorological data set applicable to the Project Study Areas.

WRF-NMM was run in hindcast mode and initialised using North American Mesoscale Forecast System (NAM) analyses available from the U.S. National Centre for Environmental Prediction (NCEP). The NAM analyses assimilate meteorological observations (e.g., land surface measurements, radiosonde, etc.) and are available every six hours at a 12 kilometre (km) horizontal grid resolution. WRF-NMM uses the NAM analyses as both the initial conditions and boundary conditions within the model and updates these values every 24 hours and six hours, respectively.

The WRF-NMM model was run using a grid spacing of four kilometres to better resolve meteorological features within the Project Study Areas. The outputs from WRF-NMM were used to generate a 3D.DAT file to input to the CALMET model. The CALMET model (version 6.5) was then run in “NOOBS” mode 1, which used a combination of data from the 3D.DAT file and Key Lake observations for the surface data, and upper air data from the 3D.DAT file. Two CALMET runs were completed: one for a 60 km by 60 km domain having a horizontal grid spacing of one kilometre; and one for a 20 km by 20 km domain having a horizontal grid spacing of 200 metres (m). This approach was necessary to reduce model run times and to generate reasonably sized CALMET output files for input to CALPUFF. Details of the CALMET modelling are provided in Appendix B.

5.2 CALPUFF

The emission sources described in Section 3.0 were parameterized in the CALPUFF model using either area sources, volume sources, or point sources, the details of which are provided in Appendix B. Using the CALMET data set, CALPUFF was run for each individual source with a unit emission rates (i.e., 1 g/s). Using the post-processing tool POSTUTIL and the emission rates described in Section 4.0, concentrations and deposition

rates were determined for each COPC at each receptor location included in the model. For this assessment, a nested receptor grid with the following spacing was used in CALPUFF:

a) 50 m spacing in a 2 km by 2 km box, centred approximately on the Project Area,
b) 250 m spacing in a 5 km by 5 km box and outside of the area described in (a),
c) 500 m spacing in a 10 km by 10 km box and outside of the area described in (b),
d) 1,000 m spacing in a 20 km by 20 km area and outside of the area described in (c), and
e) 2,000 m spacing in a 40 km by 40 km area and outside of the area described in (d).

In addition to the nested model grid, receptors were placed every 50 m along the Property Boundary, and road receptors were placed parallel to the unpaved roads at distances of 50 m, 150 m, and 250 m from the road edge at a spacing of 200 m. In addition, 16 receptors were included for the for the human health and ecological risk assessment (HHERA) and the worker exposure assessment. The UTM coordinates of these discrete receptors are provided in Table 4, while the full receptor grid is illustrated graphically in Appendix B.

Although receptors inside of the Property Boundary were modelled, they were not considered when assessing the model results against the Project criteria in accordance with the Saskatchewan Air Quality Modelling Guideline [18].

Table 4: Discrete Receptor Locations in CALPUFF

ID	Receptor Type	Description	UTM Coordinates	
			X (m)	X (m)
WE1	Worker exposure	ISR Plant	477122	6374321
WE2	Worker exposure	Special waste pad	477342	6374486
WE3	Worker exposure	Industrial landfill	476829	6375006
WE4	Worker exposure	Process precipitates storage pad	477115	6374492
WE5	Worker exposure	Wash bay/scanning facility	477087	6374079
WE6	Worker exposure	Fe disposal wellfield	477486	6374846
WE7	Worker exposure	Wellfield boundary 1	476721	6373937
WE8	Worker exposure	Wellfield boundary 2	476777	6373864
WE9	Worker exposure	Wellfield boundary 3	477043	6374042
WE10	Worker exposure	Wellfield boundary 4	477001	6374109
WE11	Worker exposure	Freeze plant	477012	6374211
Risk1	Risk	Ecological on-site	477708	6374351
Risk2	Risk	Human Location – Seasonal Resident at McGowan Lake	478245	6372039
Risk3	Risk	Human Location - Camp Worker	476896	6373487
Risk4	Risk	Human Location - Seasonal Resident at Russell Lake	478415	6368289
Risk5	Risk	Reference Receptor Location	473146	6375099

Notes:
The locations of the receptors are in UTM coordinates in metres relative to the NAD83 datum (Zone 13N).

6.0 SUMMARY OF MODELLING RESULTS

Results of the air dispersion modelling are presented in Section 6.1 (Construction), Section 6.2 (Operations), and Section 6.3 (Decommissioning). The overall maximum predicted COPC concentrations outside of the Project Property Boundary are presented in tabular format. For traceability, predicted COPC concentrations for the HHERA and worker exposure receptors are summarized in tabular format in Appendix C; however, the effects of the predicted concentrations on human and ecological health are assessed in the Human Health and Terrestrial Environment reports under separate cover. Contour plots have also been created for those COPC that have applicable provincial or federal air quality standards or criteria, as well as radon. Contour plots of uranium and metals were only created if the maximum predicted concentration was greater than 5% of the applicable Project criteria. As a result, contour plots are limited to uranium in this report.

As previously discussed, the SaskMoE requires that background COPC concentrations be added to modelled concentrations before comparing the results to the Project criteria. As a result, predicted COPC concentrations presented in the Tables and Figures of this report are ***total*** concentrations (i.e., modelled + background). As discussed in Section 6.1.3.5 of the EIS, the provincial background value for SO_2 is zero; therefore, predicted concentrations for SO_2 are incremental. The model results for radon have also been presented as incremental concentrations since background concentrations are used to provide context for the results (see Section 6.1.1.2.3 of the EIS).

For refined air dispersion modelling assessments, the Saskatchewan Air Quality Modelling Guideline [18] allows for the elimination of the top n^{th} highest concentrations predicted at each receptor location to lessen the influence of “rare and unusual” meteorological conditions on the model-predicted concentrations. Therefore, when comparing modelled concentrations to Project criteria, meteorological anomalies were removed in this assessment, as follows:

- The top eight concentrations for those COPC with 1-hour air quality standards were eliminated, and
- The top concentration for those COPC with 8-hour or 24-hour air quality standards were eliminated.

As discussed in Section 4.0, the emission rates used in the modelling were conservatively based on maximum production rates expected to occur in each of the Project assessment scenarios. Actual emissions of COPC from Project activities are expected to be less than the emission rates considered in this assessment most of the time. As such, this dispersion modelling assessment represents an upper bound case for Project activities to ensure that the predicted COPC concentrations reflect the concurrence of maximum emission rates with adverse meteorological conditions. This conservative approach is expected to adequately capture the potential maximum effects from any year of construction, operations, or decommissioning in the current Project schedule. Given these considerations and the multiple levels of conservativism built into the assessment, it is expected that actual air concentrations of COPC due to the Project will be lower than those predicted by the model and discussed in the proceeding sections.

6.1 CONSTRUCTION SCENARIO

The Construction scenario represents the three-year construction phase of the Project, and considered activities like earthworks, building construction, freeze hole drilling, and field pump tests. Table 5 presents the overall,

off-property maximum COPC concentrations (including background concentrations) predicted for this scenario, while concentration isopleths are provided graphically in Figures 1 through 17.

6.1.1 Particulate Matter

Model predicted concentrations of TSP, PM_{10}, $PM_{2.5}$ and dustfall (including background) for the Construction scenario are provided in Table 5 for the maximum off-property receptor and contour plots for particulate matter and dustfall are provided in Figure 1 through Figure 6. As shown in the Table and Figures, maximum 24-hour concentrations of TSP and PM_{10} are predicted to be above the Project criteria at some off-property locations in the LSA, while dustfall, annual TSP concentrations, and 24-hour and annual $PM_{2.5}$ concentrations are below the Project criteria throughout the LSA. The overall, off-property maximum concentrations of 24-hour TSP, and PM_{10} are 313.3 µg/m³ and 116.2 µg/m³, respectively, or 313% and 242% of the Project criteria.

Figure 1 shows that the maximum predicted 24-hour concentrations of TSP are above the Project criteria along a small section of the northwest Property Boundary and at locations outside of the site around Highway 914, with the overall maximum occurring at a receptor next to the Highway. Figures 1 and 2 also show that the isopleths of 24-hour and annual TSP concentrations closely follow the shape of the roadways, indicating that one of the largest contributors to TSP concentrations is unpaved road dust. Concentrations are also elevated around the centre of the Project Area, showing the influence of dust from earthworks activities during construction.

Isopleths of predicted 24-hour PM_{10} concentrations (Figure 4) and dustfall (Figure 3) have a similar pattern to TSP, illustrating that unpaved road dust and earthworks activities also influence PM_{10} and dustfall during construction. As shown in Figure 5, the concentration isopleths of 24-hour $PM_{2.5}$ also have a similar pattern to TSP, illustrating that unpaved road dust influences $PM_{2.5}$ concentrations during construction. However, concentrations of $PM_{2.5}$ are elevated near the standby generators, reflecting emissions of fine particulate matter from diesel combustion.

6.1.2 Gaseous COPC

The predicted incremental concentrations of combustion gases (CO, SO_2, and NO_2) associated with Project construction are provided in Table 5 for the maximum off-property receptor. Contour plots for these COPC are provided in Figure 7 through Figure 14. As discussed in Section 6.1.3.2.5 of the EIS, background SO_2 concentrations are zero, therefore, predicted concentrations of SO_2 are presented as incremental concentrations (i.e., without the addition of background).

As shown in Table 5 and the Figures, no exceedances of the Project criteria for CO or SO_2 are predicted at any receptor location. 24-hour and annual NO_2 concentrations are also predicted to be below the Project criteria outside of the Property Boundary. However, the predicted 1-hour NO_2 concentrations are above the applicable Project criteria of 79 µg/m³ at some off-property receptors in the LSA (Figure 12).

The overall maximum off-property 1-hour NO_2 concentration is 176.5 µg/m³ (or 224% of the Project criteria) and occurs at a receptor that is located approximately 220 m from the northwest Property Boundary (see Figure 12). Figures 12 to 14 also show that NO_2 concentrations are highest near the centre of the Project Area, where the diesel generators will be located, indicating that the largest contributor to NO_2 concentrations during construction is on-site power generation.

6.1.3 Uranium and Metals

The predicted incremental concentrations of uranium and metals associated with Project construction are provided in Table 5 for the maximum off-property receptor. As the Table shows, predicted concentrations of uranium and metals are all below their applicable Project criteria throughout the LSA. Only uranium has predicted concentrations that are greater than 5% of the Project criteria. The maximum off-property uranium concentration is 8.75E-03 µg/m³ or 6% of the Project criteria for 24-hours, and 1.00E-03 µg/m³ or 3% of the Project criteria for the annual averaging period. As a result, only contour plots for uranium are presented for the Construction scenario.

Figure 15 and Figure 16 show that the contours of uranium are elevated near the ore zone, with the maxima occurring at northwest property boundary receptors. This pattern shows the influence of drilling and handling drill cuttings in the wellfield area during construction.

6.1.4 Radon

The predicted incremental concentrations radon associated with Project construction are provided in Table 5 for the maximum off-property receptor. Annual radon concentrations during construction are predicted to be low and well below the range of background concentrations (<7.4 to 25 Bq/m³) reported by the Canadian Nuclear Safety Commission (CNSC) [20]. The predicted radon concentration at the maximum off-property receptor is 1.1 Bq/m³.

Like uranium, Figure 17 shows that annual radon concentrations are highest near the ore zone reflecting emissions from wellfield development (i.e., drilling), as well as pump tests. The contour plot also shows that radon concentrations drop off quickly with distance from the Project site - within approximately 1 km of the Project Boundary, concentrations are predicted to be less than 0.5 Bq/m³.

Table 5: Model Predicted COPC Concentrations for the Construction Scenario

COPC		Time Averaging Period	Units	Project AQ Criteria	Background Conc.	Maximum Off-Property Location				
						Max Predicted Conc.	% Of Criteria	Predicted No. of Exceedances	Location of Max Conc.	
									UTM X (km)	UTM Y (km)
Particulate	TSP	24-hour	µg/m³	100	46.2	**313.3**	**313%**	**104 days per year**	477.809	6369.081
		Annual	µg/m³	60	12.4	25.9	43%	n/a	478.087	6369.414
	PM_{10}	24-hour	µg/m³	50	23.1	**116.2**	**232%**	**61 days per year**	478.087	6369.414
	$PM_{2.5}$	24-hour	µg/m³	27	6.5	16.3	60%	0	478.087	6369.414
		Annual	µg/m³	8.8	3.1	3.6	41%	n/a	478.087	6369.414
	Dustfall	30-Day	mg/cm²/30 days	2	0.06	0.19	9%	0	477.286	6368.111
Gases	CO	1-hour	µg/m³	15,000	575	614.7	4%	0	475.995	6375.539
		8-hour	µg/m³	6,000	575	596.0	10%	0	476.185	6375.316
	SO_2	1-hour	µg/m³	170	0	1.71E-01	0%	0	475.995	6375.539
		24-hour	µg/m³	125	0	3.55E-02	0%	0	476.406	6375.735
		Annual	µg/m³	10	0	3.29E-03	0%	n/a	477.981	6373.810
	NO_2	1-hour	µg/m³	79	11.3	**176.5**	**224%**	**28 hours per year**	475.995	6375.539
		24-hour	µg/m³	200	9.4	42.9	21%	0	476.406	6375.735
		Annual	µg/m³	23	3.8	6.8	30%	n/a	477.981	6373.810
Metals and Radon	As	24-hour	µg/m³	0.3	3.00E-03	3.01E-03	1%	0	476.094	6374.966
	Cd	24-hour	µg/m³	0.025	2.77E-04	2.78E-04	1%	0	476.094	6374.966
		Annual	µg/m³	0.005	7.44E-05	7.45E-05	1%	n/a	476.090	6374.922
	Co	24-hour	µg/m³	0.1	2.63E-03	2.64E-03	3%	0	476.094	6374.966
	Cr	24-hour	µg/m³	0.5	5.54E-04	5.62E-04	0%	0	476.094	6374.966
	Cu	24-hour	µg/m³	50	3.29E-01	3.29E-01	1%	0	476.094	6374.966
	Mo	24-hour	µg/m³	120	2.68E-03	2.69E-03	0%	0	476.094	6374.966
	Ni	24-hour	µg/m³	0.2	2.00E-03	2.01E-03	1%	0	476.094	6374.966
		Annual	µg/m³	0.04	4.00E-04	4.01E-04	1%	n/a	476.090	6374.922
	Pb	24-hour	µg/m³	0.5	1.62E-02	1.64E-02	3%	0	476.094	6374.966

COPC		Time Averaging Period	Units	Project AQ Criteria	Background Conc.	Maximum Off-Property Location				
						Max Predicted Conc.	% Of Criteria	Predicted No. of Exceedances	Location of Max Conc.	
									UTM X (km)	UTM Y (km)
Metals and Radon	Pb	30 days	µg/m³	0.2	6.24E-03	6.27E-03	3%	0	476.087	6374.878
	Se	24-hour	µg/m³	10	8.03E-04	8.05E-04	0%	0	476.094	6374.966
	U	24-hour	µg/m³	0.15	3.00E-03	8.75E-03	6%	0	476.094	6374.966
		Annual	µg/m³	0.03	6.00E-04	1.00E-03	3%	n/a	476.090	6374.922
	Vn	24-hour	µg/m³	2	5.31E-03	5.34E-03	0%	0	476.094	6374.966
	Zn	24-hour	µg/m³	120	1.13E+00	1.13	1%	0	476.094	6374.966
	Rn-222	Annual	Bq/m³	n/a	n/a	1.12	n/a	n/a	476.098	6375.011

Notes:
[1] **Bold** values indicate predicted concentrations that are above the Project criteria.
[2) Predicted concentrations are presented after removal of meteorological anomalies.
[3) The locations of the maximum predicted concentrations are listed in UTM coordinates in kilometres relative to the NAD83 datum (Zone 13N).
[4) Results include the addition of background air concentrations where available.
[5) n/a – not applicable

6.2 OPERATIONS SCENARIO

The Operations scenario represents a conservative, upper-bound emissions scenario based on work being completed in Phase 5 of mine plan and a recovered solution flow rate of 30 m^3/h. Table 6 presents the overall, off-property maximum COPC concentrations (including background concentrations) predicted for this scenario, while concentration isopleths are also provided graphically in Figures 18 through 34.

6.2.1 Particulate Matter

Model predicted concentrations of TSP, PM_{10}, $PM_{2.5}$, and dustfall (including background) for the Operations scenario are provided in Table 6 for the maximum off-property receptor. Contour plots for particulate matter concentrations and dustfall are also provided in Figure 18 through Figure 23. As shown in Table 6, 24-hour concentrations of TSP and PM_{10} are predicted to be above the Project criteria at the maximum off-property receptor. The maximum off-property concentrations of 24-hour TSP and PM_{10} are 281.2 $\mu g/m^3$ and 103.8 $\mu g/m^3$, respectively or 281% and 208% of the Project criteria. Figure 18 shows that 24-hour TSP concentrations closely follow the shape of the roadways, with exceedances of the Project criteria occurring at off-property receptors located along Highway 914. This pattern indicates that one of the largest contributors to TSP concentrations is unpaved road dust. Isopleths of predicted 24-hour PM_{10} (Figure 21) have a similar pattern to TSP, illustrating that unpaved road dust is also a main contributor to PM_{10} concentrations during the Operations scenario.

Annual TSP concentrations, 30-day dustfall rates, and 24-hour and annual $PM_{2.5}$ concentrations are below the Project criteria at the maximum off-property receptor. Isopleths of dustfall (Figure 20) have a similar pattern to TSP, illustrating that unpaved road dust also influences dustfall during operations. The concentration isopleths of 24-hour $PM_{2.5}$ (Figure 22) also follow the shape of the roadways, illustrating that unpaved road dust influences $PM_{2.5}$ concentrations. However, concentrations of 24-hour $PM_{2.5}$ are elevated around the standby generators at the freeze plant, reflecting emissions of fine particulate matter from diesel combustion.

Compared to the Construction scenario, particulate matter levels are lower in the Operations scenario, which is expected given that site-wide emission rates of particulate matter are reduced relative to the Construction scenario (see Section 4.0). The reduction is more pronounced at receptors near the Project Area since dust-generating earthworks activities have ceased, and little fugitive dust is produced by the ISR process. Since traffic is similar between the two scenarios, there is only a small reduction in road dust emissions along Highway 914 and the overall maximum 24-hour TSP and PM_{10} concentrations predicted near the Highway are similar as a result.

6.2.2 Gaseous COPC

The predicted incremental concentrations of combustion gases (CO, SO_2, and NO_2) associated with operations are provided in Table 6 for the maximum off-property receptor. Contour plots for these COPC are provided in Figure 24 through Figure 31. As mentioned earlier, background SO_2 concentrations are zero; therefore, predicted concentrations of SO_2 are presented as incremental concentrations (i.e., without the addition of background; see Section 6.1.3.2.5 of the EIS).

As shown in the Table and the Figures, no exceedances of the Project criteria for CO or SO_2 are predicted at any receptor location. 24-hour and annual NO_2 concentrations are also predicted to be below the Project criteria outside of the Property Boundary. However, the predicted 1-hour NO_2 concentrations are above the applicable Project criteria of 79 µg/m³ at some off-property receptors in the LSA (Figure 29).

The overall maximum off-property 1-hour NO_2 concentration is 177.7 µg/m³ (or 225% of the Project criteria) and occurs at a receptor that is located approximately 260 m from the northwest Property Boundary (see Figure 29). Figure 29 and Figure 30 illustrate how short-term NO_2 concentrations are elevated where the standby diesel generators will be located – at the freeze plant, near the worker camp, and near the operations building.

Compared to the Construction scenario, 1- and 24-hour NO_2 concentrations for the Operations scenario are similar at the maximum off-property receptor location since both scenarios assessed worst-case conditions where power is not available from the grid (see Section 2.0).

6.2.3 Uranium and Metals

The predicted concentrations of uranium and metals (i.e., including background) associated with Project operations are provided in Table 6 for the maximum off-property receptor. The Table shows that predicted concentrations of all metals are below their applicable Project criteria at the maximum off-property receptor. Annual uranium concentrations are predicted to be below the Project criteria at the maximum off-property; however, 24-hour uranium concentrations are predicted to exceed the Project criteria at the maximum off-property receptor.

The maximum off-property uranium concentration predicted for the Operations scenario is 2.23E-01 µg/m³ for 24-hours or 148% of the Project criteria, and 1.87E-02 µg/m³ for an annual averaging period or 62% of the Project criteria. Compared to the Construction scenario, uranium concentrations are two orders of magnitude higher, which is explained by uranium emissions from the ISR plant (see Section 4.0). The influence of the ISR plant on uranium concentrations is illustrated in Figure 32 and Figure 33, which show how the contours of uranium are elevated within the Project Area near the ISR plant, with the maxima occurring at a Property Boundary receptor located downwind of the plant.

6.2.4 Radon

The predicted incremental concentrations radon associated with Project operations are provided in Table 6 for the maximum off-property receptor. Compared to the Construction scenario, annual radon concentrations are predicted to be about 10 times higher at off-property receptor locations, which is primarily explained by emissions from wellfield operations, particularly the recovered solution surge tank (see Section 4.0). Although concentrations have increased, the maximum off-property concentration is within the range of background concentrations (<7.4 to 25 Bq/m³) reported by the CNSC [20]. The radon concentration predicted at the maximum off-property receptor is 13.8 Bq/m³.

Figure 34 shows that annual radon concentrations are highest near the recovered solution surge tank, with the overall maximum concentration occurring downwind from this primary emission source. Radon concentrations then drop off quickly with distance from the Project site and within 1 km of the Project Boundary, concentrations are predicted to be less than 5 Bq/m³.

Table 6: Model Predicted COPC Concentrations for the Operations Scenario

COPC		Time Averaging Period	Units	Project AQ Criteria	Background Conc.	Maximum Off-Property Location				
						Max Predicted Conc.	% Of Criteria	Predicted No. of Exceedances	Location of Max Conc.	
									UTM X (km)	UTM Y (km)
Particulate	TSP	24-hour	µg/m³	100	46.2	**281.2**	**281%**	**80 days per year**	477.809	6369.081
		Annual	µg/m³	60	12.4	18.8	31%	n/a	478.087	6369.414
	PM_{10}	24-hour	µg/m³	50	23.1	**103.8**	**208%**	**42 days per year**	478.087	6369.414
	$PM_{2.5}$	24-hour	µg/m³	27	6.5	15.0	55%	0	478.087	6369.414
		Annual	µg/m³	8.8	3.1	3.3	38%	n/a	478.087	6369.414
	Dustfall	30-Day	mg/cm²/30 days	2	0.06	0.12	6%	0	477.286	6368.111
Gases	CO	1-hour	µg/m³	15,000	575	614.2	4%	0	475.995	6375.539
		8-hour	µg/m³	6,000	575	596.2	10%	0	476.245	6375.789
	SO_2	1-hour	µg/m³	170	0	1.72E-01	0%	0	476.646	6375.539
		24-hour	µg/m³	125	0	4.03E-02	0%	0	476.245	6375.789
		Annual	µg/m³	10	0	9.55E-04	0%	n/a	477.458	6373.283
	NO_2	1-hour	µg/m³	79	11.3	**177.7**	**225%**	**28 hours per year**	475.995	6375.539
		24-hour	µg/m³	200	9.4	46.8	23%	0	476.245	6375.789
		Annual	µg/m³	23	3.8	4.4	20%	n/a	477.458	6373.283
Metals and Radon	As	24-hour	µg/m³	0.3	3.00E-03	3.07E-03	1%	0	476.087	6374.878
	Cd	24-hour	µg/m³	0.025	2.77E-04	2.94E-04	1%	0	475.997	6374.859
		Annual	µg/m³	0.005	7.44E-05	7.59E-05	2%	n/a	478.132	6374.207
	Co	24-hour	µg/m³	0.1	2.63E-03	2.72E-03	3%	0	475.997	6374.859
	Cr	24-hour	µg/m³	0.5	5.54E-04	7.98E-04	0%	0	476.087	6374.878
	Cu	24-hour	µg/m³	50	3.29E-01	3.33E-01	1%	0	475.997	6374.859
	Mo	24-hour	µg/m³	120	2.68E-03	2.76E-03	0%	0	476.087	6374.878
	Ni	24-hour	µg/m³	0.2	2.00E-03	2.22E-03	1%	0	475.997	6374.859
		Annual	µg/m³	0.04	4.00E-04	4.19E-04	1%	n/a	478.132	6374.207
	Pb	24-hour	µg/m³	0.5	1.62E-02	2.05E-02	4%	0	475.997	6374.859

COPC		Time Averaging Period	Units	Project AQ Criteria	Background Conc.	Maximum Off-Property Location				
						Max Predicted Conc.	% Of Criteria	Predicted No. of Exceedances	Location of Max Conc.	
									UTM X (km)	UTM Y (km)
Metals and Radon	Pb	30 days	µg/m³	0.2	6.24E-03	7.02E-03	4%	0	476.087	6374.878
	Se	24-hour	µg/m³	10	8.03E-04	8.42E-04	0%	0	475.997	6374.859
	U	24-hour	µg/m³	0.15	3.00E-03	**2.23E-01**	**148%**	**3**	477.105	6373.029
		Annual	µg/m³	0.03	6.00E-04	1.87E-02	62%	n/a	477.981	6373.810
	Vn	24-hour	µg/m³	2	5.31E-03	5.75E-03	0%	0	475.997	6374.859
	Zn	24-hour	µg/m³	120	1.13E+00	1.13	1%	0	475.997	6374.859
	Rn-222	Annual	Bq/m³	n/a	n/a	13.8	n/a	n/a	478.106	6374.169

Notes:
[1] **Bold** values indicate predicted concentrations that are above the Project criteria.
[2) Predicted concentrations are presented after removal of meteorological anomalies.
[3) The locations of the maximum predicted concentrations are listed in UTM coordinates in kilometres relative to the NAD83 datum (Zone 13N).
[4) Results include the addition of background air concentrations where available.
[5) n/a – not applicable

6.3 DECOMMISSIONING SCENARIO

The Decommissioning scenario represents the six-year decommissioning phase of the Project, which considered remediation works such as disposal of contaminated materials. Table 7 presents the overall, off-property maximum COPC concentrations (including background concentrations) predicted for this scenario, while concentration isopleths are also provided graphically in Figure 35 through Figure 49.

6.3.1 Particulate Matter

Model predicted concentrations of TSP, PM_{10}, $PM_{2.5}$, and dustfall (including background) for the Decommissioning scenario are provided in Table 7 for the maximum off-property receptor and contour plots are also provided in Figure 35 through Figure 40. As shown in Table 7, the 24-hour concentration of TSP is predicted to be above the Project criteria at the maximum off-property receptor, with a value of 114.8 µg/m³ or 115% of the Project criteria. However, there are no off-property receptors where the 24-hour Project criteria for PM_{10} is exceeded. Figure 35 shows that 24-hour TSP concentrations follow the shape of the roadways, with exceedances of the Project criteria occurring at off-property receptors along Highway 914. This pattern indicates that one of the largest contributors to TSP concentrations is unpaved road dust. Concentrations are also elevated around the centre of the Project Area, also showing the influence of dust from material handling activities during decommissioning. Isopleths of predicted 24-hour PM_{10} (Figure 38) have a similar pattern to TSP, indicating that the same sources influence PM_{10} concentrations.

Annual TSP concentrations, 30-day dustfall rates, and 24-hour and annual $PM_{2.5}$ concentrations are below the Project criteria at the maximum off-property receptor. As expected, isopleths of dustfall (Figure 37) have a similar pattern to TSP, illustrating that unpaved road dust and material handling influence dustfall during decommissioning. The concentration isopleths of 24-hour $PM_{2.5}$ (Figure 39) also follow the roadways, illustrating that unpaved road dust influences $PM_{2.5}$ concentrations. However, concentrations of 24-hour $PM_{2.5}$ are also elevated around the standby generators at the freeze plant, which emit fine particulate matter from combustion of diesel fuel.

Compared to the Construction and Operations scenarios, particulate matter levels are the lowest during the Decommissioning scenario, which is expected since there are limited sources of dust during decommissioning (see Section 4.0). During decommissioning, traffic volumes are reduced, and because there is limited waste generated by the project, disposal activities are also limited. As a result, particulate emissions are reduced.

6.3.2 Gaseous COPC

The predicted incremental concentrations of combustion gases (CO, SO_2, and NO_2) associated with the Decommissioning scenario are provided in Table 7 for the maximum off-property receptor. Contour plots for these COPC are provided in Figure 41 through Figure 48. As mentioned earlier, background SO_2 concentrations are zero, therefore, predicted concentrations of SO_2 are presented as incremental concentrations (i.e., without the addition of background; see Section 6.1.3.2.5 of the EIS).

As shown in the Table and Figures, no exceedances of the Project criteria for CO or SO_2 are predicted at any receptor location. 24-hour and annual NO_2 concentrations are also predicted to be below the Project criteria

outside of the Property Boundary. However, like the other scenarios, predicted 1-hour NO_2 concentrations are above the applicable Project criteria of 79 µg/m³ at some off-property receptors in the LSA (Figure 46).

The overall maximum off-property 1-hour NO_2 concentration is the same as the Operations scenario (177.7 µg/m³ or 225% of the criteria) and occurs at a receptor that is located approximately 260 m from the northwest Property Boundary. The source influencing the maximum off-property concentration (the freeze plant generators), is assumed to have the same short-term emission rate of NO_2 during operations and decommissioning (see Section 4.0); therefore, the maximum off-property concentration is the same.

6.3.3 Uranium and Metals

The predicted concentrations of uranium and metals (i.e., including background) associated with Project decommissioning are provided in Table 7 for the maximum off-property receptor. The Table shows that predicted concentrations of uranium and metals are low and all below their applicable Project criteria at the maximum off-property receptor.

Compared to the Construction and Operations scenario, the Decommissioning scenario has the lowest predicted uranium and metals concentrations. Since the Project generates minimal waste, sources of uranium and metals during decommissioning are limited and only includes disposal of special waste. At 5%, uranium has the highest predicted off-property concentrations relative to the 24-hour Project criteria. Since there are no COPC above 5% of the Project criteria, contour plots have not been generated for this scenario.

6.3.4 Radon

The predicted incremental radon concentrations associated with Project decommissioning are provided in Table 7 for the maximum off-property receptor. The radon concentration at the maximum off-property receptor is 7.94 Bq/m³, which is within the range of background concentrations (< 7.4 to 25 Bq/m³) reported by the CNSC [20]. The predictions are slightly lower than the Operations scenario, which can be explained by reduced emissions of radon from wellfield restoration compared to wellfield operations (see Section 4.0).

Like the Operations scenario, Figure 49 shows that annual radon concentrations are highest near the recovered solution surge tank, with the maxima occurring downwind from this primary emission source. Radon concentrations then drop off quickly with distance from the Project site and within 1 km of the Project Footprint, concentrations are predicted to be less than 3 Bq/m³.

Table 7: Model Predicted COPC Concentrations for the Decommissioning Scenario

COPC		Time Averaging Period	Units	Project AQ Criteria	Background Conc.	Maximum Off-Property Location				
						Max Predicted Conc.	% Of Criteria	Predicted No. of Exceedances	Location of Max Conc.	
									UTM X (km)	UTM Y (km)
Particulate	TSP	24-hour	µg/m³	100	46.2	**114.8**	**115%**	**2 days per year**	477.563	6368.717
		Annual	µg/m³	60	12.4	16.0	27%	n/a	478.087	6369.414
	PM_{10}	24-hour	µg/m³	50	23.1	47.4	95%	0	478.087	6369.414
	$PM_{2.5}$	24-hour	µg/m³	27	6.5	9.9	35%	0	476.087	6374.878
		Annual	µg/m³	8.8	3.1	3.4	38%	n/a	476.098	6375.011
	Dustfall	30-Day	mg/cm²/30 days	2	0.06	0.09	5%	0	477.286	6368.111
Gases	CO	1-hour	µg/m³	15,000	575	614.9	4%	0	475.995	6375.539
		8-hour	µg/m³	6,000	575	595.7	10%	0	475.995	6375.539
	SO_2	1-hour	µg/m³	170	0	1.66E-01	0%	0	475.995	6375.539
		24-hour	µg/m³	125	0	3.42E-02	0%	0	477.066	6373.000
		Annual	µg/m³	10	0	2.84E-03	0%	n/a	477.811	6373.538
	NO_2	1-hour	µg/m³	79	11.3	**177.7**	**225%**	**25 hours per year**	475.995	6375.539
		24-hour	µg/m³	200	9.4	42.7	21%	0	477.066	6373.000
		Annual	µg/m³	23	3.8	6.6	29%	n/a	477.811	6373.538
Metals and Radon	As	24-hour	µg/m³	0.3	3.00E-03	3.01E-03	1%	0	476.098	6375.011
	Cd	24-hour	µg/m³	0.025	2.77E-04	2.78E-04	1%	0	476.098	6375.011
		Annual	µg/m³	0.005	7.44E-05	7.45E-05	1%	n/a	478.169	6374.333
	Co	24-hour	µg/m³	0.1	2.63E-03	2.64E-03	3%	0	476.098	6375.011
	Cr	24-hour	µg/m³	0.5	5.54E-04	5.63E-04	0%	0	476.098	6375.011
	Cu	24-hour	µg/m³	50	3.29E-01	3.29E-01	1%	0	476.098	6375.011
	Mo	24-hour	µg/m³	120	2.68E-03	2.69E-03	0%	0	476.098	6375.011
	Ni	24-hour	µg/m³	0.2	2.00E-03	2.01E-03	1%	0	476.098	6375.011
		Annual	µg/m³	0.04	4.00E-04	4.01E-04	1%	n/a	478.169	6374.333
	Pb	24-hour	µg/m³	0.5	1.62E-02	1.64E-02	3%	0	476.098	6375.011

COPC		Time Averaging Period	Units	Project AQ Criteria	Background Conc.	Maximum Off-Property Location				
						Max Predicted Conc.	% Of Criteria	Predicted No. of Exceedances	Location of Max Conc.	
									UTM X (km)	UTM Y (km)
Metals and Radon	Pb	30 days	µg/m³	0.2	6.24E-03	6.28E-03	3%	0	476.087	6374.878
	Se	24-hour	µg/m³	10	8.03E-04	8.05E-04	0%	0	476.098	6375.011
	U	24-hour	µg/m³	0.15	3.00E-03	7.41E-03	2%	0	476.098	6375.011
		Annual	µg/m³	0.03	6.00E-04	9.14E-04	3%	n/a	478.169	6374.333
	Vn	24-hour	µg/m³	2	5.31E-03	5.33E-03	0%	0	476.098	6375.011
	Zn	24-hour	µg/m³	120	1.13E+00	1.13	1%	0	476.098	6375.011
	Rn-222	Annual	Bq/m³	n/a	n/a	7.94	n/a	n/a	476.138	6375.187

NOTES:
[1] **Bold** values indicate predicted concentrations that are above the Project criteria.
[2) Predicted concentrations are presented after removal of meteorological anomalies.
[3) The locations of the maximum predicted concentrations are listed in UTM coordinates in kilometres relative to the NAD83 datum (Zone 13N).
[4) Results include the addition of background air concentrations where available.
[5) n/a – not applicable

7.0 FREQUENCY ANALYSIS

For all assessment scenarios, exceedances of the 24-hour Project criteria for TSP and the 1-hour Project criteria for NO_2 were predicted at off-property locations. In the Construction and Operations scenarios, exceedances of the 24-hour PM_{10} criteria were also predicted at the maximum off-property receptor. For the Operations scenario, 24-hour uranium concentrations also exceeded the Project criteria at the maximum off-property receptor.

To examine the nature of the predicted exceedances, a frequency analysis was completed and is discussed in the following sections. The total number of exceedances (including background) for each assessment scenario were determined over the one-year meteorological data period and are summarized in Table 5, Table 6, and Table 7 at the maximum off-property receptor. The frequency analysis is also presented graphically in Figure 50 through Figure 57.

7.1 PARTICULATE MATTER

The frequency analysis for 24-hour TSP shows that concentrations are predicted to exceed the Project criteria of 100 µg/m³ 28% of the time during Construction, 21% of the time during Operations, and 0.5% of the time during Decommissioning at the maximum off-property receptor. For the Construction and Operations scenarios, 24-hour PM_{10} concentrations are predicted to exceed the Project criteria of 50 µg/m³ 17% of the time at the maximum off-property receptor.

The results of the frequency analysis are also presented graphically in Figure 50 through Figure 54. Relative to the Property Boundary, the Figures show that the predicted exceedances of 24-hour TSP and PM_{10} are limited to areas within 250 m of the Property Boundary during the Construction scenario. Along Highway 914, exceedances are limited to about 300 m on either side of the roadway during Construction. The frequency of exceedances at these distances are expected to be only a single day per year (i.e., 0.3% of the time). In Operations and Decommissioning, the geographic extent of predicted exceedances is even less.

Although exceedances of the 24-hour TSP and PM_{10} Project criteria are predicted to occur at receptors outside of the Property Boundary in the LSA, the magnitude of these predictions and number of exceedances are considered conservative. As mentioned in Section 6.1.3.7 of the EIS, conservative background concentrations of particulate matter have been added to the maximum concentrations predicted by the air dispersion model. Additionally, as detailed in Section 4.0, conservative emission scenarios were used by assuming that sources operate individually at their maximum rates of production year-round. Production rates and background concentrations will vary day-to-day and the likelihood of worst-case particulate matter emissions occurring simultaneously with elevated background concentrations and unfavourable meteorological conditions (e.g., calm winds, stable conditions) is low. Therefore, concentrations of TSP and PM_{10}, and the number of exceedances of Project criteria are likely overestimated.

In addition to the mitigation measures already accounted for in the assessment, other strategies to avoid or reduce the likelihood of TSP and PM_{10} exceedances include:

- Planning: limit material handling activities during dry conditions and/or periods of high winds.
- Planning: limit vehicle and equipment speeds on unpaved roadways/surfaces.

- Planning: optimize the number of vehicle and equipment movements and minimize travel distances, where possible.
- Planning: maintain unpaved roads via grading or other maintenance practices to reduce the number of fine particles available for dispersion.
- Monitoring: collect dust measurements during construction, operations, and decommissioning, and determine whether the actual impact of Project activities is lower than that what was modelled.

7.2 NO_2

The analysis for 1-hour NO_2 shows that the frequency of exceedances of the Project criteria of 79 µg/m³ at the maximum off property receptor is limited for each scenario and is predicted to be less than 1% of the time during Construction, Operations, Decommissioning of the Project. As Figure 55 and Figure 56 show, exceedances are predicted in the LSA out to a maximum distance of 1 km from the Property Boundary; however, the frequency of exceedances at this distance is expected to be only a single day per year (i.e., 0.3% of the time).

Although exceedances of the 1-hour NO_2 criteria are predicted to occur in the LSA, concentrations are judged to be conservative. The Saskatchewan Air Quality Modelling Guideline [18] notes that ambient ratio method (see Section 6.1.1.2.4 of the EIS) used to convert NOx to NO_2 is conservative. In addition, the short-term emissions scenario for Operations and Decommissioning described in Section 2.0 and detailed in Appendix A, is considered a conservative operating case where electricity from the SaskPower grid is unavailable and all backup generators continuously supply power to support site activities. The likelihood of a power loss that requires all backup power to be fully utilized occurring concurrently with maximum emissions from other site activities and under adverse meteorological conditions is low. Therefore, actual concentrations of NO_2 and the number of exceedances of the 1-hour Project criteria are likely to be less than what has been predicted by the model, particularly for the Operations and Decommissioning scenarios.

Other strategies to avoid or reduce the likelihood of 1-hour NO_2 exceedances include:

- Planning: employ standard operating procedures for the use of equipment and machinery, including maintenance requirements.
- Planning: limit idling and optimize the number of vehicle and equipment movements to minimize travel distances, where possible.

7.3 URANIUM

The frequency analysis for 24-hour uranium for the Operations scenario shows that concentrations are predicted to exceed the Project criteria of 0.15 µg/m³ less than 0.8% of the time at the maximum off-property receptor. The results of the frequency analysis are also presented graphically in Figure 57, which shows that the predicted exceedances of uranium are limited to areas within the LSA out to a maximum distance of 400 m from the Property Boundary. At this distance, frequency of exceedances is expected to be only a single day per year (i.e., 0.3% of the time).

Although exceedances of the 24-hour uranium Project criteria are predicted to occur at receptors outside of the Property Boundary in the LSA, the magnitude of these predictions and number of exceedances are considered conservative. As detailed Appendix A, the uranium emission rates for the ISR stacks are considered

conservative. Emissions of particulate matter from the ISR stacks were based on pre-feasibility engineering design documents that applied a general emission target of 10 mg/Nm³ for particulate matter [14]. The maximum percentage of uranium in yellowcake was then applied to this target to develop conservative emission estimates of uranium. It is likely that lower emissions targets will be achieved during the detailed design phase on the Project; therefore, concentrations of uranium, and the number of exceedances of Project criteria are likely overestimated.

8.0 RECOMMENDED EMISSIONS MANAGEMENT PRACTICES

The following emissions management practices are recommended based on industry best practices for reducing the likelihood of impacts during the various phases of the Project.

Administrative controls

- Create and implement a dust management plan, including the application of water and/or chemical suppressant to control fugitive dust, in addition to other operational strategies to assist in dust control,
- Planning vehicle and equipment routes to minimize travel distances, where possible, and
- Employ standard operating procedures and complete regular inspections of equipment machinery to ensure it is in good working order

Physical controls

- Avoid dust-generating activities (e.g., earthworks, material handling) during dry or high wind conditions,
- Avoid dropping material from height,
- Ensure all exhausts (e.g., mobile equipment, generators) are in good working condition,
- Turn off vehicles and equipment when not being used,
- Minimize or reduce vehicle and equipment speed by enforcing speed limits,
- Apply water at least twice per day to unpaved roads and surfaces, and
- Maintain unpaved road surfaces via grading or other maintenance practices to reduce the amount of silt (i.e., fines) present in the roadbed material.

9.0 CONCLUSIONS

The air quality assessment considered the construction, operations, and decommissioning phases of the Project. Conservative assessment scenarios were prepared for each phase based on information from Denison on the expected construction fleet, construction activity, and operating/physical data for process sources. Emissions of COPC for each source were derived primarily from the compendium of emission factors published by the U.S. EPA in the AP-42 database. The COPC emissions associated with each scenario were then modelled based on planning drawings and pre-feasibility engineering data for the proposed Project configuration. The predictive modelling was completed in CALPUFF (version 7), an advanced 3-D dispersion model that can handle complex terrain and multiple emissions sources from facilities and activities located over large areas. The results of the modelling assessment were compared to Project air quality criteria derived from provincial and federal guidelines that have relevance to the Project.

The guidelines that were followed in the preparation of this assessment each required an accounting of the existing conditions at the site. As discussed in Section 6.1.3.2 of the EIS, Denison has been conducting baseline air quality monitoring at the Wheeler River site since 2016, including measurements of particulate (as dustfall), trace gases (NO_2 and SO_2), external gamma, and radon. The results indicated that the background air quality is typical of a remote setting. The model predictions indicate that COPC concentrations return to baseline ambient levels within approximately 15 km of the Property Boundary.

The comparison of model predicted COPC concentrations to the adopted Project air quality criteria indicate that:

- Majority of the COPC and averaging periods are below Project criteria at all receptor locations in the Study Areas, including:
  - 30-day dustfall,
  - Annual TSP concentrations,
  - 24-hour and annual $PM_{2.5}$ concentrations,
  - 1-, 24-hour and annual SO_2 concentrations,
  - 1- and 8-hour CO concentrations,
  - 24-hour and annual NO_2 concentrations,
  - 24-hour concentrations of arsenic, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, lead, selenium, vanadium, and zinc, and annual concentrations of cadmium, nickel, and uranium.
- In the Construction, Operations, and Decommissioning scenarios, annual average radon concentrations beyond the Property Boundary are expected to be below the range of background concentrations (< 7.4 to 25 Bq/m³) reported by the CSNC [20] and would be indiscernible from background. For the Operations and Decommissioning scenarios, predicted annual radon concentrations at the maximum off-property receptor were similar, and the overall maximum radon concentration was predicted to be 8.0 µg/m³ at a Property Boundary receptor. For Construction, the overall maximum radon concentration was 1.1 Bq/m³.
- In the Construction, Operations, and Decommissioning scenarios, concentrations of 24-hour TSP and PM_{10} were predicted to exceed the Project criteria at receptors located outside of the Property Boundary in the LSA. The highest off-property concentrations of particulate matter were predicted in

the Construction scenario when the highest emissions of particulate matter are expected. The maximum 24-hour TSP and PM_{10} concentrations were predicted to be 313 µg/m³ and 116 µg/m³, respectively.

- 1-hour NO_2 concentrations were predicted to exceed the Project criteria at off-property receptors in the LSA for the Construction, Operations, and Decommissioning scenarios, reflecting worst-case operations of the stand-by diesel generators. The highest 1-hour NO_2 concentration was predicted to be 177.1 µg/m³ at the maximum off-property receptor.
- 24-hour uranium concentrations were predicted to exceed the Project criteria at off-property receptors in the Operations scenario only, reflecting worst-case operations of ISR stacks. The highest 24-hour uranium concentration was predicted to be 2.23E 01 µg/m³ at the maximum off-property receptor.

An assessment of potential impacts was completed by evaluating the frequencies and geographic extent of the predicted exceedances. The analysis showed that:

- Exceedances of the 24-hour TSP and PM_{10} Project criteria are limited in frequency and extent and do not go beyond 250 m from the Property Boundary. Along Highway 914, 24-hour TSP and PM_{10} exceedances are limited to 300 m on either side of the roadway. Exceedances are predicted to occur less than 30% of the time at a maximum off-property receptor next to Highway 914.
- Exceedances of the 1-hour NO_2 Project criteria are limited in frequency and extent and are predicted to occur less than 1% of the time at the maximum off-property receptor. Exceedances also do not extend beyond 1 km from the Property Boundary.
- Exceedances of the 24-hour uranium Project criteria are limited in frequency and extent. Exceedances are predicted to occur less than 1% of the time at the maximum off-property receptor and do not extend beyond 400 m from the Property Boundary.

Due to the conservative assumptions that have been built into this air quality assessment, it is likely that the actual COPC concentrations and exceedances will be less than what was predicted by the dispersion model. Despite these assumptions, the assessment demonstrates that any potential excursions are limited in both space and duration.

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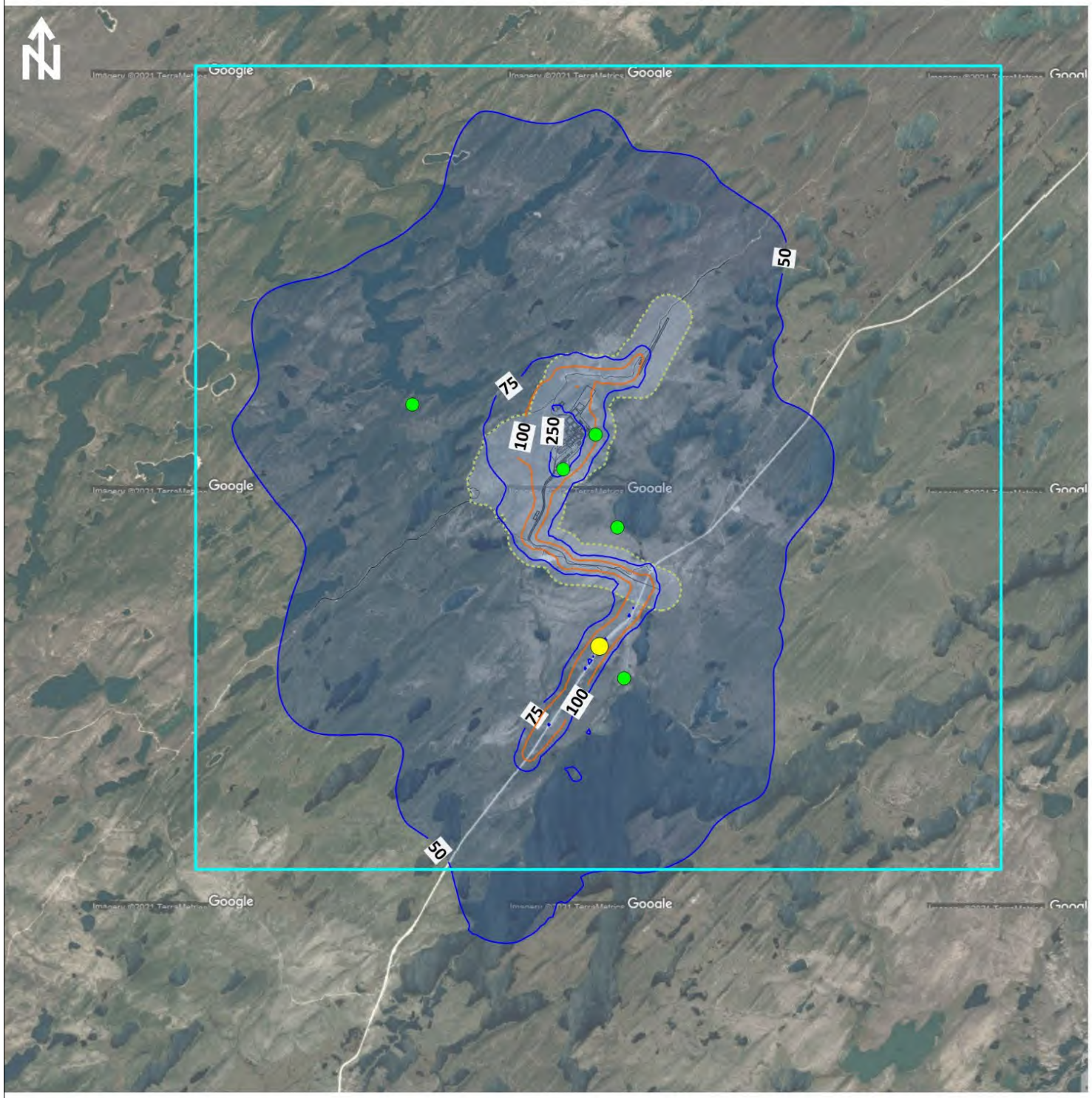
Figures:



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 46.2 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 24-hour TSP Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	1
Date:	**Project No.:**	
July 2022	SX19-0043	

LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 12.4 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

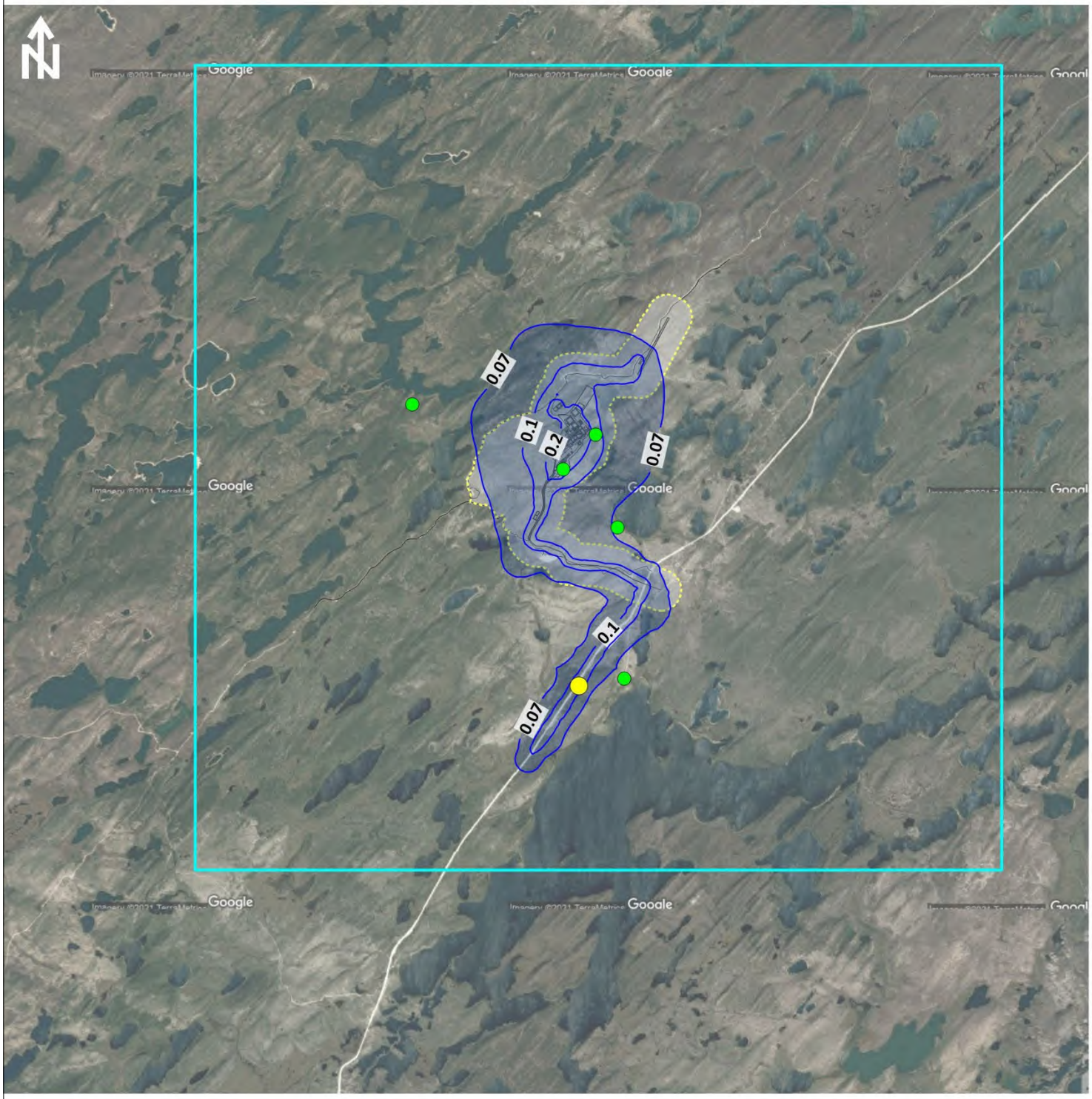
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum Annual TSP Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	2
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Deposition (mg/cm²/30d)
- Project Criteria (mg/cm²/30d)
- Maximum off-property deposition location
- Risk Receptor

NOTES:

Dustfall includes the addition of a background value of 0.06 mg/cm²/30d.

SCALE:

0 km 2.5 km 5 km 7.5 km

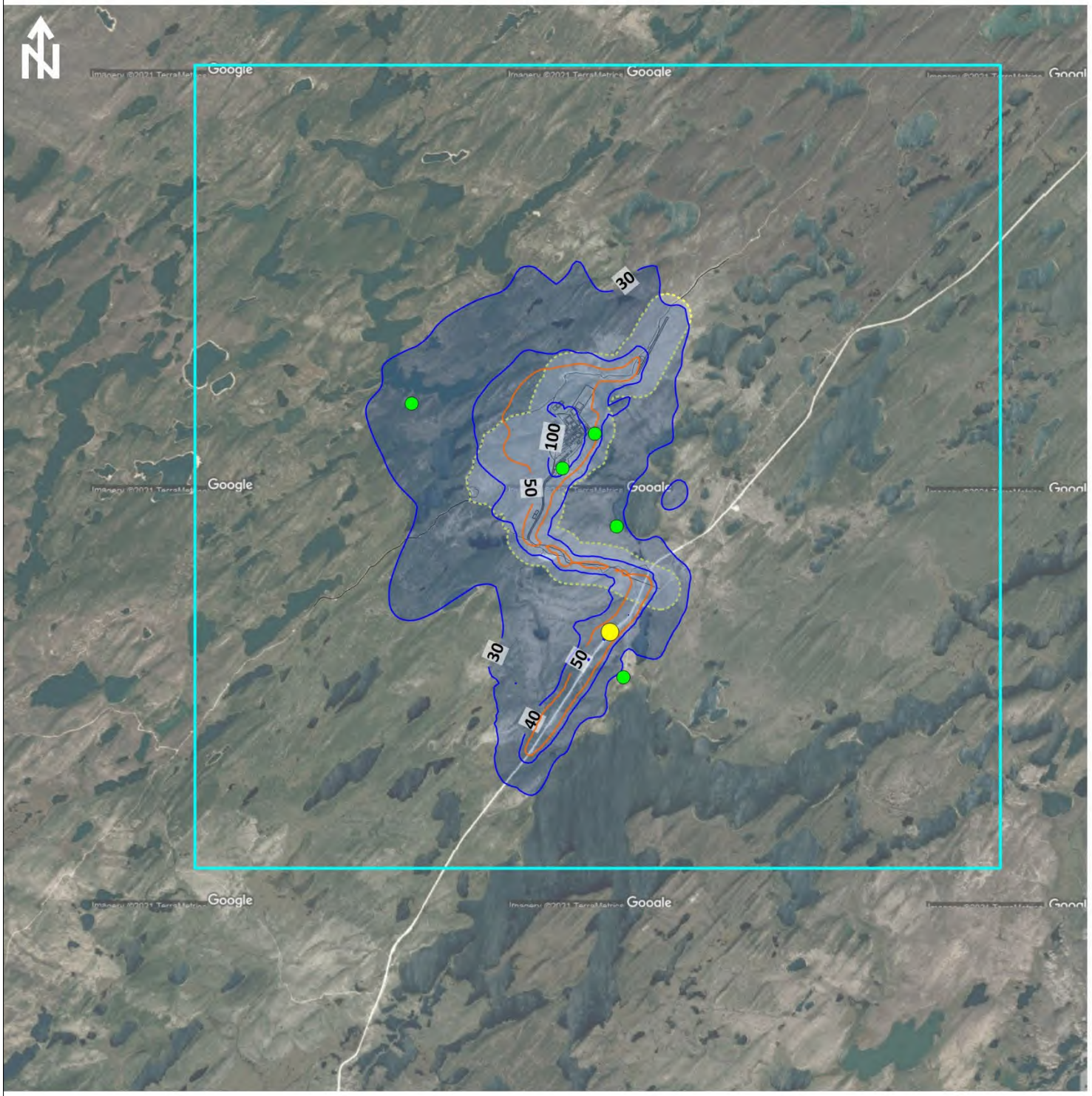
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
30-Day Dustfall (mg/cm²/30-days)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	3
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 23.1 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

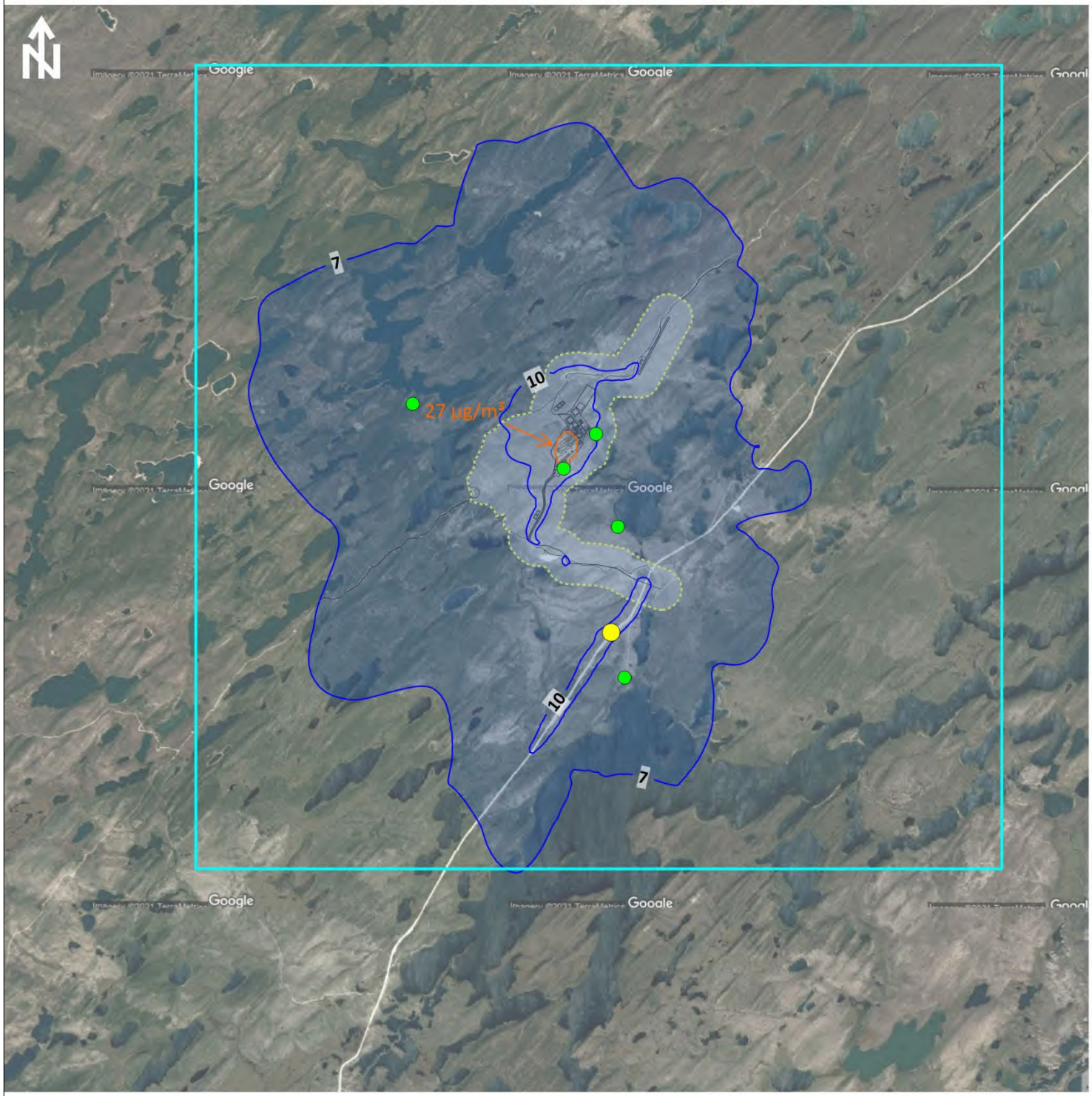
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 24-hour PM_{10} Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	4
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 6.5 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 24-hour $PM_{2.5}$ Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	5
Date:	**Project No.:**	
July 2022	SX19-0043	

LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.1 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

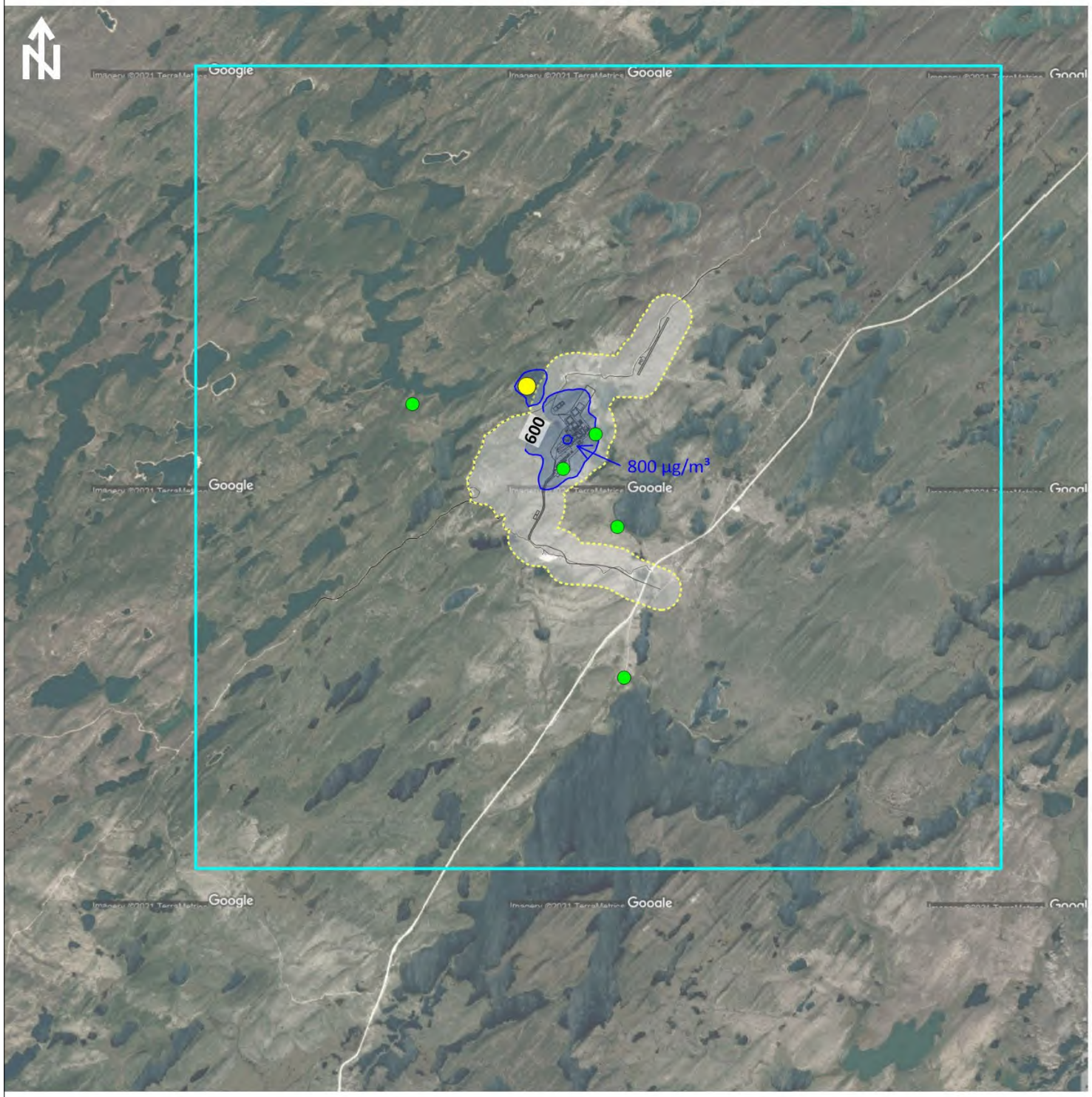
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum Annual $PM_{2.5}$ Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	6
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 575 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

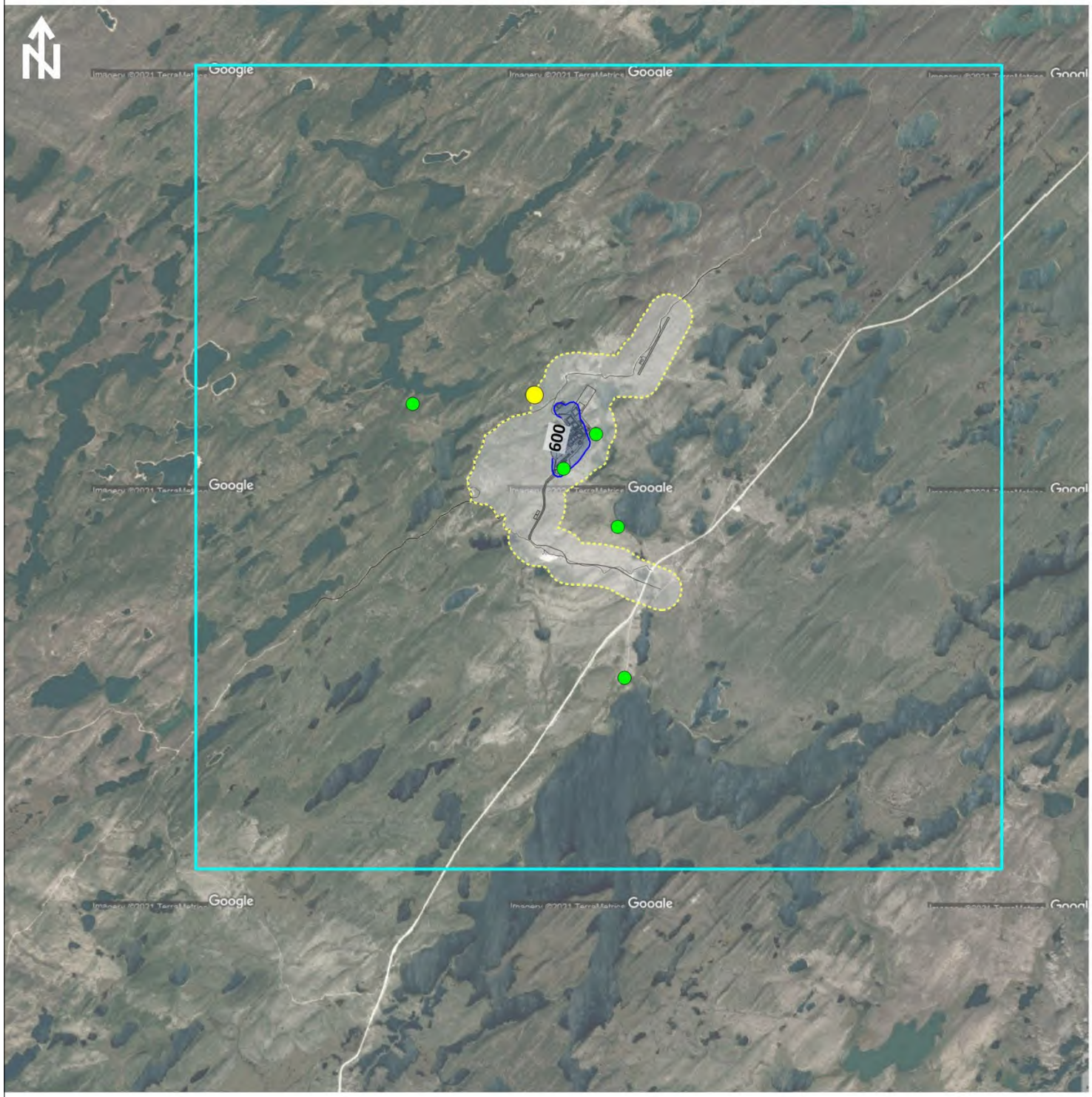
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 1-hour CO Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	7
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 575 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

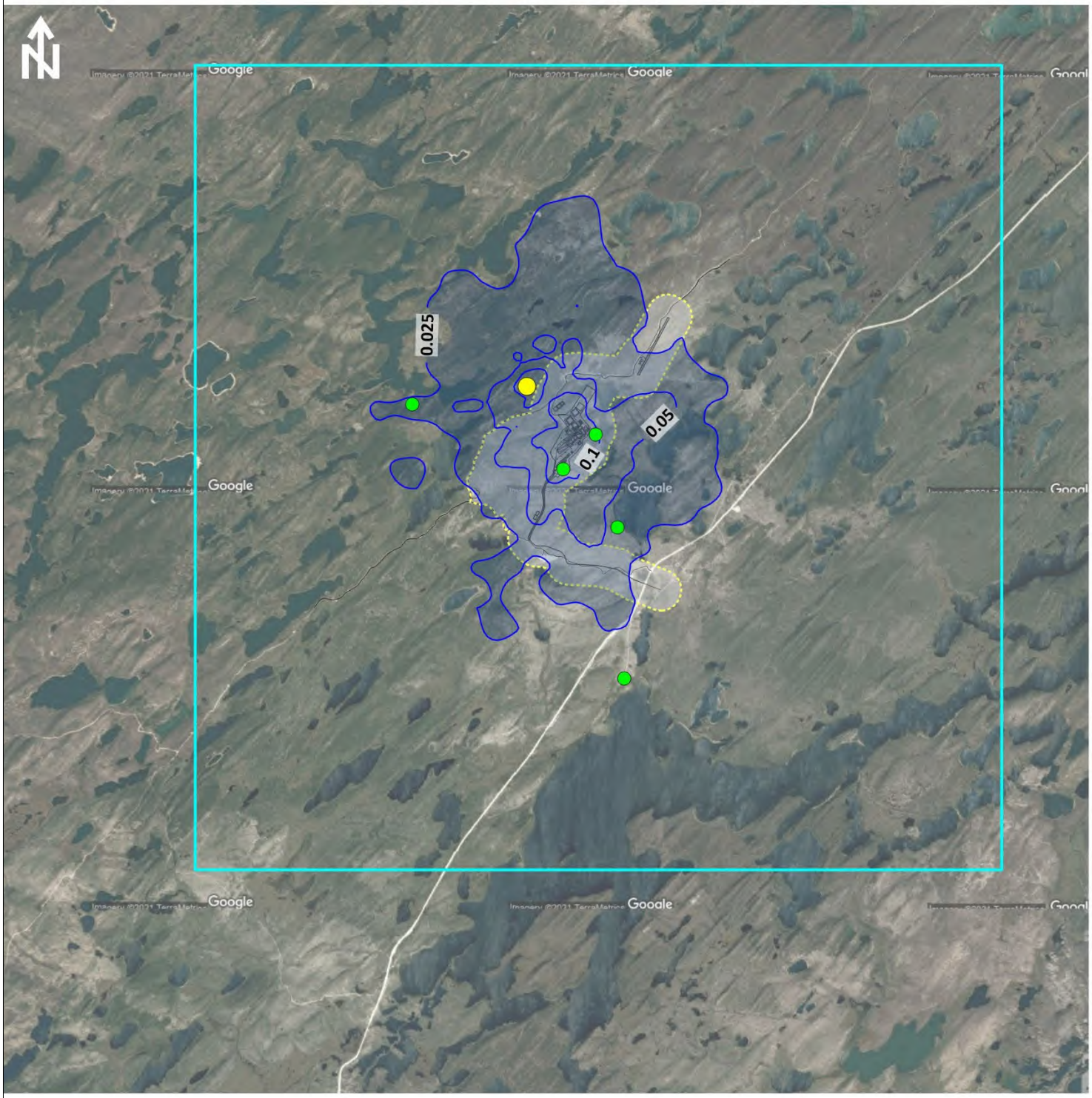
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 8-hour CO Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	8
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

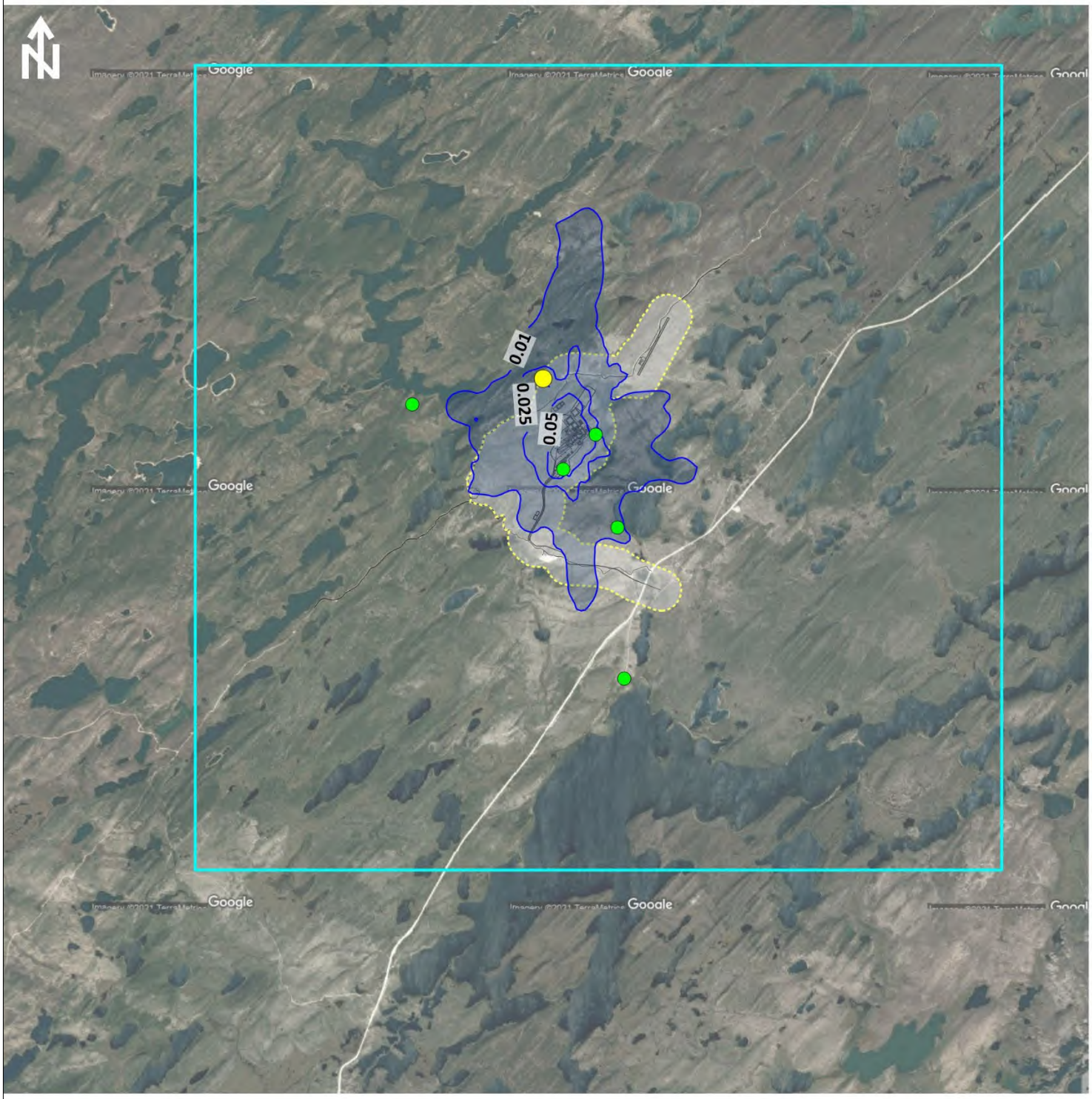
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
1-hour SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	9
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

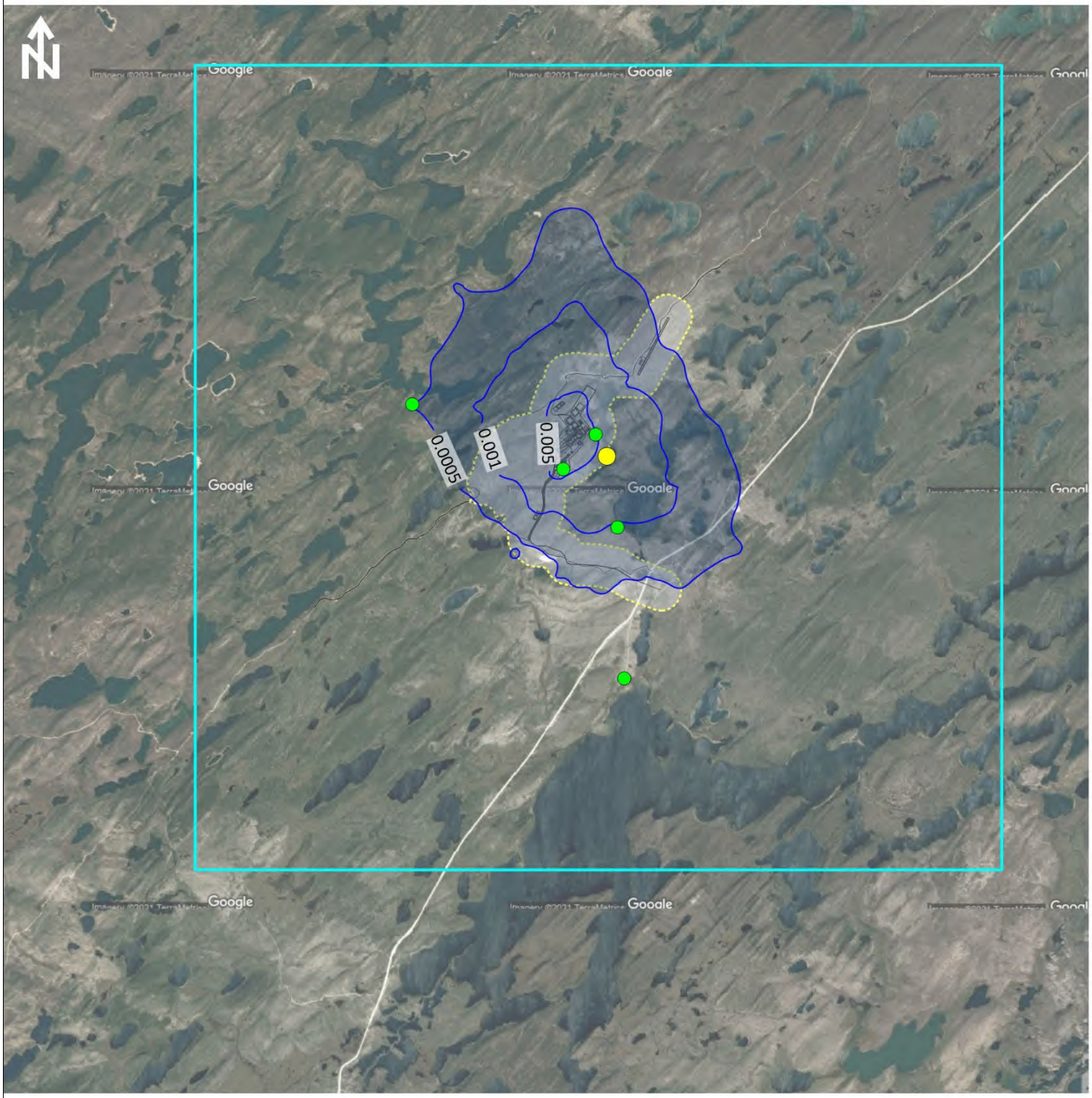
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
24-hour SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	10
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

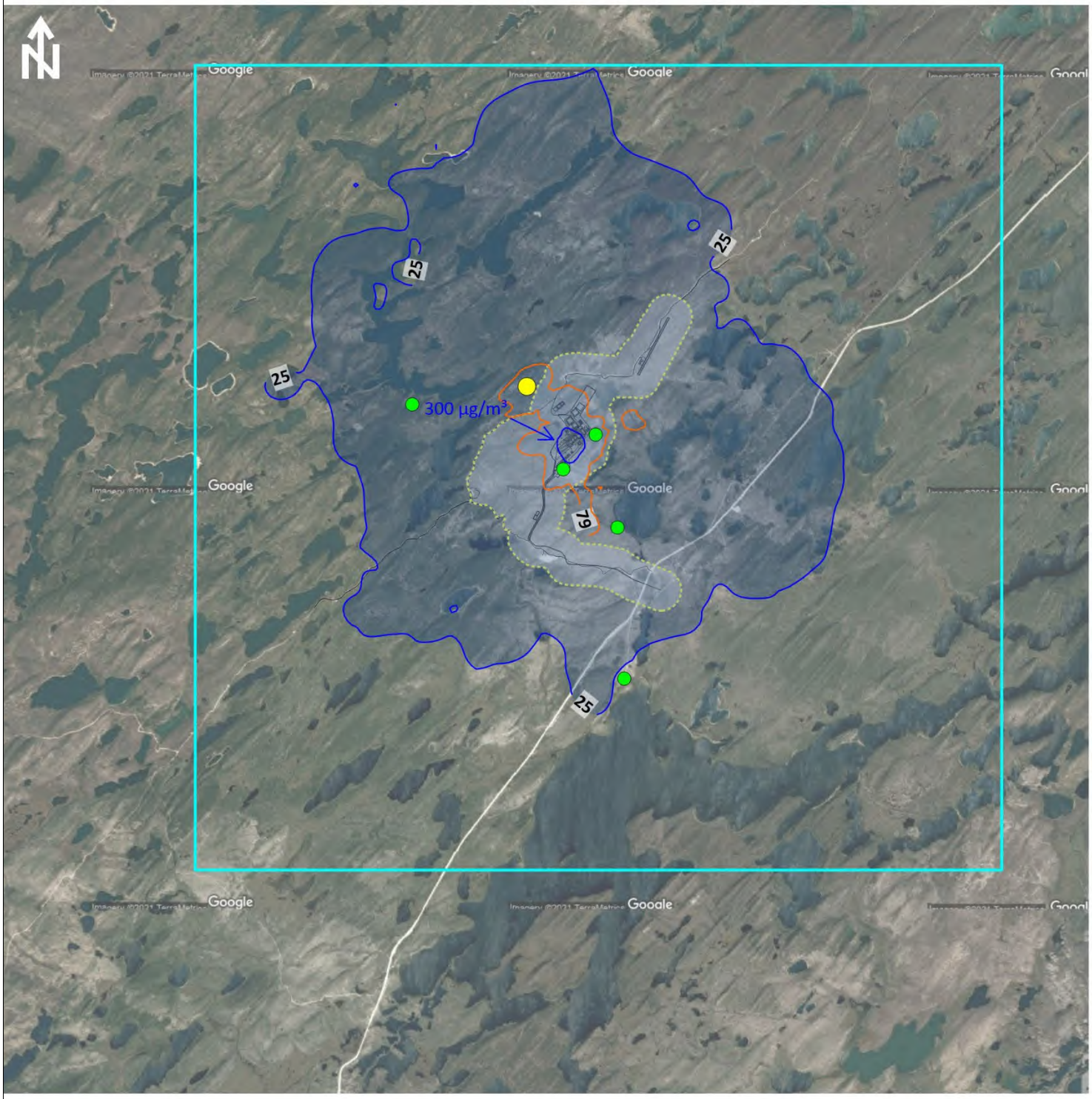
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Annual SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	11
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 11.3 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

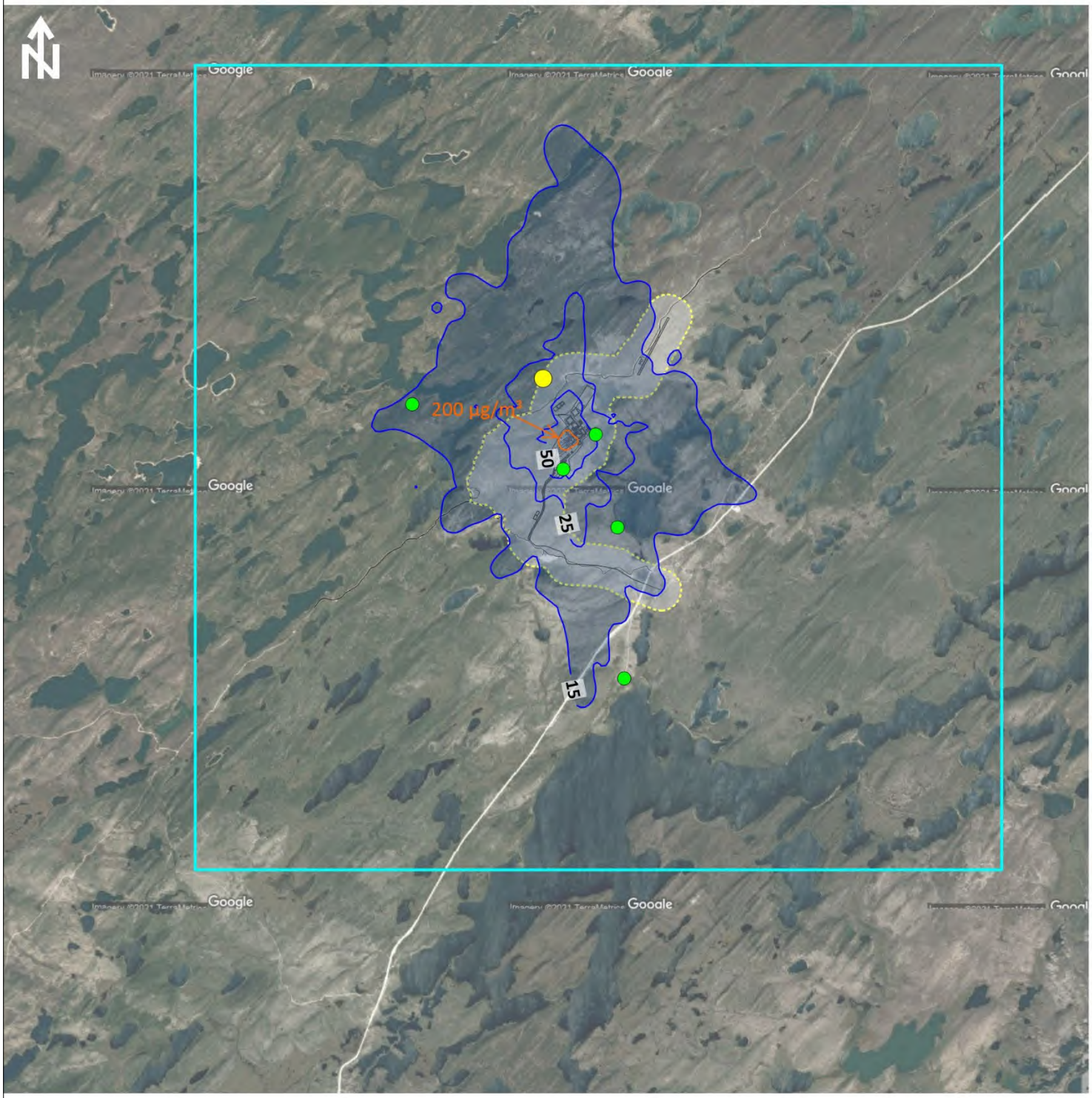
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 1-hour NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	12
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 9.4 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 24-hour NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	13
Date: July 2022	Project No.: SX19-0043	

LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.8 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

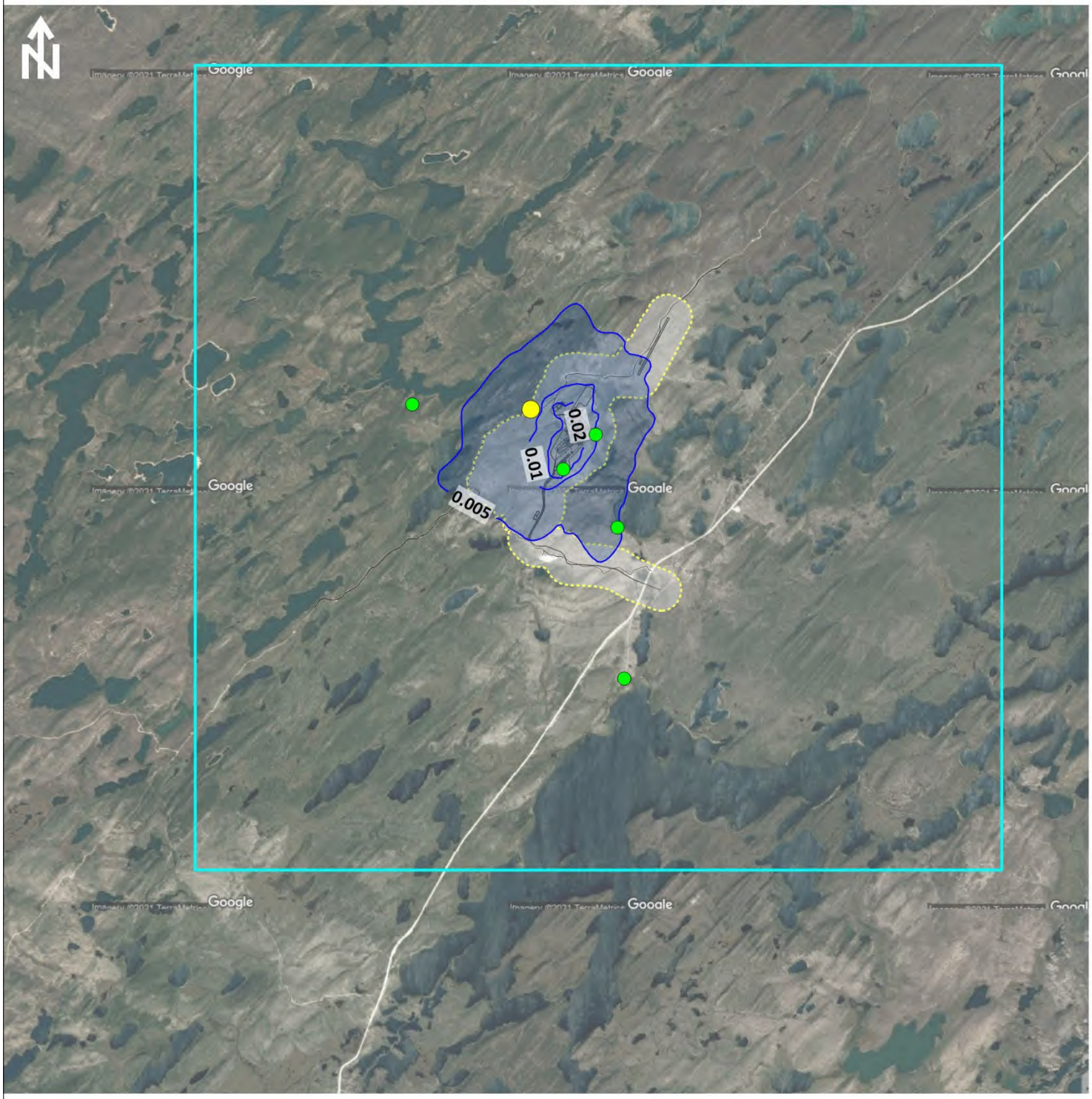
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum Annual NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	14
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.00E-03 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

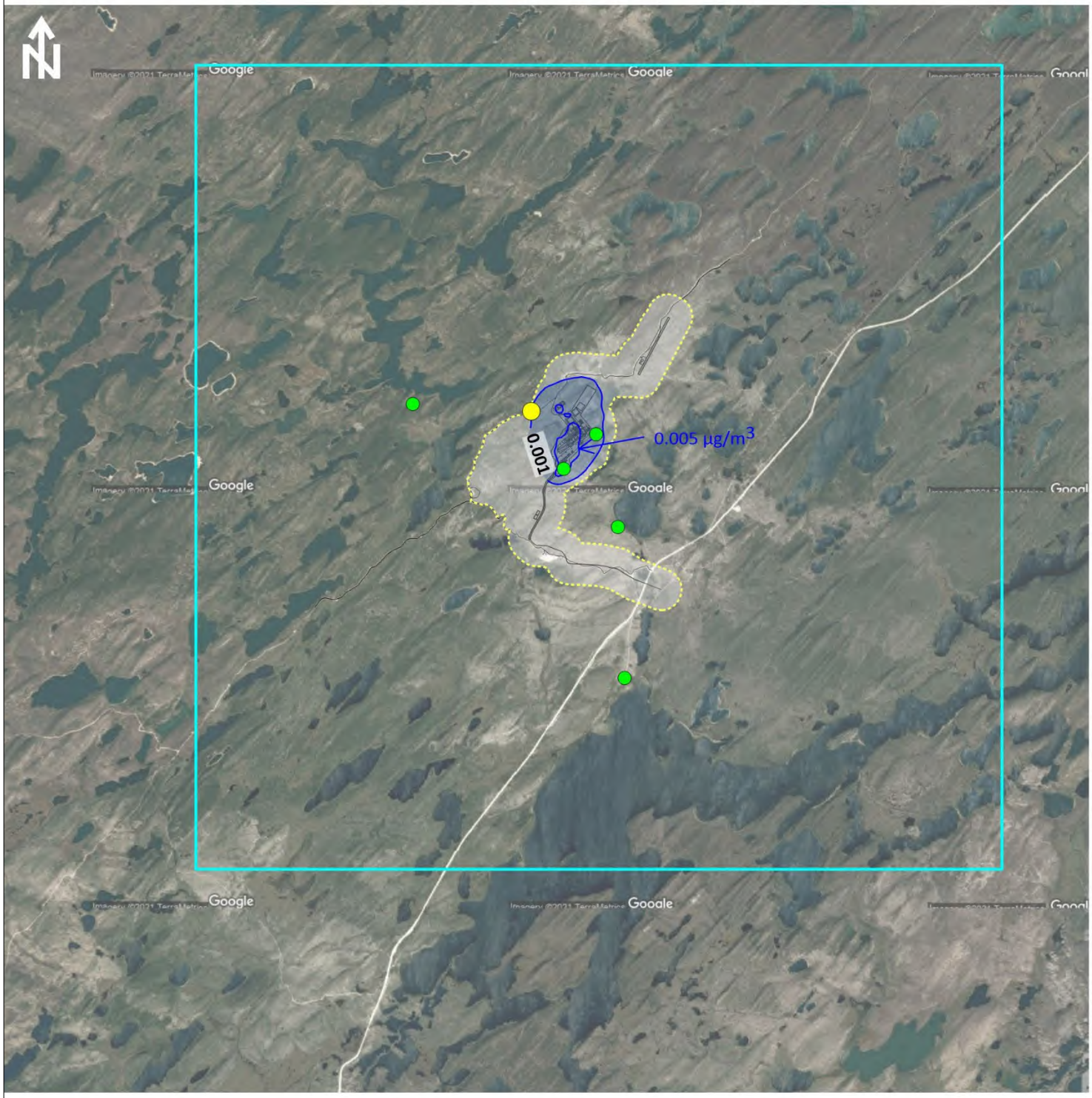
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 24-hour Uranium Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	15
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 6.00E-04 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

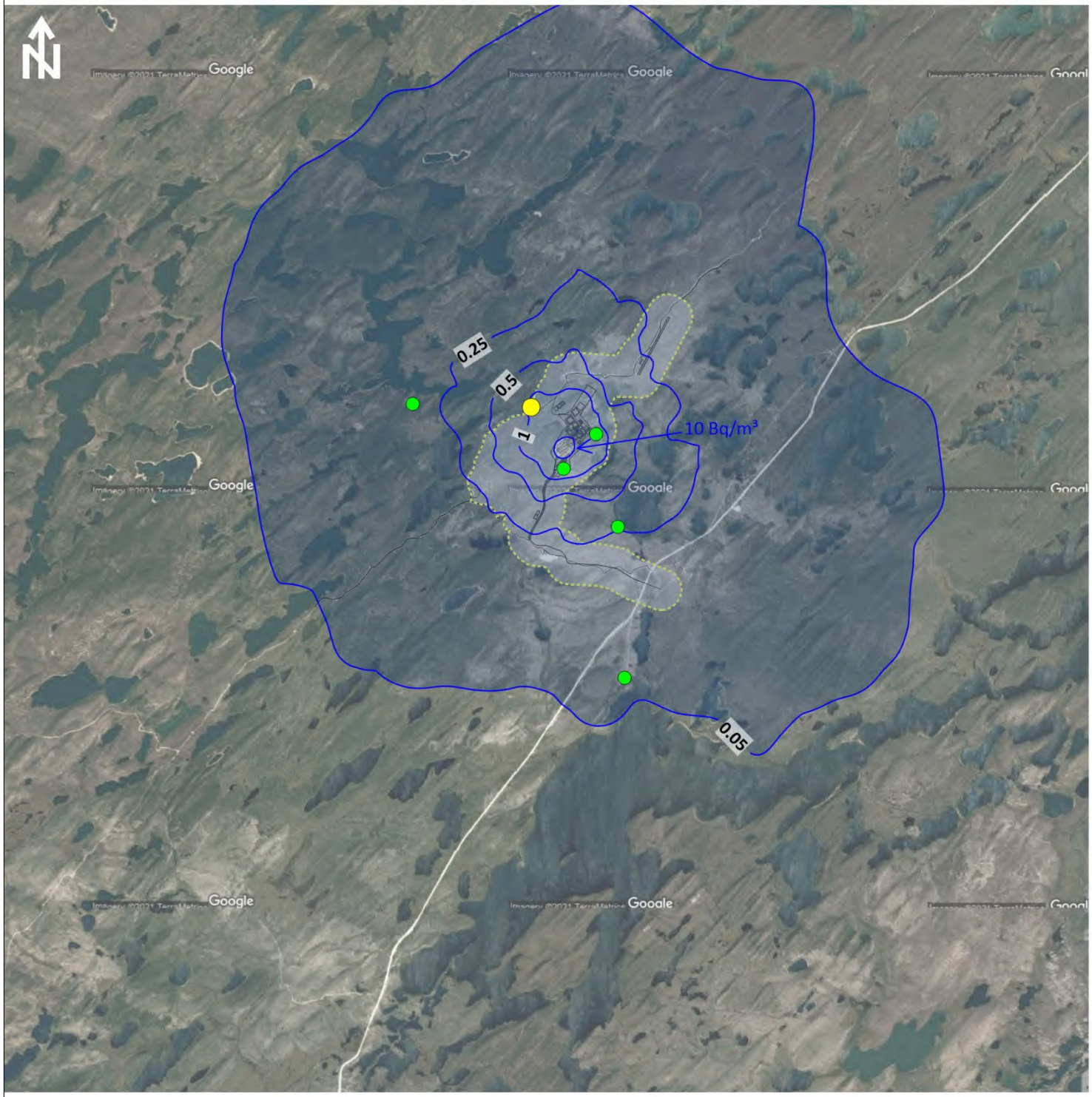
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum Annual Uranium Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	16
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (Bq/m³)
- Project Criteria (Bq/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 Bq/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

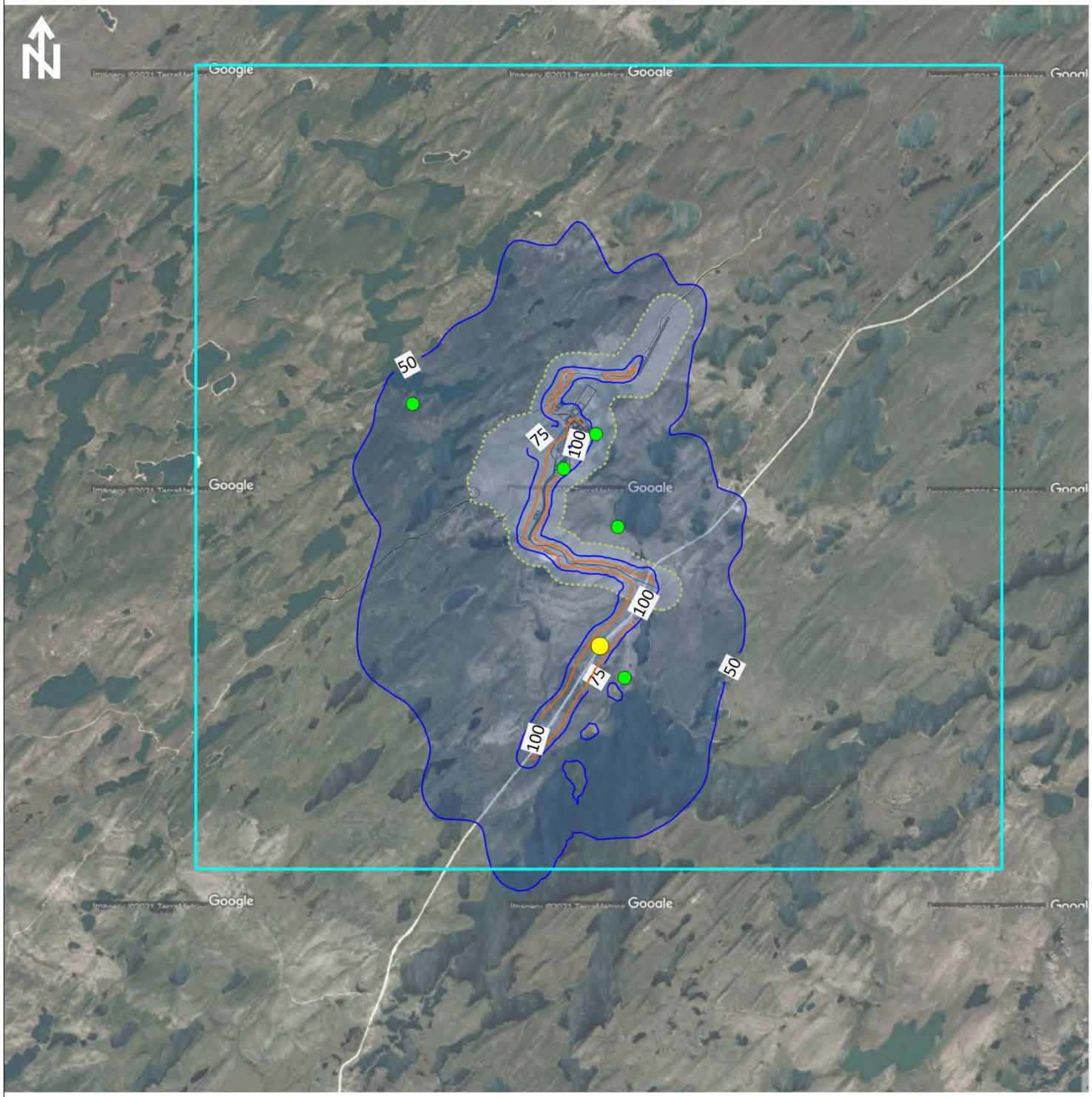
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Annual Radon Concentrations (Bq/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	17
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 46.2 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

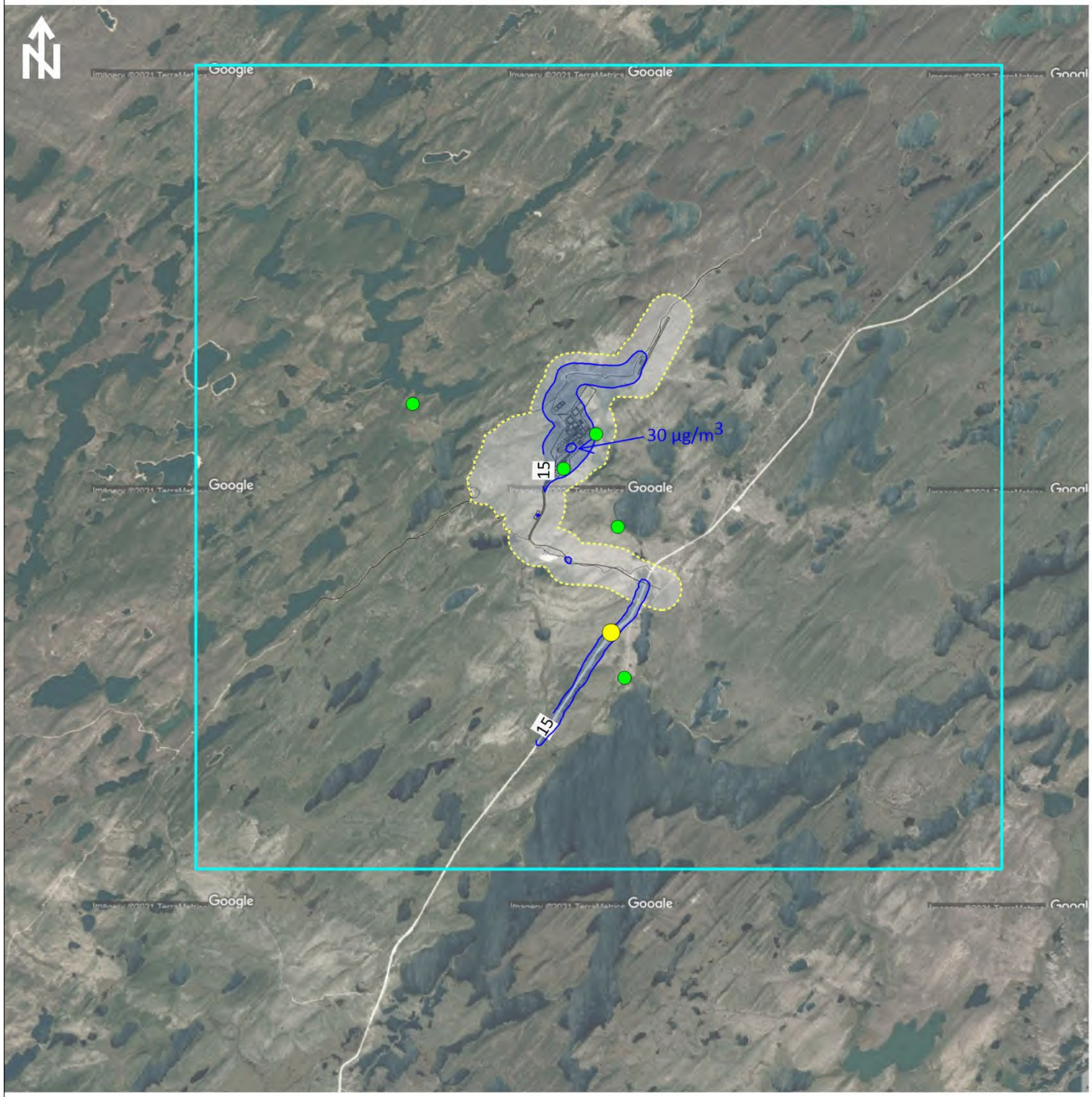
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour TSP Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	18
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 12.4 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

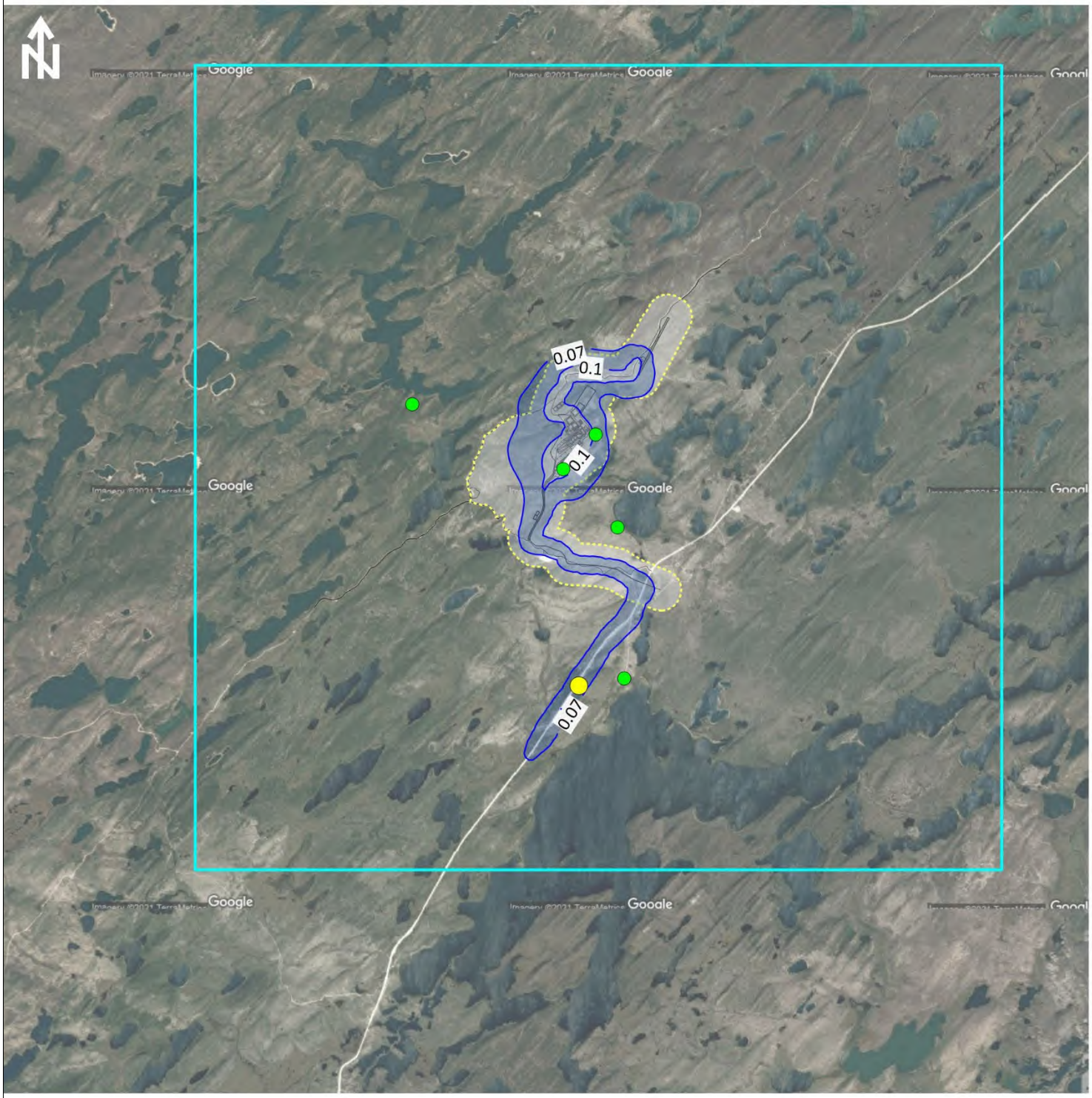
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum Annual TSP Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	19
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Deposition (mg/cm²/30d)
- Project Criteria (mg/cm²/30d)
- Maximum off-property deposition location
- Risk Receptor

NOTES:

Dustfall includes the addition of a background value of 0.06 mg/cm²/30d.

SCALE:

0 km 2.5 km 5 km 7.5 km

REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
30-Day Dustfall (mg/cm²/30-days)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	20
Date: July 2022	Project No.: SX19-0043	

LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 23.1 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

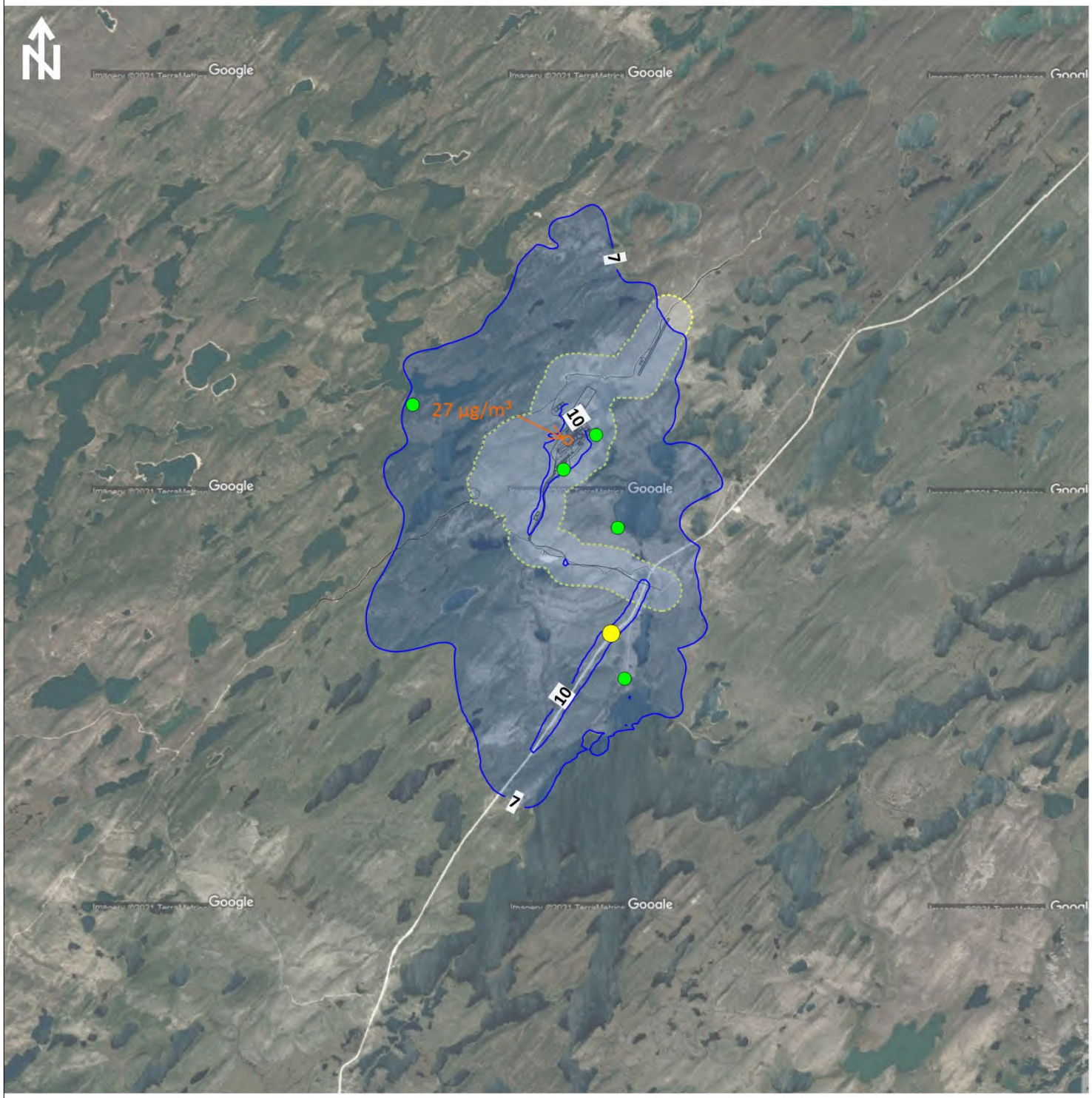
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour PM_{10} Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	21
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 6.5 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

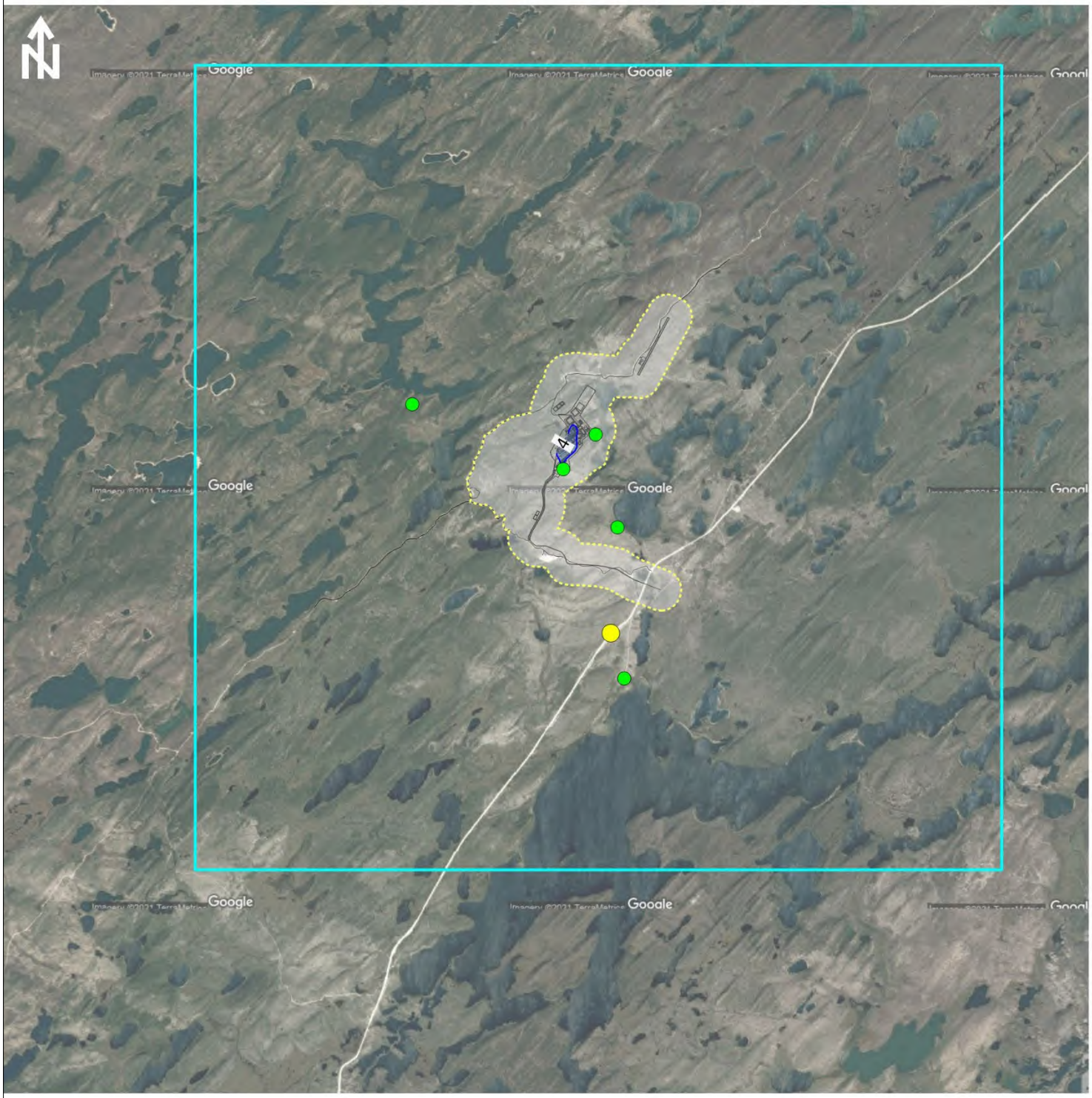
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour $PM_{2.5}$ Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	22
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.1 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum Annual $PM_{2.5}$ Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	23
Date:	Project No.:	
July 2022	SX19-0043	

LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 575 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

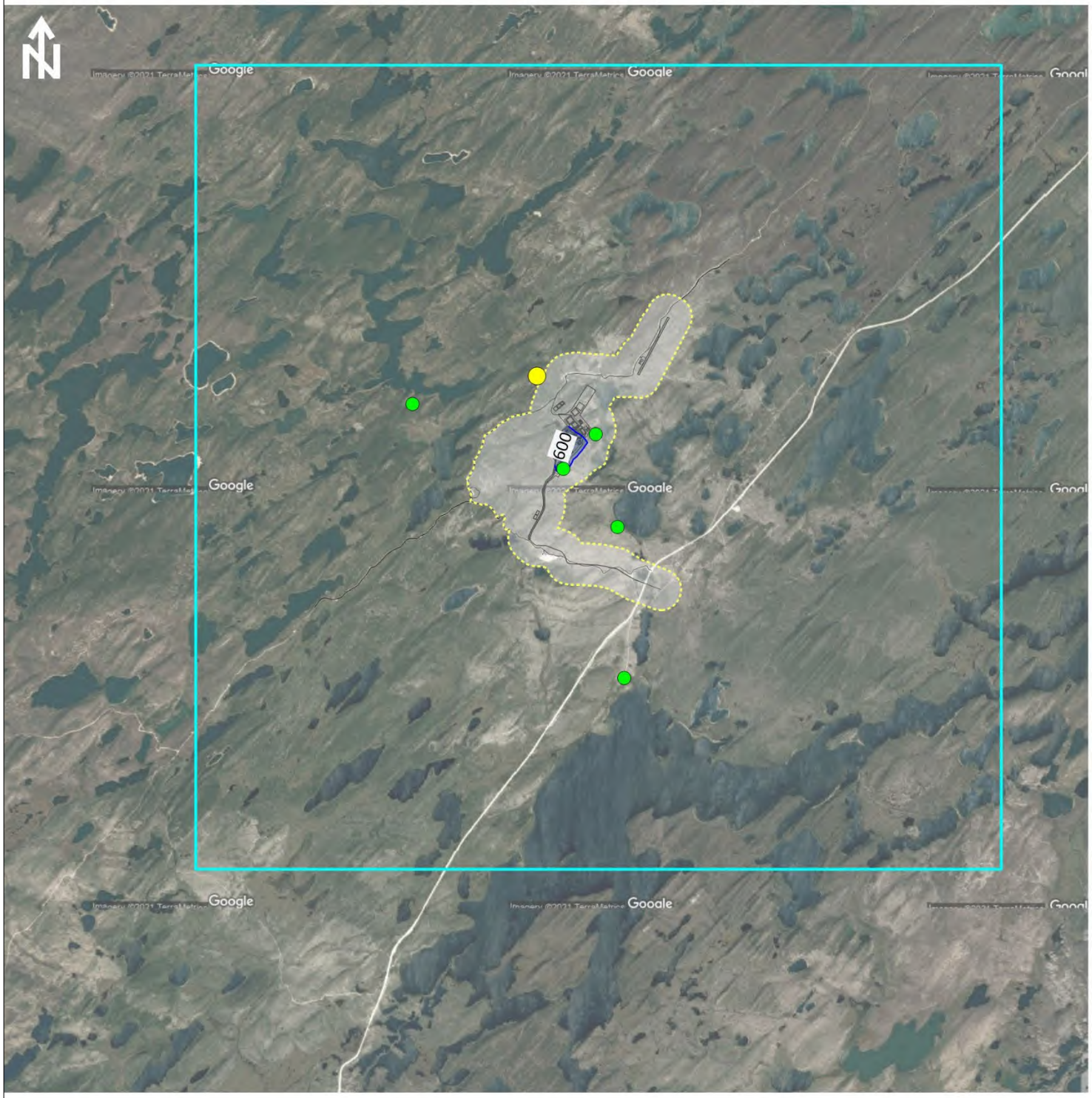
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 1-hour CO Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	24
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 575 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

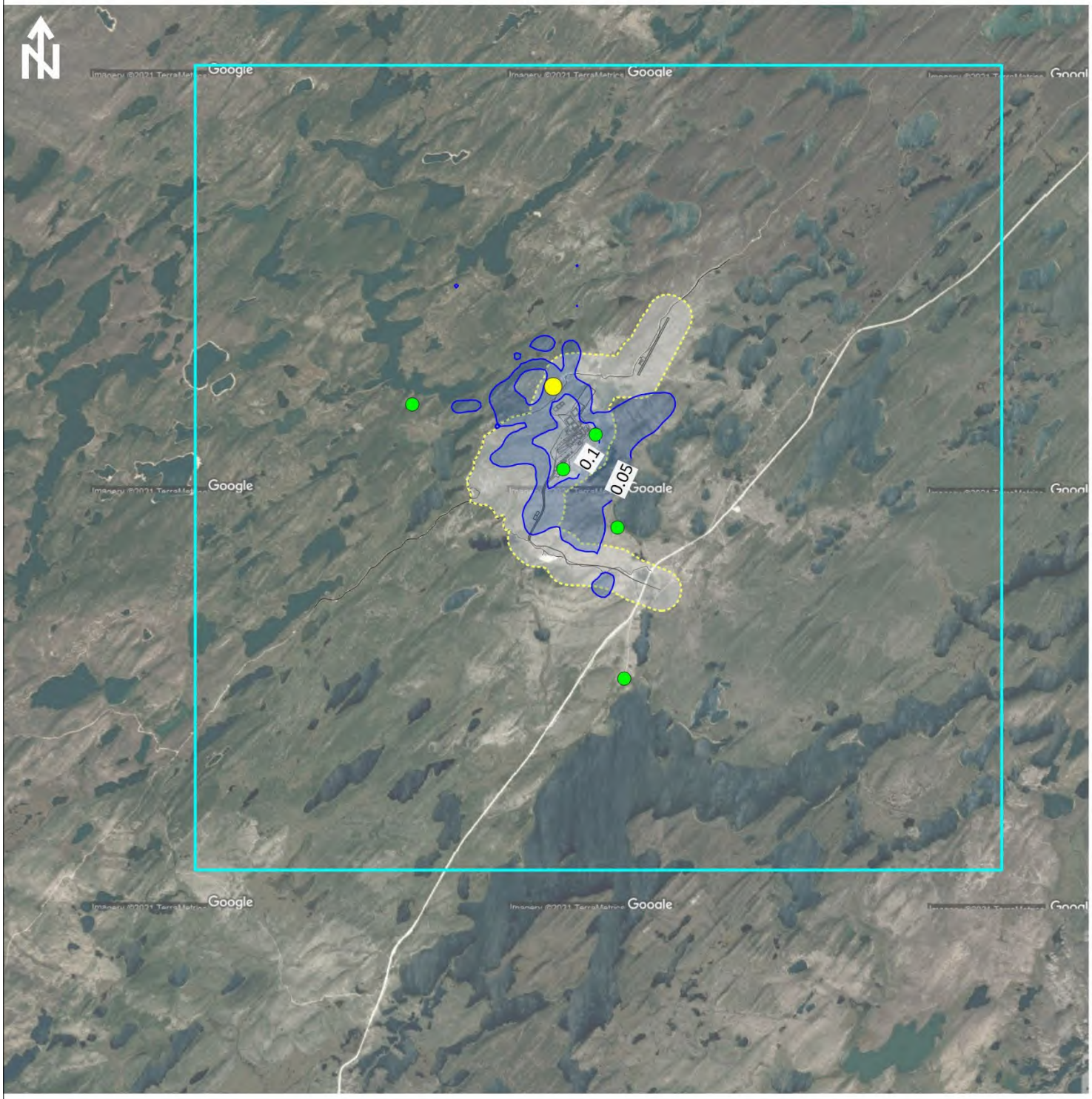
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 8-hour CO Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	25
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

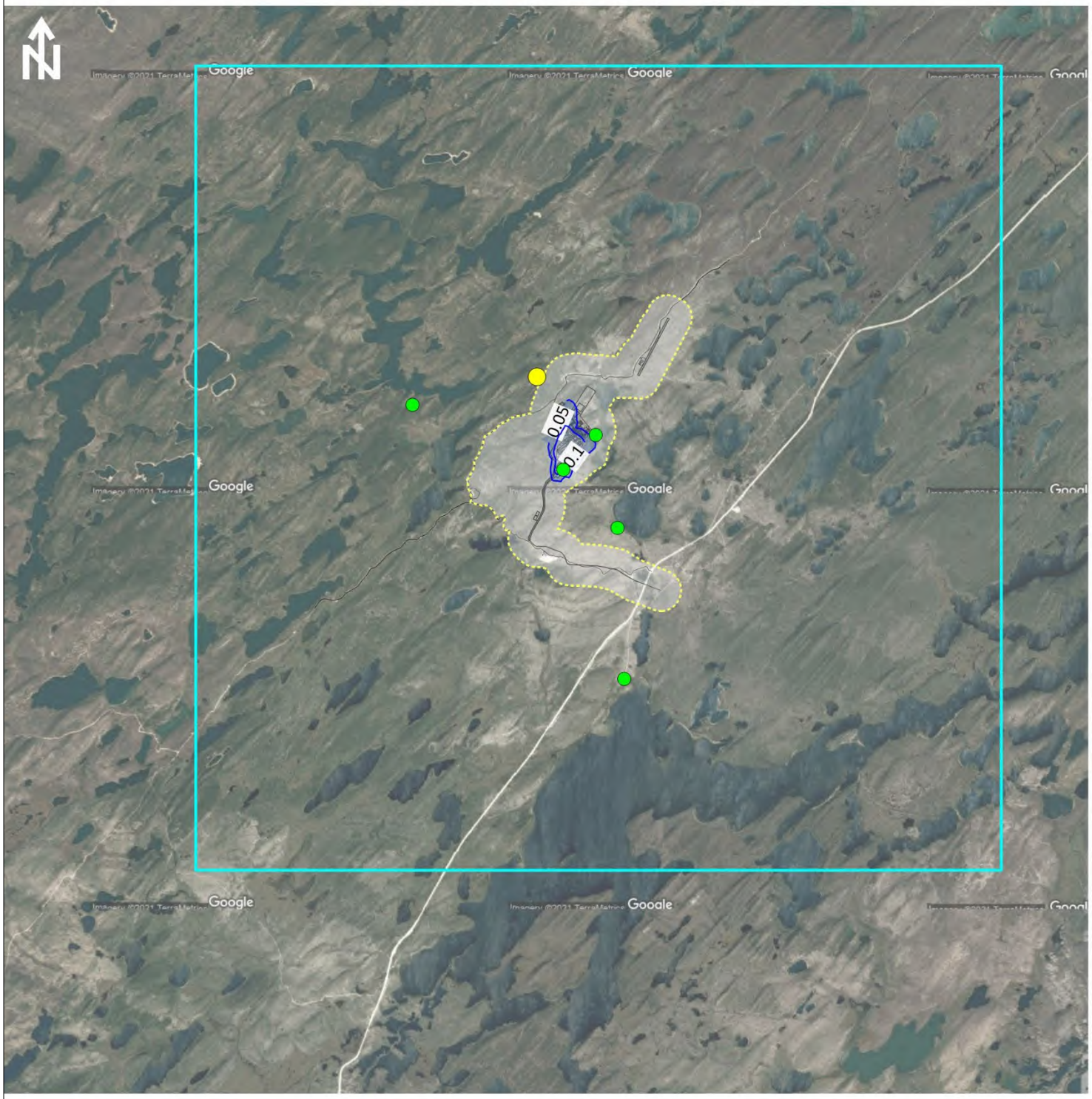
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
1-hour SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	26
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

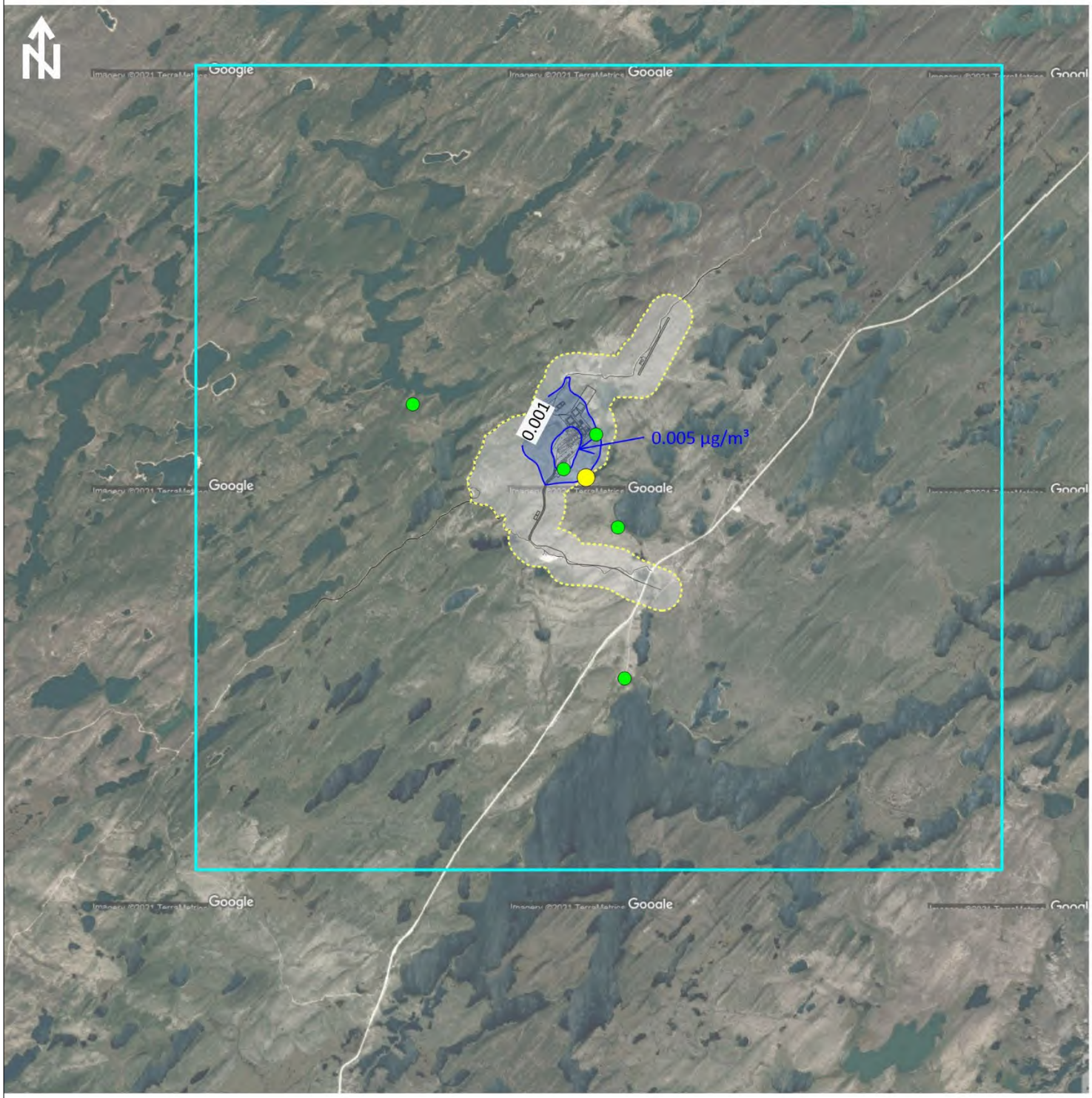
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
24-hour SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	27
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

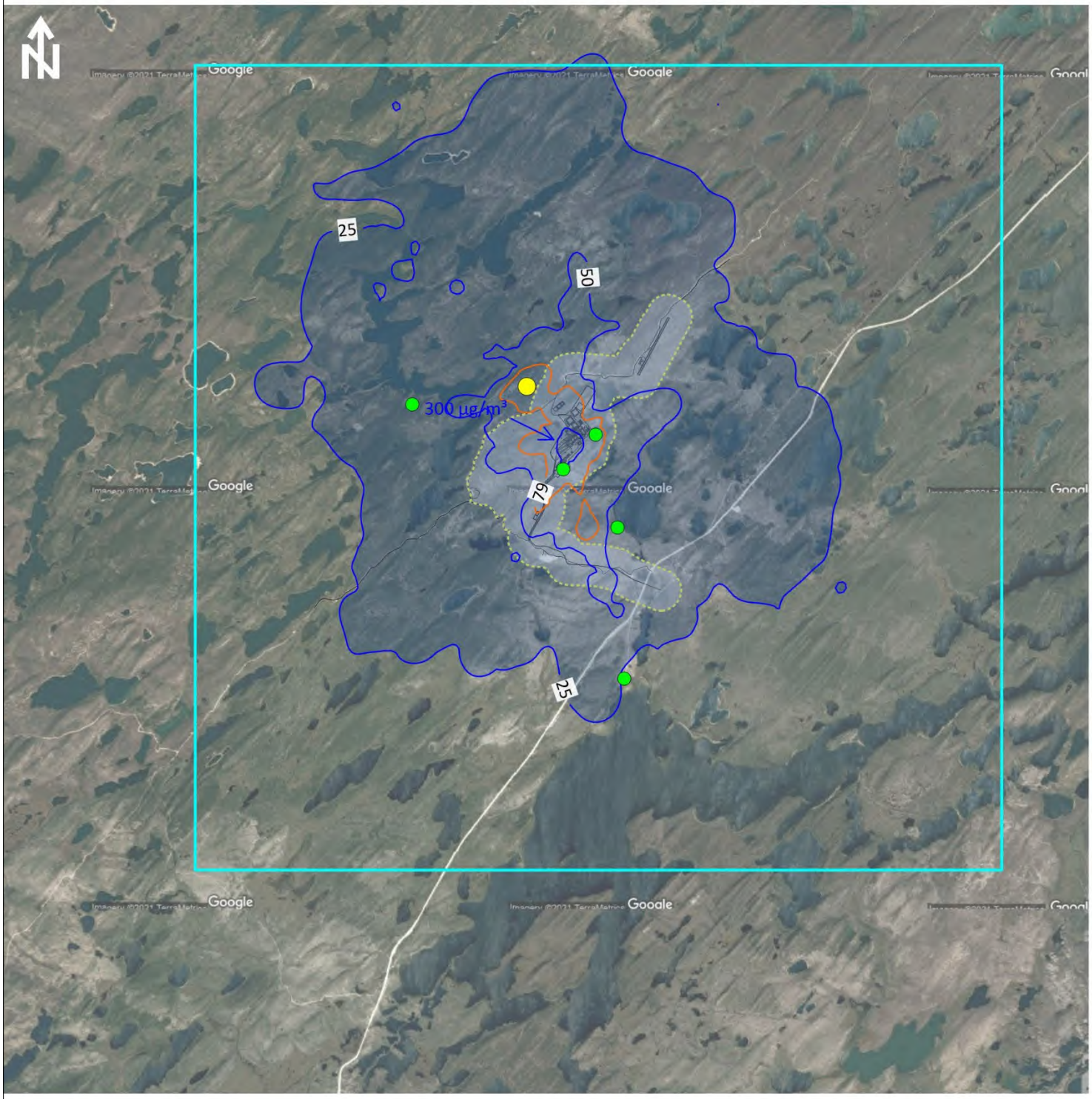
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Annual SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	28
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 11.3 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

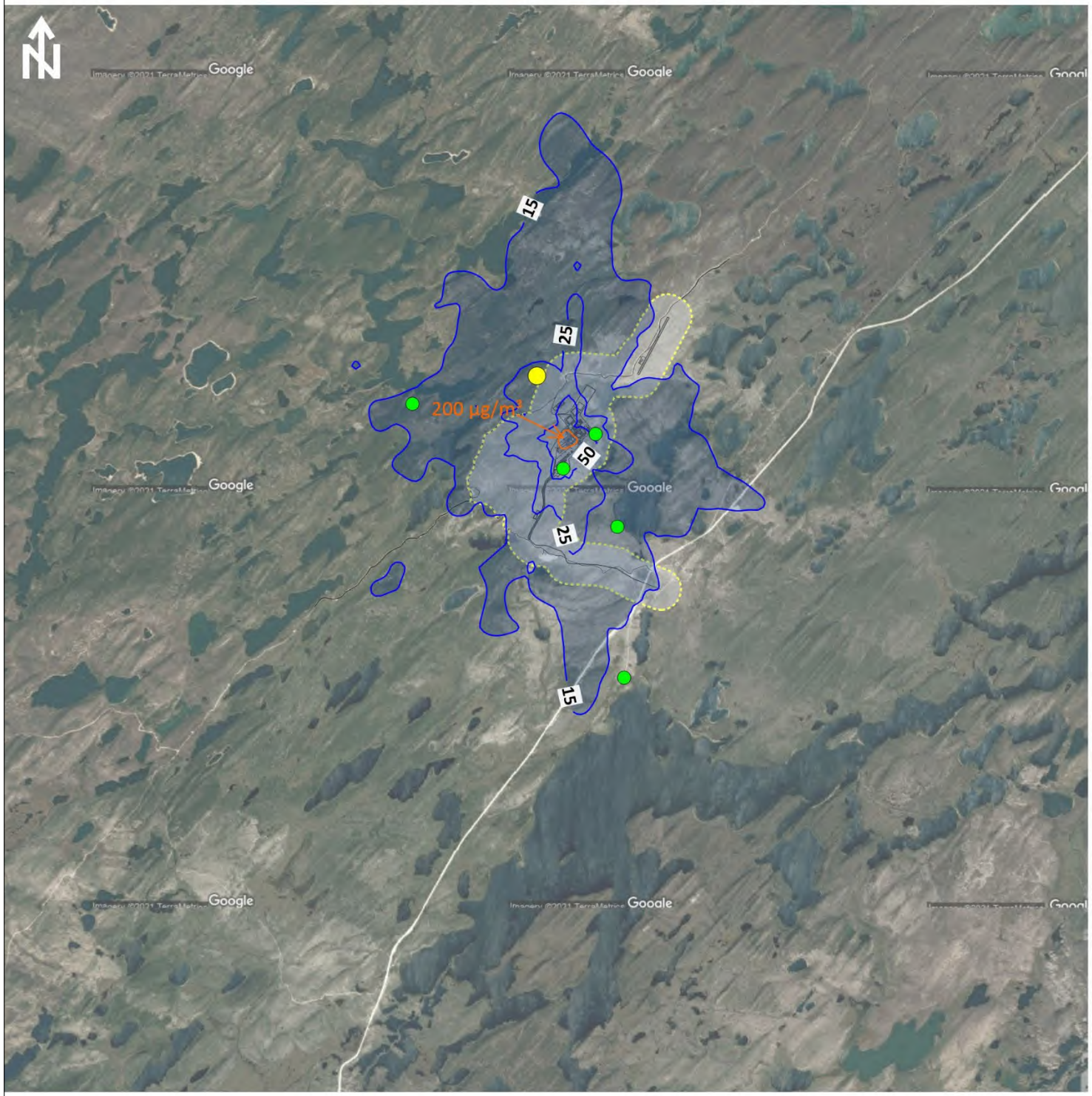
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 1-hour NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	29
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 9.4 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

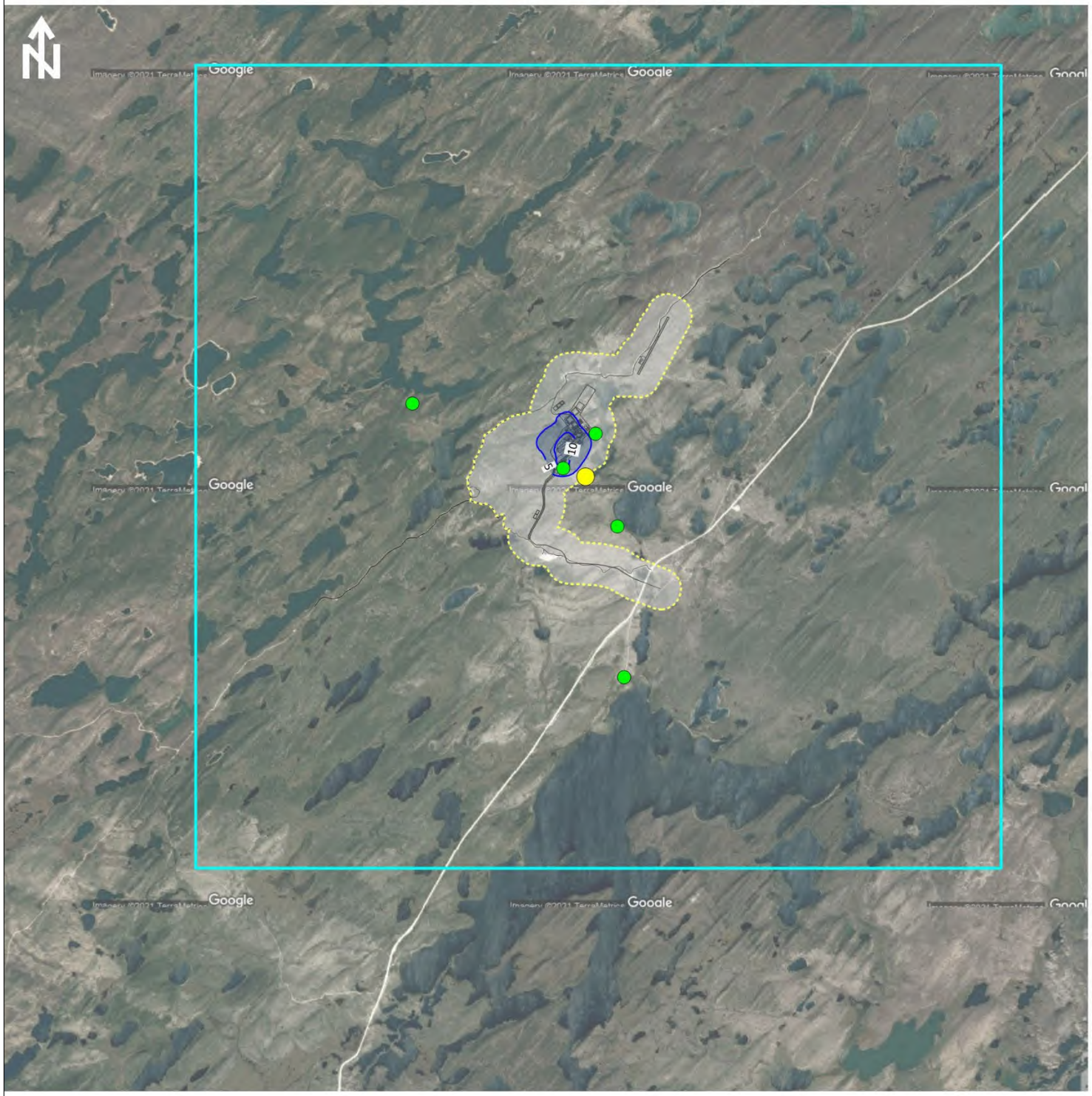
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	30
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.8 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

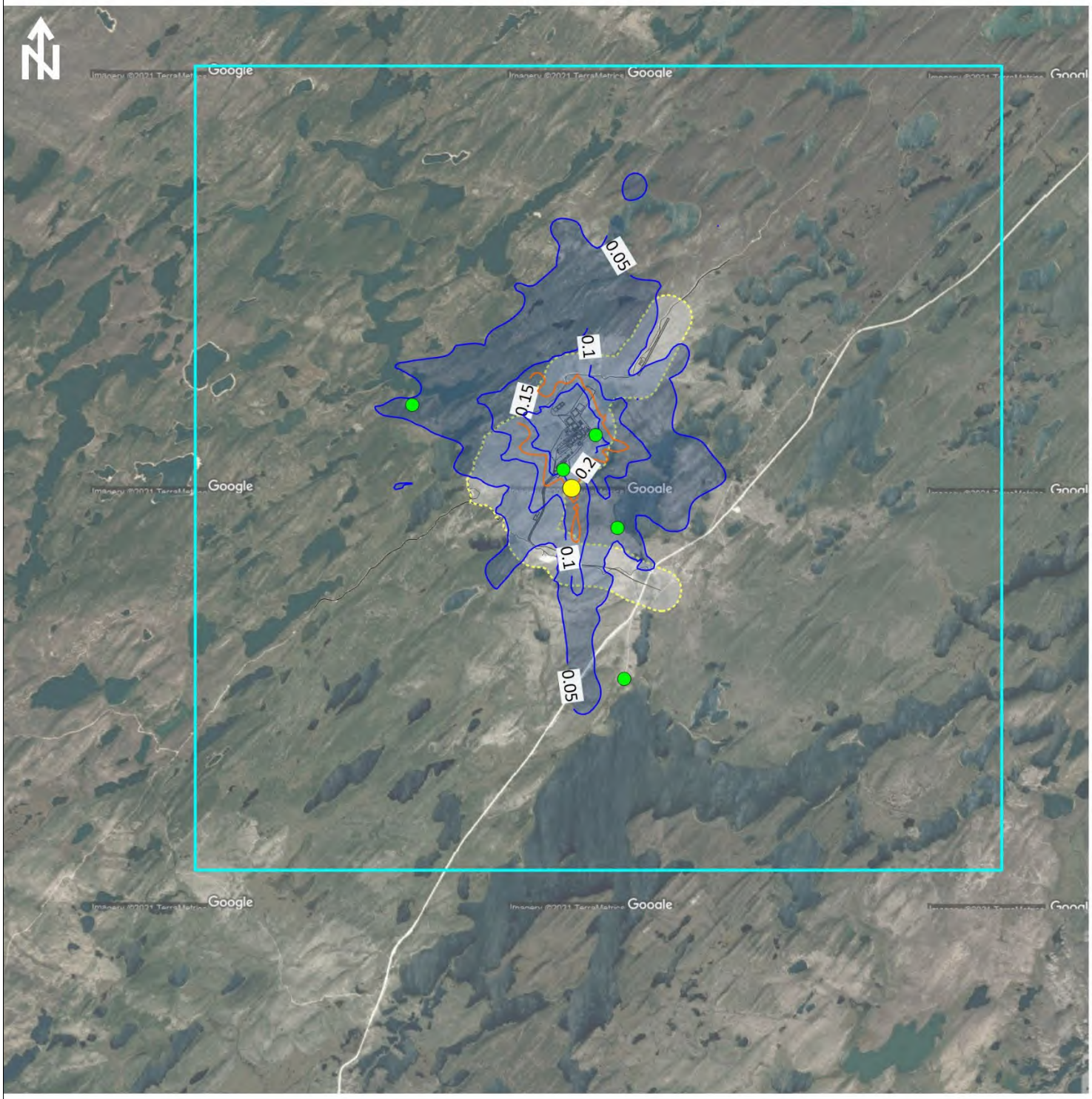
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum Annual NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	31
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.00E-03 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

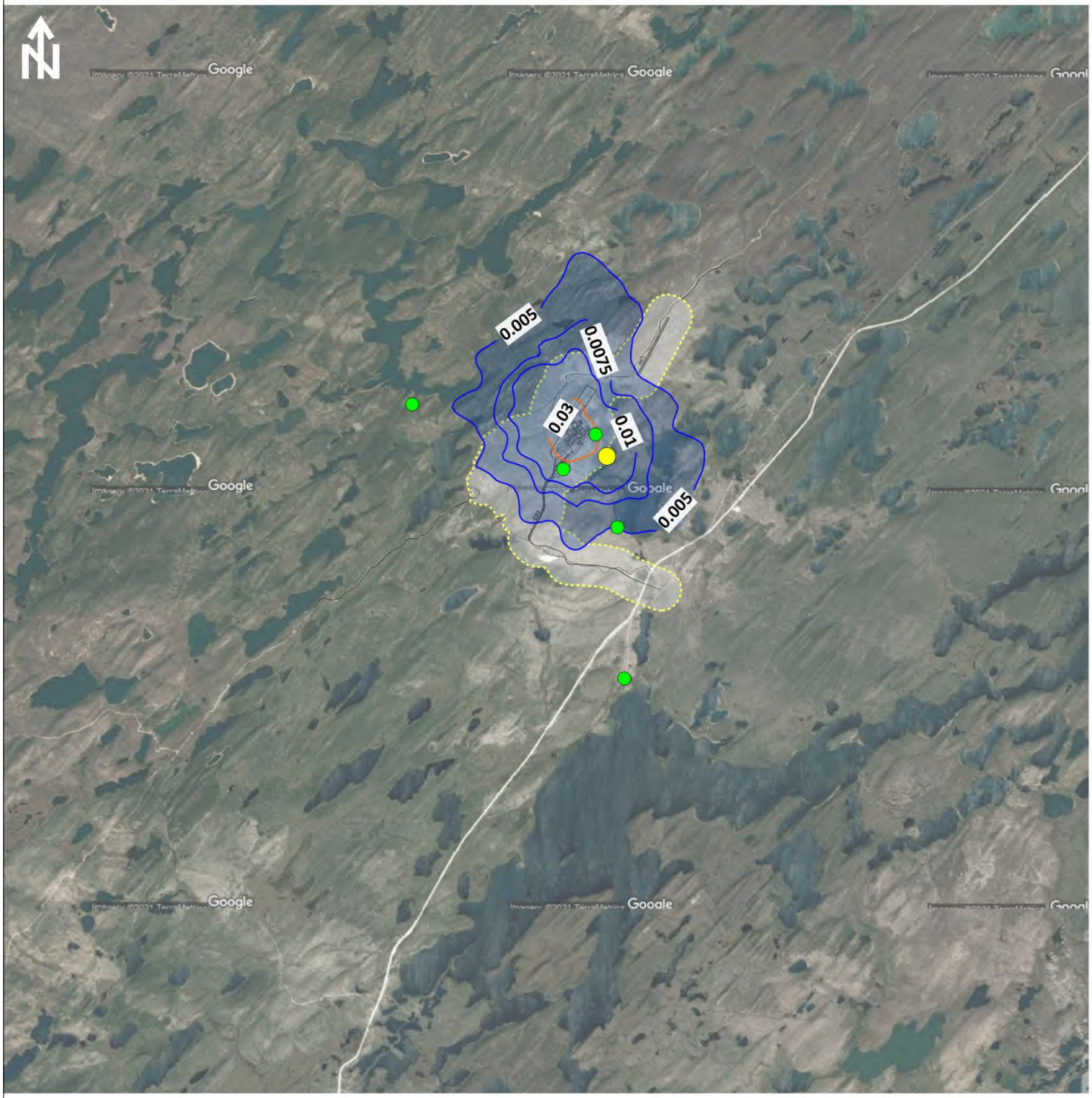
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour Uranium Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	32
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 6.00E-04 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

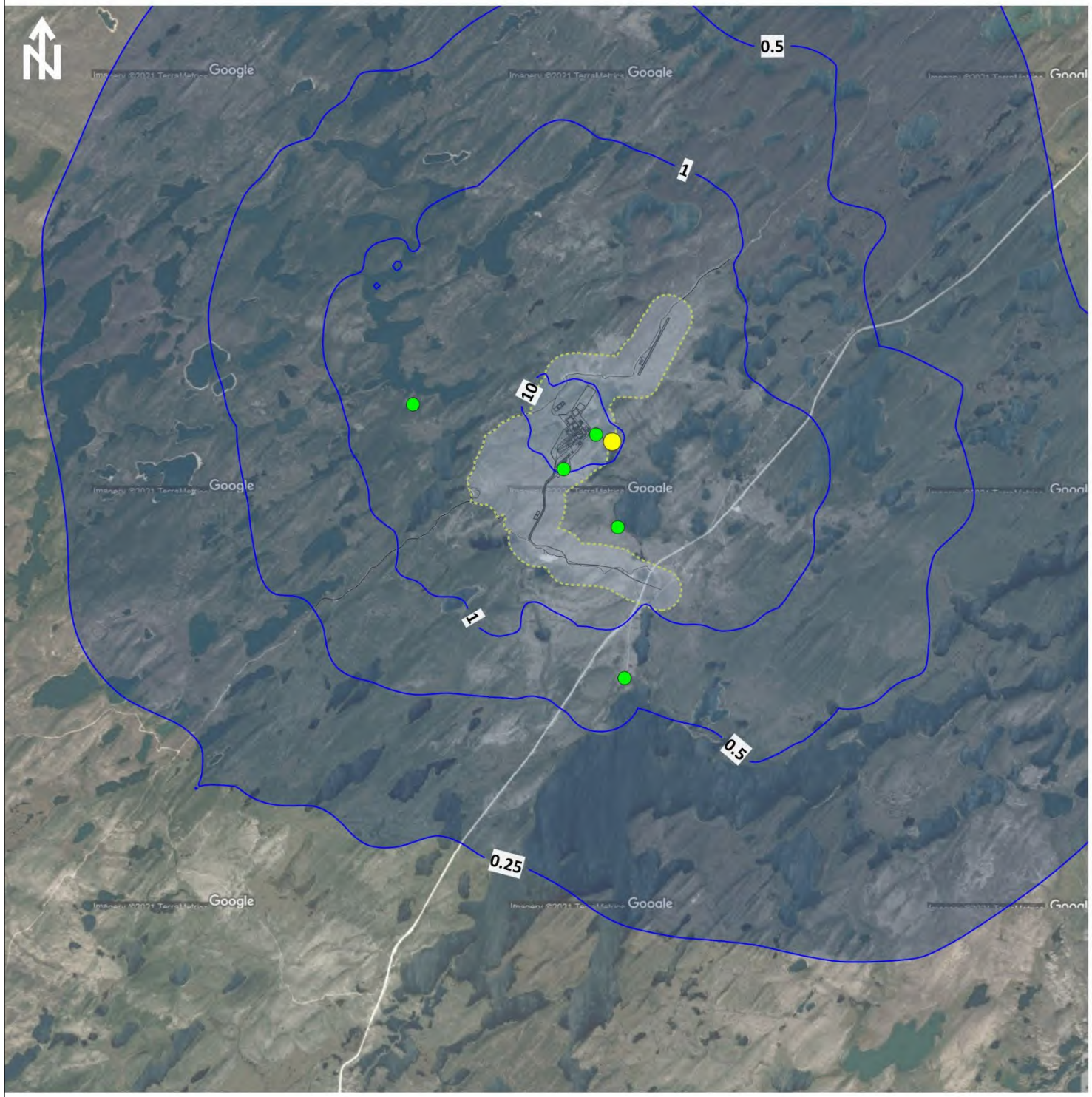
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum Annual Uranium Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	33
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (Bq/m³)
- Project Criteria (Bq/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 Bq/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

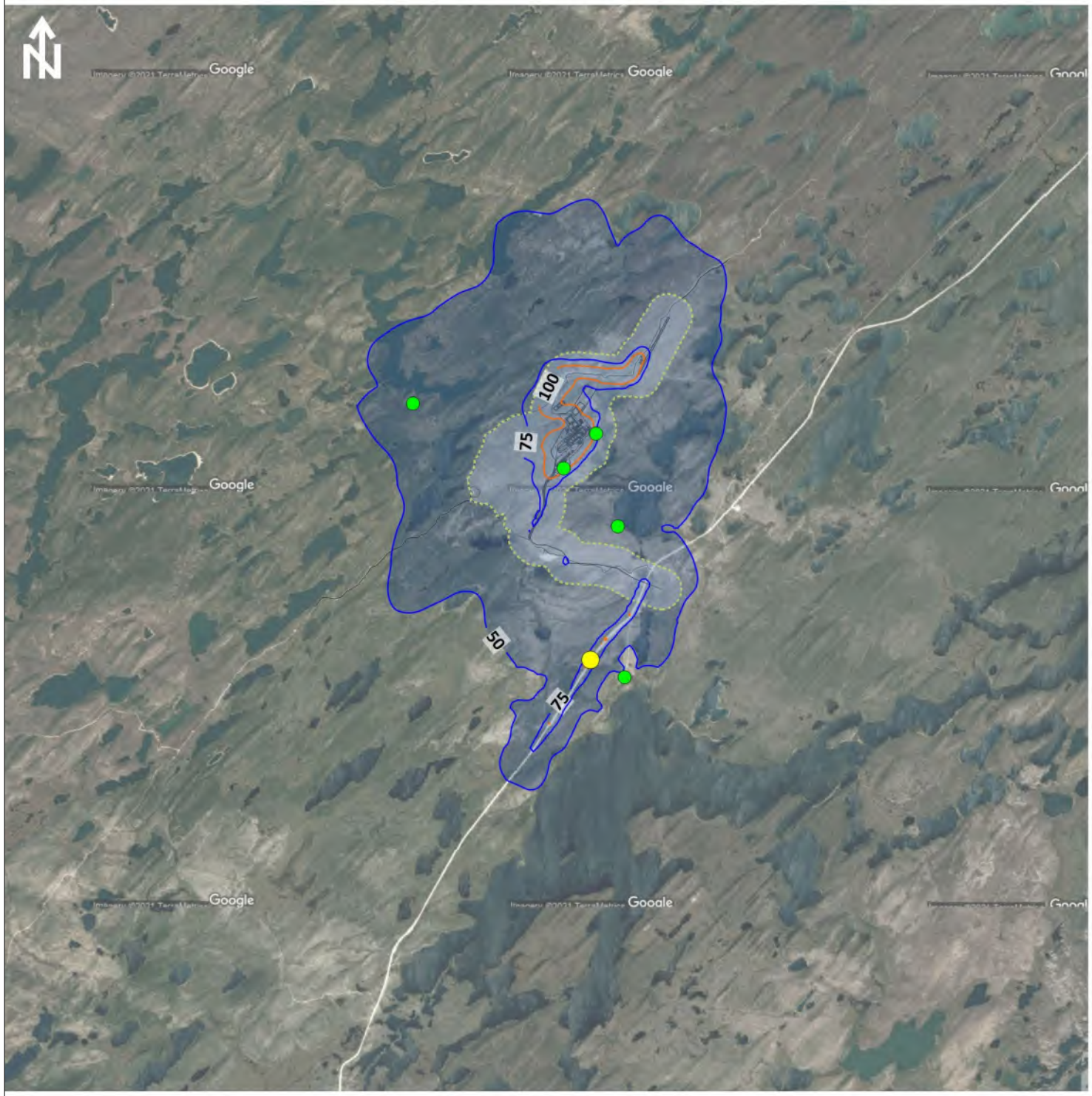
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Annual Radon Concentrations (Bq/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	34
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 46.2 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

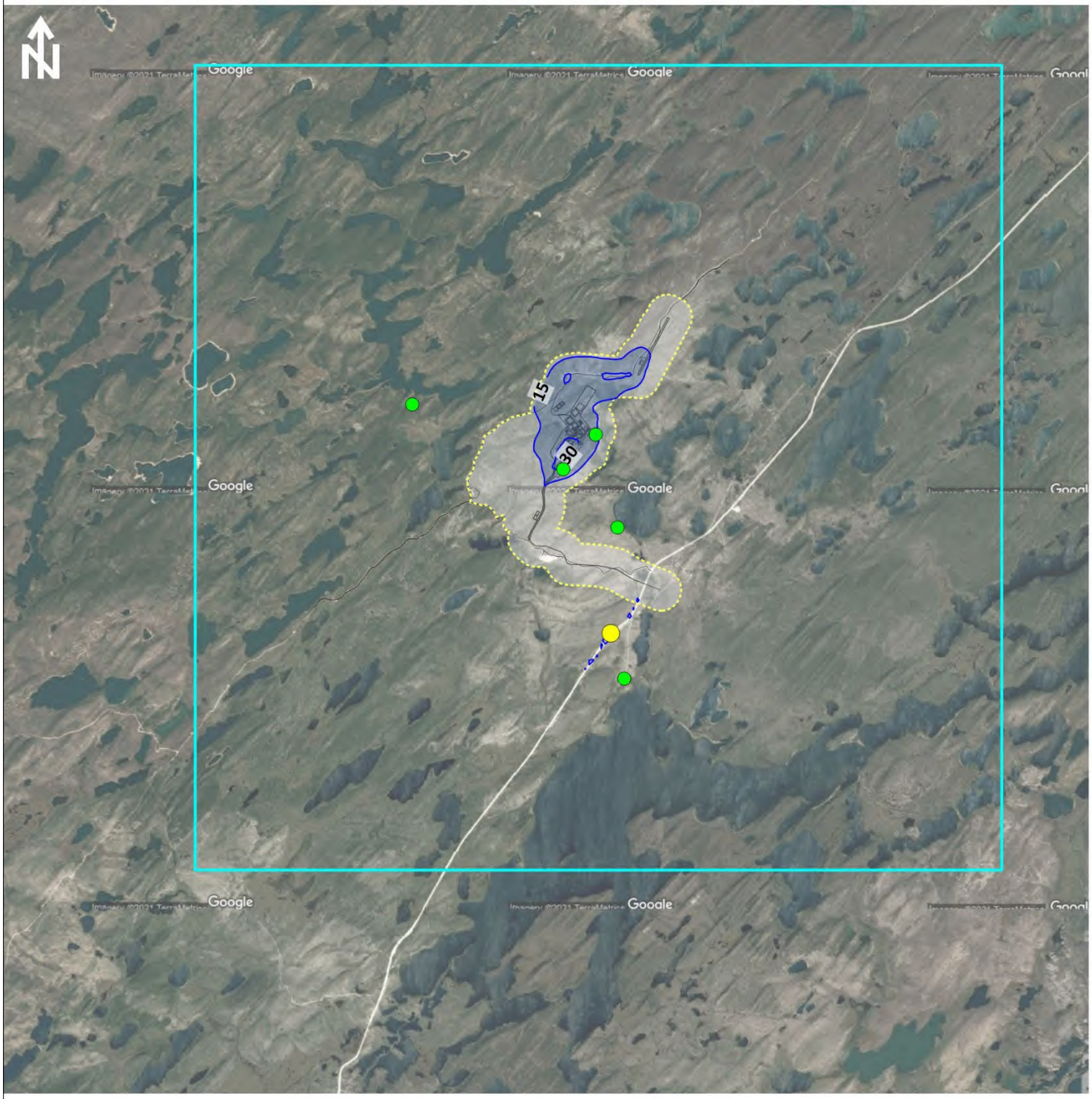
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 24-hour TSP Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	35
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 12.4 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

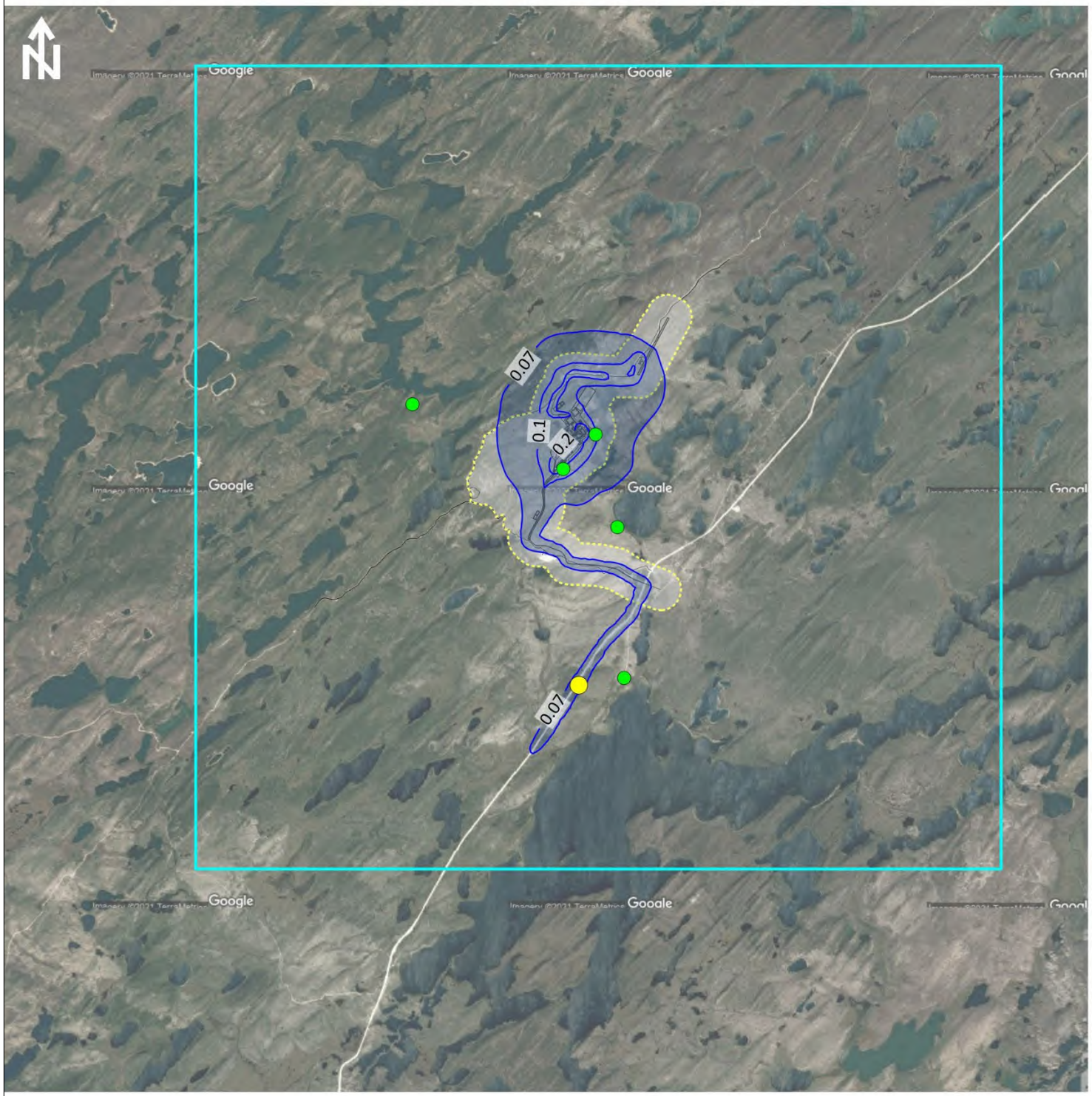
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum Annual TSP Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	36
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Deposition (mg/cm²/30d)
- Project Criteria (mg/cm²/30d)
- Maximum off-property deposition location
- Risk Receptor

NOTES:

Dustfall includes the addition of a background value of 0.06 mg/cm²/30d.

SCALE:

0 km 2.5 km 5 km 7.5 km

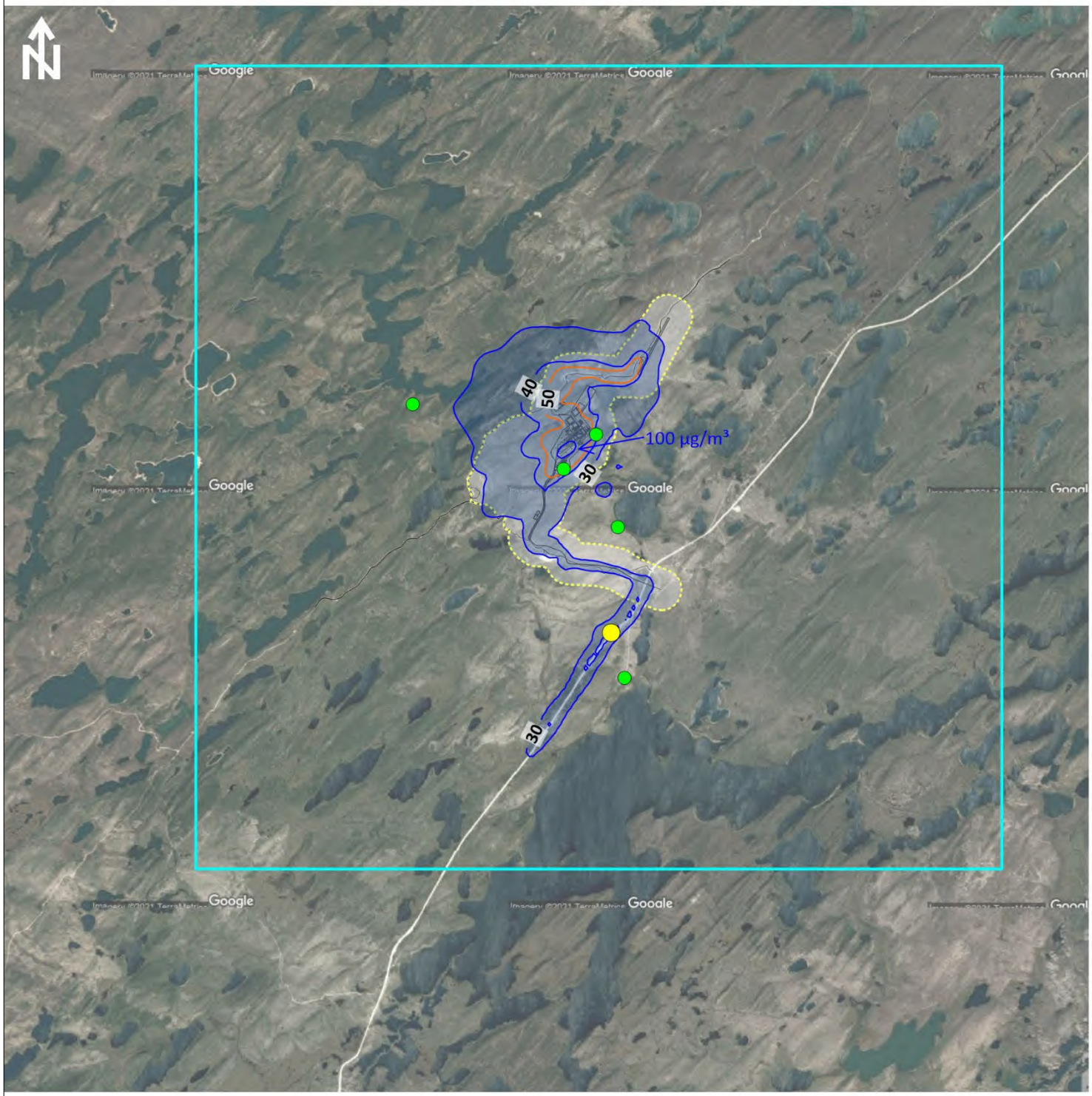
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
30-Day Dustfall (mg/cm²/30-days)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	37
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 23.1 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

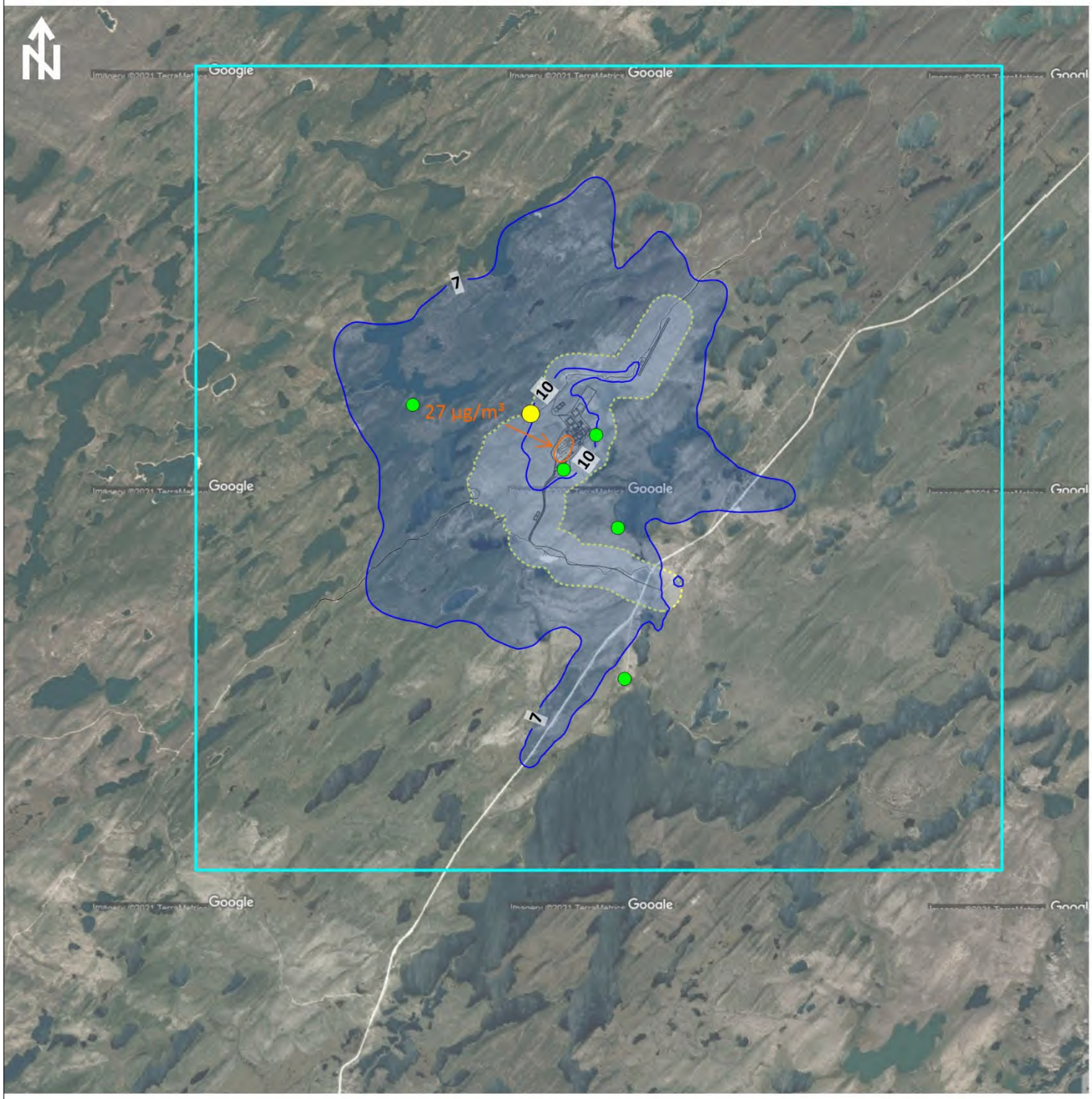
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 24-hour PM_{10} Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	38
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 6.5 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

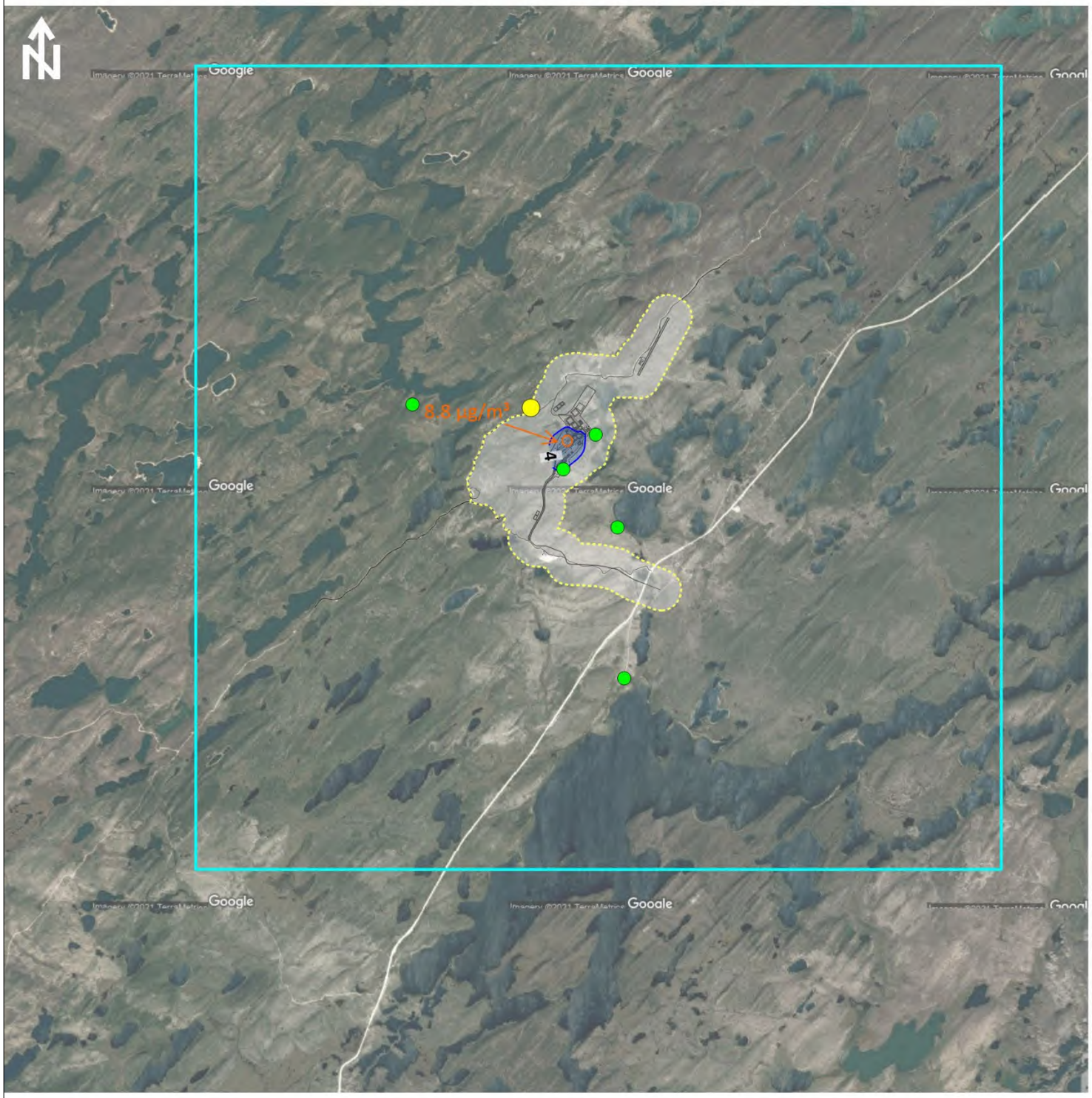
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 24-hour $PM_{2.5}$ Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	39
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.1 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

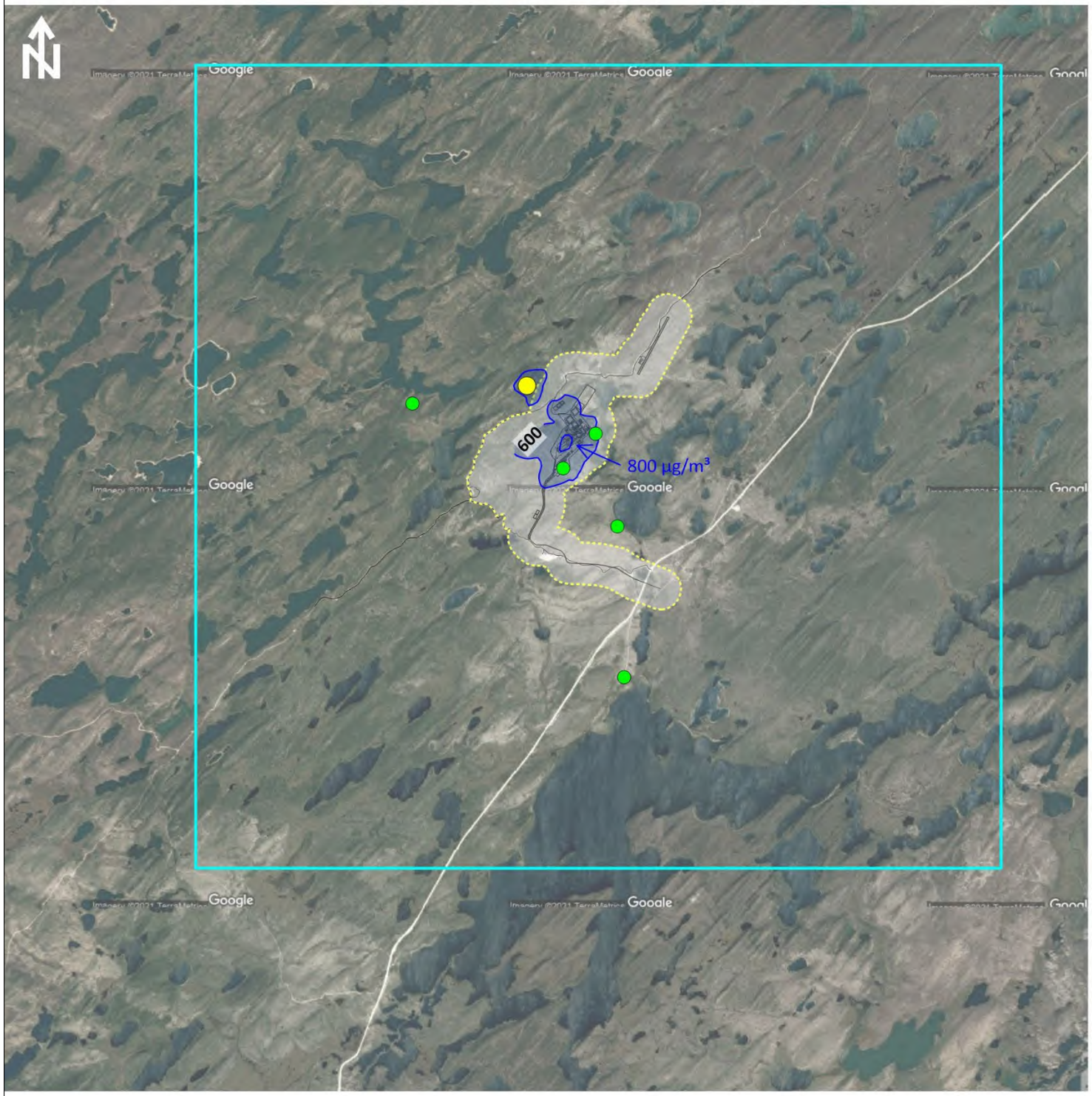
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum Annual $PM_{2.5}$ Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	40
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 575 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

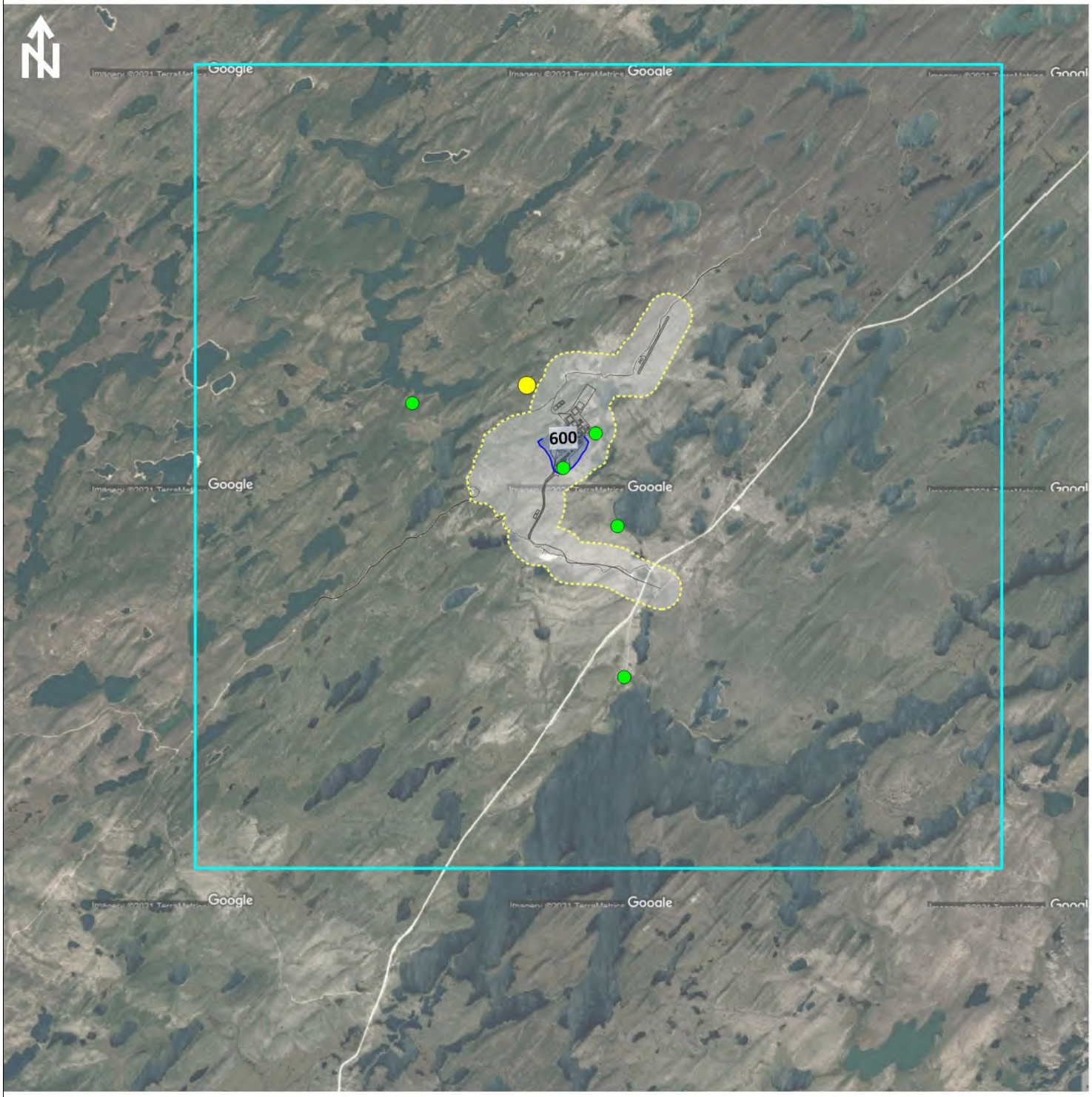
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 1-hour CO Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	41
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 575 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

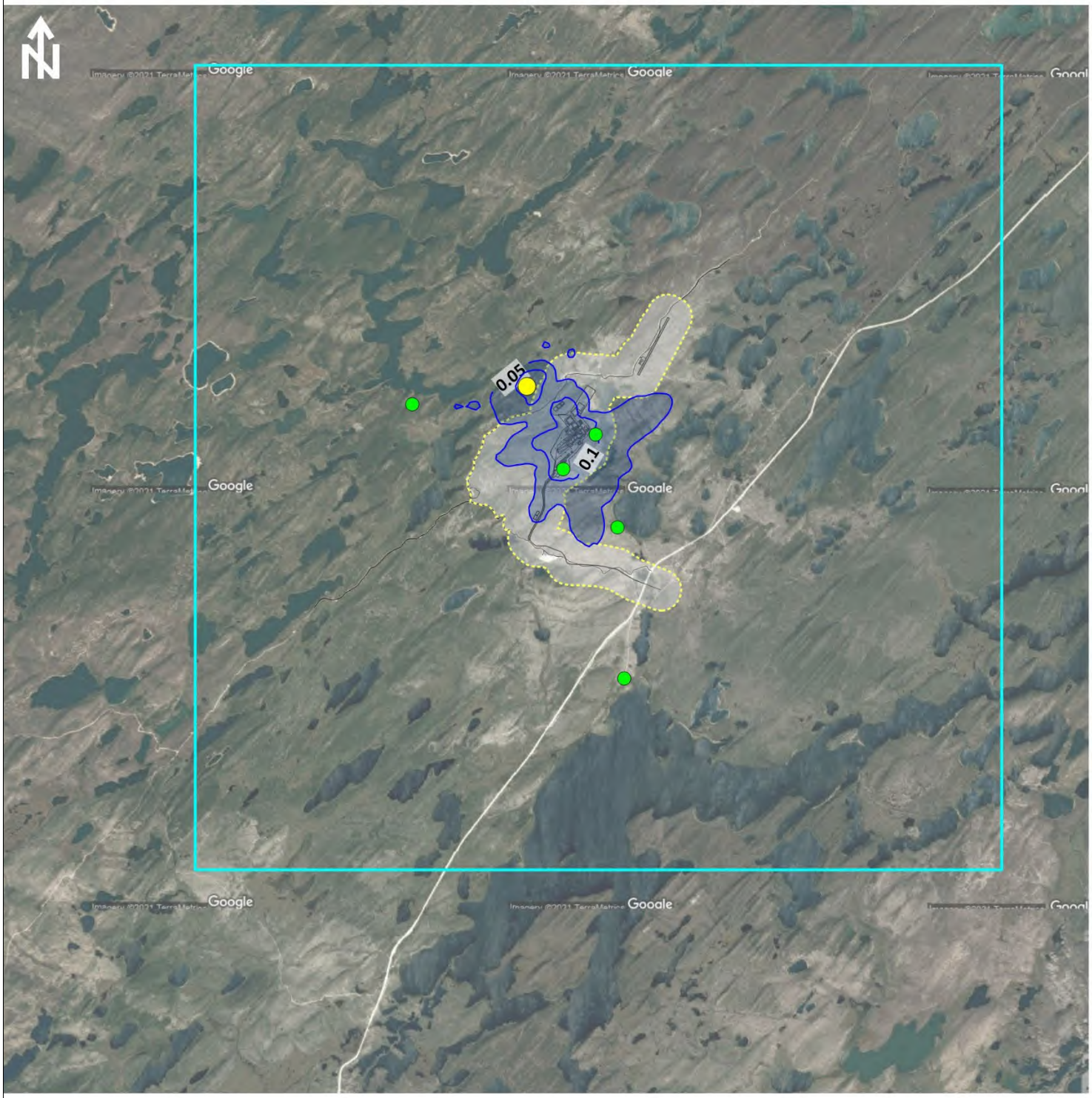
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 8-hour CO Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	42
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

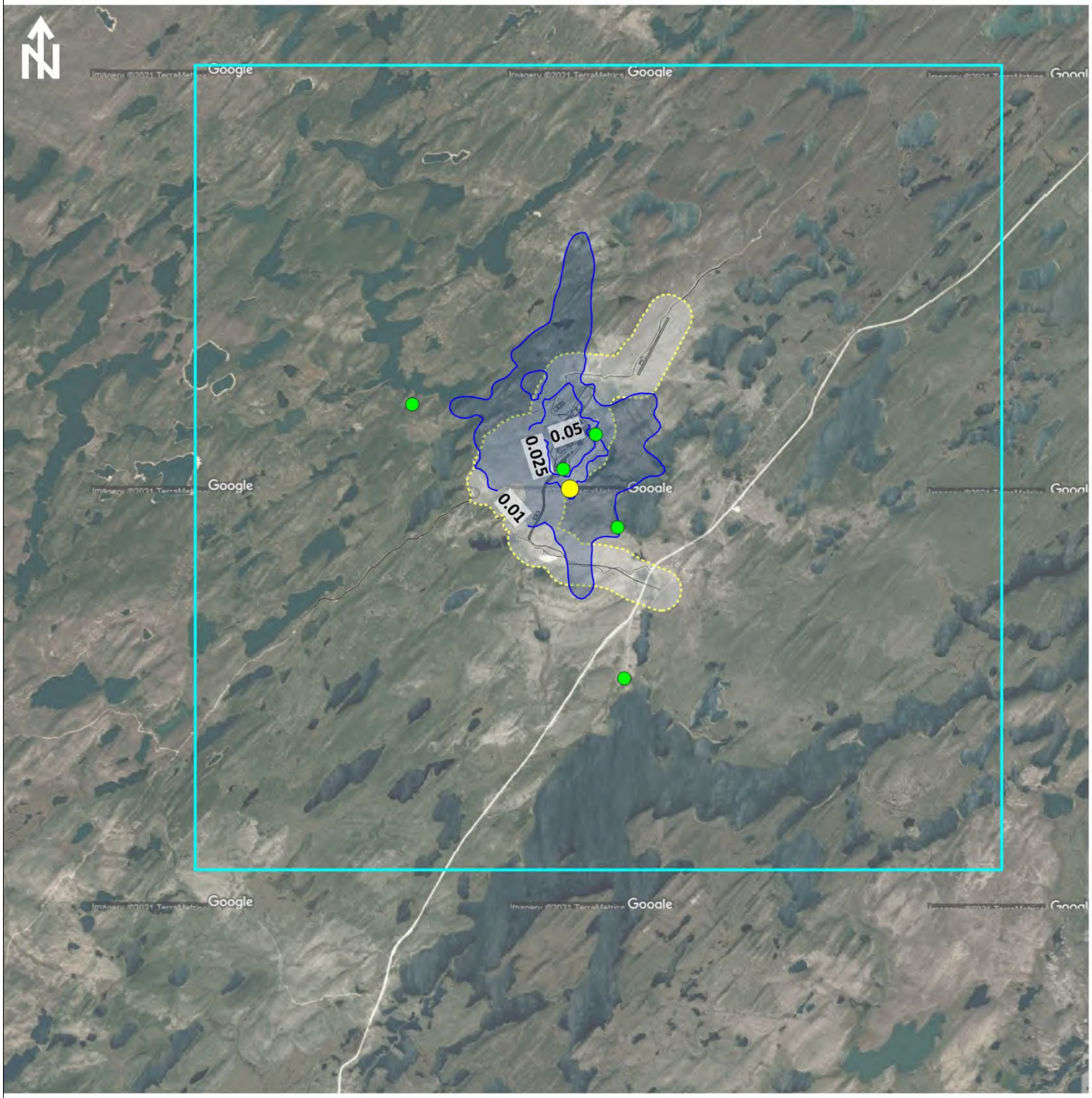
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
1-hour SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	43
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

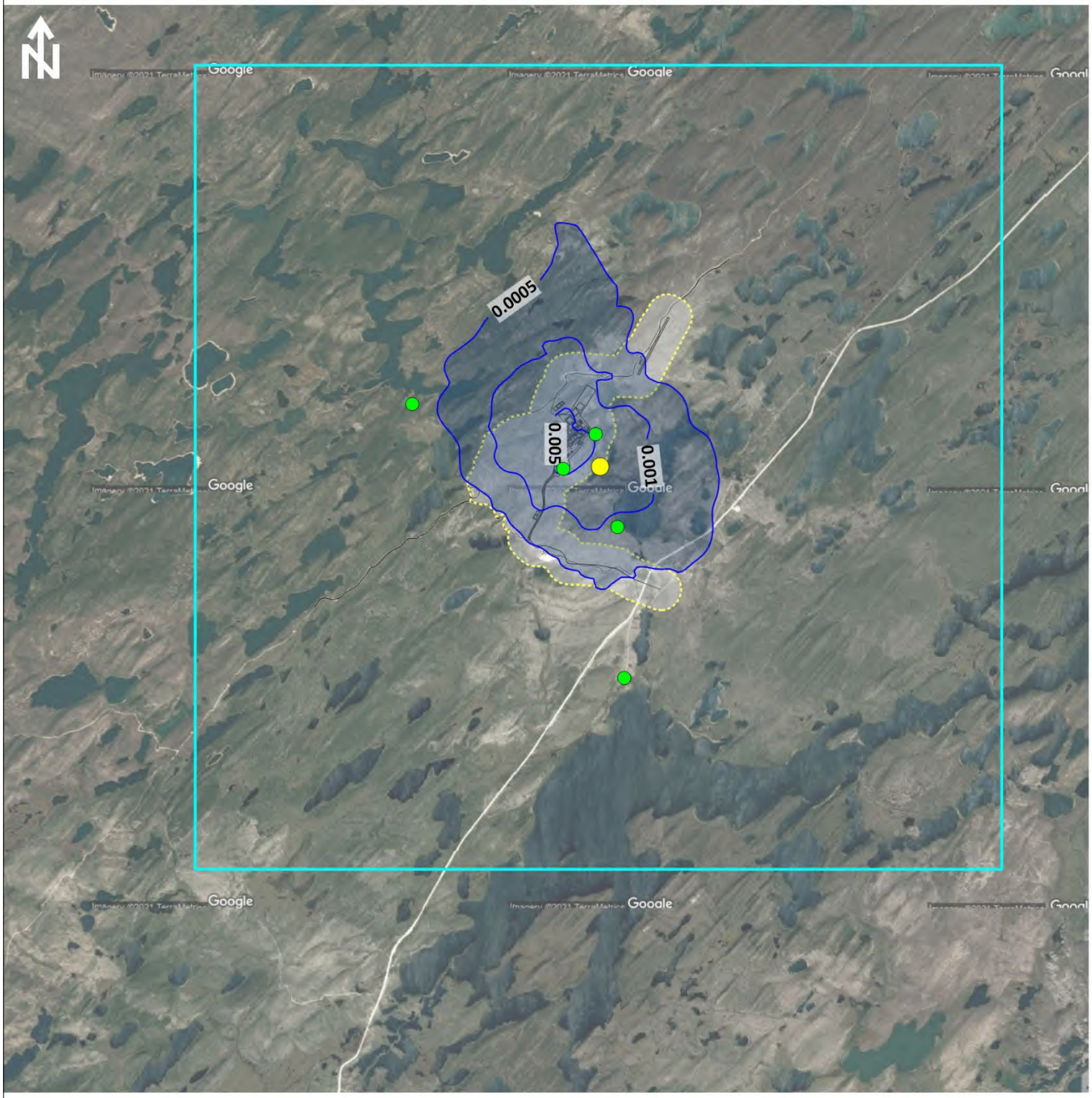
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
24-hour SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	44
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

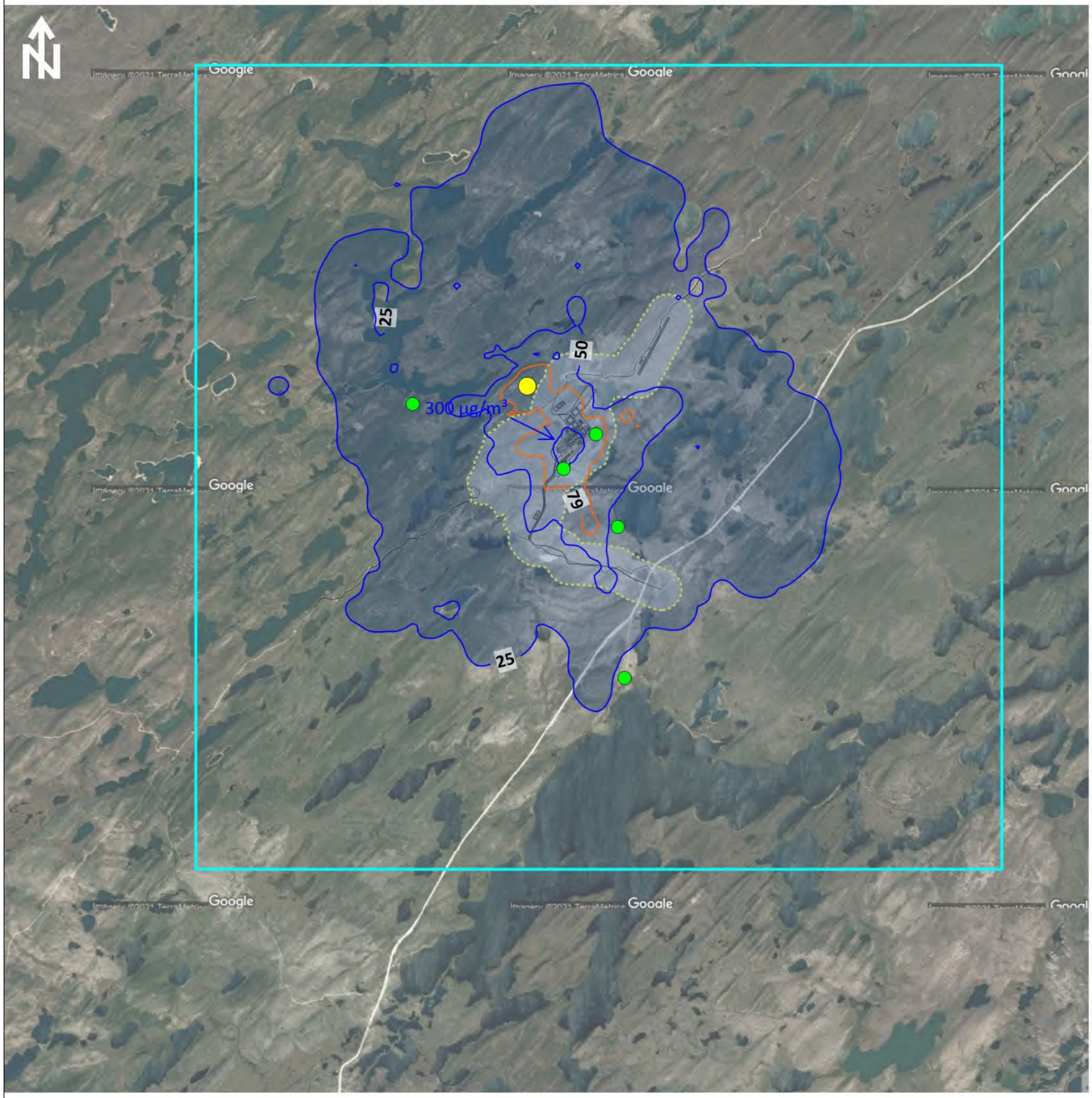
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Annual SO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	45
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 11.3 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

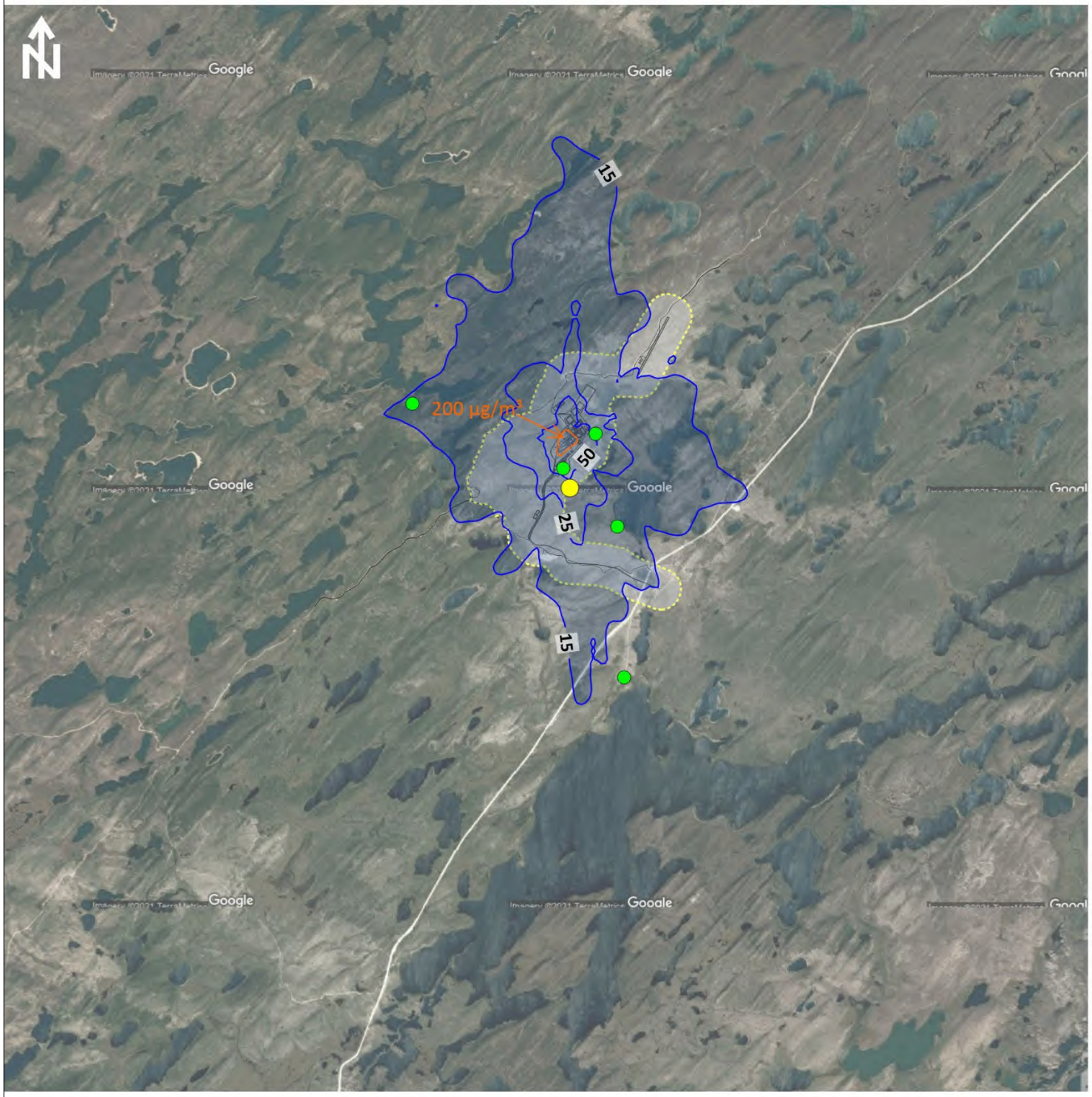
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 1-hour NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	46
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 9.4 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

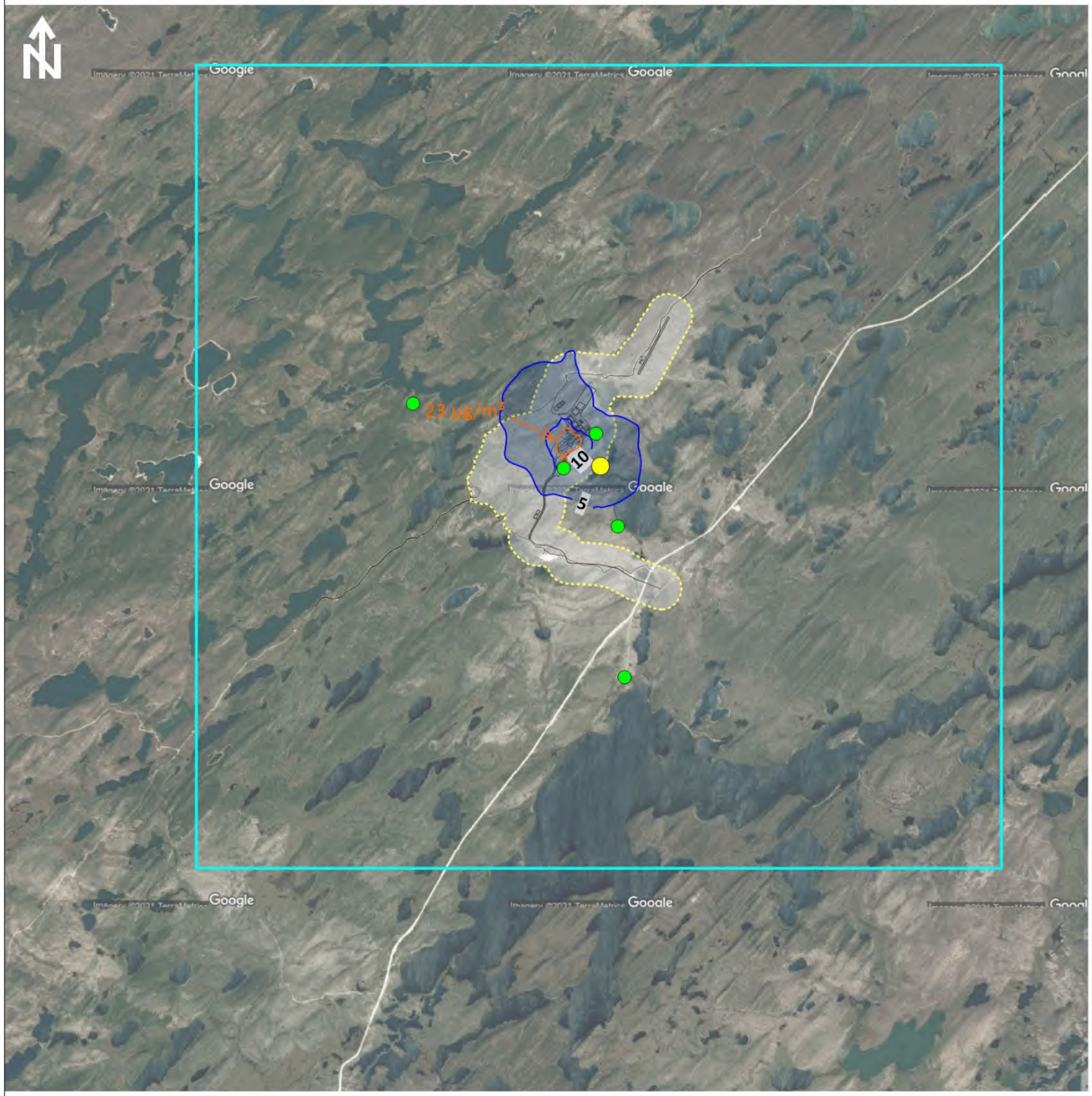
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 24-hour NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	47
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (µg/m³)
- Project Criteria (µg/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 3.8 µg/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

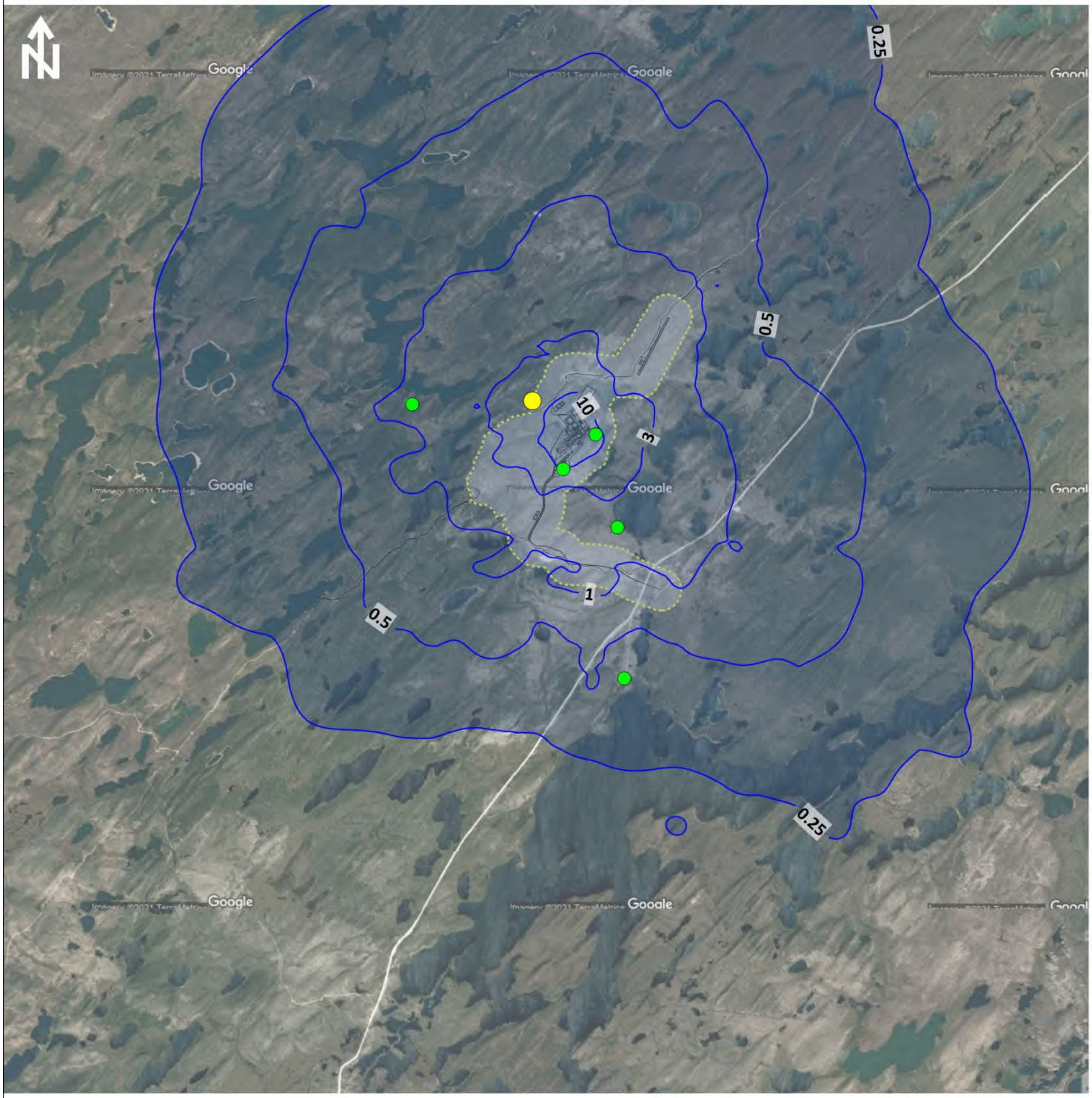
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum Annual NO_2 Concentrations (µg/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	48
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Concentration (Bq/m³)
- Project Criteria (Bq/m³)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

Concentrations include the addition of a background value of 0 Bq/m³.

SCALE:

0 km 2.5 km 5 km 7.5 km

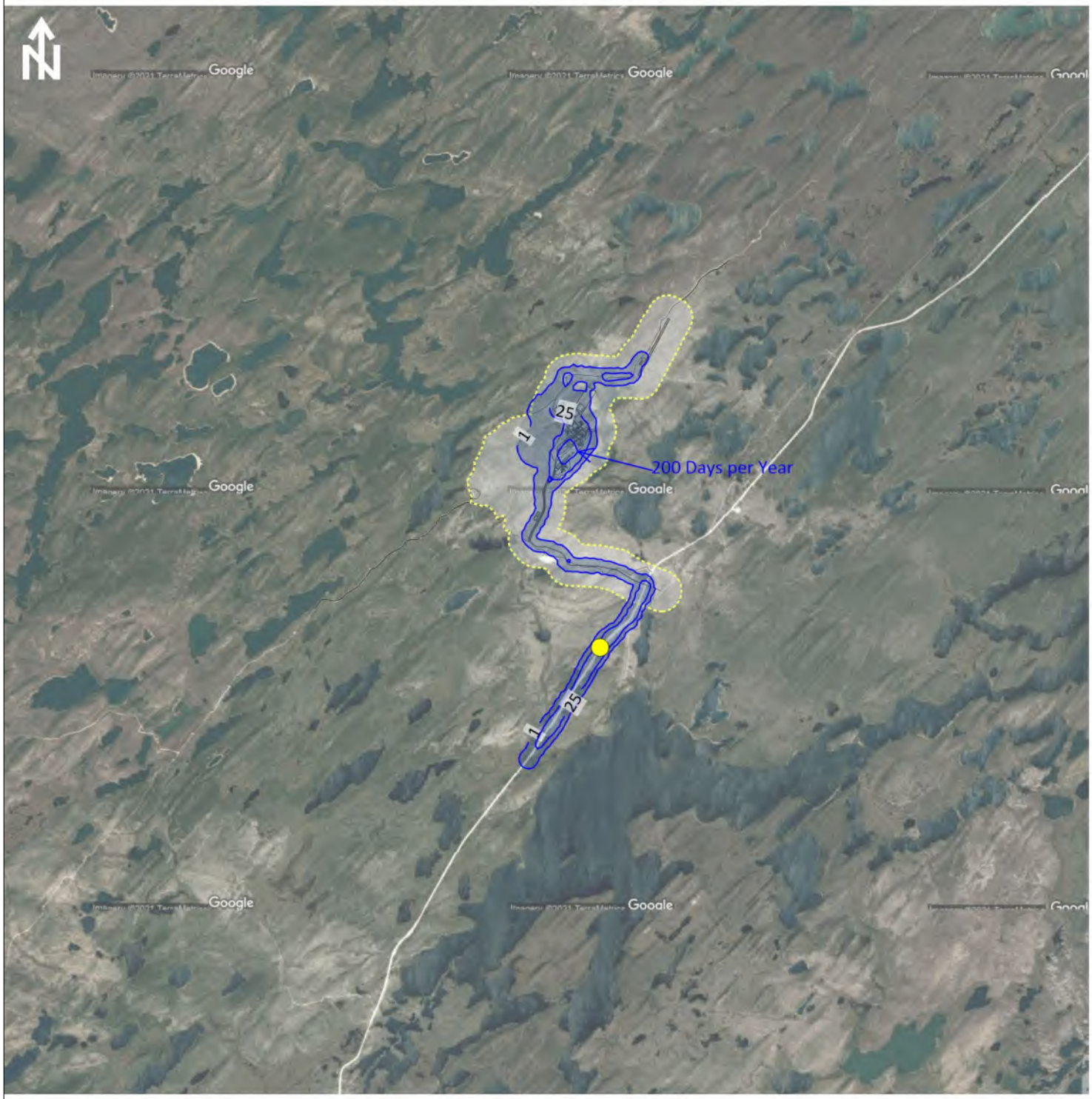
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Annual Radon Concentrations (Bq/m³)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	49
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (days per year)
- Maximum off-property concentration location
- Risk Receptor

SCALE:

0 km 2.5 km 5 km 7.5 km

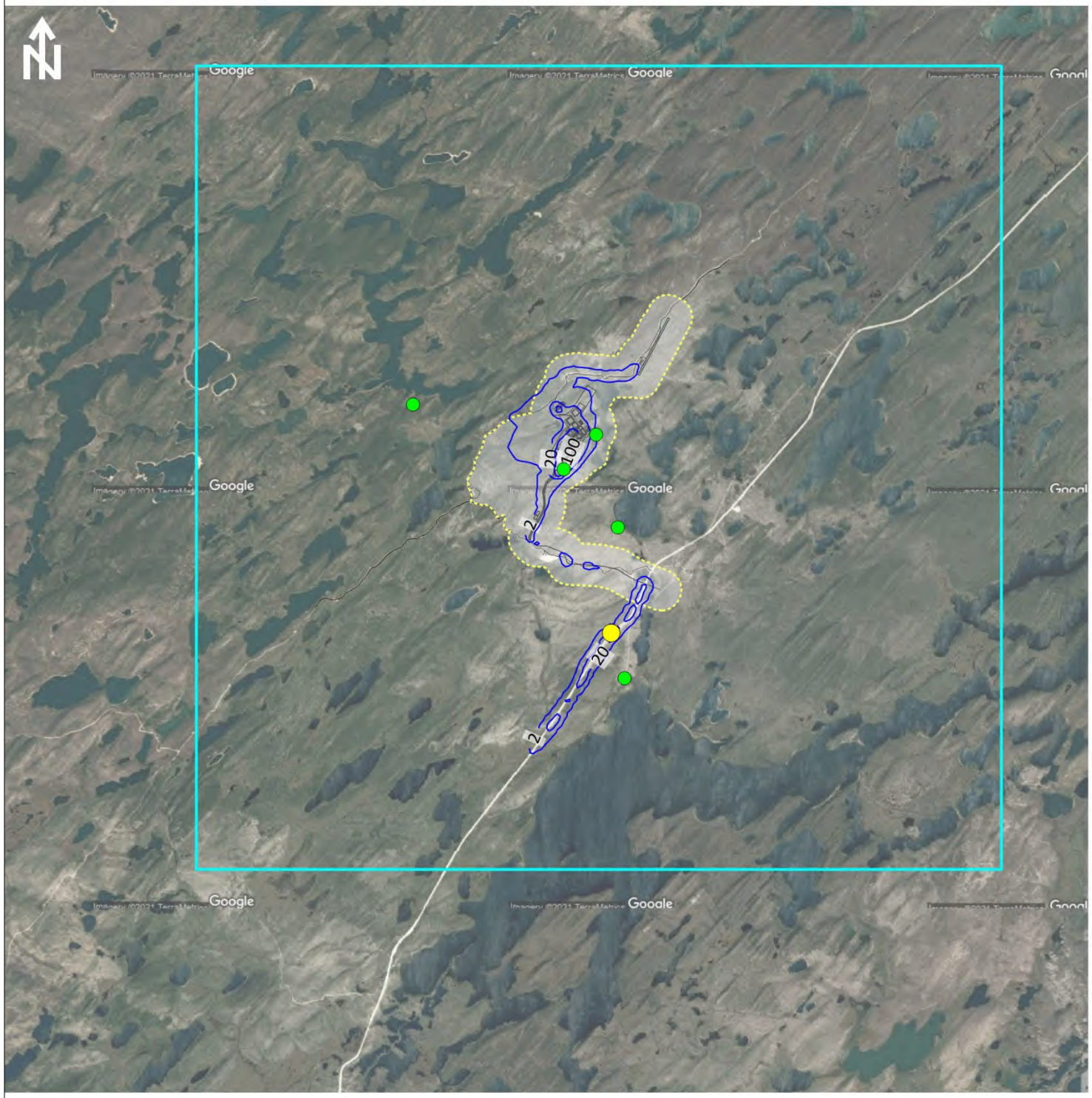
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 24-hour TSP Exceedances (days per year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	50
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (days per year)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

SCALE:

0 km 2.5 km 5 km 7.5 km

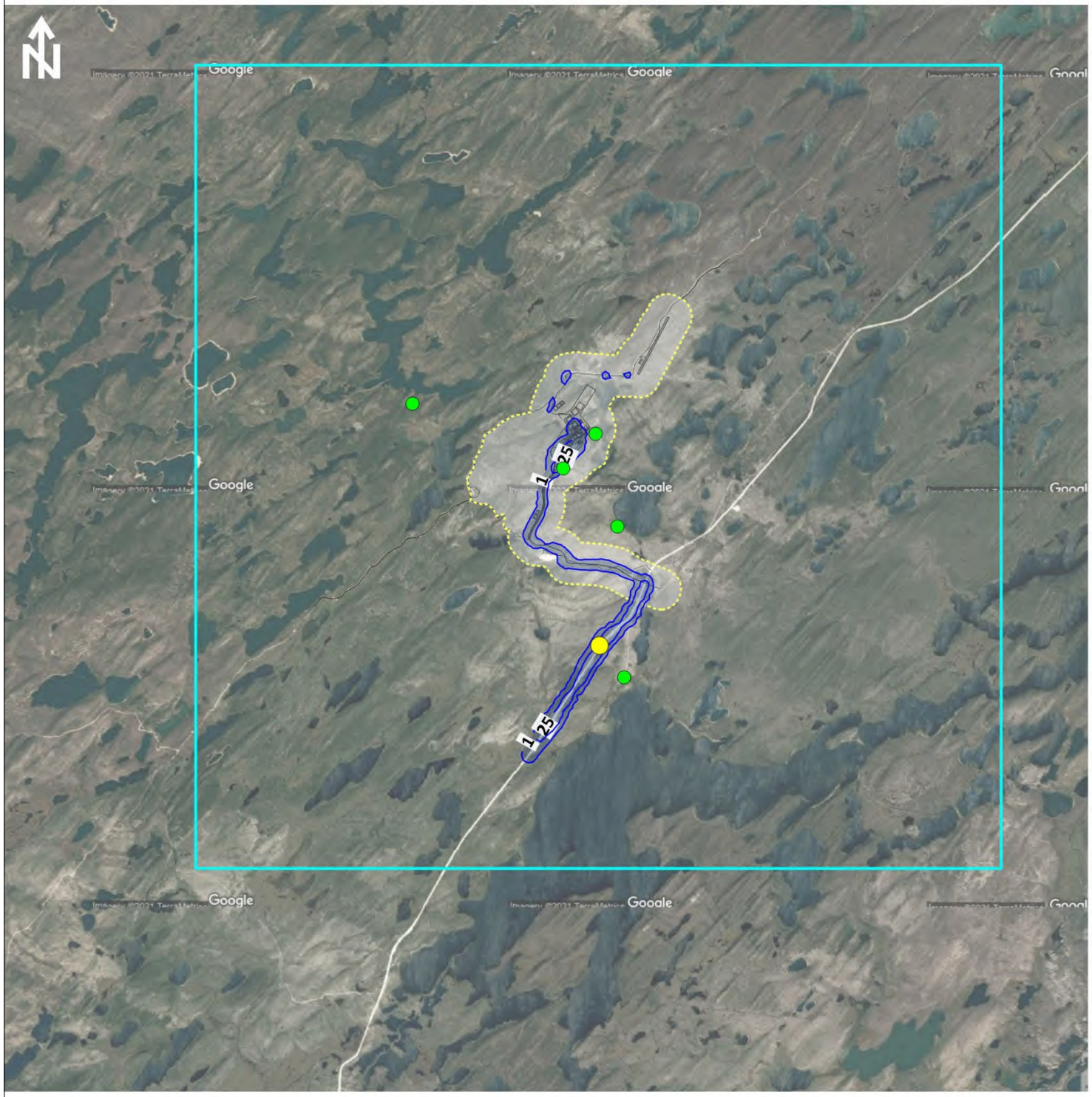
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Construction Scenario:
Maximum 24-hour PM_{10} Exceedances (Days per Year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	51
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (days per year)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

SCALE:

0 km 2.5 km 5 km 7.5 km

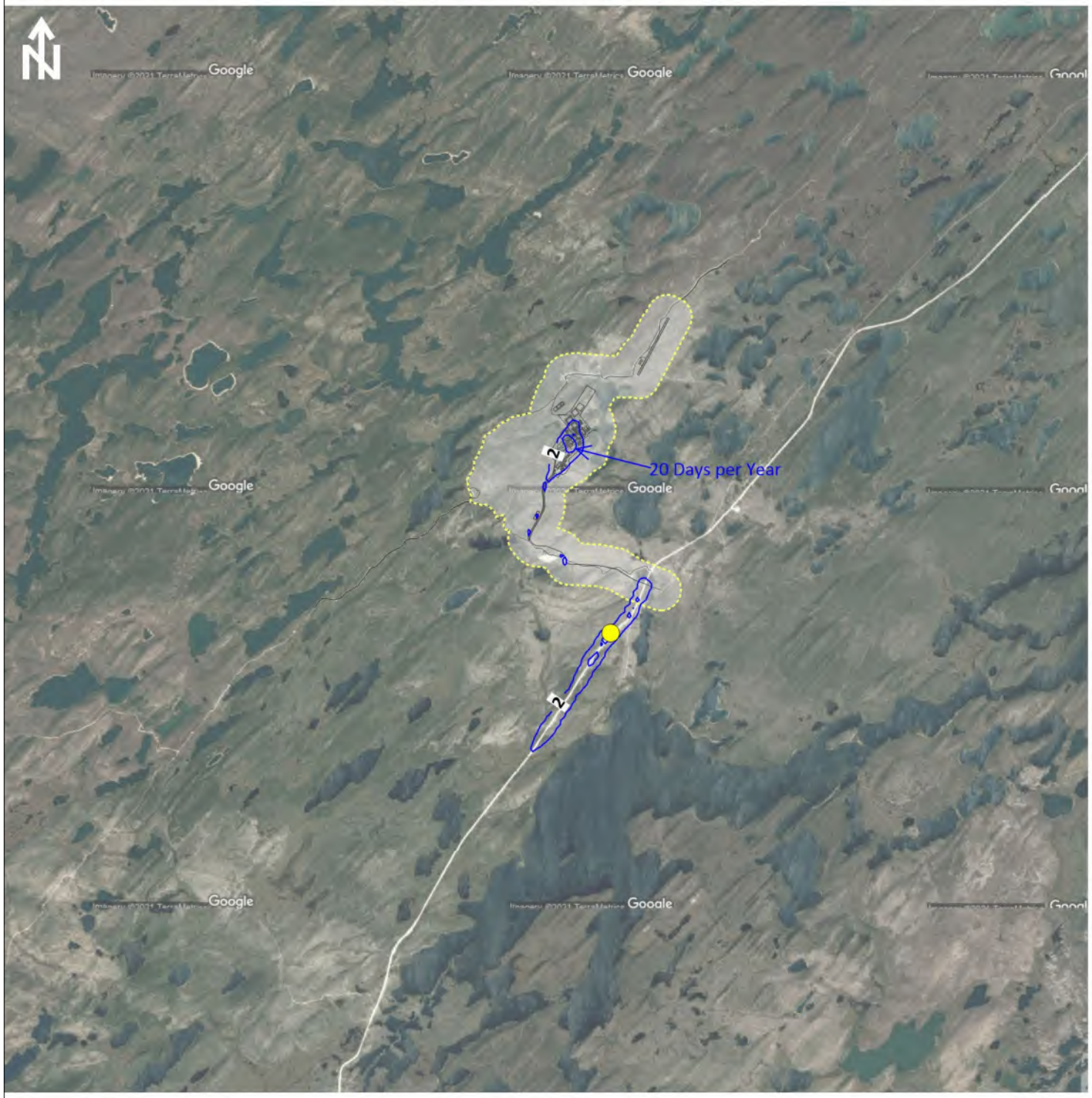
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour TSP Exceedances (Days per Year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	52
Date:	Project No.:	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (days per year)
- Maximum off-property concentration location
- Risk Receptor

SCALE:

0 km 2.5 km 5 km 7.5 km

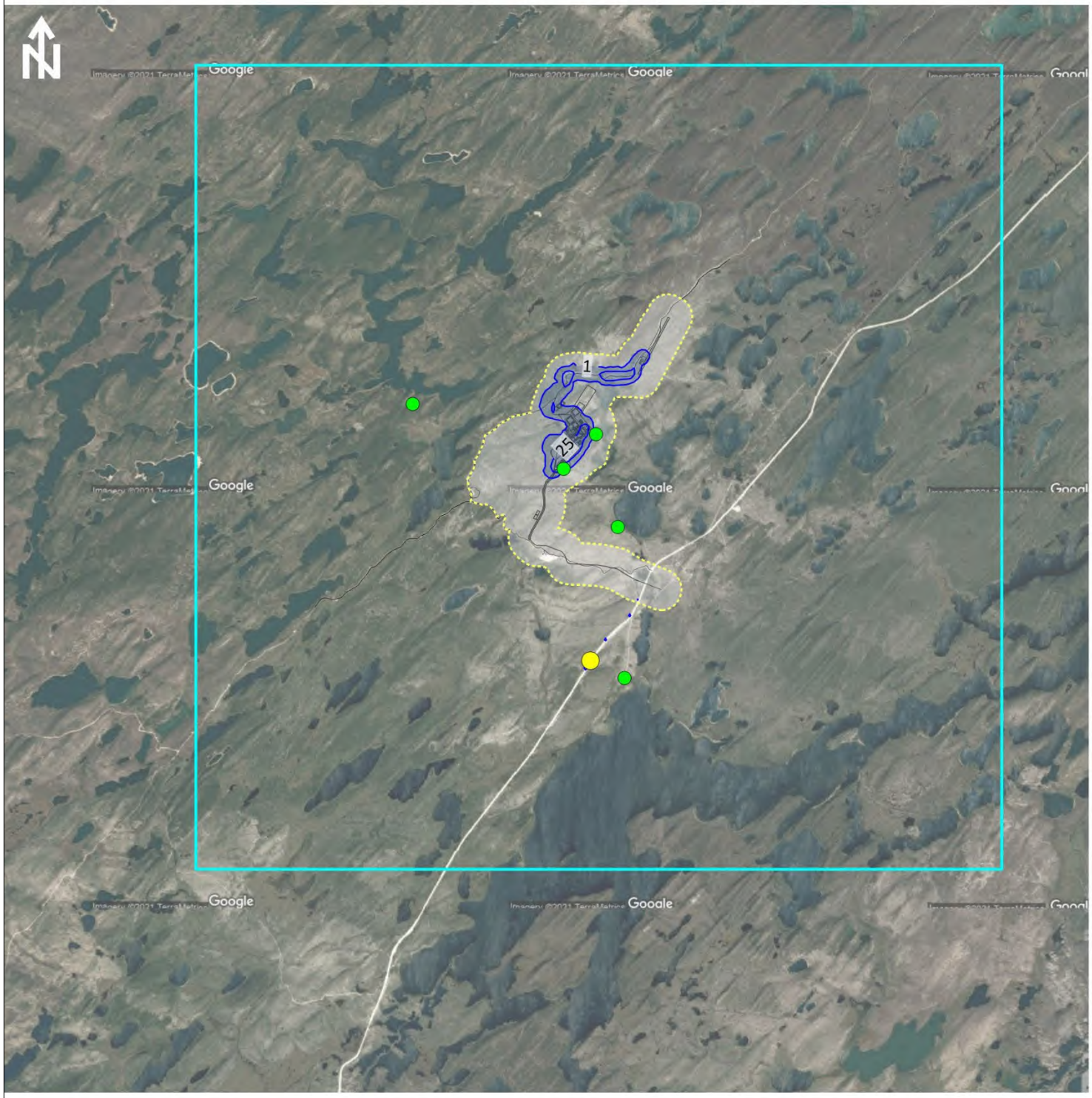
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour PM_{10} Exceedances (days per year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	53
Date:	**Project No.:**	
July 2022	SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (days per year)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

SCALE:

0 km 2.5 km 5 km 7.5 km

REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 24-hour TSP Exceedances (Days per Year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	54
Date:	Project No.:	
July 2022	SX19-0043	

LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (hours per year)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

SCALE:

0 km 2.5 km 5 km 7.5 km

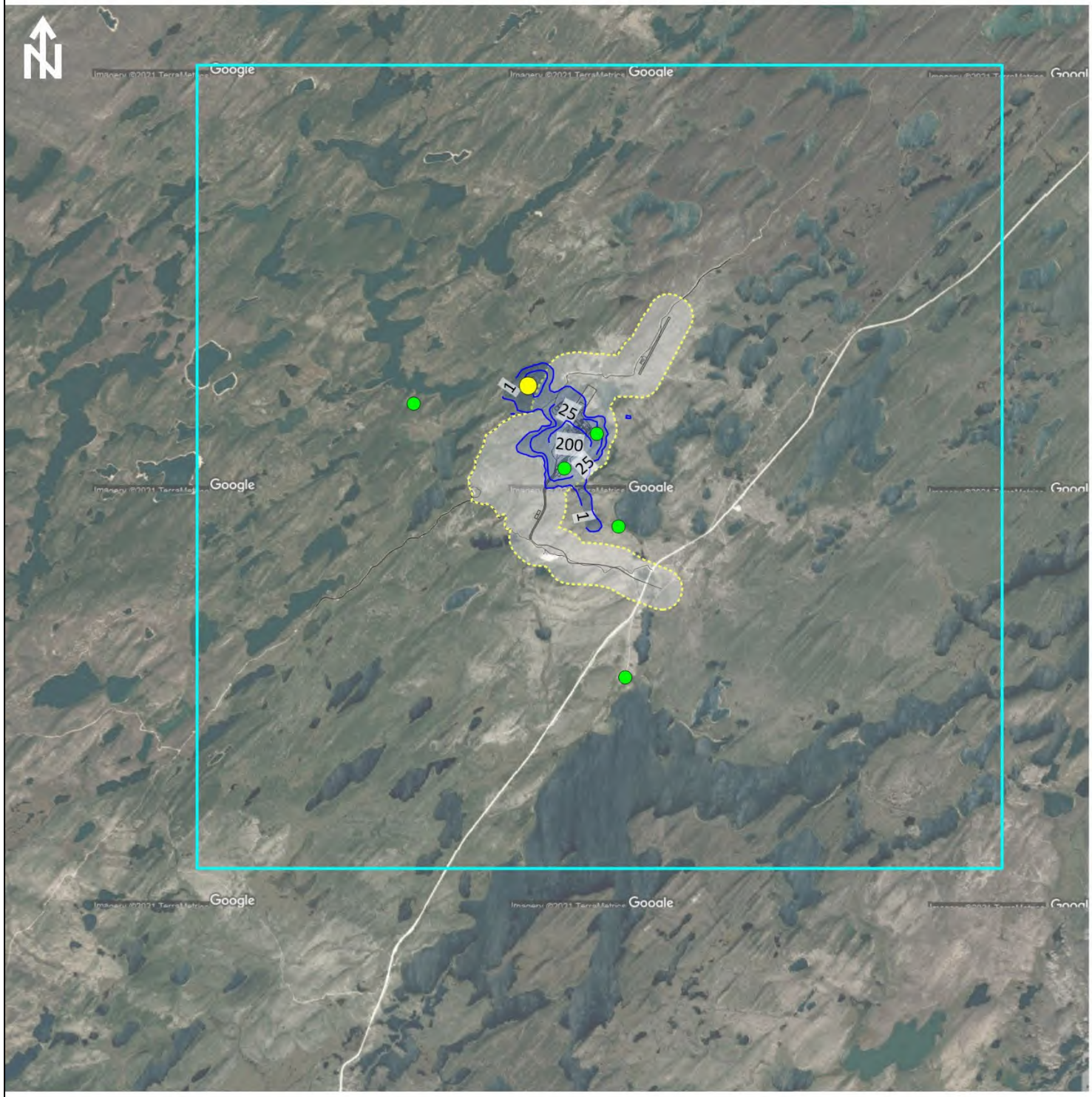
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 1-hour NO_2 Exceedances (Hours per Year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	55
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (hours per year)
- Maximum off-property concentration location
- Risk Receptor

NOTES:

SCALE:

0 km 2.5 km 5 km 7.5 km

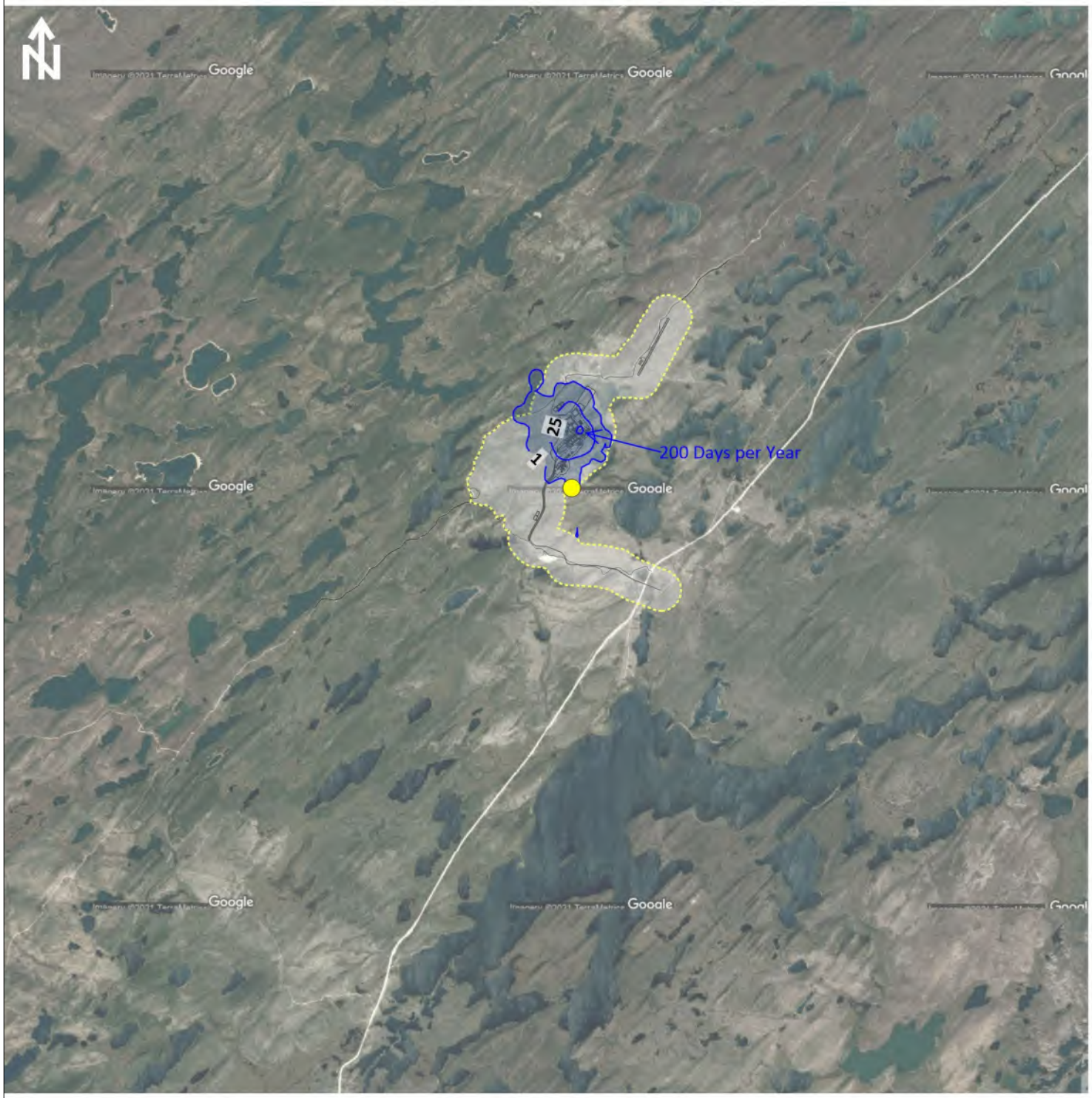
REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Decommissioning Scenario:
Maximum 1-hour NO_2 Exceedances (Hours per Year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	56
Date: July 2022	Project No.: SX19-0043	



LEGEND:

- LSA
- Property Boundary
- Project Area
- Exceedances (days per year)
- Maximum off-property concentration location
- Risk Receptor

SCALE:

0 km 2.5 km 5 km 7.5 km

REFERENCE:

Basemap: Google Earth 2021
UTM Zone 13T, WGS84

Denison Mines Corp.
Wheeler River Project, SK

Operations Scenario:
Maximum 24-hour Uranium Exceedances (days/year)

Drawn By:	Approved By:	Figure No.:
JMH	PLK	57
Date: July 2022	Project No.: SX19-0043	

Appendix A:

Air Emissions Inventory

Appendix A: Air Emissions Inventory

As discussed in the main body of the report, construction, operations, and decommissioning of the Project will result in COPC emissions to air. The significant sources of air emissions and expected COPC during each Project phase are summarized in Table A. 1. In general, the main air emission sources over the life of the Project can be categorized as follows:

- General construction,
- Wellfield drilling,
- Material handling,
- Grading,
- Bulldozing,
- Wind erosion,
- Batch plant operations,
- Unpaved road dust,
- Mobile and stationary fuel combustion, and
- Wellfield and ISR plant operations.

The emissions quantification methods for each of the above sources are discussed in more detail below. The production information and variables and assumptions that were used to calculate the air emissions are summarized in a series of tables provided at the end of this Appendix. For example, the production information to support the calculations for construction is provided in Table A. 2. These tables will be referred to throughout the discussion below.

Table A. 1: Summary of Expected Air Emission Sources and COPC

Primary Emissions Source	Secondary Emissions Source	Applicable Scenarios				Potential COPC					Reference	Notes
		Const.	Ops.	Decomm.	Post-Decomm.	Dust	Combustion Products	Uranium	Metals [1]	Radon		
General construction	Earthworks and cut/fill	x	x			x					Section A.1	Dozing, material handling, and wind erosion during construction captured under general construction.
Stationary diesel combustion	Fixed generators	x	x	x			x				Section A.11	
	Portable generators	x	x	x			x					
Stationary propane combustion	Comfort heating		x	x			x				Section A.12	
	Calciner thermal heater		x				x				Section A.13	
Mobile equipment/vehicle combustion	E.g., dozers, graders, trucks, etc.	x	x	x			x				Sections A.9 and A.10	
Unpaved road dust		x	x	x		x					Section A.2	Assume clean fill used to construct roads, so not a source of uranium, metals, or radon.
Grading	Road maintenance	x	x	x		x			x		Section A.5	For road maintenance/snow removal during operations and decommissioning.
Dozing		x		x		x		x	x		Section A.1 and A.6	
Drilling	ISR well field (freeze, injection, recovery)	x	x			x		x	x	x	Section A.7	Also see 'Wellfield' source.
	Monitoring wells	x				x						Minimal number of monitoring wells minimal during ops. /decomm.
	Fresh water wells					x						Minimal number of fresh waste and recharge wells and considered negligible.
	Recharge wells					x						
Concrete Production		x	x	x		x			x		Section A.8	
Borrow area	Wind erosion	x	x	x		x					Section A.4	Clean fill not a source of uranium or metals.
	Material handling	x	x	x		x					Section A.1 and A.3	
Clean waste pad	Wind erosion		x	x		x					Section A.4	Clean waste not a source of uranium, metals, or radon.
	Material handling		x	x		x					Section A.3	
	Radon emanation										Section A.16	
Special waste pad	Wind erosion		x			x		x	x		Section A.4	
	Material handling		x			x		x	x	x	Section A.3	
	Radon emanation		x							x	Section A.16	
Landfills (domestic/ construction)	Wind erosion	x	x	x		x					Section A.4	Domestic/construction waste not a source of uranium, metals, or radon.
	Material handling	x	x	x		x					Section A.1 and A.3	
	Radon emanation										n/a	

Primary Emissions Source	Secondary Emissions Source	Applicable Scenarios				Potential COPC					Reference	Notes
		Const.	Ops.	Decomm.	Post-Decomm.	Dust	Combustion Products	Uranium	Metals [1]	Radon		
Industrial landfill	Wind erosion	x	x	x		x					Section A.4	Radon emissions negligible. Consistent with worker exposure assumptions.
	Material handling	x	x	x		x					Section A.1 and A.3	
Industrial landfill	Radon emanation										n/a	
Storage Ponds	Contaminated runoff pond										n/a	Not expected to be a source of COPC.
	Industrial WWTP precipitate pond(s)		x	x						x	Section A.16	Minor source of radon. Material kept wet, therefore, no dust expected.
	Leachate collection pond										n/a	Not expected to be sources of COPC.
	Clean waste pond										n/a	
	Effluent monitoring or release pond(s)										n/a	
	Process water pond										n/a	
	Domestic wastewater pond										n/a	
	Process precipitates pond		x							x	Section A.16	Material kept wet, therefore, no dust or metals expected.
	Uranium rich solution holding area	x	x	x						x	Section A.16	
	Surge tank	x	x	x						x	Section A.16	
Wellfield	Wellfield Drilling	x	x			x		x	x	x	Sections A.7 and A.16	
	Freeze Drilling	x	x			x		x	x	x	Sections A.7 and A.16	
	Pump Houses		x				x				Section A.12	Radon captured in wellfield/piping. Only combustion COPC from propane heating in pump house.
	Wellfield piping		x	x						x	Section A.16	
	Core shack	x	x							x	Section A.16	
Freeze Plant			x	x			x					Only combustion COPC from propane heating.
ISR Plant	Dryer process gas stack		x			x		x	x		Section A.13	
	Calciner process gas stack		x			x	x	x	x			In this case, 'combustion products' refers to SO_2 from calciner.
	Hygiene scrubber stack		x			x		x	x			
	Calciner exhaust for thermal fluid heater		x				x					
	Reagent storage exhausts					x					n/a	Intermittent PM emissions when filling reagent tanks. Considered negligible.
	Water treatment exhausts										n/a	Not expected to be a source of COPC.
	Yellowcake precipitation area									x	Section A.16	Assume dust emissions captured in hygiene scrubber stack.
	Ra/Fe Precipitation exhausts		x							x		
	General exhausts (e.g., washrooms, shops, etc.)		x	x						x		
Silo loading	Lime		x	x		x					Section A.15	Intermittent dust emissions during deliveries. Lime silo will be connected to dust collection system.
Hazardous waste storage											n/a	Not a source of COPC.
Fuel storage (outdoor)											n/a	Not a source of COPC.
Welding						x			x		n/a	Assume welding emissions sporadic and negligible.
Airstrip						x					n/a	Assume flights are infrequent enough that emissions can be considered negligible.

A.1 Construction

Fugitive dust is emitted from earthworks activities during construction including clearing and grubbing, grading, dozing, material stockpiling, building construction, etc. Emissions of dust from general construction was estimated using the Level 2 calculation method from the Western Regional Air Partnership (WRAP) Fugitive Dust Handbook [21], Table 3-2, which breaks construction emissions into two parts:

Dust from general construction activities:

$$EF\ (PM_{10}) = 0.11 \frac{\frac{ton}{acre}}{month} \text{ (for average conditions)}$$

Dust from cut/fill activities:

$$EF\ (PM_{10}) = 0.059\ ton/yd^3$$

The $PM_{2.5}/PM_{10}$ ratio factor of 0.1 from the WRAP Handbook was applied. TSP emission factors were developed by scaling the general construction TSP emission factor from U.S. EPA AP-42 Chapter 13.2.3 [22] to the Level 1 (i.e., worst-case) PM_{10} emission factor from the WRAP Handbook. For example, the TSP emission factor for general construction was calculated as follows:

$$EF\ (\text{TSP}) = 0.11 \frac{\frac{ton}{acre}}{month} \times 1.2 \frac{\frac{ton}{acre}}{month} \div 0.42 \frac{\frac{ton}{acre}}{month} = 0.314\ \frac{\frac{ton}{acre}}{month} = 0.70\ \frac{\frac{tonnes}{ha}}{month}$$

To estimate dust emissions from general construction, the construction area is required and for emissions from cut/fill activities, the volume of material is required (see Table A. 2). The duration of construction is also required for both calculations. For this assessment, the construction area is estimated to be about 170 ha and it was conservatively assumed that construction activities occur year-round. The volume of material handled is expected to be about 1.3 million m^3 over a one-year period. It was also assumed that fugitive dust emissions will be mitigated through watering during the summer months (i.e., May to October), and a control factor of 50% was applied to construction emissions. During the winter months (November to April), it was assumed a natural mitigation factor of 90% was applied to account for snow cover and frozen conditions [23].

Dust emissions from unpaved road dust, wind erosion, grading, drilling, and concrete batching during construction are captured in the individual calculations for these sources (see Sections A.2, A.4, A.5, A.7, and A.8), while combustion emissions are discussed in Sections A.9 to A.12.

A.2 Unpaved Road Dust

Dust is emitted from unpaved roads by the action of vehicle wheels against the surface and by the turbulent wake created behind a moving vehicle. Emissions of unpaved road dust were estimated using the emission factor equation for industrial roads from U.S. EPA AP-42 Chapter 13.2.2 [24]:

$$EF = 281.9 \times k \times \left(\frac{s}{12}\right)^a \times \left(\frac{W}{3}\right)^{0.45}$$

Where:
EF = emission factor in lb/VKT
k = particle size multiplier (TSP = 4.9; PM_{10} = 1.5; $PM_{2.5}$ = 0.15)
s = silt content (%)
W = vehicle weight (tons)
a = constant (TSP = 0.7; PM_{10} and $PM_{2.5}$ = 0.9)
VKT = vehicle kilometres travelled

To estimate emissions from unpaved roads, silt content, average vehicle weight, and the number of vehicle kilometres travelled (VKT) is required. As shown in Table A. 2, a silt content of 8.3% was used, based on default data from U.S. EPA AP-42 [8]. Traffic information, including vehicle weights and VKT are provided in Table A. 3.

Emissions of road dust can be mitigated through operational practices such as watering or applying chemical dust suppressants. For the summer months, a control of 70% was applied to the roads to account for the application of water at least twice per day [25]. In the winter, a control of 90% was applied, which is based on the findings of a study completed at the De Beers diamond mine in northern Ontario [23]. An additional 44% control was applied in both seasons to the mine roads to account for vehicle speeds under 40 km/h as per the WRAP Handbook [21]. The mine roads are expected to have an average speed limit of 30 km/h (Table A. 2).

A.3 Material Handling

Emissions of dust from material handling during construction are captured in the general construction emissions discussed in Section A.1. During operations and decommissioning, emissions of dust will be generated when materials are added to or removed from a storage area. Material handling emissions were estimated using the emission factor equation from U.S. EPA AP-42 Chapter 13.2.4 [26]:

$$EF = k \times 0.0016 \times \left(\frac{U}{2.2}\right)^{1.3} \times \left(\frac{M}{2}\right)^{-1.4}$$

Where:
EF = emission factor in kg/tonne
k = particle size multiplier (TSP = 0.74; PM_{10} = 0.35; $PM_{2.5}$ = 0.053)
U = wind speed (m/s)
M = material moisture content (%)

To estimate emissions from material handling, wind speed, material moisture content, and the amount of material (e.g., wellfield cuttings) handled is required. The mean annual wind speed in the vicinity at the Project site is 3.4 m/s (Table A. 2), which is based on data from the meteorological data set (see Appendix B). The assumed moisture content of the waste rock is 11% (Table A. 2), based on default data from U.S. EPA AP-42 [26]. Finally, material handling rates are provided in Table A. 5.

A.4 Wind Erosion

Material storage areas like the clean waste storage pad and special waste pad are susceptible to wind erosion. Wind erosion emissions were estimated using the emission factor equation presented in the WRAP Handbook [21]:

$$EF = k \times 1.9 \times \left(\frac{s}{1.5}\right) \times \left(\frac{f}{15}\right)$$

Where:
EF = emission factor in kg/ha/day
k = particle size multiplier (TSP = 1.0; PM_{10} = 0.5; $PM_{2.5}$ = 0.075)
s = silt content (%)
f = percentage of the time with the unobstructed wind speed greater than 5.4 m/s in percent (%)

To estimate emissions from wind erosion, the following variables are required: material silt content; the frequency of winds greater than 5.4 m/s; and the surface area of the storage area. As shown in Table A. 2, a silt content of 20% was assumed for wellfield cuttings, while a silt content of 12% assumed for sand/aggregate materials. The frequency term 'f' was calculated to be 6.5% based on data from CALMET (see Appendix B). The calculated surface areas of the storage areas subject to wind erosion are outlined in Table A. 6.

A control of 90% was applied to winter emissions to account for natural mitigation of dust from snow and ice cover [3]. In summer, storage areas that will be actively watered (i.e., the clean waste and special waste pads) were controlled by 50%. For the short-term emissions scenarios, no emissions control was applied to the remaining piles; however, for the annual emissions scenario, storage areas not actively mitigated by watering were controlled by 47% due to natural mitigation from rainfall.

A.5 Grading

For this assessment, it was assumed that the mine site roads and the access road will be maintained with grading. Emissions of dust from grading were estimated using the emission factor equation in U.S. EPA AP-42 Chapter 11.9 [27]:

$$EF\ (TSP) = 0.0034 \times S^{2.5}$$

$$EF\ (PM_{10}) = 0.60\ \times 0.0056 \times S^{2.0}$$

$$EF\ (PM_{2.5}) = 0.031 \times 0.0034 \times S^{2.5}$$

Where:
EF = emission factor in kg/VKT
S = grader speed in km/h
VKT = vehicle kilometres travelled

The above equation requires an estimate of the grader speed (assumed to be 10 km/h) as well as the number of kilometres travelled, which was calculated based on the length of road and the number of gradings, which was assumed to be two passings in a day for one day of the week. Note that grading was assumed to occur only during the summer months.

A.6 Dozing

Emissions of dust from dozing during construction are captured in the general construction emissions discussed in Section A.1. For this assessment, it was assumed that a bulldozer will be used during decommissioning for

reclamation activities in the wellfield and storage pads. Emissions of dust from bulldozing were estimated using the emission factor equation in U.S. EPA AP-42 Chapter 11.9 [27]:

$$EF\ (TSP) = 2.6 \times s^{1.2} \times M^{-1.3}$$

$$EF\ (PM_{10}) = k \times 0.75\ \times 0.45 \times s^{1.5} \times M^{-1.4}$$

$$EF\ (\mathrm{PM}_{2.5}) = 0.105 \times 2.6 \times s^{1.2} \times M^{-1.3}$$

Where:
EF = emission factor in kg/hour
s = material silt content in percent (%)
M = material moisture content in percent (%)

The above equation requires the silt and moisture content of the material being bulldozed, as well as the number of operating hours. The silt and moisture content were assumed to be 20% and 11%, respectively (Table A. 2). There are two bulldozers that were assumed to be used 8 hours a day in each location. For the annual emissions scenario, it was also assumed that dozing occurs during the summer months only.

A.7 Drilling

For the Project's ISR mining process, freeze wells, injection wells, recovery wells, and monitoring wells are drilled. Emissions of dust from wellfield drilling were estimated using the emission factors from the Environment and Climate Change Canada's (ECCC) guidance document for pits and quarries [28]:

$$EF\ (TSP) = 0.59\ kg/hole$$

$$EF\ (PM_{10}) = 0.31\ kg/hole$$

$$EF\ (\mathrm{PM}_{2.5}) = 0.31\ kg/hole$$

The above emission factors simply require the number of holes drilled, which are summarized in Table A. 7 for each assessment scenario. The emission factors assume wet drilling; therefore, no additional controls were applied.

A.8 Batch Plant

Concrete will be required for foundations and pads, and cement will be needed for wellfield casings. Emissions from batch plant operations were estimated using the emission factors provided in U.S. EPA AP-42 Chapter 11.12 [29], which are summarized in the following table:

Activity	Emission Factor (kg/tonne material)		
	TSP	PM_{10}	$PM_{2.5}$
aggregate transfer (controlled by 30%)	1.14E-03	5.52E-04	1.70E-04
sand transfer (controlled by 30%)	2.73E-04	1.27E-04	4.10E-05
cement unloading to storage silo	6.10E-05	2.07E-05	9.15E-06
cement supplement to silo	8.16E-05	4.35E-05	1.22E-05
weigh hopper loading (controlled by 30%)	1.49E-03	7.45E-04	2.23E-04
truck loading	6.87E-03	1.84E-03	1.03E-03

The volume of concrete required for each assessment scenario is 3,000 m^3 for construction, and 1,000 m^3 for operations and decommissioning. The default concrete composition from U.S. EPA AP-42 was then applied to determine the concrete production rates by weight:

Material	Material Density		% Of Concrete
	lb / yd^3	kg / yd^3	
coarse aggregate	1,865	846	46%
sand	1,428	648	35%
cement	491	223	12%
cement supplement	73	33	2%
water	167	76	4%
concrete product	**4,024**	**1,825**	-

A.9 On-Road Mobile Combustion Emissions

On-road mobile combustion sources include any vehicles permitted to drive on public roads (e.g., delivery/shipping trucks). To calculate exhaust emissions from on-road mobile combustion sources, U.S. EPA Tier 2 emission factors (which apply to vehicles for model years 2004-2009) were conservatively used and are summarized in the table below.

Emission Factors for On-Road Vehicles Conforming to U.S. EPA Tier 2 Standards (Model Years 2004-2009)

Vehicle Type	Fuel Type	Technology Type	Emission Factors				Units
			HC	CO	NOx	PM	HC
Light Duty Vehicle (LDV)	Gasoline	Tier 2	0.09	4.20	0.07	0.01	g/mile
	Diesel	Tier 2	0.09	4.20	0.07	0.01	g/mile
Medium Duty Vehicle (MDV)	Gasoline	Tier 2	0.09	4.20	0.07	0.01	g/mile
	Diesel	Tier 2	0.09	4.20	0.07	0.01	g/mile
Heavy Duty Vehicle (HDV)	Gasoline	Tier 2	0.14	15.50	0.20	0.01	g/bph-hr
	Diesel	Tier 2	0.14	15.50	0.20	0.01	g/bph-hr

Emission factors for light- and medium-duty on-road vehicles depend on the number of vehicle kilometers travelled (VKT), whereas emission factors for heavy-duty vehicles depend on the engine size and number of operating hours. Equipment information is summarized in Table A. 4, while VKT is provided in Table A. 3.

Instead of emission factors, SO_2 emissions from on-road mobile sources were calculated using a mass balance approach based on the fuel sulphur content:

$$SO_2\left(\frac{g}{s}\right) = FC \times FD \times sox \times 0.01 \times 2.00$$

Where:
FC = fuel consumption in L
FD = fuel density in g/L
sox = fuel sulphur content in %
0.01= conversion from percent to fraction
2.00 = the mass ratio of sulphur dioxide to sulphur (assumes 100% oxidation of sulphur)

Fuel consumption data was calculated based on the vehicle fuel economy and VKT data (Table A. 4 and Table A. 3). The fuel sulphur content for diesel and gasoline was based on the *Sulfur in Diesel Fuel Regulations* [30] and *Sulphur in Gasoline Regulations* [31], which specify sulphur contents of 15 parts per million (ppm) and 30 ppm, respectively, for diesel and gasoline.

A.10 Non-Road Combustion

Non-road or off-road combustion sources at the Project site include heavy equipment (e.g., dozers, graders, loaders) and vehicles (e.g., haul trucks) that are not permitted to travel on public roads. In general, emissions for these sources were calculated as follows:

$$ER\left(\frac{g}{s}\right) = EF\left(\frac{g}{hp-hr}\right) \div BSFC\left(\frac{lb\ fuel}{hp-hr}\right) \times FC\left(\frac{lb\ fuel}{yr}\right) \div 365\left(\frac{days}{yr}\right) \div 24\left(\frac{hr}{day}\right) \div 3600\left(\frac{s}{hr}\right)$$

Where:
ER = emission rate
EF = emission factor
BSFC = brake-specific fuel consumption
FC = annual fuel consumption

The emission factors and brake-specific fuel consumption (BSFC) values were obtained from the U.S. EPA document *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition* [32]. For non-road diesel combustion, Tier 4 emission factors were assumed. All the emission factors used in the assessment are summarized in the table below while engine horsepower data are provided in Table A. 4. SO_2 emissions were calculated using the same methodology described above in Section A.9.

Emission Factors for Off-Road Vehicles Conforming to U.S. EPA Tier 2 Standards (Model Years 2004-2009)

Equipment Type	Engine Tier	Fuel Type	BSFC	Steady State Emission Factor (g/hp-hr)			
				HC	CO	NOx	PM
Water truck	Tier 2	Diesel	0.367	0.1669	0.8425	4.3351	0.1316
Grader	Tier 2	Diesel	0.367	0.3384	0.8667	4.1	0.18
Haul truck	Tier 2	Diesel	0.367	0.1669	1.3272	4.1	0.1316
Dozer	Tier 2	Diesel	0.367	0.1669	0.7642	4.1	0.1316
Forklift	Tier 2	Diesel	0.367	0.3384	0.8667	4.1	0.18
Man lift	Tier 2	Diesel	0.408	0.2789	1.5323	4.7279	0.3389
Wheel loader	Tier 2	Diesel	0.367	0.3384	0.8667	4.1	0.18
Skid steer	Tier 2	Diesel	0.408	0.2789	1.5323	4.7279	0.3389
Flat deck truck	Tier 2	Diesel	0.367	0.1669	0.8425	4.3351	0.1316
Vacuum truck	Tier 2	Diesel	0.367	0.1669	0.8425	4.3351	0.1316
Crane	Tier 2	Diesel	0.367	0.3085	0.7475	4	0.1316
DR drill rig	Tier 2	Diesel	0.367	0.1669	0.8425	4.3351	0.1316
Mud rotary drill rig	Tier 2	Diesel	0.367	0.1669	0.8425	4.3351	0.1316

A.11 Diesel Generator Emissions

To estimate emissions from the stationary diesel generators, emission factors from manufacturer's specifications were applied. For the smaller, portable generators, emission factors from U.S. EPA AP-42, Chapter 3.3, Gasoline and Diesel Industrial Engines [13] were used. The generator emission factors are summarized in the following table:

Emission Factors for Diesel Generators

Type	Description	No. Units	Fuel Consumption	TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NOx	Units
C3512	Diesel, 1.1 MW	2	356.8 L/h	0.32	0.32	0.32	1.74	-	11.96	g/kW-h
C15	Diesel, 450 kW	2	106.1 L/h	0.00	0.00	0.00	0.80	-	6.17	g/kW-h
Portable	Diesel, <600 hp	2	16.1 L/h	5.1	5.1	5.1	15.6	-	72.6	g/L

Notes:
Assumes TSP = PM_{10} = $PM_{2.5}$

SO_2 emissions were calculated using the same methodology described above in Section A.9. The fuel consumption rates required to estimate SO_2 are provided in the above table.

For the Construction scenario, two (2) C3512 generators and two (2) portable generators were assumed to operate continuously, year-round. For the Operations and Decommissioning scenarios, the maximum short-term emission rates assumed that two (2) C3512 generators and two (2) C15 generators operate continuously, while two (2) portable generators operate 12 hours per day. For average annual emission rates, the expected operating hours were used, which is 2 hours per day for one C3512 unit and 12 hours per day for one portable generator.

A.12 Propane Combustion Emissions

Propane combustion sources include propane heaters for comfort heating and cooking appliances for supporting infrastructure (e.g., camp). To estimate emissions from propane sources, U.S. EPA AP-42 emission factors were used. The propane combustion emission factors are summarized in the following table:

COPC	Emission Factor [1]	Units
TSP	0.024	kg/m³
PM_{10}	0.024	kg/m³
$PM_{2.5}$	0.024	kg/m³
SO_2	0	kg/m³
CO	0.899	kg/m³
NOx	1.558	kg/m³

Notes:
[1] Source: [33]

The fuel consumption rates required to estimate emissions from propane combustion are provided in Table A. 8 for each assessment scenario.

A.13 ISR Plant Stacks

The calciner, dryer, and hygiene exhaust stacks in the ISR plant will be sources of particulate (and its constituents). In addition, the calciner stack will also be a source of SO_2, while the calciner burner exhaust will be a source of combustion products. The calciner, dryer, and hygiene stacks will be equipped with scrubber systems to control emissions of COPC.

To estimate emissions from the ISR stacks, in-stack concentrations based on a preliminary engineering study [14] were used, which are summarized in the following table:

Source Description	In-Stack Concentration						Actual Flow Rate
	TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NOx	
	mg/dNm³	mg/dNm³	mg/dNm³	mg/dNm³	ppm	mg/dNm³	DNm³/s
Dryer scrubber stack	10	10	10	0.0	0.0	0.0	
Calciner scrubber stack	10	10	10	0.0	26	0.0	
Hygiene scrubber stack	10	10	10	0	0.0	0	
Calciner burner exhaust	13	13	13	144	0.0	250	

Notes:
Assume TSP = PM_{10} = $PM_{2.5}$

Expected flow rates from the same engineering study [14], were applied to the above emission limits to estimate the emission rates using to the following equations:

$$Max\ ER\left(\frac{g}{s}\right) = Flow\ Rate\left(\frac{dNm^3}{s}\right) \times COPC\ Conc.\left(\frac{mg}{DNm^3}\right) \div 1000\left(\frac{mg}{g}\right)$$

$$Average\ ER\left(\frac{g}{s}\right) = Flow\ Rate\left(\frac{dNm^3}{s}\right) \times COPC\ Conc.\left(\frac{mg}{DNm^3}\right) \div 1000\left(\frac{mg}{g}\right) \times Plant\ Availability\ (95\%)$$

A.14 Uranium and Metals in TSP

Emission rates of uranium and metals were calculated based on the composition of the parent material from which dust is emitted. Emissions were conservatively based on TSP. The specific calculation is:

$$Uranium\ or\ Metal\ \left(\frac{\mathrm{g}}{\mathrm{s}}\right) = TSP\ \left(\frac{g}{s}\right) \times uranium\ or\ metal\ content\ (\%)$$

The uranium grade and metal content of the various material types are outlined in Table A. 9.

A.15 Lime Silo

Lime will be used in the ISR water treatment process and will be stored inside of a silo in the ISR plant, equipped with a dust collection system exhausting to the atmosphere by its own stack. Dust emissions will be generated when lime is transferred to the storage silo.

Emissions for loading of the lime silo were estimated using the emission factors provided in U.S. EPA AP-42 Chapter 11.19 [9], which are summarized in the following table:

Activity	Emission Factor (kg/tonne)		
	TSP	PM_{10}	$PM_{2.5}$
Lime transfer to storage silo	0.0055	0.0008	0.0003

During operations, 66,240 tonnes of lime will be used on an annual basis (181 tonnes per day). For the decommissioning phase, it was assumed that half that amount will be required for ongoing water treatment.

A.16 Radon Emissions

Radon emissions are expected from various Project elements; however, the primary source of radon emissions will be wellfield operations and restoration. The following sections described how radon emissions were estimated for the air quality assessment. Note that for all calculations, equilibrium between radium-226 (Ra-226) and radon gas (Rn-222) is assumed unless otherwise specified.

A.16.1 Wellfield Development

For the Construction and Operations scenarios, radon gas will be released during wellfield drilling from radium-bearing ore cuttings. The amount of radon gas available for release can be estimated using the following equation from Appendix D of the U.S. NRC document *Standard Review Plan for In Situ Leach Uranium Extraction Lease Applications* [15]:

$$Rn_{nw} = 10^{-12}\ E\ L\ [Ra]\ T\ M\ N$$

A description of the variables and the values that will be used in the wellfield drilling calculations are summarized in Table A. 10.

Radon gas will also be released when groundwater containing dissolved radon gas is pumped to the surface during wellfield development. To estimate radon from groundwater pumping, the following mass balance approach was used:

$$Rn_{gw} = V\ w\ C\ \times 3.2 \times 10^{-8}\ \frac{s}{yr}$$

Where:
Rn_{gw} = radon emissions from groundwater pumping (g/s)
V = average water volume per well (m^3) = 60 m^3/well
w = number of injection/recovery wells (see Table A. 7*)*
C = Rn-222 concentration in groundwater (Bq/L) = 6 million Bq/L

A.16.2 Wellfield Production

In an ISR wellfield, radon released from the ore body is removed by the process water or recovered mining solution moving through the production wellfield. Radon gas is then released to the atmosphere wherever the recovered mining solution is vented. In the case of the Project, a portion of the radon is expected to be released in the wellfield from occasional venting from the wellheads and leaking transport piping. Majority is assumed to be released when the process water arrives at the surge tank, with a minor amount released from the recovered solution pond, which is open to the atmosphere. Per discussions with Denison staff, purge or bleed in the production wellfield is not expected, so radon emissions from purge water are assumed to be zero.

The amount of radon gas released from wellfield venting (Rn_{vent}) and the surge tank (Rn_{tank}) was estimated using the following equations:

$$C_{Rn} = \frac{10^6\ [Ra]\ A\ D\ P\ E\ L\ f}{(L + v)\ V +\ F_p +\ F_i}$$

$$Rn_{vent} = 3.65 \times 10^{-10}\ v\ C_{Rn}$$

$$Rn_{tank} = 3.65 \times 10^{-10}\ F_i\ C_{Rn}$$

A description of the variables and the values that will be used in the above equations are summarized in Table A. 11.

The amount of radon gas released from the recovered solution pond (Rn_{pond}) was estimated using the following equation as described in [34]:

$$Rn_{pond} = Ra_{pond} \times 1000\ \times D \times SA\ \times 2.1 \times 10^{-6}$$

Where:
Rn_{pond} = radon emissions from the recovered solution pond pumping (g/s)
Ra_{pond} = Ra-226 concentration in the recovered solution pond (Bq/L) = 3,700 Bq/L [35]
1000 = conversion from litres to m³
D = wave depth (m) = assumed 1 m
SA = surface area (m²) = 2,500 m² (see Table A. 6*)*
2.1E-06 = decay constant (Bq Rn/s per Bq Ra-226)

During the Construction scenario, pump tests may also be completed towards the end of the construction phase for up to six months. Emissions from these pump tests can be estimated using the same above equations. For the assessment, it was conservatively assumed that pump tests would occur concurrently with all other construction activities.

A.16.3 Wellfield Restoration

For the Decommissioning scenario, wellfield restoration will be a source of radon gas. The mechanisms for release are similar to the production wellfield, therefore, the same equations outlined in Section A.16.2 are used. A description of the variables and the values that will be used in the wellfield restoration calculations are summarized in Table A. 12.

A.16.4 Other Sources

Other radon sources expected from the Project include:

- the core shack,
- the special waste pad,
- the process precipitates storage pad,
- the gypsum storage pad; and
- the ISR plant
    - recovered solution feed (in the process precipitates removal area)
    - process precipitates cake (in the process precipitates removal area)
    - yellowcake precipitation circuit
    - water treatment area.

For the storage areas, and the process precipitates cake in the ISR plant, the methods used by Ecometrix in support of the Worker Health assessment (EIS Section 10) and outlined in the International Atomic Energy Agency (IAEA) Technical Report Series No. 474 [17], were followed. The equation used to estimate radon gas from these sources is:

$$Rn = F_{Rn}\, A\, \frac{dw}{fw}\, S$$

Where:
Rn = radon emissions (g/s)
F_{Rn} = flux of Rn-222 (Bq/m²/s per Bq/g Ra-226)
A = activity concentration Ra-226 (Bq/kg)
dw/fw= dry weight to fresh weight ratio
S = surface area (m²)

The values that were used in the calculations are summarized in Table A. 13. Note that most variables in were selected by Ecometrix in support of the Worker Health assessment.

Radon emissions from the recovered solution feed, yellowcake precipitation circuit, and water treatment area in the ISR plant were calculated following the method recommended by Ecometrix and outlined in the U.S. Nuclear Regulatory Commission (NRC) document *Risk Assessment of Radon in Drinking Water* [16]. The equation used to estimate radon gas from these sources is:

$$Rn = \frac{10^3\ C_{Rn} F\ T}{3600}$$

Where:
C_{Rn} = Ra-226 Concentration (Bq/L)
10^3 = conversion from L to m³
F = solution feed (m³/hour)
T = transfer efficiency = 0.55 (dimensionless)
3600 = conversion from hours to seconds

The Ra-226 activity levels were selected by Ecometrix and are 3,000 Bq/L, 1,350 Bq/L, and 610 Bq/L for the recovered mining solution, the yellowcake precipitate solution, and wastewater treatment solution, respectively. The solution feed rate was assumed to be 30 m³/hour.

One exception to the above methods is during the Decommissioning scenario when special waste will be removed from the storage pad and placed in the industrial landfill. To estimate radon emissions from special waste handling, the following equation was used:

$$Rn = \frac{10^6\ M\ C_{Rn}}{3.15 \times 10^7}$$

Where:
M = material handling rate (tonnes/year)
C_{Rn} = Ra-226 concentration (Bq/g)
10^6 = conversion from tonnes to g
3.15E+07 = conversion from year to seconds

Further, it was assumed that the special waste will be removed over the summer months or 184 days.

Table A. 2: Production and Miscellaneous Data

Parameter	Units	Value	Notes	Comments/Questions
Operating Days per Year	number	345	[1]	95% plant availability = 345 operating days
Peak Production Rate - annual	lbs U_3O_8/year	12,000,000	[1]	
Average Production Rate - annual	lbs U_3O_8/year	8,955,000	[1]	
Production Rate - average daily	lbs U_3O_8/day	27,897	[1]	
ISR Plant Availability	%	95%	[1]	
Process plant feed rate (UBS solution) - avg. LOM	m^3/year	262,800	[1]	
Process plant feed rate (UBS solution) - avg. LOM	m^3/h	30	[1][2]	
Process Plant feed grade - avg. LOM	g/L	20	[1]	
Process plant U_3O_8 recovery	%	98.5	[1]	
Total disturbed area	Ha	169.6	[1]	For construction calculations. Total disturbed footprint for clearing/grubbing.
Construction cut/fill volume	m^3/year	1,325,904	[1]	Total cut/fill quantity
Material density - Mineralized drill cuttings	kg/m^3	3,600	[3]	Used average.
Material density - non-Mineralized drill cuttings	kg/m^3	3,600	[3]	Used average.
Material density - Aggregate (sand/gravel from borrow areas)	kg/m^3	1,650		Assumed.
Moisture content - Mineralized drill cuttings	%	11	[4]	Assumed.
Moisture content - non-Mineralized drill cuttings	%	11	[4]	Assumed.
Moisture content - Aggregate (sand/gravel from borrow areas)	%	11	[4]	Assumed.
Silt content - Ore cuttings	%	20		Assumed based on other projects in Saskatchewan.
Silt content - Special waste	%	20		Assumed based on other projects in Saskatchewan.
Silt content - Aggregate (sand/gravel from borrow areas)	%	12	[4]	Assumed.
Silt content - Roads	%	8.3	[5]	Assumed.
Mean wind speed	m/s	3.4		CALMET model output.
% of time wind speed >5.4 m/s	%	6.5		CALMET model output.

Parameter	Units	Value	Notes	Comments/Questions
Number of frozen days per year	Days	281	[6]	Key Lake Climate Normals. 84 frost-free days.
Number of days with rainfall > 0.2mm	Days	86		CALMET model output.
Control efficiency - natural (storage pads, unpaved roads) (winter)	%	90	[7]	
Control efficiency - watering (storage pads) (summer)	%	50	[8]	
Control efficiency - watering (outdoor material handling) (year-round)	%	0		Assume no control of fugitive dust.
Control efficiency - watering (unpaved roads) (summer)	%	70	[8][11]	Assumed. Controls on Highway 914 and onsite roads will achieve 70% through watering and/or chemical dust suppression. Assumes watering will occur at least 2+ times per day.
Control efficiency - speed <40 km/h (unpaved roads) (year-round)	%	44	[8]	
Diesel - fuel sulphur	%	0.0015	[9]	
Gasoline - fuel sulphur	%	0.0012	[10]	
Diesel - density	kg/L	0.85		
Gasoline - density	kg/L	0.74		
Vehicle speed - Grader	km/h	10		
Speed limit	km/h	30		

Notes:

[1] Design Basis Document. *20201012_WRE_EIS_Design Basis File freeze wall REV 1.xlsx.*
[2] Confirmed during teleconference call with Denison 22 June 2021.
[3] Site specific data provided by Denison.
[4] US EPA AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles, Table 13.2.4-1 [26]
[5] US EPA AP-42 Chapter 13.2.2 Unpaved Roads, Table 13.2.2-1 [24]
[6] Environment and Climate Change Canada (ECCC). Canadian Climate Normals 1981-2010 Station Data, Key Lake, Saskatchewan. Available at: https://climate.weather.gc.ca/
[7] Golder Associates. Determination of Natural Winter Mitigation of Road Dust Emissions from Mining Operations in Northern Canada, 2012 [3].
[8] Countess Environmental. 2006. Western Regional Air Partnership (WRAP) Fugitive Dust Handbook. September [4].
[9] Government of Canada. 2017. Sulphur in Diesel Fuel Regulations, SOR/2002-254 [30].
[10] Government of Canada. 2020. Sulphur in Gasoline Regulations, SOR/99-236 [31].
[11] ECCC Road dust emissions from unpaved surfaces: guide to reporting [25].

Table A. 3: Traffic Data

Road ID	Description	Start	End	Length (m)	Speed (km/h)	MaxPERF Truck	Crew Van	Loader	Haul Truck	Pick-up Trucks	Ambulance	Fire Truck	Delivery/Freight	Weight (tonnes)	Height (m)	Width (m)	Total Daily VKT
Construction Max Daily Traffic (One-Way Traffic)																	
HWY914	Highway 914	HWY914	ACCESS	5000	80	1	0	0	0	20	0	0	53	25	2.7	2.4	740
ACCESS	Access road from Hwy 914	ACCESS	SITE1/2	5155.6	30	1	0	0	0	20	0	0	53	25	2.7	2.4	763
SITE1	Site road to accommodations area	SITE1	SITE3	951.9	30	0	50	0	0	100	0	0	27	11	2.2	2.1	337
SITE2	Site road to ISR plant	SITE2	SITE3	899.1	30	10	50	30	64	100	0	0	27	22	2.9	2.7	505
SITE3	Site road from ISR plant to airport	SITE3	Airport	4705	30	0	10	20	30	10	0	0	0	30	3.5	3.3	659
Construction Average Daily Traffic (One-Way Traffic)																	
HWY914	Highway 914	HWY914	ACCESS	5000	80	1	0	0	0	20 [2]	0	0	6	14	2.3	2.1	270
ACCESS	Access road from Hwy 914	ACCESS	SITE1/2	5155.6	30	1	0	0	0	20 [2]	0	0	6	14	2.3	2.1	278
SITE1	Site road to accommodations area	SITE1	SITE3	951.9	30	0	50	0	0	100	0	0	3	8	2.1	2.0	291
SITE2	Site road to ISR plant	SITE2	SITE3	899.1	30	5	50	15	32	100	0	0	3	17	2.6	2.5	369
SITE3	Site road from ISR plant to airport	SITE3	Airport	4705	30	0	10	10	15	10	0	0	0	25	3.2	3.0	423
Operations Max Daily Traffic (One-Way Traffic)																	
HWY914	Highway 914	HWY914	ACCESS	5000	80	1	0	0	0	0	0	0	58	31	3.0	2.5	590
ACCESS	Access road from Hwy 914	ACCESS	SITE1/2	5155.6	30	1	0	0	0	0	0	0	58	31	3.0	2.5	608
SITE1	Site road to accommodations area	SITE1	SITE3	951.9	30	0	50	0	0	50	1	1	29	13	2.3	2.1	249
SITE2	Site road to ISR plant	SITE2	SITE3	899.1	30	10	50	20	0	50	1	1	29	13	2.5	2.2	290
SITE3	Site road from ISR plant to airport	SITE3	Airport	4705	30	0	10	0	0	50	1	1	0	8	2.0	2.0	583
Operations Average Daily Traffic (One-Way Traffic)																	
HWY914	Highway 914	HWY914	ACCESS	5000	80	1	0	0	0	0	0	0	8	31	3.0	2.5	90
ACCESS	Access road from Hwy 914	ACCESS	SITE1/2	5155.6	30	1	0	0	0	0	0	0	8	31	3.0	2.5	93
SITE1	Site road to accommodations area	SITE1	SITE3	951.9	30	0	50	0	0	50	1	1	4	8	2.1	2.0	202
SITE2	Site road to ISR plant	SITE2	SITE3	899.1	30	10	50	20	0	50	1	1	4	10	2.4	2.1	245
SITE3	Site road from ISR plant to airport	SITE3	Airport	4705	30	0	10	0	0	50	1	1	0	8	2.0	2.0	583
Decommissioning Max Daily Traffic (One-Way Traffic)																	
HWY914	Highway 914	HWY914	ACCESS	5000	80	0	0	0	0	0	0	0	17	31	3.0	2.5	170
ACCESS	Access road from Hwy 914	ACCESS	SITE1/2	5155.6	30	0	0	0	0	0	0	0	17	31	3.0	2.5	175
SITE1	Site road to accommodations area	SITE1	SITE3	951.9	30	0	50	0	0	50	1	1	9	9	2.1	2.0	211

Road ID	Description	Start	End	Length (m)	Speed (km/h)	MaxPERF Truck	Crew Van	Loader	Haul Truck	Pick-up Trucks	Ambulance	Fire Truck	Delivery/Freight	Weight (tonnes)	Height (m)	Width (m)	Total Daily VKT
SITE2	Site road to ISR plant	SITE2	SITE3	899.1	30	0	50	0	64	50	1	1	9	27	2.9	3.1	315
SITE3	Site road from ISR plant to airport	SITE3	Airport	4705	30	0	10	0	30	50	1	1	0	25	2.8	2.9	866
Decommissioning Average Daily Traffic (One-Way Traffic)																	
HWY914	Highway 914	HWY914	ACCESS	5000	80	0	0	0	0	0	0	0	5	31	3.0	2.5	50
ACCESS	Access road from Hwy 914	ACCESS	SITE1/2	5155.6	30	0	0	0	0	0	0	0	5	31	3.0	2.5	52
SITE1	Site road to accommodations area	SITE1	SITE3	951.9	30	0	50	0	0	50	1	1	3	8	2.1	2.0	200
SITE2	Site road to ISR plant	SITE2	SITE3	899.1	30	0	50	0	32	50	1	1	3	20	2.6	2.7	246
SITE3	Site road from ISR plant to airport	SITE3	Airport	4705	30	0	10	0	15	50	1	1	0	18	2.5	2.6	725

Notes:
VKT = vehicle kilometres travelled
[1] Vehicle weight, height, and width are weighted averages calculated based on vehicle information in Table A. 4.
[2] At the time the assessment was completed, 20 pick-up trucks were assumed. However, the expected amount is 4 trucks. As such, the assumption used in the assessment is conservative.

Table A. 4: Vehicle/Equipment Information

Vehicle Type	Make/ Model	EF-Type	Fuel Type	Engine Size (HP)	Vehicle Height (m)	Vehicle Width (m)	Empty Weight (tonnes)	Full Weight (tonnes)	Avg. Weight (tonnes)	Capacity (tonnes)	Fuel Consumption (L/h)
MaxPERF Truck	Kenworth T800	On-Road HDV	Diesel	510	3.0	2.5	24.9	36.3	30.6	11.3	76.7
Crew Van	Ford E-350	On-Road MDV	Gasoline	350	2.1	2.0	4.6	8.4	6.5	3.8	6.2
Loader	JD 410L	Off-Road	Diesel	116	3.9	2.3	8.2	9.5	8.8	1 m^3	13.7
Haul Truck	CAT 772G	Off-Road	Diesel	605	4.3	4.8	35.0	82.0	58.5	47.0	50
Pick-up Trucks	Ford F250	On-Road LDV	Gasoline	430	2.0	2.0	6.4	9.9	8.2	3.5	4.9
Ambulance	-	On-Road MDV	Gasoline	255	2.0	2.0	5.0	5.0	5.0	n/a	9.7
Fire Truck	-	On-Road MDV	Diesel	300	4.0	3.0	20.0	25.0	22.5	n/a	19.6
Delivery/Freight	Kenworth T800	On-Road HDV	Diesel	510	3.0	2.5	24.9	36.3	30.6	11.3	76.7
Cement Truck	SCM Twin Cementer	On-Road HDV	Diesel	750	n/a	n/a	n/a	n/a	n/a	n/a	102.4
Water truck	-	Off-Road	Diesel	425	n/a	n/a	n/a	n/a	n/a	n/a	19.6
Grader	JD 770	Off-Road	Diesel	152	n/a	n/a	n/a	n/a	n/a	n/a	42.0
Dozer	D11	Off-Road	Diesel	913	n/a	n/a	n/a	n/a	n/a	n/a	110.0
Forklift	JLG 943	Off-Road	Diesel	110	n/a	n/a	n/a	n/a	n/a	n/a	13.7
Man lift	JLG 400	Off-Road	Diesel	49	n/a	n/a	n/a	n/a	n/a	n/a	6.0
Skid steer	JD 324G	Off-Road	Diesel	47	n/a	n/a	n/a	n/a	n/a	n/a	12.8
Flat deck truck	M2106 freightliner	Off-Road	Diesel	350	n/a	n/a	n/a	n/a	n/a	n/a	37.5
Vacuum truck	Peterbilt 348	Off-Road	Diesel	380	n/a	n/a	n/a	n/a	n/a	n/a	51.1
Crane	RT765E-2	Off-Road	Diesel	260	n/a	n/a	n/a	n/a	n/a	n/a	42.0
DR drill rig	Foremost DR-12	Off-Road	Diesel	525	n/a	n/a	n/a	n/a	n/a	n/a	88.0
Mud rotary drill rig	Ingersoll Rand TH-100	Off-Road	Diesel	470	n/a	n/a	n/a	n/a	n/a	n/a	76.7

Notes:
n/a – information not required for emissions calculations; HDV = heavy-duty vehicle; MDV = medium-duty vehicle; LDV = light-duty vehicle

Table A. 5: Material Handling Rates for Operations and Decommissioning

Scenario	Description	Material Origin	Material Type	Handling Rate (tonnes/year)
Max Operations	Well cuttings to loader	Injection wells	Mineralized	6,755
	Well cuttings to loader	Recovery wells	Mineralized	2,252
	Well cuttings to loader	Freeze wells	Blend	1,943
	Well cuttings to loader	Monitoring wells	Clean	0
	Well cuttings to special waste pad	Injection/recovery/freeze wells	Mineralized	9,977
	Well cuttings to clean waste pad	Freeze/monitoring wells	Clean	971
	Borrow materials for landfill cover (summer only)	Borrow pit	Aggregate	13,531
	Domestic landfill cover (summer only)	Borrow pit	Aggregate	4,510
	Construction waste laydown area cover (summer only)	Borrow pit	Aggregate	4,510
	Industrial landfill cover (summer only)	Borrow pit	Aggregate	4,510
Average Operations	Well cuttings to loader	Injection wells	Mineralized	6,755
	Well cuttings to loader	Recovery wells	Mineralized	2,252
	Well cuttings to loader	Freeze wells	Blend	1,943
	Well cuttings to loader	Monitoring wells	Clean	0
	Well cuttings to special waste pad	Injection/recovery/freeze wells	Mineralized	9,977
	Well cuttings to clean waste pad	Freeze/monitoring wells	Clean	971
	Borrow materials for landfill cover (summer only)	Borrow pit	Aggregate	13,531
	Domestic landfill cover (summer only)	Borrow pit	Aggregate	4,510
	Construction waste laydown area cover (summer only)	Borrow pit	Aggregate	4,510
	Industrial landfill cover (summer only)	Borrow pit	Aggregate	4,510
Max. Decommissioning	Special waste to industrial landfill (summer only)	Special waste pad	Mineralized	317
	Borrow materials for landfill cover (summer only)	Borrow pit	Aggregate	13,531
	Domestic landfill cover (summer only)	Borrow pit	Aggregate	6,766
	Construction waste laydown area cover (summer only)	Borrow pit	Aggregate	6,766
Average Decommissioning	Special waste to industrial landfill (summer only)	Special waste pad	Mineralized	317
	Borrow materials for landfill cover (summer only)	Borrow pit	Aggregate	13,531

Scenario	Description	Material Origin	Material Type	Handling Rate (tonnes/year)
	Domestic landfill cover (summer only)	Borrow pit	Aggregate	6,766
	Construction waste laydown area cover (summer only)	Borrow pit	Aggregate	6,766

Notes:
Material handling emissions for construction activities captured under general construction calculations (Section A.1)

Table A. 6: Storage Area Information

Name	Description	Max. Footprint (m^2)	Max. Storage Capacity	Max. Height (m)	Final Disposal Plan/Location [2]
Clean waste pad	Clean drill waste storage area	2,500	17,024 tonnes	4	Clean waste can be used for road maintenance or used during reclamation for soil cover. Remaining will be contoured.
Special waste pad	Mineralized drill cuttings storage area and contaminated ground from spills.	2,500	317 tonnes	0 [1]	Mineralized waste disposed of in industrial landfill.
Domestic landfill		6,000	n/a	0	Cover & revegetate.
Construction waste laydown area		2,500	n/a	0	Cover & revegetate.
Industrial landfill		10,000	n/a	0	Cover & revegetate.
Process precipitate pond	Process plant radioactive waste	5,776	10,000 m^3	0 [1]	Removed from site at the end of operation for processing.
Uranium rich solution holding area	Process solution pond	3,481	5,000 m^3	0	Process solution in the ponds through the mill and remove any sludge. Cover pond with geotextile liner system (encapsulate in place), drainage layer and rocks.
Industrial WWTP precipitate pond	Process plant waste	22,500	50,000 m^3	0	Removed from site at the end of operation for processing.

Notes:
[1] Special waste pad and process precipitates will be sub-grade.
[2] Assumed worst-case options for air quality emissions based on preliminary decommissioning plans.

Table A. 7: Drilling Data

Well Type	Hole Size (diameter x depth)	Total Number	Max Number Per Year			Notes
			Construction	Operations	Decomm.	
Injection	12" x 600 m	300	30	43	n/a	
Recovery	12" x 600 m	100	20	14	n/a	
Freeze	5" x 600 m	500	75	71	n/a	Assume half in mineralized waste
Monitoring	5" x 600 m	50	50	0	n/a	Clean waste
Well Type	**Hole Size (m^3)**	**Total Quantity (tonnes)**	**Material Amounts (tonnes)**			**Notes**
			Construction	Operations	Decomm.	
Injection	43.8	11483	4728	6755	n/a	
Recovery	43.8	5404	3152	2252	n/a	
Freeze	7.6	3995	2052	1943	n/a	Assume half in mineralized waste
Monitoring	7.6	1368	1368	0	n/a	Clean waste

Table A. 8: Propane Consumption

Scenario/Location	Value	Units
Construction Propane Consumption		
Construction heating	386,211	L/year
Operations Propane Consumption		
ISR Plant heating	4,237,539 [1]	L/year
Pumphouse heating	4,985	L/year
Freeze plant heating	82,862	L/year
Operations centre heating	85,433	L/year
Camp heating	288,789	L/year
Storage building heating	19,694	L/year
Substation propane	5,539	L/year
Airport terminal heating	15,435	L/year
Decommissioning Propane Consumption		
ISR Plant heating	1,460,527 [1]	L/year
Pumphouse 1 heating	0	L/year
Pumphouse 2 heating	0	L/year
Pumphouse 3 heating	0	L/year
Freeze plant heating	82,862	L/year
Operations centre heating	85,433	L/year
Camp heating	288,789	L/year
Storage building heating	19,694	L/year

Scenario/Location	Value	Units
Substation propane	5,539	L/year
Airport terminal heating	15,435	L/year

Notes:

[1] Excludes calciner burner consumption – this is accounted for in the calciner exhaust emission rates (see Section A.13).

Table A. 9: Geochemistry Data

Material	As	Cd	Co	Cu	Pb	Mo	Ni	Se	U	Vn	Zn	Cr	Ra-226	
	%												Bq/g or Bq/L	
Clean waste [1]	0	0	0	0	0	0	0	0	0	0	0		0	
Mineralized waste	0.0327	0.0039	0.0192	0.9596	0.9968	0.0388	0.0516	0.0090	24.20	0.1015	0.3291	0.050	2061	Bq/g
Gypsum [2]	0	0	0	0	0	0	0	0	0	0	0	0	0.6	Bq/g
Borrow material [1]	0	0	0	0	0	0	0	0	0	0	0	0	0	
Yellowcake	0.0001	0.0039	0.0192	0.9596	0.9968	0.0001	0.0516	0.0090	60.10	0.1	0.3291	0.050	nd	

Notes:
nd = no data
[1] Clean waste and borrow quarry materials assumed to have negligible quantities of uranium, metals, and radionuclides.
[2] Material assumed wet, therefore, no emissions of uranium or metals in dust are not expected.

Table A. 10: Radon Calculation Variables for Wellfield Drilling

Variable	Description	Value	Notes
[Ra]	Concentration of Ra-226 in ore (pCi/g)	55,700	Pre-feasibility Study, Table 13-8 [36]. 2,061 Bq/g.
E	Emanating power (dimensionless)	0.2	Typical value used in other uranium mine projects in Saskatchewan.
L	Decay constant of Rn-222 (1/d)	0.181	Constant.
T	Storage time in mud pit (d)	1	Storage time in mud tanks instead of a pit.
M	Average mass of ore material in the pit (g)	3.61E+06	Calculated based on ore zone thickness, drill hole diameter, and bult density.
N	Number of mud pits generated per year	100	Use wells instead of pits. 50 wells per year with safety factor of 2.
	Ore zone thickness (m)	6	
	Drill hole diameter (inches)	12	Diameter ranges from 6 to 12 inches. Used maximum.
	Ore bulk density (g/cm³)	8.24	Extracted from Denison Geological Database.

Table A. 11: Radon Calculations Variables for Wellfield Production

Variable	Description	Value	Notes
V	Volume of water in circulation (L)	6.62E+06	Calculated from mined area (A), ore body thickness (D) and porosity of ore (p). V = A x D x p x 1000 L per m³.
C_{Rn}	Rn-222 concentration in process water (pCi/L)	3.23E+7	Calculated.
F	Fraction of radon source carried by circulating water (dimensionless)	0.8	Default.
L	Decay constant of Rn-222 (1/d)	0.181	Constant.
V	Rate of radon venting from piping and valves during circulation (1/d)	0.01	Default.
Fp	Purge rate of treated water (L/d)	0	Captured in Fi
Fi	Water discharge rate to recovered solution pond (L/d)	7.20E+05	30 m³/h
10^6	Unit conversion factor (cm^3/m^3)	1.0E+06	Constant.
E	Emanating power of active ore zone (dimensionless)	0.06	
[Ra]	Ra-226 concentration in ore zone (pCi/g)	55,700	Pre-feasibility Study, Table 13-11 [36]. 2,061 Bq/g.
A	Active area of ore zone (m^2)	6.13E+03	Area of Phase 5 measured from drawings (approx. 9700 m²), which is mined over 19 months.
D	Average thickness of ore zone (m)	6	
P	Bulk density of ore material (g/cm^3)	3.6	Extracted from Denison Geological Database.
p	Ore porosity (%)	0.18	Maximum from Table 13-5 of Prefeasibility Study [36].

Table A. 12: Radon Calculation Variables for Wellfield Restoration

Variable	Description	Value	Notes
V	Volume of water in circulation (L)	6.62+06	Calculated from mined area (A), ore body thickness (D) and porosity of ore (p). V = A x D x p x 1000 L per m^3.
C_{Rn}	Rn-222 concentration in process water (pCi/L)	3.54E+07	Calculated.
F	Fraction of radon source carried by circulating water (dimensionless)	0.8	Default.
L	Decay constant of Rn-222 (1/d)	0.181	Constant.
V	Rate of radon venting from piping and valves during circulation (1/d)	0.01	Default.
Fp	Purge rate of treated water (L/d)	5.45E+05	Assume a purge rate of 100 gallons per minute.
Fi	Water discharge rate to recovered solution pond (L/d)	0	No recovered solution, therefore, Rn_u is zero.
10^6	Unit conversion factor (cm^3/m^3)	1.0E+06	Constant.
E	Emanating power of active ore zone (dimensionless)	0.06	
[Ra]	Ra-226 concentration in ore zone (pCi/g)	5.57E+04	Pre-feasibility Study, Table 13-8 [36]. 2,061 Bq/g.
A	Active area of ore zone (m^2)	6.13E+03	Same as operations.
D	Average thickness of ore zone (m)	6	
P	Bulk density of ore material (g/cm^3)	3.6	Extracted from Denison Geological Database.
p	Ore porosity (%)	0.18	Maximum from Table 13-5 of Prefeasibility Study [36].

Table A. 13: Radon Calculation Variables for Other Sources

Material	Location	Flux of Rn/Ra concentration ($Bq/m^2/s$ per Bq/g Ra-226)	Activity concentration Ra-226 (Bq/g)	dw/fw Ratio	Surface area (m^2)
Ore (dry) [1]	Core shack	0.08	2061	0.9	0.96
Ore (cuttings) [1]	Special waste pad	0.9	2061	0.7	2,500
Sludge (moist) [1]	Process precipitates storage pad	0.6	240	0.5	22,500
Process precipitate cake [1]	Process precipitates removal area in ISR plant	0.9	240	0.8	2.35
WWTP solids [2]	Gypsum pond	0.6	0.6	0.5	67,500

Notes:
[1] Variables previously selected by Ecometrix.
[2] WWTP solids will be disposed of in the gypsum pond. Flux and dw/fw were assumed to be like the process precipitates storage pad (i.e., moist sludge).

Appendix B:

CALMET/CALPUFF Information

B.1 CALMET

To overcome the limited meteorological observing record in the Project study area, a meteorological data set was generated using a combination of surface observations from Key Lake airport and data from the Weather Research Forecast Non-Hydrostatic Mesoscale Model (WRF-NMM) for the 2016 calendar year. The model year was selected in consultation with Dennis Fudge at the Saskatchewan Ministry of the Environment (SaskMoE) [19] so that the SaskMoE could compare the CALMET model results to their AERMOD-ready regional meteorological data set applicable to the Project Study Areas. The CALMET modelling approach and results were detailed in a technical memo [37]and reviewed by the SaskMoE in April and May 2021 [38] [39] [40].

B.1.1 Meteorology

WRF-NMM was run in hindcast mode and initialised using North American Mesoscale Forecast System (NAM) analyses available from the U.S. National Centre for Environmental Prediction (NCEP). The NAM analyses assimilate meteorological observations (e.g., land surface measurements, radiosonde, etc.) and are available every six hours at a 12 kilometre (km) horizontal grid resolution. WRF-NMM uses the NAM analyses as both the initial conditions and boundary conditions within the model and updates these values every 24 hours and six hours, respectively.

The WRF-NMM model was run using a grid spacing of 4 km to better resolve meteorological features within the Project Study Areas. The outputs from WRF-NMM were used to generate a 3D.DAT file to input to the CALMET model. The CALMET model (version 6.5) was then run in “NOOBS” mode 2, which uses the 3D.DAT file for all surface and upper air data. Two CALMET runs were completed: one for a 60 km by 60 km domain having a horizontal grid spacing of 1 km; and one for a 20 km by 20 km domain having a horizontal grid spacing of 200 metres (m). This approach was necessary to reduce model run times and to generate reasonably sized CALMET output files for input to CALPUFF.

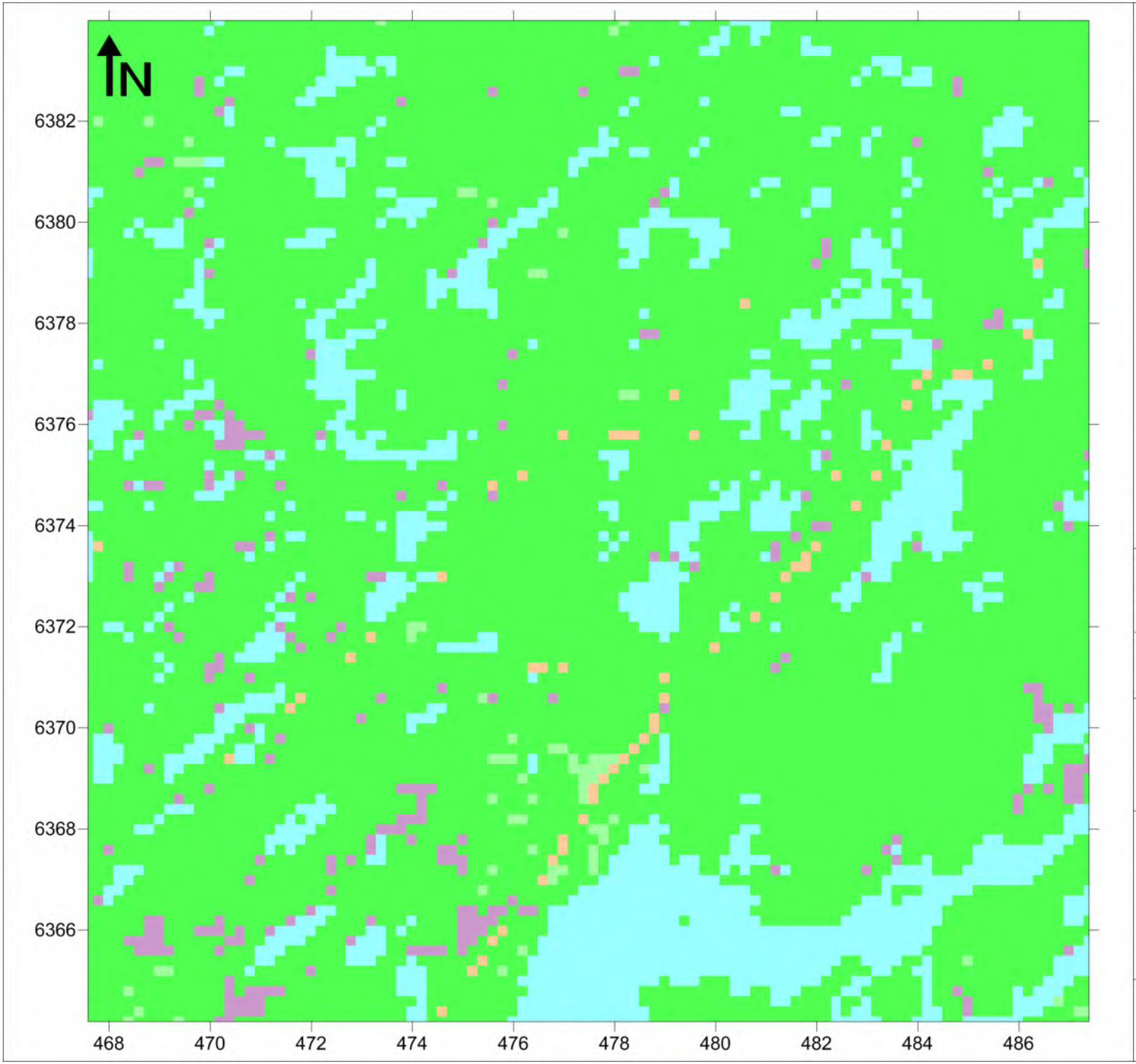
Following an evaluation of the CALMET model run in NOOBS mode 2, problems with the WRF-NMM model results were discovered, which were ultimately attributed to issues in the NAM data files:

- total cloud cover was overestimated,
- total precipitation was overpredicted, and
- extreme minimum temperatures were overestimated in most months, while extreme maximum temperatures were underestimated in the winter and slightly overestimated during the summer.

Due to the problems with the NAM data, temperature and cloud cover data from Key Lake airport were used instead of WRF-NMM data. At an approximate distance of 35 km, Key Lake is the closest observing station to the Project site. To correct precipitation, hourly outputs from WRF-NMM were scaled down using the ratio of total annual precipitation from WRF-NMM (625.7 mm) to total annual precipitation from the 1981-2010 Key Lake climate normals (482.5 mm). The resulting hourly precipitation file was used as input to CALMET. CALMET was then run in “NOOBS” mode 1 using a combination of WRF-NMM outputs and observations from Key Lake to produce surface and precipitation files. The 3D.DAT file generated by WRF-NMM was used for upper air observations.

B.1.2 Terrain and Land Use Data

The terrain data used for CALMET was Shuttle Radar Topography Mission (SRTM) elevation data [41] and used to run the TERREL preprocessor program (version 7). Land use files were generated using the program CTGPROC (version 7) and data from the Canadian Land Cover Geobase Series [42]. Separate land use files were made for 'summer' (May to October) and 'winter' (November to April). To make a winter file, the summer file was modified to change all small water body land use (code 51) to ice/snow (code 90). The MAKEGEO program (version 3.2) was then used to merge terrain and land use data into a geophysical data file for CALMET. The resulting land use and terrain data for the inner CALMET domain are shown in Figure B. 1, Figure B. 2, and Figure B. 3.



Legend

- 100
- 90 (snow/ice)
- 80 (tundra)
- 70 (barren land)
- 60 (wetland)
- 55 (large water body)
- 50 (small water body)
- 40 (forest)
- 30 (rangeland)
- 20 (agricultural)
- 10 (urban)

Notes

Land use produced by MAKEGEO for the 20 km by 20 km CALMET domain

Map Reference

NAD83 UTM (km) Zone 13

Independent Envrionmental Consultants

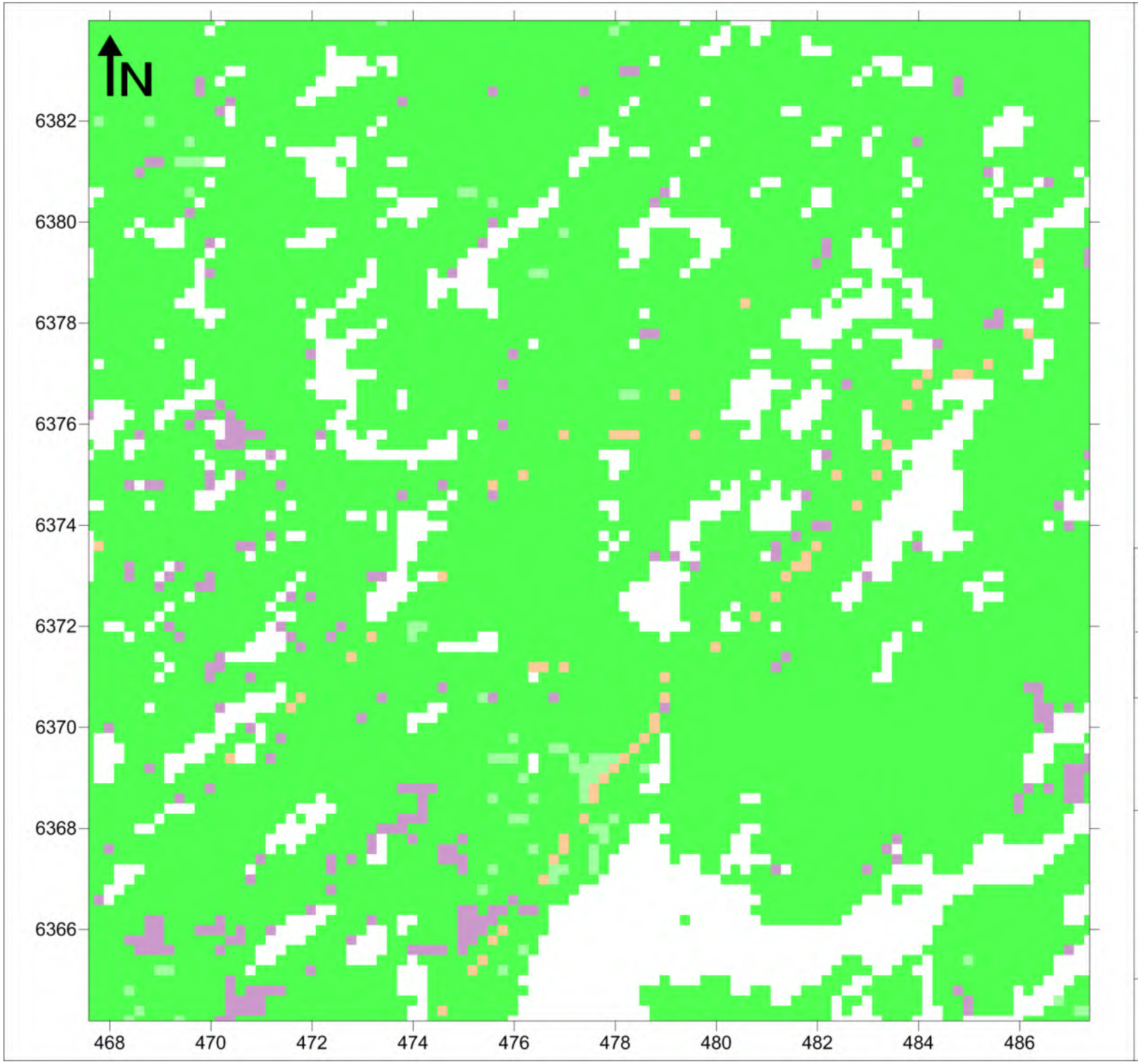
Denison Mines

Wheel River Project EIA

Figure B.1

CALMET Land Use - Summer

Project	Date
SX19-0043	Mar 2022



Legend

- 100
- 90 (snow/ice)
- 80 (tundra)
- 70 (barren land)
- 60 (wetland)
- 55 (large water body)
- 50 (small water body)
- 40 (forest)
- 30 (rangeland)
- 20 (agricultural)
- 10 (urban)

Notes

Land use produced by MAKEGEO for the 20 km by 20 km CALMET domain

Map Reference

NAD83 UTM (km) Zone 13

Independent Envrionmental Consultants

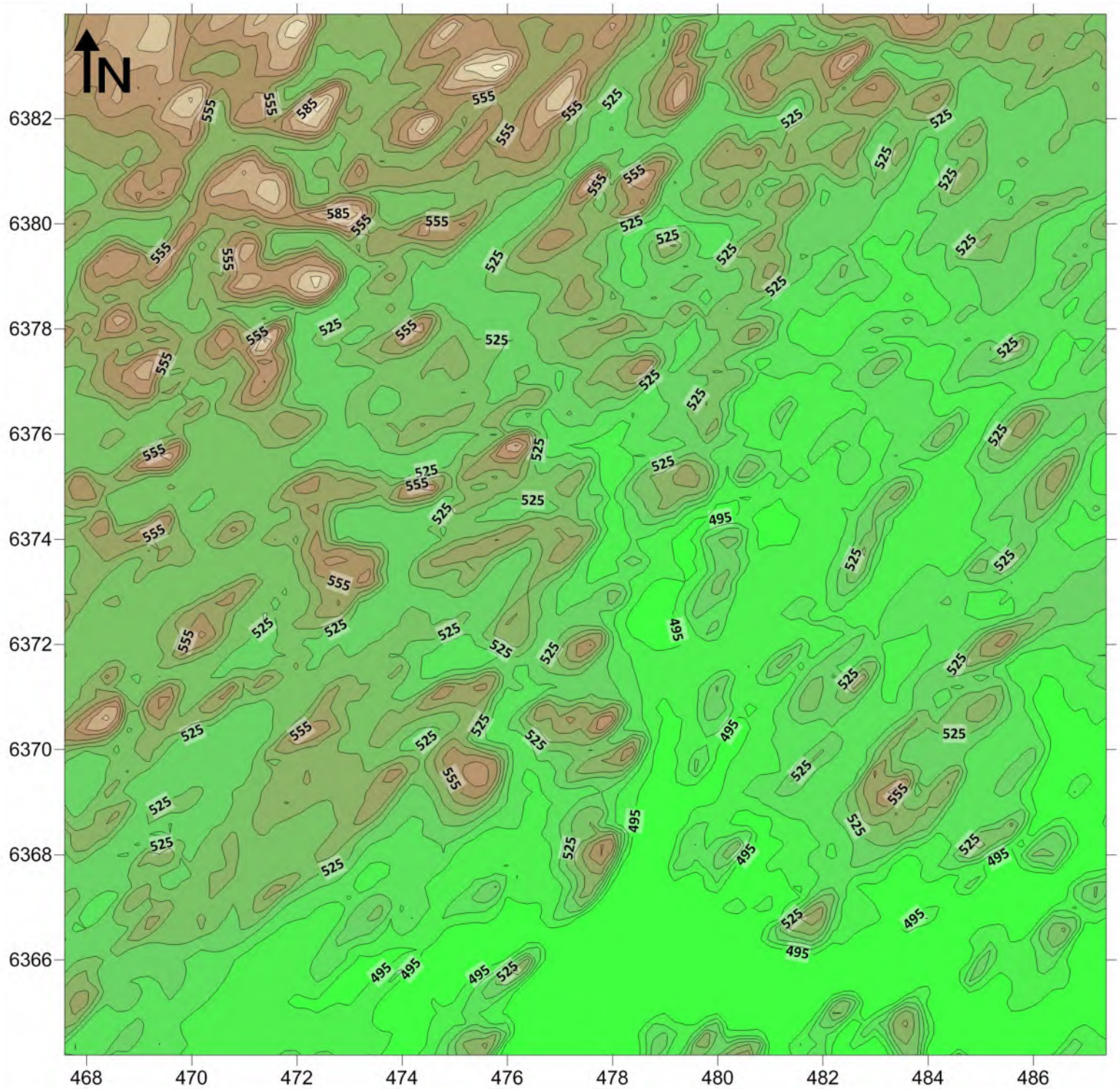
Denison Mines

Wheel River Project EIA

Figure B.2

CALMET Land Use - Winter

Project	Date
SX19-0043	Mar 2022



Legend

Terrain Elevations (m)

605
595
585
575
565
555
545
535
525
515
505
495
485

Notes

Terrain produced by MAKEGEO
for the 20 km by 20 km CALMET domain

Map Reference

NAD83 UTM (km) Zone 13

Independent Envrionmental Consultants

Denison Mines

Wheel River Project EIA

Figure B.3

CALMET Terrain

Project	Date
SX19-0043	Mar 2022

B.1.3 CALMET Options

The following table provides all non-default options used in the CALMET modelling.

CALMET Option	Selected Option	Explanation
No. of Vertical Layers	NZ = 10	10 vertical layers used: 0, 20, 40, 80, 160, 300, 600, 1000, 1500, 2200, 3000 m
No Observation Mode	NOOBS = 1	Use surface and overwater stations (no upper air observations). Use 3D.DAT for upper air data.
Number of surface stations	NSSTA = 1	One surface station
Number of precipitation stations	NPSTA = 1	One precipitation station
Extrapolate surface wind observations to upper layers	IEXTRP = -1	No extrapolation is done. 3D.DAT used for upper air.
Layer-dependent biases modifying the weights of surface and upper air stations	BIAS = 0.0	3D.DAT used for upper air
Use varying radius of influence	LVARY = T	Use varying radius of influence
Maximum radius of influence over land in the surface layer	RMAX1 = 1	Maximum radius of influence of surface stations over land is 1 km
Maximum radius of influence over land in the layer aloft	RMAX2 = 1	Maximum radius of influence of upper air stations over land is 1 km
Maximum radius of influence over water	RMAX3 = 1	Maximum radius of influence of upper air stations over water is 1 km
Radius of influence of terrain features	TERRAD = 1	Terrain effects are considered up to 1 km for each grid point
Relative weighting of the first guess field and observations in the surface layer	R1 = 1	Weighting used for surface layer is 1km
Relative weighting of the first guess field and observations in the layers aloft	R2 = 1	Weighting used for layers aloft is 1 km
Maximum number of stations used in each layer for the interpolation of data to a grid point	NINTR2 = 5	Number of stations for each layer is 5
3D temperature from observations or from prognostic data	ITPROG = 1	Use Surface stations and 3D.DAT for upper air data
Radius of influence for temperature interpolation	TRADKM = 50	Radius of influence is 50 km
Maximum search radius in averaging process	MNMDAV = 10	10 grid cells used to make mixing height more uniform
Maximum overwater mixing height	ZIMAXW = 2500	Maximum overwater mixing height is 2500 m
Maximum number of stations to include in temperature interpolation	NUMTS = 1	Number of surface stations is 1

CALMET Option	Selected Option	Explanation
Land use categories for temperature interpolation over water	JWAT1 = 999 JWAT2 = 999	Temperature interpolation disabled using 999
Precipitation interpolation parameters, radius of influence	SIGMAP = 50	Radius of influence is 50 km

As mentioned above, the CALMET modelling was reviewed by the SaskMoE [38] [39] [40]. During the review process, the selection of terrain data and non-default CALMET options were discussed and the sensitivity of the model to the selection of the following parameters was tested:

- Shuttle Radar Topography (STRM3) terrain data vs. Canadian digital elevation data (CDEM),
- TERRAD = 6 km vs. 1 km, and
- NINTR = 99 vs. 5.

From the testing process, it was determined that the CALMET model results were not sensitive to these parameters and would have a minimal impact on the CALPUFF model results. Consequently, the non-default CALMET options presented in the above table were agreed to with the SaskMoE and applied in the model.

B.1.4 CALMET Results

Wind, temperature, precipitation, and atmospheric stability results from the CALMET model are presented below for a grid point near the centre of the Project site and compared to available observations for the same model year (2016). Comparisons are also made to the 30-year Climate Normals (1981 to 2010) for Key Lake, where available. To ensure that the 2016 CALMET data set is representative of current meteorological conditions, the most recent five years of Key Lake observations available at the time when the analysis was completed (2016 to 2020) are also discussed.

B.1.4.1 Wind Speed and Direction

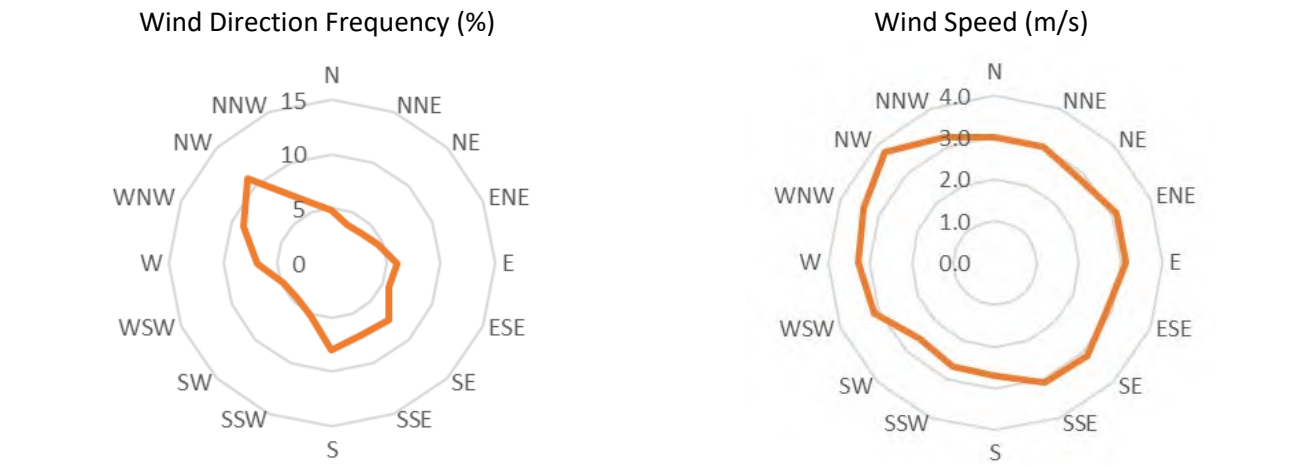
Wind direction frequencies and the average wind speed (by direction) generated by CALMET are presented as a wind rose in Figure B. 4 for a grid point near the Project site. Figure B. 4 shows that the dominant wind direction at the Project site is northwest (NW) followed by west-northwest (WNW). The average wind speed is 3.4 m/s, and the percentage of calms (wind speeds less than 0.5 m/s) is 1.41%.

Due to a lack of observations near the Project site, a wind rose based on WRF-NMM outputs for a grid point near Key Lake airport was created and compared to observations from the NAV Canada Key Lake weather station (Climate ID 4063757) for both the 2016 calendar year and the 2016 to 2020 period. Figure B. 5 shows that there is good agreement between the observed wind speed and WRF-NMM. The average observed wind speed in 2016 and the 2016 to 2020 period is 3.6 m/s, while the average wind speed predicted by WRF-NMM at Key Lake airport is 3.9 m/s.

Generally, there is good agreement between observed and predicted wind directions, however, the SE and NW directions are slightly overestimated by WRF-NMM, while the E and W directions are underestimated. Comparing 2016 observations to observations for the 2016 to 2020 period, there has been little change in the

distribution of wind direction and wind speed, demonstrating that 2016 wind data is representative of current conditions.

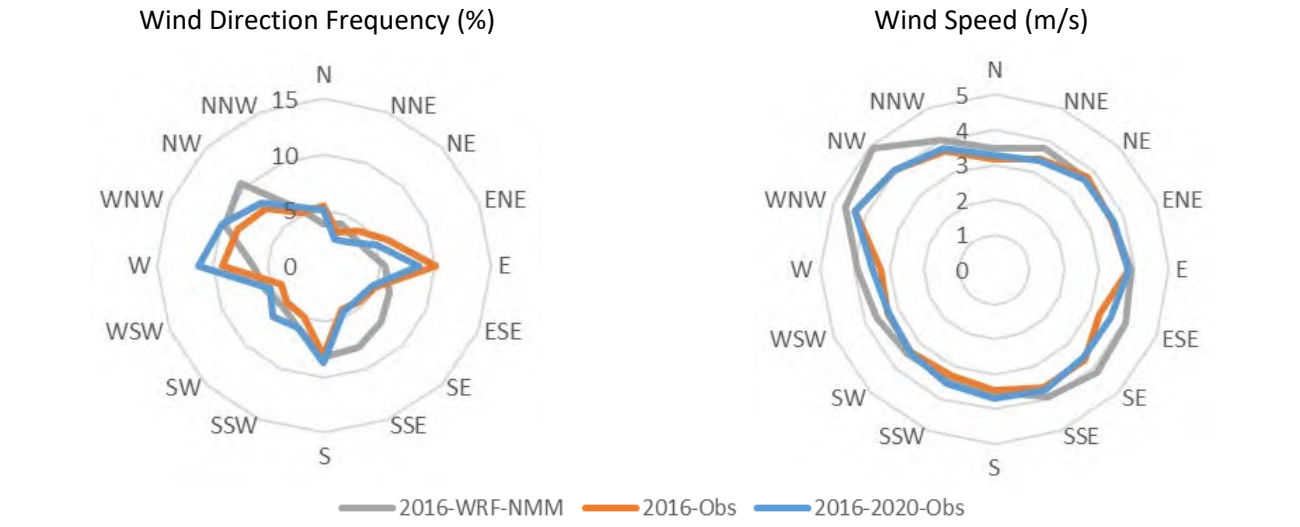
Figure B. 4: Wind Rose from CALMET (2016) for a Grid Point Near the Project Site



Note: the directions shown are the direction that the wind blows **from**

Percentage calms = 1.41%

Figure B. 5: Wind Rose from WRF-NMM (2016) compared to Key Lake Airport Observations



Note: the directions shown are the direction that the wind blows **from**

Percentage calms = 0.5% for WRF-NMM
5.1% for 2016 Observations
1.0% for2016-2020 Observations

B.1.4.2 Temperature

Mean daily, extreme maximum, and extreme minimum temperature data from the CALMET model are provided in Table B. 1 for a grid point near the Project site. The results are compared to surface observations from Key Lake for the 2016 calendar year, and the 2016 to 2020 period. These data were obtained from the Climate Baseline Report, provided under separate cover [43]. Table B. 1 also presents the Key Lake 30-year Climate Normals (1981 to 2010).

Based on the CALMET model, mean daily temperature ranges from -21.1°C to 16.9°C, with an overall annual average of -0.3°C. This compares well with mean daily surface observations in 2016, which range from -21.8°C to 16.0°C, with an overall annual average of -1.1°C. Extreme daily maximum and minimum temperatures also compare well. The extreme daily maximum from CALMET is 29.0°C and 29.5°C from the observations. The extreme daily minimum is -41.9°C from CALMET and -45.2°C from the observations.

Mean daily temperature observations for the 2016 to 2020 period range from -20.9°C to 16.1°C and have an overall annual average of -2.8°C. The extreme daily maximum for this period is 34.0°C, while the extreme daily minimum is -48.0°C. This temperature range is comparable to the 30-year Climate Normals, which have an average annual temperature of -2.3°C, and extremes of -52.5°C and 36°C. Compared to 2016 temperature data, the average annual temperature for the 2016 to 2020 period is slightly colder. This difference is driven by colder temperatures during most of the winter months. The impact of these temperature differences to the dispersion modelling would be minor. As discussed in Section B.2, most modelled sources are non-buoyant ground-based releases (i.e., volume sources and area sources), which are not sensitive to ambient temperature. For point sources, colder ambient temperatures would increase buoyancy and enhance dispersion and so, warmer temperatures in the 2016 data set would be conservative.

In addition to monthly temperature, the average diurnal temperature profile based on CALMET is presented in Figure B. 6. The Figure shows a typical daily temperature profile that increases shortly after sunrise and decreases after sunset, demonstrating that CALMET can reproduce the expected diurnal pattern of temperature.

B.1.4.3 Precipitation

Mean monthly precipitation amounts from the CALMET model are provided in Table B. 2 for a grid point near the Project site. The results are compared to the Key Lake observations for the 2016 calendar year and the 2016 to 2020 period [43]. Key Lake 1981-2010 Climate Normals are also presented for comparison.

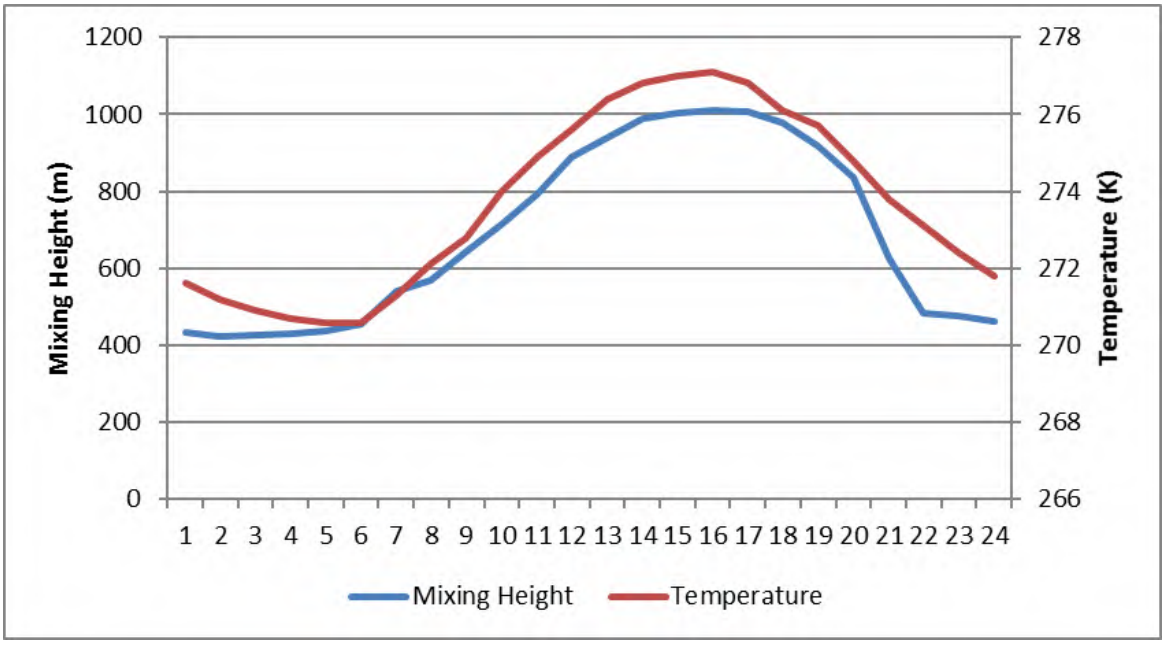
Based on the CALMET model, mean monthly precipitation ranges from 10.5 mm to 101.1 mm and has an overall annual total of 485.8 mm, while the 2016 total from Key Lake observations was 550 mm. The annual total for the 2016 to 2020 period is 479.4 mm, which is comparable to the 30-year Climate Normals (482.5 mm). While the annual total from CALMET is less than the observed total in 2016, it compares well with the 2016 to 2020 period, illustrating that precipitation in the model is representative of recent meteorological conditions. It should be noted, however, that the CALPUFF model results are not sensitive to precipitation. Deposition of COPC is driven by dry mechanisms, therefore, precipitation has little impact on modelled deposition rates and concentrations.

Table B. 1: Monthly Temperature Data from CALMET (2016) Compared to Key Lake Airport Observations

Month	Mean Daily Temperature (°C)				Extreme Max. Temperature (°C)				Extreme Min. Temperature (°C)			
	CALMET 2016*	Key Lake Observ. 2016	Key Lake Observ. 2016-2020	Key Lake Climate Normals (1981-2010)	CALMET 2016*	Key Lake Observ. 2016	Key Lake Observ. 2016-2020	Key Lake Climate Normals (1981-2010)	CALMET 2016*	Key Lake Observ. 2016	Key Lake Observ. 2016-2020	Key Lake Climate Normals (1981-2010)
January	-17.1	-20.1	-22.3	1.0	2.0	4.5	10.0	-36.0	-38.7	-48.0	-52.5	-17.1
February	-19.3	-20.9	-18.7	2.0	2.5	8.0	9.0	-40.9	-45.2	-47.7	-48.5	-19.3
March	-10.3	-13.2	-11.7	7.0	7.5	12.3	15.0	-36.9	-40.4	-44.6	-50.5	-10.3
April	-3.2	-5.0	-1.9	21.0	20.8	20.8	28.5	-31.9	-35.6	-40.2	-40.0	-3.2
May	9.6	7.0	6.5	26.6	29.5	31.5	32.5	-2.0	-7.2	-24.6	-21.5	9.6
June	13.8	13.2	13.3	29.0	29.1	34.0	34.5	2.2	-1.2	-6.9	-5.0	13.8
July	16.0	16.1	16.3	29.0	29.0	31.4	33.5	4.2	0.8	-0.7	-1.0	16.0
August	13.9	14.1	14.7	26.0	27.5	32.1	36.0	2.2	-1.1	-1.5	-3.0	13.9
September	9.6	7.5	8.0	20.6	20.5	28.0	28.5	-0.9	-3.5	-8.0	-8.5	9.6
October	-1.3	-1.4	0.0	10.0	10.5	16.9	24.5	-11.9	-13.7	-23.2	-28.0	-1.3
November	-3.6	-11.6	-11.8	9.0	10.0	10.0	12.2	-22.9	-24.1	-36.2	-43.0	-3.6
December	-21.8	-18.8	-19.5	-3.3	-3.5	5.2	5.0	-41.9	-44.5	-46.4	-48.0	-21.8
Annual	**-1.1**	**-2.8**	**-2.3**	**29.0**	**29.5**	**34.0**	**36.0**	**-41.9**	**-45.2**	**-48.0**	**-52.5**	**-1.1**

Notes:
*Data extracted from CALMET outputs for a grid point near the centre of the Project site
Key Lake observations from the Climate Baseline Report [43]
Key Lake Climate Normals available from https://climate.weather.gc.ca/climate_normals/index_e.html

Figure B. 6: Diurnal Temperature and Mixing Height Profiles from CALMET (2016)*



Notes:
*Data extracted from CALMET outputs for a grid point near the centre of the Project site

Table B. 2: Precipitation Data from CALMET (2016) Compared to Key Lake Observations and Climate Normals

Month	Mean Total Precipitation (mm)			
	CALMET 2016*	Key Lake Climate Normals (1981-2010)	Key Lake ECCC Station (2016)	Key Lake ECCC Station (2016 to 2020)
January	18.6	22.1	20.1	21.8
February	15.5	17.4	18.9	14.1
March	34.9	21.1	30.5	20.7
April	42.7	23.7	27.6	21.0
May	19.3	36.5	4.1	28.9
June	101.1	63.4	97.9	74.9
July	82.9	88.3	144.4	91.0
August	45.6	66.9	58.9	83.3
September	63.8	58	54.2	45.2
October	37.3	36.4	65.4	41.8
November	10.5	28.6	14.2	20.6
December	13.7	20.2	13.8	16.1
Annual	**485.8**	**482.5**	**550.0**	**479.4**

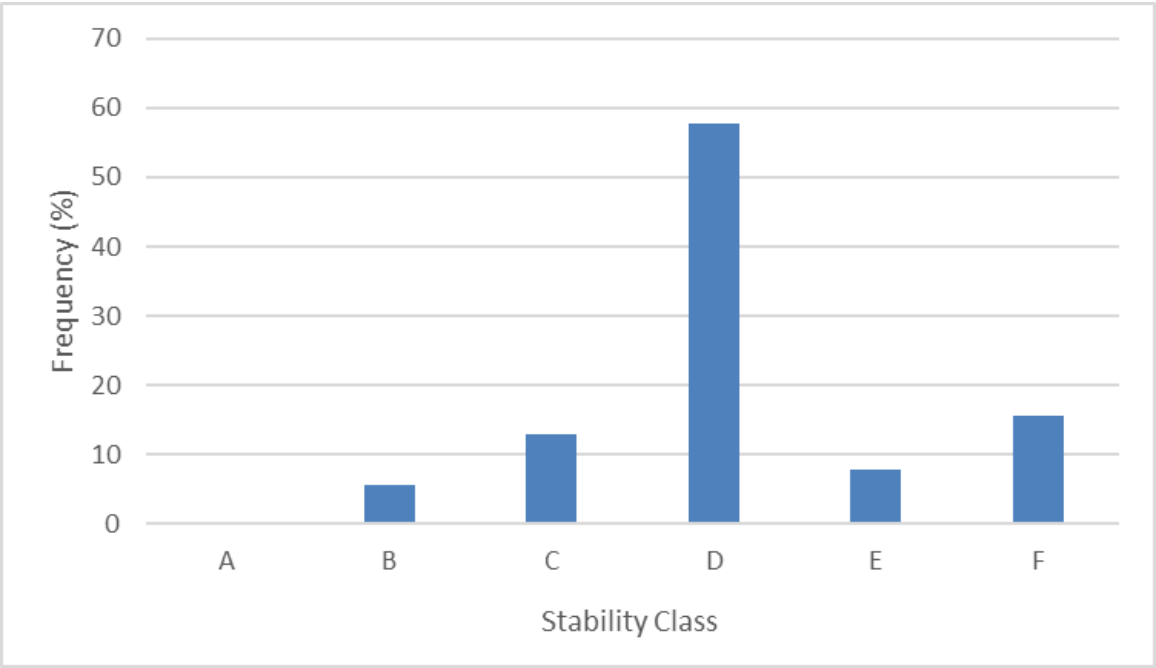
Notes:
*Data extracted from CALMET outputs for a grid point near the centre of the Project site
Key Lake observations from the Climate Baseline Report [43]
Key Lake Climate Normals available from https://climate.weather.gc.ca/climate_normals/index_e.html

B.1.4.4 Atmospheric Stability and Mixing Height

The occurrence of each stability class predicted by CALMET is presented in Figure B.7. The Figure shows that D stability class (neutral) occurs 57.6% of the time. Stability classes E and F, which are indicative of stable atmospheric conditions, are shown to occur 23.5% of the time. Finally, unstable conditions represented by classes B and C occur 18.7% of the time, while very unstable conditions (class A) occur very infrequently (less than 1% of the time). This type of distribution is expected for this region of Saskatchewan.

The diurnal variation of average annual mixing height produced by CALMET was shown in Figure B. 6. The Figure shows that the mixing height grows shortly after sunrise, peaks in the afternoon, and decreases shortly after sunset. Together, the stability class outputs and mixing height profile show that the boundary layer development is accurately represented by the CALMET model, which is important for air dispersion modelling.

Figure B. 7: Stability Class Distribution from CALMET (2016)*



Notes:
*Data extracted from CALMET outputs for a grid point near the centre of the Project site

B.2 CALPUFF

The following sections outline the CALPUFF model setup including a description of the sources, building layout, and receptor grids that were used in the model. The CALPUFF model setup and input file were provided to the SaskMoE for review. The SaskMoE indicated that the source setup and CALPUFF model switches were appropriate [44].

B.2.1 Modelled Sources

Three types of sources were used in the CALPUFF model to represent the various emission sources at the mine, including volume sources, area sources, and point sources. Majority of the emission sources, including general construction activities, the wellfield, waste storage pads/areas, and landfills were represented using area sources. Note that some sources must be represented by multiple area sources. Area sources should not have a length to width ratio greater than 10:1 and ideally should not span across a CALMET grid. Therefore, in some cases multiple area sources must be used to represent a single source. For example, 27 sources were used to represent general construction activities. Point sources were used to represent emissions from stacks where relevant stack information was available (e.g., ISR stacks and generators). Finally, unpaved roads and sources lacking specific point source parameters like general ventilation sources and propane heating, were represented by volumes sources.

Figure B. 8 presents the physical configuration of the proposed model sources for the Construction scenario, while Figure B. 9 and Figure B. 9 present the proposed model sources for the Operations and Decommissioning scenarios. For simplicity, the roads are shown as lines, but as noted above, they will be modelled as a series of volume sources. For detailed source parameters, see Table B. 3 (area sources), Table B. 4 (volume sources), and Table B. 5 (point sources). Note that the locations of the modelled sources are listed in UTM coordinates in metres relative to the NAD83 datum (Zone 13N).

Table B. 3: CALPUFF Area Source Parameters

Model ID	Description	Elevation (m)	Height (m)	Model Area (m^2)	UTM Coordinates - SW Corner	
					X (m)	Y (m)
CONST	General construction area sources (27 areas)	Various	0	991,000	Various	
PH5_1	Phase 5 wellfield area 1	542.67	0	10,924	476747	6373889
PH5_2	Phase 5 wellfield area 2	543.77	0	11,433	476883	6373932
FE_RA	Process precipitates pond	530.57	0	5706	477031	6374489
UBS	Uranium rich solution holding area (pond)	534.75	0	2,425	477227	6374394
LNDFL_1	Domestic landfill area 1	539.28	0	3,219	476161	6372235
LNDFL_2	Domestic landfill area 2	540.44	0	5,644	476175	6372289
LNDFL_C	Construction waste laydown area	540.11	0	2,214	476259	6372353
SWPAD	Special waste pad	527.01	0	2,738	477285	6374518
CWPAD	Clean waste pad	523.36	2	2,724	477441	6374488
BORROW1	Borrow area 1	536.85	0	40,000	477083	6374889
BORROW2	Borrow area 2	530.80	0	15,000	477283	6374889
BORROW3	Borrow area 3	534.66	0	32,000	477323	6375289

Model ID	Description	Elevation (m)	Height (m)	Model Area (m²)	UTM Coordinates - SW Corner	
					X (m)	Y (m)
CONST	General construction area sources (27 areas)	Various	0	991,000	Various	
BORROW4	Borrow area 4	530.65	0	28,000	477483	6375290
BORROW5	Borrow area 5	538.44	0	40,000	477283	6375089
LNDFL_CN	Industrial landfill	528.25	0	8,763	476780	6374985
GYPSUM	Industrial wastewater precipitate pond (Gypsum Pond)	528.67	0	22,444	476978	6374589

Table B. 4: CALPUFF Volume Source Parameters

Model ID	Description	Elevation (m)	Height (m)	Sigma-Y (m)	Sigma-Z (m)	UTM Coordinates	
						X (m)	Y (m)
ISR	ISR plant general ventilation	538.00	22.4	11.63	10.56	477079	6374374
PUMP1	Pumphouse propane heating	542.12	3.0	2.83	1.4	476773	6373971
BATCH	Batch plant	533.59	5.0	2.33	6.98	476971	6374873
FREEZE	Freeze plant propane heating	544.74	10.0	5.81	4.65	476992	6374236
OPS	Operations facility propane heating	544.54	3.0	6.98	1.4	476764	6373555
CAMP	Camp propane heating	542.00	3.0	6.98	1.4	476912	6373544
STORAGE	Storage facility propane heating	545.98	6.0	3.02	2.79	476881	6373696
SUBSTN	Substation propane heating	541.00	2.0	3.49	0.47	476749	6373398
AIRPORT	Airport propane heating	513.91	9.0	6.98	4.19	478858	6376182
CORE	Core shack ventilation	537.34	2.4	0.56	1.12	477134	6374303
HWY914	Highway 914 (121 volumes)	Various	2.13	19.38	0.92	Various	
ACCESS	Access road (162 volumes)	Various	2.13	14.85	0.92	Various	
SITE1	Site road 1 (31 volumes)	Various	2.13	14.51	0.92	Various	
SITE2	Site road 2 (29 volumes)	Various	2.13	14.67	0.92	Various	
SITE3	Site road 3 (148 volumes)	Various	2.13	14.84	0.92	Various	

Table B. 5: CALPUFF Point Source Parameters

Model ID	Description	Elevation (m)	Height (m)	Diam [m]	Velocity [m/s]	Temp. [K]	Orientation	UTM Coordinates	
								X (m)	Y (m)
GEN1	1.1 MW Generator	544.14	4.25	0.380	38	797.15	Vertical	476950	6374239
GEN2	1.1 MW Generator	544.09	4.25	0.380	38	797.15	Vertical	476954	6374242
GEN3	450 kW Generator	542.23	4.25	0.380	15	804.25	Vertical	476724	6373548
GEN4	450 kW Generator	548.71	4.25	0.380	15	804.25	Vertical	476787	6373438
S1	Dryer process gas scrubber	538.00	45.0	0.076	18	365.15	Vertical	477038	6374377
S2	Calciner/process gas scrubber	538.00	45.0	0.067	18	345.15	Vertical	477034	6374382
S3	Dryer/calciner hygiene scrubber	538.00	45.0	1.003	18	316.15	Vertical	477030	6374387
S4	Calciner burner exhaust	538.00	45.0	0.153	18	1173.0	Vertical	477020	6374402
LIME	Lime silo	538.00	23.0	0.300	5	293.15	Vertical	477042	6374413
RN_TANK	Recovered solution surge tank	534.75	10.0	0.254	53.17	273.15	Vertical	477257	6374402

B.2.2 Building Layout

Buildings affect the flow of air in the vicinity of a point source and cause the plume from a point source to be downwashed. To simulate the effect of building downwash in the model, the Plume Rise Model Enhancements version of the Building Profile Input Program (BPIP PRIME) was utilized in the CALPUFF model. The building configuration that was used in the model is shown in Figure B. 11, and detailed building information is provided in Table B. 6. Note that only the generators and the recovered solution surge tank will be subject to building downwash in the Construction scenario, therefore, the generator trailers and the surge tank are the only structures that were modelled during this scenario.

Table B. 6: Modelled Buildings

Building ID	Description	Elevation (m)	Tier Height (m)	Diameter (m)	UTM Coordinates -SW Corner	
					X (m)	Y (m)
OPS	Operations centre	544.51	3.0	n/a	476729.82	6373517
STORAGE	Covered storage	544.83	6.0	n/a	476854.05	6373681
WTP_CAMP	Camp wastewater treatment	547.96	3.0	n/a	476842.27	6373429.31
CAMP_S	Camp south unit	548.35	3.0	n/a	476849.2	6373495.3
CAMP_C	Camp central building	549.68	3.0	n/a	476884.42	6373538.92
CAMP_N	Camp north unit	551.13	3.0	n/a	476960.52	6373541.72
TANK1	Water tank	549.50	3.0	18	477024.39	6373829
TANK2	Fire water tank	549.23	3.0	n/a	477034.02	6373832
PH_PH2	Pumphouse phase 2	538.43	3.0	n/a	477142.58	6374267
PH_PH3	Pumphouse phase 3	541.94	3.0	n/a	477059.83	6374189
PH_PH5	Pumphouse phase 5	542.13	3.0	n/a	476758.14	6373956
FREEZE	freeze plant	544.74	10.0	n/a	476954.67	6374201
ISR_1	ISR plant tier 1	538.00	22.7	n/a	477017.05	6374314
ISR_2	ISR plant tier 2	538.00	14.7	n/a	477087.33	6374363
GEN1	1.1 MW generator trailer	544.56	3.3	n/a	476954.04	6374232
GEN2	1.1 MW generator trailer	544.52	3.3	n/a	476957.88	6374235
GEN3	450 kW generator trailer	542.35	3.3	n/a	476729.15	6373541
GEN4	450 kW generator trailer	548.61	3.3	n/a	476787.1	6373436.33
CORE	Core shack	537.53	2.4	n/a	477130.77	6374299
RN_TANK	Recovered solution surge tank	534.75	3.0	3.6	477254.7	6374400.35

B.2.3 Modelling Domain and Receptors

The Local and Regional Study Areas (LSA/RSA) and the property boundary were discussed in Section 6.1.1.3 of the EIS. A nested receptor grid was used in CALPUFF to cover the Study Areas with the following spacing:

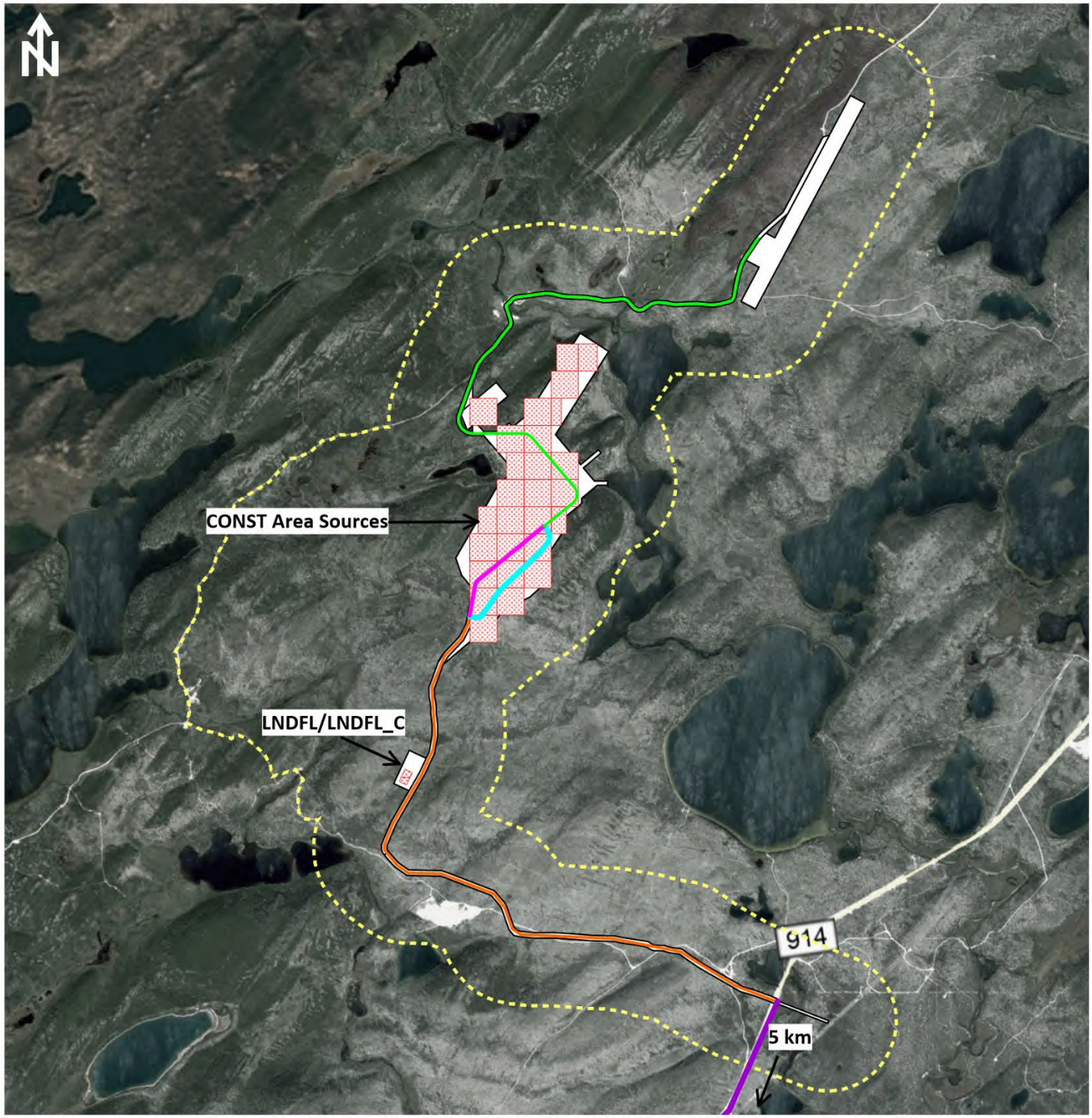
a) 50 m spacing in a 2 km by 2 km box, centred approximately on the mine site,
b) 250 m spacing in a 5 km by 5 km box and outside of the area described in (a),
c) 500 m spacing in a 10 km by 10 km box and outside of the area described in (b),
d) 1,000 m spacing in a 20 km by 20 km area and outside of the area described in (c), and

e) 2,000 m spacing in a 40 km by 40 km area and outside of the area described in (d).

In addition to the nested model grid, receptors were placed every 50 m along the Property Boundary, and road receptors were placed parallel to the roads at distances of 50 m, 150 m, and 250 m from the road edge at a spacing of 200 m. Sixteen discrete receptors were also included in the model to provide model outputs for other disciplines (e.g., risk). The UTM coordinates of these sensitive receptors are provided in Table B. 7 and are listed in metres relative to the NAD83 datum (Zone 13N).

Table B. 7: Discrete Receptors Included in CALPUFF

ID	Type	Description	UTM Coordinates	
			X (m)	X (m)
WE1	Worker exposure	ISR Plant	477122	6374321
WE2	Worker exposure	Special Waste Pad	477342	6374486
WE3	Worker exposure	Industrial landfill	476829	6375006
WE4	Worker exposure	Process precipitates storage pad	477115	6374492
WE5	Worker exposure	Wash Bay/Scanning Facility	477087	6374079
WE6	Worker exposure	Fe disposal wellfield	477486	6374846
WE7	Worker exposure	Wellfield boundary 1	476721	6373937
WE8	Worker exposure	Wellfield boundary 2	476777	6373864
WE9	Worker exposure	Wellfield boundary 3	477043	6374042
WE10	Worker exposure	Wellfield boundary 4	477001	6374109
WE11	Worker exposure	Freeze Plant	477012	6374211
Risk1	Risk	Eco on-site	477708	6374351
Risk2	Risk	Human Location Seasonal Resident at McGowan Lake	479490	6372582
Risk3	Risk	Human Location Camp Worker	476896	6373487
Risk4	Risk	Human Location Seasonal Resident at Russell Lake	478415	6368289
Risk5	Risk	Reference Receptor Location	473146	6375099



LEGEND:

- Modelled Property Boundary
- Modelled Highway 914
- Modelled Access Road
- Modelled Site Road 1
- Modelled Site Road 2
- Modelled Site Road 3
- Modelled Area Source

NOTES:

1. 5 km of Highway 914 south of the mine site is modelled.
2. The point sources modelled during construction (generators, radon surge tank) are illustrated in Figures B.9 and B.10.

SCALE:

0 m 1000 m 2000 m

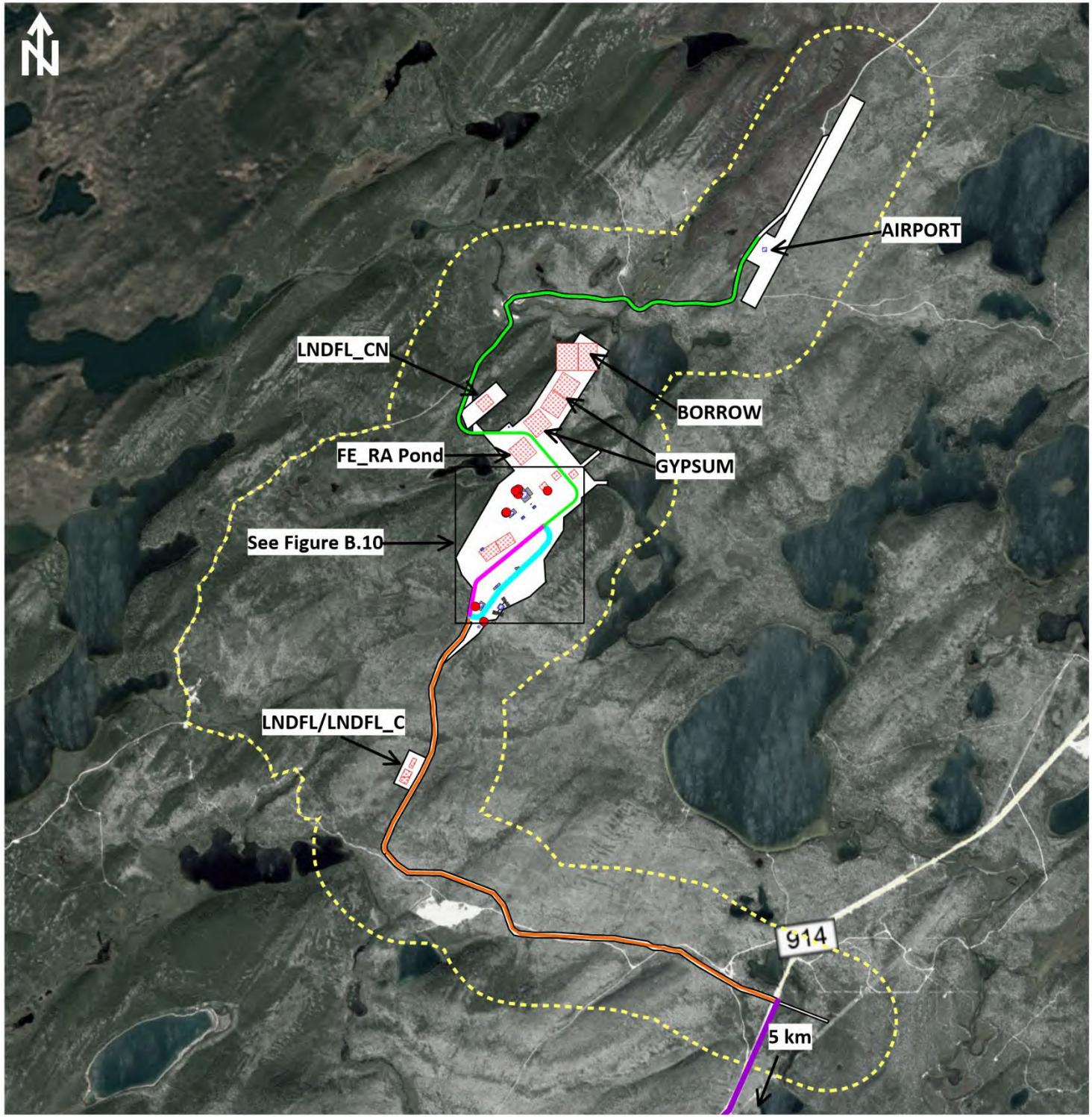
REFERENCE:

UTM Zone 13T, WGS84

Denison Mines
Wheeler River Project, SK

CALPUFF Model Layout - Construction Scenario

Drawn By:	Approved By:	Figure No.:
KT	PLK	B.8
Date: June 2022	Project No.: SX19-0043	



LEGEND:

- Modelled Property Boundary
- Modelled Highway 914
- Modelled Access Road
- Modelled Site Road 1
- Modelled Site Road 2
- Modelled Site Road 3
- Modelled Area Source
- Modelled Volume Source
- Modelled Building
- Modelled Point Source

NOTES:

1. 5 km of Hlghway 914 south of the mine site was modelled.

SCALE:

0 m 1000 m 2000 m

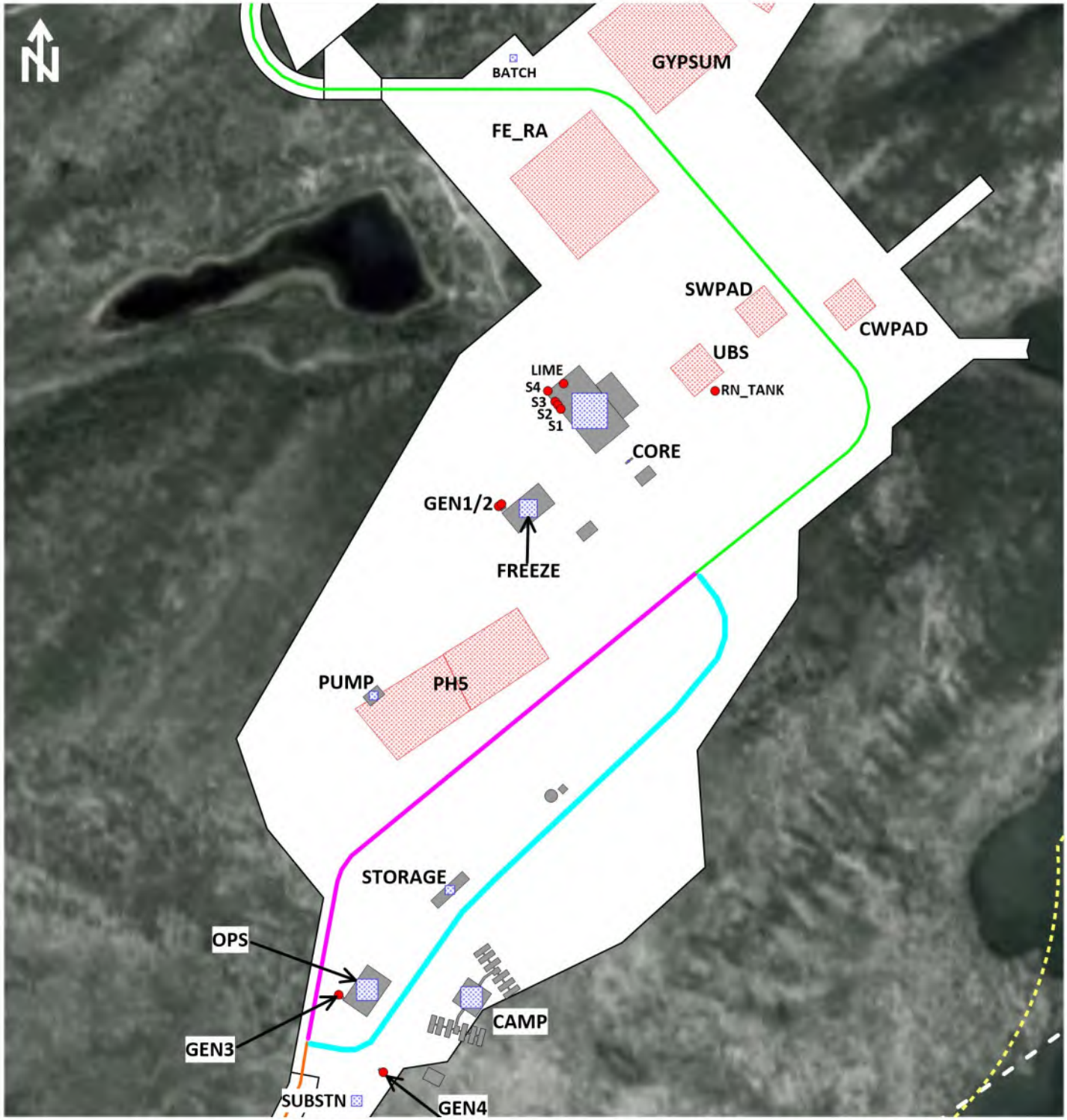
REFERENCE:

UTM Zone 13T, WGS84

Denison Mines
Wheeler River Project, SK

CALPUFF Model Layout - Operations/Decomm. Scenarios

Drawn By:	Approved By:	Figure No.:
KT	PLK	B.9
Date: June 2022	Project No.: SX19-0043	



LEGEND:

- Modelled Property Boundary
- Modelled Highway 914
- Modelled Access Road
- Modelled Site Road 1
- Modelled Site Road 2
- Modelled Site Road 3
- Modelled Area Source
- Modelled Volume Source
- Modelled Building
- Modelled Point Source

NOTES:

SCALE:

0 m 200 m 400 m

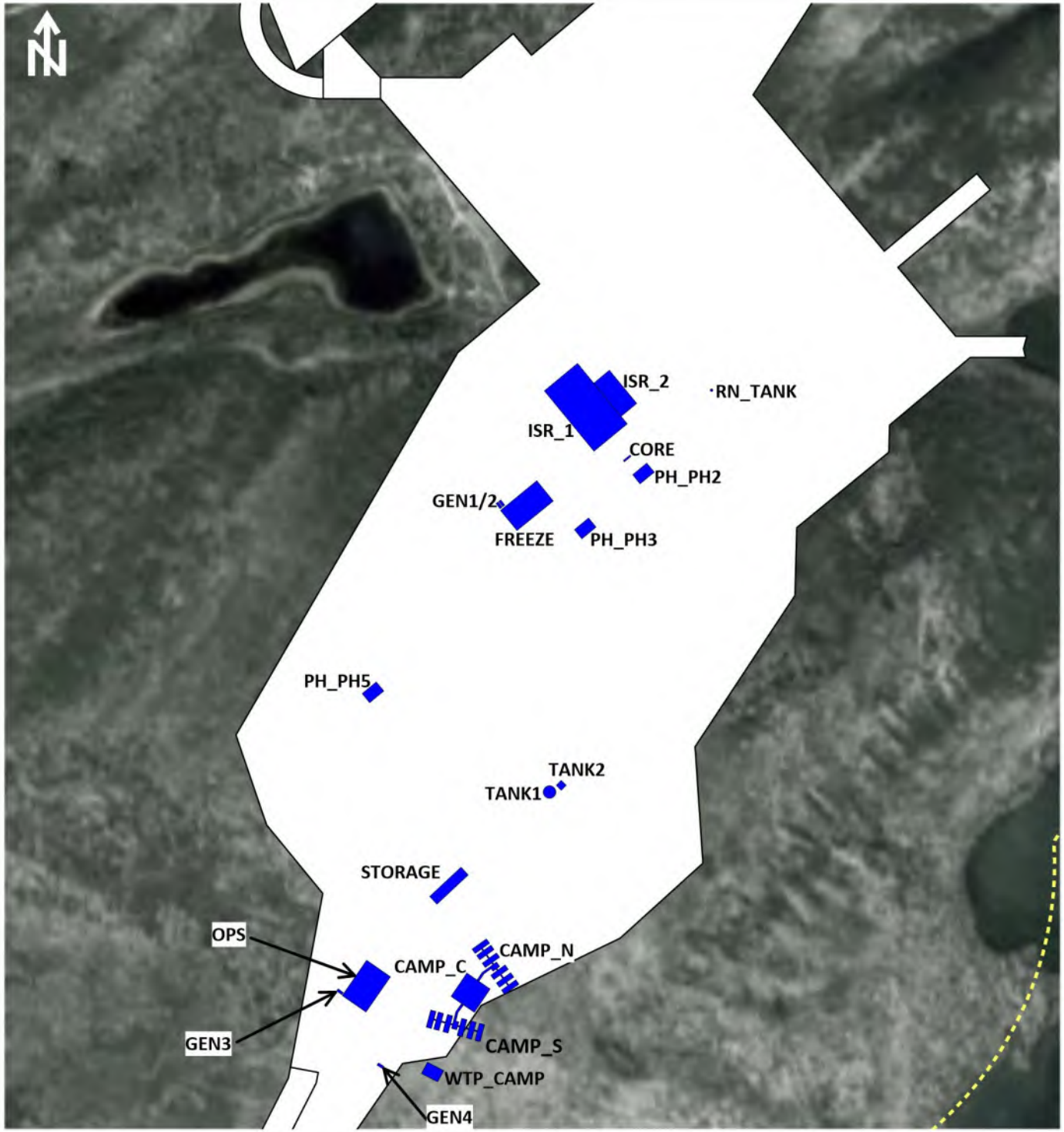
REFERENCE:

UTM Zone 13T, WGS84

Denison Mines
Wheeler River Project, SK

Detailed CALPUFF Model Layout
- Operations/Decomm. Scenarios

Drawn By:	Approved By:	Figure No.:
KT	PLK	B.10
Date: June 2022	Project No.: SX19-0043	



LEGEND:

Modelled Property Boundary

Modelled Building

NOTES:

SCALE:

0 m 200 m 400 m

REFERENCE:

UTM Zone 13T, WGS84

Denison Mines
Wheeler River Project, SK

CALPUFF Building Layout

Drawn By:	Approved By:	Figure No.:
KT	PLK	B.11
Date: June 2022	Project No.: SX19-0043	

Appendix C:

HHERA and Worker Exposure Model Results

Table C. 1: Model Predictions of Particulate Matter, CO, SO_2, and NO_2 Concentrations (µg/m³) for HHERA and Worker Exposure Receptors: Construction Scenario

UTM Easting (km)	UTM Northing (km)	ID	TSP 24-hour	24-h TSP Exceedances (days/year)	TSP Annual	PM_{10} 24-hour	24-h PM_{10} Exceedances (days/year)	$PM_{2.5}$ 24-hour	24-h $PM_{2.5}$ Exceedances (days/year)	$PM_{2.5}$ Annual	CO 1-hour	CO 8-hour	SO_2 1-hour	SO_2 24-hour	SO_2 Annual	NO_2 1-hour	1-h NO_2 Exceedances (hours/year)	NO_2 24-hour	24-h NO_2 Exceedances (days/year)	NO_2 Annual
477.122	6374.321	WE1	341.47	158	73.78	162.22	133	25.87	0	7.51	700.7	648.8	5.72E-01	1.87E-01	4.44E-02	578.63	1489	192.89	0	42.20
477.342	6374.487	WE2	315.81	116	52.49	126.01	77	18.79	0	5.56	630.0	613.6	1.87E-01	8.07E-02	1.95E-02	194.88	338	73.94	0	19.86
476.829	6375.006	WE3	336.56	141	63.99	170.27	123	25.56	0	6.68	651.6	626.5	2.47E-01	1.20E-01	2.86E-02	205.46	646	101.04	0	27.02
477.115	6374.493	WE4	306.79	128	61.61	143.48	107	21.93	0	6.51	646.8	629.7	2.35E-01	1.11E-01	2.94E-02	204.11	858	93.71	0	28.01
477.087	6374.079	WE5	668.85	221	82.38	263.42	177	34.65	1	7.77	708.9	667.2	6.09E-01	1.99E-01	4.76E-02	613.59	1911	194.66	0	46.86
477.486	6374.847	WE6	123.56	6	21.03	66.31	7	12.18	0	3.81	606.7	596.6	9.53E-02	3.55E-02	5.36E-03	84.25	12	36.31	0	8.25
476.721	6373.938	WE7	422.99	168	73.86	209.45	136	30.16	1	7.22	653.9	633.4	2.46E-01	1.14E-01	3.18E-02	203.46	660	94.71	0	29.38
476.777	6373.865	WE8	716.01	244	101.78	293.98	210	38.83	3	8.58	675.2	643.2	3.19E-01	1.50E-01	3.95E-02	248.69	1012	122.23	0	35.26
477.043	6374.042	WE9	731.85	246	102.09	288.44	213	37.16	3	8.77	723.7	668.0	6.66E-01	2.48E-01	4.99E-02	655.73	1834	249.97	3	46.95
477.002	6374.109	WE10	681.31	232	102.03	295.47	214	41.03	6	10.06	770.5	698.6	9.03E-01	3.43E-01	7.49E-02	912.41	2553	349.63	14	70.50
477.012	6374.212	WE11	519.67	231	92.38	239.55	257	58.92	113	18.81	1055.0	943.4	2.26E+00	1.34E+00	3.20E-01	2289.10	4045	1365.58	160	320.18
477.708	6374.352	Risk1	97.13	0	18.67	49.89	0	10.04	0	3.64	602.6	591.9	1.17E-01	3.43E-02	5.07E-03	124.32	47	41.08	0	8.34
478.245	6372.039	Risk2	58.55	0	13.52	31.04	0	7.65	0	3.21	583.3	580.1	3.35E-02	1.14E-02	9.28E-04	42.97	0	20.11	0	4.65
476.896	6373.487	Risk3	285.6	108	48.0	136.0	78	20.5	0	5.4	645.7	614.2	2.16E-01	8.14E-02	1.65E-02	181.0	296	70.6	0	17.1
478.415	6368.290	Risk4	57.2	0	13.0	29.1	0	7.3	0	3.1	578.2	577.2	1.24E-02	3.55E-03	1.96E-04	22.9	0	12.6	0	4.0
473.146	6375.100	Risk5	57.3	0	12.9	32.4	0	7.8	0	3.2	582.8	580.1	3.03E-02	6.75E-03	4.88E-04	40.2	0	15.8	0	4.2
Air Quality Criteria			100	100	60	50	50	27	27	10	15,000	6,000	450	125	20	79	79	200	200	45
Background			46.2	46.2	12.4	23.1	23.1	6.5	6.5	3.1	575	575	0	0	0	11.3	11.3	9.4	9.4	3.8

Table C. 2: Model Predictions of Uranium and Metals Concentrations (µg/m³) for HHERA and Worker Exposure Receptors: Construction Scenario

UTM Easting (km)	UTM Northing (km)	ID	As 24-hour	As Annual	Cd 24-hour	Cd Annual	Co 24-hour	Co Annual	Cr 24-hour	Cr Annual	Cu 24-hour	Cu Annual	Mo 24-hour	Mo Annual	Ni 24-hour	Ni Annual	Pb 24-hour	Pb Annual	Se 24-hour	Se Annual	U 24-hour	24-h U Exceedances (days/year)	U Annual	Vn 24-hour	Vn Annual	Zn 24-hour	Zn Annual
477.122	6374.321	WE1	3.05E-03	7.09E-04	2.84E-04	7.55E-05	2.67E-03	7.12E-04	6.04E-04	1.57E-04	3.31E-01	6.33E-02	2.74E-03	7.30E-04	2.09E-03	4.15E-04	1.78E-02	3.39E-03	8.18E-04	1.57E-04	4.31E-02	0	7.58E-03	5.48E-03	1.46E-03	1.13E+00	2.16E-01
477.342	6374.487	WE2	3.04E-03	7.05E-04	2.81E-04	7.50E-05	2.65E-03	7.10E-04	5.87E-04	1.54E-04	3.30E-01	6.32E-02	2.72E-03	7.26E-04	2.06E-03	4.09E-04	1.73E-02	3.26E-03	8.13E-04	1.55E-04	2.92E-02	0	4.60E-03	5.42E-03	1.44E-03	1.13E+00	2.16E-01
476.829	6375.006	WE3	3.05E-03	7.09E-04	2.84E-04	7.54E-05	2.66E-03	7.12E-04	6.04E-04	1.57E-04	3.31E-01	6.33E-02	2.74E-03	7.29E-04	2.08E-03	4.14E-04	1.78E-02	3.36E-03	8.18E-04	1.56E-04	4.26E-02	0	6.94E-03	5.48E-03	1.45E-03	1.13E+00	2.16E-01
477.115	6374.493	WE4	3.05E-03	7.08E-04	2.83E-04	7.54E-05	2.66E-03	7.12E-04	6.00E-04	1.56E-04	3.30E-01	6.32E-02	2.74E-03	7.29E-04	2.08E-03	4.13E-04	1.77E-02	3.35E-03	8.16E-04	1.56E-04	3.94E-02	0	6.61E-03	5.47E-03	1.45E-03	1.13E+00	2.16E-01
477.087	6374.079	WE5	3.05E-03	7.06E-04	2.83E-04	7.52E-05	2.66E-03	7.10E-04	5.96E-04	1.55E-04	3.30E-01	6.32E-02	2.73E-03	7.27E-04	2.07E-03	4.10E-04	1.76E-02	3.29E-03	8.15E-04	1.56E-04	3.66E-02	0	5.25E-03	5.45E-03	1.45E-03	1.13E+00	2.16E-01
477.486	6374.847	WE6	3.02E-03	7.01E-04	2.79E-04	7.46E-05	2.64E-03	7.08E-04	5.70E-04	1.50E-04	3.29E-01	6.30E-02	2.70E-03	7.21E-04	2.03E-03	4.02E-04	1.67E-02	3.15E-03	8.08E-04	1.54E-04	1.54E-02	0	1.70E-03	5.36E-03	1.43E-03	1.13E+00	2.16E-01
476.721	6373.938	WE7	3.05E-03	7.09E-04	2.83E-04	7.55E-05	2.66E-03	7.12E-04	6.00E-04	1.57E-04	3.30E-01	6.33E-02	2.74E-03	7.30E-04	2.08E-03	4.15E-04	1.77E-02	3.39E-03	8.17E-04	1.57E-04	3.96E-02	0	7.58E-03	5.47E-03	1.46E-03	1.13E+00	2.16E-01
476.777	6373.865	WE8	3.07E-03	7.12E-04	2.85E-04	7.58E-05	2.67E-03	7.14E-04	6.14E-04	1.60E-04	3.31E-01	6.33E-02	2.76E-03	7.33E-04	2.10E-03	4.19E-04	1.82E-02	3.46E-03	8.21E-04	1.57E-04	5.14E-02	0	9.30E-03	5.52E-03	1.46E-03	1.13E+00	2.16E-01
477.043	6374.042	WE9	3.07E-03	7.10E-04	2.85E-04	7.55E-05	2.67E-03	7.12E-04	6.15E-04	1.58E-04	3.31E-01	6.33E-02	2.76E-03	7.31E-04	2.10E-03	4.15E-04	1.82E-02	3.39E-03	8.21E-04	1.57E-04	5.17E-02	0	7.66E-03	5.52E-03	1.46E-03	1.13E+00	2.16E-01
477.002	6374.109	WE10	3.07E-03	7.13E-04	2.86E-04	7.60E-05	2.67E-03	7.14E-04	6.18E-04	1.61E-04	3.31E-01	6.34E-02	2.76E-03	7.35E-04	2.11E-03	4.21E-04	1.83E-02	3.50E-03	8.22E-04	1.58E-04	5.46E-02	0	1.03E-02	5.53E-03	1.47E-03	1.13E+00	2.16E-01
477.012	6374.212	WE11	3.07E-03	7.11E-04	2.86E-04	7.57E-05	2.68E-03	7.13E-04	6.21E-04	1.59E-04	3.31E-01	6.33E-02	2.77E-03	7.32E-04	2.11E-03	4.17E-04	1.84E-02	3.43E-03	8.23E-04	1.57E-04	5.65E-02	0	8.73E-03	5.54E-03	1.46E-03	1.13E+00	2.16E-01
477.708	6374.352	Risk1	3.01E-03	7.01E-04	2.78E-04	7.45E-05	2.64E-03	7.07E-04	5.62E-04	1.50E-04	3.29E-01	6.30E-02	2.69E-03	7.20E-04	2.01E-03	4.01E-04	1.64E-02	3.13E-03	8.05E-04	1.54E-04	9.24E-03	0	1.26E-03	5.34E-03	1.43E-03	1.13E+00	2.16E-01
478.245	6372.039	Risk2	3.00E-03	7.00E-04	2.78E-04	7.44E-05	2.64E-03	7.07E-04	5.57E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.63E-02	3.10E-03	8.04E-04	1.54E-04	5.15E-03	0	6.90E-04	5.32E-03	1.43E-03	1.13E+00	2.16E-01
476.896	6373.487	Risk3	3.03E-03	7.05E-04	2.81E-04	7.50E-05	2.65E-03	7.10E-04	5.82E-04	1.53E-04	3.30E-01	6.31E-02	2.71E-03	7.25E-04	2.05E-03	4.08E-04	1.71E-02	3.24E-03	8.11E-04	1.55E-04	2.49E-02	0	4.12E-03	5.40E-03	1.44E-03	1.13E+00	2.16E-01
478.415	6368.290	Risk4	3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.55E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	3.57E-03	0	6.19E-04	5.32E-03	1.43E-03	1.13E+00	2.16E-01
473.146	6375.100	Risk5	3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.56E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	4.21E-03	0	6.59E-04	5.32E-03	1.43E-03	1.13E+00	2.16E-01
Air Quality Criteria			0.3	n/a	0.025	0.005	0.1	n/a	0.5	n/a	50	n/a	120	n/a	0.2	0.04	0.5	n/a	10	n/a	0.15	0.15	0.03	2	n/a	120	n/a
Background			3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.54E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	3.00E-03	3.00E-03	6.00E-04	5.31E-03	1.43E-03	1.13E+00	2.16E-01

Table C. 3: Model Predictions of Radon Concentrations (Bq/m³) for HHERA and Worker Exposure Receptors: Construction Scenario [1]

UTM Easting (km)	UTM Northing (km)	ID	Rn-222 Annual
477.122	6374.321	WE1	9.89E+00
477.342	6374.487	WE2	1.02E+01
476.829	6375.006	WE3	1.84E+00
477.115	6374.493	WE4	9.35E+00
477.087	6374.079	WE5	1.24E+01
477.486	6374.847	WE6	1.74E+00
476.721	6373.938	WE7	1.59E+01
476.777	6373.865	WE8	1.63E+01
477.043	6374.042	WE9	2.23E+01
477.002	6374.109	WE10	2.32E+01
477.012	6374.212	WE11	1.10E+01
477.708	6374.352	Risk1	1.98E+00
478.245	6372.039	Risk2	2.60E-01
476.896	6373.487	Risk3	2.15E+00
478.415	6368.290	Risk4	5.64E-02
473.146	6375.100	Risk5	1.97E-01

Notes:
[1] Model predictions are incremental (i.e., with no background added).

Table C. 4: Model Predictions of Annual Deposition Rates for HHERA and Worker Exposure Receptors: Construction Scenario

UTM Easting	UTM Northing	ID	TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NO_2	As	Cd	Co	Cr	Cu	Mo	Ni	Pb	Se	U	Vn	Zn	Rn-222
(km)	(km)		mg/cm²/year																		Bq/cm²/year
477.122	6374.321	WE1	7.85E+00	7.58E-01	2.86E-03	4.77E-02	5.77E-04	4.68E-01	1.11E-05	4.40E-06	4.18E-05	8.88E-06	1.03E-04	4.26E-05	4.19E-05	1.28E-05	8.42E-05	8.22E-05	8.45E-05	3.09E-04	1.08E+02
477.342	6374.487	WE2	5.32E+00	4.58E-01	1.64E-03	2.19E-02	2.33E-04	1.81E-01	1.10E-05	4.40E-06	4.18E-05	8.84E-06	1.01E-04	4.25E-05	4.18E-05	1.13E-05	8.42E-05	4.58E-05	8.44E-05	3.08E-04	1.43E+02
476.829	6375.006	WE3	6.97E+00	7.11E-01	1.85E-03	3.30E-02	3.36E-04	2.59E-01	1.11E-05	4.40E-06	4.18E-05	8.88E-06	1.02E-04	4.26E-05	4.19E-05	1.26E-05	8.42E-05	7.71E-05	8.45E-05	3.08E-04	1.76E+01
477.115	6374.493	WE4	2.90E+00	2.36E-01	1.40E-03	1.74E-02	1.96E-04	1.62E-01	1.10E-05	4.40E-06	4.17E-05	8.81E-06	1.00E-04	4.25E-05	4.18E-05	1.05E-05	8.42E-05	2.60E-05	8.43E-05	3.08E-04	4.33E+01
477.087	6374.079	WE5	7.98E+00	6.62E-01	2.93E-03	4.75E-02	5.77E-04	5.03E-01	1.10E-05	4.40E-06	4.18E-05	8.84E-06	1.01E-04	4.25E-05	4.18E-05	1.13E-05	8.42E-05	4.72E-05	8.44E-05	3.08E-04	1.20E+02
477.486	6374.847	WE6	1.32E+00	6.30E-02	6.27E-04	5.86E-03	5.84E-05	4.64E-02	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.98E-05	4.25E-05	4.17E-05	9.82E-06	8.42E-05	1.02E-05	8.42E-05	3.08E-04	1.89E+01
476.721	6373.938	WE7	7.80E+00	7.86E-01	2.36E-03	3.75E-02	3.85E-04	2.93E-01	1.11E-05	4.41E-06	4.18E-05	8.89E-06	1.03E-04	4.26E-05	4.19E-05	1.29E-05	8.42E-05	8.58E-05	8.45E-05	3.09E-04	1.51E+02
476.777	6373.865	WE8	1.13E+01	1.13E+00	2.85E-03	4.69E-02	4.70E-04	3.56E-01	1.11E-05	4.41E-06	4.18E-05	8.91E-06	1.04E-04	4.26E-05	4.19E-05	1.39E-05	8.42E-05	1.09E-04	8.46E-05	3.09E-04	1.56E+02
477.043	6374.042	WE9	1.08E+01	9.74E-01	3.18E-03	5.32E-02	6.00E-04	4.98E-01	1.11E-05	4.40E-06	4.18E-05	8.88E-06	1.03E-04	4.26E-05	4.19E-05	1.27E-05	8.42E-05	8.00E-05	8.45E-05	3.08E-04	2.28E+02
477.002	6374.109	WE10	1.09E+01	1.11E+00	3.87E-03	7.76E-02	9.41E-04	7.95E-01	1.11E-05	4.41E-06	4.18E-05	8.92E-06	1.04E-04	4.26E-05	4.20E-05	1.41E-05	8.42E-05	1.15E-04	8.47E-05	3.09E-04	2.29E+02
477.012	6374.212	WE11	8.47E+00	8.63E-01	3.15E-03	4.18E-02	4.30E-04	3.23E-01	1.11E-05	4.41E-06	4.18E-05	8.90E-06	1.03E-04	4.26E-05	4.19E-05	1.32E-05	8.42E-05	9.30E-05	8.46E-05	3.09E-04	1.03E+02
477.708	6374.352	Risk1	1.24E+00	5.80E-02	7.18E-04	4.34E-03	5.35E-05	4.27E-02	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.98E-05	4.25E-05	4.17E-05	9.74E-06	8.42E-05	8.28E-06	8.42E-05	3.08E-04	2.17E+01
478.245	6372.039	Risk2	7.91E-01	6.77E-03	1.14E-04	6.12E-04	7.74E-06	6.05E-03	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.54E-06	8.42E-05	3.40E-06	8.42E-05	3.07E-04	1.83E+00
476.896	6373.487	Risk3	4.65E+00	4.37E-01	1.31E-03	1.92E-02	1.88E-04	1.45E-01	1.10E-05	4.40E-06	4.18E-05	8.83E-06	1.01E-04	4.25E-05	4.18E-05	1.12E-05	8.42E-05	4.34E-05	8.43E-05	3.08E-04	1.93E+01
478.415	6368.290	Risk4	7.75E-01	4.46E-03	4.76E-05	1.39E-04	1.54E-06	1.29E-03	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.52E-06	8.42E-05	3.01E-06	8.42E-05	3.07E-04	3.94E-01
473.146	6375.100	Risk5	7.52E-01	3.44E-03	1.58E-04	3.81E-04	4.45E-06	3.47E-03	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.53E-06	8.42E-05	3.21E-06	8.42E-05	3.07E-04	1.35E+00
		Air Quality Standard	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Background	0.73	n/a	n/a	n/a	n/a	n/a	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.52E-06	8.42E-05	2.93E-06	8.42E-05	3.07E-04	n/a

Table C. 5: Model Predictions of Particulate Matter, CO, SO_2, and NO_2 Concentrations (µg/m³) for HHERA and Worker Exposure Receptors: Operations Scenario

UTM Easting (km)	UTM Northing (km)	ID	TSP 24-hour	24-h TSP Exceedances (days/year)	TSP Annual	PM_{10} 24-hour	24-h PM_{10} Exceedances (days/year)	$PM_{2.5}$ 24-hour	24-h $PM_{2.5}$ Exceedances (days/year)	$PM_{2.5}$ Annual	CO 1-hour	CO 8-hour	SO_2 1-hour	SO_2 24-hour	SO_2 Annual	NO_2 1-hour	1-h NO_2 Exceedances (hours/year)	NO_2 24-hour	24-h NO_2 Exceedances (days/year)	NO_2 Annual
477.122	6374.321	WE1	102.02	1	19.46	49.70	0	13.00	0	4.05	686.7	638.5	5.27E-01	1.65E-01	1.25E-02	543.15	796	175.04	0	9.42
477.342	6374.487	WE2	113.19	1	23.16	52.50	1	10.65	0	3.73	613.3	596.2	1.72E-01	5.49E-02	2.54E-03	174.50	77	58.75	0	5.04
476.829	6375.006	WE3	85.18	0	18.17	44.44	0	10.03	0	3.48	603.6	595.1	1.26E-01	5.15E-02	1.67E-03	132.40	103	54.19	0	4.71
477.115	6374.493	WE4	87.26	0	16.87	44.56	0	10.72	0	3.53	620.6	604.8	2.21E-01	7.94E-02	5.96E-03	190.16	260	67.81	0	6.49
477.087	6374.079	WE5	254.37	60	35.35	95.89	33	15.06	0	4.35	692.8	656.4	5.55E-01	1.83E-01	1.02E-02	571.02	1693	179.17	0	11.19
477.486	6374.847	WE6	66.88	0	14.86	34.48	0	8.28	0	3.28	588.5	583.3	6.16E-02	1.83E-02	1.09E-03	63.27	0	23.75	0	4.34
476.721	6373.938	WE7	143.01	7	20.34	69.31	4	13.65	0	3.92	672.8	637.8	3.58E-01	1.48E-01	1.13E-02	280.46	466	116.77	0	12.41
476.777	6373.865	WE8	215.32	30	27.63	93.10	13	17.16	0	4.17	681.2	648.9	3.99E-01	1.86E-01	1.25E-02	308.18	519	148.62	0	13.14
477.043	6374.042	WE9	263.45	64	35.93	99.77	35	17.81	0	4.63	705.4	664.9	5.99E-01	2.12E-01	1.60E-02	602.58	1409	219.48	2	15.91
477.002	6374.109	WE10	155.40	19	24.31	67.48	8	20.46	0	4.35	756.5	688.2	8.65E-01	3.34E-01	1.68E-02	876.29	1945	336.50	10	16.86
477.012	6374.212	WE11	120.49	6	20.65	76.11	71	58.25	86	4.28	1043.5	940.2	2.22E+00	1.33E+00	1.92E-02	2260.54	3415	1358.37	153	20.77
477.708	6374.352	Risk1	62.88	0	14.59	32.15	0	8.30	0	3.28	599.0	588.6	1.12E-01	2.97E-02	1.17E-03	116.30	36	35.22	0	4.41
478.245	6372.039	Risk2	54.19	0	12.86	28.45	0	7.22	0	3.14	582.5	579.9	3.17E-02	1.14E-02	2.81E-04	40.18	0	19.57	0	3.97
476.896	6373.487	Risk3	124.0	8	20.6	56.6	4	11.0	0	3.7	690.6	639.1	3.71E-01	1.23E-01	1.11E-02	274.8	402	100.31	0	11.3
478.415	6368.290	Risk4	54.5	0	12.7	27.7	0	7.1	0	3.1	578.2	576.9	1.49E-02	4.28E-03	5.73E-05	24.0	0	12.97	0	3.8
473.146	6375.100	Risk5	51.1	0	12.6	26.9	0	7.0	0	3.1	582.7	580.0	3.45E-02	7.21E-03	1.66E-04	43.2	0	15.75	0	3.9
Air Quality Criteria			100	100	60	50	50	27	27	10	15,000	6,000	450	125	20	79	79	200	200	45
Background			46.2	46.2	12.4	23.1	23.1	6.5	6.5	3.1	575	575	0	0	0	11.3	11.3	9.4	9.4	3.8

Table C. 6: Model Predictions of Uranium and Metals Concentrations (µg/m³) for HHERA and Worker Exposure Receptors: Operations Scenario

UTM Easting (km)	UTM Northing (km)	ID	As 24-hour	As Annual	Cd 24-hour	Cd Annual	Co 24-hour	Co Annual	Cr 24-hour	Cr Annual	Cu 24-hour	Cu Annual	Mo 24-hour	Mo Annual	Ni 24-hour	Ni Annual	Pb 24-hour	Pb Annual	Se 24-hour	Se Annual	U 24-hour	24-h U Exceedances (days/year)	U Annual	Vn 24-hour	Vn Annual	Zn 24-hour	Zn Annual
477.122	6374.321	WE1	3.26E-03	7.23E-04	3.64E-04	9.39E-05	3.06E-03	8.02E-04	1.92E-03	4.71E-04	3.50E-01	6.78E-02	2.99E-03	7.46E-04	3.14E-03	6.57E-04	3.83E-02	8.05E-03	1.00E-03	1.99E-04	1.33E+00	164	2.75E-01	7.55E-03	1.93E-03	1.14E+00	2.18E-01
477.342	6374.487	WE2	6.31E-03	1.39E-03	6.74E-04	1.59E-04	4.58E-03	1.12E-03	5.61E-03	1.24E-03	4.26E-01	8.38E-02	6.61E-03	1.53E-03	7.22E-03	1.52E-03	1.17E-01	2.47E-02	1.71E-03	3.49E-04	2.46E+00	300	5.50E-01	1.56E-02	3.63E-03	1.16E+00	2.23E-01
476.829	6375.006	WE3	3.11E-03	7.08E-04	2.97E-04	7.72E-05	2.73E-03	7.20E-04	8.76E-04	1.89E-04	3.34E-01	6.37E-02	2.81E-03	7.29E-04	2.27E-03	4.36E-04	2.14E-02	3.80E-03	8.49E-04	1.60E-04	3.08E-01	22	3.43E-02	5.84E-03	1.50E-03	1.13E+00	2.16E-01
477.115	6374.493	WE4	3.36E-03	7.21E-04	3.23E-04	8.11E-05	2.86E-03	7.40E-04	1.18E-03	2.49E-04	3.40E-01	6.46E-02	3.10E-03	7.44E-04	2.60E-03	4.88E-04	2.78E-02	4.80E-03	9.07E-04	1.69E-04	5.59E-01	71	8.02E-02	6.50E-03	1.60E-03	1.13E+00	2.17E-01
477.087	6374.079	WE5	3.18E-03	7.18E-04	3.27E-04	8.03E-05	2.88E-03	7.36E-04	1.33E-03	2.31E-04	3.41E-01	6.44E-02	2.89E-03	7.40E-04	2.66E-03	4.78E-04	2.90E-02	4.60E-03	9.17E-04	1.68E-04	7.71E-01	59	7.19E-02	6.60E-03	1.58E-03	1.13E+00	2.16E-01
477.486	6374.847	WE6	3.18E-03	7.16E-04	3.09E-04	7.73E-05	2.79E-03	7.21E-04	9.97E-04	1.90E-04	3.37E-01	6.37E-02	2.89E-03	7.38E-04	2.42E-03	4.39E-04	2.43E-02	3.85E-03	8.76E-04	1.61E-04	3.09E-01	12	2.85E-02	6.14E-03	1.50E-03	1.13E+00	2.16E-01
476.721	6373.938	WE7	3.29E-03	7.18E-04	3.17E-04	7.79E-05	2.83E-03	7.24E-04	9.97E-04	1.90E-04	3.39E-01	6.39E-02	3.02E-03	7.40E-04	2.52E-03	4.46E-04	2.62E-02	3.99E-03	8.93E-04	1.62E-04	3.34E-01	29	3.52E-02	6.35E-03	1.52E-03	1.13E+00	2.16E-01
476.777	6373.865	WE8	3.41E-03	7.18E-04	3.32E-04	7.79E-05	2.90E-03	7.24E-04	1.08E-03	1.90E-04	3.42E-01	6.39E-02	3.17E-03	7.40E-04	2.72E-03	4.47E-04	3.00E-02	4.00E-03	9.27E-04	1.62E-04	4.31E-01	30	3.54E-02	6.73E-03	1.52E-03	1.13E+00	2.16E-01
477.043	6374.042	WE9	3.24E-03	7.25E-04	3.33E-04	8.07E-05	2.91E-03	7.38E-04	1.42E-03	2.28E-04	3.43E-01	6.45E-02	2.96E-03	7.49E-04	2.74E-03	4.83E-04	3.05E-02	4.70E-03	9.31E-04	1.68E-04	8.61E-01	60	6.94E-02	6.76E-03	1.59E-03	1.13E+00	2.17E-01
477.002	6374.109	WE10	3.26E-03	7.27E-04	3.24E-04	8.13E-05	2.87E-03	7.41E-04	1.29E-03	2.37E-04	3.41E-01	6.47E-02	2.99E-03	7.51E-04	2.62E-03	4.90E-04	2.82E-02	4.85E-03	9.11E-04	1.70E-04	7.08E-01	71	7.65E-02	6.53E-03	1.61E-03	1.13E+00	2.17E-01
477.012	6374.212	WE11	3.15E-03	7.18E-04	3.34E-04	8.16E-05	2.91E-03	7.42E-04	1.48E-03	2.55E-04	3.43E-01	6.48E-02	2.86E-03	7.40E-04	2.75E-03	4.95E-04	3.08E-02	4.93E-03	9.34E-04	1.70E-04	8.65E-01	75	9.17E-02	6.79E-03	1.61E-03	1.13E+00	2.17E-01
477.708	6374.352	Risk1	3.13E-03	7.12E-04	3.01E-04	7.75E-05	2.75E-03	7.22E-04	8.96E-04	1.93E-04	3.35E-01	6.38E-02	2.83E-03	7.34E-04	2.32E-03	4.41E-04	2.23E-02	3.89E-03	8.58E-04	1.61E-04	2.60E-01	17	3.45E-02	5.93E-03	1.51E-03	1.13E+00	2.16E-01
478.245	6372.039	Risk2	3.01E-03	7.01E-04	2.81E-04	7.47E-05	2.65E-03	7.08E-04	6.12E-04	1.54E-04	3.30E-01	6.31E-02	2.69E-03	7.20E-04	2.05E-03	4.04E-04	1.72E-02	3.19E-03	8.12E-04	1.55E-04	6.10E-02	0	5.05E-03	5.41E-03	1.43E-03	1.13E+00	2.16E-01
476.896	6373.487	Risk3	3.05E-03	7.04E-04	2.95E-04	7.58E-05	2.72E-03	7.14E-04	7.91E-04	1.68E-04	3.33E-01	6.33E-02	2.74E-03	7.24E-04	2.23E-03	4.18E-04	2.06E-02	3.45E-03	8.43E-04	1.57E-04	2.08E-01	8	1.77E-02	5.76E-03	1.46E-03	1.13E+00	2.16E-01
478.415	6368.290	Risk4	3.00E-03	7.00E-04	2.79E-04	7.45E-05	2.64E-03	7.07E-04	5.80E-04	1.50E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.02E-03	4.01E-04	1.66E-02	3.12E-03	8.07E-04	1.54E-04	2.83E-02	0	1.79E-03	5.36E-03	1.43E-03	1.13E+00	2.16E-01
473.146	6375.100	Risk5	3.01E-03	7.01E-04	2.81E-04	7.46E-05	2.65E-03	7.08E-04	6.07E-04	1.52E-04	3.30E-01	6.31E-02	2.70E-03	7.20E-04	2.05E-03	4.03E-04	1.71E-02	3.16E-03	8.11E-04	1.55E-04	5.19E-02	0	3.50E-03	5.40E-03	1.43E-03	1.13E+00	2.16E-01
Air Quality Criteria			0.3	n/a	0.025	0.005	0.1	n/a	0.5	n/a	50	n/a	120	n/a	0.2	0.04	0.5	n/a	10	n/a	0.15	0.15	0.03	2	n/a	120	n/a
Background			3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.54E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	3.00E-03	3.00E-03	6.00E-04	5.31E-03	1.43E-03	1.13E+00	2.16E-01

Table C. 7: Model Predictions of Radon Concentrations (Bq/m³) for HHERA and Worker Exposure Receptors: Operations Scenario [1]

UTM Easting (km)	UTM Northing (km)	ID	Rn-222 Annual
477.122	6374.321	WE1	1.17E+02
477.342	6374.487	WE2	8.82E+02
476.829	6375.006	WE3	2.97E+01
477.115	6374.493	WE4	9.03E+01
477.087	6374.079	WE5	5.34E+01
477.486	6374.847	WE6	3.85E+01
476.721	6373.938	WE7	3.70E+01
476.777	6373.865	WE8	3.74E+01
477.043	6374.042	WE9	6.18E+01
477.002	6374.109	WE10	6.75E+01
477.012	6374.212	WE11	6.26E+01
477.708	6374.352	Risk1	3.61E+01
478.245	6372.039	Risk2	2.50E+00
476.896	6373.487	Risk3	1.24E+01
478.415	6368.290	Risk4	5.92E-01
473.146	6375.100	Risk5	2.07E+00

Notes:
[1] Model predictions are incremental (i.e., with no background added)

Table C. 8: Model Predictions of Annual Deposition Rates for HHERA and Worker Exposure Receptors: Operations Scenario

UTM Easting	UTM Northing	ID	TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NO_2	As	Cd	Co	Cr	Cu	Mo	Ni	Pb	Se	U	Vn	Zn	Rn-222
(km)	(km)		mg/cm²/year																		Bq/cm²/year
477.122	6374.321	WE1	1.22E+00	3.71E-02	5.37E-04	1.31E-02	4.87E-05	6.34E-02	1.12E-05	4.43E-06	4.19E-05	9.30E-06	1.09E-04	4.27E-05	4.22E-05	1.92E-05	8.43E-05	3.85E-04	8.52E-05	3.11E-04	1.29E+03
477.342	6374.487	WE2	1.88E+00	1.18E-01	5.78E-04	2.82E-03	3.02E-05	1.34E-02	2.29E-05	5.90E-06	4.91E-05	2.82E-05	4.69E-04	5.65E-05	6.16E-05	3.93E-04	8.76E-05	1.00E-02	1.23E-04	4.34E-04	1.09E+04
476.829	6375.006	WE3	1.23E+00	4.94E-02	3.21E-04	1.80E-03	1.71E-05	8.65E-03	1.10E-05	4.44E-06	4.19E-05	9.45E-06	1.11E-04	4.25E-05	4.23E-05	2.11E-05	8.43E-05	6.40E-04	8.54E-05	3.11E-04	2.80E+02
477.115	6374.493	WE4	1.08E+00	3.27E-02	5.33E-04	3.76E-03	4.49E-05	1.98E-02	1.11E-05	4.51E-06	4.23E-05	1.06E-05	1.29E-04	4.27E-05	4.33E-05	4.03E-05	8.45E-05	1.68E-03	8.73E-05	3.18E-04	9.25E+02
477.087	6374.079	WE5	3.12E+00	1.68E-01	7.95E-04	1.10E-02	1.06E-04	7.36E-02	1.11E-05	4.49E-06	4.22E-05	1.02E-05	1.24E-04	4.26E-05	4.30E-05	3.46E-05	8.44E-05	1.39E-03	8.67E-05	3.16E-04	5.01E+02
477.486	6374.847	WE6	9.16E-01	1.55E-02	1.95E-04	1.09E-03	1.15E-05	5.33E-03	1.11E-05	4.42E-06	4.19E-05	9.18E-06	1.06E-04	4.26E-05	4.21E-05	1.67E-05	8.42E-05	3.44E-04	8.49E-05	3.10E-04	3.91E+02
476.721	6373.938	WE7	1.37E+00	4.85E-02	6.10E-04	1.16E-02	1.10E-04	8.06E-02	1.11E-05	4.44E-06	4.19E-05	9.37E-06	1.11E-04	4.26E-05	4.23E-05	2.11E-05	8.43E-05	5.61E-04	8.54E-05	3.11E-04	3.42E+02
476.777	6373.865	WE8	2.16E+00	1.03E-01	6.49E-04	1.30E-02	1.22E-04	8.82E-02	1.11E-05	4.43E-06	4.19E-05	9.32E-06	1.10E-04	4.26E-05	4.23E-05	2.02E-05	8.43E-05	5.10E-04	8.53E-05	3.11E-04	3.47E+02
477.043	6374.042	WE9	3.16E+00	1.71E-01	9.01E-04	1.68E-02	1.68E-04	1.22E-01	1.12E-05	4.48E-06	4.22E-05	9.97E-06	1.21E-04	4.27E-05	4.29E-05	3.22E-05	8.44E-05	1.14E-03	8.65E-05	3.15E-04	5.98E+02
477.002	6374.109	WE10	1.68E+00	6.85E-02	7.34E-04	1.72E-02	1.74E-04	1.29E-01	1.12E-05	4.49E-06	4.22E-05	1.01E-05	1.23E-04	4.27E-05	4.30E-05	3.35E-05	8.44E-05	1.26E-03	8.66E-05	3.15E-04	6.40E+02
477.012	6374.212	WE11	1.32E+00	4.35E-02	5.79E-04	9.68E-03	8.05E-05	5.44E-02	1.11E-05	4.51E-06	4.23E-05	1.05E-05	1.29E-04	4.26E-05	4.33E-05	3.96E-05	8.45E-05	1.70E-03	8.73E-05	3.17E-04	5.97E+02
477.708	6374.352	Risk1	9.26E-01	1.89E-02	3.14E-04	1.06E-03	1.21E-05	5.64E-03	1.11E-05	4.45E-06	4.20E-05	9.56E-06	1.13E-04	4.26E-05	4.24E-05	2.33E-05	8.43E-05	6.96E-04	8.56E-05	3.12E-04	3.63E+02
478.245	6372.039	Risk2	7.59E-01	2.63E-03	4.44E-05	2.01E-04	2.27E-06	1.17E-03	1.10E-05	4.40E-06	4.17E-05	8.83E-06	1.00E-04	4.25E-05	4.18E-05	1.04E-05	8.42E-05	5.01E-05	8.43E-05	3.08E-04	1.66E+01
476.896	6373.487	Risk3	1.58E+00	7.42E-02	3.46E-04	1.35E-02	1.14E-04	7.43E-02	1.10E-05	4.41E-06	4.18E-05	9.03E-06	1.04E-04	4.25E-05	4.19E-05	1.38E-05	8.42E-05	2.38E-04	8.46E-05	3.09E-04	1.08E+02
478.415	6368.290	Risk4	7.52E-01	2.04E-03	2.10E-05	4.33E-05	4.32E-07	2.26E-04	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.97E-05	4.25E-05	4.17E-05	9.69E-06	8.42E-05	1.27E-05	8.42E-05	3.07E-04	4.14E+00
473.146	6375.100	Risk5	7.40E-01	1.22E-03	6.35E-05	1.53E-04	1.35E-06	7.21E-04	1.10E-05	4.39E-06	4.17E-05	8.83E-06	1.00E-04	4.25E-05	4.18E-05	1.03E-05	8.42E-05	4.44E-05	8.43E-05	3.08E-04	1.40E+01
		Air Quality Standard	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Background	0.73	n/a	n/a	n/a	n/a	n/a	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.52E-06	8.42E-05	2.93E-06	8.42E-05	3.07E-04	n/a

Table C. 9: Model Predictions of Particulate Matter, CO, SO_2, and NO_2 Concentrations (µg/m³) for HHERA and Worker Exposure Receptors: Decommissioning Scenario

UTM Easting (km)	UTM Northing (km)	ID	TSP 24-hour	24-h TSP Exceedances (days/year)	TSP Annual	PM_{10} 24-hour	24-h PM_{10} Exceedances (days/year)	$PM_{2.5}$ 24-hour	24-h $PM_{2.5}$ Exceedances (days/year)	$PM_{2.5}$ Annual	CO 1-hour	CO 8-hour	SO_2 1-hour	SO_2 24-hour	SO_2 Annual	NO_2 1-hour	1-h NO_2 Exceedances (hours/year)	NO_2 24-hour	24-h NO_2 Exceedances (days/year)	NO_2 Annual
477.122	6374.321	WE1	143.22	6	22.32	66.03	4	16.22	0	4.61	687.1	639.8	5.26E-01	1.65E-01	2.11E-02	543.87	895	176.41	0	25.17
477.342	6374.487	WE2	225.06	30	26.99	77.03	15	19.89	0	3.95	623.7	600.7	2.05E-01	5.18E-02	5.20E-03	173.78	114	62.08	0	8.74
476.829	6375.006	WE3	111.44	3	21.38	56.08	2	11.92	0	3.75	606.6	597.4	1.24E-01	4.61E-02	4.32E-03	135.21	105	54.82	0	8.01
477.115	6374.493	WE4	106.30	1	18.48	54.27	1	12.84	0	3.84	625.1	606.7	1.76E-01	5.61E-02	8.00E-03	189.88	292	66.45	0	11.83
477.087	6374.079	WE5	356.62	124	45.98	133.75	61	27.17	1	6.57	764.4	681.3	5.52E-01	1.78E-01	3.95E-02	570.96	1826	187.93	0	43.41
477.486	6374.847	WE6	88.27	0	16.21	43.75	0	10.69	0	3.41	594.5	585.3	6.28E-02	1.69E-02	1.97E-03	67.47	0	25.14	0	5.69
476.721	6373.938	WE7	212.17	38	26.73	90.53	28	35.00	3	5.60	776.0	705.4	4.59E-01	1.76E-01	1.90E-02	470.09	724	188.75	0	23.36
476.777	6373.865	WE8	303.81	76	36.55	113.91	51	50.82	2	5.96	789.4	723.7	4.96E-01	2.34E-01	2.10E-02	508.48	756	242.09	1	24.72
477.043	6374.042	WE9	366.14	149	49.47	137.88	87	34.52	7	7.55	837.3	723.2	6.20E-01	2.30E-01	4.12E-02	631.82	1713	239.83	4	45.93
477.002	6374.109	WE10	222.18	63	34.79	103.68	50	41.79	11	7.78	829.7	759.6	8.54E-01	3.22E-01	5.62E-02	876.01	2215	335.61	18	61.70
477.012	6374.212	WE11	161.57	31	35.49	88.84	95	58.25	96	15.79	1043.5	940.2	2.22E+00	1.33E+00	2.96E-01	2260.54	3508	1358.37	153	303.77
477.708	6374.352	Risk1	78.97	0	15.76	38.24	0	9.72	0	3.43	601.3	588.2	1.09E-01	2.64E-02	3.34E-03	120.86	39	35.77	0	7.08
478.245	6372.039	Risk2	52.25	0	12.90	26.54	0	7.40	0	3.17	583.3	580.3	3.10E-02	1.06E-02	8.20E-04	41.64	0	19.79	0	4.60
476.896	6373.487	Risk3	135.0	6	22.1	61.1	6	14.5	0	4.0	740.8	661.1	4.71E-01	1.54E-01	1.74E-02	355.1	494	119.9	0	16.4
478.415	6368.290	Risk4	49.7	0	12.6	25.1	0	6.8	0	3.1	578.2	576.9	1.16E-02	3.02E-03	1.71E-04	22.7	0	12.4	0	4.0
473.146	6375.100	Risk5	52.1	0	12.7	28.0	0	7.4	0	3.1	582.7	580.0	2.76E-02	6.31E-03	4.27E-04	39.0	0	15.6	0	4.2
		Air Quality Criteria	100	100	60	50	50	27	27	10	15,000	6,000	450	125	20	79	79	200	200	45
		Background	46.2	46.2	12.4	23.1	23.1	6.5	6.5	3.1	575	575	0	0	0	11.3	11.3	9.4	9.4	3.8

Table C. 10: Model Predictions of Uranium and Metals Concentrations (µg/m³) for HHERA and Worker Exposure Receptors: Decommissioning Scenario

UTM Easting (km)	UTM Northing (km)	ID	As 24-hour	As Annual	Cd 24-hour	Cd Annual	Co 24-hour	Co Annual	Cr 24-hour	Cr Annual	Cu 24-hour	Cu Annual	Mo 24-hour	Mo Annual	Ni 24-hour	Ni Annual	Pb 24-hour	Pb Annual	Se 24-hour	Se Annual	U 24-hour	Exceedances days/year	U Annual	Vn 24-hour	Vn Annual	Zn 24-hour	Zn Annual
477.122	6374.321	WE1	3.03E-03	7.02E-04	2.80E-04	7.46E-05	2.65E-03	7.08E-04	5.95E-04	1.52E-04	3.30E-01	6.31E-02	2.71E-03	7.21E-04	2.04E-03	4.03E-04	1.70E-02	3.16E-03	8.10E-04	1.55E-04	2.27E-02	0	2.02E-03	5.40E-03	1.43E-03	1.13E+00	2.16E-01
477.342	6374.487	WE2	3.33E-03	7.68E-04	3.17E-04	8.26E-05	2.83E-03	7.47E-04	1.06E-03	2.53E-04	3.39E-01	6.50E-02	3.08E-03	8.00E-04	2.53E-03	5.08E-04	2.64E-02	5.19E-03	8.94E-04	1.73E-04	2.50E-01	20	5.12E-02	6.35E-03	1.64E-03	1.13E+00	2.17E-01
476.829	6375.006	WE3	3.02E-03	7.01E-04	2.79E-04	7.45E-05	2.64E-03	7.07E-04	5.78E-04	1.50E-04	3.30E-01	6.30E-02	2.70E-03	7.20E-04	2.03E-03	4.01E-04	1.68E-02	3.12E-03	8.08E-04	1.54E-04	1.71E-02	0	1.11E-03	5.37E-03	1.43E-03	1.13E+00	2.16E-01
477.115	6374.493	WE4	3.06E-03	7.04E-04	2.84E-04	7.49E-05	2.67E-03	7.09E-04	6.42E-04	1.55E-04	3.31E-01	6.31E-02	2.75E-03	7.24E-04	2.09E-03	4.06E-04	1.79E-02	3.16E-03	8.13E-04	1.55E-04	2.96E-02	0	2.04E-03	5.42E-03	1.43E-03	1.13E+00	2.16E-01
477.087	6374.079	WE5	3.01E-03	7.01E-04	2.79E-04	7.45E-05	2.64E-03	7.07E-04	5.71E-04	1.50E-04	3.29E-01	6.30E-02	2.69E-03	7.20E-04	2.02E-03	4.01E-04	1.65E-02	3.12E-03	8.06E-04	1.54E-04	1.11E-02	0	1.18E-03	5.35E-03	1.43E-03	1.13E+00	2.16E-01
477.486	6374.847	WE6	3.02E-03	7.02E-04	2.79E-04	7.46E-05	2.64E-03	7.08E-04	5.81E-04	1.51E-04	3.30E-01	6.30E-02	2.70E-03	7.21E-04	2.03E-03	4.02E-04	1.67E-02	3.15E-03	8.08E-04	1.54E-04	1.58E-02	0	1.72E-03	5.37E-03	1.43E-03	1.13E+00	2.16E-01
476.721	6373.938	WE7	3.01E-03	7.00E-04	2.78E-04	7.44E-05	2.64E-03	7.07E-04	5.63E-04	1.49E-04	3.29E-01	6.30E-02	2.69E-03	7.20E-04	2.01E-03	4.01E-04	1.63E-02	3.11E-03	8.05E-04	1.54E-04	7.19E-03	0	8.59E-04	5.33E-03	1.43E-03	1.13E+00	2.16E-01
476.777	6373.865	WE8	3.00E-03	7.00E-04	2.78E-04	7.44E-05	2.64E-03	7.07E-04	5.61E-04	1.49E-04	3.29E-01	6.30E-02	2.69E-03	7.20E-04	2.01E-03	4.01E-04	1.63E-02	3.11E-03	8.04E-04	1.54E-04	6.40E-03	0	8.52E-04	5.33E-03	1.43E-03	1.13E+00	2.16E-01
477.043	6374.042	WE9	3.01E-03	7.01E-04	2.78E-04	7.45E-05	2.64E-03	7.07E-04	5.68E-04	1.50E-04	3.29E-01	6.30E-02	2.69E-03	7.20E-04	2.01E-03	4.01E-04	1.64E-02	3.12E-03	8.05E-04	1.54E-04	9.69E-03	0	1.09E-03	5.34E-03	1.43E-03	1.13E+00	2.16E-01
477.002	6374.109	WE10	3.01E-03	7.01E-04	2.78E-04	7.45E-05	2.64E-03	7.07E-04	5.68E-04	1.50E-04	3.29E-01	6.30E-02	2.69E-03	7.20E-04	2.01E-03	4.01E-04	1.64E-02	3.12E-03	8.05E-04	1.54E-04	9.53E-03	0	1.13E-03	5.34E-03	1.43E-03	1.13E+00	2.16E-01
477.012	6374.212	WE11	3.01E-03	7.01E-04	2.79E-04	7.45E-05	2.64E-03	7.07E-04	5.76E-04	1.50E-04	3.29E-01	6.30E-02	2.70E-03	7.20E-04	2.02E-03	4.02E-04	1.66E-02	3.13E-03	8.07E-04	1.54E-04	1.35E-02	0	1.31E-03	5.36E-03	1.43E-03	1.13E+00	2.16E-01
477.708	6374.352	Risk1	3.01E-03	7.01E-04	2.79E-04	7.45E-05	2.64E-03	7.07E-04	5.74E-04	1.51E-04	3.29E-01	6.30E-02	2.70E-03	7.21E-04	2.02E-03	4.02E-04	1.66E-02	3.14E-03	8.07E-04	1.54E-04	1.26E-02	0	1.47E-03	5.35E-03	1.43E-03	1.13E+00	2.16E-01
478.245	6372.039	Risk2	3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.56E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	3.68E-03	0	6.39E-04	5.32E-03	1.43E-03	1.13E+00	2.16E-01
476.896	6373.487	Risk3	3.00E-03	7.00E-04	2.78E-04	7.44E-05	2.64E-03	7.07E-04	5.61E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.01E-03	4.00E-04	1.63E-02	3.11E-03	8.04E-04	1.54E-04	6.23E-03	0	7.70E-04	5.33E-03	1.43E-03	1.13E+00	2.16E-01
478.415	6368.290	Risk4	3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.55E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	3.14E-03	0	6.08E-04	5.31E-03	1.43E-03	1.13E+00	2.16E-01
473.146	6375.100	Risk5	3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.56E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	3.81E-03	0	6.32E-04	5.32E-03	1.43E-03	1.13E+00	2.16E-01
Air Quality Criteria			0.3	n/a	0.025	0.005	0.1	n/a	0.5	n/a	50	n/a	120	n/a	0.2	0.04	0.5	n/a	10	n/a	0.15	0.15	0.03	2	n/a	120	n/a
Background			3.00E-03	7.00E-04	2.77E-04	7.44E-05	2.63E-03	7.07E-04	5.54E-04	1.49E-04	3.29E-01	6.30E-02	2.68E-03	7.19E-04	2.00E-03	4.00E-04	1.62E-02	3.10E-03	8.03E-04	1.54E-04	3.00E-03	3.00E-03	6.00E-04	5.31E-03	1.43E-03	1.13E+00	2.16E-01

Table C. 11: Model Predictions of Radon Concentrations (Bq/m³) for HHERA and Worker Exposure Receptors: Decommissioning Scenario [1]

UTM Easting (km)	UTM Northing (km)	ID	Rn-222 Annual
477.122	6374.321	WE1	7.76E+01
477.342	6374.487	WE2	8.21E+01
476.829	6375.006	WE3	1.57E+01
477.115	6374.493	WE4	4.63E+01
477.087	6374.079	WE5	4.00E+01
477.486	6374.847	WE6	1.53E+01
476.721	6373.938	WE7	3.23E+01
476.777	6373.865	WE8	3.29E+01
477.043	6374.042	WE9	5.19E+01
477.002	6374.109	WE10	5.59E+01
477.012	6374.212	WE11	4.44E+01
477.708	6374.352	Risk1	1.71E+01
478.245	6372.039	Risk2	1.51E+00
476.896	6373.487	Risk3	8.57E+00
478.415	6368.290	Risk4	3.71E-01
473.146	6375.100	Risk5	1.37E+00

Notes:
[1] Model predictions are incremental (i.e., with no background added).

Table C. 12: Model Predictions of Annual Deposition Rates for HHERA and Worker Exposure Receptors: Decommissioning Scenario

UTM Easting	UTM Northing	ID	TSP	PM_{10}	$PM_{2.5}$	CO	SO_2	NO+	As	Cd	Co	Cr	Cu	Mo	Ni	Pb	Se	U	Vn	Zn	Rn-222
(km)	(km)		mg/cm²/year																		Bq/cm²/year
477.122	6374.321	WE1	1.43E+00	5.25E-02	1.43E-03	2.48E-02	3.01E-04	2.77E-01	1.10E-05	4.39E-06	4.17E-05	8.81E-06	1.00E-04	4.25E-05	4.18E-05	1.00E-05	8.42E-05	1.56E-05	8.42E-05	3.08E-04	9.00E+02
477.342	6374.487	WE2	2.27E+00	1.20E-01	7.04E-04	6.25E-03	7.04E-05	6.12E-02	1.22E-05	4.53E-06	4.24E-05	1.06E-05	1.34E-04	4.39E-05	4.36E-05	4.58E-05	8.45E-05	8.81E-04	8.79E-05	3.19E-04	1.22E+03
476.829	6375.006	WE3	1.50E+00	6.96E-02	4.89E-04	4.72E-03	4.90E-05	4.55E-02	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.97E-05	4.25E-05	4.17E-05	9.67E-06	8.42E-05	6.72E-06	8.42E-05	3.07E-04	1.55E+02
477.115	6374.493	WE4	1.21E+00	4.07E-02	6.79E-04	9.30E-03	1.09E-04	1.01E-01	1.10E-05	4.39E-06	4.17E-05	8.81E-06	1.00E-04	4.25E-05	4.17E-05	9.99E-06	8.42E-05	1.44E-05	8.42E-05	3.08E-04	5.03E+02
477.087	6374.079	WE5	4.04E+00	2.31E-01	2.24E-03	4.26E-02	4.85E-04	4.60E-01	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.97E-05	4.25E-05	4.17E-05	9.69E-06	8.42E-05	7.18E-06	8.42E-05	3.07E-04	3.84E+02
477.486	6374.847	WE6	1.03E+00	2.36E-02	3.11E-04	2.42E-03	2.53E-05	2.22E-02	1.10E-05	4.39E-06	4.17E-05	8.80E-06	9.98E-05	4.25E-05	4.17E-05	9.76E-06	8.42E-05	8.78E-06	8.42E-05	3.08E-04	1.73E+02
476.721	6373.938	WE7	1.81E+00	7.52E-02	1.73E-03	2.71E-02	1.94E-04	1.92E-01	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.96E-05	4.25E-05	4.17E-05	9.59E-06	8.42E-05	4.81E-06	8.42E-05	3.07E-04	3.04E+02
476.777	6373.865	WE8	2.87E+00	1.47E-01	1.58E-03	2.97E-02	2.13E-04	2.05E-01	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.96E-05	4.25E-05	4.17E-05	9.59E-06	8.42E-05	4.74E-06	8.42E-05	3.07E-04	3.11E+02
477.043	6374.042	WE9	4.35E+00	2.48E-01	2.57E-03	5.13E-02	4.86E-04	4.70E-01	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.97E-05	4.25E-05	4.17E-05	9.66E-06	8.42E-05	6.47E-06	8.42E-05	3.07E-04	5.15E+02
477.002	6374.109	WE10	2.32E+00	1.04E-01	2.63E-03	6.33E-02	6.80E-04	6.61E-01	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.97E-05	4.25E-05	4.17E-05	9.69E-06	8.42E-05	7.04E-06	8.42E-05	3.07E-04	5.42E+02
477.012	6374.212	WE11	1.58E+00	6.15E-02	1.65E-03	1.80E-02	1.39E-04	1.29E-01	1.10E-05	4.39E-06	4.17E-05	8.80E-06	9.98E-05	4.25E-05	4.17E-05	9.76E-06	8.42E-05	8.78E-06	8.42E-05	3.08E-04	4.32E+02
477.708	6374.352	Risk1	1.04E+00	2.80E-02	4.81E-04	3.00E-03	3.79E-05	3.23E-02	1.10E-05	4.39E-06	4.17E-05	8.80E-06	9.99E-05	4.25E-05	4.17E-05	9.90E-06	8.42E-05	1.21E-05	8.42E-05	3.08E-04	1.96E+02
478.245	6372.039	Risk2	7.59E-01	2.75E-03	7.42E-05	5.83E-04	7.07E-06	5.83E-03	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.52E-06	8.42E-05	3.11E-06	8.42E-05	3.07E-04	1.03E+01
476.896	6373.487	Risk3	1.70E+00	8.40E-02	5.53E-04	2.02E-02	1.81E-04	1.27E-01	1.10E-05	4.39E-06	4.17E-05	8.79E-06	9.96E-05	4.25E-05	4.17E-05	9.56E-06	8.42E-05	3.98E-06	8.42E-05	3.07E-04	7.63E+01
478.415	6368.290	Risk4	7.45E-01	1.35E-03	2.24E-05	1.25E-04	1.36E-06	1.20E-03	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.52E-06	8.42E-05	2.97E-06	8.42E-05	3.07E-04	2.61E+00
473.146	6375.100	Risk5	7.43E-01	1.61E-03	1.10E-04	3.70E-04	3.97E-06	3.30E-03	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.52E-06	8.42E-05	3.14E-06	8.42E-05	3.07E-04	9.28E+00
		Air Quality Standard	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
		Background	0.73	n/a	n/a	n/a	n/a	n/a	1.10E-05	4.39E-06	4.17E-05	8.78E-06	9.96E-05	4.25E-05	4.17E-05	9.52E-06	8.42E-05	2.93E-06	8.42E-05	3.07E-04	n/a

Appendix D:

Quantitative Screening Level Analysis of Acrolein (IR-35)

The air quality assessment in the EIS considered combustion emissions (i.e., NOx, SO_2, CO, and fine particulate matter) from diesel-powered equipment/vehicles and the standby diesel generators. While acrolein is a component of diesel exhaust, it was not identified as a contaminant of potential concern (COPC) given that the use of diesel equipment/vehicles and generators at the Wheeler River Project will be limited. To demonstrate this, a quantitative screening level assessment of acrolein emissions from diesel combustion was carried out. Because there is no acrolein criterion or standard in Saskatchewan, 1- and 24-hour Ambient Air Quality Criteria (AAQC) from Ontario were used [45]. These short-term criteria have also been adopted in Alberta. Annual concentrations were evaluated using the tolerable concentration from Environment and Climate Change Canada (ECCC) and Health Canada's (HC) Priority Substance List Assessment Report [46] and the chronic reference concentration from the U.S. EPA [47]. The screening level assessment is described in the following paragraphs.

Using the nitrogen oxide (NOx) results from the air quality modelling assessment, 1-hour, 24-hour, and annual dispersion factors (i.e., µg/m³ per g/s emitted) were calculated for each assessment scenario. A dispersion factor was calculated for both the worker camp receptor, and the off-property receptor with the highest predicted NOx concentration. These dispersion factors were then applied to estimates of acrolein emissions to predict 1-hour, 24-hour, and annual concentrations of acrolein at both locations. The acrolein emission rate from the standby diesel generators were estimated using fuel flow rates from manufacturer's specifications and emission factors from Chapters 3.3 and 3.4 of the U.S. EPA AP-42 Compilation of Emission Factors, depending on the generator size. For mobile equipment and vehicles, a ratio of acrolein to non-methane hydrocarbons (NMHC) was applied to the total HC emission factors (see Section A.9 and A.10), conservatively assuming total HC equals NMHC. The ratio of acrolein to NMHC was obtained from the U.S. EPA document "*Speciation Profiles and Toxic Emission Factors for Non-road Engines in MOVES3*" (2022) and assumed Tier II engines. The short-term (i.e., 1- and 24-hour) site-wide emission rates for acrolein were estimated to be 1.89E-03 g/s for Construction, 1.04E-03 g/s for Operation, and 1.53E-03 g/s for Decommissioning, while the annual emission rates for the same scenarios were 1.55E-03 g/s, 7.58E-04 g/s, and 1.20E-03 g/s. In all scenarios, the generators were assumed to operate 24-hours per day and increased equipment usage during Construction and Decommissioning resulted in higher acrolein emissions compared to the Operation scenario.

The results of the screening level assessment are outlined in Table D.1 below. Calculated acrolein concentrations are compared against Ontario AAQC for the 1- and 24-hour averaging periods and ECCC/HC and U.S. EPA guidelines for the annual averaging period. As can be seen in the table, acrolein concentrations are expected to be below the applicable criteria and guidelines for all scenarios. The highest estimated short-term concentrations occur for the Decommissioning scenario and are 6.7% of the 24-hour AAQC, and 1.8% of the 1-hour AAQC at the worker camp. At the maximum off- property receptor, the estimated acrolein concentrations for Decommissioning are predicted to be 0.9% and 2.0% of the 1-hour and 24-hour AAQC, respectively. The annual concentration is highest for the Operation scenario and is 1.5% of the ECCC/HC guideline at the worker camp and 0.1% of the guideline at the maximum off-property receptor. Compared to the U.S. EPA chronic reference concentration, the highest annual concentration is 30.1% of the reference level at the worker camp and 2.4% at the maximum off-property receptor.

Based on the results of the screening level assessment, acrolein is not considered a COPC.

Table D.1: Calculated Dispersion Factors and Resulting Acrolein Concentrations

Scenario	Averaging Period	Criteria or Guideline (µg/m³)	Emission Rate (g/s)	Dispersion Factor [1] (µg/m³ per g/s)		Concentration [2] (µg/m³)		% of Criteria or Guideline	
				Camp Receptor	Max Off-Property Receptor	Camp Receptor	Max Off-Property Receptor	Camp Receptor	Max Off-Property Receptor
Construction	1-hour	4.5	1.89E-03	25.5	24.9	4.84E-02	4.71E-02	1.1%	1.0%
	24-hour	0.4		9.2	5.0	1.75E-02	9.56E-03	4.4%	2.4%
	Annual	0.4	1.55E-03	2.1	0.5	3.19E-03	7.29E-04	0.8%	0.2%
		0.02						16.0%	3.6%
Operations	1-hour	4.5	1.04E-03	37.5	23.6	3.91E-02	2.47E-02	0.9%	0.5%
	24-hour	0.4		12.9	5.3	1.35E-02	5.55E-03	3.4%	1.4%
	Annual	0.4	7.58E-04	7.9	0.6	6.02E-03	4.84E-04	1.5%	0.1%
		0.02						30.1%	2.4%
Decomm.	1-hour	4.5	1.53E-03	54.1	26.2	8.29E-02	4.01E-02	1.8%	0.9%
	24-hour	0.4		17.4	5.2	2.66E-02	8.02E-03	6.7%	2.0%
	Annual	0.4	1.20E-03	2.0	0.5	2.44E-03	5.48E-04	0.6%	0.1%
		0.02						12.2%	2.7%

Notes:

[1] Based on the incremental NOx predictions at the worker camp receptor and the off-property receptor where maximum NOx concentrations were predicted.

[2] Concentrations are incremental and do not include the addition of a background. Background is expected to be negligible.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Section 6: Engagement Database Summary Table – Air Quality

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-EN-ERFN-140.27	140	Site Visit	2019-08-28	Denison provided a site tour of the Wheeler River Project to the Chief of English River First Nation, along with three ERFN Councillors. Also on the tour was the local ERFN land user who resides near to the Wheeler River Project site location.	English River First Nation, ERFN Trapper	What would be the impact on air?	Denison considered this in section: Scope of the Assessment, Valued Component Selection	The context in which this comment was used within the Atmospheric and Acoustic Environment section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a site visit in the year 2019. The record reference serves to support the inclusion of air quality as a valued component. Denison has completed an environmental assessment to understand Project impacts on the environment. The assessment considers potential impacts to air. Denison has determined that there will be no significant impacts as a result of Project activities.
21 EN-ERFNSUR-456.21	456	Survey	2021-04-09	As part of engagement activities for English River First Nation, Denison prepared and shared an online survey which included information about Denison, the Wheeler River Project, and posed validation questions about the Valued Components being assessed as part of the environmental assessment process. A total of 23 responses were received. The information related to the Valued Components was incorporated into the assessment and questions asked on the surveys was incorporated into the overall engagement database.	English River First Nation	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Health and well-being of humans and wildlife	Denison considered this in section: Scope of the Assessment, Valued Component Selection And in section Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Atmospheric and Acoustic Environment section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who completed a survey in the year 2021. The record reference serves to support the inclusion of air quality as a valued component. Denison has completed an environmental assessment to understand Project impacts on the environment. The assessment considers potential impacts to humans and wildlife. Denison has determined that there will be no significant impacts as a result of Project activities.
21 EN-ERFNSUR-456.22	456	Survey	2021-04-09	Same as above	English River First Nation	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Health	Denison considered this in section: Scope of the Assessment, Valued Component Selection And in section Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Atmospheric and Acoustic Environment section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who completed a survey in the year 2021.The record reference serves to support the inclusion of air quality as a valued component. Denison has completed an environmental assessment to understand Project impacts on the environment. The assessment considers potential impacts to human health. Denison has determined that there will be no significant impacts as a result of Project activities.

Section 6: Engagement Database Summary Table – Noise

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
20-LK-LEASE-328.10	328	Meeting	2020-01-31	Denison staff met with a local leaseholder / cabin owner to discuss the Wheeler River Project.	Leaseholder	Leaseholder said they can sometimes hear noise from drilling activities at his cabin. Although they weren't particularly concerned about noise from Wheeler if it goes ahead.	Denison considered this in section: Scope of the Assessment, Valued Component Selection And in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Atmospheric and Acoustic Environment section of the EIS serves as a local perspective, documented as coming from a member of local leaseholder who attended a meeting in the year 2020. The record reference serves to support the inclusion of air quality as a valued component.
21-EN-ERFN-447-45	447	Virtual Meeting	2021-03-31	Denison hosted a virtual meeting for English River First Nation (Patuanak, La Plonge and Urban Members). Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	English River First Nation	With all of this construction and noise, how will this effect the moose and caribou population?	Denison considered this in section: Scope of the Assessment, Valued Component Selection	The context in which this comment was used within the Atmospheric and Acoustic Environment section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a virtual meeting in the year 2021. In this section, the record reference serves to support the inclusion of air quality as a valued component. Denison has completed an environmental assessment to understand Project impacts on the environment. The assessment considers potential impacts to the atmospheric and acoustic environment and potential impacts to wildlife, including moose and caribou. Denison has determined that there will be no significant impacts as a result of Project activities.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Appendix 6-C
Climate Baseline and Greenhouse Gas Emissions Report: Denison Mines – Wheeler River Project

Prepared for:

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1.0 INTRODUCTION

Denison Mines Corp. (Denison) is proposing a new uranium mine and processing plant in northern Saskatchewan, referred to as the Wheeler River Project (or, the *Project*). The Project site is located approximately 4 km west of Highway 914 and approximately 35 km north of the Key Lake uranium operation. Denison is proposing to apply an innovative approach to uranium mining called In-Situ Recovery (ISR), which is used extensively internationally but has yet to be used in Canada. This approach eliminates the need for large open pits, shafts, and underground mine workings that are the norm for uranium mining in Canada to-date.

Denison is completing an Environmental Impact Assessment (EIA) in support of the Project, which will evaluate the potential impacts of each phase of the Project on the biophysical and socio-economic environment. This report constitutes the assessment of baseline and projected future climate conditions at the Wheeler River site, for use in estimating the potential impacts associated with the Project.

The scope of the climate baseline report considers the requirements and guidance for characterization of the baseline environment from:

- Canadian Nuclear Safety Commission (CNSC), *Generic Guidelines for the Preparation of an Environmental Impact Assessment Pursuant to the Canadian Environmental Assessment Act, 2012*. March 2021. (EIS Guidelines) [1]; and
- CNSC REGDOC-2.9.1 *Environmental Protection: Environmental Principles, Assessments and Protection Measures* (REGDOC-2.9.1) [2].

In accordance with REGDOC-2.9.1, the pertinent climate data to be included in the assessment are air temperature, relative humidity, precipitation, wind speed and direction, atmospheric pressure, and solar radiation. In addition, weather phenomena such as lightning, temperature inversions, and fog are to be considered for discussion, as well as rare occurrences such as tornadoes. The data applied to describe the existing climate conditions in this report were collected primarily from meteorological data summaries maintained by Environment and Climate Change Canada (ECCC). The existing climate is discussed in Section 2.0.

In addition to establishing the baseline conditions, this report also provides estimations of future climate out to the year 2100 using Representative Concentration Pathway (RCP) trajectory analysis in accordance with methods adopted by the Intergovernmental Panel on Climate Change (IPCC). The future climate scenarios and analysis are discussed in Section 3.0.

2.0 EXISTING CLIMATE

The Project Area is located within the Athabasca Plain ecoregion of the Boreal Shield ecozone, specifically in the cold and snowy forest zone of northern Saskatchewan. The climate of the Project Area is typical of the continental sub-arctic region as characterized by extremely cold, dry winters and brief, cool and moist summers.

Climate is typically defined as the long-term pattern of weather for a given area, often defined by the "climate normals" for the area. Climate normals, or climate averages, are arithmetic calculations based on observed climate values for a given location over a specified time period, typically 30 years. The 30-year datasets are compiled every 10 years and are used to track changes to the typical climate over time. ECCC provides 30-year climate normals for many of the stations that they operate, with the 1981-2010 datasets being the most recently available. The nearest ECCC meteorological station to the Wheeler River site is located approximately 32 km away at Key Lake. Data from this station were used to characterize the existing climate conditions at Wheeler River.

Local climate and meteorological conditions are important considerations in the assessment of impacts on the atmospheric environment. With regard to air quality, meteorology governs the transport, dispersion, and deposition of air emissions. Specifically, dispersion of contaminants is largely driven by wind speed and wind direction. Wind speed will also affect the dilution of contaminants, with dilution increasing with increasing wind speed, resulting in a more rapid decrease in contaminant concentration with distance as wind speeds increase. Conversely, calm winds result in minimal dispersion, potentially leading to high local ground-level concentrations of contaminants. Wind speed and direction also factor into noise conditions, with more effective propagation of noise occurring in downwind directions. Atmospheric stability and mixing height influence the mixing of air contaminants in the atmosphere, whereas precipitation may wash out contaminants from the atmosphere. Temperature inversions, such as may occur over large bodies of water, tend to have the effect of increasing noise propagation due to the dense air causing sound waves to bend back toward the surface, resulting in multiple ground reflections. The near-surface temperature also controls the reaction rates of contaminants.

There have been multiple stations operating at Key Lake since meteorological monitoring commenced at the site in 1976. The scope of monitoring at these stations are summarized in Table 1. Data for the last ten years have been included for the purposes of establishing the existing conditions at the site (2011 to 2020), along with the most recent climate normals (1980 to 2010). The data from Key Lake is considered to be representative of conditions in the Project Area, the Local Study Area, and the Regional Study Area.

Table 1: Key Lake Meteorological Station Summary

Station ID	Years Active	Operator	Used in Assessment (Y/N)	Notes
4063753	2011 – Present	ECCC	Y	2011 data not used as station was not active until September 2011.
4063755	1976 – 2018	CCN [1]	Y	No data beyond September 2018.
4063757	2010 – Present	NAVCAN	Y	Low level precipitation not reliable; only used for statistics relating to maximum daily values.
4063759	1994 – 2010	N/I [2]	N	Data predates assessment period.

Notes:
All data collected from ECCC Historical Data archive [3] and Canadian Climate Normals archive [4]
[1] Co-operative Climate Network (operated by Cameco)
[2] No Information

2.1 TEMPERATURE

Temperature data collected at Key Lake over the period of 2011 to 2020 are summarized in Table 2. The mean daily temperatures over the period of 2011 to 2020 were slightly cooler on average compared to the climate normals, with an annual average temperature of -2.6°C in 2011 to 2020 compared to -2.3°C from 1981 to 2010. The daily average temperatures were less than or equal to 0°C between October and April for both the normals and the period of 2011 to 2020. The coldest month on average for the 2011-2020 period was January, with a daily mean temperature of -21.1°C, while July was the warmest month with a daily mean temperature of 16.4°C. The 30-year climate normals also identify January and July as the coldest and warmest months on average, respectively, with a daily mean temperature of -22.3°C in January and 16.3°C in July.

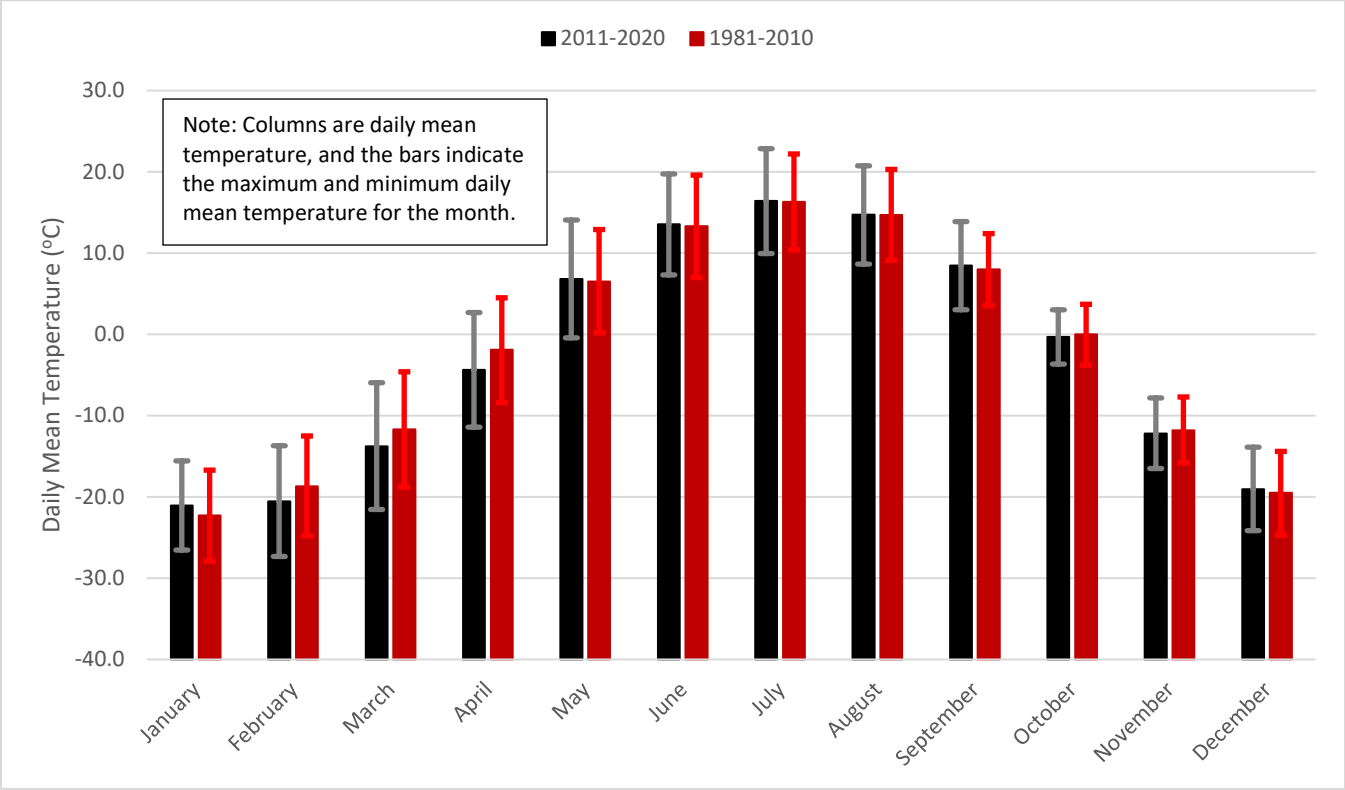
The mean daily maximum temperature for the 2011-2020 period ranged from a high of 22.8°C in July to a low of -15.6°C in January, with an annual average of 3.3°C. The annual average for the 1981-2010 climate normals period was the same at 3.3°C, ranging from 22.2°C in July to -16.7°C in January. The extreme maximum temperature for the period of 2011-2020 was 34°C, compared to 36°C for the climate normals. The mean daily minimum temperature for the 2011-2020 period ranged from a high of 9.9°C in July to a low of -27.3°C in February, with an annual average of -8.6°C. The annual average for the 1981-2010 climate normals period was slightly higher at -7.8°C, ranging from 10.4°C in July to -27.9°C in January. The extreme minimum temperature for the period of 2011-2020 was -48.3°C, compared to -52.5°C for the climate normals.

As illustrated in Figure 1, the daily mean, average daily minimum, and average daily maximum temperatures over the period of 2011-2020 match closely with the climate normals over the 1981-2010 period on a month-by-month basis, particularly during the period of May through December. In the period from February to April, the daily mean temperatures from the climate normals tended to be 2-3°C warmer than those measured from 2011-2020, while in January the measured temperatures were approximately 1°C warmer on average.

Table 2: Measured Temperature Data (2011-2020) Compared to Climate Normals (1981-2010) for Key Lake, SK

Parameter	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
2011 to 2020													
Mean Daily Temperature	-21.1	-20.5	-13.8	-4.4	6.8	13.6	16.4	14.7	8.5	-0.3	-12.2	-19.0	-2.6
Mean Daily Maximum Temperature	-15.6	-13.7	-5.9	2.7	14.1	19.7	22.8	20.7	13.9	3.0	-7.8	-13.9	3.3
Mean Daily Minimum Temperature	-26.5	-27.3	-21.5	-11.4	-0.4	7.3	9.9	8.6	3.0	-3.7	-16.5	-24.1	-8.6
Extreme Maximum Temperature	4.5	17.0	14.5	22.9	31.5	34.0	34.0	32.1	30.5	22.4	10.0	5.2	34.0
Extreme Minimum Temperature	-48.0	-47.7	-45.0	-40.2	-24.6	-6.9	-0.7	-1.7	-8.5	-23.3	-41.2	-48.3	-48.3
Climate Normals (1980 to 2010)													
Mean Daily Temperature	-22.3	-18.7	-11.7	-1.9	6.5	13.3	16.3	14.7	8.0	0.0	-11.8	-19.5	-2.3
Mean Daily Maximum Temperature	-16.7	-12.5	-4.6	4.5	12.9	19.6	22.2	20.3	12.4	3.7	-7.7	-14.4	3.3
Mean Daily Minimum Temperature	-27.9	-24.8	-18.8	-8.4	0.2	7.0	10.4	9.1	3.5	-3.8	-15.8	-24.7	-7.8
Extreme Maximum Temperature	10.0	9.0	15.0	28.5	32.5	34.5	33.5	36.0	28.5	24.5	12.2	5.0	36.0
Extreme Minimum Temperature	-52.5	-48.5	-50.5	-40.0	-21.5	-5.0	-1.0	-3.0	-8.5	-28.0	-43.0	-48.0	-52.5

Figure 1: Measured Daily Mean Temperatures (2011-2020) Compared to Climate Normals (1981-2010) at Key Lake, SK



2.2 PRECIPITATION

Precipitation data collected over the period of 2011 to 2020 are summarized in Table 3. Due to inconsistency in reporting of rainfall and snowfall throughout the period, only data pertaining to total precipitation are shown. The term 'precipitation' is defined as the water equivalent of all types of precipitation (i.e., rainfall plus snowfall). In general, ECCC applies a ratio of 10 to 1 to the snowfall to determine its water equivalent (i.e., 1 cm of snow is equivalent to about 1 mm of water once the snow is melted).

The average annual amount of total precipitation at the ECCC station (4063753) for the period of 2011-2020 was 437 mm/year, while that at the CCN station (4063755) was 483 mm/year, for an average of 456 mm between the two stations. For comparison, the annual average total precipitation for the climate normals period of 1981-2010 was 483 mm/year. Total precipitation is not presented for the NAVCAN station (4063757) as low levels did not appear to be well resolved. The greatest amount of total precipitation in a 24-hour period was 45.9 mm, which was recorded at station 4063753 and occurred on August 8th, 2020. The maximum 24-hr precipitation from the climate normals was 72 mm, which occurred on July 12th, 1998. The average number of days with measurable precipitation between stations 4063753 and 4063755 from 2011-2020 was 132 days, compared to 149 days for the climate normals period of 1981-2010.

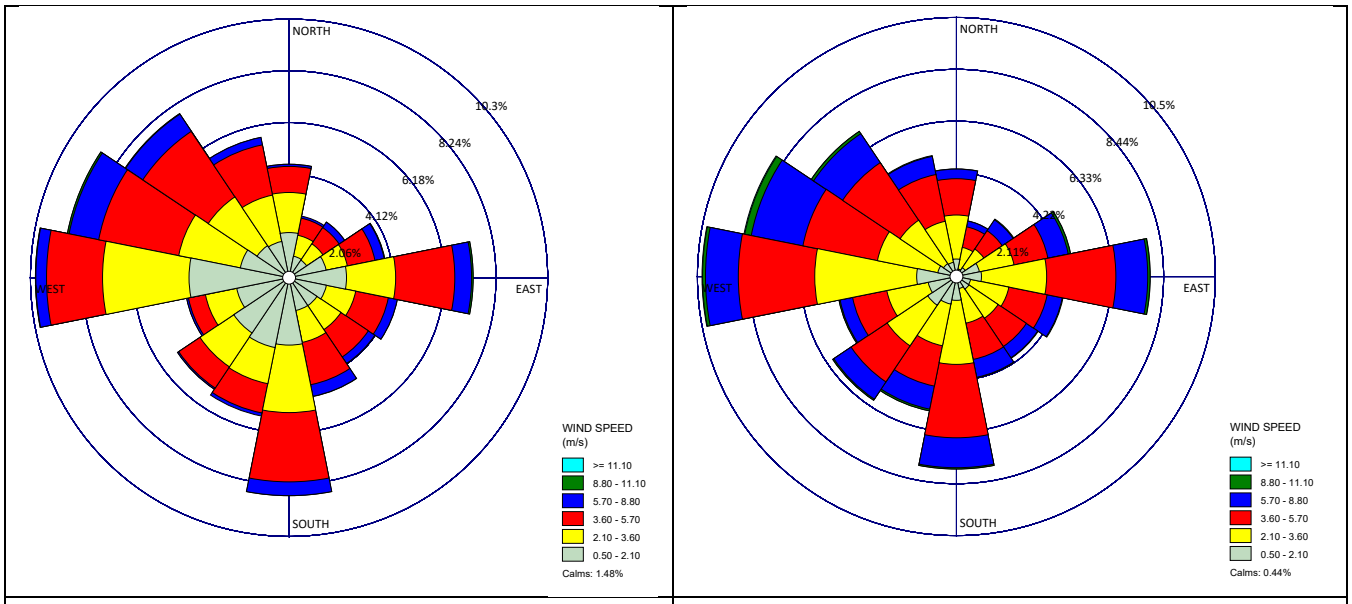
Table 3: Measured Precipitation Data (2011-2020) Compared to Climate Normals (1981-2010) for Key Lake, SK

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
2011 to 2020													
Mean Monthly Precipitation, mm	26.6	12.8	24.5	22.6	31.1	62.8	85.3	66.1	45.8	39.3	21.6	17.5	456.1
Maximum Precipitation in 24-hrs, mm	22.8	14.8	29.0	26.2	21.9	37.2	39.6	48.3	28.4	31.2	25.3	9.8	48.3
Number of days with measurable precipitation	11.3	8.3	9.6	7.4	7.6	12.6	13.5	11.8	12.5	14.7	11.8	10.8	131.6
Climate Normals (1980 to 2010)													
Mean Monthly Precipitation, mm	22.1	17.4	21.1	23.7	36.5	63.4	88.3	66.9	58.0	36.4	28.6	20.2	482.5
Maximum Precipitation in 24-hrs, mm	25.2	10.4	17.1	27.7	26.0	68.7	72.0	52.7	33.6	26.1	18.2	16.5	72.0
Number of days with measurable precipitation	11.1	10.1	9.5	7.0	10.3	12.8	16.2	16.4	16.2	13.7	14.2	11.2	148.8

2.3 WIND

Hourly wind speed data were available for the ECCC station (4063753) and for the NAVCAN station (4063757). These were analyzed for the period of 2011-2020 to create wind rose plots showing the wind direction, frequency, and average wind speed. The wind rose plots are provided in Figure 2. These plots each show that the predominant wind direction is from the west (approximately 10-11% of the time), with southerly and easterly winds being the next most frequent at approximately 7-8% each. The average wind speed at 4063753 was 3.1 m/s, and at 4063757 was 3.8 m/s.

Figure 2: Wind Roses for Key Lake, SK (2011-2020)



(a) Station 4063753	(b) Station 4063757

2.4 ATMOSPHERIC PRESSURE

Atmospheric pressure data is available on an hourly basis from station 4063753 and station 4063757. The hourly data was summarized into monthly averages for each station and is summarized in Table 4. It should be noted that atmospheric pressure is not tracked with the climate normals datasets, and therefore a comparison to historic data is not available. Over the period of 2011-2020 the annual average atmospheric pressure was 95.3 kPa at station 4063753 and 95.2 kPa at station 4063757), each with a standard deviation of 0.1 kPa. On an hourly basis, the standard deviation for the period of 2011-2020 was 0.8 kPa at both stations, indicating that the atmospheric pressure was relatively constant over this period.

Table 4: Measured Atmospheric Pressure at Key Lake, SK (2011-2020)

Year	Station 4063753	Station 4063757
2011	95.2	95.1
2012	95.2	95.2
2013	95.4	95.4
2014	95.3	95.3
2015	95.2	95.2
2016	95.2	95.3
2017	95.2	95.2
2018	95.3	95.3
2019	95.3	95.3
2020	95.1	95.1
Average	**95.3**	**95.2**

2.5 RELATIVE HUMIDITY

Relative humidity is a measure of the amount of water vapor present in air expressed as a percentage of the amount needed for saturation at the same temperature. At 100% relative humidity, the air is saturated (i.e., at its dew point). Relative humidity data is available on an hourly basis from station 4063753 and station 4063757. The hourly data was summarized into monthly averages for each station and is summarized in Table 5. It should be noted that relative humidity is not tracked with the climate normals datasets, and therefore a comparison to historic data is not available. Over the period of 2011-2020 the annual average relative humidity at 4063753 was 71.0% with a standard deviation of 1.8%, and at 4063757 it was 73.7% with a standard deviation of 1.8%. The standard deviations on an hourly basis were calculated to be 18.4% and 19.0% at stations 4063753 and 4063757, respectively.

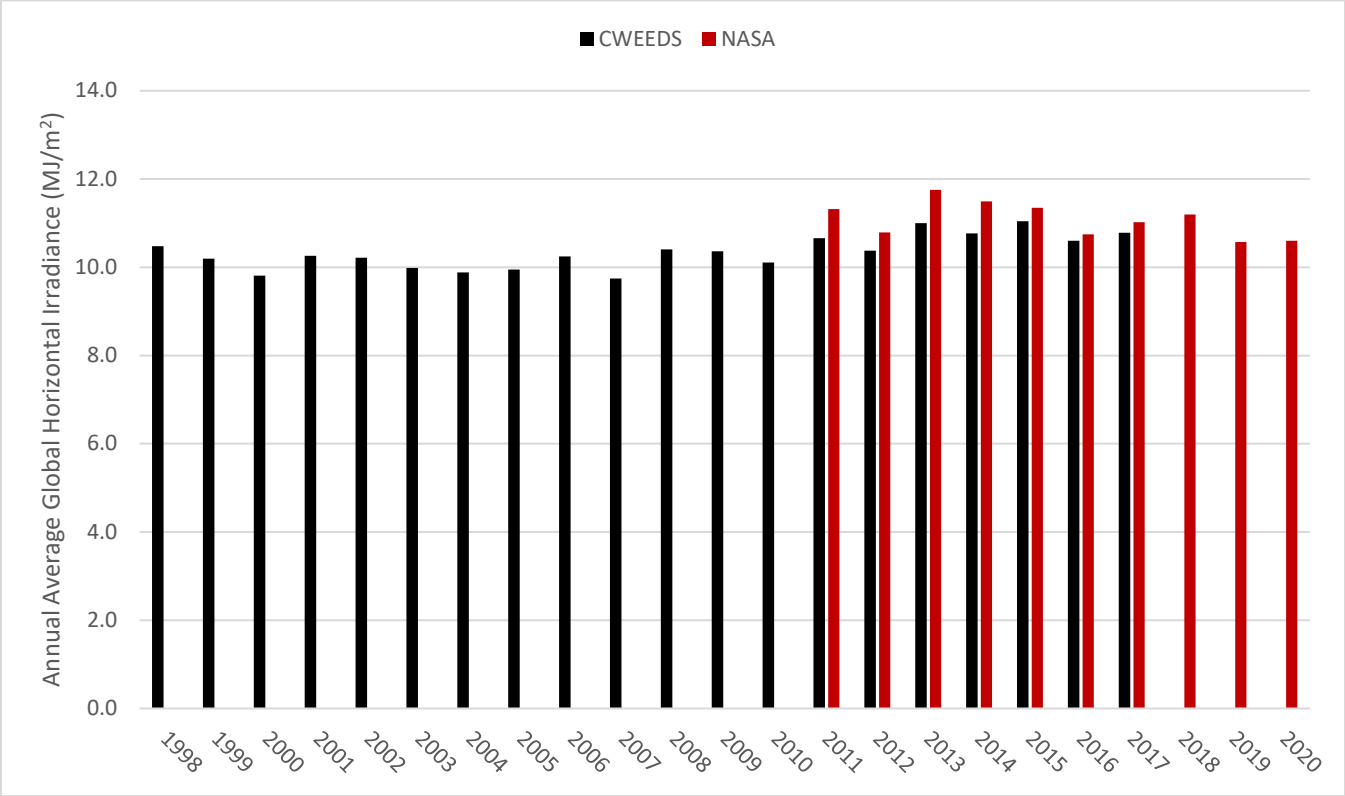
Table 5: Measured Relative Humidity at Key Lake, SK (2011-2020)

Year	Station 4063753	Station 4063757
2011	74.8	73.4
2012	72.6	74.0
2013	70.1	70.8
2014	70.8	72.7
2015	69.6	71.9
2016	71.4	75.0
2017	69.9	73.9
2018	69.6	73.5
2019	70.7	75.1
2020	73.4	77.1
Average	**71.0**	**73.7**

2.6 SOLAR RADIATION

Solar radiation, or solar irradiance, is a measure of the radiant energy from the sun on a horizontal surface and is measured in watts per square metre (W/m^2) and may be integrated over time to provide the radiant energy being emitted to the environment in units of joules per square metre (J/m^2). Solar radiation is not included in the meteorological measurement datasets available for Key Lake from ECCC; however, ECCC has compiled *Canadian Weather Energy and Engineering Datasets* (CWEEDS), which include data from direct observation (where available) and data derived from polar-orbiting meteorological satellites to fill any data gaps [5]. The most recent CWEEDS database at the time that this assessment was completed includes the period from 1998-2017 and includes a Key Lake dataset. The technical documentation for the CWEEDS database indicates that the Key Lake data is based on observations [6]. The datasets are partly compiled using information from the NASA POWER Project, which was used to obtain data for the 2011-2020 period. The data are presented in Figure 3. The annual average of the CWEEDS data (1998-2017) was 10.3 MJ/m^2. The NASA data, which are not based on directly observed data at Key Lake, trended higher than the CWEEDS data. The annual average of the NASA data for the period of 2011-2020 was 11.1 MJ/m^2.

Figure 3: Solar Radiation at Key Lake, SK (1998-2020)



2.7 WEATHER PHENOMENON

2.7.1 Extreme Weather Conditions

Extreme weather conditions include extreme precipitation, extreme temperatures, and extreme winds. As noted previously, the extreme maximum temperature for the period of 2011-2020 was 34°C, compared to 36°C for the climate normals at Key Lake, and the extreme minimum temperature for the period of 2011-2020 was -48.3°C, compared to -52.5°C for the climate normals. The greatest amount of total precipitation in a 24-hour period was 45.9 mm, which was recorded at station 4063753 and occurred on August 8th, 2020, while the maximum 24-hr precipitation from the climate normals was 72 mm, which occurred on July 12th, 1998. The maximum hourly wind speed was 57 km/hr, detected at station 4063757 on March 14th, 2012, at 11:00 am. The maximum hourly wind speed from the climate normals (1981-2010) was 60 km/hr, which was measured on April 20th, 1985.

2.7.2 Lightning

According to statistics on lightning activity in Canadian cities maintained by ECCC [7], the region around Key Lake experiences approximately 20.9 days per year with lightning on average. The total number of cloud-to-ground

lightning flashes observed within 25 km of Key Lake between 1999 and 2018 was 9,120. Key Lake is the northernmost site where observations have been logged by ECCC. The next closest location is La Ronge, approximately 250 km south of Key Lake, which experiences an average of 28.8 days per year with lightning, and 17,937 total lightning flashes observed between 1999 and 2018.

Table 6: ECCC Lightning Activity in Canadian Cities (SK) (1999-2018)

City	Total cloud-to-ground lightning flashes from 1999 to 2018	Average number of days with lightning (within 25 km)
Estevan	54,025	33.7
Key Lake	**9,120**	**20.9**
La Ronge	17,937	28.8
Moose Jaw	32,112	31.0
North Battleford	21,061	28.0
Prince Albert	23,461	28.2
Regina	32,853	30.1
Saskatoon	22,340	27.0
Swift Current	26,437	31.0
Yorkton	32,249	29.4

2.7.3 Temperature Inversions

Temperature inversions occur when the air at the surface is cooler than the air above it, which is the reverse of the typical situation in which the upper air is cooler than the air at ground level. Temperature inversions are known to trap air pollutants at ground level, as the layer of warm air acts as a barrier to dispersion. Similarly, temperature inversions cause sound waves to bend back down toward the surface rather than radiating freely in all directions, resulting in sound travelling further than it would under normal conditions. In order to quantify the number of temperature inversions per year, it would be necessary to have measured temperatures at two heights (or more) for comparison; however, the meteorological data at Key Lake is measured at only one height. It should be noted however that the air quality modelling accounts for atmospheric stability, with stable atmospheric conditions tending to produce inversions and result in poorer air quality. When the meteorological data is processed in the model, atmospheric stability is identified by Pasquill stability class, ranging through six categories from unstable, through neutral, to stable. Similarly, the noise model has been developed such that predictions are valid for a moderate temperature inversion and can be adjusted if it is expected that there is a possibility of a regular temperature inversion (e.g., large body of water between the source and receptor).

2.7.4 Fog

Fog is generally defined as suspended water droplets in the air that lead to a reduction in visibility to less than 1 km. Visibility is tracked at the Key Lake meteorological station that is operated by NAVCAN (4063757). The data from 2011-2020 was analyzed to calculate the annual number of hours and days that visibility was reduced to less than 1 km. The results are summarized in Table 7. On average there were 51.4 hours with visibility at less than 1 km between 2011-2020, and 20.2 days per year with fog occurring. The total number of fog days ranged from 11 in 2015 to 27 in 2019.

Table 7: Estimated Hours and Days with Fog at Key Lake, SK (2011-2020)

Year	Fog Hours	Fog Days
2011	73	25
2012	53	22
2013	26	14
2014	51	22
2015	29	11
2016	61	24
2017	53	18
2018	54	16
2019	58	27
2020	56	23
Average	**51.4**	**20.2**

2.7.5 Tornadoes

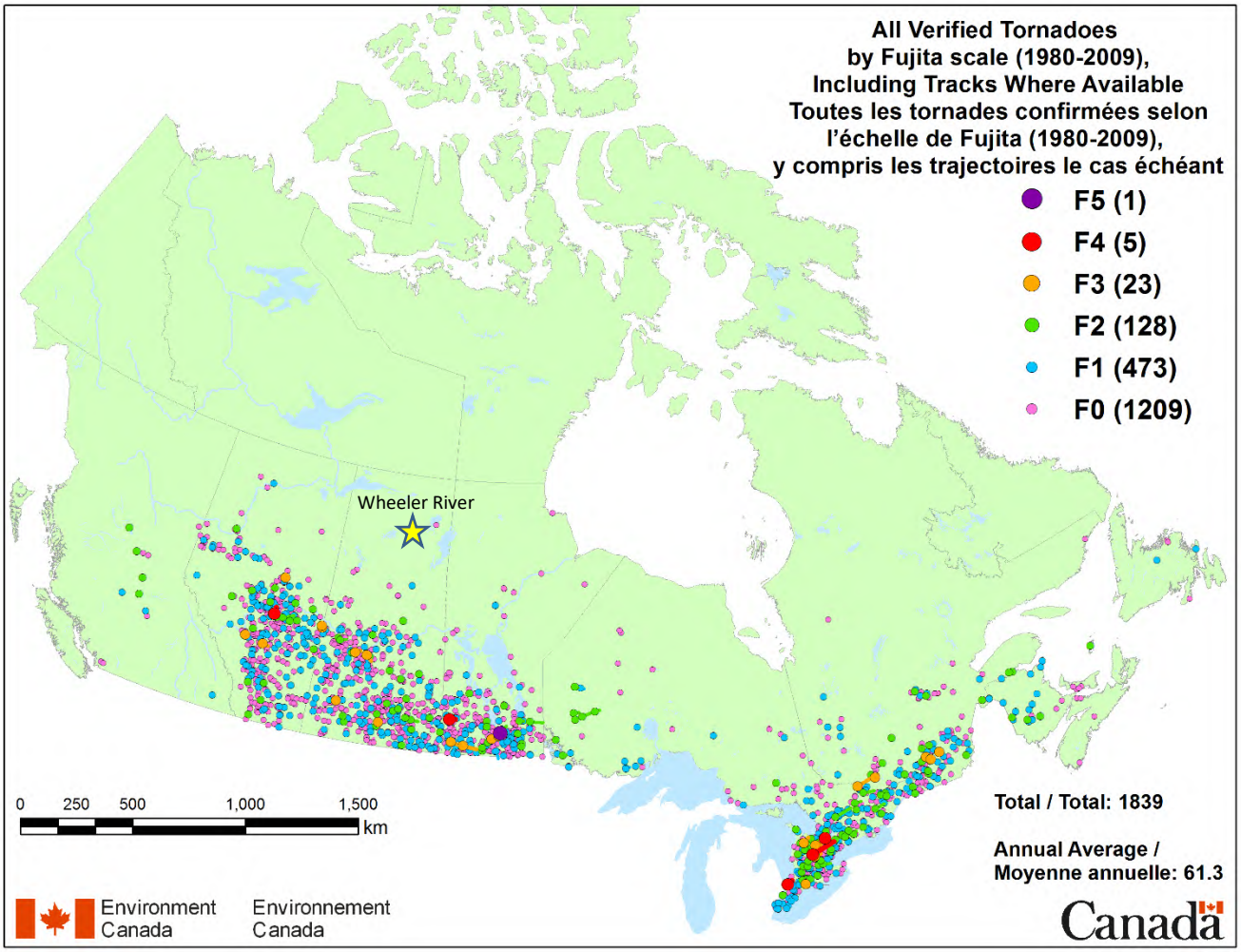
Tornadoes in Canada are tracked by ECCC and logged in the Canadian National Tornado Database [8]. The most current database collects records of the 30-year period between 1980 and 2009. Tornadoes are most frequently reported across two main bands: from southern Alberta to northwestern Ontario (includes southern Saskatchewan and southern Manitoba), and from southern Ontario to New Brunswick (via southern Quebec). This dataset indicates that an average of 61.3 tornadoes are reported in Canada per year, and Saskatchewan has the highest incidence of tornado reports at 17.6 per year. A map of the locations of reported tornados in Canada is provided in Figure 4 [8]. This shows that the majority of reported tornadoes in Saskatchewan largely occur south of Prince Albert, which marks the approximate transition in land geography from the characteristic prairie lands in the south to boreal forest in the north. Tornado activity reported in the boreal forest areas of

Saskatchewan is rare; however, this may have to do with lower population density resulting in under-reporting of tornado activity. Of the 529 tornadoes that were reported in Saskatchewan over the period of 1980-2009, only 15 (2.8%) were located above the 54th parallel.

Canada uses the Enhanced Fujita (EF) scale to categorize tornadoes by strength, with six categories defined by ranges of wind speed and propensity to cause damage. F0 is a relatively weak tornado with winds between 90-130 km/hr, and F5 is considered to be devastating with winds exceeding 315 km/hr. Of the 529 tornadoes that were reported in Saskatchewan over the period of 1980-2009, 73% were F0, 22% were F1, 4% were F2, and 1% were F3. There were no F4 or F5 tornadoes reported in Saskatchewan over this period. There were three (3) tornadoes reported within a 250 km radius of the Wheeler River site over the 1980-2009 period with the closest being an F0 tornado at Wollaston Lake (150 km away) in July 1991. In July 2000, an F1 tornado was reported at Guncoat Bay, 225 km to the south of Wheeler River and an F0 tornado was reported at Besnard Lake, 235 km to the south of Wheeler River.

Based on the above, the baseline frequency and severity of tornadoes in the Regional Study Area is very low, with no tornadoes reported within 150 km of the Project site in the 30-year period from 1980-2009, and those reported as being nearest to the site being of the lowest EF rating. The baseline tornado activity for the Site and Local Study Areas will be the same as that for the Regional Study Area, as tornadoes are a regional phenomena and incidence would not be expected vary greatly across small distances.

Figure 4: Verified Tornadoes in Canada (1980-2009)



3.0 FUTURE CLIMATE

In order to evaluate how the climate at the Wheeler River site may change in the future, estimations of key climate parameters out to the year 2100 have been completed using RCP trajectory analysis in accordance with methods adopted by the IPCC and outlined in the IPCC Synthesis Report AR5 [9]. Three future climate scenarios have been evaluated in accordance with this method:

- **RCP 2.6**: Stringent mitigation scenario (emissions strongly declining)
- **RCP 4.5**: Intermediate scenario (emissions slowly declining)
- **RCP 8.5**: High GHG emissions (emissions increasing)

RCP 2.6 assumes that carbon emissions reduce to zero by the end of the century, while RCP 4.5 reflects a scenario in which global carbon emissions stabilize by the end of the century. RCP 8.5 assumes that global carbon emissions are still increasing by the end of the century, and not stabilize until 2250. Predictions for the various RCP scenarios include a median and a likely range. For purposes of plotting and presenting the data, the median values have been used. RCP data sets have been generated for various locales across Canada by the Computer Research Institute of Montréal (CRIM), with financial support from ECCC [10]. Key parameters from the data set generated for Key Lake are presented in the following sections, which have been reduced to show changes by decade. The plots provided in Appendix A and B include the full annual data sets.

3.1 TEMPERATURE

The historic temperature data at the site has been discussed in Section 2.1, and the mean daily temperatures have been included in the future projections for reference with the modelled RCP data. The measured mean daily temperature at the Key Lake site from 2011 to 2020 was 2.6°C, with a mean daily maximum and minimum temperatures of 3.3°C and -8.6°C, respectively. Each of the RCP projections shown in Table 8 predict that the mean daily temperatures will be above 0°C by 2100, with actual predicted increases (from 2011-2020 average to 2100) of +1.4°C for RCP 2.6, +2.5°C for RCP 4.5, and +6.1°C for RCP 8.5. The increments for the mean daily maximums and minimums are similar.

In addition to the daily means, the extreme maximum and minimum temperature projections were also compared with the current conditions and summarized in Table 9. Section 2.1, the extreme maximum temperature from 2011-2020 was 34°C, while the extreme minimum was -48.3°C. The RCP projections show these each warming, with the change to the extreme minimum temperature being more pronounced that the predicted overall change to the extreme maximum temperature. In the RCP 2.6 scenario, the extreme minimum is predicted in increase by +3.1°C, while the extreme maximum is not predicted to change. The RCP4.5 and 8.5 scenarios predict that the extreme minimum will increase by +4.7°C and +12.5°C, respectively, while the predictions for the extreme maximum for these scenarios are +1.7°C and +6.3°C, respectively.

Table 8: Existing and Predicted Daily Mean Temperature Data for Key Lake

Year	Mean Daily Temperature (°C)				Mean Daily Maximum Temperature (°C)				Mean Daily Minimum Temperature (°C)			
	Measured	RCP 2.6	RCP 4.5	RCP 8.5	Measured	RCP 2.6	RCP 4.5	RCP 8.5	Measured	RCP 2.6	RCP 4.5	RCP 8.5
2011-2020	-2.6	-0.93	-1.1	-0.81	3.3	4.5	4.3	4.5	-8.6	-6.4	-6.5	-6.2
2030		-0.57	-0.77	0.12		4.9	4.9	5.4		-6.0	-6.4	-5.3
2040		-0.26	-0.09	0.33		5.2	5.2	5.7		-5.6	-5.4	-5.0
2050		0.11	-0.01	1.4		5.5	5.3	6.7		-5.5	-5.4	-4.0
2060		0.06	0.57	2.0		5.5	5.9	7.2		-5.3	-4.8	-3.3
2070		-0.03	1.3	2.9		5.3	6.6	7.9		-5.4	-4.1	-2.2
2080		0.05	1.3	3.7		5.4	6.7	9.1		-5.3	-4.2	-1.5
2090		-0.25	1.8	4.5		4.9	6.9	9.5		-5.3	-3.5	-0.5
2100		0.42	1.3	5.3		6.0	6.9	10.3		-5.0	-4.5	0.3
Overall Increase:		**1.3**	**2.5**	**6.1**		**1.4**	**2.6**	**5.8**		**1.4**	**2.0**	**6.5**

Table 9: Existing and Predicted Extreme Temperature Data for Key Lake

Year	Coldest Day (°C)				Hottest Day (°C)			
	Measured	RCP 2.6	RCP 4.5	RCP 8.5	Measured	RCP 2.6	RCP 4.5	RCP 8.5
2011-2020	-48.3	-41.5	-41.3	-41.3	34.0	31.6	31.6	31.6
2030		-39.7	-39.6	-38.7		31.7	32.0	31.8
2040		-39.0	-39.1	-38.4		31.3	31.9	32.0
2050		-38.3	-38.3	-36.0		31.6	32.8	34.2
2060		-39.1	-37.5	-35.1		31.7	32.7	34.4
2070		-39.5	-36.6	-31.9		32.8	33.0	34.6
2080		-39.4	-37.0	-30.6		31.9	33.1	35.7
2090		-39.0	-35.4	-30.5		31.4	33.6	37.8
2100		-38.4	-36.6	-28.8		31.6	33.3	37.8
Overall Increase:		**3.1**	**4.7**	**12.5**		**0.0**	**1.7**	**6.3**

Predictions for other parameters of interest, such as days with temperatures above and below given thresholds, days of first spring frost and last fall frost, as well as the length of the frost-free season, are provided as plots in Appendix A.

3.2 PRECIPITATION

The historic precipitation data and normals at the Key Lake site are summarized in Section 2.2, and the RCP predictions are compared to this data in Table 10 for annual total precipitation and maximum daily precipitation. On average, approximately 455 mm of annual precipitation was measured over the period of 2011-2020, and the maximum amount that fell in one day over that period was 48.3 mm. In terms of annual totals, the RCP projections show little difference between the RCP 2.6 and RCP 4.5 scenarios, with predicted increases of +28 mm and +26 mm, respectively, between 2011-2020 and 2100. The RECP 8.5 scenario predicts an increase in annual total precipitation of 51 mm. In terms of maximum single day precipitation events, the predicted changes are more moderate, with the RCP 2.6 and RCP 4.5 scenarios predicting small reductions to the current levels of -6 mm and -2 mm, respectively, by 2100. The RCP 8.5 scenario predictions indicate a minor increase of +1 mm by 2100.

Table 10: Existing and Predicted Precipitation Data for Key Lake

Year	Total Annual (mm)				Maximum 1-day (mm)			
	Measured	RCP 2.6	RCP 4.5	RCP 8.5	Measured	RCP 2.6	RCP 4.5	RCP 8.5
2011-2020	455	518	509	508	48	29	27	27
2030		528	503	537		27	24	26
2040		487	498	514		28	29	24
2050		504	524	520		26	29	33
2060		513	515	523		26	33	26
2070		527	534	568		29	31	28
2080		539	551	547		30	33	28
2090		543	545	548		31	32	35
2100		546	535	559		23	25	28
Overall Increase:		**28**	**26**	**51**		**-6**	**-2**	**1**

Predictions for other parameters of interest, such as days with precipitation exceeding given thresholds, and days of consecutive precipitation events, are provided as plots in Appendix B.

4.0 GREENHOUSE GAS EMISSIONS

The discussion in Section 3.0 provides projections of climate parameters associated with temperature and precipitation. Another indicator of climate change is the emission of Greenhouse Gases (GHGs). Estimating GHG emissions for a proposed development allows for tracking of climate change commitments made by the Government of Canada. To assist in developing emissions estimates, the ECCC have developed a draft technical guide, *Draft Technical Guide Related to the Strategic Assessment of Climate Change* [11] (SACC Report). The types of emissions covered in the SACC Report include Direct GHG Emissions (e.g., from combustion sources), Acquired Energy GHG Emissions (e.g., emissions attributable to the generation of electricity acquired from a third party), and Avoided Domestic GHG Emissions. Avoided Domestic GHG Emissions are related to reduction or elimination of GHG Emissions due to a project. This assessment focuses on the emissions generated by the project, and so only Direct and Acquired Energy GHG Emissions have been estimated.

4.1 DIRECT GREENHOUSE GAS EMISSIONS

Direct GHG Emissions are emissions generated by the project activities. For the Wheeler River Project these pertain to stationary and mobile combustion sources and emissions due to land use change (i.e., removing vegetation to develop the Project Area). These are discussed in the following sections.

4.1.1 Combustion Sources

The combustion source types that are relevant to the Project include:

- On-road mobile sources (trucks and vans that utilize roadways),
- Off-road mobile sources (heavy equipment such as graders and dozers), and
- Stationary sources (generators and propane heating).

Per the SACC Report, the calculation of combustion emissions utilizes emission factors that estimate the amount of GHG emissions per unit volume of fuel used (e.g., g/L), and these emission factors vary by the source type and the fuel type. These emission factors are then multiplied by the amount of fuel used over one year, for each source type, to arrive at an annual quantity of emissions per source. The recommended emission factors for combustion are provided in the *National Inventory Report 1990–2019: Greenhouse Gas Sources and Sinks in Canada* [12] (the NIR), and include emissions of carbon dioxide (CO_2), nitrous oxide (N_2O), and CH_4. Global Warming Potential (GWP) factors are then used to quantify the total emissions in terms of equivalent emissions of CO_2 (CO_2e). The GWP factors are referenced by ECCC for use in these calculations are from the IPCC Fourth Assessment Report [13].

Information provided by Denison on vehicle usage and associated fuel consumption were used to calculate the annual amounts of fuel used for each source type and each phase of operations (Construction, Operations, and Decommissioning). The emission factors applied in the assessment, the fuel types and quantities, and the calculated emissions are detailed in Appendix C. A summary of the emissions associated with the combustion sources are provided in Table 11.

Table 11: Combustion GHG Emissions

Source	Scenario	Emissions (tonne/year)			
		CO2	CH4	N2O	CO2e
100-year Global Warming Potential (GWP) [1]:		1	25	298	
On-Road Mobile Combustion	Construction	1,560	0.07	0.08	1,586
	Operations	541	0.02	0.03	551
	Decommissioning	357	0.01	0.02	363
Off-Road Mobile Combustion	Construction	6,507	0.18	0.55	6,676
	Operations	3,119	0.08	0.26	3,200
	Decommissioning	3,485	0.09	0.30	3,575
Stationary Combustion	Construction	18,570	0	0	18,647
	Operations	8,092	0	1	8,251
	Decommissioning	20,952	0	0	21,081

4.1.2 Land Use Change

The Project involves clearing an area of approximately 169.6 hectares, which is currently vegetated to varying degrees, for the site infrastructure (the Project Area). ECCC recommends following guidance in the NIR and IPCC *Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories*, Volume 4 [14] (the IPCC Guidelines). The calculation involves identifying the current coverage of the planned area that is to be changed and assigning a carbon stock value based on a number of parameters such as the above-ground mass of the vegetation, and the estimated carbon content. The relevant equations are provided in Chapter 2 of the IPCC Guideline, and the SACC Report provides a summary of the calculation approach in Annex B [11].

For calculations in which the land use is changing from a disturbed area to a developed, built-up area such as an industrial site, it is assumed that there will be no biomass on the developed land after the change, and no growth of biomass on the land over the time it remains developed. The current vegetative cover of the Project Area was derived from the EIS, Chapter 9.2 Terrestrial Environment – Vegetation and Ecosystems, Listed Plant Species and Wetlands [15]. According to Table 9.2-5 of the EIS, the vegetation within in the LSA is primarily made up of low and tall shrubs, young forest, and mature forest [15]. These make up approximately 90% of the LSA, and it was assumed that the full Project Area was similarly vegetated. The ratio of the area of forested lands and shrub-covered lands were applied to the 169.6 hectares that comprise the Project Area. While the approach in the SACC Report identifies that site-specific information on the above-ground mass of the vegetation species must be used, this data was not available, and so default data from Table 20 of the SAC Report were applied [11]. Per Table 20 of the SACC Report, the carbon stock for trees and shrubs in the boreal

plains regions of Saskatchewan are 32 and 1.5 tonnes of carbon per hectare, respectively [11]. The carbon content in the identified biomass was also not available as a site-specific value, and so a median value of 0.51 was selected from Table 4.3 of the IPCC Guide (Volume 4), which pertains to boreal domains, and conifer type vegetation [14]. The full calculation is provided in Appendix C. The summary of the carbon stock in the biomass identified, and the equivalent CO2 emissions are summarized in Table 12. Note that the emissions associated with the change in land use only apply to the first year of the Construction phase.

Table 12: Land Use Change GHG Emissions

Source	Scenario	Annual Change in Carbon Stock associated with Land Conversion (Tonnes C/yr)	Emissions of CO2 Equivalent (Tonnes CO2e/yr)
Land Use Change	Construction	1,126	4,130
	Operations	0	0
	Decommissioning	0	0

4.2 Acquired Energy Greenhouse Gas Emissions

During the Operations phase of the Project, Denison will be acquiring power from the Provincial grid (SaskPower) to provide electricity to the site. In accordance with SACC, the GHG emissions associated with the generation of that electricity are to be accounted for in the emissions inventory. According to the Prefeasibility Study, the annual power demand at the site is expected to be 46,252,800 kWh. The SACC report recommends the use of Emission Intensity (EI) projections, which predict future emissions of CO2 equivalent per GWh of electricity generated. Annex C of the SACC report provides projections of EI values by province out to 2030. The maximum value for Saskatchewan of 404.3 tonnes CO2eq per GWh was conservatively used in the assessment. The calculation is simply the power demand for the Project (46.3 GWh) multiplied by the EI of 404.3, for a total emission of 18,700 tonnes CO2e/year. It should be reiterated that this applies only to the Operations years, as noted above, during Construction and Decommissioning the power will be provided using diesel generators. Based on the EI projections, the emissions total will trend downward over time due to policies and emission reduction measures.

4.3 Summary of GHG Emissions

The total maximum GHG emissions from each phase of the project, and each GHG emissions type are summarized in Table 13.

Table 13: Summary of Total GHG Emissions

Scenario	Emissions (tonne/year)			
	CO2	CH4	N2O	CO2e
Direct GHG Emissions				
CONST_Ann	30,767	0	1	31,039
OPS_Ann	11,752	0	1	12,002
DECOM_Ann	24,794	0	1	25,019
TOTAL GHG Emissions				
CONST_Ann				0
OPS_Ann				18,700
DECOM_Ann				0
TOTAL GHG Emissions (CO2e/yr)				
CONST_Ann	**Construction**			**31,039**
OPS_Ann	**Operations**			**30,702**
DECOM_Ann	**Decommissioning**			**25,019**

5.0 REFERENCES

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[15] Denison Mines, "Wheeler River Project Environmental Impact Statement," Denison, Saskatoon, 2021.

Appendix A:

Future Temperature Predictions (RCP 2.6, 4.5 and 8.5)

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	-3.03	-4.67	-1.73									
01/01/1951 0:00	1951	-3.55	-4.7	-2.43									
01/01/1952 0:00	1952	-3.35	-4.96	-2.32									
01/01/1953 0:00	1953	-3.61	-4.84	-2.82									
01/01/1954 0:00	1954	-3.26	-4.57	-1.82									
01/01/1955 0:00	1955	-3.55	-4.46	-1.9									
01/01/1956 0:00	1956	-3.1	-5.08	-1.93									
01/01/1957 0:00	1957	-4.05	-5.13	-2.07									
01/01/1958 0:00	1958	-3.74	-4.81	-2.58									
01/01/1959 0:00	1959	-3.66	-5.32	-1.99									
01/01/1960 0:00	1960	-3.45	-4.63	-2.48									
01/01/1961 0:00	1961	-2.89	-5.38	-1.86									
01/01/1962 0:00	1962	-3.51	-5.26	-2.52									
01/01/1963 0:00	1963	-3.86	-4.69	-2.58									
01/01/1964 0:00	1964	-3.84	-5.92	-3.04									
01/01/1965 0:00	1965	-3.96	-4.55	-2.73									
01/01/1966 0:00	1966	-3.89	-4.58	-2.18									
01/01/1967 0:00	1967	-3.44	-4.7	-1.89									
01/01/1968 0:00	1968	-4.07	-4.85	-2.53									
01/01/1969 0:00	1969	-3.85	-5.62	-2.75									
01/01/1970 0:00	1970	-3.21	-4.63	-2.13									
01/01/1971 0:00	1971	-3.62	-4.79	-1.95									
01/01/1972 0:00	1972	-3.56	-4.43	-2.44									
01/01/1973 0:00	1973	-3.32	-4.93	-2.04									
01/01/1974 0:00	1974	-3.84	-5.57	-2.19									
01/01/1975 0:00	1975	-3.64	-4.72	-2.41									
01/01/1976 0:00	1976	-3.45	-4.82	-2.33									
01/01/1977 0:00	1977	-3.25	-4.34	-1.69									
01/01/1978 0:00	1978	-3.28	-3.94	-2.73									
01/01/1979 0:00	1979	-3.1	-4.79	-2.23									
01/01/1980 0:00	1980	-3.55	-4.79	-2.52									
01/01/1981 0:00	1981	-3.31	-4.77	-2.61									
01/01/1982 0:00	1982	-3.82	-5.25	-2.88									
01/01/1983 0:00	1983	-3.71	-5.3	-2.87									
01/01/1984 0:00	1984	-2.9	-4.39	-1.76									

01/01/1985 0:00	1985	-3.46	-4.97	-2.57									
01/01/1986 0:00	1986	-3.82	-4.93	-1.73									
01/01/1987 0:00	1987	-3.09	-4.33	-1.94									
01/01/1988 0:00	1988	-3.36	-4.64	-2.26									
01/01/1989 0:00	1989	-3.29	-3.99	-1.69									
01/01/1990 0:00	1990	-3.57	-4.64	-1.46									
01/01/1991 0:00	1991	-3.28	-4.5	-1.89									
01/01/1992 0:00	1992	-3.4	-4.5	-2.11									
01/01/1993 0:00	1993	-2.72	-4.47	-1.96									
01/01/1994 0:00	1994	-2.99	-4.4	-1.73									
01/01/1995 0:00	1995	-3.22	-4.21	-2.39									
01/01/1996 0:00	1996	-3.46	-4.34	-2.12									
01/01/1997 0:00	1997	-2.53	-4.56	-1.11									
01/01/1998 0:00	1998	-3.35	-4.12	-1.71									
01/01/1999 0:00	1999	-3	-3.96	-1.52									
01/01/2000 0:00	2000	-2.57	-3.93	-1.31									
01/01/2001 0:00	2001	-3.08	-4.22	-1.25									
01/01/2002 0:00	2002	-2.46	-4.25	-1.19									
01/01/2003 0:00	2003	-2.99	-3.9	-1.6									
01/01/2004 0:00	2004	-2.58	-3.64	-0.87									
01/01/2005 0:00	2005	-2.66	-3.73	-1.47	-2.66	-3.73	-1.47	-2.65	-3.72	-1.49	-2.67	-3.75	-1.47
01/01/2006 0:00	2006				-2.4	-3.94	-1.15	-1.88	-3.07	-0.87	-2.31	-3.57	-0.99
01/01/2007 0:00	2007				-2.15	-4.01	-1.37	-2.67	-4.08	-0.83	-2.58	-3.87	-0.72
01/01/2008 0:00	2008				-2.38	-3.44	-0.94	-2.34	-3.91	-1.06	-2.26	-4.16	-0.87
01/01/2009 0:00	2009				-2.11	-3.88	-0.27	-2.19	-3.4	-0.83	-1.95	-4.17	-0.88
01/01/2010 0:00	2010				-2.32	-3.42	-0.97	-2.49	-3.72	-0.6	-2.33	-4	-0.84
01/01/2011 0:00	2011				-2.47	-3.95	-0.5	-2.07	-3.05	-0.72	-2.54	-3.59	-0.74
01/01/2012 0:00	2012				-2.01	-3.57	-0.94	-2.76	-3.39	-0.93	-1.74	-3.21	-1
01/01/2013 0:00	2013				-2.02	-3.4	-0.73	-2.41	-3.36	-1.09	-2.45	-3.83	-1.13
01/01/2014 0:00	2014				-1.87	-3.65	-0.85	-1.95	-3.37	0.06	-2.27	-3.61	-0.06
01/01/2015 0:00	2015				-2.12	-3.22	-0.84	-2.13	-3.39	-0.89	-2.17	-3.29	-0.64
01/01/2016 0:00	2016				-1.66	-3.54	0.73	-2.42	-3.18	-1.31	-1.49	-2.8	-0.89
01/01/2017 0:00	2017				-2.03	-3.71	-0.97	-2.1	-3.47	-0.54	-1.23	-2.91	-0.09
01/01/2018 0:00	2018				-2.03	-3.34	-0.71	-1.69	-3.68	-0.86	-1.82	-3.65	-0.98
01/01/2019 0:00	2019				-2.06	-2.96	-1.18	-2.01	-3.32	-0.3	-1.72	-3.58	-0.59
01/01/2020 0:00	2020				-1.69	-3.2	-0.86	-2.5	-3.52	-1.18	-1.73	-3.08	-0.72
01/01/2021 0:00	2021				-1.57	-3.45	-0.44	-1.96	-3.36	-0.41	-2.01	-3.17	-0.94
01/01/2022 0:00	2022				-1.5	-3.44	-0.08	-2.18	-3.39	-1.03	-1.3	-2.25	0.14

01/01/2023 0:00	2023	-1.38	-2.74	-0.28	-1.47	-3.89	-0.37	-1.32	-2.77	0.13
01/01/2024 0:00	2024	-1.37	-3.02	-0.47	-1.26	-2.08	0.18	-1.91	-2.99	-0.71
01/01/2025 0:00	2025	-1.83	-3.37	-0.62	-1.72	-2.93	-0.23	-1.99	-2.99	-0.29
01/01/2026 0:00	2026	-1.67	-3.42	-0.84	-1.28	-2.83	0.02	-1.47	-2.92	-0.51
01/01/2027 0:00	2027	-1.32	-3.69	0.13	-1.87	-2.67	0.05	-1.15	-3.17	0.28
01/01/2028 0:00	2028	-1.15	-3.33	-0.22	-1.34	-3.11	0.52	-1.26	-2.85	0.35
01/01/2029 0:00	2029	-1.57	-2.41	-0.01	-2.22	-3.73	-0.57	-1.03	-2.19	-0.1
01/01/2030 0:00	2030	-1.69	-2.88	-0.27	-1.8	-2.68	-0.69	-0.94	-2.17	0.19
01/01/2031 0:00	2031	-2.14	-3.27	-0.25	-1.35	-2.9	0.23	-1.37	-2.71	-0.67
01/01/2032 0:00	2032	-1.54	-3.27	0.19	-1.25	-3.65	0.35	-1.11	-2.59	-0.15
01/01/2033 0:00	2033	-1.83	-2.83	-0.16	-1.45	-2.73	0.86	-1.1	-2.04	0.78
01/01/2034 0:00	2034	-1.21	-2.17	0.28	-1.18	-2.05	0.27	-1.27	-2.83	1.85
01/01/2035 0:00	2035	-1.84	-3.05	-0.17	-1.77	-3.08	-0.15	-0.75	-2.34	0.51
01/01/2036 0:00	2036	-1.08	-2.81	0.44	-1.63	-2.37	0.24	-1.3	-2.59	0.14
01/01/2037 0:00	2037	-1.34	-3.48	0.13	-0.99	-2.51	0.43	-0.9	-2.13	1.43
01/01/2038 0:00	2038	-1.7	-2.77	-0.43	-1.38	-2.35	1.21	-0.66	-1.92	1.65
01/01/2039 0:00	2039	-1.28	-2.32	1.07	-1.66	-2.45	0.26	-1.06	-2.74	0.32
01/01/2040 0:00	2040	-1.35	-2.69	0.73	-1.15	-2.39	0.15	-0.74	-2.69	0.24
01/01/2041 0:00	2041	-0.89	-2.77	1.14	-0.94	-1.73	0.24	-0.52	-1.8	1.2
01/01/2042 0:00	2042	-1.32	-2.27	0.63	-1.09	-1.99	0.28	-0.73	-1.82	1.62
01/01/2043 0:00	2043	-1.28	-2.13	-0.01	-0.75	-2.19	1.85	-0.2	-2.52	1.88
01/01/2044 0:00	2044	-1.44	-3.02	-0.19	-0.59	-1.32	0.53	-0.16	-2.13	1.6
01/01/2045 0:00	2045	-1.28	-2.54	0.08	-0.47	-1.81	0.79	-0.26	-1.62	0.9
01/01/2046 0:00	2046	-1.35	-2.81	0.6	-1	-1.93	1.24	-0.24	-1.52	0.72
01/01/2047 0:00	2047	-1.06	-2.37	0.21	-0.67	-1.85	0.33	-0.09	-1.75	1.29
01/01/2048 0:00	2048	-1.05	-2.89	0.51	-1.04	-2.72	0.55	0.15	-1.64	1.72
01/01/2049 0:00	2049	-1.12	-2.46	0.1	-0.4	-2.16	0.85	0.23	-1.03	1.33
01/01/2050 0:00	2050	-0.99	-3.53	0.18	-1.03	-1.92	0.42	0.25	-1	1.7
01/01/2051 0:00	2051	-1.15	-2.65	0.67	-0.6	-1.85	1.01	0.18	-1.54	1.67
01/01/2052 0:00	2052	-1.49	-2.86	0.62	-0.39	-1.38	0.79	0.1	-2.2	1.98
01/01/2053 0:00	2053	-1.49	-2.48	0.2	-0.04	-2.59	0.95	0.67	-0.87	2.16
01/01/2054 0:00	2054	-1.47	-2.41	0.02	-0.65	-1.78	1.56	0.38	-1.69	1.37
01/01/2055 0:00	2055	-1.09	-2.37	0.75	-0.24	-2.46	1.53	1.22	-1.23	2.27
01/01/2056 0:00	2056	-0.77	-2.19	1.12	-0.31	-1.37	0.87	0.79	-0.65	2.45
01/01/2057 0:00	2057	-1.05	-3.01	0.41	-0.85	-2.19	0.8	0.86	-1.1	2.6
01/01/2058 0:00	2058	-1.17	-2.91	0.54	-0.14	-1.59	1.03	1.23	-0.44	2.34
01/01/2059 0:00	2059	-1.43	-2.48	1.3	-0.53	-2.16	0.81	0.95	-0.66	3.05
01/01/2060 0:00	2060	-0.82	-1.98	1.06	-0.38	-1.96	1.38	0.73	-1.17	3.42

01/01/2061 0:00	2061	-1	-2.5	0.62	-0.43	-1.45	0.85	0.6	-0.8	2.67
01/01/2062 0:00	2062	-0.41	-2.51	1.9	-0.66	-1.9	1.99	0.89	-0.24	3.06
01/01/2063 0:00	2063	-1.25	-3.07	0.38	-0.52	-1.91	2.68	1.83	-0.18	3.72
01/01/2064 0:00	2064	-1.11	-3.07	0.58	0.05	-1.27	1.18	1.41	-0.9	2.8
01/01/2065 0:00	2065	-1.18	-1.9	0.73	0.12	-1.49	1.63	1.31	-0.31	2.95
01/01/2066 0:00	2066	-1.21	-2.34	0.7	0.26	-1.02	2.12	1.32	-0.87	3.92
01/01/2067 0:00	2067	-1.26	-2.71	-0.42	0.38	-1.16	1.83	1.83	0.38	4.12
01/01/2068 0:00	2068	-1.23	-2.3	0.89	-0.14	-1.72	2.35	1.6	-0.19	4.21
01/01/2069 0:00	2069	-0.87	-2.54	0.44	-0.33	-2.01	1.57	2.36	0.72	3.67
01/01/2070 0:00	2070	-1.17	-2.34	0.66	0.17	-0.74	1.27	1.69	-0.13	4.2
01/01/2071 0:00	2071	-1.01	-2.79	1.1	0.28	-1.11	1.78	1.91	-0.42	3.98
01/01/2072 0:00	2072	-1.13	-3.02	0.26	0.16	-1.14	1.86	2.09	0.16	3.75
01/01/2073 0:00	2073	-1.67	-2.51	0.71	0.01	-2.18	1.8	2.14	0.33	4.74
01/01/2074 0:00	2074	-1.12	-2.03	0.29	-0.23	-1.79	1.54	2.31	0.06	4.46
01/01/2075 0:00	2075	-1.21	-2.52	0.33	0.47	-0.81	1.64	2.52	0.39	4.4
01/01/2076 0:00	2076	-0.54	-1.8	0.82	0.09	-1.6	1.21	2.33	0.75	4.79
01/01/2077 0:00	2077	-1.67	-2.93	-0.34	0.01	-1.66	2.54	2.76	0.87	5.09
01/01/2078 0:00	2078	-1.49	-2.64	0.12	0.67	-1.68	2.7	3.07	0.8	5.14
01/01/2079 0:00	2079	-1.03	-2.43	1.24	0.28	-1.32	2.49	3.05	0.93	4.68
01/01/2080 0:00	2080	-1.06	-2.22	0.54	0.19	-1.03	1.62	2.47	1.11	5.25
01/01/2081 0:00	2081	-1.63	-2.67	0.72	0.25	-0.84	1.76	2.42	1.62	5.56
01/01/2082 0:00	2082	-0.61	-1.8	0.09	0.27	-0.95	2.32	3.3	1.74	6.06
01/01/2083 0:00	2083	-1	-2.73	0.73	0.58	-1.72	2.37	3.8	1.04	5.23
01/01/2084 0:00	2084	-1.26	-2.46	0.49	0.74	-1.18	3.02	3.3	1.27	5.06
01/01/2085 0:00	2085	-1.46	-2.56	0.92	0.1	-1.92	2.62	3.36	0.87	5.62
01/01/2086 0:00	2086	-1.04	-1.88	0.86	0.33	-1.18	2.24	3.14	0.9	5.1
01/01/2087 0:00	2087	-1.39	-2.26	1.85	0.32	-1.59	1.79	3.73	1.49	5.14
01/01/2088 0:00	2088	-0.71	-1.7	1.48	0.15	-2	1.97	3.29	0.72	5.72
01/01/2089 0:00	2089	-0.56	-2.57	1.05	0.32	-1.28	2.8	3.48	1.38	6.09
01/01/2090 0:00	2090	-1.26	-2.97	0.41	0.72	-1.32	2.72	3.21	0.77	5.15
01/01/2091 0:00	2091	-1.29	-2.39	0.73	0.41	-0.85	1.96	3.83	2.31	7.42
01/01/2092 0:00	2092	-0.88	-2.52	0.67	0.16	-1.35	2.88	3.61	1.43	5.66
01/01/2093 0:00	2093	-1.4	-2.61	0.52	0.21	-1.12	1.7	3.75	1.37	6.36
01/01/2094 0:00	2094	-1.16	-2.58	-0.26	0.29	-1.46	2.57	4.07	1.48	5.57
01/01/2095 0:00	2095	-1.16	-2.48	0.69	0.27	-0.79	2.48	3.33	1.52	6.6
01/01/2096 0:00	2096	-1.41	-2.31	0.41	0.92	-0.72	1.95	4.11	1.34	6.65
01/01/2097 0:00	2097	-1.08	-2.34	0.36	0.36	-1.86	2.92	4.15	2.81	6.99
01/01/2098 0:00	2098	-1.57	-2.86	0.31	0.63	-1.28	2.44	4.57	1.85	6.77

01/01/2099 0:00	2099	-0.85	-2.32	0.96	0.72	-0.9	2.5	4.78	1.93	7.18

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	2.36	0.61	3.75									
01/01/1951 0:00	1951	1.91	0.6	3.15									
01/01/1952 0:00	1952	1.92	0.42	3.04									
01/01/1953 0:00	1953	1.67	0.33	2.42									
01/01/1954 0:00	1954	2.08	0.87	3.34									
01/01/1955 0:00	1955	1.94	0.59	3.45									
01/01/1956 0:00	1956	2.45	0.23	3.31									
01/01/1957 0:00	1957	1.39	0.23	3.14									
01/01/1958 0:00	1958	1.64	0.56	2.89									
01/01/1959 0:00	1959	1.73	-0.06	3.55									
01/01/1960 0:00	1960	2.03	0.54	3.18									
01/01/1961 0:00	1961	2.4	-0.04	3.38									
01/01/1962 0:00	1962	1.85	0.02	2.95									
01/01/1963 0:00	1963	1.66	0.39	2.66									
01/01/1964 0:00	1964	1.39	-0.59	2.32									
01/01/1965 0:00	1965	1.54	0.63	2.73									
01/01/1966 0:00	1966	1.83	0.64	3.45									
01/01/1967 0:00	1967	2.12	0.58	3.37									
01/01/1968 0:00	1968	1.55	0.57	2.92									
01/01/1969 0:00	1969	1.4	-0.17	2.41									
01/01/1970 0:00	1970	2.33	0.88	3.3									
01/01/1971 0:00	1971	1.85	0.5	3.45									
01/01/1972 0:00	1972	1.79	0.95	2.76									
01/01/1973 0:00	1973	2.1	0.22	3.39									
01/01/1974 0:00	1974	1.59	-0.33	3.16									
01/01/1975 0:00	1975	1.99	0.56	3.03									
01/01/1976 0:00	1976	1.94	0.48	3.05									
01/01/1977 0:00	1977	1.95	1.08	3.57									
01/01/1978 0:00	1978	2.14	1.47	2.68									
01/01/1979 0:00	1979	2.27	0.59	3.21									
01/01/1980 0:00	1980	1.66	0.44	2.88									
01/01/1981 0:00	1981	2.16	0.29	2.92									
01/01/1982 0:00	1982	1.57	0.23	2.74									
01/01/1983 0:00	1983	1.53	0.06	2.76									
01/01/1984 0:00	1984	2.53	0.94	3.62									
01/01/1985 0:00	1985	2.02	0.66	2.93									
01/01/1986 0:00	1986	1.6	0.33	3.73									

01/01/1987 0:00	1987	1.96	0.8	3.41									
01/01/1988 0:00	1988	2.14	0.56	3.23									
01/01/1989 0:00	1989	2.11	1.13	3.92									
01/01/1990 0:00	1990	1.86	0.44	4.01									
01/01/1991 0:00	1991	2.03	0.63	3.6									
01/01/1992 0:00	1992	1.98	0.86	2.97									
01/01/1993 0:00	1993	2.48	1.23	3.49									
01/01/1994 0:00	1994	2.21	0.73	3.63									
01/01/1995 0:00	1995	2.03	1.3	2.9									
01/01/1996 0:00	1996	1.97	0.96	3.2									
01/01/1997 0:00	1997	2.59	0.84	4.14									
01/01/1998 0:00	1998	1.95	1.3	3.57									
01/01/1999 0:00	1999	2.23	1.38	3.74									
01/01/2000 0:00	2000	2.71	1.42	4.1									
01/01/2001 0:00	2001	2.37	0.95	3.88									
01/01/2002 0:00	2002	2.88	1.16	3.94									
01/01/2003 0:00	2003	2.29	1.13	3.7									
01/01/2004 0:00	2004	2.71	1.43	4.38									
01/01/2005 0:00	2005	2.68	1.45	3.85	2.68	1.45	3.85	2.69	1.45	3.85	2.57	1.46	3.83
01/01/2006 0:00	2006				2.68	1.69	4.29	3.41	2.06	4.6	2.9	1.72	4.38
01/01/2007 0:00	2007				3.06	1.23	4.25	2.67	1.23	4.03	2.88	1.34	4.56
01/01/2008 0:00	2008				2.87	1.86	3.94	3.05	1.18	4.38	3	1.37	4.41
01/01/2009 0:00	2009				3.27	1.45	4.71	3	1.84	4.23	3.29	1.16	4.53
01/01/2010 0:00	2010				2.77	2.07	4.28	2.83	1.41	4.81	3.02	1.12	4.41
01/01/2011 0:00	2011				2.87	1.29	4.79	3.24	2.45	4.61	2.8	1.85	4.41
01/01/2012 0:00	2012				3.3	1.63	4.24	2.66	1.84	4.27	3.48	2.06	4.45
01/01/2013 0:00	2013				3.14	1.6	4.73	2.79	1.83	4.09	2.78	1.66	4.11
01/01/2014 0:00	2014				3.4	1.49	4.44	3.35	1.83	5.01	3.1	1.73	5.38
01/01/2015 0:00	2015				3.15	2.28	4.34	3.19	1.93	4.59	3.22	1.98	4.62
01/01/2016 0:00	2016				3.77	1.7	6.13	3.07	1.71	4.06	3.87	2.54	4.38
01/01/2017 0:00	2017				3.33	1.74	4.47	3.29	1.97	4.6	3.66	2.22	5.24
01/01/2018 0:00	2018				3.28	1.99	4.55	3.52	1.69	4.49	3.35	1.64	4.46
01/01/2019 0:00	2019				3.3	2.08	4.29	3.46	2.11	5.14	3.67	1.69	4.71
01/01/2020 0:00	2020				3.6	2.03	4.32	2.73	1.48	4.13	3.55	2.12	4.52
01/01/2021 0:00	2021				3.78	2	5.05	3.26	2.1	5.11	3.31	2.18	4.46
01/01/2022 0:00	2022				3.77	1.86	5.14	3.13	1.87	4.36	4.05	2.85	5.65
01/01/2023 0:00	2023				3.96	2.45	4.83	4.08	1.41	4.91	3.74	2.68	5.43
01/01/2024 0:00	2024				3.89	2.22	4.9	3.98	3.16	5.62	3.41	1.93	4.64
01/01/2025 0:00	2025				3.22	1.89	4.46	3.6	2.52	5.3	3.38	2.21	5.12
01/01/2026 0:00	2026				3.64	1.69	4.56	3.99	2.58	5.34	3.73	2.27	5.2

01/01/2027 0:00	2027	3.76	1.61	5.58	3.55	2.48	5.03	4.09	1.99	5.5
01/01/2028 0:00	2028	4.17	2.03	5.36	3.92	2.36	5.78	3.92	2.58	5.26
01/01/2029 0:00	2029	3.85	2.67	5.07	2.99	1.27	4.65	3.94	3.07	5.22
01/01/2030 0:00	2030	3.67	2.41	5.07	3.55	2.57	4.84	4.32	3.14	5.28
01/01/2031 0:00	2031	3.26	2.02	5.09	3.8	2.42	5.53	3.94	2.52	4.56
01/01/2032 0:00	2032	3.6	2.1	5.61	4	1.38	5.57	3.92	2.92	4.87
01/01/2033 0:00	2033	3.64	2.18	4.88	3.86	2.57	6.07	3.98	3.14	6.15
01/01/2034 0:00	2034	3.98	3.13	5.65	4.15	2.84	5.61	3.87	2.34	7.01
01/01/2035 0:00	2035	3.32	2.16	5.03	3.74	2.38	5.08	4.49	3.02	5.94
01/01/2036 0:00	2036	4.18	2.41	5.58	3.58	2.73	5.6	3.84	2.83	5.15
01/01/2037 0:00	2037	3.9	1.77	5.04	4.41	2.69	5.77	4.44	3.15	6.72
01/01/2038 0:00	2038	3.56	2.43	4.98	4.04	2.53	6.44	4.44	3.3	6.63
01/01/2039 0:00	2039	3.79	2.84	6.39	3.66	2.89	5.55	4.26	2.31	5.46
01/01/2040 0:00	2040	4.04	2.42	5.74	4.02	2.76	5.56	4.54	2.18	5.59
01/01/2041 0:00	2041	4.44	2.71	6.26	4.19	3.37	5.49	4.65	3.34	6.1
01/01/2042 0:00	2042	3.76	2.91	6.24	4.09	2.96	5.56	4.39	3.24	6.81
01/01/2043 0:00	2043	3.95	3.07	5.3	4.48	3.22	7.19	5.04	2.75	7.18
01/01/2044 0:00	2044	3.86	2.19	5.01	4.54	3.81	5.82	4.82	2.99	6.73
01/01/2045 0:00	2045	3.89	2.71	5.56	4.82	3.12	5.84	4.38	3.39	6.07
01/01/2046 0:00	2046	4.09	2.58	5.7	4.22	2.96	6.63	4.83	3.4	5.98
01/01/2047 0:00	2047	3.86	2.97	5.61	4.35	3.41	5.66	5.14	3.45	6.19
01/01/2048 0:00	2048	4.22	2.26	5.5	4.09	2.46	5.64	5.2	3.3	7.34
01/01/2049 0:00	2049	4.29	2.74	5.13	4.73	2.64	6.08	5.32	3.96	6.65
01/01/2050 0:00	2050	4.24	1.82	5.46	4.08	3.19	5.71	5.5	3.97	6.85
01/01/2051 0:00	2051	4.15	2.52	5.55	4.65	3.27	6.14	5.47	3.33	6.73
01/01/2052 0:00	2052	3.82	2.52	5.96	4.63	3.68	6.27	5.32	2.8	6.83
01/01/2053 0:00	2053	3.79	2.78	5.09	5.05	2.33	6.09	5.57	4.17	7.5
01/01/2054 0:00	2054	3.89	2.62	5.29	4.52	3.34	6.3	5.31	3.64	6.5
01/01/2055 0:00	2055	4.38	2.8	6.06	4.77	2.91	6.63	6.11	4.07	7.52
01/01/2056 0:00	2056	4.46	3.06	6.06	4.79	3.61	6.48	5.98	4.25	7.66
01/01/2057 0:00	2057	4.21	2.32	5.49	4.38	2.88	6.08	6.1	4.02	7.22
01/01/2058 0:00	2058	4.03	2.2	6.04	5.13	3.42	6.43	6.11	4.96	7.63
01/01/2059 0:00	2059	3.71	2.88	6.14	4.59	2.85	6.51	6.05	4.39	8.35
01/01/2060 0:00	2060	4.42	3.22	6.43	4.81	3.12	6.57	5.88	3.85	8.49
01/01/2061 0:00	2061	4.19	2.74	5.55	4.6	3.76	6.6	5.76	4.29	7.87
01/01/2062 0:00	2062	4.55	2.79	7.16	4.89	3.13	6.92	5.95	4.66	7.79
01/01/2063 0:00	2063	3.67	2.2	5.35	4.71	3.27	7.13	6.97	4.81	8.84
01/01/2064 0:00	2064	3.88	2.16	5.68	5.3	3.75	6.26	6.56	4.24	8.08
01/01/2065 0:00	2065	3.99	3.04	5.81	5.1	3.58	6.85	6.34	4.92	8.15
01/01/2066 0:00	2066	4.03	2.65	5.68	5.51	4.08	7.33	6.85	4.2	9.06

01/01/2067 0:00	2067	3.89	2.39	4.93	5.29	4.17	7.13	6.95	5.07	9.18
01/01/2068 0:00	2068	4.05	2.78	6.28	4.95	3.25	7.54	6.55	4.72	9.47
01/01/2069 0:00	2069	4.3	2.82	5.86	5.09	3.18	6.68	7.23	5.74	8.65
01/01/2070 0:00	2070	3.8	2.97	6.04	5.28	4.49	6.53	6.71	4.79	9.22
01/01/2071 0:00	2071	4.13	2.18	6.15	5.44	4.06	6.96	7.14	4.84	8.9
01/01/2072 0:00	2072	3.9	2.23	5.39	5.1	3.89	6.94	7.14	5.23	8.88
01/01/2073 0:00	2073	3.55	2.7	5.96	5.33	2.69	7.38	7.29	4.94	9.57
01/01/2074 0:00	2074	4.1	3.14	5.49	4.79	3.1	6.83	7.45	4.6	9.73
01/01/2075 0:00	2075	4.02	2.19	5.76	5.31	4.1	6.7	7.64	5.2	9.22
01/01/2076 0:00	2076	4.47	3.53	6.44	5.28	3.81	6.42	7.64	5.55	9.77
01/01/2077 0:00	2077	3.5	2.23	5.01	5.2	3.56	7.4	8.01	5.85	9.78
01/01/2078 0:00	2078	3.86	2.41	5.14	5.84	3.16	7.65	7.84	5.58	10.21
01/01/2079 0:00	2079	4.15	3	6.54	5.29	3.68	7.75	7.98	5.59	9.9
01/01/2080 0:00	2080	4.34	2.89	6.34	5.6	4.09	6.93	7.89	5.88	9.88
01/01/2081 0:00	2081	3.65	2.54	5.9	5.25	4.14	6.73	7.58	6.49	10.45
01/01/2082 0:00	2082	4.61	3.58	5.19	5.5	3.8	7.23	8.65	6.57	11.02
01/01/2083 0:00	2083	4.08	2.31	6	5.48	3.28	7.45	8.62	5.75	10.36
01/01/2084 0:00	2084	3.98	2.96	5.7	5.91	3.8	7.99	8.1	5.79	10.43
01/01/2085 0:00	2085	3.91	2.57	6.09	5.16	2.9	7.67	8.17	5.57	10.48
01/01/2086 0:00	2086	4.04	3.17	6.26	5.31	3.79	7.47	8.2	5.46	10.68
01/01/2087 0:00	2087	3.81	3	6.91	5.45	2.93	7.34	8.67	6.33	10.31
01/01/2088 0:00	2088	4.6	3.5	6.91	5.12	2.93	7.25	8.31	5.49	10.68
01/01/2089 0:00	2089	4.63	2.72	6.54	5.63	3.76	7.47	8.34	6.17	11.02
01/01/2090 0:00	2090	3.67	2.17	5.6	5.73	3.83	7.83	7.98	5.81	10.24
01/01/2091 0:00	2091	3.9	2.67	6.07	5.39	4.26	7.17	8.74	6.88	12.7
01/01/2092 0:00	2092	4.63	2.53	5.78	5.17	3.64	8.11	8.68	6	10.85
01/01/2093 0:00	2093	3.89	2.62	5.75	5.32	3.82	6.95	8.77	5.92	11.28
01/01/2094 0:00	2094	3.98	2.58	5.27	5.42	3.33	7.47	9.09	6.53	10.73
01/01/2095 0:00	2095	3.95	2.81	5.88	5.52	3.98	7.96	8.39	6.06	11.63
01/01/2096 0:00	2096	3.87	2.71	5.46	6.04	4.3	7.22	9.01	6.22	11.7
01/01/2097 0:00	2097	4.39	2.85	5.88	5.46	3.1	8.17	9.42	7.57	11.55
01/01/2098 0:00	2098	3.49	2.36	5.72	5.56	3.82	7.38	9.63	6.55	11.8
01/01/2099 0:00	2099	4.33	2.7	5.9	5.74	3.76	7.69	9.85	6.65	11.95

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	-10.03	-7.23									
01/01/1951 0:00	1951	-10.01	-7.71									
01/01/1952 0:00	1952	-10.19	-7.88									
01/01/1953 0:00	1953	-10.21	-7.93									
01/01/1954 0:00	1954	-10.08	-6.99									
01/01/1955 0:00	1955	-9.69	-7.06									
01/01/1956 0:00	1956	-10.41	-7.33									
01/01/1957 0:00	1957	-10.62	-7.37									
01/01/1958 0:00	1958	-10.22	-8.15									
01/01/1959 0:00	1959	-10.89	-7.52									
01/01/1960 0:00	1960	-9.94	-7.56									
01/01/1961 0:00	1961	-10.52	-7.15									
01/01/1962 0:00	1962	-10.64	-7.94									
01/01/1963 0:00	1963	-9.98	-8.03									
01/01/1964 0:00	1964	-11.25	-8.38									
01/01/1965 0:00	1965	-10.18	-8.01									
01/01/1966 0:00	1966	-9.94	-7.58									
01/01/1967 0:00	1967	-9.78	-7.33									
01/01/1968 0:00	1968	-10.28	-7.79									
01/01/1969 0:00	1969	-10.96	-7.85									
01/01/1970 0:00	1970	-10.2	-7.6									
01/01/1971 0:00	1971	-10.15	-7.36									
01/01/1972 0:00	1972	-9.82	-7.88									
01/01/1973 0:00	1973	-10.3	-7.49									
01/01/1974 0:00	1974	-10.73	-7.53									
01/01/1975 0:00	1975	-10.13	-7.88									
01/01/1976 0:00	1976	-10.2	-7.68									
01/01/1977 0:00	1977	-9.83	-7.1									
01/01/1978 0:00	1978	-9.24	-7.99									
01/01/1979 0:00	1979	-10.17	-7.42									
01/01/1980 0:00	1980	-10.16	-7.96									
01/01/1981 0:00	1981	-9.9	-8.03									
01/01/1982 0:00	1982	-10.79	-8.55									
01/01/1983 0:00	1983	-10.72	-8.28									

01/01/1984 0:00	1984	-9.71	-7.15									
01/01/1985 0:00	1985	-10.6	-8.06									
01/01/1986 0:00	1986	-10.32	-7.09									
01/01/1987 0:00	1987	-9.83	-7.14									
01/01/1988 0:00	1988	-9.87	-7.66									
01/01/1989 0:00	1989	-9.24	-7.31									
01/01/1990 0:00	1990	-9.71	-6.99									
01/01/1991 0:00	1991	-9.64	-7.38									
01/01/1992 0:00	1992	-9.91	-7.27									
01/01/1993 0:00	1993	-10.05	-7.23									
01/01/1994 0:00	1994	-9.67	-7									
01/01/1995 0:00	1995	-9.62	-7.51									
01/01/1996 0:00	1996	-9.65	-7.44									
01/01/1997 0:00	1997	-10.02	-6.33									
01/01/1998 0:00	1998	-9.62	-6.86									
01/01/1999 0:00	1999	-9.23	-6.88									
01/01/2000 0:00	2000	-9.16	-6.72									
01/01/2001 0:00	2001	-9.51	-6.55									
01/01/2002 0:00	2002	-9.66	-6.22									
01/01/2003 0:00	2003	-9.16	-6.81									
01/01/2004 0:00	2004	-8.92	-6.21									
01/01/2005 0:00	2005	-9.02	-6.56	-7.85	-9.02	-6.56	-7.86	-9.08	-6.58	-7.87	-9.16	-6.55
01/01/2006 0:00	2006			-7.59	-9.38	-6.28	-7.19	-8.58	-6.34	-7.57	-8.79	-6.28
01/01/2007 0:00	2007			-7.41	-9.26	-6.69	-8.02	-9.44	-6.01	-7.91	-8.94	-6.12
01/01/2008 0:00	2008			-7.79	-8.73	-6.13	-7.72	-8.95	-6.33	-7.59	-9.71	-6.19
01/01/2009 0:00	2009			-7.12	-9.14	-5.53	-7.43	-8.86	-5.84	-7.31	-9.44	-6.23
01/01/2010 0:00	2010			-7.65	-8.85	-6.18	-7.86	-8.79	-6.02	-7.47	-9.13	-6.21
01/01/2011 0:00	2011			-7.69	-9.29	-5.76	-7.21	-8.6	-6.07	-7.81	-9.09	-5.85
01/01/2012 0:00	2012			-7.36	-8.71	-6.22	-8.26	-8.65	-6.43	-7.19	-8.72	-6.35
01/01/2013 0:00	2013			-7.33	-8.54	-5.92	-7.53	-8.73	-6.57	-7.49	-9.3	-6.2
01/01/2014 0:00	2014			-7.19	-8.8	-6.23	-7.35	-8.74	-4.98	-7.52	-8.98	-5.66
01/01/2015 0:00	2015			-7.53	-8.52	-6.16	-7.44	-8.77	-6.34	-7.48	-8.62	-5.91
01/01/2016 0:00	2016			-6.96	-8.66	-4.66	-7.68	-8.52	-6.61	-6.78	-8.18	-6.08
01/01/2017 0:00	2017			-7.6	-9.06	-6.3	-7.4	-9.05	-5.73	-6.42	-8.03	-5.3
01/01/2018 0:00	2018			-7.32	-8.66	-6.06	-7.11	-9.11	-6.12	-7.04	-9.35	-6.26
01/01/2019 0:00	2019			-7.44	-8.16	-6.54	-7.35	-8.76	-5.66	-7.07	-8.88	-5.94
01/01/2020 0:00	2020			-6.91	-8.52	-5.88	-7.67	-8.66	-6.46	-7.07	-8.34	-5.97

01/01/2021 0:00	2021	-6.96	-8.58	-5.84	-7.15	-8.81	-5.73	-7.28	-8.31	-6.3
01/01/2022 0:00	2022	-7.24	-8.78	-5.27	-7.67	-8.72	-6.18	-6.9	-7.67	-5.3
01/01/2023 0:00	2023	-6.69	-7.94	-5.54	-6.76	-9.13	-5.61	-6.35	-8.35	-5.2
01/01/2024 0:00	2024	-6.75	-8.38	-5.7	-6.47	-7.54	-5.02	-7.04	-7.95	-5.93
01/01/2025 0:00	2025	-7.05	-8.74	-5.89	-6.89	-8.41	-5.75	-7.2	-8.25	-5.34
01/01/2026 0:00	2026	-7.08	-8.49	-6.15	-6.59	-8.21	-4.99	-6.88	-8.18	-5.95
01/01/2027 0:00	2027	-6.41	-9.02	-5.17	-7.25	-7.84	-5.19	-6.56	-8.48	-4.96
01/01/2028 0:00	2028	-6.63	-8.66	-5.59	-6.54	-8.59	-4.68	-6.39	-8.14	-4.44
01/01/2029 0:00	2029	-6.92	-7.84	-5.21	-7.41	-9.1	-5.76	-6.53	-7.37	-5.32
01/01/2030 0:00	2030	-6.96	-8.18	-5.58	-7.16	-8.1	-5.91	-6.17	-7.48	-4.68
01/01/2031 0:00	2031	-7.45	-8.76	-5.49	-6.35	-8.21	-4.75	-6.74	-7.75	-5.68
01/01/2032 0:00	2032	-6.95	-8.64	-5.25	-6.59	-8.5	-4.82	-6.63	-8.07	-5.15
01/01/2033 0:00	2033	-7.17	-7.96	-5.28	-6.58	-8.21	-4.25	-6.35	-7.37	-4.66
01/01/2034 0:00	2034	-6.39	-7.54	-5.09	-6.3	-7.32	-4.95	-6.43	-7.76	-3.32
01/01/2035 0:00	2035	-7.04	-8.28	-5.35	-6.81	-8.36	-5.46	-6.08	-7.82	-4.41
01/01/2036 0:00	2036	-6.38	-8.03	-4.72	-6.62	-7.75	-5	-6.48	-8.06	-4.88
01/01/2037 0:00	2037	-6.6	-8.69	-5.41	-6.29	-7.82	-4.81	-6.03	-7.59	-3.86
01/01/2038 0:00	2038	-6.86	-8.13	-5.54	-6.67	-7.63	-4.02	-5.83	-7.19	-3.45
01/01/2039 0:00	2039	-6.62	-7.6	-3.99	-6.94	-7.76	-4.91	-6.15	-7.8	-4.45
01/01/2040 0:00	2040	-6.55	-8	-4.51	-6.5	-7.65	-5.01	-6.03	-7.61	-4.77
01/01/2041 0:00	2041	-6.27	-8.21	-4.11	-6.07	-7.07	-4.83	-5.55	-6.96	-3.82
01/01/2042 0:00	2042	-6.46	-7.61	-4.98	-6.32	-6.94	-4.96	-5.65	-7.2	-3.57
01/01/2043 0:00	2043	-6.42	-7.57	-5.27	-5.94	-7.44	-3.4	-5.35	-7.4	-3.36
01/01/2044 0:00	2044	-6.62	-8.32	-5.58	-5.76	-6.43	-4.56	-5.08	-7.32	-3.55
01/01/2045 0:00	2045	-6.46	-7.99	-5.05	-5.74	-6.98	-4.12	-5.24	-6.99	-3.86
01/01/2046 0:00	2046	-6.78	-8.19	-4.45	-6.32	-7.26	-3.88	-5.25	-6.45	-4.35
01/01/2047 0:00	2047	-6.27	-7.71	-5.2	-6	-7.01	-4.78	-5.21	-6.95	-4.03
01/01/2048 0:00	2048	-6.29	-8.07	-4.45	-6.41	-7.9	-4.55	-5.13	-6.39	-3.39
01/01/2049 0:00	2049	-6.48	-7.95	-4.88	-5.64	-7.29	-4.38	-4.88	-6.21	-3.84
01/01/2050 0:00	2050	-6.47	-8.72	-5.15	-6.34	-7.21	-4.64	-4.91	-6.21	-3.63
01/01/2051 0:00	2051	-6.54	-7.82	-4.46	-5.71	-7.08	-4.01	-5.34	-6.26	-2.92
01/01/2052 0:00	2052	-6.8	-8.15	-4.43	-5.45	-6.44	-4.59	-5.24	-7.08	-2.94
01/01/2053 0:00	2053	-6.89	-7.92	-5.1	-5.41	-7.48	-3.98	-4.24	-5.9	-2.84
01/01/2054 0:00	2054	-6.69	-7.42	-5.04	-5.74	-6.82	-3.34	-4.71	-6.94	-3.73
01/01/2055 0:00	2055	-6.38	-7.57	-4.47	-5.3	-7.49	-3.57	-4.28	-6.32	-2.58
01/01/2056 0:00	2056	-5.89	-7.45	-3.77	-5.32	-6.38	-4.32	-4.56	-5.63	-2.56
01/01/2057 0:00	2057	-6.06	-8.52	-4.74	-6.08	-7.26	-4.17	-4.37	-6.38	-2.26

01/01/2058 0:00	2058	-6.75	-8.16	-4.49	-5.6	-6.81	-4.1	-3.93	-5.68	-2.64
01/01/2059 0:00	2059	-6.67	-7.93	-3.39	-5.69	-7.09	-4.37	-4.15	-5.7	-2.19
01/01/2060 0:00	2060	-6.09	-7.21	-4.32	-5.56	-7.11	-3.59	-4.41	-6.38	-1.63
01/01/2061 0:00	2061	-6.26	-7.8	-4.26	-5.12	-6.78	-4.11	-4.61	-5.65	-2.19
01/01/2062 0:00	2062	-5.63	-7.91	-3.25	-6.06	-7.11	-2.75	-4.3	-5.24	-1.98
01/01/2063 0:00	2063	-6.48	-8.36	-4.85	-5.6	-7.13	-2	-3.37	-5.44	-1.54
01/01/2064 0:00	2064	-6.22	-8.18	-4.93	-5.04	-6.48	-3.74	-3.43	-5.82	-2.08
01/01/2065 0:00	2065	-6.29	-7.21	-4.59	-5.08	-6.62	-3.37	-3.64	-5.44	-2.22
01/01/2066 0:00	2066	-6.43	-7.68	-4.44	-4.99	-6.22	-3.16	-3.81	-5.95	-1.37
01/01/2067 0:00	2067	-6.59	-7.88	-5.58	-4.57	-6.53	-3.2	-3.55	-4.91	-0.96
01/01/2068 0:00	2068	-6.44	-7.4	-4.5	-5.09	-6.7	-2.9	-3.46	-5.25	-1.16
01/01/2069 0:00	2069	-6.02	-7.81	-4.75	-5.59	-7.13	-3.7	-2.64	-4.43	-1.29
01/01/2070 0:00	2070	-6.49	-7.76	-4.61	-5.02	-6.1	-3.47	-3.17	-5.08	-0.67
01/01/2071 0:00	2071	-6.26	-7.78	-3.95	-4.87	-6.44	-2.98	-3.12	-5.33	-1.02
01/01/2072 0:00	2072	-6.22	-8.27	-5.14	-5.07	-6.44	-3.34	-3.18	-4.93	-1.18
01/01/2073 0:00	2073	-6.83	-7.68	-4.3	-5.12	-7.17	-3.24	-3.1	-4.33	-0.08
01/01/2074 0:00	2074	-6.24	-7.27	-4.7	-5.27	-6.76	-3.74	-2.91	-4.51	-0.12
01/01/2075 0:00	2075	-6.54	-7.5	-5.03	-4.69	-6.1	-3.4	-2.64	-4.42	-0.4
01/01/2076 0:00	2076	-5.54	-7.16	-4.6	-4.91	-7.07	-3.96	-2.77	-4.15	-0.15
01/01/2077 0:00	2077	-6.67	-8.22	-5.65	-5.1	-6.96	-2.71	-2.43	-4.32	0.19
01/01/2078 0:00	2078	-6.73	-8.17	-4.49	-4.45	-6.58	-2.28	-1.7	-4.39	0
01/01/2079 0:00	2079	-6.24	-7.98	-4.05	-4.84	-6.34	-2.74	-1.9	-3.73	-0.46
01/01/2080 0:00	2080	-6.16	-7.47	-4.93	-5.13	-6.01	-3.72	-2.61	-3.75	0.42
01/01/2081 0:00	2081	-6.74	-8.17	-4.65	-4.72	-6.24	-3.21	-2.76	-3.73	0.72
01/01/2082 0:00	2082	-5.83	-7.19	-4.81	-4.68	-5.84	-2.88	-1.83	-3.16	1.27
01/01/2083 0:00	2083	-6.38	-7.72	-4.49	-4.4	-6.84	-2.59	-1.19	-3.74	0.64
01/01/2084 0:00	2084	-6.58	-7.84	-4.73	-4.33	-6.13	-2.07	-2.02	-3.38	-0.16
01/01/2085 0:00	2085	-6.74	-7.9	-4.21	-4.93	-6.54	-2.57	-1.94	-3.77	0.91
01/01/2086 0:00	2086	-6.17	-7.31	-4.68	-4.81	-6.25	-3.03	-1.78	-3.67	-0.12
01/01/2087 0:00	2087	-6.41	-7.7	-3.19	-4.79	-6.18	-3.56	-1.2	-3.43	-0.03
01/01/2088 0:00	2088	-5.87	-7.02	-4	-4.94	-6.9	-3.16	-1.87	-4.07	1.04
01/01/2089 0:00	2089	-5.79	-7.84	-4.37	-5.06	-6.21	-2.48	-1.36	-3.54	0.99
01/01/2090 0:00	2090	-6.29	-8.27	-4.52	-4.32	-6.21	-2.38	-1.55	-4.04	0.13
01/01/2091 0:00	2091	-6.29	-7.84	-4.61	-4.82	-5.97	-3.09	-0.71	-2.74	1.89
01/01/2092 0:00	2092	-6.27	-7.62	-4.44	-4.91	-6.35	-2.62	-1.39	-3.27	0.95
01/01/2093 0:00	2093	-6.39	-7.75	-4.52	-4.99	-6.12	-3.37	-1.17	-3.41	1.49
01/01/2094 0:00	2094	-6.58	-8.01	-5.22	-4.83	-6.73	-2.53	-0.97	-3.38	0.93

01/01/2095 0:00	2095	-6.45	-7.92	-4.36	-4.94	-6	-2.89	-1.65	-3.06	1.55
01/01/2096 0:00	2096	-6.45	-7.76	-4.77	-4.02	-5.77	-3.25	-0.72	-3.54	1.61
01/01/2097 0:00	2097	-6.1	-7.49	-4.83	-4.77	-6.65	-2.64	-0.65	-1.86	2.5
01/01/2098 0:00	2098	-6.66	-8.23	-5.05	-4.54	-6.38	-2.21	-0.36	-2.93	2.5
01/01/2099 0:00	2099	-6.16	-7.49	-4.09	-4.36	-5.87	-2.41	-0.42	-2.8	2.77

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	26.83	34.21									
01/01/1951 0:00	1951	26.04	31.32									
01/01/1952 0:00	1952	26.61	32.96									
01/01/1953 0:00	1953	24.04	31.42									
01/01/1954 0:00	1954	26.93	32.87									
01/01/1955 0:00	1955	26.34	33.01									
01/01/1956 0:00	1956	25.93	34.47									
01/01/1957 0:00	1957	27.2	33.68									
01/01/1958 0:00	1958	26.27	32.72									
01/01/1959 0:00	1959	26.27	32.44									
01/01/1960 0:00	1960	26.36	34.79									
01/01/1961 0:00	1961	27.25	31.77									
01/01/1962 0:00	1962	25.76	30.05									
01/01/1963 0:00	1963	25.93	31.21									
01/01/1964 0:00	1964	27.15	31.56									
01/01/1965 0:00	1965	27.01	31.58									
01/01/1966 0:00	1966	26.72	34.25									
01/01/1967 0:00	1967	27.16	31.43									
01/01/1968 0:00	1968	26.81	32.43									
01/01/1969 0:00	1969	25.94	30.7									
01/01/1970 0:00	1970	26.8	34.55									
01/01/1971 0:00	1971	26.92	34.14									
01/01/1972 0:00	1972	25.11	31.35									
01/01/1973 0:00	1973	26.22	31.75									
01/01/1974 0:00	1974	26.16	31.04									
01/01/1975 0:00	1975	26.66	31.19									
01/01/1976 0:00	1976	26.2	32.58									
01/01/1977 0:00	1977	26.01	33.44									
01/01/1978 0:00	1978	28.09	33.11									
01/01/1979 0:00	1979	27.5	32.82									
01/01/1980 0:00	1980	27.44	33.63									
01/01/1981 0:00	1981	26.91	33.61									
01/01/1982 0:00	1982	26.96	31.84									
01/01/1983 0:00	1983	26.26	32.51									

01/01/1984 0:00	1984	26.91	34.28									
01/01/1985 0:00	1985	26.65	33.37									
01/01/1986 0:00	1986	26.2	33.8									
01/01/1987 0:00	1987	26.37	31.87									
01/01/1988 0:00	1988	27.01	33.25									
01/01/1989 0:00	1989	27.14	34.95									
01/01/1990 0:00	1990	27.36	33.04									
01/01/1991 0:00	1991	26.78	31.6									
01/01/1992 0:00	1992	26.14	32.16									
01/01/1993 0:00	1993	26.85	32.58									
01/01/1994 0:00	1994	25.84	33.78									
01/01/1995 0:00	1995	27.17	32.56									
01/01/1996 0:00	1996	26.09	31.05									
01/01/1997 0:00	1997	26.74	32.75									
01/01/1998 0:00	1998	28.14	31.87									
01/01/1999 0:00	1999	27.46	32.16									
01/01/2000 0:00	2000	27.45	31.25									
01/01/2001 0:00	2001	26.05	33.16									
01/01/2002 0:00	2002	27.91	32.43									
01/01/2003 0:00	2003	25.7	32.83									
01/01/2004 0:00	2004	26.38	32.83									
01/01/2005 0:00	2005	26.99	32.83	30.64	26.99	32.83	30.49	27.12	32.83	30.43	27.05	32.83
01/01/2006 0:00	2006			29.41	27.2	32.33	30.46	27.53	33.9	30.61	26.89	33.43
01/01/2007 0:00	2007			28.67	27.16	31.92	30.53	27.07	33.47	29.67	27.63	35.04
01/01/2008 0:00	2008			29.18	25.96	34.22	30.39	27.52	33.08	30.01	27.25	32.64
01/01/2009 0:00	2009			29.96	26.95	34.71	30.01	26.78	34.44	31.01	27.74	33.29
01/01/2010 0:00	2010			29.58	27.06	32.44	30.66	27.16	32.49	28.65	26.05	33.09
01/01/2011 0:00	2011			30.03	26.92	32.19	30.61	28.52	32.49	30.36	28.01	34.83
01/01/2012 0:00	2012			30.39	27.25	34.03	29.86	27.34	34.31	29.98	27.2	32.22
01/01/2013 0:00	2013			29.89	26.98	32.78	30.46	26.25	35.58	30.36	27.24	32.54
01/01/2014 0:00	2014			30.39	27.36	33.15	30.86	28.05	33.09	29.75	28.43	32.25
01/01/2015 0:00	2015			30.3	27.84	34.34	30.45	27.98	33.39	30.14	28.25	34.83
01/01/2016 0:00	2016			31.06	26.91	34.59	29.02	26.82	32.71	30.83	28.35	34.52
01/01/2017 0:00	2017			31.76	27.03	34.96	30.04	28.38	33.62	30.25	28.21	34
01/01/2018 0:00	2018			30.94	27.53	34.59	31.44	28.54	34.6	30.75	27.82	33.35
01/01/2019 0:00	2019			30.19	27.61	34.89	30.76	27.68	35.75	30.19	27.87	33.6
01/01/2020 0:00	2020			29.45	26.81	33.94	29.28	27.06	34.49	31.72	27.98	34.53

01/01/2021 0:00	2021	31.68	27.56	35.19	30.87	28.44	35.68	30.39	28.96	33.25
01/01/2022 0:00	2022	31.46	28.44	36	30.57	26.78	34.3	31.6	27.99	35.48
01/01/2023 0:00	2023	30.02	28.55	35.01	31.19	27.9	33.15	31.26	28.15	34.96
01/01/2024 0:00	2024	31.75	27.52	34.97	32.06	28.28	37	31.23	27.38	34.07
01/01/2025 0:00	2025	31.81	28.34	33.5	31.07	29.66	33.7	31.32	28.18	34.78
01/01/2026 0:00	2026	31.53	28.7	34.59	31.34	28.91	34.81	31.29	29.11	36.3
01/01/2027 0:00	2027	30.27	28.82	33.4	31.22	28.89	33.97	32.28	27.93	36.28
01/01/2028 0:00	2028	30.93	28.44	32.82	31.14	29.02	34.67	31.26	26.89	34.82
01/01/2029 0:00	2029	31.29	27.31	34.97	31.29	27.74	35.32	31.17	29.45	35.47
01/01/2030 0:00	2030	31.37	27.8	33.32	31.49	28.11	33.72	30.99	28.31	33.76
01/01/2031 0:00	2031	31.78	28.54	35.13	30.88	28.34	35.69	30.74	26.99	37.42
01/01/2032 0:00	2032	30.23	27.33	33.22	31.1	28.02	33.32	30.73	29.32	33.93
01/01/2033 0:00	2033	31.58	27.74	35.22	32.44	27.79	35.89	31.16	28.29	37.02
01/01/2034 0:00	2034	31.89	28.83	36.18	31.91	28.23	36.27	31.19	28.36	36.34
01/01/2035 0:00	2035	31.2	28.7	34.03	31.24	29.16	34.2	32.21	28.82	35.5
01/01/2036 0:00	2036	31.87	28.61	35.29	32.14	27.56	34.41	31.37	29.02	33.15
01/01/2037 0:00	2037	29.87	28.25	32.71	30.51	27.55	34.55	31.37	28.61	35.14
01/01/2038 0:00	2038	29.79	28.06	31.94	30.7	28.48	36.31	32.95	29.76	37.1
01/01/2039 0:00	2039	31.55	28.73	34.91	30.88	28.2	34.89	32.05	29.29	34.19
01/01/2040 0:00	2040	30.3	28.48	33.14	30.86	28.69	34.76	31.67	27.4	35.36
01/01/2041 0:00	2041	31.33	28.48	35.81	31.6	28.47	34.75	31.42	29.04	34.93
01/01/2042 0:00	2042	31.1	28.72	36.76	30.84	28.12	36.17	30.94	27.8	33.53
01/01/2043 0:00	2043	30.84	27.74	33.36	31.99	30.25	35.84	32.09	28.59	35.64
01/01/2044 0:00	2044	31.37	27.26	34.53	32.49	29.68	36.69	32.41	28.03	37.99
01/01/2045 0:00	2045	30.99	27.82	34.2	30.84	27.94	35.32	31.38	29.27	36.26
01/01/2046 0:00	2046	30.66	28.42	34.94	31.85	28.43	35.3	31.78	29.75	35.89
01/01/2047 0:00	2047	32.16	26.86	36.13	31.2	29.05	36.05	32.12	29.9	35.73
01/01/2048 0:00	2048	30.67	27.22	35.68	31.31	29.3	35.56	32.33	28.62	35.31
01/01/2049 0:00	2049	31.15	28.07	35.92	31.32	29.02	36.82	32.5	29.52	35.41
01/01/2050 0:00	2050	31.39	28.06	34.59	32.28	29.45	37.68	33.44	30.48	38.57
01/01/2051 0:00	2051	30.95	27.77	33.27	31.21	28.65	34.21	32.5	29.15	35.14
01/01/2052 0:00	2052	30.72	27.97	34.18	31.68	29.35	34.65	32.67	31.11	35.55
01/01/2053 0:00	2053	31.35	28.28	35.55	31.27	28.21	35.12	32.7	30.14	38.37
01/01/2054 0:00	2054	31.92	29.57	35.51	30.72	27.92	35.12	32.84	30.05	36.98
01/01/2055 0:00	2055	31.73	29.31	35.51	32.05	29	37.5	33.81	28.45	37.13
01/01/2056 0:00	2056	30.88	28.08	33.99	31.96	28.79	34.52	33.53	28.43	37.22
01/01/2057 0:00	2057	30.78	28	34.72	30.69	27.58	36.11	33.71	29.46	37.31

01/01/2058 0:00	2058	31.27	28.64	36.42	32.51	29.31	34.89	33.98	30.4	38.82
01/01/2059 0:00	2059	30.8	28.28	35.13	31.53	29.14	34.67	33.92	30.2	37.52
01/01/2060 0:00	2060	30.86	28.57	33.93	32.73	29.22	35.86	33.9	30.35	38.51
01/01/2061 0:00	2061	32.04	28.03	34.54	32.67	29.17	37.46	33.6	29.04	37.61
01/01/2062 0:00	2062	32.37	29.25	36.26	31.39	28.67	36.02	34.4	31.69	37.18
01/01/2063 0:00	2063	30	26.88	34.01	31.14	28.32	34.47	34.98	29.44	40.24
01/01/2064 0:00	2064	31.3	28.92	33.75	32.2	29.68	37.47	33.29	28.37	35.81
01/01/2065 0:00	2065	31.61	29.13	33.82	32.12	28.65	36.33	35.81	30.86	39.66
01/01/2066 0:00	2066	31.49	27.7	33.44	32.23	28.95	36.14	35.2	31.69	40.34
01/01/2067 0:00	2067	31.69	27.06	33.91	32.44	30.08	35.99	34.94	31.79	38.73
01/01/2068 0:00	2068	31.07	28.99	35.43	31.52	29.91	34.82	33.74	31.4	39.96
01/01/2069 0:00	2069	30.66	29.54	33.67	33.33	30.51	35.5	34.48	31.14	37.61
01/01/2070 0:00	2070	31.34	28.41	35.92	32.83	29.55	37.61	34.26	29.31	37.94
01/01/2071 0:00	2071	31.23	27.84	35.54	32.27	29.45	34.02	34.28	29.78	38.98
01/01/2072 0:00	2072	31.5	28	36.49	32.78	30.59	36.58	34.64	30.57	38.86
01/01/2073 0:00	2073	30.78	27.39	34.76	31.97	29.82	36.99	33.18	32.16	40.31
01/01/2074 0:00	2074	30.18	27.96	35.67	32.75	30.69	37.05	34.84	30.09	39.94
01/01/2075 0:00	2075	31.95	27.76	37.36	32.91	28.96	37.74	34.71	30.5	38.8
01/01/2076 0:00	2076	31.62	27.97	34.8	32.64	28.63	36.53	35.11	32.66	37.5
01/01/2077 0:00	2077	31.38	28.21	36.11	33.41	30.03	38.61	36.09	30.47	40.75
01/01/2078 0:00	2078	31.14	28.62	35.4	33.39	28.9	37.16	35.33	32.01	40.83
01/01/2079 0:00	2079	31.16	28.62	35.2	33.15	29.51	35.58	34.67	31.53	39.38
01/01/2080 0:00	2080	31.51	29.52	35.47	32.41	29.68	37.34	34.68	32.18	37.92
01/01/2081 0:00	2081	31.53	28.96	37.71	31.79	29.76	35.18	36.51	32.03	39.78
01/01/2082 0:00	2082	30.68	28.94	34.83	32.42	29.57	36.87	35.97	32.54	39.6
01/01/2083 0:00	2083	31.96	28.88	36.51	31.99	29.43	37.04	36.11	32.14	39.33
01/01/2084 0:00	2084	31.27	28.34	34.58	33.46	30.16	36.43	34.79	31.18	38.87
01/01/2085 0:00	2085	31.12	27.84	34.5	32.52	29.77	37.19	35.73	32.22	40.42
01/01/2086 0:00	2086	31.91	27.3	36.39	32.45	29.6	37.23	35.2	32.37	41.01
01/01/2087 0:00	2087	32	28.51	35.42	33.31	28.83	36.22	35.69	32.09	39.06
01/01/2088 0:00	2088	31.19	28.54	34.91	33.05	28.88	36.55	35.29	31.02	38.29
01/01/2089 0:00	2089	30.89	29.16	34.08	33.46	29.2	37.63	36.37	31.86	39.83
01/01/2090 0:00	2090	31.2	28.58	34.57	33.21	29.09	37.1	36.13	32.51	42.19
01/01/2091 0:00	2091	30.83	28.96	34.02	32.5	29.24	36.2	36.77	31.99	43.57
01/01/2092 0:00	2092	32.37	27.52	34.2	32.38	29.45	36.35	35.62	32.52	38.94
01/01/2093 0:00	2093	31.71	28.87	35.09	32.04	28.84	35.02	35.88	32.98	39.35
01/01/2094 0:00	2094	31.65	27.07	35.47	32.8	29.24	36.62	36.03	31.71	41.31

01/01/2095 0:00	2095	30.75	28.51	33.02	32.98	29.19	38.51	36.09	31.64	40.14
01/01/2096 0:00	2096	32.11	28.7	34.41	33.17	30.33	37.55	36.68	31.51	41.07
01/01/2097 0:00	2097	31.65	27.39	36.13	31.8	29.21	37.95	36.19	34.67	40.13
01/01/2098 0:00	2098	31.06	27.15	35.69	33.06	29.39	38.62	37.38	32.75	41.45
01/01/2099 0:00	2099	30.81	27.78	33.54	33.12	29.6	37.46	37.48	31.8	44.62

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	-47.8	-41.88									
01/01/1951 0:00	1951	-48.95	-42.7									
01/01/1952 0:00	1952	-47.31	-42.45									
01/01/1953 0:00	1953	-48.99	-41.68									
01/01/1954 0:00	1954	-47.54	-42.2									
01/01/1955 0:00	1955	-47.79	-42									
01/01/1956 0:00	1956	-47.22	-41									
01/01/1957 0:00	1957	-47.69	-40.71									
01/01/1958 0:00	1958	-49.02	-43.46									
01/01/1959 0:00	1959	-46.61	-43.46									
01/01/1960 0:00	1960	-47.63	-42.6									
01/01/1961 0:00	1961	-48.34	-40.49									
01/01/1962 0:00	1962	-47.78	-40.71									
01/01/1963 0:00	1963	-47.3	-41.84									
01/01/1964 0:00	1964	-48.57	-43.15									
01/01/1965 0:00	1965	-48.68	-41.42									
01/01/1966 0:00	1966	-47.41	-43.21									
01/01/1967 0:00	1967	-47.08	-40.94									
01/01/1968 0:00	1968	-47.28	-43.17									
01/01/1969 0:00	1969	-48.9	-41.94									
01/01/1970 0:00	1970	-47.81	-42.83									
01/01/1971 0:00	1971	-48.47	-42.54									
01/01/1972 0:00	1972	-49.02	-42.13									
01/01/1973 0:00	1973	-47.09	-42.82									
01/01/1974 0:00	1974	-47.93	-42.7									
01/01/1975 0:00	1975	-46.15	-42.04									
01/01/1976 0:00	1976	-47.27	-43.32									
01/01/1977 0:00	1977	-46.64	-40.56									
01/01/1978 0:00	1978	-47.12	-41.13									
01/01/1979 0:00	1979	-47.52	-41.34									
01/01/1980 0:00	1980	-48.37	-42.66									
01/01/1981 0:00	1981	-48.84	-42.68									
01/01/1982 0:00	1982	-47.05	-42.49									
01/01/1983 0:00	1983	-48.38	-40.68									

01/01/1984 0:00	1984	-46.28	-41.54									
01/01/1985 0:00	1985	-48.02	-42.15									
01/01/1986 0:00	1986	-48.63	-39.51									
01/01/1987 0:00	1987	-48.05	-40.15									
01/01/1988 0:00	1988	-47.65	-42.21									
01/01/1989 0:00	1989	-46.98	-40.91									
01/01/1990 0:00	1990	-47.6	-40.95									
01/01/1991 0:00	1991	-47.92	-41.08									
01/01/1992 0:00	1992	-46.36	-41.92									
01/01/1993 0:00	1993	-46.95	-39.95									
01/01/1994 0:00	1994	-48.46	-42.09									
01/01/1995 0:00	1995	-47.38	-41.15									
01/01/1996 0:00	1996	-47.85	-40.51									
01/01/1997 0:00	1997	-47.28	-40.96									
01/01/1998 0:00	1998	-46.72	-41.07									
01/01/1999 0:00	1999	-45.02	-40.26									
01/01/2000 0:00	2000	-47.02	-40.43									
01/01/2001 0:00	2001	-47.16	-40.51									
01/01/2002 0:00	2002	-46.86	-40.2									
01/01/2003 0:00	2003	-45.71	-40.38									
01/01/2004 0:00	2004	-46.04	-38.16									
01/01/2005 0:00	2005	-47.78	-40.27	-43.08	-47.78	-40.27	-43.03	-47.26	-40.42	-42.97	-46.83	-40.43
01/01/2006 0:00	2006			-42.76	-45.89	-41.12	-41.33	-45.6	-38.91	-42.71	-45.12	-38.85
01/01/2007 0:00	2007			-43.51	-47.49	-41.4	-43.37	-45.66	-40.99	-43.16	-44.61	-40.15
01/01/2008 0:00	2008			-43.6	-47.39	-39.75	-42.79	-44.32	-41.13	-42.83	-44.15	-40.55
01/01/2009 0:00	2009			-41.91	-45.13	-40.04	-42.98	-46.48	-38.9	-43.07	-46.41	-40.26
01/01/2010 0:00	2010			-41.82	-45.75	-39.87	-42.55	-46.06	-39.97	-41.95	-45.81	-39.84
01/01/2011 0:00	2011			-42.73	-46.99	-38.18	-41.98	-45.91	-39.74	-42.18	-45.32	-40.21
01/01/2012 0:00	2012			-43.25	-46.26	-41.46	-42.7	-45.29	-40.11	-43.72	-45.57	-40.56
01/01/2013 0:00	2013			-42.09	-44.91	-39.92	-42.99	-46.19	-40.7	-42.99	-47.84	-39.11
01/01/2014 0:00	2014			-42.42	-44.78	-39.65	-42.87	-47.65	-38.47	-41.94	-45.75	-37.5
01/01/2015 0:00	2015			-42.17	-45.98	-39.16	-42.37	-45.76	-39.78	-43.22	-44.74	-40.5
01/01/2016 0:00	2016			-40.99	-44.75	-38.54	-42.77	-47.32	-39.5	-41.53	-43.54	-38.68
01/01/2017 0:00	2017			-43.69	-48.39	-39.48	-43.42	-46.93	-40.17	-41.74	-44.84	-38.1
01/01/2018 0:00	2018			-42.38	-45.45	-38.51	-42.95	-46.16	-40.89	-42.02	-44.02	-39.56
01/01/2019 0:00	2019			-43.49	-45.36	-40.54	-42.05	-44.01	-38.47	-41.63	-44.45	-39.21
01/01/2020 0:00	2020			-42.08	-45.37	-38.75	-41.88	-46.03	-39.58	-42.74	-45.58	-39.08

01/01/2021 0:00	2021	-42.67	-46.01	-39.94	-42.36	-44.04	-39.19	-42.27	-45.64	-39.6
01/01/2022 0:00	2022	-43.22	-47.18	-39.24	-42.86	-47.91	-40.54	-41.55	-43.67	-39.17
01/01/2023 0:00	2023	-42.36	-44.75	-40.07	-42.73	-46.69	-37.97	-41.17	-44.05	-39.62
01/01/2024 0:00	2024	-42.47	-43.69	-38.47	-42.17	-44.15	-38.87	-42.17	-44.72	-39.06
01/01/2025 0:00	2025	-43.19	-46.36	-38.76	-42.18	-45.67	-39.57	-41.5	-45.59	-38.44
01/01/2026 0:00	2026	-42.49	-46.59	-38.88	-43.07	-45.37	-38.52	-41.07	-44.76	-38.89
01/01/2027 0:00	2027	-42	-44.18	-38	-41.81	-43.86	-38.63	-41.58	-43.88	-39.03
01/01/2028 0:00	2028	-42.21	-44.5	-37.97	-40.31	-44.5	-37.64	-41.17	-43.97	-38.08
01/01/2029 0:00	2029	-42.08	-47.13	-39.1	-43.06	-46.13	-40.13	-41.45	-42.95	-39.81
01/01/2030 0:00	2030	-41.82	-46.43	-37.47	-40.9	-43.14	-38.39	-41.51	-45.51	-38.27
01/01/2031 0:00	2031	-42.58	-47.69	-37.13	-43.6	-45.61	-39.96	-41.39	-43.99	-38.55
01/01/2032 0:00	2032	-42.05	-46.73	-38.41	-41.87	-45.6	-38.74	-41.38	-43.95	-36.98
01/01/2033 0:00	2033	-41.15	-45.12	-38.81	-41.95	-43.62	-37.05	-41.57	-44.5	-36.47
01/01/2034 0:00	2034	-42.58	-45.88	-37.77	-42.32	-44.34	-37.95	-41.54	-47.06	-37.09
01/01/2035 0:00	2035	-42.28	-44.7	-38.14	-41.41	-45.4	-38.42	-41.24	-44.98	-36.99
01/01/2036 0:00	2036	-41.5	-44.56	-37.38	-42.39	-46.84	-39.88	-42.47	-45.09	-38.36
01/01/2037 0:00	2037	-41.56	-45.77	-37.74	-41.27	-45.27	-37.46	-40.7	-43.32	-38.78
01/01/2038 0:00	2038	-41.66	-43.52	-37.52	-41.12	-44.5	-38.85	-40.94	-44.95	-36.76
01/01/2039 0:00	2039	-41.78	-44.72	-38.29	-41.14	-44.37	-38.46	-41.74	-44.74	-37.29
01/01/2040 0:00	2040	-41.48	-44.48	-38.49	-41.96	-44.93	-37.29	-40	-43.78	-37.64
01/01/2041 0:00	2041	-41.66	-44.79	-37.24	-40.74	-47.45	-38.04	-40.2	-43.68	-38.02
01/01/2042 0:00	2042	-41.24	-44.04	-38.61	-40.74	-43.27	-38.17	-39.78	-42.22	-36.66
01/01/2043 0:00	2043	-41.93	-43.55	-38.61	-40.43	-43.93	-36.59	-39.86	-42.19	-34.97
01/01/2044 0:00	2044	-40.39	-43.86	-37.83	-40.3	-43.38	-37.81	-38.45	-42.13	-35.94
01/01/2045 0:00	2045	-41.65	-43.97	-38.83	-40.07	-43.55	-35.48	-38.16	-44.73	-36.34
01/01/2046 0:00	2046	-41.89	-44.4	-37.38	-41.05	-43.28	-36.59	-39.05	-41.09	-35.41
01/01/2047 0:00	2047	-39.57	-43.64	-37.97	-40.04	-43.2	-36.94	-39.15	-42.85	-36.7
01/01/2048 0:00	2048	-41.3	-46.1	-36.93	-40.5	-45.62	-36.57	-37.07	-42.16	-34.34
01/01/2049 0:00	2049	-41.11	-44.42	-38.76	-40.02	-45.11	-36.38	-38.34	-41.67	-34.53
01/01/2050 0:00	2050	-41.7	-44.2	-37.63	-41.09	-42.77	-36.99	-38.57	-44.26	-35.36
01/01/2051 0:00	2051	-40.89	-43.06	-38.2	-40.61	-44.02	-36.62	-39.19	-43.05	-35.88
01/01/2052 0:00	2052	-41.84	-45.87	-37.26	-39.38	-41.54	-37.83	-39.42	-43.05	-36.21
01/01/2053 0:00	2053	-41.6	-45.13	-37.47	-39.71	-43.55	-37.11	-38.36	-42.01	-34.27
01/01/2054 0:00	2054	-41.53	-45.37	-39.08	-40.53	-45.04	-36.64	-38.32	-41.02	-35.12
01/01/2055 0:00	2055	-41.11	-45.48	-37.86	-39.94	-43.76	-34.99	-38.54	-41.83	-34.74
01/01/2056 0:00	2056	-40.73	-43.9	-37.03	-39.72	-42.4	-36.51	-37.49	-41.35	-34.37
01/01/2057 0:00	2057	-41.23	-44.86	-38.65	-40.45	-44.56	-37.05	-38.44	-39.99	-32.17

01/01/2058 0:00	2058	-41.28	-45.5	-38.63	-39.65	-41.88	-35.9	-37.17	-40.9	-33.55
01/01/2059 0:00	2059	-41.91	-45.3	-38.26	-40.14	-42.81	-36.09	-38.27	-42.38	-32.73
01/01/2060 0:00	2060	-41.2	-44.25	-38.39	-40.55	-44.81	-36.33	-36.99	-41.58	-33.01
01/01/2061 0:00	2061	-40.56	-43.86	-37.44	-40.71	-42.66	-36.04	-37.78	-40.08	-33.94
01/01/2062 0:00	2062	-41.41	-43.85	-36.3	-40.78	-43.41	-34.44	-37.39	-40.2	-34.59
01/01/2063 0:00	2063	-41.73	-44.57	-38.74	-39.52	-43.22	-35.21	-36.46	-41.36	-33.42
01/01/2064 0:00	2064	-42.12	-44.74	-39.56	-39.73	-42.79	-35.54	-36.83	-40.67	-32.91
01/01/2065 0:00	2065	-41.02	-44.4	-37.75	-39.73	-41.87	-35.23	-36.72	-40.46	-32.36
01/01/2066 0:00	2066	-41.39	-44.71	-36.71	-39.32	-41.89	-33.94	-37.64	-41.26	-31.92
01/01/2067 0:00	2067	-41.21	-46.01	-38.58	-39.32	-42.12	-35.31	-37.29	-39.41	-33.44
01/01/2068 0:00	2068	-40.32	-42.71	-38.31	-38.97	-40.7	-34.86	-37.64	-43.04	-33.04
01/01/2069 0:00	2069	-39.97	-43.48	-37.55	-40.38	-43.81	-36	-33.69	-39.87	-31.95
01/01/2070 0:00	2070	-41.15	-44.04	-38.09	-38.95	-40.7	-35.88	-34.63	-39.89	-32.35
01/01/2071 0:00	2071	-40.38	-44.13	-38.47	-38.27	-40.64	-35.88	-34.86	-38	-30.41
01/01/2072 0:00	2072	-42.02	-45.38	-37.36	-38.58	-41.63	-35.06	-36.97	-40.05	-31.07
01/01/2073 0:00	2073	-40.76	-44	-36.69	-39.43	-42.99	-35.54	-34.93	-41.11	-30.1
01/01/2074 0:00	2074	-40.03	-43.96	-35.79	-38.13	-42.86	-35.28	-34.62	-38.95	-31.24
01/01/2075 0:00	2075	-41.1	-43.98	-37.66	-38.94	-42.22	-35.75	-33.47	-37.62	-31.12
01/01/2076 0:00	2076	-40.51	-44.52	-38.63	-39	-43.01	-36.09	-34.89	-38.8	-29.78
01/01/2077 0:00	2077	-41.29	-44.21	-38.21	-39.59	-45.06	-34.79	-34.94	-39.35	-29.16
01/01/2078 0:00	2078	-41.79	-44.5	-37.66	-38.46	-41.19	-35	-33.7	-37.42	-29.53
01/01/2079 0:00	2079	-41.01	-43.61	-37.84	-38.19	-42.62	-35.22	-35.06	-39.07	-31
01/01/2080 0:00	2080	-41.38	-44.28	-37.69	-39.82	-42.93	-35.44	-32.39	-38.48	-27.99
01/01/2081 0:00	2081	-41.21	-46.64	-37.64	-38.57	-40.78	-34.89	-32.98	-37.1	-27.48
01/01/2082 0:00	2082	-40.6	-44.66	-38.12	-39.42	-43.36	-34.04	-34.48	-38.55	-27.18
01/01/2083 0:00	2083	-41.53	-42.89	-37.64	-38.66	-40.79	-35.25	-32.93	-38.5	-28.39
01/01/2084 0:00	2084	-41.43	-44.51	-39.21	-38.36	-42.05	-33.64	-33.43	-37.09	-29.32
01/01/2085 0:00	2085	-41.85	-44.4	-38.51	-38.15	-42.83	-35.11	-33.93	-37.06	-29.02
01/01/2086 0:00	2086	-41.33	-45.54	-39.19	-39.05	-43.23	-36.26	-34.29	-36.82	-29.49
01/01/2087 0:00	2087	-40.92	-45.31	-36.6	-38.08	-41.34	-35.59	-32.33	-37.82	-28.12
01/01/2088 0:00	2088	-40.49	-44.83	-37.41	-39.11	-40.96	-35.51	-32.95	-37.21	-28.47
01/01/2089 0:00	2089	-40.16	-43.5	-37.2	-38.68	-40.6	-34.55	-32.42	-37.51	-28.87
01/01/2090 0:00	2090	-40.99	-43.92	-37.91	-37.54	-41.98	-34.04	-33.57	-35.86	-27.16
01/01/2091 0:00	2091	-40.62	-44.7	-37.83	-38.43	-40.62	-35.65	-32.5	-36.06	-27.9
01/01/2092 0:00	2092	-41.68	-44.47	-37.13	-39.7	-42.33	-34.48	-32.38	-37.24	-27.38
01/01/2093 0:00	2093	-40.58	-43.09	-38.27	-38.73	-40.85	-35.71	-34.55	-37.23	-25.94
01/01/2094 0:00	2094	-41.73	-44.63	-39.42	-38.36	-41.34	-34.57	-31.97	-36.58	-26.14

01/01/2095 0:00	2095	-40.92	-44	-37.43	-38.61	-43.79	-34.98	-33.3	-35.85	-27.38
01/01/2096 0:00	2096	-39.91	-43.14	-37.03	-39.36	-42.03	-34.93	-31.77	-36.69	-28.39
01/01/2097 0:00	2097	-41.39	-45.7	-39	-39.13	-40.46	-36.11	-31.01	-34.64	-27.1
01/01/2098 0:00	2098	-41.32	-45.75	-39.31	-39.15	-40.56	-34.46	-32	-37.93	-27.43
01/01/2099 0:00	2099	-40.88	-44.76	-37.24	-39.32	-41.98	-34.24	-30.85	-34.37	-24.19

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	4.3	24.9									
01/01/1951 0:00	1951	3.3	23.7									
01/01/1952 0:00	1952	4.3	23.7									
01/01/1953 0:00	1953	0	24.1									
01/01/1954 0:00	1954	4.3	30.3									
01/01/1955 0:00	1955	3.6	25									
01/01/1956 0:00	1956	4	24.8									
01/01/1957 0:00	1957	4.3	30									
01/01/1958 0:00	1958	3.3	21									
01/01/1959 0:00	1959	2	24.7									
01/01/1960 0:00	1960	4.3	28.9									
01/01/1961 0:00	1961	5	19.4									
01/01/1962 0:00	1962	2	15.1									
01/01/1963 0:00	1963	3.3	18									
01/01/1964 0:00	1964	5	21.4									
01/01/1965 0:00	1965	2.6	22.5									
01/01/1966 0:00	1966	2.3	32.1									
01/01/1967 0:00	1967	3	16.7									
01/01/1968 0:00	1968	3.6	18.4									
01/01/1969 0:00	1969	2.3	13.4									
01/01/1970 0:00	1970	6	23									
01/01/1971 0:00	1971	7	27.8									
01/01/1972 0:00	1972	1	30.1									
01/01/1973 0:00	1973	2	18.7									
01/01/1974 0:00	1974	2.3	19									
01/01/1975 0:00	1975	3.3	31.4									
01/01/1976 0:00	1976	2.9	32									
01/01/1977 0:00	1977	1.3	24.6									
01/01/1978 0:00	1978	6.3	21.7									
01/01/1979 0:00	1979	6.3	27.2									
01/01/1980 0:00	1980	5	22.8									
01/01/1981 0:00	1981	3.3	29.1									
01/01/1982 0:00	1982	4	22.5									
01/01/1983 0:00	1983	5	15									

01/01/1984 0:00	1984	3.9	24.4									
01/01/1985 0:00	1985	5.3	28.4									
01/01/1986 0:00	1986	3.3	22									
01/01/1987 0:00	1987	3.3	23.1									
01/01/1988 0:00	1988	5.6	24.7									
01/01/1989 0:00	1989	3.3	29.7									
01/01/1990 0:00	1990	4.9	24.7									
01/01/1991 0:00	1991	4.3	27.1									
01/01/1992 0:00	1992	3	25.8									
01/01/1993 0:00	1993	4.3	28.7									
01/01/1994 0:00	1994	2.3	26.8									
01/01/1995 0:00	1995	3.3	24.7									
01/01/1996 0:00	1996	3	23									
01/01/1997 0:00	1997	5.3	25									
01/01/1998 0:00	1998	9	28.4									
01/01/1999 0:00	1999	4.6	22									
01/01/2000 0:00	2000	7.3	30.6									
01/01/2001 0:00	2001	1.3	30.9									
01/01/2002 0:00	2002	5.9	27.7									
01/01/2003 0:00	2003	1.3	21.7									
01/01/2004 0:00	2004	9.3	31.3									
01/01/2005 0:00	2005	4.6	28.2	16	4.6	28.2	16	3.9	27.9	15.5	3.9	28.9
01/01/2006 0:00	2006			13	6.3	35.1	14.5	6	33.1	15.5	6.6	23
01/01/2007 0:00	2007			20	3	27.1	15	6.3	34.6	13.5	6.3	30.7
01/01/2008 0:00	2008			13.5	2	22.8	17	7.3	40.2	14.5	6	23.7
01/01/2009 0:00	2009			15.5	6.6	25.7	15	6	34.7	20	7	38.4
01/01/2010 0:00	2010			15	6.6	26.4	18	6.2	38.2	14	2.6	37.4
01/01/2011 0:00	2011			15	5.3	24.1	16.5	10	36	17	6.3	31
01/01/2012 0:00	2012			21	6.3	32.2	14.5	4.6	29.1	19.5	10.2	31.7
01/01/2013 0:00	2013			13	3.3	26.1	18	6	26	14	3.9	30.4
01/01/2014 0:00	2014			17	6	30.4	21.5	8.3	36.2	15	7	24.1
01/01/2015 0:00	2015			15.5	8	32.5	18	10.6	27.7	20.5	13	32.7
01/01/2016 0:00	2016			20.5	7.9	42	12.5	3.6	24.7	17	6.6	37.2
01/01/2017 0:00	2017			16	6.6	28.7	19	8.3	27.7	16	9.6	37.8
01/01/2018 0:00	2018			14	8	36.5	17	7.3	30.8	16.5	7	37.1
01/01/2019 0:00	2019			15	8.3	33.2	22.5	10	34.8	21.5	6.3	31.7
01/01/2020 0:00	2020			15	5.3	26.7	16	2.3	28.4	21.5	6.6	32.7

01/01/2021 0:00	2021	20	7.2	36.4	21.5	11.3	38.6	16.5	7.6	35.5
01/01/2022 0:00	2022	20.5	12.3	43.9	16	4.9	30.4	29	11.3	36.4
01/01/2023 0:00	2023	19	6.9	36.1	16.5	9.3	31.1	23	8.3	31.7
01/01/2024 0:00	2024	20.5	11.6	28.7	19.5	7.6	32.7	20.5	8.8	32.7
01/01/2025 0:00	2025	22	12.3	37.5	25	11.9	36.5	20.5	12.6	34
01/01/2026 0:00	2026	22	9.2	39.4	20	12	43	22.5	11.9	41.4
01/01/2027 0:00	2027	21.5	7.3	38.1	21.5	15.3	28	27	11.9	41.1
01/01/2028 0:00	2028	20	8.6	41.5	20.5	9.2	43.6	19	5.6	44.6
01/01/2029 0:00	2029	20.5	7.3	35.1	25.5	6	41.9	23.5	10	42.5
01/01/2030 0:00	2030	20	9.6	33.8	24	8.3	35.7	17	11.6	36.1
01/01/2031 0:00	2031	24	8.9	39.8	23.5	14	42.4	19.5	6	45.7
01/01/2032 0:00	2032	20.5	10	37.4	21.5	9.3	33	24	19	40
01/01/2033 0:00	2033	18	5.9	37	26	8.3	46.4	25.5	11.6	52.8
01/01/2034 0:00	2034	25.5	13.3	39.2	20	7.5	32.4	21.5	10.6	39.4
01/01/2035 0:00	2035	20.5	7.6	42.6	24.5	9.9	32.4	26	11.6	37
01/01/2036 0:00	2036	23	11.3	37.4	23.5	4.3	34.1	23	13.2	38
01/01/2037 0:00	2037	18	9.3	33.9	20	8.9	37.5	27	13	42
01/01/2038 0:00	2038	20	8.5	29.7	19.5	8.9	40.5	28.5	16	45.7
01/01/2039 0:00	2039	31	12	46.4	19.5	10.3	40.5	27	7.8	44.6
01/01/2040 0:00	2040	20.5	10.6	35.7	24.5	8.3	37	24	9.3	41.7
01/01/2041 0:00	2041	31	11.3	47.7	22.5	12.2	38.7	29.5	16.3	43.1
01/01/2042 0:00	2042	21.5	9.3	39.1	22.5	9.3	36	19.5	9.3	38.5
01/01/2043 0:00	2043	21.5	9.3	34.6	24.5	11.3	44	30	8.9	47.4
01/01/2044 0:00	2044	19.5	8.3	33.4	26.5	13	42.2	22	9.9	43.7
01/01/2045 0:00	2045	18.5	7.2	33.4	19	8.3	40	21.5	9.3	41.1
01/01/2046 0:00	2046	22.5	12.6	36.2	25	11.9	48.1	28	12.3	44
01/01/2047 0:00	2047	23.5	5.6	49.2	24.5	12.3	40.8	32.5	16	48.8
01/01/2048 0:00	2048	15	8	39.1	25	15.3	37.4	27	10.2	54.9
01/01/2049 0:00	2049	26	12	38.1	24	10.3	40.4	27.5	17	47.7
01/01/2050 0:00	2050	29	8.3	44.4	28.5	8.3	39	35	18	47.7
01/01/2051 0:00	2051	25.5	3.2	40.4	30	15.3	41.9	35.5	16.6	49.4
01/01/2052 0:00	2052	19.5	10.3	41.7	26.5	17.6	44	34.5	16.6	48
01/01/2053 0:00	2053	24.5	10.3	37.1	24.5	7.3	37.7	35	14.2	53.7
01/01/2054 0:00	2054	21	10.9	39	26.5	8.6	40.1	29	13	53.7
01/01/2055 0:00	2055	25.5	12.3	40.7	28.5	8.9	49.6	37	15.3	54.3
01/01/2056 0:00	2056	20	13	33.8	25	13.6	44.8	37.5	14.5	65.5
01/01/2057 0:00	2057	19	9.3	45.9	26	6	50.8	38	12.1	57.3

01/01/2058 0:00	2058	22.5	11	33.7	28.5	9.9	46	36.5	19	60.6
01/01/2059 0:00	2059	18.5	9.6	35	25	15.6	51.2	40.5	19.9	65.9
01/01/2060 0:00	2060	26	8.3	44.3	35	18.3	42.4	40	20.9	60.7
01/01/2061 0:00	2061	24	8.3	35.1	33	13.3	45.4	34.5	16	64
01/01/2062 0:00	2062	24	12.6	46.2	26.5	12.3	50.4	41	23.3	59.5
01/01/2063 0:00	2063	20	8	29.1	26.5	17	39.8	52.5	21.9	72
01/01/2064 0:00	2064	19.5	10.3	31.7	33.5	19	57	40	14.9	56.4
01/01/2065 0:00	2065	25.5	11.8	38.7	29.5	13.9	43	41	29.6	60.4
01/01/2066 0:00	2066	20	9.9	36.1	29	14.2	42.1	44	18	65.5
01/01/2067 0:00	2067	21.5	6	38.7	32	19.3	51.8	53.5	24.7	75.5
01/01/2068 0:00	2068	25.5	8.9	45.4	31.5	15.1	46	44	27.9	67.7
01/01/2069 0:00	2069	22	14.3	33.7	33	18.3	56.8	45.5	21.1	64.5
01/01/2070 0:00	2070	19.5	12.3	40.8	29	17.2	45.1	33	17.9	56.8
01/01/2071 0:00	2071	21	11	45.5	32.5	17.9	47.1	49.5	22	68.7
01/01/2072 0:00	2072	26	9.4	46.1	35	18.3	48.5	43	22.3	71
01/01/2073 0:00	2073	24	4.8	39.3	26	13	53.8	48	24.8	61.4
01/01/2074 0:00	2074	21	9.3	35	30	12.6	42.1	51	16.4	70.5
01/01/2075 0:00	2075	26	4.3	39	27.5	7.1	43.5	48.5	19	80.6
01/01/2076 0:00	2076	25.5	8.3	42.7	32	6.6	45.4	52	32.3	67.7
01/01/2077 0:00	2077	22	13	35	30.5	17.3	63	48.5	33.9	64
01/01/2078 0:00	2078	22.5	12.6	34.9	41.5	13.1	49	51	30.3	75
01/01/2079 0:00	2079	26.5	10.3	41	30	12.2	54.7	52.5	28.9	77.4
01/01/2080 0:00	2080	20	11	53.8	31	17	51.5	52.5	29.1	76.7
01/01/2081 0:00	2081	22.5	12.3	40.5	33.5	14.6	53.2	56.5	35.3	74.8
01/01/2082 0:00	2082	24.5	11.3	35.4	30	13.6	47.4	61	35.9	76.4
01/01/2083 0:00	2083	22.5	11	34.5	32	11.6	54.1	51.5	34.3	77.8
01/01/2084 0:00	2084	24	13	39.1	36.5	15	49.1	58	23.6	76.8
01/01/2085 0:00	2085	19.5	10.3	43.8	26	16.2	48	67.5	25.5	84.4
01/01/2086 0:00	2086	25	6.9	45.5	33.5	12.9	49.1	54	33.3	91.1
01/01/2087 0:00	2087	24.5	12	53.8	33.5	15.3	51.4	60	35	81.9
01/01/2088 0:00	2088	24	14	40.7	32.5	15	45.7	61	34.6	79
01/01/2089 0:00	2089	28.5	10.9	41	34.5	13.5	52.4	64	31.8	91
01/01/2090 0:00	2090	22.5	8.9	41.5	32.5	15.3	46.4	55.5	28.5	90.8
01/01/2091 0:00	2091	25.5	10.9	38.8	30	18.3	58.3	62.5	40	94.5
01/01/2092 0:00	2092	22.5	7.6	38	32	14.6	57.4	61	43.3	80.5
01/01/2093 0:00	2093	24.5	12	43.4	33.5	16.1	48.1	67	28.7	89.7
01/01/2094 0:00	2094	21.5	6	43.4	33	16.9	52	59.5	38.3	80.7

01/01/2095 0:00	2095	22.5	10	38.1	39.5	18.9	56.1	61	26.4	85.7
01/01/2096 0:00	2096	18	8.6	37.4	39.5	23.2	61.3	62.5	28	91.1
01/01/2097 0:00	2097	19.5	9.5	41.3	31	16	50.8	63.5	37.9	92.1
01/01/2098 0:00	2098	19.5	9.3	45.7	38.5	15.3	62.8	71.5	39.7	89.2
01/01/2099 0:00	2099	19.5	9.6	32.4	34.5	15.6	57.6	69.5	34.1	99.4

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	0	3.7									
01/01/1951 0:00	1951	0	2									
01/01/1952 0:00	1952	0	3									
01/01/1953 0:00	1953	0	1.7									
01/01/1954 0:00	1954	0	5.7									
01/01/1955 0:00	1955	0	3.7									
01/01/1956 0:00	1956	0	3.7									
01/01/1957 0:00	1957	0	2.7									
01/01/1958 0:00	1958	0	3.7									
01/01/1959 0:00	1959	0	3									
01/01/1960 0:00	1960	0	4.7									
01/01/1961 0:00	1961	0	2.4									
01/01/1962 0:00	1962	0	0.7									
01/01/1963 0:00	1963	0	2									
01/01/1964 0:00	1964	0	2									
01/01/1965 0:00	1965	0	2.7									
01/01/1966 0:00	1966	0	5.4									
01/01/1967 0:00	1967	0	1.7									
01/01/1968 0:00	1968	0	3									
01/01/1969 0:00	1969	0	1									
01/01/1970 0:00	1970	0	4.7									
01/01/1971 0:00	1971	0	3.7									
01/01/1972 0:00	1972	0	1.7									
01/01/1973 0:00	1973	0	1.7									
01/01/1974 0:00	1974	0	1									
01/01/1975 0:00	1975	0	2									
01/01/1976 0:00	1976	0	3									
01/01/1977 0:00	1977	0	4									
01/01/1978 0:00	1978	0	3.4									
01/01/1979 0:00	1979	0	2.7									
01/01/1980 0:00	1980	0	3.7									
01/01/1981 0:00	1981	0	4.7									
01/01/1982 0:00	1982	0	3									
01/01/1983 0:00	1983	0	2.7									

01/01/1984 0:00	1984	0	6.4								
01/01/1985 0:00	1985	0	5.4								
01/01/1986 0:00	1986	0	3								
01/01/1987 0:00	1987	0	2								
01/01/1988 0:00	1988	0	2.7								
01/01/1989 0:00	1989	0	6.7								
01/01/1990 0:00	1990	0	4.7								
01/01/1991 0:00	1991	0	4								
01/01/1992 0:00	1992	0	3.1								
01/01/1993 0:00	1993	0	3.7								
01/01/1994 0:00	1994	0	3								
01/01/1995 0:00	1995	0	4								
01/01/1996 0:00	1996	0	3								
01/01/1997 0:00	1997	0	3								
01/01/1998 0:00	1998	0	2								
01/01/1999 0:00	1999	0	3								
01/01/2000 0:00	2000	0	2								
01/01/2001 0:00	2001	0	4								
01/01/2002 0:00	2002	0	3								
01/01/2003 0:00	2003	0	3.7								
01/01/2004 0:00	2004	0	3.4								
01/01/2005 0:00	2005	0	5.4	1	0	5.4	1	0	5.4	1	0	5.4
01/01/2006 0:00	2006			0	0	5	1	0	5.4	1	0	5.7
01/01/2007 0:00	2007			0	0	3.7	1	0	7.4	0	0	6.7
01/01/2008 0:00	2008			0	0	6	1	0	8.7	0.5	0	3
01/01/2009 0:00	2009			0.5	0	6.4	0.5	0	6.7	1.5	0	6
01/01/2010 0:00	2010			0	0	3.7	1	0	5	0	0	7.7
01/01/2011 0:00	2011			0.5	0	4.4	1	0	6	2	0	4.7
01/01/2012 0:00	2012			1	0	6.7	0.5	0	5	0.5	0	4.7
01/01/2013 0:00	2013			0	0	3.7	1	0	4	1	0	7.1
01/01/2014 0:00	2014			1	0	3.7	1	0	9.8	0	0	3.7
01/01/2015 0:00	2015			1	0	10.2	1	0	6.8	0.5	0	7
01/01/2016 0:00	2016			2	0	11.4	0	0	3	1.5	0	8.1
01/01/2017 0:00	2017			2.5	0	6.7	0.5	0	3.7	0.5	0	7
01/01/2018 0:00	2018			2	0	11	2	0	8.7	2	0	7.5
01/01/2019 0:00	2019			1	0	7.1	1	0	7.7	1.5	0	6.7
01/01/2020 0:00	2020			0	0	8.4	0	0	5.7	1.5	0	8.8

01/01/2021 0:00	2021	2	0	9.7	2	0	6.7	1	0	5.7
01/01/2022 0:00	2022	2	0	14.2	1	0	6.7	2	0	8.7
01/01/2023 0:00	2023	0.5	0	8	2	0	6.7	2	0	9.1
01/01/2024 0:00	2024	2	0	6.7	3	0	5.7	2	0	6
01/01/2025 0:00	2025	2	0	6.7	2	0	9.5	2	0	11.7
01/01/2026 0:00	2026	2.5	0	9.7	3.5	0	7	2	0	11
01/01/2027 0:00	2027	1	0	3	2	0	5	4	0	10
01/01/2028 0:00	2028	1.5	0	6.7	2	0	8	2	0	8.7
01/01/2029 0:00	2029	2.5	0	7.7	2.5	0	13.4	1	0	10.4
01/01/2030 0:00	2030	1.5	0	5.7	2	0	6.7	2	0	6.4
01/01/2031 0:00	2031	3	0	8.7	1	0	11.7	1.5	0	14.1
01/01/2032 0:00	2032	1.5	0	8.1	1.5	0	7.7	2.5	0	6
01/01/2033 0:00	2033	2	0	9.4	3.5	0	10.7	3	0	12.1
01/01/2034 0:00	2034	3	0	6.4	2	0	8.7	2	0	8.1
01/01/2035 0:00	2035	2	0	10.4	3	0	8	4	0	8.7
01/01/2036 0:00	2036	4	0	10.1	2.5	0	8.1	3	0	6
01/01/2037 0:00	2037	0	0	5.4	1.5	0	10.7	3	0	10.7
01/01/2038 0:00	2038	0	0	3.7	1	0	8.7	5	0.3	13.5
01/01/2039 0:00	2039	3	0	9.4	1.5	0	9.7	3	0	8.4
01/01/2040 0:00	2040	1	0	5.7	2	0	9.7	2.5	0	8.4
01/01/2041 0:00	2041	3	0	13.3	2	0	8.7	3	0	11.4
01/01/2042 0:00	2042	1.5	0	11.4	2	0	7	2	0	6.4
01/01/2043 0:00	2043	2	0	5.7	3.5	1	8.4	5	0	11.7
01/01/2044 0:00	2044	2	0	5	3.5	0	13.4	2.5	0	15.4
01/01/2045 0:00	2045	2	0	6	2	0	9.8	2	0	12.5
01/01/2046 0:00	2046	1	0	8.7	3.5	0	11.7	4	0	12.5
01/01/2047 0:00	2047	2	0	16.4	2.5	0	10.4	3.5	0.6	9.7
01/01/2048 0:00	2048	1	0	9	2	0	11.7	3	0	11.4
01/01/2049 0:00	2049	2	0	8.7	2.5	0	10.4	4	0	13.7
01/01/2050 0:00	2050	3	0	9	4	0	12.1	6	1.3	11
01/01/2051 0:00	2051	3	0	7.7	2	0	9.4	4	0	16
01/01/2052 0:00	2052	3	0	11.4	2	0	10.7	6	2	13.7
01/01/2053 0:00	2053	3	0	8.7	2	0	11	5.5	0.6	20.8
01/01/2054 0:00	2054	2	0	9.7	1.5	0	7.7	5	0.3	14.7
01/01/2055 0:00	2055	4	0	10.7	5	0	10.7	11	0	20.4
01/01/2056 0:00	2056	2	0	8	5	0	15.4	7	0	21.7
01/01/2057 0:00	2057	1	0	13.2	2	0	13.5	10	0	22.4

01/01/2058 0:00	2058	2	0	11	4	0	12.5	8	3	22.4
01/01/2059 0:00	2059	2	0	7.7	3	0	12.7	11	1.3	22.7
01/01/2060 0:00	2060	2	0	8.1	4.5	0	10	8	1	26.8
01/01/2061 0:00	2061	3.5	0	10.8	5	0	12.7	5.5	0	24.8
01/01/2062 0:00	2062	3.5	0	10.1	2.5	0	13.8	10.5	3.3	24.7
01/01/2063 0:00	2063	0.5	0	5.4	2.5	0	9.7	14.5	0	23
01/01/2064 0:00	2064	1.5	0	6.7	6	0.3	11.4	6.5	0	20.1
01/01/2065 0:00	2065	2.5	0	8.7	4	0	15.1	8.5	2	23
01/01/2066 0:00	2066	2	0	6.7	3.5	0	12	11.5	1.3	40.7
01/01/2067 0:00	2067	3	0	9	6	0.3	15	16.5	4	34.5
01/01/2068 0:00	2068	2.5	0	8.7	4.5	0	17.7	8.5	2.3	30.4
01/01/2069 0:00	2069	2	0	6.7	7.5	1.3	17.1	12	3.3	25.7
01/01/2070 0:00	2070	1.5	0	8.4	3.5	0.3	18.7	9	0	20
01/01/2071 0:00	2071	3	0	10.7	5	0	9	14	1.2	26
01/01/2072 0:00	2072	3.5	0	9.7	6	1	11.4	11	2	34.5
01/01/2073 0:00	2073	2	0	9.4	3	0	12.7	10.5	5	26.6
01/01/2074 0:00	2074	1	0	6.4	3	1	14	16	0.3	34.9
01/01/2075 0:00	2075	4	0	6.7	4	0	13.7	17.5	2.6	31.7
01/01/2076 0:00	2076	3.5	0	11.7	5.5	0	11	14.5	7.6	28.7
01/01/2077 0:00	2077	1.5	0	10.1	4.5	0.3	21.1	15.5	1.8	30.8
01/01/2078 0:00	2078	2	0	7.7	8.5	0	15.7	13	5.3	41.8
01/01/2079 0:00	2079	2	0	12.4	7	0	14	14.5	4	36.1
01/01/2080 0:00	2080	2	0	18.2	3.5	0	17.2	15.5	4.3	34.9
01/01/2081 0:00	2081	2.5	0	13.9	3.5	0	12	17.5	4.2	30.7
01/01/2082 0:00	2082	2	0	7.7	3.5	0	14.5	19.5	5.6	34.7
01/01/2083 0:00	2083	2.5	0	7.7	4	0	18.7	17	4.6	34.4
01/01/2084 0:00	2084	2	0	6.7	7.5	1.3	14.8	16.5	2.3	28
01/01/2085 0:00	2085	1.5	0	11.1	6	0	14.7	20.5	5	41.7
01/01/2086 0:00	2086	2.5	0	14.1	6	0	13.8	17	5	45.1
01/01/2087 0:00	2087	2.5	0	12.7	4.5	0	17.4	18	6.3	33.4
01/01/2088 0:00	2088	2	0	6.4	4	0	20.1	16.5	2	37.4
01/01/2089 0:00	2089	2	0	8.7	8	0	15	21	8.3	42
01/01/2090 0:00	2090	1	0	9.4	3.5	0	12.4	18	3.9	43.4
01/01/2091 0:00	2091	2	0	7.1	4.5	0	20.4	22.5	7	52.5
01/01/2092 0:00	2092	3.5	0	7.7	4.5	0	17.4	20.5	9.5	38.7
01/01/2093 0:00	2093	3	0	10	4.5	0	11.1	17.5	6.9	47
01/01/2094 0:00	2094	2.5	0	8.7	4.5	0	17.8	22.5	3	40

01/01/2095 0:00	2095	2	0	5	6.5	0	19.7	18.5	4.3	42.3
01/01/2096 0:00	2096	2	0	10.8	7	1.3	18.1	18.5	5	45.4
01/01/2097 0:00	2097	3	0	7.7	3	0	17.8	22.5	8.6	44
01/01/2098 0:00	2098	2	0	13.6	4.5	0	18	30.5	9.3	53.7
01/01/2099 0:00	2099	1	0	4.4	8	0.6	19.5	36	3.2	54.7

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	109	139.4									
01/01/1951 0:00	1951	108.3	135.7									
01/01/1952 0:00	1952	117	141.4									
01/01/1953 0:00	1953	114.3	138.8									
01/01/1954 0:00	1954	107	139.2									
01/01/1955 0:00	1955	104.5	133.4									
01/01/1956 0:00	1956	107.5	139.4									
01/01/1957 0:00	1957	111.8	139									
01/01/1958 0:00	1958	116.6	142.5									
01/01/1959 0:00	1959	103.2	139.8									
01/01/1960 0:00	1960	105.1	140									
01/01/1961 0:00	1961	104.3	141									
01/01/1962 0:00	1962	112.3	136									
01/01/1963 0:00	1963	114.3	138.7									
01/01/1964 0:00	1964	116	140.5									
01/01/1965 0:00	1965	112.3	132.7									
01/01/1966 0:00	1966	111.3	136.7									
01/01/1967 0:00	1967	101.6	138									
01/01/1968 0:00	1968	106.7	141.1									
01/01/1969 0:00	1969	109.9	140.4									
01/01/1970 0:00	1970	107.3	134.7									
01/01/1971 0:00	1971	109	139									
01/01/1972 0:00	1972	115	130									
01/01/1973 0:00	1973	108.3	138.6									
01/01/1974 0:00	1974	107.9	142.1									
01/01/1975 0:00	1975	112.9	135.4									
01/01/1976 0:00	1976	109.3	136.8									
01/01/1977 0:00	1977	102.9	128.4									
01/01/1978 0:00	1978	109.3	129.7									
01/01/1979 0:00	1979	110	138.1									
01/01/1980 0:00	1980	111.9	139.1									
01/01/1981 0:00	1981	115.6	137.4									
01/01/1982 0:00	1982	117	142.5									
01/01/1983 0:00	1983	114.6	144.4									

01/01/1984 0:00	1984	105.3	131.7									
01/01/1985 0:00	1985	117.3	144.2									
01/01/1986 0:00	1986	106.2	137.7									
01/01/1987 0:00	1987	105.8	139									
01/01/1988 0:00	1988	109.3	141.5									
01/01/1989 0:00	1989	110.2	135.1									
01/01/1990 0:00	1990	106.3	138.7									
01/01/1991 0:00	1991	113.1	136.1									
01/01/1992 0:00	1992	106.6	133									
01/01/1993 0:00	1993	108	136.4									
01/01/1994 0:00	1994	108	137.5									
01/01/1995 0:00	1995	105.1	136									
01/01/1996 0:00	1996	108.8	136.4									
01/01/1997 0:00	1997	100.3	143.1									
01/01/1998 0:00	1998	105.1	136.7									
01/01/1999 0:00	1999	110	132.4									
01/01/2000 0:00	2000	104	133									
01/01/2001 0:00	2001	104.2	133.4									
01/01/2002 0:00	2002	102.3	134.4									
01/01/2003 0:00	2003	108	133.4									
01/01/2004 0:00	2004	96.2	129.7									
01/01/2005 0:00	2005	97.8	130.6	120	97.8	130.6	120	97.4	130.6	120	97.9	131
01/01/2006 0:00	2006			116.5	103.3	134.1	114	105	130.4	113.5	101.3	128.6
01/01/2007 0:00	2007			116	96.6	134	119.5	103	131.8	119	99.1	128.1
01/01/2008 0:00	2008			118	100	125.7	121	99.5	131.5	117.5	97.3	133.1
01/01/2009 0:00	2009			110	95.6	126.4	113	104.9	127.1	116	104	131.1
01/01/2010 0:00	2010			117.5	97.2	131	119	101	130.7	114	103.2	129.7
01/01/2011 0:00	2011			116	101	133.5	110	103	123.7	120.5	96.5	134
01/01/2012 0:00	2012			114	96.3	128	117	98.9	128.4	112.5	101	126.7
01/01/2013 0:00	2013			114.5	98.3	130.1	114.5	99.2	127.5	118	97.6	133.7
01/01/2014 0:00	2014			115	97.9	132.7	114	88.1	128.7	118.5	97.3	128.4
01/01/2015 0:00	2015			111.5	89.7	130.7	119	101.9	127.7	111	100.6	127.4
01/01/2016 0:00	2016			107.5	85	125.8	113.5	100.9	132.9	111.5	95	124.4
01/01/2017 0:00	2017			121	104.3	134.5	114	93.1	133.7	105.5	88.3	121.1
01/01/2018 0:00	2018			113	103.3	126.7	119.5	100.6	136	114	101.3	139.7
01/01/2019 0:00	2019			117.5	102.4	125	114	98.3	134.6	112.5	95.6	131.7
01/01/2020 0:00	2020			112.5	97.5	127.7	120.5	102.3	130.7	113.5	96.9	130.1

01/01/2021 0:00	2021	110.5	91.8	128	114	97.1	125.1	115.5	100.3	126
01/01/2022 0:00	2022	113	95.2	129.4	117.5	97.9	129	108.5	94.6	117.7
01/01/2023 0:00	2023	109	89.6	124.1	105.5	93.6	134.7	107.5	95.3	132.5
01/01/2024 0:00	2024	111.5	98.6	131.1	104.5	91.9	113.4	112	98.3	129
01/01/2025 0:00	2025	112	102.6	132	111	98.3	125.4	112	90.9	128
01/01/2026 0:00	2026	115	99.9	128.7	107.5	90.3	122.1	109	98.3	129.4
01/01/2027 0:00	2027	106.5	96	127.2	114	90	124.5	107	91.5	126.4
01/01/2028 0:00	2028	110	91.3	126.8	106	85.4	124	106.5	81.7	119.7
01/01/2029 0:00	2029	108	90	119.8	116.5	97	133.7	110	91.3	118.7
01/01/2030 0:00	2030	108.5	94.3	127.7	117.5	95.1	127.7	103	83.2	121.4
01/01/2031 0:00	2031	116	96.9	131.9	108.5	92.9	126.8	114.5	102.3	123
01/01/2032 0:00	2032	115.5	92.3	134.4	110.5	84.6	131.2	113.5	91.2	126.1
01/01/2033 0:00	2033	110.5	94.1	124.7	109	90.9	126.7	107	90.5	122.7
01/01/2034 0:00	2034	106.5	93.3	120	107	93.6	120.8	107.5	80.3	126
01/01/2035 0:00	2035	110.5	94.2	127.4	112	98.3	129.7	102.5	87.3	124.4
01/01/2036 0:00	2036	106.5	91	128.6	108.5	90.3	120.4	110	90.1	126.7
01/01/2037 0:00	2037	111.5	97.3	126.5	107.5	89.5	117.8	99	78.5	120
01/01/2038 0:00	2038	113.5	90.9	133.9	111	85	124.9	102	84	111.7
01/01/2039 0:00	2039	105.5	84.6	117.7	106	93.6	124.4	103.5	76.9	128.4
01/01/2040 0:00	2040	108	82.8	123.7	108.5	94.3	128.7	104	87.7	129.4
01/01/2041 0:00	2041	109	89.6	126.9	105.5	89.2	119.1	94	81.9	124.7
01/01/2042 0:00	2042	106	92.4	124.7	104.5	87.8	118.7	103	77	119.4
01/01/2043 0:00	2043	112	91.4	121.7	104	77.9	118	99.5	70.8	126.4
01/01/2044 0:00	2044	107	89	125.8	99.5	80.1	114.1	98	81.6	119.5
01/01/2045 0:00	2045	104.5	94	120.2	98	82.4	119.1	103.5	78.3	119.7
01/01/2046 0:00	2046	107	89.6	121.7	105.5	85.8	121.5	102	78.1	114
01/01/2047 0:00	2047	107	88.3	126.4	104.5	91.6	114.7	98.5	86.3	119.4
01/01/2048 0:00	2048	107	89.2	122.2	110.5	92.3	122.1	99	75	115.8
01/01/2049 0:00	2049	109.5	86.1	123.7	102.5	86	118.7	96	78.6	114.8
01/01/2050 0:00	2050	112	92.2	127.9	105	84	118.7	95	80.3	117.7
01/01/2051 0:00	2051	107.5	88	117.7	101.5	84.2	113.7	99.5	77.2	112
01/01/2052 0:00	2052	110.5	91.6	129.4	102	83.6	113.4	101.5	81.1	118.7
01/01/2053 0:00	2053	110	94.5	122.9	101.5	80.9	118.7	87.5	78.9	108.5
01/01/2054 0:00	2054	107	88.1	123.4	104	79.3	119	98	83.9	125.1
01/01/2055 0:00	2055	104.5	84.6	120.1	98	74	119.5	94	63.5	114.4
01/01/2056 0:00	2056	103	79.1	118.4	102	78.9	116.7	96.5	66.6	106.7
01/01/2057 0:00	2057	103.5	88.9	128.7	104	87.6	115	91.5	77.2	116.5

01/01/2058 0:00	2058	108.5	85.5	128.2	104	88.3	116.4	92.5	63	111.4
01/01/2059 0:00	2059	106	70.9	119	103.5	91	122.5	92.5	59.6	106.1
01/01/2060 0:00	2060	106.5	88.3	119.4	101	87.3	118.2	90.5	64.1	109
01/01/2061 0:00	2061	104	85.6	123.8	100.5	85.9	115.1	92.5	69.6	114.3
01/01/2062 0:00	2062	101.5	77.8	126	100.5	73.1	117.7	95	65.5	106.8
01/01/2063 0:00	2063	108.5	95.6	124.7	104	57.2	115.8	87.5	65.6	100.7
01/01/2064 0:00	2064	103	89	131.1	97.5	74	113.3	84	61	108.2
01/01/2065 0:00	2065	103.5	86.7	118.5	97.5	72.8	119.7	89	64	105.7
01/01/2066 0:00	2066	104	84.6	122.5	94.5	75.9	110.7	89	60.5	109
01/01/2067 0:00	2067	110.5	99.6	126.4	96	75.5	112.7	86	60	112.9
01/01/2068 0:00	2068	103.5	93.3	122.4	96.5	63	125.8	78.5	62.4	108.2
01/01/2069 0:00	2069	107.5	93.6	124.4	100.5	80	120.4	81	56.2	95.2
01/01/2070 0:00	2070	109	91.3	118.5	97	81.9	114.8	85	50.8	108.4
01/01/2071 0:00	2071	105	89	122.1	99.5	78.3	114.8	87.5	69.3	101
01/01/2072 0:00	2072	109	86.2	130.7	105.5	78.3	118.8	87	60.2	108.8
01/01/2073 0:00	2073	112.5	96.3	120.7	95.5	72.1	116	87	48.7	105.6
01/01/2074 0:00	2074	108	89.6	116.1	101.5	81.3	115.4	84.5	57.3	100.4
01/01/2075 0:00	2075	110.5	96.9	122	92	75.9	112.4	83.5	62	104.1
01/01/2076 0:00	2076	99.5	88	113.4	95.5	81.6	115.7	78	55.2	96.8
01/01/2077 0:00	2077	109	93.7	124.7	94.5	72.9	113	75	53.2	103.4
01/01/2078 0:00	2078	109	83.3	126.4	93.5	72.6	121	71.5	53.9	98.7
01/01/2079 0:00	2079	108	84.6	119.1	94.5	70.7	120.1	71	56.9	98.2
01/01/2080 0:00	2080	110	86.3	122.1	97.5	86.3	105.7	78.5	52.2	94.8
01/01/2081 0:00	2081	111.5	93.9	125.7	100.5	73.1	118.4	79.5	38.9	95
01/01/2082 0:00	2082	101	88.9	117.7	94	68.6	109	70.5	43.4	88.7
01/01/2083 0:00	2083	107.5	92.3	126.7	91	72.5	112.7	69.5	52.6	91.5
01/01/2084 0:00	2084	108.5	87.3	123.7	85	63.9	112.4	77	51.2	93.7
01/01/2085 0:00	2085	107	88.3	122.8	97.5	69.1	111.7	78	51.6	98.7
01/01/2086 0:00	2086	108.5	84.3	117	94	71.6	107.7	80	51.6	95.4
01/01/2087 0:00	2087	103	84.3	119.7	93	72.3	107.7	69	36.6	93.7
01/01/2088 0:00	2088	105	76.9	118.1	102	75	126	72	50.3	99.4
01/01/2089 0:00	2089	106.5	82.7	127.7	94	67.7	115.8	66.5	53	90.7
01/01/2090 0:00	2090	107.5	88.3	129	91	67.6	109.1	72	43.6	94.4
01/01/2091 0:00	2091	108.5	86.5	128.7	95.5	76	106.4	64	39	86.5
01/01/2092 0:00	2092	106	79.7	121.3	94	73.9	113.7	67.5	42.6	88.8
01/01/2093 0:00	2093	112.5	85.8	122	98	79.6	110.7	67	37.9	96.1
01/01/2094 0:00	2094	110.5	90.7	122.7	94	74.9	117.4	66	40.1	100.3

01/01/2095 0:00	2095	109.5	88.1	126.7	94	79.3	111	69.5	41.7	97.6
01/01/2096 0:00	2096	111	91.2	130	96.5	76.9	108	66.5	39	94.9
01/01/2097 0:00	2097	103	83.3	120.1	101	54.3	117.7	59.5	45.3	79.8
01/01/2098 0:00	2098	108.5	89.9	131	94.5	71.3	118	61.5	25.5	91.5
01/01/2099 0:00	2099	102.5	84.6	119.1	93	69.3	108.7	59	32.6	94

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	52	84.4									
01/01/1951 0:00	1951	55.7	89.4									
01/01/1952 0:00	1952	59	85.8									
01/01/1953 0:00	1953	57.9	85.7									
01/01/1954 0:00	1954	47.2	87.4									
01/01/1955 0:00	1955	52.3	77.7									
01/01/1956 0:00	1956	51.9	96.3									
01/01/1957 0:00	1957	53.3	93.7									
01/01/1958 0:00	1958	65.3	85.7									
01/01/1959 0:00	1959	55.6	92.6									
01/01/1960 0:00	1960	54.9	90.8									
01/01/1961 0:00	1961	52.9	82.7									
01/01/1962 0:00	1962	59.2	87.7									
01/01/1963 0:00	1963	59.5	85									
01/01/1964 0:00	1964	63.6	96.4									
01/01/1965 0:00	1965	61.8	87.4									
01/01/1966 0:00	1966	55.6	85									
01/01/1967 0:00	1967	53.3	89.2									
01/01/1968 0:00	1968	55.3	95.7									
01/01/1969 0:00	1969	57	89.4									
01/01/1970 0:00	1970	55.2	83.7									
01/01/1971 0:00	1971	51.8	84.7									
01/01/1972 0:00	1972	60.6	83.7									
01/01/1973 0:00	1973	58	84.1									
01/01/1974 0:00	1974	52.6	91.4									
01/01/1975 0:00	1975	59.3	89.8									
01/01/1976 0:00	1976	58.2	87									
01/01/1977 0:00	1977	53.5	78.4									
01/01/1978 0:00	1978	57.2	83.1									
01/01/1979 0:00	1979	52	86.7									
01/01/1980 0:00	1980	58.8	89									
01/01/1981 0:00	1981	59.3	86.3									
01/01/1982 0:00	1982	66.3	94.4									
01/01/1983 0:00	1983	65	93.8									

01/01/1984 0:00	1984	49.3	87.1									
01/01/1985 0:00	1985	56.3	88									
01/01/1986 0:00	1986	54.6	85.7									
01/01/1987 0:00	1987	48.6	81.8									
01/01/1988 0:00	1988	55.6	87									
01/01/1989 0:00	1989	50	83.7									
01/01/1990 0:00	1990	49.9	84									
01/01/1991 0:00	1991	59.2	84									
01/01/1992 0:00	1992	53.3	88.1									
01/01/1993 0:00	1993	51.3	79.7									
01/01/1994 0:00	1994	56.6	81.1									
01/01/1995 0:00	1995	54	90									
01/01/1996 0:00	1996	54.2	85.4									
01/01/1997 0:00	1997	43.3	89.9									
01/01/1998 0:00	1998	47.3	90									
01/01/1999 0:00	1999	47.9	75.7									
01/01/2000 0:00	2000	52.6	78.7									
01/01/2001 0:00	2001	51.6	84.4									
01/01/2002 0:00	2002	47	89.4									
01/01/2003 0:00	2003	45.7	80.7									
01/01/2004 0:00	2004	43.9	79.7									
01/01/2005 0:00	2005	50	76.6	64	50	76.6	62	50.4	77.6	64	49.9	79.4
01/01/2006 0:00	2006			61.5	48.9	82.8	58	42.5	72.7	60.5	46	75.4
01/01/2007 0:00	2007			61	46.9	83.7	67.5	38.1	83.1	60.5	49.3	77.8
01/01/2008 0:00	2008			64	51.6	79.7	68	47.9	80	57.5	44.6	86.5
01/01/2009 0:00	2009			55	41.3	71.7	60	48.1	79.4	59.5	50	83
01/01/2010 0:00	2010			59.5	42	78.7	65.5	45.9	80.7	60.5	47.6	85.7
01/01/2011 0:00	2011			62.5	45.9	83.7	59	48.3	80.3	59.5	46.2	83.7
01/01/2012 0:00	2012			59	46.9	79.2	66	40.9	82	64	44.6	81.5
01/01/2013 0:00	2013			52.5	45.6	82.6	63.5	51.9	83.6	62	41.5	82.4
01/01/2014 0:00	2014			57.5	47	71.7	65	39.2	78.4	66	40.6	80
01/01/2015 0:00	2015			59	46.5	73.5	61.5	53	73.4	63.5	51.6	80.7
01/01/2016 0:00	2016			55.5	40.2	70.8	61.5	45.9	79.2	57	42.3	75.9
01/01/2017 0:00	2017			67	48.5	82.7	63	47	79.4	55	40.3	69.7
01/01/2018 0:00	2018			60	51.3	70.4	60	44.3	85.7	58.5	46.6	84.2
01/01/2019 0:00	2019			62.5	48.3	74.7	60.5	41.3	83.7	57	46	79.4
01/01/2020 0:00	2020			60	42.9	75.4	65	49.6	76.8	60.5	45.3	79.1

01/01/2021 0:00	2021	64	45.9	74.4	65	46.6	81.1	62.5	54.3	73.1
01/01/2022 0:00	2022	61.5	42.6	79.2	67.5	49.1	82.4	55	41.8	74.7
01/01/2023 0:00	2023	59.5	46.3	71.5	56	38.8	79.4	53	42.3	71.4
01/01/2024 0:00	2024	56.5	49.6	77.1	50	38.3	69	58	45.8	76.7
01/01/2025 0:00	2025	60.5	44.3	78.5	63	45.2	79.4	58	45.3	76.5
01/01/2026 0:00	2026	65	50.3	76.7	56	41	75.1	57.5	49	70.1
01/01/2027 0:00	2027	53.5	39.6	75	60	45	70.4	54	36.8	78.1
01/01/2028 0:00	2028	56	41.6	74.2	55	37.9	76.7	55	34.3	75.4
01/01/2029 0:00	2029	61	38.5	71.7	65.5	47.9	83.4	55	40.5	69.1
01/01/2030 0:00	2030	60	39.8	72	62	43	75.7	52	38	67.7
01/01/2031 0:00	2031	61	39.9	82.4	58	40.3	73.5	58	43.3	75.4
01/01/2032 0:00	2032	56.5	42.3	77.4	58.5	36.6	77.7	59.5	41.3	76
01/01/2033 0:00	2033	60	39.6	79.5	49.5	37.6	77.7	54.5	36.6	65
01/01/2034 0:00	2034	53.5	36.3	66.7	54	34.5	70.7	55.5	27.3	78.6
01/01/2035 0:00	2035	63.5	42.9	76.7	62	42.8	79.9	52	37	73.8
01/01/2036 0:00	2036	55	33.2	69	55	39.5	72.4	59.5	36.2	76.4
01/01/2037 0:00	2037	60.5	35	80.7	49	38.3	68.4	51	32.3	64.7
01/01/2038 0:00	2038	61	44.6	79.7	54.5	33	66	53	32.5	73.7
01/01/2039 0:00	2039	56.5	32.6	73.7	59	38.8	75.5	48	33.2	71.5
01/01/2040 0:00	2040	55	27.9	69.7	57.5	39.1	72.9	56.5	39.2	71.8
01/01/2041 0:00	2041	53.5	31.3	75.1	55.5	38.6	67	48	37	68.4
01/01/2042 0:00	2042	61.5	42.7	69	56.5	38.9	65	47	31.6	66.8
01/01/2043 0:00	2043	55	44.8	67	47	27.6	66.4	48.5	30	57.7
01/01/2044 0:00	2044	60	40.6	73	46.5	34.3	61.4	49	30.9	64.4
01/01/2045 0:00	2045	51	41.2	72.8	50	31	62	46.5	27.3	64.4
01/01/2046 0:00	2046	53	34.3	78.9	56	33.1	66.1	53	36.3	64.1
01/01/2047 0:00	2047	57.5	41.5	69.4	52	36.3	63.1	43	35.6	66.4
01/01/2048 0:00	2048	58.5	33.6	72.8	57.5	33.3	68.7	43	25.9	59.1
01/01/2049 0:00	2049	55.5	33.7	85.6	49.5	34	72.7	47	32.6	59
01/01/2050 0:00	2050	60	45	79.1	54	40.3	67	42.5	28.2	59.7
01/01/2051 0:00	2051	62	33.4	72.8	53	32	68	43	29.3	67.3
01/01/2052 0:00	2052	60.5	32.2	73	47.5	37.6	58.7	48	30.9	68.9
01/01/2053 0:00	2053	60	35.3	75.4	50	27.3	68.2	40.5	27.3	59.3
01/01/2054 0:00	2054	57	40.3	74.9	48.5	32.9	65.7	44	29.3	62.8
01/01/2055 0:00	2055	53	34.2	71	48	23.2	64.9	41.5	26	60.4
01/01/2056 0:00	2056	50	32	67.1	46.5	33.2	59.1	45	24.8	55.2
01/01/2057 0:00	2057	54	34.9	70.1	53	37.2	66.8	43.5	22.9	61.9

01/01/2058 0:00	2058	52	41.6	75.1	49	33.2	64.4	40	18.3	58.8
01/01/2059 0:00	2059	59.5	35.3	72.4	52	33.7	69.4	41	19	59.9
01/01/2060 0:00	2060	52	28.6	67.4	48	35	68.1	41.5	15.3	60.9
01/01/2061 0:00	2061	52	35.3	67.2	43.5	36.6	64.7	41	24.3	63.9
01/01/2062 0:00	2062	49	24.3	77.7	50.5	22.3	69.1	42.5	21.2	54.1
01/01/2063 0:00	2063	53	36.6	72	46.5	14.6	73	34.5	13.6	50.1
01/01/2064 0:00	2064	56	35.6	71.4	44.5	28.4	58.4	33.5	20.2	63
01/01/2065 0:00	2065	50	37.3	63	43	28.9	61.6	34.5	14.5	61.1
01/01/2066 0:00	2066	54.5	37.6	72.2	41.5	21.9	55.4	33.5	14.8	62
01/01/2067 0:00	2067	53.5	44.6	65.7	41.5	27.3	55.7	35	23.3	62.4
01/01/2068 0:00	2068	53	35.2	61.7	42	18.5	62.7	35	18.5	54.6
01/01/2069 0:00	2069	54.5	34.6	73.8	50	31	66.7	26.5	17.3	49
01/01/2070 0:00	2070	57.5	37.1	67.4	46.5	32	63	29.5	14.6	47.4
01/01/2071 0:00	2071	49.5	37	67.7	45	22.5	61.8	28	13	46.4
01/01/2072 0:00	2072	54	36.9	78.8	48	34	63.4	37	14.6	55.4
01/01/2073 0:00	2073	58.5	39.5	67	41	26.9	65.8	24.5	15.6	55.3
01/01/2074 0:00	2074	51	38.9	63.4	48.5	32.2	65.7	29	13.6	49.6
01/01/2075 0:00	2075	54.5	40	66.1	44.5	28.2	58.4	29.5	16.5	45.7
01/01/2076 0:00	2076	51.5	35.3	67.7	43	28.5	64.4	28	14.3	46.7
01/01/2077 0:00	2077	55.5	41.3	77.7	45	24.3	60.8	24.5	11	48.7
01/01/2078 0:00	2078	59	33.1	75	46	26.3	55.7	24.5	8.2	49
01/01/2079 0:00	2079	57	39.3	66.7	44.5	26.9	61.5	22	8.9	41.1
01/01/2080 0:00	2080	49.5	35.6	63.7	48.5	34.3	59.4	22	7.5	39.4
01/01/2081 0:00	2081	58	34	76.1	43	27.2	64.1	22.5	4.6	43.5
01/01/2082 0:00	2082	49.5	31.8	65.1	42	26.3	60.5	20.5	3	34.7
01/01/2083 0:00	2083	56	36.5	69.4	44.5	24.6	61.7	20.5	6.3	45
01/01/2084 0:00	2084	55.5	39.3	76.5	37.5	20.6	62	23	13.3	35.9
01/01/2085 0:00	2085	56	38.3	74.7	51	24.6	62.4	27.5	10.6	39.1
01/01/2086 0:00	2086	50	36	66.7	41	28.3	59.3	24	9.9	37
01/01/2087 0:00	2087	57	33.2	70	42	36.3	56.9	20.5	4	39.7
01/01/2088 0:00	2088	53	25.9	63	46	27.9	67.4	21	6.3	41
01/01/2089 0:00	2089	48	40.3	70.7	46.5	21.3	60.1	19.5	4	42
01/01/2090 0:00	2090	59.5	33.6	76.4	37	13.6	61	21.5	5.3	35.7
01/01/2091 0:00	2091	54	30	73.2	45	30.6	54.4	20.5	3.6	36
01/01/2092 0:00	2092	55.5	38	67.1	49	24.6	64.7	21	4.6	48.2
01/01/2093 0:00	2093	54	35.9	79.7	47.5	29.9	56.4	20	1.6	41.7
01/01/2094 0:00	2094	59.5	38.2	78	45.5	28	68.1	18	4.2	46.7

01/01/2095 0:00	2095	52.5	29.8	67.7	44.5	26.3	54.7	24	2.6	37.9
01/01/2096 0:00	2096	53.5	30.7	79.7	41	25.6	59.7	18.5	4.3	38.5
01/01/2097 0:00	2097	53.5	39.3	74.1	49	20.1	62.4	17.5	1	27.7
01/01/2098 0:00	2098	58	40.3	76.7	48.5	17.7	66.1	15.5	2	32.7
01/01/2099 0:00	2099	49.5	31	69.4	40	25.9	59.7	14	0	30.4

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	6869.95	7897.7									
01/01/1951 0:00	1951	7066.52	7893.66									
01/01/1952 0:00	1952	7107.41	8035.6									
01/01/1953 0:00	1953	7226.32	7973.08									
01/01/1954 0:00	1954	6890.12	7877.03									
01/01/1955 0:00	1955	6849.98	7827.66									
01/01/1956 0:00	1956	6922.8	8048.84									
01/01/1957 0:00	1957	6976.27	8118.56									
01/01/1958 0:00	1958	7136.23	7945.69									
01/01/1959 0:00	1959	6946.55	8177.1									
01/01/1960 0:00	1960	7095.57	7953.09									
01/01/1961 0:00	1961	6879.55	8130.36									
01/01/1962 0:00	1962	7139.5	8113.37									
01/01/1963 0:00	1963	7171.86	7908.83									
01/01/1964 0:00	1964	7359.06	8381.27									
01/01/1965 0:00	1965	7207.86	7859.09									
01/01/1966 0:00	1966	7007.3	7862.96									
01/01/1967 0:00	1967	6895.41	7897.51									
01/01/1968 0:00	1968	7139.24	7949.35									
01/01/1969 0:00	1969	7198.53	8229.76									
01/01/1970 0:00	1970	7021.85	7902.8									
01/01/1971 0:00	1971	6989.39	7940.58									
01/01/1972 0:00	1972	7091.22	7798.2									
01/01/1973 0:00	1973	7023.01	7995.02									
01/01/1974 0:00	1974	7050.34	8217									
01/01/1975 0:00	1975	7110.25	7932.46									
01/01/1976 0:00	1976	7128.63	7914.23									
01/01/1977 0:00	1977	6842.92	7818.35									
01/01/1978 0:00	1978	7224.85	7595.2									
01/01/1979 0:00	1979	7011.85	7970.78									
01/01/1980 0:00	1980	7155.5	7964.57									
01/01/1981 0:00	1981	7179.47	7925.45									
01/01/1982 0:00	1982	7300.15	8138.08									
01/01/1983 0:00	1983	7259.43	8123.48									

01/01/1984 0:00	1984	6967.72	7802.5									
01/01/1985 0:00	1985	7242.51	8015.83									
01/01/1986 0:00	1986	6889.48	7972.09									
01/01/1987 0:00	1987	6931.81	7800.78									
01/01/1988 0:00	1988	7080.25	7911.51									
01/01/1989 0:00	1989	6883.82	7665.86									
01/01/1990 0:00	1990	6774.03	7917.27									
01/01/1991 0:00	1991	6944.01	7828.22									
01/01/1992 0:00	1992	6998.61	7851.76									
01/01/1993 0:00	1993	7012.74	7860.74									
01/01/1994 0:00	1994	6856.31	7791.41									
01/01/1995 0:00	1995	7081.16	7764.96									
01/01/1996 0:00	1996	7006.59	7766.05									
01/01/1997 0:00	1997	6623.41	7879.35									
01/01/1998 0:00	1998	6856.4	7749.98									
01/01/1999 0:00	1999	6731.38	7613									
01/01/2000 0:00	2000	6724.04	7641.27									
01/01/2001 0:00	2001	6702.7	7766.95									
01/01/2002 0:00	2002	6661.57	7775.44									
01/01/2003 0:00	2003	6814.68	7627.56									
01/01/2004 0:00	2004	6564.04	7575.64									
01/01/2005 0:00	2005	6750.98	7604.81	7173.53	6750.98	7604.81	7168.79	6760.93	7601.99	7175.35	6751.14	7612.07
01/01/2006 0:00	2006			7111.84	6661.44	7672.39	6956.17	6579.4	7308.01	7075.1	6603.13	7518.94
01/01/2007 0:00	2007			7023.18	6738.67	7708.87	7197.27	6553.6	7720.78	7163.04	6545.28	7628.55
01/01/2008 0:00	2008			7105.33	6576.81	7481.6	7119.93	6622.23	7655.49	7069.99	6526.09	7744.56
01/01/2009 0:00	2009			6970.66	6385.16	7633.98	7005.03	6458.46	7441.02	6948.31	6562.16	7724.89
01/01/2010 0:00	2010			7074.33	6603.21	7450.85	7155.7	6483.15	7568.94	7060.07	6644.63	7635.68
01/01/2011 0:00	2011			7106.66	6422.37	7620.51	7011.66	6527.88	7350.4	7124.67	6495.77	7522.68
01/01/2012 0:00	2012			6983.46	6650.18	7533.1	7236.77	6640.12	7474	6907.47	6676.6	7412.88
01/01/2013 0:00	2013			6946.17	6512.82	7478.15	7107.48	6625.27	7463.74	7075.94	6657.2	7612.12
01/01/2014 0:00	2014			6901.5	6580.72	7543.96	6975.69	6264.77	7488.7	7062.18	6310.01	7533.69
01/01/2015 0:00	2015			7014.49	6526.62	7369.97	7033.22	6553.12	7465.33	6989.7	6534.97	7433.23
01/01/2016 0:00	2016			6871.76	6065.36	7476.46	7122.3	6698.04	7409.6	6814.78	6596.53	7314.26
01/01/2017 0:00	2017			7007.47	6556.75	7571.85	7010.5	6444.06	7505.46	6713.51	6269.28	7260.02
01/01/2018 0:00	2018			6941.56	6568.84	7436.27	6845.85	6593	7548.82	6895.61	6597.04	7590.67
01/01/2019 0:00	2019			7001.07	6654.17	7319.46	6991.34	6364.14	7446.41	6896.28	6506.15	7499.79
01/01/2020 0:00	2020			6922.65	6496.56	7407.86	7132.44	6671.91	7545.16	6888.85	6535.38	7345.69

01/01/2021 0:00	2021	6825.33	6469.42	7456.76	6936.3	6417.54	7451.5	6960.79	6583.57	7404.33
01/01/2022 0:00	2022	6937.4	6316.92	7463.75	7055.71	6574.38	7456.47	6779.86	6301.07	7101.37
01/01/2023 0:00	2023	6748.13	6369.26	7275.15	6769.19	6388.08	7621.64	6699.96	6245.57	7267.89
01/01/2024 0:00	2024	6749.7	6419.85	7367.16	6735.59	6247.89	7061.64	6912.47	6543.77	7365.18
01/01/2025 0:00	2025	6928.36	6488.83	7463.97	6871.26	6402.9	7322.85	6944.1	6339.67	7354.04
01/01/2026 0:00	2026	6875.77	6569.11	7476.46	6704.8	6272.35	7289.92	6793.57	6493.43	7360.61
01/01/2027 0:00	2027	6719.89	6203.88	7551.89	6931.49	6264.95	7233.23	6736.47	6234.41	7438.49
01/01/2028 0:00	2028	6674.24	6391.77	7438.27	6759.86	6139.17	7383.25	6734.12	6165.22	7272.87
01/01/2029 0:00	2029	6794.07	6242.93	7124.98	7083.05	6474.72	7596.35	6653.26	6262.66	7061.58
01/01/2030 0:00	2030	6861.34	6343.55	7267.01	6919.81	6534.08	7211.07	6612.5	6200.02	7048.53
01/01/2031 0:00	2031	7040.08	6398.33	7498.28	6765.4	6212.08	7325.75	6831.73	6509.45	7182.44
01/01/2032 0:00	2032	6821.97	6313.77	7488.21	6748.57	6144.93	7591.33	6655.2	6396.12	7258.37
01/01/2033 0:00	2033	6917.8	6332.86	7312.83	6772.27	6064.02	7241.24	6656.19	6034.45	7003.67
01/01/2034 0:00	2034	6698.15	6225.36	7067.09	6718.82	6249	6992.83	6756.05	5661.73	7268.38
01/01/2035 0:00	2035	6895.12	6257.01	7331.36	6894.8	6345.59	7379.26	6544.58	6103.2	7152.2
01/01/2036 0:00	2036	6719.28	6175.77	7267.82	6829.07	6281.19	7125.29	6765.11	6268.52	7153.92
01/01/2037 0:00	2037	6765.8	6282.48	7499.79	6606.19	6143.83	7169.47	6604.15	5809.91	7013.64
01/01/2038 0:00	2038	6845.01	6450.11	7277.89	6762.11	5939.97	7135.93	6536.27	5787.68	6960.53
01/01/2039 0:00	2039	6735.77	5949.52	7113.2	6880.69	6205.38	7145.25	6663.87	6150.48	7245.27
01/01/2040 0:00	2040	6764.33	6072.03	7187.91	6690	6253.78	7152.39	6576.09	6211.31	7207.2
01/01/2041 0:00	2041	6667.12	5989.03	7308.7	6611.97	6217.25	6971.23	6497.15	5883.16	6926.51
01/01/2042 0:00	2042	6780.42	6120.46	7089.12	6624.25	6183.37	6976.81	6514.8	5804.28	6961.8
01/01/2043 0:00	2043	6684.03	6269.83	7044.76	6552.25	5673.73	7093.55	6397.19	5629.76	7165.39
01/01/2044 0:00	2044	6789.04	6337.14	7383.5	6509.07	6095.9	6806.01	6345.52	5768.18	7011.08
01/01/2045 0:00	2045	6724.47	6244.39	7158.81	6467.41	6047.67	6922.5	6413.53	5884.83	6830.28
01/01/2046 0:00	2046	6760.23	6056.48	7264.44	6675.34	5932.34	7001.58	6391.85	6059.75	6808.67
01/01/2047 0:00	2047	6688.08	6205.41	7077.46	6580.7	6157.75	6918.91	6349.11	5893.68	6913.72
01/01/2048 0:00	2048	6643.34	6116.82	7248.14	6698.76	6115.78	7215.08	6300.62	5766.63	6840.99
01/01/2049 0:00	2049	6644.76	6202.22	7193.99	6429.75	6000.86	7064.91	6229.35	5831.71	6629.34
01/01/2050 0:00	2050	6664.93	6252.69	7476.58	6667.96	6168.09	6964.46	6204.78	5783.66	6648.51
01/01/2051 0:00	2051	6705.82	6119.9	7172.98	6477.39	5937.4	6924.23	6253.74	5787.62	6780.76
01/01/2052 0:00	2052	6825.9	6032.29	7262.12	6491.4	6089.56	6737.14	6302.83	5645.72	7108.01
01/01/2053 0:00	2053	6753.38	6301.16	7187.26	6309.29	5968.27	7202.24	6110.07	5637.23	6573.02
01/01/2054 0:00	2054	6796.77	6272.28	7139.89	6520.41	5802.38	6879.75	6204.04	5900.74	6893.55
01/01/2055 0:00	2055	6648.98	6009.49	7102.05	6362.62	5731.43	7144.2	5967.75	5460.65	6800.57
01/01/2056 0:00	2056	6534.32	6034.98	7058.54	6416.52	6062.92	6760.27	6073.67	5419.93	6502.84
01/01/2057 0:00	2057	6650.86	6231.14	7303.22	6566.86	6025.78	6991.75	6065.28	5419.6	6692.79

01/01/2058 0:00	2058	6731.2	6103.79	7273.63	6360.09	5977.38	6810.96	5845.09	5533	6435.78
01/01/2059 0:00	2059	6769.85	5793.46	7146.57	6466.32	6090.57	7050.32	6012.44	5386.22	6516.28
01/01/2060 0:00	2060	6604.49	5871.45	6979.24	6463.58	5827.84	6999.08	6068.52	5226.44	6783.78
01/01/2061 0:00	2061	6639.96	6039.72	7151.7	6387.6	6038.75	6853.68	6119.09	5397.01	6549.39
01/01/2062 0:00	2062	6450.7	5702.99	7182.98	6526.3	5555.89	6942.67	6082.62	5311.46	6488.38
01/01/2063 0:00	2063	6697.85	6302.98	7371.66	6462.59	5335.65	7001.34	5780.07	5161.96	6458.58
01/01/2064 0:00	2064	6705.13	6083.86	7317.62	6288.79	5840.21	6854.15	5853.7	5360.64	6627.55
01/01/2065 0:00	2065	6718.4	6124.19	6962.06	6285.98	5744.86	6790.41	5967.65	5325.84	6500.59
01/01/2066 0:00	2066	6713.76	6046.91	7121.59	6181.44	5566.35	6647.14	5879.79	5082.63	6616.68
01/01/2067 0:00	2067	6707.14	6480.75	7218.44	6204.66	5633.3	6722.41	5810.73	5123.98	6286.15
01/01/2068 0:00	2068	6729.36	5993.87	7070.84	6348.59	5580.32	6895.24	5815.89	5050.55	6475.56
01/01/2069 0:00	2069	6576.35	6111.71	7210.86	6432.66	5795.66	7004.11	5581.75	5203.18	6113.85
01/01/2070 0:00	2070	6688.38	6067.95	7084.58	6220.47	5900.53	6635.7	5698.33	4929.16	6340.34
01/01/2071 0:00	2071	6661.73	6007.76	7197.85	6240.66	5718.13	6736.54	5687.75	5208	6456.05
01/01/2072 0:00	2072	6695.89	6286.12	7380.52	6352.78	5725.04	6669.49	5702.62	5205.64	6305.72
01/01/2073 0:00	2073	6825.13	6045.03	7165.1	6290.85	5646.05	7067.24	5647.99	4691.39	6214.09
01/01/2074 0:00	2074	6633.18	6189.36	6997.21	6412.56	5827.17	6856.52	5656.44	4888.26	6250.39
01/01/2075 0:00	2075	6694.23	6199.65	7120.76	6167.96	5705.51	6602.12	5520.24	5149.96	6152.96
01/01/2076 0:00	2076	6471.55	6063.43	6895.36	6252.32	5944.01	6875.23	5592.25	4826.94	6093.91
01/01/2077 0:00	2077	6876.2	6393.4	7287.09	6259.84	5698.56	6925.5	5446.48	4733.07	6044.01
01/01/2078 0:00	2078	6828.46	6256.54	7205.89	6093.8	5468.51	6848.55	5365.54	4738.78	6103.53
01/01/2079 0:00	2079	6654.29	5996.49	7115.09	6234.71	5500.72	6711.93	5358.13	4882.32	5975.01
01/01/2080 0:00	2080	6665.95	6165.71	7042.04	6243.64	5813.07	6696.8	5502.36	4799.99	6008.06
01/01/2081 0:00	2081	6841.14	6199.2	7239.62	6265.93	5642.28	6717.06	5564.63	4687.04	5887.38
01/01/2082 0:00	2082	6466.84	6223.56	6883.89	6195.13	5503.5	6588.84	5361.58	4603.22	5826.91
01/01/2083 0:00	2083	6676.79	6017.48	7210.58	6099.37	5550.68	6895.43	5188.14	4821.74	5930.24
01/01/2084 0:00	2084	6705.64	6160.99	7154.99	6033.85	5284.26	6768.98	5339.53	4683.39	5896.01
01/01/2085 0:00	2085	6739.32	5977.34	7208.76	6294.78	5462.71	7030	5420.69	4751.55	6022.13
01/01/2086 0:00	2086	6627.74	6141.64	7003.08	6195.42	5541.64	6701.8	5353.52	4759.09	6042.17
01/01/2087 0:00	2087	6738.85	5716.6	7082.51	6293.62	5675.96	6797.83	5186.58	4788.71	5836.5
01/01/2088 0:00	2088	6552.69	5871.21	6891.22	6286.23	5713.35	6971.49	5286.69	4699.64	6103.36
01/01/2089 0:00	2089	6491.83	5928.91	7230.54	6205.01	5459.26	6744.82	5196.05	4444.06	5944.33
01/01/2090 0:00	2090	6697.44	6128.35	7315.11	6086.37	5385.88	6737.34	5292.25	4795.65	6121.16
01/01/2091 0:00	2091	6721.82	6067.94	7134.1	6200.04	5791.87	6585.56	5043.7	4267.41	5664.85
01/01/2092 0:00	2092	6585.39	6112.51	7188.09	6299.76	5387.48	6733.45	5233.33	4533.32	5893.11
01/01/2093 0:00	2093	6738.22	6113.85	7208.82	6313.44	5686.25	6620.75	5117.37	4287.29	5838.54
01/01/2094 0:00	2094	6742.01	6338.42	7228.76	6173.82	5554.88	6807.13	5098.31	4515.56	5856.85

01/01/2095 0:00	2095	6681.96	6012.46	7155.82	6223.76	5533.19	6683.14	5316.23	4341.14	5858.52
01/01/2096 0:00	2096	6758.66	6109.53	7070.26	6038.94	5741.44	6602.45	5105.44	4331.45	5901.69
01/01/2097 0:00	2097	6682.84	6164.49	7069.39	6232.63	5397.1	6924.14	5052.67	4309.13	5399.96
01/01/2098 0:00	2098	6839.09	6283.33	7250.72	6121.47	5658.68	6735.63	4979.33	4386.28	5771.77
01/01/2099 0:00	2099	6570.28	5962.23	7093.04	6060.95	5454.15	6604.49	4928.02	4107.97	5759.42

DateTime	Year	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	7.11	52.14									
01/01/1951 0:00	1951	1.83	48.15									
01/01/1952 0:00	1952	3.89	59.12									
01/01/1953 0:00	1953	0.08	37.03									
01/01/1954 0:00	1954	5.4	59.41									
01/01/1955 0:00	1955	4.05	52.04									
01/01/1956 0:00	1956	4.42	56.78									
01/01/1957 0:00	1957	6.25	74.24									
01/01/1958 0:00	1958	6.12	48.12									
01/01/1959 0:00	1959	0.95	49.75									
01/01/1960 0:00	1960	3.98	51.8									
01/01/1961 0:00	1961	6.89	42.27									
01/01/1962 0:00	1962	3.01	20.32									
01/01/1963 0:00	1963	3.72	49.66									
01/01/1964 0:00	1964	4.66	46.67									
01/01/1965 0:00	1965	4.47	45.31									
01/01/1966 0:00	1966	5.96	74.5									
01/01/1967 0:00	1967	4.35	41.18									
01/01/1968 0:00	1968	6.2	49.05									
01/01/1969 0:00	1969	1.7	29									
01/01/1970 0:00	1970	8.93	54.79									
01/01/1971 0:00	1971	5.57	60.51									
01/01/1972 0:00	1972	1.57	57.02									
01/01/1973 0:00	1973	2.95	47.27									
01/01/1974 0:00	1974	4.55	40.65									
01/01/1975 0:00	1975	5.26	44.61									
01/01/1976 0:00	1976	3.28	69.66									
01/01/1977 0:00	1977	2.83	51.22									
01/01/1978 0:00	1978	13.88	55.9									
01/01/1979 0:00	1979	9.88	61.74									
01/01/1980 0:00	1980	9.3	55.03									
01/01/1981 0:00	1981	4.64	59.2									
01/01/1982 0:00	1982	4.51	51.81									
01/01/1983 0:00	1983	4.73	31.69									

01/01/1984 0:00	1984	4.38	81.72									
01/01/1985 0:00	1985	5.65	63.01									
01/01/1986 0:00	1986	4.26	49.17									
01/01/1987 0:00	1987	4.85	51.77									
01/01/1988 0:00	1988	10.7	56.22									
01/01/1989 0:00	1989	5.38	64.33									
01/01/1990 0:00	1990	9.58	54.19									
01/01/1991 0:00	1991	5.79	63.58									
01/01/1992 0:00	1992	5.2	65.48									
01/01/1993 0:00	1993	5.16	61.31									
01/01/1994 0:00	1994	2.2	64.84									
01/01/1995 0:00	1995	5.98	57.25									
01/01/1996 0:00	1996	6.1	54.78									
01/01/1997 0:00	1997	9.34	59.7									
01/01/1998 0:00	1998	15.5	56.3									
01/01/1999 0:00	1999	6.17	50.21									
01/01/2000 0:00	2000	11.63	52.79									
01/01/2001 0:00	2001	2.59	67.91									
01/01/2002 0:00	2002	11.45	66.68									
01/01/2003 0:00	2003	2.63	63.58									
01/01/2004 0:00	2004	14.05	56.29									
01/01/2005 0:00	2005	9.33	77.3	33.12	9.33	77.3	34.89	9	77.11	34.49	9.19	77.41
01/01/2006 0:00	2006			32.8	11.79	86.08	38.29	9.1	72.47	38.65	8.78	64.04
01/01/2007 0:00	2007			39.4	5.31	68.74	27.39	11.47	94.79	29.21	18.5	87.55
01/01/2008 0:00	2008			27.73	4.18	64.11	36.79	11.58	100.9	31.12	10.63	52.49
01/01/2009 0:00	2009			39.4	11.29	67.59	31.33	10.44	77.88	44.84	13.58	98.5
01/01/2010 0:00	2010			29.48	16.38	70.38	41.68	14.16	90.79	28.77	6.06	109.97
01/01/2011 0:00	2011			32.27	7.99	76.4	42.79	22	85.13	35.77	12.68	99.78
01/01/2012 0:00	2012			46.89	10.39	99.12	29.36	12.81	86.11	46.01	20.5	74.28
01/01/2013 0:00	2013			24.71	10.07	62.22	42.34	6.83	87.06	29.11	6.51	83.02
01/01/2014 0:00	2014			46.01	10.93	64	50.43	23.62	118.63	36.29	17.6	66.49
01/01/2015 0:00	2015			39	23.34	120.05	45.47	21.51	89.64	44.2	25.42	107.26
01/01/2016 0:00	2016			46.98	11.65	122.59	29.54	9.99	62.73	45.89	18.13	111.93
01/01/2017 0:00	2017			48.95	13.74	91.67	40.47	20.49	80.33	33.46	15.34	97.62
01/01/2018 0:00	2018			37.26	12.06	131.52	49.84	17.1	108.94	38.59	14.71	94.69
01/01/2019 0:00	2019			38.57	17.51	101.81	57.25	19.36	106.42	43.84	15.4	88.5
01/01/2020 0:00	2020			32.61	11.2	102	35.48	9.05	85.42	47.97	10.57	99.41

01/01/2021 0:00	2021	55.1	17.47	104.23	55.09	25.7	85.81	38.31	13.24	103.1
01/01/2022 0:00	2022	51.09	21.48	162.09	37.31	12.22	93.53	71.94	24.39	114.01
01/01/2023 0:00	2023	46.08	18.81	114.44	42.59	17.96	90.5	58.56	19.75	116.45
01/01/2024 0:00	2024	49.67	28.95	87.33	48.38	16.18	108.13	50.8	15.58	104.51
01/01/2025 0:00	2025	49.24	23.25	90.51	65.07	26.48	121.23	53.6	23.16	123.21
01/01/2026 0:00	2026	57.59	20.71	118.15	66.48	25.34	130.11	71.22	29.35	146.84
01/01/2027 0:00	2027	58.45	19.04	103.08	51.42	35.6	90.22	72.88	22.92	136.5
01/01/2028 0:00	2028	51.5	21.72	128.59	47	25.53	127.73	54.97	10.3	146.89
01/01/2029 0:00	2029	56.15	15.76	103.12	63.73	16.25	127.72	65.31	22.88	115.6
01/01/2030 0:00	2030	49.68	21.05	96.85	74.66	16.18	106.18	49.63	26.8	106.16
01/01/2031 0:00	2031	58.15	23.89	118.61	64.57	28.54	138.94	56.23	16.03	147.19
01/01/2032 0:00	2032	51.85	19.53	111.8	56.94	21.87	104.52	65.16	44.39	119.11
01/01/2033 0:00	2033	46.28	9.76	128.55	68.85	22.87	166.9	74.15	20.12	147.26
01/01/2034 0:00	2034	66.86	28.03	112.34	60.79	20.58	111.38	65.06	20.35	130.31
01/01/2035 0:00	2035	49.51	16	141.1	65.52	24.9	104.24	78.07	29.48	126.71
01/01/2036 0:00	2036	68.64	25.46	123.88	57.36	9.58	112.42	67.8	34.04	124.15
01/01/2037 0:00	2037	42.24	19.72	101.46	51.64	20.38	115.78	77.87	35.43	145.43
01/01/2038 0:00	2038	52.05	19.96	90.1	55.66	26.02	131.45	90.02	41.64	161.91
01/01/2039 0:00	2039	77.45	31.12	147.19	56.74	25.14	144.68	65.71	27.47	161.66
01/01/2040 0:00	2040	50.51	23.03	108.25	65.62	20.72	128.45	76.27	17.77	136.03
01/01/2041 0:00	2041	65.82	25.9	180.57	74.19	28.75	134.34	86.74	48.68	151.7
01/01/2042 0:00	2042	54.29	28.64	136.42	70.39	26.17	104.93	60.14	17.38	132.98
01/01/2043 0:00	2043	54.13	17.05	103.12	66.67	34.55	157.22	81.43	29.55	153.69
01/01/2044 0:00	2044	53.54	15.81	100.63	70.46	36.56	173.55	69.01	28.87	178.85
01/01/2045 0:00	2045	50.41	19.83	112.49	55.24	18.27	157.61	76.57	21.04	167.18
01/01/2046 0:00	2046	57.5	25.41	116.17	72.35	23.92	156.19	82.71	39.09	178.07
01/01/2047 0:00	2047	59.69	8.09	175.91	65.24	30.56	146.58	113.81	51.61	150.53
01/01/2048 0:00	2048	52.14	14.48	157.56	70.94	34.26	136.41	87.63	22.84	184.28
01/01/2049 0:00	2049	67.85	23.54	126.5	71.98	27.48	139.14	88.57	43.26	176.83
01/01/2050 0:00	2050	85.83	12.47	129.85	88.78	29.16	144.5	114.46	50.15	201.95
01/01/2051 0:00	2051	66.85	7.93	134.11	89.08	33.41	144.3	115.38	39.39	206.94
01/01/2052 0:00	2052	63.32	19.68	144.33	68.38	48.44	155.81	113.33	51.84	178.96
01/01/2053 0:00	2053	73.87	22.94	109.79	68.63	21.04	156.15	105.41	40.77	258.99
01/01/2054 0:00	2054	69.93	23.77	145.93	81.54	28.13	119.86	108.35	41.36	205.22
01/01/2055 0:00	2055	62.42	40.55	149.29	85.6	25.81	177.33	151.78	34.67	242.38
01/01/2056 0:00	2056	60.26	24.15	116.72	73.19	30.92	211.96	119.45	50.8	260.78
01/01/2057 0:00	2057	52.47	22.82	161.42	66.5	19.24	211.05	149.28	36.63	224.75

01/01/2058 0:00	2058	53.68	27	134.76	82.61	30.58	147.46	127.98	67.05	268.08
01/01/2059 0:00	2059	45.69	21.72	138.43	87.41	44.19	187.86	156.13	64.75	267.13
01/01/2060 0:00	2060	63.46	22.01	123.73	108	35.55	155.29	136.71	68.48	280.87
01/01/2061 0:00	2061	72.79	24.56	119.6	113.39	34.62	166.86	110.8	50.92	288.38
01/01/2062 0:00	2062	76.02	38.27	164.03	74.56	38.01	217.94	159.7	90.77	280.83
01/01/2063 0:00	2063	46.86	10.14	96.93	68.29	52	148.5	211.82	86.32	305.05
01/01/2064 0:00	2064	56.05	24.9	92.44	95.64	51.81	204.74	129.62	47.72	274.3
01/01/2065 0:00	2065	64.89	25.43	129.64	100.79	38.77	189.82	163.09	104.46	269.88
01/01/2066 0:00	2066	52.38	21.51	120.42	85.26	28.35	177.47	171.17	61.13	368.53
01/01/2067 0:00	2067	56.38	13.1	130.27	99.04	46.7	219.1	209.72	94.39	386.85
01/01/2068 0:00	2068	71.59	23.31	129.49	101.5	50.46	216.41	173.31	90.6	343.37
01/01/2069 0:00	2069	67.1	31.89	98.2	116.84	50.03	215.74	176.01	85.7	331
01/01/2070 0:00	2070	54.72	26.78	157.12	98.2	57.59	168.96	152.12	58.52	222.19
01/01/2071 0:00	2071	59.78	29.47	151.22	102.43	41.29	173.9	195.79	81	326.66
01/01/2072 0:00	2072	60.28	23.67	153.94	108.7	49.81	186.17	177.22	91.11	409.65
01/01/2073 0:00	2073	63.22	12.86	127.59	84.14	49.52	182.06	175.78	84.95	316.34
01/01/2074 0:00	2074	55.5	19.85	108.05	95.07	38.96	169.16	217.32	64.48	404.14
01/01/2075 0:00	2075	70.53	11.6	126.67	89.09	27.47	176.72	247.68	63.62	436.27
01/01/2076 0:00	2076	64.71	23.85	152.08	105.28	25.34	163.57	226.92	129.46	368.04
01/01/2077 0:00	2077	53.81	24.6	146.4	93.98	50.14	279.17	249.71	113.39	356.93
01/01/2078 0:00	2078	63.35	24.22	122.18	135.19	38.07	204.59	221.28	115.39	429.77
01/01/2079 0:00	2079	72.06	18.98	154.04	107.25	40.01	206.39	217.69	108.78	430.26
01/01/2080 0:00	2080	45.86	21.96	177.47	92.97	46.63	230.2	216.69	103.94	490.28
01/01/2081 0:00	2081	64.75	30.52	145.65	108.09	33.28	211.8	240.03	123.6	483.75
01/01/2082 0:00	2082	54.34	25.29	136.22	101.74	29.97	213.18	281.79	135.63	496.53
01/01/2083 0:00	2083	68.6	23.61	122.91	96.07	36.87	248.34	246.03	129.4	470.36
01/01/2084 0:00	2084	66.24	26.8	131.24	140.44	35.5	213.29	262.94	87.31	375.08
01/01/2085 0:00	2085	52.54	17.7	144.84	102.33	50.3	199.03	274.6	104.94	463.31
01/01/2086 0:00	2086	66.14	17.51	163.07	112.26	43.01	202.57	256.27	132.57	560.61
01/01/2087 0:00	2087	57.66	20.46	184.61	111.06	43.41	206.4	284.21	133.83	443.94
01/01/2088 0:00	2088	69.42	24.02	139.45	98.37	51.24	231.72	264.47	134.69	521.5
01/01/2089 0:00	2089	81.24	30.69	145.38	102.77	40.06	231.53	286.9	155.54	546.09
01/01/2090 0:00	2090	68.8	16.73	143.29	112.73	40.44	207.95	237.73	109.13	598.2
01/01/2091 0:00	2091	63.78	28.26	124.53	95.02	48.76	286.13	309.33	165.2	644.06
01/01/2092 0:00	2092	71.35	17.91	95.84	97.14	41.28	229.83	276.43	175.88	487.59
01/01/2093 0:00	2093	67.3	30.49	153.77	97.68	43.46	172.78	281.98	127.54	553.07
01/01/2094 0:00	2094	73.71	13.73	131.43	106.62	40.39	265.85	285.02	138.17	530.12

01/01/2095 0:00	2095	54.81	27.92	134.48	132.66	57.87	273.95	267.29	114.63	510.92
01/01/2096 0:00	2096	53.93	22.67	136.58	133.04	74.41	261.57	273.15	125.69	590.3
01/01/2097 0:00	2097	64	26.11	135.53	102.99	46.55	210.25	299.21	172.35	585.28
01/01/2098 0:00	2098	62.65	25.41	177.1	133.38	49.75	254.11	373.16	178.54	595.51
01/01/2099 0:00	2099	48.34	16.94	121.62	120.76	50.17	211.63	405.4	147.94	677.84

Appendix B:

Future Precipitation Predictions (RCP 2.6, 4.5 and 8.5)

RCP2.6

Total Annual Precip (mm)

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp26 (kg m-	pr MIROC-ESM-CHEM historical rcp26 (kg m-	pr CNRM-CM5 historical rcp26 (kg m-	pr MRI-CGCM3 historical rcp26 (kg m-	pr MPI-ESM-MR historical rcp26 (kg m- 2 d-1)	pr MPI-ESM-LR historical rcp26 (kg m- 2 d-1)	pr HadGEM2-ES historical rcp26 (kg m- 2 d-1)	pr HadGEM2-AO historical rcp26 (kg m- 2 d-1)	pr bcc-csm1-1-m historical rcp26 (kg m- 2 d-1)	pr FGOALS-g2 historical rcp26 (kg m- 2 d-1)	pr IPSL-CM5A-MR historical rcp26 (kg m- 2 d-1)	pr GFDL-CM3 historical rcp26 (kg m- 2 d-1)	pr CESM1-CAM5 historical rcp26 (kg m-	pr CanESM2 historical rcp26 (kg m- 2 d-1)	pr GFDL-ESM2G historical rcp26 (kg m-	pr IPSL-CM5A-LR historical rcp26 (kg m- 2 d-1)	pr MIROC5 historical rcp26 (kg m- 2 d-1)	pr bcc-csm1-1 historical rcp26 (kg m- 2 d-1)	pr NorESM1-M historical rcp26 (kg m- 2 d-1)	pr BNU-ESM historical rcp26 (kg m- 2 d-1)	pr NorESM1-ME historical rcp26 (kg m- 2 d-1)	pr GFDL-ESM2M historical rcp26 (kg m-	pr CCSM4 historical rcp26 (kg m- 2 d-1)	pr CSIRO-Mk3-6-0 historical rcp26 (kg m-
2011	469.7	476.7	338.1	614.7	338.1	524.9	449.6	481.8	466.6	504.2	457.4	473.9	438.4	522.7	380.0	486.5	448.3	612.4	568.5	472.8	384.8	614.7	458.0	474.6	526.3	446.3	461.2	449.4
2012	471.0	472.2	332.5	581.2	487.5	358.1	470.6	363.1	542.5	462.6	580.4	515.1	448.7	471.4	534.0	565.6	379.6	485.1	499.7	411.0	445.3	581.2	409.3	569.7	420.6	566.5	432.2	332.5
2013	472.0	475.8	335.9	578.7	469.9	425.8	462.9	578.7	474.0	465.0	507.8	516.2	518.4	550.8	335.9	454.3	368.3	565.6	465.9	379.9	474.9	572.3	407.0	548.1	450.4	509.2	497.5	421.5
2014	490.3	491.6	349.6	685.9	516.2	433.2	554.7	436.3	490.8	580.5	544.4	568.4	465.5	490.8	563.9	489.8	576.9	385.6	491.8	349.6	425.9	433.7	465.3	685.9	466.1	529.1	394.7	459.4
2015	459.7	470.9	350.4	595.0	435.6	470.7	397.1	499.9	422.2	520.1	430.7	498.7	540.8	383.9	425.1	414.2	512.0	544.9	436.8	595.0	526.1	404.3	350.4	448.6	533.2	527.8	558.9	425.5
2016	451.2	469.0	330.5	607.2	493.3	394.3	449.1	453.4	515.4	554.8	527.4	445.4	419.1	379.3	378.7	428.2	583.9	607.2	443.1	463.7	330.5	352.8	599.9	585.7	475.6	586.3	413.2	375.5
2017	470.9	476.6	307.3	626.9	396.5	499.7	536.5	419.1	376.2	620.9	487.4	503.0	626.9	433.6	436.0	617.6	426.0	538.1	500.9	466.1	513.9	351.7	403.5	571.3	473.2	464.0	468.5	307.3
2018	484.1	482.7	335.9	591.1	473.7	485.3	590.2	482.8	547.9	517.6	498.2	407.3	562.2	557.4	523.1	478.0	455.3	433.8	335.9	442.3	591.1	337.3	576.0	519.3	462.1	391.2	407.8	509.7
2019	436.1	462.6	325.4	681.4	642.9	519.1	353.7	523.4	445.4	447.2	399.1	429.4	530.8	437.5	401.1	597.1	434.6	373.1	325.4	478.7	412.7	681.4	398.7	432.7	495.9	547.9	421.5	373.9
2020	525.0	504.7	376.4	619.5	376.4	484.0	526.5	457.1	555.4	432.2	619.5	426.5	523.5	393.8	558.7	463.9	542.7	557.8	539.6	575.1	387.4	517.9	480.8	553.2	549.4	614.8	530.1	446.0
2021	453.9	459.8	289.2	738.0	480.4	425.3	448.2	383.5	459.4	454.8	374.5	394.3	456.1	541.3	364.5	505.8	468.8	457.5	565.8	526.5	289.2	442.6	435.0	738.0	453.0	559.3	426.2	385.8
2022	458.1	454.3	358.3	585.5	467.1	418.8	395.6	381.1	407.2	358.3	508.2	454.2	379.9	585.5	470.5	519.2	474.8	359.9	421.8	414.1	462.1	521.4	569.9	500.8	432.4	383.9	510.2	507.2
2023	467.9	486.1	346.1	642.7	384.0	371.0	350.8	533.7	346.1	544.0	465.7	520.5	430.6	467.5	586.0	448.5	537.5	642.7	579.7	463.0	545.2	582.2	421.3	634.0	453.5	468.3	495.0	396.5
2024	467.0	461.6	325.0	568.0	563.7	525.1	448.4	414.5	444.0	517.1	468.1	407.6	407.7	325.0	374.8	487.0	513.4	452.8	458.5	378.7	395.1	489.2	476.3	568.0	465.9	489.8	494.9	512.2
2025	434.1	455.6	282.5	628.5	502.1	394.6	500.8	439.3	472.0	613.8	355.9	404.8	554.0	427.1	399.7	628.5	438.0	558.7	282.5	428.4	430.2	406.8	598.9	392.7	528.9	306.4	469.4	400.9
2026	478.0	464.0	277.0	570.5	507.3	569.1	486.1	532.4	570.5	478.3	435.7	405.5	538.9	333.4	423.4	439.4	386.7	464.2	338.6	487.6	554.7	480.2	510.6	464.7	503.7	277.0	470.4	477.7
2027	514.5	510.2	365.7	670.9	550.3	524.2	549.4	425.0	470.7	609.3	447.3	433.1	452.9	475.9	670.9	484.1	510.3	546.3	550.1	460.3	365.7	419.8	578.0	439.2	556.5	595.8	518.8	611.1
2028	473.5	481.8	325.5	691.5	691.5	459.1	426.3	381.4	542.8	587.0	500.3	524.9	423.4	520.8	467.4	537.9	414.6	510.6	584.6	409.7	483.0	451.4	468.9	469.6	477.4	482.1	325.5	424.0
2029	474.9	468.0	334.9	639.1	539.5	506.1	377.5	338.3	547.2	570.5	472.8	360.8	434.4	566.5	440.0	423.6	423.0	491.9	492.7	477.0	427.2	425.2	501.9	639.1	493.1	526.4	334.9	423.2
2030	489.4	503.2	311.1	702.9	478.9	702.9	547.7	473.0	311.1	498.0	602.5	400.1	499.2	525.4	621.5	412.0	460.9	463.2	479.1	436.7	535.2	549.3	535.5	555.2	480.8	460.2	583.3	465.0
2031	509.9	492.1	381.9	659.9	530.4	424.3	541.2	510.0	659.9	618.2	630.8	480.9	398.3	509.8	388.0	518.6	510.9	474.4	510.7	410.5	594.2	513.5	408.1	518.6	381.9	435.0	440.2	401.0
2032	466.7	490.2	377.7	749.1	413.8	557.6	377.7	398.2	591.2	398.5	453.9	599.8	543.6	460.5	381.8	613.4	395.0	472.9	506.7	408.0	393.6	504.4	510.3	679.9	520.4	749.1	407.8	427.8
2033	470.1	454.6	328.0	582.1	468.1	562.1	500.3	401.2	352.0	349.9	507.2	436.9	472.1	450.4	345.8	577.6	364.5	432.3	328.0	487.8	499.7	483.8	547.8	524.6	505.5	582.1	367.2	362.4
2034	488.6	483.1	385.0	745.5	530.3	437.6	509.6	504.6	745.5	485.1	542.5	526.7	455.9	446.5	403.4	454.7	500.2	529.1	443.9	508.6	402.8	516.3	489.8	487.5	409.6	493.3	386.3	385.0
2035	492.9	507.2	362.7	685.3	631.5	438.0	575.9	392.6	500.4	384.5	580.7	545.8	479.1	465.2	592.4	485.4	643.2	445.6	685.3	569.8	441.6	397.0	622.7	362.7	521.8	373.2	575.7	462.2
2036	469.2	483.3	349.9	685.6	456.5	525.6	447.8	466.5	405.8	536.7	445.6	540.3	503.2	390.4	586.3	349.9	469.4	685.6	577.4	417.8	495.9	366.5	469.0	551.3	448.8	472.2	559.7	430.2
2037	508.5	503.5	379.5	633.0	553.4	390.4	448.9	510.3	509.1	570.3	617.7	569.5	514.2	387.4	476.5	475.0	558.4	494.8	497.6	560.7	507.9	387.7	633.0	496.2	604.5	431.3	509.5	379.5
2038	478.8	486.4	365.0	655.4	462.5	466.3	405.3	365.0	655.4	477.6	485.5	452.2	464.4	454.6	511.5	483.4	531.9	579.0	427.0	571.1	429.5	443.9	502.3	429.6	510.9	480.0	581.6	502.1
2039	468.4	490.9	408.3	635.9	547.0	631.6	414.7	446.3	435.6	457.3	494.4	465.8	442.7	418.1	408.3	621.7	534.7	554.3	531.5	482.9	474.5	469.6	467.3	529.5	635.9	442.6	442.9	431.4
2040	448.6	473.3	381.4	769.6	623.3	505.5	448.4	530.3	769.6	416.0	418.4	489.2	427.5	434.6	448.7	526.0	402.9	397.1	452.3	492.4	405.9	482.0	413.5	530.6	512.5	381.4	409.0	442.2
2041	477.5	473.0	294.6	617.3	488.9	520.1	617.3	583.8	605.9	547.5	437.2	523.0	420.6	476.6	411.6	548.4	498.3	374.5	497.0	355.3	294.6	494.5	474.2	408.6	439.8	448.9	478.4	407.7
2042	480.5	482.5	360.2	640.2	605.1	616.3	485.9	438.1	640.2	467.0	364.4	426.5	432.8	512.8	419.3	518.9	490.2	540.3	446.2	442.1	516.3	459.2	482.6	410.5	360.2	500.0	527.2	478.3
2043	488.2	504.9	348.8	675.5	572.1	535.9	348.8	466.3	456.2	571.2	598.3	416.5	525.0	497.4	675.5	474.5	448.0	592.1	479.1	372.1	601.8	433.3	416.7	633.7	524.3	655.2	384.7	438.5
2044	492.3	498.5	346.0	686.2	565.7	574.9	423.5	346.0	478.5	429.4	563.7	656.0	439.6	383.4	520.3	497.4	595.6	599.9	498.0	434.9	686.2	554.7	493.9	476.4	426.7	490.8	425.0	402.5
2045	491.4	490.3	366.4	613.1	538.0	564.5	366.4	586.4	613.1	492.0	519.0	422.2	369.7	462.0	486.5	509.9	368.7	535.4	474.2	560.3	509.0	581.8	457.5	490.7	465.4	472.6	384.6	538.1
2046	507.8	488.2	296.2	591.4	587.2	425.5	527.8	468.9	510.2	537.9	591.4	565.5	455.7	511.3	296.2	433.5	473.1	452.8	542.6	387.8	456.9	542.5	522.0	548.9	505.5	457.0	377.8	539.3
2047	495.4	488.6	275.4	679.4	614.5	557.6	573.7	387.3	456.1	436.1	440.0	522.8	530.9	607.6	536.1	562.2	504.0	352.2	679.4	420.8	275.4	437.3	600.9	359.4	472.6	550.9	361.9	486.8
2048	510.0	494.5	275.7	646.0	513.3	613.5	560.4	405.0	521.6	646.0	569.7	447.0	418.1	421.4	516.0	275.7	547.1	514.6	618.7	440.0	561.4	447.2	427.1	506.7	470.0	502.4	385.2	539.5
2049	483.0	481.5	318.6	620.6	447.1	556.3	520.9	495.7	427.6	550.6	518.9	366.1	596.9	473.4	318.6	488.1	508.4	374.5	457.7	521.3	620.6	432.9	478.0	552.0	458.0	414.1	475.9	502.2
2050	467.0	476.1	353.8	643.9	353.8	536.2	487.8	466.7	549.7	452.6	383.5	407.9	379.7	597.1	495.2	512.1	460.2	439.2	537.1	466.7	459.0	471.8	425.7	467.2	484.5	643.9	487.3	460.4
2051	479.7	486.6	306.7	677.5	523.3	428.1	414.6	438.5	530.0	426.9	589.1	513.1	482.1	677.5	306.7	429.4	476.4	593.4	478.8	609.1	561.7	480.6	542.6	383.5	432.0	482.1	417.0	461.9
2052	483.3	485.7	348.8	655.7	551.3	453.0	442.9	374.5	552.0	612.6	515.7	489.5	488.2	406.7	436.1	406.3	348.8	655.7	603.2	469.4	349.2	466.6	486.3	480.3	496.3	589.8	433.3	549.2
2053	489.0	486.7	332.5	635.6	595.6	448.1	531.9	547.2	535.1	425.9	635.6	435.6	546.6	487.4	446.2	520.5	386.4	389.4	490.6	539.7	609.5	461.5	420.9	528.0	417.3	332.5	457.2	492.8
2054	488.9	490.9	384.9	593.4	482.1	524.0	540.0	449.5	528.9	412.9	422.6	484.8	441.4	425.0	467.0	518.6	563.2	593.4	455.8	512.3	384.9	574.3	491.9	570.3	528.7	516.5	486.0	407.0
2055	458.4	474.0	367.6	731.6	391.4	489.8	558.8	669.2	478.7	492.1	500.1	397.7	458.6	423.4	423.1	367.6	473.1	508.2	377.0	383.9	429.2	422.1	460.2	731.6	418.5	651.8	412.1	458.2
2056	519.7	528.6	348.1	716.9	572.0	716.9	519.8	490.5	519.6	635.2	501.4	556.2	546.6	594.3	574.9	473.3	535.0	507.5	490.1	448.1	503.7	534.9	494.9	601.4	537.3	510.5	348.1	474.3
2057	492.9	498.7	309.2	678.1	397.9	544.5	454.2	309.2	439.7	485.8	465.7	553.8	513.0	499.9	463.4	509.1	457.3	678.1	421.4	576.4	590.1	482.8	460.8	531.6	476.6	586.3	563.5	508.0
2058	489.7	494.4	373.5	631.9	401.5	445.4	523.1	517.8	460.7	631.9	373.5	575.3	504.3	533.3	443.5	482.4	426.9	445.4	481.2	513.1	485.0	454.8	506.0	612.9	455.1	597.0	500.3	494.3
2059	531.9	528.4	410.8	674.9	444.7	596.4	590.9	598.1	432.8	442.5	505.0	536.6	410.8	540.8	604.8	527.2	481.0	674.9	476.3	591.9	538.1	581.7	464.6	520.2	583.3	566.9	465.0	507.6
2060	473.0	480.8	393.9	653.7	396.0	653.7	395.8	436.7	518.4	566.1	467.7	505.4	440.8	427.8	491.8	472.7	454.5	549.5	541.3	460.2	505.1	474.4	534.6	505.0	416.8	457.1	393.9	473.3
2061	455.3	470.6	319.0	683.5	379.1	530.0	480.5	534.7	443.3	584.3	683.5	436.1	464.8	452.9	534.9	543.4	365.2	533.9	427.1	456.0	319.0	632.5	472.4	410.7	454.6	363.4	358.9	434.1
2062	483.7	494.6	375.2	698.5	396.9	437.9	499.1	506.6	375.2	455.8	418.2	452.6	461.2	521.7	597.9	502.0	488.0	599.4	414.5	479.3	556.6	555.2	421.0	564.7	698.5	451.4	552.9	464.3
2063	516.0	522.1	404.5	652.7	550.9	461.2	431.8	503.9	425.9	523.6	628.7	599.5	497.8	482.6	430.7	504.9	618.9	625.0	545.2	534.2	543.0	652.7	569.4	453.3	508.4	561.4	471.9	404.5
2064	527.8	515.0	308.2	645.4	599.7	530.9	508.9	609.7	529.6	510.1	593.9	444.5	556.9	420.1	373.8	553.4	497.0	446.3	458.7	308.2	537.4	587.2	645.4	612.6	525.9	504.8	453.5	552.3
2065	465.5	475.0	386.7	587.1	539.9	443.1	558.9	450.6	414.4	448.2	464.3	528.7	411.4	438.5	496.9	440.3	527.4	443.2	386.7	493.1	393.5	489.9	485.1	484.8	587.0	466.6	420.5	587.1
2066	492.6	484.1	409.8	586.3	496.5	442.7	498.1	521.7	542.3	437.1	564.0	488.7	412.3	497.3	442.6	458.9	508.0	451.2	421.5	454.3	409.8	515.3	580.1	516.5	586.3	459.8	414.8	498.1
2067	471.9	487.6	406.4	674.9	418.1	475.2	443.4	533.9	491.9	428.4	457.6	425.3	428.8	540.9	540.7	475.9	468.5	494.2	615.9	552.7	564.4	466.2	513.8	416.4	427.6	442.0	406.4	674.9
2068	494.6	487.4	318.1	604.9	511.8	495.9	498.7	591.7	318.1	396.8	383.4	528.0	576.6	472.1	487.4	493.4	459.7	552.1	434.5	499.8	604.9	492.2	374.8	530.2	446.7	533.4	443.6	572.2
2069	483.3	479.3	349.2	620.7	388.8	482.3	560.8	492.3	508.0	509.2	620.7	521.2	445.7	575.4	472.3	540.9	448.2	449.4	466.3	499.7	484.4	510.1	349.2	446.0	416.9	360.6	434.6	520.1
2070	503.3	498.8	403.4	666.3	417.8	572.5	567.0	427.3	403.4	564.3	563.0	503.2	546.1	516.8	405.3	582.1	503.4	450.0	435.5	473.2	403.8	446.4	417.8	666.3	652.3	516.4	415.5	522.1
2071	482.9	477.8	314.5	594.1	314.5	488.0	422.6	349.4	521.3	507.3	521.0	589.5	414.8	542.0	377.8	567.4	413.2	466.6	499.5	473.4	515.1	428.3	486.4	572.9	479.5	464.4	594.1	458.9
2072	479.7	486.4	370.5	709.3	462.4	460.9	487.8	709.3	482.5	489.9	507.7	450.5	424.8	444.2	407.4	503.1	439.7	611.0	370.5	434.5	517.6	615.8	527.1	506.8	476.8	500.7	377.6	464.3
2073	474.7	475.8	367.9	590.3	482.0	465.6	410.9	512.5	533.2	367.9	439.8	452.7	474.1	430.2	539.2	486.0	478.6	465.1	475.2	590.3	468.1	451.0	388.9	443.5	503.7	482.0	565.2	513.2
2074	481.2	481.8	374.8	627.4	374.8	535.7	627.4	391.4	490.7	526.1	418.6	550.7	457.6	588.7	471.7	440.8	495.1	434.4	445.7	526.7	446.0	490.9	502.8	456.9	563.7	438.4	392.4	494.6
2075	498.8	509.2	391.2	820.1	423.7	449.2	593.3	391.2	433.2	507.0	537.3	421.8	521.7	579.9	491.2	589.5	517.2	502.4	585.9	468.3	417.6	396.1	495.3	820.1	578.8	451.2	584.8	463.2
2076	494.5	494.9	348.3	663.0	348.3	477.6	396.7	419.6	508.9	513.2	550.6	563.6	553.8	515.9	443.5	596.0	600.7	621.2	473.8	663.0	457.2	384.5	512.7	388.0	480.1	536.0	419.7	453.1
2077	503.3	496.2	346.3	642.4	582.4	523.9	462.9	412.2	423.6	601.8	487.3	429.2	642.4	534.7	438.8	608.7	361.6	467.4	599.6	346.3	519.9	510.0	530.5	549.9	485.8	496.5	348.7	545.2
2078	483.7	488.1	296.8	617.2	478.2	573.7	583.2	363.3	534.6	553.2	411.6	395.4	426.5	543.5	489.2	575.1	296.8	464.4	568.7	448.6	459.1	510.0	433.7	617.2	537.1	467.8	519.2	465.2
2079	473.0	490.9	344.4	736.6	574.2	477.3	625.2	423.1	579.5	544.8	509.3	434.3	444.8	388.7	498.2	381.0	412.5	477.1	400.9	427.7	469.0	736.6	395.3	635.4	589.2	344.4	571.7	440.6
2080	484.4	474.0	309.1	664.2	531.2	309.1	377.6	497.8	664.2	375.2	549.0	418.2	465.0	600.0	394.5	373.9	460.5	504.7	510.7	535.0	412.7	471.0	557.6	567.3	500.0	511.8	426.9	363.2
2081	488.6	481.7	338.0	613.7	434.7	467.2	356.0	338.0	433.1	590.6	484.7	441.3	484.1	589.3	497.3	553.0	500.2	613.7	541.9	548.7	493.9	532.1	452.4	492.4	448.9	383.1	390.5	494.5
2082	485.2	483.9	399.5	594.5	532.1	537.1	496.4	476.2	508.3	401.4	487.6	511.1	526.1	463.7	513.5	564.9	436.7	594.5	482.7	420.4	411.2	423.9	516.9	481.0	471.2	399.5	429.3	528.7
2083	497.8	505.4	279.6	796.2	796.2	458.0	557.0	542.0	478.8	494.7	366.8	453.3	408.4	514.0	500.9	455.6	515.5	714.7	516.2	389.2	399.8	484.1	553.1	613.5	550.3	279.6	614.3	474.1
2084	465.7	473.4	325.4	595.2	474.4	441.7	335.9	365.3	459.2	398.5	491.4	325.4	562.4	445.4	559.3	489.6	460.5	595.2	531.7	524.6	465.6	465.7	419.9	424.5	577.7	528.4	567.3	452.1
2085	499.2	497.7	344.6	607.1	573.0	497.6	520.0	536.7	497.4	465.1	344.6	477.7	495.7	556.6	516.4	502.2	543.1	607.1	455.8	475.0	572.7	539.3	408.8	491.0	500.7	546.0	442.9	380.0
2086	505.5	497.5	314.0	702.3	556.5	467.3	491.9	370.2	511.9	550.4	501.4	446.1	557.5	545.7	509.6	657.8	541.5	534.8	314.0	443.9	469.1	462.5	374.5	702.3	550.7	603.8	360.8	416.2
2087	480.4	489.9	339.3	700.0	474.7	485.2	456.3	397.9	536.6	475.5	551.0	529.5	422.9	560.7	369.0	421.9	565.9	536.8	577.6	700.0	339.3	445.7	429.4	501.7	561.0	455.2	531.2	433.1
2088	466.9	469.6	295.5	650.9	466.4	544.8	473.6	505.6	475.2	371.4	492.3	467.4	397.6	455.2	425.5	549.6	483.0	650.9	295.5	414.5	463.0	474.6	444.0	449.5	507.8	454.4	561.7	447.7
2089	476.8	498.2	372.9	696.4	476.3	607.8	400.4	373.3	395.9	606.9	470.3	477.2	507.9	467.6	435.7	582.1	518.3	625.8	594.3	696.4	395.9	422.8	476.3	558.7	456.6	372.9	551.1	486.2

2090	496.2	489.6	325.7	679.4	502.5	532.4	526.7	507.3	520.1	549.6	489.9	370.1	427.9	442.0	488.3	464.9	392.5	615.9	592.8	462.3	509.1	461.9	540.8	679.4	535.4	325.7	399.9	412.9
2091	483.6	480.7	355.4	579.4	521.0	439.9	430.7	481.6	436.3	516.9	514.6	355.4	579.4	547.6	437.6	485.7	503.8	473.8	443.4	465.2	415.3	555.7	547.8	536.5	388.4	508.8	575.6	375.3
2092	474.9	467.2	356.7	576.6	523.9	572.8	576.6	359.4	492.6	473.6	476.2	465.2	417.6	489.2	544.6	378.6	388.3	469.2	511.3	426.2	488.4	356.7	526.3	543.7	506.3	417.4	412.4	395.3
2093	483.6	483.2	386.1	604.7	419.2	483.8	483.5	550.5	388.3	534.7	506.9	437.8	568.4	447.3	481.7	473.8	425.6	412.8	508.5	509.8	386.1	459.7	488.6	490.9	538.9	527.4	466.9	604.7
2094	472.9	470.1	315.8	624.7	503.7	521.2	460.8	493.8	479.4	409.5	420.4	323.8	443.5	462.2	466.5	624.7	618.5	413.2	517.2	511.1	489.8	453.2	484.1	431.5	529.1	499.8	315.8	409.9
2095	485.4	477.4	326.7	593.9	493.7	566.2	555.7	411.5	485.3	335.4	326.7	530.6	529.2	569.4	363.5	565.4	522.0	593.9	444.2	480.4	403.7	436.7	485.4	420.4	549.6	473.7	491.8	422.9
2096	503.4	508.4	354.6	646.8	570.4	434.3	354.6	593.9	646.8	445.7	531.6	416.6	450.0	420.3	504.5	504.6	497.9	528.5	564.3	645.3	555.5	498.8	459.5	574.5	535.7	476.0	502.4	488.8
2097	483.2	492.0	369.5	613.8	594.9	583.5	476.9	500.4	455.6	531.3	613.8	407.1	475.6	612.3	489.5	513.7	398.1	402.2	492.1	449.5	431.3	472.9	369.5	558.1	525.6	464.9	470.9	517.4
2098	496.2	500.4	311.2	707.1	519.8	445.6	496.5	707.1	311.2	361.6	601.5	496.9	618.7	478.3	435.9	496.0	365.7	443.6	520.1	605.0	454.7	558.4	545.1	494.5	487.3	579.4	553.8	432.4
2099	485.7	507.7	422.5	626.9	456.8	553.1	472.9	481.4	595.8	596.3	444.9	626.9	518.5	422.5	518.6	535.0	586.9	483.1	503.8	444.8	563.8	481.2	488.3	439.7	456.8	593.9	459.7	460.2
2100	495.5	488.9	376.1	593.0	505.2	430.8	586.5	376.1	593.0	398.5	544.6	452.7	513.1	519.7	469.9	451.8	546.0	517.8	485.8	534.1	536.7	576.3	402.6	471.8	431.0	460.6	382.5	546.1

RCP2.6

Max Daily Precip (mm)

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp26 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp26 (kg m-2 d-1)	pr CNRM-CM5 historical rcp26 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp26 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp26 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp26 (kg m-2 d-1)	pr HadGEM2-ES historical rcp26 (kg m-2 d-1)	pr HadGEM2-AO historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp26 (kg m-2 d-1)	pr FGOALS-g2 historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp26 (kg m-2 d-1)	pr GFDL-CM3 historical rcp26 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp26 (kg m-2 d-1)	pr CanESM2 historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp26 (kg m-2 d-1)	pr MIROC5 historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp26 (kg m-2 d-1)	pr NorESM1-M historical rcp26 (kg m-2 d-1)	pr BNU-ESM historical rcp26 (kg m-2 d-1)	pr NorESM1-ME historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp26 (kg m-2 d-1)	pr CCSM4 historical rcp26 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp26 (kg m-2 d-1)
2011	23.1	25.3	12.9	40.5	19.3	28.2	20.3	21.9	15.8	40.5	12.9	14.2	16.8	30.8	29.0	20.8	21.9	34.3	27.8	23.4	20.1	36.3	31.7	22.9	33.8	35.4	21.6	28.1
2012	22.5	25.3	13.0	49.7	13.6	15.6	49.3	13.0	26.5	19.3	49.7	25.2	48.4	22.5	22.2	24.3	27.1	21.0	22.9	20.4	16.2	30.2	18.9	22.5	26.2	40.4	16.8	14.5
2013	24.1	24.8	13.5	47.7	17.8	14.4	26.7	32.5	25.2	18.7	40.9	21.5	15.6	28.7	13.5	29.8	16.6	25.6	17.0	15.3	25.5	27.9	17.0	47.7	34.8	23.0	21.7	37.1
2014	23.0	27.8	13.2	72.5	23.2	13.2	58.6	22.9	16.1	33.1	41.4	36.2	72.5	19.7	23.2	32.6	30.7	20.5	19.1	18.9	23.8	18.4	17.8	25.3	22.7	18.2	18.1	40.7
2015	19.5	20.3	14.5	32.7	20.6	27.4	17.6	16.3	16.7	18.2	20.1	20.4	18.4	25.6	20.1	17.9	25.5	20.6	16.6	32.7	25.1	17.4	19.0	14.5	20.4	18.8	22.5	14.6
2016	21.8	23.1	12.4	47.4	18.1	18.2	24.1	21.8	16.8	30.3	24.3	34.2	12.4	28.4	17.2	19.3	34.0	47.4	23.2	14.3	14.6	12.5	27.0	30.6	31.6	21.8	17.4	15.7
2017	21.7	24.2	10.5	46.2	16.9	16.8	16.7	18.8	18.3	37.4	31.1	31.7	46.2	18.4	25.9	23.9	15.7	34.4	23.8	19.5	25.9	15.3	17.3	25.5	42.6	19.5	27.9	10.5
2018	21.2	23.3	13.5	57.2	18.1	17.3	31.9	17.0	32.6	20.5	27.1	17.7	22.1	27.9	57.2	24.3	20.1	13.5	17.5	30.1	16.8	22.6	26.4	14.2	21.8	18.7	17.5	27.5
2019	22.0	26.3	13.3	55.0	51.9	20.9	32.4	52.9	17.4	19.2	17.0	35.1	23.4	23.7	20.4	33.3	24.0	13.7	13.3	26.0	23.0	55.0	20.1	17.5	20.1	35.9	17.7	16.4
2020	21.2	24.6	15.0	46.9	15.0	21.1	20.5	27.2	28.3	16.1	46.9	19.8	19.3	17.4	33.6	16.1	30.7	28.8	24.3	21.4	17.6	45.2	19.0	16.9	22.7	36.2	17.6	28.2
2021	22.4	23.8	12.1	56.8	27.4	22.5	17.9	16.5	16.4	22.1	18.7	17.2	22.3	30.8	18.1	23.0	20.4	26.7	56.8	20.4	12.1	30.5	23.4	23.5	31.0	18.9	24.6	29.6
2022	18.1	23.7	12.8	67.4	16.8	12.8	23.9	14.5	17.6	17.2	22.6	16.7	17.0	67.4	17.7	22.6	29.1	22.9	31.3	15.6	18.0	25.5	33.9	18.2	16.5	13.7	42.2	35.3
2023	24.5	25.8	11.2	48.4	30.5	18.4	15.5	48.4	11.2	29.6	32.5	37.1	14.1	18.8	29.4	20.9	24.1	31.9	16.7	24.8	24.0	27.8	22.6	25.2	17.0	35.7	42.0	20.0
2024	19.7	22.8	13.8	40.6	26.9	40.6	13.8	16.2	19.1	30.5	36.4	17.3	26.8	19.1	17.7	17.6	20.8	25.3	16.9	15.0	18.0	17.6	20.3	27.0	23.4	24.2	16.6	40.2
2025	21.5	23.7	9.4	49.5	17.8	23.2	26.7	15.3	22.1	38.0	11.3	24.4	31.7	18.9	34.4	27.3	18.2	33.5	9.4	20.9	25.4	13.7	49.5	15.7	44.2	14.2	14.7	18.1
2026	25.8	25.9	9.6	46.3	30.1	38.6	35.9	23.0	46.3	23.3	31.5	28.2	25.9	14.1	28.1	25.7	17.2	25.2	20.0	29.5	26.8	23.8	21.0	34.1	14.3	9.6	19.5	29.2
2027	29.8	30.1	13.1	53.6	37.2	31.2	42.3	15.5	30.3	28.5	19.8	30.4	20.3	13.1	23.2	21.0	30.7	33.6	52.6	29.3	25.5	21.4	37.6	40.3	24.9	24.1	37.0	53.6
2028	21.9	24.0	14.5	60.7	38.3	17.2	21.3	14.5	24.5	21.8	18.5	24.8	17.1	20.6	18.5	17.3	22.9	60.7	23.9	23.4	28.6	31.6	22.4	29.3	21.9	20.2	17.1	19.0
2029	22.2	26.1	11.9	60.7	38.6	24.0	15.6	11.9	22.2	14.2	26.4	22.1	16.5	60.7	17.5	37.6	19.9	36.3	15.6	15.7	21.6	22.2	24.1	44.8	46.8	29.7	17.1	25.0
2030	24.5	27.8	14.0	70.1	35.1	65.8	27.7	22.6	16.2	30.9	70.1	24.6	30.0	15.1	25.5	24.5	20.0	16.9	31.0	18.2	14.0	17.9	26.2	48.2	15.8	17.8	23.7	30.4
2031	22.0	24.9	13.6	46.1	23.8	18.1	27.8	27.9	30.6	46.1	42.6	22.3	21.8	28.1	41.6	26.6	20.1	21.2	33.4	22.7	20.0	18.4	14.8	21.8	16.9	18.8	18.0	13.6
2032	25.0	27.2	15.1	87.2	33.1	28.0	17.7	20.5	26.8	15.9	24.4	31.7	30.7	18.7	26.7	25.6	34.9	39.1	16.5	19.7	27.3	20.6	18.9	36.2	20.9	87.2	15.1	15.2
2033	20.7	24.3	14.0	59.0	21.0	20.0	59.0	14.0	16.4	31.5	30.8	15.7	17.2	32.2	23.1	32.6	19.3	20.0	14.2	24.9	24.0	27.8	42.3	20.3	20.4	23.8	17.5	15.4
2034	24.0	28.3	16.1	50.7	19.5	23.7	22.4	23.3	43.3	31.7	50.7	19.9	25.0	39.5	18.7	20.8	41.3	37.5	16.1	29.9	24.4	49.3	17.7	22.5	21.4	35.2	26.6	17.8
2035	23.0	25.0	14.0	56.8	39.2	16.2	30.4	14.0	24.2	32.1	26.0	19.0	20.8	25.7	32.2	16.9	30.2	25.4	56.8	19.3	18.7	19.4	29.9	18.1	28.3	19.1	17.2	21.9
2036	25.4	26.6	11.6	53.4	19.1	18.1	34.5	28.1	15.8	21.2	26.9	23.2	25.4	11.8	25.5	33.3	22.9	53.4	32.0	11.6	23.2	24.0	26.8	30.4	44.5	27.8	42.2	16.3
2037	24.0	26.9	11.2	52.8	42.7	11.2	12.2	43.8	32.0	29.8	23.6	36.1	40.9	11.5	22.9	22.6	24.5	34.8	32.3	19.7	27.6	13.5	52.8	21.6	19.3	18.8	35.8	14.8
2038	23.4	23.3	13.3	42.5	15.2	15.1	27.3	18.2	30.4	25.6	24.1	13.3	24.4	26.4	27.1	35.2	20.8	25.0	15.7	42.5	14.8	16.2	19.2	21.7	22.6	24.5	38.3	16.3
2039	25.8	29.0	11.4	63.3	30.3	63.3	23.2	22.6	23.4	31.4	33.6	31.0	40.6	25.4	16.9	56.0	18.3	20.3	33.2	16.4	26.0	37.5	16.8	25.5	41.8	28.4	11.4	22.0
2040	24.6	26.0	13.7	54.6	54.6	38.4	23.8	25.0	29.5	18.6	25.7	33.7	29.0	18.4	26.4	26.9	21.1	24.2	24.1	24.2	14.6	16.0	13.7	26.6	29.6	19.9	44.0	15.5
2041	21.8	25.2	12.2	52.5	20.6	29.6	28.1	34.2	52.5	34.7	33.6	31.6	22.9	49.0	15.0	31.3	24.5	17.4	18.7	15.9	12.2	20.2	25.8	14.0	19.6	20.3	17.1	15.0
2042	23.0	25.0	12.6	45.8	28.4	30.9	21.0	30.2	28.1	12.6	20.0	23.1	14.8	16.2	45.8	18.2	36.0	34.4	22.8	28.6	37.8	28.3	19.5	19.1	13.1	21.4	20.6	28.1
2043	20.0	22.8	9.2	38.9	29.0	19.7	9.2	13.9	14.5	32.5	25.3	13.4	38.9	33.6	25.9	16.6	20.3	38.9	15.0	16.9	27.1	15.2	19.2	25.8	16.9	31.7	18.5	30.0
2044	21.4	27.1	11.9	59.2	34.1	19.6	21.0	14.2	18.7	22.1	44.9	53.0	24.2	11.9	57.8	24.9	39.0	19.7	18.3	12.9	21.6	32.0	59.2	18.1	13.4	21.3	16.1	32.3
2045	23.9	23.7	14.1	50.0	26.4	29.7	21.0	31.8	28.2	18.0	19.3	16.6	17.1	17.8	50.0	23.4	14.1	25.7	15.0	32.1	25.1	19.3	24.3	25.5	14.2	19.0	25.0	29.8
2046	23.8	25.0	13.0	53.1	25.4	21.3	53.1	15.2	19.8	33.4	29.6	27.6	22.2	13.0	16.0	26.6	17.8	30.6	32.9	17.3	22.3	16.7	30.2	21.4	25.8	31.8	16.6	33.9
2047	23.4	23.8	11.5	49.0	25.9	25.3	18.5	22.1	13.5	15.0	33.3	26.5	20.9	31.9	26.5	24.2	24.5	17.4	31.2	49.0	11.5	21.1	36.2	22.5	24.7	19.2	12.5	18.0
2048	19.7	23.6	10.8	65.4	25.6	65.4	16.1	13.7	35.5	31.9	24.5	14.8	43.2	28.8	25.4	15.8	18.4	19.0	17.9	24.6	24.3	19.9	10.8	17.7	12.6	19.5	16.7	25.1
2049	21.1	24.5	14.4	56.2	14.4	56.2	20.7	15.3	20.0	30.8	23.4	46.7	52.4	21.6	14.8	15.9	15.7	14.5	17.9	32.9	24.0	18.1	21.4	25.7	16.5	16.9	22.0	29.8
2050	22.2	23.1	11.5	44.7	11.5	20.1	18.1	21.9	30.1	29.2	13.0	27.5	14.6	27.7	15.1	23.9	25.2	27.5	25.9	21.7	44.7	21.4	27.1	18.2	22.2	22.2	17.5	28.2
2051	24.2	27.0	10.2	57.8	23.7	39.7	23.1	14.5	17.2	18.1	31.7	19.3	17.5	45.5	10.2	24.2	33.4	17.4	57.8	47.1	26.4	31.8	31.2	21.6	27.9	28.7	16.5	24.2
2052	25.1	26.4	13.3	63.6	25.4	16.3	17.7	17.2	32.4	28.1	35.5	32.2	16.1	13.3	26.5	22.5	18.9	31.3	63.6	29.9	14.4	19.6	39.9	19.4	25.5	38.3	24.3	24.8
2053	25.2	26.2	8.7	50.0	26.4	29.6	50.0	44.0	44.6	18.2	25.5	23.1	36.1	20.2	25.2	25.2	11.0	23.9	26.0	18.3	27.7	27.0	14.1	19.8	24.6	8.7	42.0	18.3
2054	24.7	26.6	13.6	52.6	24.4	28.8	25.5	50.7	18.9	27.4	26.7	35.1	25.0	24.5	24.9	21.0	27.3	21.7	16.1	24.6	22.2	31.9	23.4	21.4	18.7	52.6	32.5	13.6
2055	21.3	23.9	13.9	43.6	16.2	26.0	21.0	43.6	22.1	18.0	35.7	20.1	30.2	36.5	21.1	15.1	21.5	22.4	22.6	13.9	23.7	16.8	15.5	41.3	20.2	32.2	16.5	20.9
2056	27.2	29.8	14.1	55.7	55.7	31.4	25.0	37.7	37.0	44.6	43.0	33.8	18.5	45.9	43.4	25.9	28.6	19.7	23.5	14.1	19.6	22.7	19.2	20.0	38.6	19.5	16.6	32.6
2057	25.0	24.6	13.4	44.9	13.6	26.7	18.6	17.2	25.9	25.4	23.1	27.9	13.4	14.9	24.6	17.6	14.6	31.9	23.0	34.3	31.5	20.0	29.9	34.9	18.8	28.6	44.9	29.9
2058	24.7	26.2	12.7	65.8	33.5	19.9	22.6	29.5	27.8	33.1	19.5	31.9	24.5	65.8	26.0	16.2	21.0	27.4	32.9	18.0	20.6	13.5	20.7	37.5	12.7	31.4	24.9	18.6
2059	24.2	28.8	15.9	69.5	19.9	43.8	24.4	31.2	20.1	22.2	22.5	34.3	18.5	58.9	69.5	15.9	21.5	43.6	17.4	29.3	24.3	16.5	33.7	24.0	21.8	35.9	24.6	17.6
2060	20.2	23.7	14.1	51.1	30.6	46.4	18.0	17.6	20.2	32.4	29.7	28.4	20.1	14.1	25.8	20.4	19.3	51.1	18.0	16.2	16.4	15.4	27.2	21.9	15.1	26.9	17.5	19.6
2061	21.0	23.6	10.0	44.3	27.7	37.8	18.7	30.2	16.9	43.0	28.3	25.9	20.1	44.3	26.2	21.5	20.3	15.1	21.5	21.1	10.0	31.4	19.3	15.2	14.8	19.6	17.6	20.9
2062	23.4	27.8	16.2	49.4	29.9	22.0	19.7	21.5	22.1	33.7	49.4	16.2	18.6	21.3	34.6	21.7	28.1	34.9	44.9	18.0	24.7	45.9	28.6	20.7	35.8	20.7	36.3	18.5
2063	23.1	25.8	15.7	47.9	20.0	23.3	19.3	30.8	17.3	17.3	35.3	32.3	25.4	21.2	30.9	16.0	21.9	38.6	35.0	21.1	31.5	27.5	19.7	22.8	47.9	31.9	16.9	15.7
2064	27.1	29.2	10.5	81.3	27.3	28.1	26.7	26.9	19.0	32.1	81.3	25.0	28.3	15.2	18.4	38.7	26.6	27.9	18.5	10.5	24.5	26.8	43.0	38.6	20.6	29.6	39.6	27.4
2065	21.6	24.8	13.1	57.4	28.3	16.1	19.8	13.1	18.3	32.7	35.9	27.4	17.3	33.3	30.2	27.8	24.5	19.0	19.9	57.4	15.6	19.7	25.6	22.3	20.9	19.5	20.5	29.8
2066	20.1	22.2	11.3	38.4	19.8	16.7	34.7	18.7	23.1	11.3	31.4	13.6	20.1	26.4	16.8	23.2	17.9	24.0	20.1	21.1	16.2	31.0	38.4	20.0	20.8	32.1	15.9	19.2
2067	23.5	25.7	14.0	53.3	14.5	19.6	15.0	28.8	31.1	22.2	29.8	16.8	25.9	34.8	25.8	24.8	16.8	53.3	52.2	17.5	24.9	26.0	18.6	14.0	20.6	19.5	16.8	48.7
2068	24.5	24.6	11.9	41.2	19.2	21.5	26.3	24.9	11.9	25.8	14.8	29.9	37.9	14.6	18.3	25.2	24.3	30.3	19.9	17.8	41.2	30.3	12.5	22.5	40.5	23.5	32.9	24.8
2069	21.2	25.0	14.0	44.5	17.7	20.9	29.6	40.4	35.0	15.3	30.3	21.4	18.8	22.2	35.0	19.8	27.6	19.2	16.3	33.6	37.6	30.0	20.6	14.0	44.5	15.4	16.8	17.6
2070	23.3	26.1	12.4	60.2	20.3	30.0	19.9	17.2	16.7	35.6	26.0	17.3	22.9	54.0	25.9	23.8	22.4	31.6	19.3	60.2	12.4	26.2	30.6	17.9	27.1	20.8	18.8	30.1
2071	24.4	24.7	11.5	59.8	28.4	24.6	15.4	16.9	31.5	24.8	26.6	22.9	19.3	30.7	11.5	24.1	19.0	29.5	26.6	18.5	30.7	18.6	59.8	17.8	20.6	30.7	18.6	25.5
2072	25.1	26.3	13.6	50.5	24.7	13.6	50.5	42.7	29.7	18.4	36.1	43.9	17.4	18.4	25.7	19.5	29.4	29.5	15.5	16.2	25.4	23.7	27.6	19.3	27.5	31.1	24.9	20.1
2073	22.2	24.0	14.0	39.2	16.2	22.0	19.8	36.2	26.0	14.0	17.0	39.2	22.5	30.5	29.7	28.4	29.6	15.3	18.1	27.8	29.1	16.6	21.6	29.8	15.8	18.2	33.8	17.9
2074	24.7	27.1	13.8	61.9	17.2	30.8	26.1	24.9	48.6	19.2	61.9	35.3	16.7	23.8	24.4	28.0	19.4	34.9	17.8	18.1	13.8	26.0	30.4	19.1	23.7	30.8	35.6	24.4
2075	24.5	25.3	8.8	51.2	16.9	17.2	22.4	24.2	27.6	34.3	51.2	49.1	20.8	16.4	27.0	23.2	30.4	22.2	29.3	29.4	18.2	8.8	18.1	24.8	24.9	20.3	25.9	25.3
2076	24.5	24.2	13.1	41.2	16.9	14.7	16.2	16.4	16.9	19.1	30.7	27.9	29.3	35.5	16.7	28.8	41.2	24.7	25.8	41.0	24.3	13.1	25.3	15.7	29.5	32.3	15.8	22.2

2077	22.0	22.9	11.1	35.7	31.7	23.6	27.9	19.5	12.2	27.7	19.9	25.7	35.6	21.3	35.7	26.2	17.5	24.0	18.8	11.1	22.3	19.2	19.9	16.6	16.8	26.9	28.2	21.8
2078	20.3	23.5	12.6	42.3	19.2	16.7	29.5	12.6	36.7	42.3	15.2	18.1	27.5	36.4	26.8	20.5	17.4	17.7	30.2	20.2	17.5	18.8	21.6	29.0	16.7	30.1	19.7	23.7
2079	23.6	29.1	11.8	67.2	67.2	58.3	23.1	37.4	17.2	56.4	21.7	11.8	22.8	17.4	18.9	17.3	28.8	35.6	15.6	24.2	22.5	63.4	14.2	27.1	16.7	25.1	30.8	24.5
2080	22.6	25.2	8.9	55.5	21.9	8.9	20.2	17.3	35.5	23.4	31.2	40.6	26.1	30.4	13.5	18.7	17.5	17.7	20.3	15.6	16.6	29.6	30.2	37.5	25.2	55.5	35.6	16.1
2081	21.5	22.3	10.9	38.8	17.5	27.8	22.6	19.2	21.3	24.9	19.0	38.8	17.7	18.9	34.2	18.4	21.6	22.0	22.4	23.8	30.9	25.8	16.2	22.3	10.9	19.3	20.6	18.5
2082	23.0	26.5	17.9	44.5	18.9	22.1	25.3	25.1	23.1	21.0	27.7	22.9	44.2	20.1	40.9	33.9	22.4	39.6	18.6	19.2	20.1	25.9	44.5	30.1	18.1	18.0	17.9	37.2
2083	24.0	28.7	13.8	62.2	50.5	21.9	31.0	36.5	23.7	32.8	20.0	15.9	13.8	22.5	24.4	23.4	23.2	39.8	33.9	19.5	22.8	30.1	27.3	62.2	40.1	19.4	31.7	23.0
2084	25.3	25.0	11.4	41.4	28.8	12.3	28.0	34.9	29.5	21.9	32.5	11.4	20.5	17.7	30.0	22.0	23.6	34.8	24.8	16.5	28.8	25.8	41.4	14.3	27.1	31.2	20.5	21.1
2085	25.5	25.9	13.1	45.1	27.9	31.0	37.8	21.1	26.8	35.2	25.7	45.1	25.2	27.0	28.8	20.6	23.7	26.0	30.5	34.4	21.2	16.4	17.9	24.7	24.5	21.9	13.1	16.0
2086	23.9	25.9	15.0	56.3	24.5	17.4	30.8	30.3	34.3	23.4	21.7	32.8	23.0	56.3	30.2	19.5	22.2	28.3	18.9	27.2	26.3	31.6	16.4	36.6	19.4	19.0	15.0	16.8
2087	24.7	26.2	9.9	71.4	28.4	41.0	18.4	18.7	23.4	25.0	24.3	22.9	16.4	32.8	14.5	14.3	31.0	27.5	26.9	71.4	9.9	26.6	14.6	31.3	17.6	30.6	40.9	21.4
2088	24.7	25.7	13.7	41.7	33.8	36.6	24.8	41.7	18.4	13.7	32.8	24.4	18.3	26.0	19.6	35.7	18.6	27.4	16.6	28.7	24.7	23.5	19.6	26.0	21.1	28.3	33.3	23.0
2089	22.7	26.2	14.0	57.4	16.3	42.3	22.9	22.1	27.0	29.8	32.2	18.1	22.5	16.9	26.3	40.3	22.1	57.4	27.5	30.0	22.2	21.3	17.3	26.6	33.3	14.0	21.8	19.7
2090	27.6	27.7	14.3	44.9	29.2	34.1	23.6	30.1	44.6	29.5	27.6	19.8	27.3	23.5	18.6	18.0	17.2	36.1	44.9	14.3	28.5	19.3	27.6	33.8	40.2	17.9	14.4	43.6
2091	23.2	25.2	11.8	62.9	27.9	13.6	19.4	15.1	27.6	29.9	62.9	14.6	25.4	47.5	19.6	25.4	26.0	17.7	18.5	30.1	21.1	32.3	20.3	17.3	11.8	27.4	40.6	13.7
2092	23.3	24.7	12.7	45.9	22.8	30.5	21.3	12.7	33.6	21.6	21.6	25.5	23.9	42.8	45.9	33.5	14.4	25.7	15.9	18.7	27.3	30.1	30.3	25.4	19.2	16.8	17.1	17.2
2093	20.8	23.2	11.6	40.5	28.2	25.2	20.9	38.2	11.9	31.9	27.0	17.4	14.7	33.2	19.3	26.8	20.7	20.7	14.8	18.8	11.6	13.5	19.2	20.3	40.5	27.4	25.3	28.7
2094	22.7	23.0	12.9	56.9	23.2	26.4	19.8	15.0	16.6	20.7	23.9	12.9	21.9	19.7	13.9	23.2	25.9	25.9	15.4	26.1	24.6	24.4	21.4	22.5	35.0	22.9	13.9	56.9
2095	21.8	23.7	12.8	49.1	15.6	27.7	27.1	21.9	20.3	13.0	12.8	33.7	18.5	36.0	23.4	37.8	14.7	21.2	30.4	30.1	16.0	15.4	23.0	15.2	21.7	49.1	20.6	24.4
2096	25.6	31.4	15.0	91.3	28.1	22.2	23.4	91.3	31.5	22.2	33.1	16.8	22.9	26.7	21.6	33.3	17.7	24.5	48.9	32.9	24.6	79.0	38.8	20.1	32.2	27.5	15.0	18.7
2097	21.6	23.6	15.2	39.1	18.8	31.2	19.1	20.7	22.5	30.2	26.1	25.3	15.4	39.1	18.7	28.4	19.8	32.4	15.2	18.3	24.6	22.5	17.9	35.6	19.1	18.0	18.0	29.9
2098	27.7	32.0	13.1	87.6	19.9	20.3	21.3	87.6	22.9	66.7	21.0	32.5	58.1	30.0	36.7	18.4	28.6	13.1	29.9	27.2	28.3	25.6	27.0	17.8	20.6	30.5	28.1	56.4
2099	24.4	27.5	15.9	62.7	16.5	36.9	21.6	22.4	25.0	34.8	17.0	40.5	34.8	20.2	23.8	27.3	22.0	20.5	62.7	18.3	25.3	19.3	35.4	15.9	34.8	29.3	37.9	16.6
2100	23.1	25.8	14.9	48.5	22.5	36.1	38.0	16.6	29.4	14.9	26.9	27.2	43.6	18.4	48.5	22.6	27.3	35.0	18.3	18.5	20.3	31.7	23.5	15.2	15.4	22.5	21.6	25.2

RCP2.6

Day with Daily Precip (mm) ... **>1**

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp26 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp26 (kg m-2 d-1)	pr CNRM-CM5 historical rcp26 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp26 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp26 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp26 (kg m-2 d-1)	pr HadGEM2-ES historical rcp26 (kg m-2 d-1)	pr HadGEM2-AO historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp26 (kg m-2 d-1)	pr FGOALS-g2 historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp26 (kg m-2 d-1)	pr GFDL-CM3 historical rcp26 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp26 (kg m-2 d-1)	pr CanESM2 historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp26 (kg m-2 d-1)	pr MIROC5 historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp26 (kg m-2 d-1)	pr NorESM1-M historical rcp26 (kg m-2 d-1)	pr BNU-ESM historical rcp26 (kg m-2 d-1)	pr NorESM1-ME historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp26 (kg m-2 d-1)	pr CCSM4 historical rcp26 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp26 (kg m-2 d-1)
2011	118	115.2	86	134	86	123	107	130	129	129	119	121	115	119	95	108	107	111	119	117	93	128	119	126	134	109	115	105
2012	113	113.7	96	133	119	96	105	105	125	124	126	123	110	120	111	111	106	110	127	103	115	133	116	120	106	119	99	99
2013	117	116.2	98	133	119	114	102	129	113	115	112	112	129	123	99	121	100	133	116	109	122	127	119	118	113	120	126	98
2014	118	118.0	99	156	122	112	117	106	127	130	120	124	110	137	109	110	119	108	120	101	119	109	127	156	117	120	99	112
2015	121	119.0	94	136	108	111	113	126	107	130	122	126	136	94	121	115	132	134	115	130	102	120	95	114	134	128	126	116
2016	114	115.7	96	149	119	109	113	122	133	110	119	114	114	100	107	105	129	141	109	120	96	102	125	131	104	149	106	100
2017	118	117.4	96	147	103	122	123	119	101	147	115	125	134	121	104	131	123	116	124	115	124	106	108	124	112	110	115	96
2018	119	117.1	87	150	112	133	120	123	132	125	127	107	122	128	124	113	121	114	87	104	150	95	122	118	112	97	109	115
2019	115	115.4	91	142	134	119	92	115	120	113	123	104	139	114	96	142	108	105	91	119	113	137	105	112	120	125	119	104
2020	122	119.2	93	145	95	122	127	122	138	115	127	93	141	120	122	110	99	120	138	124	101	110	111	134	128	145	124	94
2021	114	114.3	97	148	109	106	117	105	116	117	103	105	107	119	98	114	127	116	126	128	97	113	113	148	120	136	106	97
2022	113	113.0	93	132	128	114	93	104	116	99	113	119	93	107	112	110	122	103	109	118	111	132	121	124	116	110	125	113
2023	118	116.1	95	133	108	98	95	121	110	123	111	107	113	118	123	115	125	132	128	120	129	118	103	133	110	122	117	108
2024	112	112.4	92	130	120	111	118	113	115	130	112	106	109	92	93	119	109	99	106	98	107	126	116	127	111	109	125	127
2025	115	113.6	74	153	120	108	129	115	112	153	98	100	121	99	108	127	114	137	76	109	117	107	124	122	127	74	111	119
2026	114	112.2	80	130	129	115	113	130	121	112	108	94	126	88	107	109	109	124	80	118	124	115	130	106	118	80	113	124
2027	119	118.0	96	138	118	131	106	101	120	120	117	107	116	134	138	120	117	114	123	115	96	119	111	101	131	135	123	119
2028	117	117.1	97	149	136	115	102	115	125	139	134	116	98	119	124	149	100	115	128	102	101	97	127	124	127	118	99	101
2029	117	113.7	86	129	126	125	103	97	129	129	109	86	117	123	109	99	114	120	122	115	110	123	121	118	116	108	91	118
2030	117	118.2	80	146	108	116	138	118	80	117	126	104	146	116	137	98	117	122	113	117	135	124	119	105	114	122	131	114
2031	120	120.2	96	143	132	115	136	121	138	143	105	120	110	118	108	131	128	121	110	110	132	123	112	115	96	111	131	119
2032	115	115.5	88	149	96	133	97	101	137	106	105	122	118	120	98	128	88	123	129	104	104	126	128	136	108	149	111	105
2033	114	114.8	92	141	109	125	123	110	107	101	116	103	114	113	94	129	106	111	92	117	141	126	123	121	116	137	110	111
2034	117	117.3	96	153	132	126	114	116	153	109	111	120	119	105	103	120	111	116	104	123	120	130	128	123	110	118	96	107
2035	120	118.4	91	136	124	119	128	113	132	98	129	133	121	116	120	113	124	115	136	136	120	95	118	99	124	91	127	111
2036	117	115.8	75	142	120	135	115	112	99	114	110	123	128	106	119	75	124	142	122	126	113	98	112	119	105	115	127	120
2037	121	122.3	100	152	139	111	119	127	120	138	127	140	130	107	120	119	122	117	114	152	123	113	133	121	129	100	112	101
2038	118	119.2	96	146	115	118	96	108	146	117	118	119	125	121	119	115	135	122	114	118	113	123	130	110	121	118	117	122
2039	116	116.5	93	136	119	136	110	110	109	103	118	93	112	105	113	115	124	130	120	126	133	109	116	118	133	105	123	116
2040	111	116.3	101	171	123	111	105	142	171	108	102	110	109	134	105	116	104	101	111	123	105	119	115	132	121	105	105	115
2041	114	113.4	88	135	109	114	130	124	129	110	120	117	96	107	103	110	114	105	116	106	88	135	123	118	116	108	120	103
2042	115	116.4	91	144	139	126	120	114	144	116	100	117	115	126	91	118	108	127	115	105	113	111	112	103	109	112	134	118
2043	120	120.8	96	152	133	123	111	114	123	128	123	112	127	117	133	118	115	114	112	98	152	115	121	141	132	138	96	103
2044	121	121.0	100	150	121	136	113	101	117	112	120	133	123	100	103	113	134	138	131	127	150	126	114	130	112	134	113	102
2045	122	120.6	96	144	123	126	99	140	144	129	126	102	110	120	108	117	103	132	122	130	114	142	120	121	117	128	96	125
2046	114	113.8	79	137	128	107	101	120	125	108	122	114	115	137	79	98	129	112	96	103	122	133	114	132	122	107	95	111
2047	118	118.3	86	149	136	110	140	109	128	118	104	120	138	127	133	118	104	110	149	97	86	112	133	97	110	138	102	121
2048	119	117.7	75	151	120	116	136	109	121	151	148	122	97	102	112	75	127	110	134	105	136	101	124	127	118	109	104	120
2049	119	115.6	76	136	132	123	135	134	112	130	114	76	127	105	90	109	136	97	120	99	129	94	112	120	122	118	111	130
2050	114	115.3	94	133	94	130	106	111	133	118	108	99	106	129	126	133	115	103	130	122	103	108	105	112	119	117	129	112
2051	117	120.9	85	156	145	107	107	127	145	110	144	127	121	141	85	98	111	156	117	144	139	105	111	91	116	130	117	108
2052	116	116.9	86	144	125	115	116	100	139	134	110	117	111	127	110	94	86	144	122	110	101	123	112	125	115	126	110	134
2053	115	115.8	95	144	144	102	112	139	126	114	118	110	110	125	119	115	118	106	105	122	125	104	105	126	114	95	103	121
2054	121	118.7	94	141	120	125	123	94	133	121	104	98	112	107	116	121	124	129	125	135	112	126	121	141	132	113	108	108
2055	116	117.5	98	148	111	131	122	134	118	132	120	106	107	100	111	112	114	126	98	107	107	123	125	148	111	125	119	113
2056	123	122.5	99	151	123	151	130	109	129	138	115	106	127	99	126	113	128	123	113	121	130	132	127	145	122	121	100	111
2057	121	121.0	88	151	106	133	113	88	119	131	102	124	129	132	115	128	120	151	113	133	120	117	121	119	124	128	117	122
2058	117	117.4	96	143	99	112	106	122	97	143	96	118	116	128	106	114	109	115	121	128	128	123	128	134	114	125	116	120
2059	124	124.5	101	152	105	133	136	137	115	131	122	110	115	119	124	123	119	152	122	131	133	142	101	108	136	131	111	133
2060	114	115.2	99	135	103	126	99	110	132	135	110	127	108	120	101	104	109	122	126	115	133	118	115	120	108	109	102	112
2061	115	116.5	86	159	110	131	123	115	104	123	138	115	129	107	118	128	97	138	97	110	86	159	112	108	122	115	99	112
2062	118	116.4	90	140	102	97	131	132	95	116	94	118	117	123	127	122	115	140	90	117	135	117	106	119	124	111	118	128
2063	120	121.2	97	151	118	97	100	122	120	140	128	141	112	107	100	120	134	135	132	115	112	151	146	104	112	131	119	113

2064	124	122.1	88	151	137	120	124	147	132	121	127	104	125	105	94	136	123	119	112	88	129	151	148	126	127	96	121	119
2065	116	117.1	103	136	119	116	129	132	113	112	108	130	119	107	120	110	114	115	113	109	103	131	117	119	136	116	103	120
2066	119	119.9	102	137	112	127	104	123	132	116	127	132	109	115	126	108	131	109	112	102	115	115	137	124	137	118	126	120
2067	118	116.6	92	139	113	121	104	128	108	92	119	104	109	126	123	118	117	116	135	133	139	118	123	110	122	99	102	119
2068	115	116.2	99	139	125	123	99	125	99	99	103	111	130	134	138	108	112	113	123	125	139	100	105	116	100	122	111	128
2069	115	114.2	91	134	107	114	128	109	113	132	125	121	108	134	97	125	113	118	120	117	116	105	91	119	106	99	107	116
2070	117	118.2	102	145	109	127	125	107	109	117	135	109	120	111	108	137	122	120	113	108	107	117	102	145	142	118	110	118
2071	115	117.3	97	143	100	109	114	104	130	119	111	141	108	135	106	120	104	125	125	113	113	115	97	143	117	108	138	121
2072	118	116.5	91	139	125	120	118	128	124	118	114	122	109	105	97	123	104	120	91	109	128	139	122	132	116	117	100	115
2073	117	117.0	90	142	127	115	90	127	142	104	126	113	110	102	104	110	118	125	118	135	110	134	107	116	112	120	126	118
2074	121	117.7	92	140	99	125	128	100	120	121	92	127	129	128	126	107	127	121	119	123	125	122	112	107	140	106	104	116
2075	121	121.0	101	145	111	114	141	114	116	125	145	110	129	120	112	128	101	127	135	108	110	125	132	141	132	101	121	106
2076	115	116.0	97	137	103	125	110	106	137	125	124	126	107	109	109	121	136	137	115	126	118	105	114	103	100	127	105	97
2077	121	118.8	90	155	124	114	108	120	115	127	131	116	131	101	106	117	98	125	128	92	155	127	128	138	121	106	90	134
2078	118	118.3	92	142	115	135	121	112	117	130	115	97	119	106	114	127	92	118	122	121	122	116	111	142	134	110	128	115
2079	117	116.4	77	156	118	104	130	91	139	107	127	120	126	107	118	91	105	108	113	113	120	123	107	156	148	77	131	115
2080	116	115.1	83	147	122	94	106	133	147	110	118	104	117	141	101	83	99	122	126	138	115	105	135	127	116	107	99	98
2081	115	118.2	101	155	113	107	103	101	115	125	117	106	122	143	117	121	112	155	124	114	130	130	114	123	115	107	109	113
2082	114	114.2	95	133	125	128	114	113	130	111	112	116	121	110	100	117	111	115	123	112	108	98	108	116	120	95	105	133
2083	115	114.9	80	139	139	102	137	115	122	110	97	106	116	124	114	107	128	136	117	103	107	104	134	120	109	80	130	100
2084	119	115.6	79	147	104	122	79	92	121	107	119	87	128	123	129	124	114	147	118	136	112	101	108	108	119	119	135	122
2085	118	119.0	94	143	131	111	130	130	124	96	94	101	123	136	116	117	119	138	112	111	131	143	116	112	113	125	124	102
2086	122	118.3	87	151	123	118	99	88	129	143	126	106	132	109	121	129	127	123	87	105	129	120	111	151	132	130	101	101
2087	118	119.0	98	140	118	116	109	109	140	136	123	116	118	125	101	104	140	135	125	118	99	98	122	108	127	113	135	120
2088	115	114.6	78	147	111	123	114	115	123	99	109	103	106	119	106	123	120	147	78	109	120	125	110	111	130	108	122	120
2089	121	119.5	95	146	117	132	102	98	112	146	115	115	125	122	102	138	125	130	141	135	99	120	119	131	101	95	127	121
2090	118	117.0	91	144	121	132	112	118	129	135	115	96	104	121	126	104	99	139	121	116	122	111	125	144	117	91	111	99
2091	120	118.8	85	136	127	113	121	121	118	114	110	85	136	128	112	119	115	134	111	120	104	123	132	132	107	123	129	116
2092	113	114.9	87	143	122	134	136	103	133	118	111	107	110	96	125	87	108	123	143	106	115	99	116	133	111	114	108	100
2093	117	117.0	105	131	112	112	109	122	105	129	107	117	130	111	116	119	106	111	125	121	116	114	121	120	123	118	112	131
2094	115	114.0	91	139	115	120	120	124	116	103	95	91	108	121	118	130	128	102	139	127	112	110	115	112	115	120	98	98
2095	120	116.5	92	145	126	118	123	92	119	94	95	124	128	116	99	127	119	145	95	124	120	125	110	123	133	102	129	110
2096	120	119.0	89	138	108	107	89	121	138	119	130	112	113	100	125	116	131	132	134	126	122	114	102	133	116	114	132	121
2097	116	116.7	96	144	143	123	126	126	122	113	135	96	110	144	106	121	115	101	126	104	117	123	97	101	124	105	115	107
2098	120	116.5	86	132	122	118	108	128	93	86	131	104	132	113	114	113	107	128	101	129	123	132	121	126	126	118	122	102
2099	122	122.3	104	144	125	117	123	113	138	130	113	113	129	132	116	127	144	128	104	120	128	118	113	119	113	128	115	130
2100	119	119.1	105	138	121	114	131	110	138	119	117	105	131	124	107	112	121	122	108	130	135	133	105	117	122	107	111	119

RCP2.6

Day with Daily Precip (mm) ... **>10**

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp26 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp26 (kg m-2 d-1)	pr CNRM-CM5 historical rcp26 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp26 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp26 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp26 (kg m-2 d-1)	pr HadGEM2-ES historical rcp26 (kg m-2 d-1)	pr HadGEM2-AO historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp26 (kg m-2 d-1)	pr FGOALS-g2 historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp26 (kg m-2 d-1)	pr GFDL-CM3 historical rcp26 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp26 (kg m-2 d-1)	pr CanESM2 historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp26 (kg m-2 d-1)	pr MIROC5 historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp26 (kg m-2 d-1)	pr NorESM1-M historical rcp26 (kg m-2 d-1)	pr BNU-ESM historical rcp26 (kg m-2 d-1)	pr NorESM1-ME historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp26 (kg m-2 d-1)	pr CCSM4 historical rcp26 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp26 (kg m-2 d-1)
2011	7	7.3	3	15	5	8	7	8	4	6	8	3	10	7	5	9	7	14	11	5	4	15	6	6	5	8	7	6
2012	7	7.5	2	15	5	4	7	3	13	8	9	9	7	7	13	15	3	8	10	5	6	9	4	14	5	6	8	2
2013	7	6.3	2	11	5	3	6	10	5	7	9	11	7	7	2	7	3	10	7	2	3	8	2	9	7	6	8	8
2014	6	7.3	1	15	11	1	10	6	5	8	10	10	6	4	11	6	10	7	10	4	6	6	6	15	5	9	3	5
2015	7	6.9	2	11	7	8	4	6	8	10	4	5	10	6	2	4	8	9	5	11	11	2	4	6	9	11	10	5
2016	7	6.7	2	14	7	4	7	4	8	11	9	6	4	3	4	8	11	11	5	4	4	2	14	10	7	7	6	4
2017	7	6.3	1	14	6	6	14	3	3	10	8	7	8	4	5	13	2	9	6	5	7	1	3	8	7	8	8	1
2018	8	7.7	2	15	10	7	15	4	7	9	9	6	10	11	10	5	8	4	2	5	9	2	12	9	8	7	5	10
2019	6	6.2	1	14	9	8	1	9	5	7	5	8	7	4	3	10	8	2	3	5	6	14	5	4	8	9	3	5
2020	8	8.0	3	13	5	5	7	7	7	9	13	8	8	3	12	7	12	10	8	9	5	8	10	10	6	8	8	8
2021	6	6.3	1	13	8	6	4	5	7	7	4	6	7	8	5	6	7	4	8	7	1	6	7	13	4	12	5	4
2022	6	6.4	2	11	5	5	8	5	4	5	7	7	6	9	9	10	5	2	4	3	9	6	11	9	5	3	6	10
2023	8	7.5	1	16	2	3	1	6	1	9	8	14	6	8	11	6	11	10	13	4	8	16	4	9	10	7	9	4
2024	6	6.6	1	13	12	6	4	5	6	9	7	7	4	3	3	5	13	12	9	3	1	5	7	8	6	12	6	6
2025	6	6.3	0	13	11	2	6	7	12	12	2	9	8	5	4	13	7	6	0	5	5	3	9	3	8	4	4	5
2026	7	6.4	0	14	7	14	6	7	10	6	4	6	6	4	7	7	4	3	4	7	7	9	10	6	5	0	7	7
2027	8	7.8	3	18	10	5	9	6	7	9	6	6	8	3	18	4	6	12	11	9	5	4	11	5	4	9	8	11
2028	6	7.0	3	18	18	6	8	3	7	9	7	10	8	10	4	4	6	6	11	5	10	6	6	4	5	7	3	6
2029	6	6.4	2	12	8	8	5	2	9	6	8	6	3	9	9	6	4	8	8	6	4	3	7	12	6	11	2	3
2030	7	7.1	3	13	5	11	5	5	3	10	9	5	3	8	13	4	7	3	9	4	6	11	6	10	8	8	11	7
2031	7	7.0	2	17	8	5	7	5	14	9	17	9	2	6	5	7	3	6	11	5	11	7	5	10	3	7	3	4
2032	7	7.2	1	17	6	7	5	5	10	3	7	14	8	3	3	11	6	7	8	6	7	7	7	17	10	10	1	4
2033	6	6.0	1	12	8	9	6	6	4	1	7	6	6	4	3	12	3	8	4	5	4	7	8	9	8	10	6	1
2034	7	6.9	2	14	4	3	8	9	12	11	9	14	7	7	5	2	9	8	8	6	2	6	7	5	4	9	5	6
2035	7	7.3	1	13	11	6	10	1	5	3	7	10	5	4	11	8	13	6	12	8	4	8	13	3	6	3	12	7
2036	6	7.3	2	14	3	9	6	8	5	9	6	12	6	2	9	6	4	14	13	3	9	5	7	11	6	6	10	5
2037	7	6.9	1	15	7	1	2	3	6	10	14	8	7	1	8	9	12	7	9	6	5	2	8	6	15	7	7	6
2038	7	7.5	5	13	6	5	9	5	10	8	8	7	6	6	10	7	9	11	5	13	6	5	5	5	6	6	11	10
2039	8	7.8	3	16	13	15	4	8	8	7	9	9	7	6	4	16	10	10	10	4	6	7	6	8	9	6	3	3
2040	6	7.0	3	17	15	11	7	6	17	4	6	8	5	3	10	11	7	5	6	3	5	10	5	7	6	4	3	5
2041	8	6.9	2	14	10	9	10	8	12	14	4	10	7	5	4	9	9	3	8	3	2	8	9	3	5	6	5	3
2042	7	7.3	2	13	10	13	6	9	10	5	4	5	4	7	6	7	7	8	5	7	13	5	10	6	2	10	7	8
2043	8	7.8	0	17	10	9	0	7	4	10	15	6	8	8	17	9	8	9	10	2	8	4	3	10	6	14	4	7
2044	7	6.3	2	12	11	7	4	2	7	6	8	12	2	3	8	7	8	10	4	4	12	9	7	4	2	7	4	3
2045	7	6.8	3	12	8	8	3	8	11	7	8	6	4	5	5	9	3	7	7	7	12	7	8	3	7	4	7	8
2046	7	7.5	3	14	9	5	9	7	6	14	12	13	4	5	4	6	4	6	10	3	3	6	9	9	11	7	7	10
2047	8	6.9	1	12	8	10	9	2	6	4	7	10	8	12	8	9	10	3	10	6	1	6	9	3	8	7	2	7
2048	8	7.6	3	13	9	11	7	4	9	9	8	6	6	7	8	3	8	8	13	6	7	8	3	8	7	10	5	13
2049	7	7.0	2	12	3	7	5	7	5	7	12	7	12	9	2	7	3	4	9	8	9	11	8	8	5	5	11	4
2050	7	7.0	1	15	1	8	10	6	8	8	2	8	3	11	7	7	6	4	8	8	9	8	6	6	6	15	6	7

2051	6	6.3	1	14	6	7	4	2	4	9	6	4	7	13	1	6	6	9	5	6	6	12	14	4	6	4	3	6
2052	7	6.9	2	13	13	5	4	4	8	10	9	9	5	3	3	5	4	12	12	6	2	8	8	5	10	8	5	7
2053	7	7.3	0	15	10	5	9	8	7	7	15	4	11	7	7	8	2	2	9	9	14	9	5	8	5	0	6	7
2054	7	7.0	3	11	9	11	10	6	7	3	5	11	4	5	8	8	9	10	7	5	3	8	7	8	9	5	5	5
2055	6	6.8	1	17	4	9	10	14	9	4	6	5	5	6	6	3	7	4	4	1	7	3	7	17	6	15	5	7
2056	8	8.6	4	16	9	16	9	6	9	10	7	12	11	12	8	10	7	11	9	7	7	8	6	6	8	8	4	6
2057	7	7.1	2	13	2	7	3	6	4	6	8	11	7	5	6	6	6	13	5	9	13	7	5	8	7	11	9	6
2058	7	7.8	4	13	6	4	13	7	13	11	6	10	10	6	7	7	7	5	7	6	6	5	8	9	5	12	9	8
2059	8	8.0	4	12	7	7	9	9	5	4	7	12	5	6	9	7	8	12	7	11	7	9	8	9	12	7	6	8
2060	7	6.7	3	12	3	10	4	5	5	8	7	3	4	4	9	8	6	10	9	5	5	8	12	11	6	8	4	7
2061	7	6.5	1	15	2	7	7	9	8	11	15	3	3	5	11	6	4	8	10	7	1	11	6	6	5	1	3	7
2062	8	7.7	2	18	5	7	5	8	7	6	4	4	7	9	14	8	9	9	5	8	8	10	4	11	18	6	11	2
2063	9	8.5	5	14	14	11	6	6	5	7	11	13	8	5	5	11	9	12	6	10	6	11	10	10	7	9	5	6
2064	8	7.9	1	15	15	8	8	9	9	11	5	8	9	5	7	6	6	6	7	1	6	8	10	11	7	12	5	11
2065	7	7.0	3	13	10	7	10	4	6	9	5	7	3	5	9	5	13	6	3	3	5	8	6	9	8	9	9	9
2066	7	6.8	3	11	8	6	9	7	8	4	8	6	3	11	4	8	5	9	5	7	5	10	8	6	8	4	7	6
2067	7	7.3	3	17	5	7	9	8	9	9	5	6	6	9	8	7	7	8	10	9	7	4	8	3	5	6	4	17
2068	8	7.2	1	14	7	6	8	11	1	4	2	14	9	3	8	6	5	8	4	9	10	11	3	10	7	8	6	12
2069	6	6.9	2	13	2	5	9	5	9	6	12	6	8	13	10	11	3	6	8	8	5	8	4	4	3	4	5	12
2070	8	8.0	3	15	7	12	8	6	8	11	6	11	12	7	4	11	9	3	8	6	5	4	5	15	12	9	7	7
2071	7	7.3	1	13	4	7	7	2	6	7	12	10	5	7	1	12	6	6	9	9	11	5	7	9	5	9	13	6
2072	7	7.6	4	17	6	4	7	17	7	9	9	5	5	7	7	7	6	13	5	4	9	12	10	5	9	9	4	6
2073	7	7.2	2	13	6	5	9	5	8	4	6	4	11	6	13	10	9	8	6	12	7	2	3	6	8	6	11	8
2074	6	6.8	2	15	5	9	15	4	10	9	6	6	6	14	6	5	8	3	5	6	3	6	9	7	6	2	5	8
2075	8	8.1	0	22	6	6	8	4	5	8	4	5	9	11	11	12	12	6	9	7	5	0	6	22	8	9	16	6
2076	8	7.7	3	15	3	5	4	4	7	7	9	10	12	9	6	10	11	9	5	15	5	4	12	5	9	9	6	9
2077	7	7.5	3	15	12	10	4	4	4	10	5	5	15	14	3	13	5	6	15	3	5	10	9	7	4	8	3	7
2078	6	7.1	2	12	9	12	11	6	10	7	5	4	6	11	6	8	2	6	12	4	4	8	7	10	5	6	6	6
2079	7	7.2	2	17	9	6	12	7	8	9	7	5	6	3	10	5	5	9	8	4	4	17	2	11	4	5	10	6
2080	7	6.5	0	13	8	0	4	6	13	3	8	4	5	10	6	6	10	6	7	7	2	11	9	11	7	5	7	2
2081	7	7.4	1	15	7	9	1	5	6	12	7	5	6	12	10	11	8	7	9	15	6	9	4	9	5	4	4	6
2082	7	7.3	4	12	8	4	8	5	7	6	6	10	9	7	12	9	8	10	7	4	6	6	11	7	8	4	6	6
2083	8	8.3	2	19	19	8	8	11	7	7	4	9	4	10	10	8	7	14	9	4	5	5	9	12	9	2	10	7
2084	7	6.8	2	12	8	7	7	5	3	5	4	2	10	7	6	4	6	9	8	7	9	9	5	6	12	5	12	6
2085	8	7.9	4	13	8	9	8	6	6	9	4	8	10	7	10	9	9	9	6	7	13	9	5	6	12	10	4	5
2086	7	7.0	2	16	12	7	9	5	8	6	5	5	10	10	6	16	11	7	3	5	3	2	3	10	8	9	5	4
2087	7	7.4	0	21	7	6	10	5	5	5	6	7	4	10	3	4	9	10	12	21	0	8	3	8	10	8	9	7
2088	7	6.9	2	12	8	7	4	6	6	2	8	12	6	6	8	8	4	10	4	3	5	7	7	9	8	8	12	8
2089	7	7.7	3	19	6	7	6	3	4	8	7	7	7	6	7	10	8	12	12	19	7	7	7	7	8	4	10	6
2090	6	6.9	3	13	3	7	9	8	7	5	9	5	6	3	6	6	5	10	13	5	9	7	5	13	11	3	5	6
2091	6	6.4	2	13	5	6	4	5	5	10	7	5	6	7	9	7	9	4	7	5	6	10	7	6	2	5	13	3
2092	7	6.4	2	11	8	8	11	3	5	7	9	8	6	8	9	7	2	4	7	5	8	6	9	3	9	3	4	5
2093	7	7.0	2	12	5	7	9	10	2	8	10	5	8	6	10	8	4	4	9	5	2	7	6	6	6	12	8	12
2094	7	6.7	1	15	8	7	6	4	6	5	7	3	5	4	9	10	15	5	9	3	10	7	10	4	10	9	1	4
2095	7	6.6	2	12	5	12	11	7	5	3	2	10	7	12	2	5	8	12	9	5	4	3	7	2	8	9	6	5
2096	7	7.9	4	14	14	7	6	8	11	4	9	6	7	5	7	10	9	7	7	13	11	4	5	8	8	7	6	10
2097	8	7.6	3	14	11	9	5	7	6	10	11	6	5	8	8	8	3	4	8	6	5	5	5	13	9	10	6	14
2098	8	8.2	4	16	5	7	9	14	5	5	16	9	8	6	6	11	4	6	13	12	5	9	9	5	7	9	12	4
2099	7	7.0	1	12	6	10	5	6	11	9	1	11	7	2	7	9	10	5	7	5	8	8	7	5	6	12	5	5
2100	8	7.0	3	11	8	4	9	4	9	4	10	8	8	9	5	5	8	5	7	6	8	11	6	6	6	9	3	10

RCP2.6

Day with Daily Precip (mm) ... **>25**

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp26 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp26 (kg m-2 d-1)	pr CNRM-CM5 historical rcp26 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp26 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp26 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp26 (kg m-2 d-1)	pr HadGEM2-ES historical rcp26 (kg m-2 d-1)	pr HadGEM2-AO historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp26 (kg m-2 d-1)	pr FGOALS-g2 historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp26 (kg m-2 d-1)	pr GFDL-CM3 historical rcp26 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp26 (kg m-2 d-1)	pr CanESM2 historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp26 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp26 (kg m-2 d-1)	pr MIROC5 historical rcp26 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp26 (kg m-2 d-1)	pr NorESM1-M historical rcp26 (kg m-2 d-1)	pr BNU-ESM historical rcp26 (kg m-2 d-1)	pr NorESM1-ME historical rcp26 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp26 (kg m-2 d-1)	pr CCSM4 historical rcp26 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp26 (kg m-2 d-1)
2011	0	0.8	0	5	0	2	0	0	0	1	0	0	0	1	2	0	0	5	1	0	0	2	1	0	1	1	0	1
2012	0	0.5	0	2	0	0	1	0	1	0	2	1	1	0	0	0	1	0	0	0	0	2	0	0	1	1	0	0
2013	1	0.8	0	3	0	0	1	2	1	0	3	0	0	1	0	1	0	1	0	0	1	2	0	2	2	0	0	2
2014	0	0.6	0	4	0	0	3	0	0	4	1	1	1	0	0	1	2	0	0	0	0	0	0	1	0	0	0	1
2015	0	0.2	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0
2016	0	0.4	0	2	0	0	0	0	0	2	0	1	0	1	0	0	1	1	0	0	0	0	1	2	1	0	0	0
2017	0	0.6	0	3	0	0	0	0	0	1	1	1	2	0	1	0	0	2	0	0	1	0	0	1	3	0	1	0
2018	0	0.5	0	2	0	0	1	0	1	0	1	0	0	1	2	0	0	0	0	2	0	0	1	0	0	0	0	2
2019	0	0.6	0	3	2	0	1	2	0	0	0	1	0	0	0	2	0	0	0	1	0	2	0	0	0	3	0	0
2020	0	0.6	0	2	0	0	0	1	2	0	2	0	0	0	1	0	1	2	0	0	0	2	0	0	0	2	0	2
2021	0	0.3	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	1	0	0	1	0	0	1
2022	0	0.6	0	4	0	0	0	0	0	0	0	0	0	4	0	0	1	0	1	0	0	1	3	0	0	0	2	2
2023	0	0.5	0	2	1	0	0	1	0	1	1	2	0	0	1	0	0	1	0	0	0	1	0	1	0	1	1	0
2024	0	0.5	0	3	1	1	0	0	0	1	1	0	3	0	0	0	0	1	0	0	0	0	0	2	0	0	0	1
2025	0	0.4	0	2	0	0	1	0	0	1	0	0	1	0	1	1	0	1	0	0	1	0	2	0	1	0	0	0
2026	1	0.8	0	4	1	4	1	0	1	0	1	1	1	0	1	1	0	1	0	1	2	0	0	1	0	0	0	1
2027	1	1.2	0	4	3	1	4	0	1	2	0	1	0	0	0	0	2	2	1	1	1	0	3	2	0	0	1	3
2028	0	0.4	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	3	0	1	0	0	0	0
2029	0	0.5	0	3	1	0	0	0	0	0	1	0	0	2	0	2	0	1	0	0	0	0	0	3	1	1	0	0
2030	0	0.8	0	6	2	6	1	0	0	1	1	0	1	0	1	0	0	0	1	0	0	0	1	4	0	0	0	1
2031	0	0.6	0	3	0	0	1	1	2	3	3	0	0	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0
2032	1	0.8	0	3	1	2	0	0	2	0	0	1	2	0	1	1	1	1	0	0	1	0	0	3	0	2	0	0
2033	0	0.3	0	2	0	0	1	0	0	1	2	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0
2034	0	0.7	0	3	0	0	0	0	3	1	2	0	0	2	0	0	1	3	0	1	0	1	0	0	0	1	1	0
2035	0	0.6	0	2	2	0	2	0	0	1	1	0	0	1	1	0	2	1	1	0	0	0	1	0	1	0	0	0
2036	1	0.5	0	1	0	0	1	1	0	0	1	0	1	0	1	1	0	1	1	0	0	0	1	1	1	1	1	0
2037	0	0.7	0	3	1	0	0	1	3	1	0	3	1	0	0	0	0	1	1	0	2	0	2	0	0	0	1	0

2038	0	0.5	0	3	0	0	1	0	3	1	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	3	0
2039	1	0.8	0	3	2	2	0	0	0	1	1	2	1	1	0	1	0	0	1	0	1	2	0	1	3	1	0	0
2040	1	0.8	0	5	3	2	0	1	5	0	1	1	1	0	2	1	0	0	0	0	0	0	0	1	1	0	1	0
2041	0	0.6	0	2	0	2	1	2	1	2	2	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0
2042	0	0.6	0	2	1	2	0	2	1	0	0	0	0	0	1	0	2	1	0	1	1	1	0	0	0	0	0	1
2043	0	0.8	0	3	1	0	0	0	0	2	1	0	1	2	2	0	0	3	0	0	1	0	0	2	0	3	0	1
2044	0	0.4	0	2	1	0	0	0	0	0	1	2	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	1
2045	0	0.6	0	3	1	3	0	2	2	0	0	0	0	0	1	0	0	1	0	1	1	0	0	1	0	0	0	2
2046	1	0.8	0	4	1	0	1	0	0	2	2	2	0	0	0	1	0	2	4	0	0	0	1	0	1	1	0	2
2047	0	0.7	0	3	2	1	0	0	0	0	3	1	0	2	1	0	0	0	3	1	0	0	2	0	0	0	0	0
2048	0	0.4	0	2	1	1	0	0	1	2	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
2049	0	0.5	0	3	0	2	0	0	0	1	0	1	1	0	0	0	0	0	0	3	0	0	0	2	0	0	0	1
2050	0	0.5	0	2	0	0	0	0	1	1	0	1	0	2	0	0	1	1	1	0	2	0	1	0	0	0	0	1
2051	0	0.6	0	3	0	1	0	0	0	0	1	0	0	3	0	0	2	0	1	2	1	1	1	0	1	1	0	0
2052	1	0.7	0	2	1	0	0	0	2	1	2	1	0	0	1	0	0	2	2	1	0	0	1	0	1	2	0	0
2053	1	0.8	0	3	2	1	3	1	2	0	1	0	2	0	1	1	0	0	2	0	1	1	0	0	0	0	2	0
2054	0	0.6	0	3	0	1	1	3	0	1	1	1	0	0	0	0	1	0	0	0	0	2	0	0	0	2	1	0
2055	0	0.6	0	5	0	1	0	2	0	0	2	0	2	2	0	0	0	0	0	0	0	0	0	1	0	5	0	0
2056	1	0.9	0	4	2	1	1	2	1	2	1	1	0	4	2	1	1	0	0	0	0	0	0	0	2	0	0	1
2057	1	0.8	0	3	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	2	2	0	2	2	0	1	3	2
2058	0	0.5	0	2	1	0	0	1	1	1	0	2	0	1	1	0	0	1	1	0	0	0	0	2	0	1	0	0
2059	0	0.6	0	3	0	2	0	1	0	0	0	2	0	1	3	0	0	2	0	2	0	0	1	0	0	1	0	0
2060	0	0.5	0	4	1	4	0	0	0	1	1	1	0	0	2	0	0	1	0	0	0	0	1	0	0	1	0	0
2061	0	0.5	0	2	1	1	0	2	0	1	1	1	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0
2062	0	0.9	0	4	1	0	0	0	0	2	1	0	0	0	3	0	1	2	1	0	0	3	1	0	4	0	2	0
2063	0	0.6	0	2	0	0	0	1	0	0	2	1	1	0	1	0	0	2	1	0	1	1	0	0	2	1	0	0
2064	1	1.0	0	3	1	3	1	1	0	1	3	0	1	0	0	1	1	1	0	0	0	1	1	2	0	2	1	2
2065	0	0.6	0	3	1	0	0	0	0	1	1	1	0	2	3	1	0	0	0	1	0	0	1	0	0	0	0	3
2066	0	0.4	0	3	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	3	0	0	2	0	0
2067	0	0.6	0	3	0	0	0	1	1	0	2	0	1	1	1	0	0	1	2	0	0	1	0	0	0	0	0	3
2068	0	0.5	0	3	0	0	1	0	0	1	0	1	2	0	0	1	0	1	0	0	3	1	0	0	1	0	1	0
2069	0	0.5	0	2	0	0	1	2	1	0	2	0	0	0	1	0	2	0	0	1	1	1	0	0	1	0	0	0
2070	0	0.7	0	3	0	1	0	0	0	2	2	0	0	1	1	0	0	1	0	3	0	1	1	0	2	0	0	2
2071	0	0.5	0	2	1	0	0	0	1	0	2	0	0	2	0	0	0	1	1	0	1	0	2	0	0	1	0	1
2072	1	0.7	0	3	0	0	1	3	1	0	3	1	0	0	1	0	1	1	0	0	1	0	1	0	1	1	0	0
2073	0	0.5	0	3	0	0	0	1	1	0	0	1	0	1	3	1	1	0	0	1	1	0	0	1	0	0	1	0
2074	0	0.5	0	2	0	2	2	0	1	0	1	1	0	0	0	1	0	1	0	0	0	1	1	0	0	1	1	0
2075	0	0.4	0	1	0	0	0	0	1	1	1	1	0	0	1	0	1	0	1	1	0	0	0	0	0	0	1	1
2076	0	0.8	0	3	0	0	0	0	0	0	1	2	3	1	0	1	3	0	1	2	0	0	1	0	2	2	0	0
2077	0	0.5	0	3	1	0	1	0	0	2	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	3	1	0
2078	0	0.7	0	3	0	0	2	0	2	2	0	0	1	2	1	0	0	0	3	0	0	0	0	2	0	1	0	0
2079	0	0.7	0	4	2	1	0	1	0	2	0	0	0	0	0	0	1	2	0	0	0	4	0	2	0	1	1	0
2080	0	0.8	0	4	0	0	0	0	2	0	4	1	1	2	0	0	0	0	0	0	0	1	1	2	1	3	2	0
2081	0	0.2	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0
2082	0	0.8	0	4	0	0	1	1	0	0	1	0	1	0	3	3	0	4	0	0	0	1	1	2	0	0	0	1
2083	0	0.8	0	6	6	0	1	1	0	1	0	0	0	0	0	0	0	2	1	0	0	1	1	2	3	0	1	0
2084	1	0.5	0	2	2	0	1	1	1	0	1	0	0	0	1	0	0	1	0	0	1	1	1	0	1	1	0	0
2085	1	0.7	0	4	1	1	1	0	1	2	1	1	1	1	1	0	0	1	1	4	0	0	0	0	0	0	0	0
2086	0	0.7	0	2	0	0	2	2	2	0	0	1	0	2	1	0	0	1	0	1	1	1	0	2	0	0	0	0
2087	1	0.7	0	2	1	1	0	0	0	1	0	0	0	2	0	0	2	1	1	2	0	2	0	1	0	1	2	0
2088	0	0.5	0	3	1	1	0	3	0	0	1	0	0	1	0	1	0	1	0	1	0	0	0	1	0	1	1	0
2089	0	0.7	0	3	0	3	0	0	1	1	1	0	0	0	2	1	0	2	1	1	0	0	0	3	1	0	0	0
2090	1	0.7	0	2	1	2	0	1	1	1	1	0	1	0	0	0	0	1	2	0	1	0	1	2	1	0	0	1
2091	1	0.6	0	2	1	0	0	0	1	1	2	0	1	1	0	1	1	0	0	1	0	2	0	0	0	1	1	0
2092	0	0.5	0	2	0	1	0	0	1	0	0	1	0	1	2	1	0	1	0	0	1	1	2	1	0	0	0	0
2093	0	0.5	0	2	1	1	0	2	0	1	2	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	1
2094	0	0.3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	1
2095	0	0.4	0	2	0	1	1	0	0	0	0	1	0	2	0	2	0	0	1	1	0	0	0	0	0	1	0	0
2096	1	0.8	0	3	1	0	0	2	2	0	1	0	0	1	0	1	0	0	2	3	0	1	2	0	1	2	0	0
2097	0	0.6	0	3	0	2	0	0	0	1	1	1	0	2	0	2	0	1	0	0	0	0	0	3	0	0	0	1
2098	1	0.8	0	2	0	0	0	2	0	1	0	1	1	1	2	0	1	0	2	2	1	1	1	0	0	1	1	1
2099	0	0.8	0	4	0	2	0	0	0	4	0	3	1	0	0	1	0	0	1	0	1	0	1	0	2	1	1	0
2100	0	0.5	0	2	0	1	1	0	1	0	1	1	1	0	1	0	1	2	0	0	0	1	0	0	0	0	0	1

RCP4.5

Total Annual Precip (mm)

Year	Median	Mean	Min	Max	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
2011	468.3	470.7	346.8	614.1	485.1	542.4	428.4	415.9	449.8	579.2	423.7	385.2	499.9	501.9	417.6	564.0	468.7	428.2	614.1	346.8	458.5	508.5	462.6	467.8	474.1	356.3	540.2	476.8
2012	474.1	475.1	351.0	689.2	379.1	499.1	455.8	402.6	559.1	520.3	512.8	498.5	394.9	473.1	364.5	511.6	475.1	419.3	689.2	420.4	374.5	522.2	351.0	456.5	522.7	592.6	613.3	394.1
2013	488.8	476.8	327.1	630.4	410.5	499.6	513.0	442.0	489.1	526.6	519.5	403.3	467.1	511.2	532.0	504.4	375.8	451.6	455.1	630.4	613.9	423.5	464.5	522.3	488.5	327.1	370.5	502.3
2014	472.1	469.6	344.2	584.9	453.8	468.3	475.9	432.8	506.8	500.7	525.5	530.4	584.9	406.8	478.1	439.5	454.8	491.9	344.2	477.6	444.7	452.0	490.8	373.4	527.7	448.0	500.7	461.3
2015	462.6	466.8	366.5	621.8	515.2	621.8	383.0	436.3	437.1	455.4	463.6	497.9	461.7	512.4	413.4	366.5	483.4	400.2	541.2	405.9	375.0	557.7	563.4	517.9	387.9	403.6	471.0	531.0
2016	480.1	481.3	374.7	599.2	555.5	445.4	528.8	379.0	529.2	459.6	437.6	551.6	530.8	490.5	518.3	512.8	450.0	394.2	374.7	599.2	383.1	590.2	469.7	420.2	409.6	514.6	542.3	463.7
2017	457.6	466.9	280.2	595.1	509.6	426.3	483.3	375.0	595.1	424.0	532.0	444.5	280.2	425.9	493.7	463.4	469.3	531.2	400.5	446.1	588.0	451.9	546.7	591.9	369.1	502.1	415.5	441.3
2018	450.8	460.0	342.9	592.8	352.4	504.0	342.9	592.8	443.3	518.4	428.3	462.7	421.8	489.0	377.0	549.3	426.6	458.2	504.8	416.3	429.8	437.6	371.4	571.1	427.7	491.1	491.8	531.3
2019	436.8	435.4	350.0	535.3	370.9	448.5	469.7	446.4	376.6	434.4	487.2	445.5	402.5	390.2	417.3	498.8	535.3	369.9	434.5	461.7	350.0	477.1	461.2	463.5	416.6	432.2	439.2	421.8
2020	469.4	489.0	362.7	632.5	571.8	379.5	474.6	555.2	585.2	410.0	569.9	454.8	552.4	448.2	392.0	362.7	442.1	453.3	421.6	432.2	522.0	470.8	461.3	632.5	468.0	486.9	623.2	567.0
2021	464.5	462.5	354.7	588.2	466.5	365.3	529.8	529.8	551.6	439.1	487.6	588.2	420.4	485.9	456.3	354.7	533.6	438.5	380.8	489.6	462.5	507.4	382.7	421.2	469.9	357.3	521.7	460.3
2022	472.1	470.0	348.8	601.6	366.5	455.8	513.6	426.9	601.6	542.1	490.3	473.5	461.0	502.0	398.0	564.5	470.8	512.5	540.7	525.1	473.8	446.3	348.8	451.8	431.8	391.4	360.6	531.4
2023	475.8	481.6	381.6	663.3	427.6	381.6	511.5	416.8	578.0	437.0	390.9	501.9	440.0	502.8	576.7	497.7	546.0	470.3	528.4	450.3	461.8	428.8	388.1	521.4	556.9	663.3	481.3	398.3
2024	471.5	476.7	365.8	585.2	491.9	553.7	453.2	385.7	580.4	570.8	464.4	585.2	497.5	481.9	426.7	520.8	413.3	429.7	498.7	403.0	496.5	365.8	471.7	542.5	470.8	471.4	431.6	433.2
2025	467.2	469.3	356.5	644.6	402.0	439.4	510.8	413.2	536.5	644.6	483.8	371.7	356.5	538.4	454.5	441.9	503.0	523.9	467.9	366.3	544.4	466.5	402.6	497.2	448.5	474.7	431.5	544.4
2026	446.9	447.3	358.2	568.8	432.2	399.1	368.5	568.8	480.8	421.6	489.2	361.0	417.3	503.3	467.3	358.2	454.8	391.3	497.6	415.2	445.8	500.5	432.8	516.1	413.7	448.0	498.1	454.1
2027	490.1	483.9	336.9	586.8	564.1	519.9	538.0	485.1	459.2	568.4	504.0	434.3	414.6	468.2	520.3	474.6	409.9	410.5	586.8	430.1	524.0	426.9	495.1	540.2	586.2	336.9	527.9	387.9
2028	466.6	477.3	369.7	632.8	410.9	375.9	566.1	369.7	468.9	374.2	471.5	555.2	485.2	459.3	439.1	512.4	447.9	626.1	632.8	392.2	549.2	461.5	476.0	424.8	446.9	525.4	464.4	518.7
2029	477.8	477.7	332.2	654.5	654.5	407.4	435.0	395.7	575.0	491.9	485.4	409.6	436.1	365.5	499.2	600.9	455.6	344.3	563.8	433.8	470.3	528.4	442.0	542.4	557.6	332.2	512.8	525.0
2030	470.5	479.9	365.5	597.2	530.8	422.7	365.5	528.8	481.8	583.5	597.2	467.2	503.5	408.9	473.9	466.3	514.2	436.9	421.0	527.8	413.0	473.9	443.7	567.4	442.0	566.6	441.3	439.3
2031	482.9	488.6	337.3	658.9	654.0	434.7	429.6	420.0	376.9	558.6	362.4	499.9	481.6	389.6	592.3	425.5	601.3	484.3	658.9	516.8	440.3	524.2	513.7	418.1	455.6	337.3	542.2	609.1
2032	498.5	502.3	389.9	661.9	404.7	486.1	629.8	490.5	410.2	425.9	500.9	481.8	496.1	536.3	516.2	428.2	527.5	389.9	657.1	424.8	476.5	516.6	516.0	661.9	547.6	487.7	531.1	511.8
2033	497.3	484.1	319.0	677.6	493.3	364.8	446.7	543.1	404.6	544.9	510.1	383.0	507.6	532.1	401.5	337.2	636.4	484.3	582.6	677.6	487.1	563.3	373.6	534.2	473.6	319.0	516.2	501.3
2034	484.5	485.2	387.2	622.3	599.8	536.0	490.7	418.0	593.1	405.0	543.3	449.0	394.8	468.7	387.2	513.8	427.8	441.0	481.7	487.4	472.0	499.1	501.3	622.3	494.7	410.6	562.8	445.8
2035	488.2	496.6	350.2	629.2	536.2	521.8	523.5	522.9	624.7	584.2	550.3	474.2	489.6	452.6	422.1	624.8	455.6	584.0	545.0	373.8	430.4	350.2	398.7	469.1	446.1	423.1	629.2	486.7
2036	485.1	490.9	337.0	671.0	442.7	579.0	426.0	542.6	425.0	527.3	422.9	377.8	455.2	542.9	382.4	496.7	452.7	477.6	501.9	582.5	426.3	613.4	483.9	516.7	337.0	611.3	671.0	486.4
2037	468.2	476.8	272.7	786.1	567.9	502.6	447.5	491.0	473.3	437.6	391.4	463.2	515.6	478.7	437.7	401.6	512.5	596.9	786.1	414.4	439.8	498.3	550.6	503.1	272.7	451.1	358.0	452.7
2038	526.6	516.2	365.8	682.2	594.1	569.0	489.6	639.5	585.5	424.5	682.2	413.5	457.6	557.5	603.0	433.3	552.8	392.5	549.8	661.3	583.1	501.9	536.1	411.0	517.2	482.3	386.9	365.8
2039	492.3	485.4	366.9	710.8	555.9	569.1	502.2	407.4	409.2	564.1	533.5	373.9	405.6	520.3	522.1	366.9	710.8	448.5	442.4	482.6	433.6	501.9	398.1	529.8	514.1	375.6	638.4	443.4
2040	483.3	477.6	347.9	620.2	580.4	402.5	531.9	543.2	511.0	405.8	514.3	373.7	357.3	491.9	570.6	514.7	442.6	454.5	347.9	620.2	455.3	501.4	455.6	474.7	405.0	581.4	388.7	538.0
2041	477.6	492.0	373.1	610.2	591.4	448.5	484.6	412.9	551.4	418.0	605.1	603.5	591.7	606.4	583.9	402.7	426.9	470.5	385.8	439.5	390.7	443.6	610.2	515.4	373.1	378.2	513.3	560.6
2042	500.4	516.0	344.3	756.5	362.2	713.7	419.9	630.9	398.3	475.2	458.8	459.4	530.3	427.4	437.4	538.7	344.3	459.7	556.1	722.6	645.7	529.5	567.5	580.1	525.6	456.0	756.5	388.5
2043	470.4	465.4	325.9	605.2	470.2	452.0	488.2	605.2	432.6	519.8	424.1	444.6	539.4	478.1	482.1	470.6	426.3	475.0	483.2	325.9	549.5	388.6	399.7	430.8	516.6	447.2	528.5	390.5
2044	475.1	482.1	343.5	619.2	452.7	418.7	512.3	504.1	436.6	481.2	519.0	562.9	445.3	518.7	489.1	515.7	574.8	440.7	441.6	460.2	343.5	453.4	488.1	567.3	402.4	469.1	619.2	453.2
2045	492.3	502.1	386.3	668.6	609.9	507.0	544.1	543.7	439.1	668.6	518.8	416.8	501.3	479.1	460.5	577.0	612.8	386.3	550.7	423.8	475.8	419.9	585.6	441.9	483.3	471.7	422.3	511.5
2046	469.7	484.6	367.0	655.0	367.0	549.9	409.4	531.7	472.8	564.1	457.1	479.0	534.6	610.5	502.7	460.8	508.6	445.4	655.0	451.7	411.0	430.8	374.5	466.6	371.4	631.3	508.4	437.1
2047	448.5	471.5	362.3	620.7	620.7	524.4	437.2	532.1	616.3	425.6	542.4	589.2	362.3	433.0	438.2	428.4	497.8	447.6	479.0	377.1	542.1	419.0	401.1	450.1	449.4	442.6	462.4	397.3
2048	463.2	472.1	307.9	634.4	465.5	307.9	488.5	613.1	571.0	478.3	463.2	506.0	533.0	378.3	412.7	599.3	463.3	441.6	634.4	405.8	510.8	447.8	445.2	433.9	437.6	486.7	407.7	399.4
2049	501.6	507.6	351.4	716.5	351.4	559.0	469.0	502.7	541.1	716.5	553.4	441.3	462.4	500.5	521.6	609.1	602.5	537.9	625.6	496.7	438.4	572.6	503.2	461.2	407.9	387.1	491.1	431.1
2050	497.5	489.1	364.0	629.3	585.5	612.7	364.3	524.7	524.0	430.7	508.0	608.2	431.1	503.6	520.1	491.4	513.5	379.0	629.3	424.0	588.4	537.9	467.0	441.9	410.2	364.0	420.4	459.2
2051	518.0	509.8	345.5	633.5	473.0	556.3	516.2	581.6	496.0	596.9	633.5	523.8	457.4	575.5	519.9	615.4	411.0	446.5	430.4	524.3	469.1	550.1	462.1	575.7	534.2	452.8	487.1	345.5
2052	484.8	495.6	375.5	624.7	482.5	588.8	472.0	403.5	559.6	551.4	624.7	578.0	402.4	537.4	431.4	609.8	504.9	533.5	422.3	455.0	538.4	375.5	428.4	584.1	421.1	487.2	433.0	470.4
2053	470.5	488.1	311.0	650.9	513.9	469.3	311.0	598.1	610.9	526.8	584.8	463.9	414.5	471.7	490.1	414.7	463.4	490.9	438.5	522.0	542.2	421.1	443.1	444.5	399.8	595.1	650.9	432.8
2054	532.0	523.9	320.4	700.6	551.2	650.4	603.7	510.6	700.6	556.1	519.1	449.8	574.0	478.3	431.9	441.1	573.2	428.5	567.9	618.0	544.8	473.8	460.5	468.5	443.5	647.1	560.4	320.4
2055	485.1	483.3	386.3	681.6	432.9	681.6	393.0	434.2	565.1	443.7	577.8	487.1	440.4	487.1	386.3	503.3	513.6	423.5	483.1	495.0	449.2	410.8	497.4	528.7	474.1	556.8	435.4	498.5
2056	483.5	485.5	295.1	671.4	493.8	549.5	530.9	615.0	295.1	392.2	459.4	442.3	468.4	468.0	483.6	484.6	497.4	402.3	460.0	454.0	671.4	505.7	670.6	483.5	540.3	374.2	502.9	406.7
2057	499.2	495.4	343.7	674.5	460.4	514.4	505.5	579.7	489.8	629.4	388.0	521.8	448.9	543.9	343.7	674.5	467.5	492.9	538.1	533.8	535.9	580.5	375.0	413.6	517.9	453.2	422.4	459.9
2058	478.8	489.6	385.7	665.8	495.4	454.8	461.6	534.6	441.3	553.7	453.9	411.2	496.1	544.4	480.9	489.8	476.6	496.6	456.9	661.0	405.4	572.7	468.0	665.8	450.4	385.7	498.6	395.9
2059	469.3	474.8	360.5	618.6	435.0	415.6	506.5	434.6	450.3	545.0	470.7	509.1	468.0	618.6	518.9	454.9	590.5	477.7	481.7	437.1	360.5	481.1	501.7	457.7	487.7	416.5	421.9	453.3
2060	500.5	491.4	351.3	674.4	552.8	425.0	510.5	474.9	539.7	513.7	418.1	456.1	674.4	496.6	413.5	397.3	529.2	441.1	439.2	351.3	427.6	506.9	534.0	646.5	505.5	504.3	617.9	417.7
2061	509.7	508.3	384.0	627.7	425.4	614.1	565.0	595.9	450.3	524.0	518.0	448.9	506.7	465.4	532.5	575.9	569.0	483.2	512.7	627.7	477.6	384.0	486.7	529.3	412.2	520.0	469.9	505.2
2062	509.4	515.4	397.0	684.8	397.0	583.3	520.1	538.5	639.5	438.6	408.9	436.5	500.8	525.5	443.7	607.6	684.8	477.6	447.0	549.0	478.0	518.1	445.9	630.5	612.4	451.5	601.4	433.3
2063	497.9	515.3	343.2	748.0	454.8	587.6	503.8	418.3	499.0	496.8	475.7	464.1	435.3	550.3	699.3	564.0	448.2	343.2	748.0	388.9	507.6	450.9	532.5	641.7	454.7	479.5	687.4	535.5
2064	495.7	497.7	354.7	625.4	458.8	453.4	619.9	416.3	607.5	525.1	505.8	495.3	497.4	439.4	423.8	496.1	597.9	474.6	539.0	448.3	537.0	354.7	497.5	625.4	473.2	618.0	406.5	433.9
2065	497.9	498.0	376.4	596.2	463.8	530.4	489.4	414.9	550.9	506.4	465.3	377.7	574.6	545.6	559.8	487.2	552.9	488.1	555.7	588.9	376.4	438.5	526.4	487.5	411.9	596.2	439.8	523.9
2066	473.1	485.9	382.6	662.6	428.8	662.6	382.6	584.7	418.9	455.6	408.9	460.0	576.2	513.4	437.9	506.2	555.2	411.3	618.5	484.7	502.5	443.8	463.2	479.2	470.3	477.8	443.4	476.0
2067	487.7	479.1	361.5	645.3	534.1	510.4	504.7	361.5	458.6	495.7	379.7	386.4	449.8	512.3	432.9	471.0	515.4	577.1	500.1	382.2	500.1	417.7	541.0	645.3	417.7	479.7	409.5	615.7
2068	487.9	496.3	373.0	630.4	564.2	424.6	490.0	513.8	522.4	545.9	426.1	533.6	442.2	479.4	417.0	373.0	559.7	603.4	472.7	420.1	535.6	485.8	630.4	478.8	541.4	482.8	412.5	556.0
2069	479.4	479.2	275.4	619.7	557.6	541.8	386.0	371.1	536.9	275.4	537.1	486.0	412.1	590.9	421.8	559.6	392.0	402.0	576.8	619.7	428.2	519.2	593.8	465.3	369.9	459.2	525.0	472.7
2070	494.4	500.7	352.1	616.7	468.1	524.7	505.8	434.8	352.1	498.0	484.5	482.4	392.6	616.7	591.8	557.0	448.9	417.0	386.9	567.3	505.8	490.7	464.8	467.5	597.9	588.8	600.5	571.7
2071	512.4	536.3	389.8	743.2	530.5	654.0	397.1	579.8	670.8	430.0	710.8	436.0	408.8	503.3	389.8	561.8	623.6	404.8	686.0	464.5	481.7	484.6	521.5	658.9	743.2	480.6	582.9	466.5
2072	505.3	517.3	392.1	650.2	599.5	526.5	454.3	550.2	548.7	497.1	402.3	504.6	408.6	447.6	571.4	618.7	650.2	542.5	578.1	480.8	458.9	490.3	601.9	506.0	392.1	466.2	626.5	492.7
2073	467.2	501.0	366.4	713.8	612.8	585.3	461.3	447.3	558.8	462.3	445.9	456.1	446.0	466.1	468.3	564.2	630.6	380.1	642.0	464.7	494.7	565.3	713.8	425.2	366.4	415.2	469.5	482.5
2074	511.4	525.7	409.1	721.5	445.2	568.2	470.6	641.5	655.4	638.5	499.8	555.6	409.1	490.5	419.1	446.4	539.0	434.0	516.5	494.7	539.4	520.1	721.5	649.9	444.8	506.3	530.4	479.2
2075	517.6	515.3	372.3	631.6	509.8	485.1	372.3	523.5	451.3	453.7	530.3	524.3	480.1	443.8	494.2	547.6	541.1	536.4	511.7	592.7	494.3	506.4	500.8	590.0	631.6	565.0	529.3	552.3
2076	502.4	492.5	349.0	668.5	497.9	626.3	353.1	459.0	501.3	668.5	524.9	413.1	535.9	468.6	373.2	473.7	598.8	349.0	551.9	548.1	355.0	401.2	503.5	537.7	391.8	531.9	635.5	519.3
2077	512.7	509.8	308.1	704.1	542.0	542.7	704.1	520.6	477.9	335.6	533.7	504.9	579.2	635.7	595.9	461.8	619.4	456.8	504.6	413.1	523.0	435.7	467.7	308.1	534.2	595.0	463.0	481.4
2078	471.6	486.0	301.3	749.5	473.0	446.9	749.5	556.7	568.8	419.4	372.3	615.6	628.2	470.2	432.6	459.3	413.1	493.2	577.8	433.5	552.9	301.3	483.1	500.7	341.2	401.4	452.2	520.8
2079	480.2	509.8	368.5	703.6	530.2	703.6	627.9	445.2	529.3	484.3	469.1	436.7	408.1	439.2	410.4	508.2	673.7	405.2	604.9	591.0	531.4	471.2	471.2	625.1	476.0	368.5	552.3	471.3
2080	517.7	507.0	349.5	644.0	631.4	641.1	529.0	609.0	533.5	442.9	471.8	458.7	349.5	644.0	553.4	405.2	571.7	358.0	591.7	520.5	550.0	513.6	514.9	417.2	386.5	541.3	466.3	467.5
2081	522.3	509.2	360.3	736.4	525.7	533.7	575.4	524.7	360.3	489.6	736.4	436.1	543.1	515.8	436.3	626.3	448.9	520.9	527.9	522.2	536.2	409.2	480.7	443.3	543.3	440.0	522.4	523.3
2082	539.1	526.5	353.9	687.6	583.5	564.7	499.0	586.9	353.9	522.0	355.0	533.2	487.6	594.7	657.2	555.9	493.0	440.5	545.0	452.6	559.6	545.9	445.6	573.9	471.6	518.7	609.5	687.6
2083	480.7	494.1	369.0	798.5	391.7	527.0	436.8	438.6	473.2	658.6	798.5	417.8	477.1	369.0	586.3	486.1	484.3	452.2	401.3	373.6	471.8	557.7	526.2	522.9	439.7	537.3	541.6	488.1
2084	467.3	483.3	337.3	753.0	593.3	462.7	602.3	483.6	346.0	527.5	438.7	510.0	435.0	402.7	499.8	457.6	753.0	420.9	472.0	353.0	337.3	489.2	507.1	591.4	587.9	446.8	420.6	460.7
2085	493.8	506.7	396.0	708.5	708.5	691.1	439.3	476.5	558.2	529.7	513.9	396.0	484.1	413.6	478.5	503.4	527.7	616.5	450.2	424.1	420.3	406.8	515.6	634.0	476.0	426.2	505.0	564.5
2086	485.7	495.9	359.3	670.0	411.4	613.8	486.0	629.5	527.2	534.5	415.0	456.5	486.9	670.0	448.9	485.5	530.8	464.0	359.3	589.1	384.6	528.4	536.7	448.3	466.1	444.5	521.7	463.3
2087	502.4	495.9	339.5	611.8	433.3	509.2	493.0	593.1	519.2	381.1	452.7	568.1	534.5	539.3	473.2	532.5	573.1	459.1	496.2	597.1	400.2	548.7	427.4	508.6	339.5	611.8	463.1	448.0
2088	464.7	449.4	288.1	572.2	572.2	353.6	542.7	484.2	565.2	460.8	427.7	416.5	438.5	494.2	468.6	348.4	489.0	383.2	532.8	382.2	392.0	504.3	481.8	502.6	416.7	288.1	346.9	493.6
2089	502.9	493.6	287.9	658.5	658.5	423.4	633.2	437.5	513.3	377.9	529.1	549.6	361.1	605.0	504.6	287.9	479.9	444.7	607.9	592.5	550.2	351.3	401.3	552.8	470.8	501.3	568.5	443.6

2090	530.8	530.5	379.4	698.5	589.2	557.1	459.9	379.4	454.9	698.5	540.8	580.3	500.4	547.7	605.6	498.0	621.4	592.1	587.2	565.1	458.5	420.1	519.7	562.4	518.8	482.4	520.9	472.5
2091	493.0	504.5	305.8	652.5	490.8	454.5	622.1	452.5	505.7	464.1	473.1	521.4	509.4	495.2	622.2	414.2	513.7	472.5	627.5	486.6	475.1	533.6	538.0	459.1	394.0	305.8	624.9	652.5
2092	499.3	512.9	399.8	667.1	538.9	541.6	456.3	623.6	452.8	585.8	452.8	408.3	437.5	471.7	568.0	667.1	553.3	457.1	492.4	568.3	593.9	501.8	529.3	482.5	547.4	399.8	482.6	496.7
2093	497.6	503.9	378.2	646.0	646.0	468.3	382.5	550.6	545.6	537.1	572.9	459.1	467.4	533.1	512.5	471.6	595.5	478.7	521.8	575.4	426.2	378.2	392.0	498.4	496.8	605.8	495.5	482.7
2094	525.7	521.7	377.6	793.2	546.1	474.1	506.4	548.1	593.3	523.0	561.6	377.6	405.1	660.6	499.5	540.5	487.8	385.2	542.2	548.6	427.0	793.2	456.8	724.7	408.6	540.8	528.4	442.3
2095	458.1	482.8	347.2	672.7	511.5	607.3	446.3	589.4	458.8	374.8	347.2	568.0	618.6	414.5	506.1	454.0	458.5	457.6	672.7	387.2	412.7	600.1	424.1	425.7	439.5	513.1	503.1	396.3
2096	450.9	462.8	326.1	617.1	570.8	617.1	476.1	556.0	442.3	479.1	442.7	432.0	373.5	473.6	440.8	428.6	500.9	404.8	533.4	377.1	326.1	520.1	469.3	438.4	442.9	503.6	398.8	458.9
2097	516.0	520.3	343.0	781.4	468.1	484.7	582.9	622.5	474.8	514.3	378.7	517.7	557.6	477.1	343.0	496.4	514.0	576.1	781.4	523.6	419.3	508.3	548.5	631.3	384.8	532.3	557.0	593.4
2098	506.8	497.4	373.0	620.4	447.7	485.5	503.2	554.8	539.5	373.0	510.5	437.7	556.5	456.4	577.1	417.9	436.0	551.1	620.4	419.8	526.5	422.6	595.2	520.8	419.8	527.9	598.2	440.4
2099	492.1	504.5	382.6	686.1	536.6	492.1	438.6	492.1	466.0	686.1	604.9	437.0	455.6	392.0	572.5	525.6	658.5	487.2	498.0	382.6	554.7	457.0	538.9	544.8	512.9	459.3	476.2	439.0
2100	514.1	509.6	327.9	701.4	543.0	586.5	701.4	467.1	548.9	420.9		495.3	539.2	605.5	582.3	370.1	588.5	376.3	513.6	514.1	470.5	579.3	487.6	427.8	499.6	327.9	518.1	558.1

RCP4.5

Max Daily Precip (mm)

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
2011	20.6	23.0	13.3	43.4	17.9	27.8	18.4	28.9	18.5	31.2	43.4	20.8	31.6	31.2	21.0	23.2	15.7	17.0	34.5	13.3	16.2	15.1	17.3	20.4	18.9	14.5	26.9	28.5
2012	25.5	25.1	14.6	37.6	19.5	26.6	25.9	24.8	31.7	22.3	28.3	33.7	37.6	16.3	29.6	15.1	22.8	20.4	29.4	14.6	31.8	31.7	17.9	27.7	17.2	25.1	26.8	24.7
2013	22.2	23.3	10.3	45.7	14.4	24.6	13.6	22.2	37.6	28.0	19.5	22.4	21.3	17.9	22.1	19.8	14.3	21.8	23.3	17.2	45.7	26.3	24.6	38.8	28.8	10.3	31.2	14.5
2014	22.3	24.4	10.7	38.3	15.8	38.3	27.9	34.1	35.6	27.8	19.9	23.7	34.3	20.3	29.4	15.2	37.4	18.0	10.7	18.3	21.4	26.9	17.5	21.4	21.7	18.7	29.6	22.8
2015	25.8	26.2	9.2	49.5	28.5	26.2	21.3	16.4	25.7	21.3	34.8	24.2	22.8	49.5	27.4	25.8	16.9	17.4	17.6	16.7	29.7	37.3	29.5	27.5	47.1	9.2	31.9	24.3
2016	23.8	28.6	13.0	64.7	22.7	53.7	64.7	13.0	35.7	16.4	30.4	35.0	25.0	20.6	46.1	14.4	21.1	17.1	17.7	37.3	18.9	51.4	25.3	21.0	15.5	32.2	33.6	18.4
2017	23.8	27.6	8.3	58.1	14.1	50.6	42.0	22.8	37.5	21.8	23.4	25.8	8.3	26.6	17.3	16.3	25.8	53.7	30.6	24.2	58.1	20.1	21.1	22.6	16.3	31.0	22.4	30.5
2018	20.7	22.3	13.3	32.8	15.4	21.4	18.8	31.9	25.6	18.4	19.5	13.3	21.4	26.8	15.4	31.9	18.0	14.1	20.2	18.5	29.4	26.4	25.8	17.9	20.4	30.9	20.9	32.8
2019	22.1	21.7	10.5	32.2	12.0	20.9	29.8	26.7	23.7	20.7	25.5	29.8	21.1	27.5	21.3	19.8	14.8	13.8	14.6	20.4	10.5	24.6	22.8	24.1	28.2	32.2	24.5	12.6
2020	22.9	27.4	14.6	65.4	36.5	49.2	26.8	55.3	30.8	16.7	19.9	17.5	65.4	18.8	19.8	21.6	22.8	14.6	19.6	19.0	26.3	15.2	23.1	27.8	27.5	14.9	38.0	31.5
2021	24.6	25.0	12.4	54.9	19.4	18.0	20.7	29.2	23.0	38.5	24.2	34.5	15.5	22.0	26.9	19.8	27.9	15.7	24.9	54.9	12.4	31.7	14.0	13.5	28.1	25.2	26.8	32.1
2022	24.2	26.6	13.5	56.7	37.0	14.6	23.3	18.6	20.4	43.6	24.4	40.5	22.5	30.7	22.2	31.5	25.4	41.0	27.3	28.3	14.0	16.4	13.5	24.0	15.9	22.8	24.6	56.7
2023	26.7	24.3	12.0	33.1	33.1	19.9	21.6	28.8	28.1	16.6	18.3	17.4	28.6	16.4	31.1	25.9	16.7	23.3	18.9	29.8	27.9	17.3	12.0	31.0	29.9	31.2	27.5	32.3
2024	22.6	24.9	13.9	73.3	28.8	25.0	21.5	13.9	46.2	27.7	17.9	21.0	24.9	73.3	15.9	21.4	17.8	16.9	27.2	18.2	18.1	16.3	23.8	27.8	28.7	24.7	15.6	26.0
2025	20.6	23.6	13.9	48.9	13.9	21.7	42.2	19.2	35.7	22.0	48.9	14.2	15.8	18.7	20.6	19.3	32.3	16.1	20.6	24.1	24.2	16.2	16.2	16.2	22.8	18.0	38.4	28.4
2026	23.8	24.1	13.4	43.5	30.7	20.1	14.7	28.7	34.8	20.0	19.8	15.1	23.9	31.2	43.5	19.3	14.3	17.0	13.4	32.4	24.4	20.4	27.4	27.6	29.3	17.4	28.8	23.7
2027	21.6	24.8	14.9	48.4	27.1	18.2	48.4	16.2	21.0	26.7	20.2	23.9	14.9	29.1	21.8	25.9	35.4	15.6	39.6	17.4	24.5	16.9	20.6	25.3	44.8	21.3	20.3	20.9
2028	19.9	23.3	14.5	51.0	23.3	14.5	30.4	15.4	18.6	18.2	17.0	40.3	19.3	18.8	51.0	22.9	15.3	27.4	16.8	22.7	30.2	28.4	19.1	16.4	20.7	20.5	15.9	36.6
2029	21.6	23.5	13.7	47.2	47.2	14.9	14.0	14.5	29.0	14.6	25.5	16.2	26.2	18.8	42.2	40.6	15.3	21.9	29.2	17.3	22.4	21.4	23.6	18.3	30.1	13.7	18.4	28.8
2030	21.3	22.6	10.6	37.2	23.2	18.3	18.0	28.0	20.9	27.1	30.0	21.6	27.0	21.0	16.5	25.8	19.5	19.2	19.8	20.8	27.6	10.6	21.7	23.6	28.2	17.4	37.2	19.8
2031	27.0	27.9	12.9	57.2	31.3	29.7	57.2	16.2	23.4	31.1	16.8	32.9	27.0	18.8	27.4	19.6	54.2	32.1	23.2	27.1	14.6	19.3	42.9	21.9	24.2	12.9	33.1	32.3
2032	26.6	26.1	12.9	43.2	15.0	32.7	36.7	31.5	18.0	26.2	22.9	29.3	21.3	27.1	22.1	12.9	27.0	43.2	20.1	17.5	42.4	15.7	31.6	27.6	23.6	35.0	28.6	19.1
2033	22.6	23.3	14.9	36.7	20.5	14.9	25.1	22.4	36.5	15.8	19.4	19.8	23.6	27.4	16.4	22.2	29.6	20.1	27.6	36.7	16.0	26.3	24.5	26.8	22.7	18.8	23.0	22.5
2034	28.8	27.0	13.1	47.1	47.1	33.8	32.1	20.0	23.5	15.3	31.4	29.3	29.6	30.8	22.3	22.8	34.1	31.1	30.5	25.1	17.1	13.1	14.1	38.5	25.4	28.2	33.8	19.8
2035	25.5	29.4	13.0	63.6	63.6	22.5	39.0	50.0	57.7	31.8	24.3	18.2	50.0	13.0	18.4	36.8	26.6	20.3	27.0	27.4	24.4	13.1	13.1	18.3	20.0	15.2	33.1	42.1
2036	23.4	24.8	11.9	48.9	23.5	37.7	29.9	36.1	25.7	19.6	22.3	14.4	22.3	27.2	13.4	37.9	11.9	17.5	15.2	28.0	15.5	48.9	18.6	23.3	17.2	25.0	33.0	31.3
2037	23.5	25.2	14.7	68.1	25.8	27.2	19.5	19.6	36.8	28.9	26.3	28.5	20.4	19.5	18.3	15.2	68.1	30.3	23.0	18.0	24.0	14.7	36.0	20.0	17.4	24.6	24.8	17.1
2038	29.2	30.3	15.7	55.6	36.3	30.6	24.7	29.0	45.0	17.9	51.9	25.0	26.2	40.9	35.6	30.8	19.8	29.4	22.2	30.7	42.3	43.8	23.5	18.8	16.0	55.6	15.7	16.1
2039	23.9	25.7	12.2	71.5	49.0	27.7	19.3	28.4	19.7	32.7	23.9	15.9	13.9	19.4	27.4	28.3	71.5	21.1	12.2	35.7	18.9	26.6	18.6	24.0	28.1	12.7	25.4	16.4
2040	23.9	24.1	16.5	34.6	28.7	20.0	18.0	34.6	30.1	17.5	21.3	17.0	26.4	28.6	26.8	22.6	30.8	16.5	25.5	21.0	30.0	20.5	26.2	23.4	20.0	28.7	24.5	19.9
2041	21.5	26.4	13.3	63.0	25.5	31.2	21.1	17.1	19.6	22.4	28.2	63.0	56.6	20.4	31.7	18.1	24.7	18.1	21.0	21.9	19.8	14.8	31.9	30.3	19.8	13.3	19.2	43.9
2042	27.3	28.2	12.4	49.9	12.4	34.7	16.8	27.2	22.8	21.7	29.4	26.9	27.3	28.9	15.8	23.6	23.6	32.1	20.7	33.1	45.0	28.1	39.7	24.5	39.1	49.9	38.6	13.9
2043	23.0	25.7	12.0	58.7	16.3	18.7	19.3	31.7	13.7	37.0	19.3	17.6	58.2	25.4	32.3	27.3	58.7	28.2	33.8	12.0	30.2	18.1	12.1	26.0	25.4	18.6	20.6	16.5
2044	22.7	26.5	13.4	51.5	14.2	29.5	28.6	41.8	21.7	16.7	23.1	49.8	37.0	19.1	35.7	25.0	22.2	17.9	17.7	37.7	17.9	38.9	13.4	28.5	14.7	17.6	51.5	14.7
2045	23.6	25.2	9.4	45.9	45.9	43.7	20.6	27.2	22.7	32.4	28.0	20.8	35.8	25.7	22.6	20.2	22.4	16.1	26.1	31.5	18.1	26.5	27.3	18.4	19.1	19.0	9.4	24.5
2046	22.6	27.8	15.9	65.6	15.9	23.9	22.7	27.3	44.4	46.4	22.6	29.9	19.8	49.4	27.7	18.2	19.3	16.3	26.4	20.6	65.6	17.6	22.3	21.9	16.1	39.0	17.6	35.3
2047	19.5	22.2	10.9	64.6	64.6	18.2	23.3	35.3	32.0	26.7	22.6	20.0	19.0	13.6	16.2	18.3	18.8	16.8	23.7	15.8	20.6	17.0	16.7	21.2	17.7	20.2	24.4	10.9
2048	25.7	26.6	10.1	49.9	33.5	10.1	15.4	49.9	30.0	22.1	21.3	30.2	23.1	23.9	29.8	25.8	28.8	14.8	37.4	31.2	30.6	38.1	25.6	24.5	24.4	25.2	13.9	29.3
2049	24.3	25.9	15.8	53.2	23.9	27.4	29.1	37.4	24.5	18.3	53.2	32.4	15.8	17.2	20.4	29.1	19.8	35.0	24.2	26.9	30.0	20.0	23.4	19.8	16.9	30.2	22.3	24.4
2050	24.4	28.1	10.9	74.1	70.5	46.8	11.7	16.5	20.7	20.2	35.2	24.6	14.8	36.9	31.2	17.9	24.3	10.9	33.6	24.8	74.1	17.9	28.4	32.9	18.7	15.2	25.5	20.4
2051	25.1	28.8	15.0	79.7	24.0	26.3	21.1	26.6	43.0	22.0	40.2	31.7	27.1	34.5	37.8	21.9	18.4	15.0	19.6	41.4	19.1	28.8	28.6	21.8	79.7	23.5	17.0	23.2
2052	26.4	26.3	13.4	45.3	25.4	32.6	20.0	16.1	25.7	21.8	36.1	27.5	27.2	21.9	28.2	19.3	33.0	17.4	18.2	45.3	24.6	13.4	23.1	28.0	28.2	36.7	30.7	30.7
2053	22.0	24.0	11.8	49.6	20.8	21.0	11.8	28.6	35.9	13.8	43.1	24.0	23.1	29.1	33.4	21.8	49.6	16.3	14.4	22.2	18.4	12.8	33.1	12.9	19.7	23.5	28.0	19.6
2054	22.8	26.9	14.5	68.3	14.8	25.7	46.1	49.0	31.3	28.6	68.3	27.2	22.4	23.1	19.7	18.0	26.5	18.4	20.7	40.1	34.5	14.5	18.2	16.9	18.2	21.8	25.0	15.8
2055	20.5	24.8	13.8	76.4	15.0	29.8	14.1	27.4	29.2	33.5	24.0	16.5	22.6	37.9	16.1	18.4	18.9	19.5	13.8	20.4	23.1	20.5	38.4	24.2	19.6	76.4	16.0	20.1
2056	21.9	27.2	12.3	94.3	18.6	14.9	19.0	27.6	21.1	28.3	23.1	16.6	21.0	20.2	24.1	19.8	61.2	20.9	18.2	35.4	94.3	24.2	40.9	27.8	26.1	12.3	22.7	14.3
2057	22.3	27.0	14.7	50.2	14.7	50.2	22.7	39.0	26.7	34.2	19.6	34.1	42.9	28.0	16.2	24.7	19.2	19.0	20.4	38.0	49.5	21.5	16.4	17.7	32.2	20.6	21.9	18.3
2058	22.4	24.3	14.2	39.4	22.6	14.7	20.2	28.5	18.4	27.8	17.8	37.0	19.6	16.8	35.3	26.2	19.0	19.6	26.3	37.5	31.1	22.2	33.0	23.8	39.4	15.6	17.5	14.2
2059	24.6	24.2	14.0	39.4	17.6	34.9	25.5	18.0	17.3	18.0	31.6	24.7	25.7	28.3	24.5	24.6	39.4	15.4	24.8	37.4	29.9	14.0	21.2	23.0	27.0	24.5	15.5	18.6
2060	23.4	26.4	11.9	55.6	33.6	18.5	22.9	27.4	30.0	55.6	26.9	19.3	43.5	18.8	50.2	28.4	27.2	23.9	11.9	20.8	21.7	21.1	18.2	32.1	19.6	16.5	32.1	13.8
2061	22.8	23.5	10.6	37.0	23.4	27.6	21.2	31.1	22.5	23.3	19.5	16.2	35.0	16.0	23.0	37.0	33.7	17.7	26.3	34.1	20.9	15.6	18.9	23.6	25.0	10.6	21.0	20.1
2062	24.9	24.0	12.2	36.6	12.2	33.3	28.9	24.3	26.6	26.6	27.8	21.7	23.0	25.7	16.1	31.2	28.8	20.4	19.4	27.3	17.3	24.3	18.2	25.5	36.6	18.2	30.1	12.4
2063	25.0	26.5	14.2	54.9	21.4	30.5	32.3	16.9	19.2	52.0	30.1	16.7	22.2	29.1	39.4	28.0	18.7	17.1	26.3	14.2	28.5	22.5	26.9	54.9	18.9	30.8	23.6	16.2
2064	23.8	23.1	10.8	39.6	24.1	10.8	39.6	16.2	36.5	25.3	27.7	19.7	13.4	15.4	15.1	26.4	21.6	27.1	14.6	31.5	23.5	17.5	22.5	29.4	24.0	33.0	11.2	29.3
2065	22.8	25.6	13.7	47.3	45.7	27.7	16.0	17.8	20.3	21.2	47.3	13.7	25.5	28.6	24.4	22.2	17.2	35.2	22.3	39.9	23.4	24.1	21.1	18.0	17.7	33.6	21.4	29.0
2066	22.8	27.7	15.4	68.5	28.0	30.8	22.2	27.3	17.5	17.0	21.6	15.4	32.0	38.0	16.1	36.8	35.2	29.5	19.5	22.8	58.4	27.4	21.3	22.8	20.4	68.5	18.9	16.8
2067	22.6	24.5	11.0	50.4	21.9	23.5	30.3	11.0	19.1	27.6	14.6	13.6	15.9	50.4	26.1	19.4	24.4	48.3	23.3	29.4	21.8	18.3	14.7	50.4	16.2	20.4	24.1	24.5
2068	27.3	26.9	15.0	42.0	27.6	15.0	23.9	24.0	37.6	27.7	20.8	27.7	30.3	19.7	30.0	27.0	28.3	16.6	22.5	19.7	40.2	22.2	37.7	30.0	19.3	37.5	19.1	42.0
2069	24.9	26.0	12.6	58.0	31.9	20.2	17.5	23.1	35.9	13.9	25.5	26.8	24.2	34.1	12.6	28.5	26.5	22.0	21.4	58.0	17.7	18.0	31.2	15.4	20.8	38.2	30.1	29.8
2070	24.9	27.2	14.3	56.1	56.1	30.6	24.6	39.5	16.7	19.6	29.0	21.9	21.3	30.8	28.0	25.9	14.3	22.5	16.9	35.0	24.8	23.2	25.0	21.7	44.1	21.2	30.8	28.6
2071	25.2	26.3	15.0	48.2	25.7	23.0	24.6	48.2	36.3	22.4	28.7	24.3	21.2	16.1	16.6	15.8	31.6	15.0	31.2	18.6	40.5	18.0	26.3	38.5	30.6	24.2	26.6	26.3
2072	26.0	27.4	15.9	52.5	28.6	52.5	17.6	24.3	21.3	16.3	21.3	26.8	15.9	30.4	27.7	28.7	47.8	22.8	25.0	30.0	17.2	29.4	38.6	23.7	22.2	36.8	27.4	25.2
2073	25.8	28.8	10.7	73.9	25.4	33.4	25.3	19.0	21.0	26.2	73.9	32.0	23.4	24.5	17.2	29.3	31.0	10.7	24.5	32.1	19.0	32.4	65.7	23.3	14.5	30.5	27.1	29.6
2074	25.8	29.6	13.4	78.5	19.9	24.9	18.4	24.7	31.4	78.5	47.3	34.4	18.6	39.4	22.4	19.5	37.1	15.9	17.5	20.0	32.0	45.5	41.5	26.7	38.1	17.8	26.6	13.4
2075	29.6	29.1	15.1	61.6	19.9	31.1	15.1	19.5	25.2	19.2	35.2	32.2	35.2	18.8	25.2	19.4	57.9	61.6	32.2	33.2	28.8	19.4	17.4	32.3	20.1	30.4	32.2	38.2
2076	24.3	24.4	10.9	50.5	20.6	32.5	24.4	15.3	21.1	23.5	19.8	26.3	24.8	18.2	16.2	20.5	50.5	10.9	24.8	27.8	24.1	17.4	26.2	43.2	13.5	27.4	30.4	26.2

2077	25.1	28.2	10.1	65.5	65.5	25.8	45.1	32.1	29.8	38.5	28.3	21.8	26.6	31.1	27.7	18.1	42.4	14.4	24.5	18.4	51.7	21.5	22.6	10.1	21.7	23.5	16.0	19.2
2078	23.1	25.6	9.1	49.9	33.9	17.6	43.7	49.9	32.4	33.6	22.1	34.7	44.0	17.8	25.3	15.8	14.9	21.4	24.1	18.8	24.1	21.5	21.4	24.4	9.1	19.8	14.1	29.7
2079	26.0	28.7	14.7	51.4	34.4	26.6	33.2	14.7	25.5	42.3	22.4	25.5	20.5	24.0	51.4	21.6	21.1	15.6	42.5	36.1	36.0	32.2	18.9	34.8	20.0	25.5	26.4	37.9
2080	27.0	29.5	12.7	75.0	43.0	31.5	59.6	45.6	32.4	34.5	16.5	20.2	27.3	30.3	30.8	18.5	75.0	12.7	23.2	35.8	27.3	25.5	26.8	21.4	18.8	12.9	20.6	18.9
2081	23.6	26.8	12.6	62.8	27.0	26.7	17.5	31.4	13.9	27.0	34.7	29.4	62.8	23.9	12.6	37.7	21.2	21.5	16.3	23.2	17.7	19.2	20.0	21.7	35.7	17.9	60.0	24.8
2082	24.4	27.6	15.8	85.2	18.9	26.2	23.9	26.3	24.4	15.8	18.7	24.4	27.2	24.0	31.0	16.0	22.4	24.3	28.0	32.2	25.4	85.2	16.4	24.3	28.8	24.5	22.9	50.6
2083	22.3	26.4	11.4	99.6	45.0	25.8	21.9	17.5	18.2	18.0	99.6	23.4	23.0	16.9	22.7	23.7	26.7	21.4	11.4	24.4	21.1	20.3	21.2	37.9	31.8	17.8	14.4	29.8
2084	22.4	24.6	14.7	50.3	20.6	40.0	38.1	17.0	14.7	22.7	17.4	18.8	18.8	21.8	27.9	23.1	50.3	21.9	16.5	14.8	31.0	26.0	29.4	28.5	30.5	24.0	15.1	22.1
2085	23.3	23.4	14.6	38.6	28.4	31.5	27.7	23.6	29.5	19.4	33.1	15.6	19.0	14.6	24.5	27.6	20.3	21.2	23.9	20.4	15.0	18.2	23.1	15.6	19.4	27.6	38.6	24.5
2086	24.7	27.9	12.6	56.5	14.1	27.9	24.3	56.5	29.2	19.1	23.9	24.5	20.1	55.0	14.2	20.6	46.0	14.1	12.6	35.9	28.9	55.4	31.7	18.3	26.8	24.9	19.2	27.2
2087	22.3	24.3	13.8	49.4	17.1	19.2	20.4	16.6	24.3	14.9	28.1	22.6	49.4	24.6	32.0	24.9	21.0	22.0	37.4	35.7	13.8	19.0	17.0	18.7	18.1	33.8	29.7	22.7
2088	19.9	22.1	12.9	36.5	36.5	13.3	16.6	19.4	29.5	23.5	25.0	24.5	20.4	18.8	12.9	13.5	31.4	19.5	27.5	35.6	15.1	16.8	35.0	20.2	17.0	17.2	17.5	22.9
2089	25.9	29.8	12.8	63.2	33.2	23.4	59.0	34.2	30.0	17.7	26.1	25.8	20.1	24.1	29.9	12.8	19.8	42.3	30.0	35.5	62.0	18.3	20.4	17.8	63.2	25.3	27.2	18.1
2090	28.9	29.1	15.5	55.6	43.4	29.1	20.6	15.7	15.5	55.6	26.9	39.6	16.7	30.4	30.3	17.9	24.4	40.4	26.0	32.8	28.6	33.0	25.6	34.2	18.1	32.0	38.2	23.1
2091	23.8	26.4	12.4	49.9	49.9	14.2	34.4	42.1	21.8	17.6	23.5	15.7	21.9	18.3	38.0	22.8	35.5	25.6	26.1	35.7	16.1	24.1	20.4	35.4	18.2	12.4	29.1	34.0
2092	23.1	24.3	14.7	46.5	14.7	31.2	15.2	31.8	16.9	26.8	21.2	24.4	20.1	15.2	21.8	39.2	18.9	19.4	31.9	46.5	26.7	18.5	15.5	28.5	28.1	15.8	25.1	30.0
2093	22.1	25.6	13.5	76.4	40.1	20.6	14.5	24.1	27.7	30.1	23.6	26.9	15.9	18.9	32.4	26.3	37.0	17.3	13.5	36.2	19.9	15.8	15.3	34.1	16.1	76.4	16.7	16.4
2094	26.2	31.4	15.7	101.5	20.6	42.1	29.1	45.2	29.9	29.8	18.9	19.7	17.9	24.0	33.9	20.9	17.8	34.4	28.4	84.8	16.8	101.5	29.5	36.3	15.7	19.8	18.5	19.0
2095	19.0	24.2	13.5	61.7	13.5	25.1	14.2	22.6	32.4	40.5	13.9	19.9	61.7	15.4	17.0	19.9	17.4	39.5	37.9	18.2	16.5	17.5	16.7	16.2	16.2	25.0	34.1	30.1
2096	20.2	23.0	15.7	40.5	22.1	28.3	20.1	28.1	22.4	39.4	16.1	19.9	22.4	18.9	15.7	19.7	18.6	19.6	32.4	19.3	25.8	20.4	19.2	40.5	25.7	19.7	22.6	16.5
2097	25.2	26.1	14.0	53.1	27.2	14.0	35.5	26.4	39.8	25.1	17.9	25.9	26.1	14.9	18.9	25.8	20.9	28.6	53.1	22.1	19.9	23.9	25.0	46.3	16.4	19.0	28.8	25.3
2098	25.0	25.9	16.2	41.4	33.0	21.9	23.4	25.0	28.2	21.6	26.9	22.8	34.9	25.8	31.8	21.4	34.7	19.9	23.4	21.2	25.0	19.6	26.4	26.9	16.2	41.4	29.9	19.2
2099	22.6	24.1	14.0	42.6	14.0	29.0	18.7	21.2	21.8	22.0	42.6	31.1	22.7	22.4	25.6	19.3	26.2	29.4	15.7	27.3	37.5	24.6	25.3	18.1	16.1	20.6	31.1	15.3
2100	22.3	25.1	10.3	66.9	32.5	19.5	35.9	21.6	23.6	29.3		30.7	20.9	24.4	28.6	21.2	66.9	21.1	15.1	20.1	22.3	26.2	27.5	26.3	20.4	10.3	15.9	17.8

RCP4.5

Day with Daily Precip (mm) ... **>1**

Year	Median	Mean	Min	Max	std pr MIROC-ESM historical rcp45 (kg m-2 d-1)	std pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	std pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	std pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	greg pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	greg pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	360d pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	360d pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	365d pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	365d pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	365d pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	365d pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	365d pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	365d pr CanESM2 historical rcp45 (kg m-2 d-1)	365d pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	365d pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	365d pr MIROC5 historical rcp45 (kg m-2 d-1)	365d pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	365d pr NorESM1-M historical rcp45 (kg m-2 d-1)	365d pr BNU-ESM historical rcp45 (kg m-2 d-1)	365d pr NorESM1-ME historical rcp45 (kg m-2 d-1)	365d pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	365d pr CCSM4 historical rcp45 (kg m-2 d-1)	365d pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
2011	117	117.3	97	146	122	115	111	107	101	146	101	111	112	124	111	123	122	118	131	97	110	134	128	113	118	113	128	118
2012	117	117.1	93	149	98	116	114	115	137	127	119	130	93	117	107	129	121	105	149	110	94	118	99	117	115	137	146	97
2013	118	116.3	93	165	107	115	124	109	120	129	123	93	119	133	124	121	99	108	97	165	125	112	117	121	106	96	95	133
2014	112	114.0	101	137	113	109	114	109	132	119	120	116	125	106	114	105	108	110	101	112	114	111	137	108	128	109	106	109
2015	116	112.5	93	131	126	118	103	118	116	123	109	117	117	114	107	97	116	96	118	103	98	125	120	131	93	120	98	116
2016	118	116.7	101	136	132	115	136	106	105	121	120	125	127	114	107	126	101	122	105	128	110	106	111	105	119	122	121	116
2017	113	113.6	84	133	123	112	110	100	127	111	122	111	84	102	115	126	113	121	98	108	124	109	125	133	102	128	108	114
2018	114	113.5	94	133	106	121	94	127	116	122	97	123	111	109	104	124	102	110	127	111	100	117	96	124	98	120	133	131
2019	109	109.4	94	123	110	105	111	119	102	103	114	114	108	109	97	123	122	109	109	110	94	104	108	117	108	111	104	114
2020	120	119.3	94	145	130	97	110	134	135	98	145	109	127	131	103	94	100	121	114	113	128	117	119	145	114	124	128	127
2021	117	115.0	90	136	119	97	135	136	134	104	115	122	117	118	107	90	127	110	100	114	120	120	100	117	130	93	121	113
2022	114	114.8	94	131	96	117	107	107	131	127	108	112	123	115	113	130	122	113	130	119	125	104	110	115	120	111	94	107
2023	118	118.5	97	140	97	106	118	114	119	117	104	125	112	130	133	131	134	118	135	113	120	111	118	118	115	140	107	108
2024	114	114.9	95	131	130	115	127	101	131	124	104	122	122	100	105	129	112	111	130	109	118	95	102	124	111	117	111	108
2025	116	116.8	92	154	113	120	100	109	133	154	111	107	95	129	115	120	110	128	116	92	119	125	113	129	111	120	114	119
2026	110	109.8	85	121	109	108	109	119	114	106	120	85	107	114	112	99	114	108	118	94	107	121	115	108	109	111	114	115
2027	115	115.6	98	144	144	113	109	127	112	118	113	98	101	110	122	117	114	102	125	110	131	115	115	119	129	99	127	104
2028	117	116.8	90	142	107	106	130	104	127	95	130	134	124	109	90	135	108	135	142	90	112	123	117	117	114	118	120	116
2029	119	118.4	95	142	136	111	112	106	129	128	120	122	104	98	123	142	129	101	116	114	106	118	109	131	126	95	123	142
2030	119	117.4	90	149	121	116	92	123	113	141	125	112	114	100	123	119	127	119	98	126	90	132	118	149	110	135	111	103
2031	116	115.6	89	142	142	109	96	119	95	133	94	130	115	102	136	111	133	108	126	118	116	113	112	105	117	89	126	129
2032	112	116.4	102	148	116	110	112	122	103	108	109	109	117	131	111	108	117	103	138	102	103	127	112	148	127	130	122	109
2033	119	118.7	83	147	119	98	111	131	93	145	126	109	130	117	118	106	147	122	131	129	125	126	114	118	104	83	133	114
2034	117	118.3	100	141	134	125	112	115	141	112	109	122	106	108	105	124	109	119	116	117	106	132	134	125	124	100	130	114
2035	116	115.3	93	129	115	127	116	114	126	129	124	122	93	124	105	129	119	128	115	108	108	99	105	121	105	98	122	114
2036	123	121.0	99	142	111	128	113	128	105	137	116	107	116	125	101	128	126	114	122	128	123	117	136	115	99	140	142	126
2037	114	115.1	83	143	127	120	111	125	109	111	93	116	125	131	104	110	113	132	143	103	105	124	131	118	83	115	100	113
2038	119	118.3	95	142	139	140	108	138	130	120	121	100	124	131	117	95	142	103	123	112	132	112	114	97	132	100	95	113
2039	120	118.0	100	143	130	131	129	102	112	119	123	111	115	131	123	104	121	118	122	111	100	123	101	122	120	106	143	116
2040	112	116.4	89	139	125	106	124	128	106	105	139	100	89	133	124	135	101	114	93	138	110	135	108	108	110	130	101	132
2041	119	118.9	101	141	135	109	125	122	140	110	128	106	110	130	130	103	109	127	101	115	104	122	141	111	113	111	128	124
2042	120	121.2	103	147	110	146	110	134	103	122	110	119	126	112	115	132	107	103	127	142	139	121	127	117	124	105	147	111
2043	113	114.3	90	140	110	119	129	140	115	111	103	110	113	124	114	113	90	110	116	93	124	112	109	104	127	113	124	120
2044	118	117.2	90	136	115	110	119	117	108	125	125	123	107	122	116	124	128	129	111	97	90	113	125	136	111	117	126	119
2045	117	118.2	90	144	136	103	132	125	105	144	113	112	117	118	102	124	135	104	133	90	115	113	135	112	117	109	121	121
2046	120	119.5	89	146	106	120	105	112	112	140	121	112	141	136	123	122	126	107	146	107	89	120	106	111	109	145	131	120
2047	116	117.3	95	142	141	127	104	141	142	103	122	140	96	111	116	116	116	135	104	107	127	98	95	116	118	112	114	114
2048	112	112.6	84	143	118	84	111	143	131	113	100	112	141	87	111	128	103	109	129	101	115	109	118	101	115	105	112	106
2049	114	117.0	92	150	95	117	113	123	106	150	105	105	120	123	125	136	130	112	144	106	100	141	127	105	107	92	114	111
2050	117	117.2	100	136	119	114	104	128	111	115	127	132	107	127	121	127	124	107	133	106	128	136	111	100	118	101	109	107
2051	120	119.0	94	142	100	134	142	121	98	128	133	120	104	127	119	142	114	122	125	115	106	135	116	122	119	101	120	94
2052	115	115.1	93	136	119	124	113	117	117	134	129	113	120	120	110	136	126	121	102	107	105	93	102	127	113	111	96	108
2053	118	117.6	82	138	107	108	82	138	119	131	130	112	114	98	117	111	116	122	118	112	132	111	123	123	109	132	126	131
2054	122	122.3	90	148	134	142	137	111	138	122	111	105	145	119	109	106	134	121	148	133	110	125	117	122	113	123	121	90
2055	117	116.6	102	145	102	145	118	110	131	117	120	112	108	106	106	136	127	116	118	122	103	110	107	117	118	118	104	127
2056	121	117.8	84	148	129	142	127	140	84	98	105	125	131	128	126	106	99	106	126	88	118	119	148	112	123	110	127	111
2057	122	121.9	96	146	134	112	122	127	133	125	116	113	121	128	96	146	115	118	135	115	128	132	119	118	130	113	105	124
2058	118	120.1	97	155	122	125	109	124	102	155	116	97	120	130	117	118	122	115	105	151	99	147	118	150	101	103	119	118
2059	114	114.3	89	136	106	104	110	118	113	117	111	112	115	136	115	106	127	113	113	113	89	122	124	103	127	114	115	120
2060	118	116.8	69	142	118	108	134	116	118	119	107	122	137	136	101	98	121	105	112	69	109	113	117	142	130	128	139	103
2061	125	122.3	102	148	111	130	132	126	112	127	135	114	122	113	128	136	130	128	120	133	105	102	126	112	116	148	106	124
2062	118	119.5	93	146	115	125	122	122	146	93	107	110	120	133	125	135	145	110	105	115	109	114	107	133	133	110	127	108
2063	119	120.9	103	166	125	138	112	103	119	112	105	107	104	116	127	130	129	108	166	107	104	123	119	143	116	121	140	127

2064	121	117.9	80	140	116	122	128	108	127	128	113	112	120	118	105	135	140	121	132	99	114	80	111	121	123	123	125	108
2065	119	118.3	91	136	109	113	116	120	130	118	109	97	116	121	136	128	131	113	129	120	91	109	127	115	108	133	123	126
2066	111	114.4	90	141	109	141	94	122	115	111	98	107	141	133	121	110	118	106	135	110	106	104	120	103	115	90	105	132
2067	112	113.0	87	141	132	111	102	102	107	114	103	104	129	124	110	117	113	121	116	92	107	103	126	128	117	106	87	141
2068	117	116.8	94	144	128	104	111	117	126	126	94	113	107	128	118	109	118	144	119	103	136	114	121	101	116	136	99	114
2069	118	114.1	78	142	122	122	100	87	115	78	119	109	110	125	116	124	99	113	128	132	116	119	142	130	88	97	120	127
2070	117	117.0	95	144	102	103	123	106	99	124	109	116	108	134	142	129	117	95	116	126	109	117	107	116	123	144	119	123
2071	124	123.0	96	163	130	132	96	111	144	105	147	106	111	129	103	132	135	116	132	118	102	136	122	132	163	105	126	118
2072	122	119.8	100	140	120	111	105	122	132	125	103	107	117	121	124	133	138	127	125	114	104	127	135	122	100	103	140	119
2073	117	116.9	95	149	127	137	109	101	119	116	96	106	114	111	133	136	125	104	132	128	118	128	149	97	95	102	104	119
2074	118	121.3	106	145	117	118	116	134	145	126	114	120	113	136	106	115	112	117	118	116	108	110	142	131	118	124	128	126
2075	121	119.4	91	137	124	104	91	123	117	105	111	111	131	116	120	126	119	117	115	136	111	122	121	130	137	131	122	125
2076	119	116.5	82	154	123	128	87	119	131	154	109	104	137	111	111	117	125	118	127	128	82	99	124	91	111	121	129	111
2077	122	120.3	95	140	123	131	134	130	134	98	116	115	134	127	129	122	126	113	117	110	112	109	110	95	124	140	121	117
2078	117	117.0	80	155	113	110	155	115	136	100	102	121	120	129	107	124	117	135	120	115	117	80	127	122	104	100	115	125
2079	121	118.3	94	149	126	149	129	111	123	100	114	94	129	104	96	127	141	100	133	117	114	126	118	123	121	102	121	122
2080	121	120.4	87	144	134	121	121	144	110	124	117	124	102	143	125	107	123	87	144	105	116	108	132	99	107	144	135	118
2081	121	119.8	100	146	121	133	130	121	106	117	146	112	120	112	122	142	118	125	124	121	125	106	112	110	113	100	114	124
2082	121	120.1	90	145	145	127	121	125	93	137	90	127	108	120	131	138	126	108	116	109	121	106	111	113	114	116	142	138
2083	115	116.4	94	152	100	115	119	108	125	152	145	105	113	95	127	120	118	122	103	94	112	114	118	113	108	116	141	110
2084	116	114.3	90	140	126	100	132	122	103	140	103	111	107	106	118	120	135	113	117	93	90	115	132	127	119	93	121	100
2085	120	118.1	95	135	133	128	114	122	125	135	119	101	121	121	112	110	122	127	113	98	107	113	122	134	117	95	111	134
2086	114	114.8	91	136	109	132	113	127	127	123	95	97	125	136	101	122	125	118	96	129	91	111	115	108	111	102	134	109
2087	119	119.0	92	145	110	120	119	145	117	107	117	125	121	126	106	133	133	119	114	132	114	132	121	108	92	127	112	106
2088	113	112.3	78	134	113	104	130	119	134	117	102	97	121	116	126	102	110	102	129	112	101	128	121	111	111	78	82	128
2089	110	114.5	84	148	148	108	122	106	123	106	108	135	96	124	120	84	117	100	139	111	101	103	108	128	113	109	132	106
2090	119	118.8	82	150	124	127	115	104	117	150	125	100	125	130	111	125	133	100	135	113	110	82	110	134	121	132	112	116
2091	117	115.7	87	139	101	120	139	91	112	106	115	130	124	129	126	105	116	115	135	98	108	121	118	103	117	87	131	129
2092	120	119.7	97	144	131	127	123	113	117	132	120	106	108	112	137	132	130	110	120	118	144	114	120	97	120	115	119	108
2093	116	118.5	92	138	134	106	110	136	138	133	116	115	114	130	111	119	132	115	133	134	94	92	113	99	121	114	124	111
2094	118	118.9	95	144	122	101	110	119	144	115	135	95	103	144	124	142	116	105	126	106	102	127	112	121	114	133	126	112
2095	115	118.2	91	149	146	131	124	134	114	101	91	124	149	100	132	110	109	115	137	96	108	144	115	110	110	114	121	101
2096	113	115.4	78	151	151	140	115	128	129	110	111	113	104	127	113	108	129	109	122	100	78	122	128	103	91	126	104	109
2097	123	123.3	89	147	119	112	130	134	116	124	89	122	136	134	104	127	121	137	142	115	107	118	140	132	112	117	124	147
2098	114	117.0	88	148	97	126	112	138	131	96	116	103	126	104	125	117	105	135	148	88	112	100	136	122	109	110	141	112
2099	117	119.5	86	150	137	108	113	115	115	150	116	105	128	110	126	116	139	111	129	86	119	118	125	129	130	107	111	124
2100	121	119.7	95	144	134	128	125	116	144	104		103	133	132	133	101	132	95	117	121	101	132	111	111	119	96	132	132

RCP4.5

Day with Daily Precip (mm) ... **>10**

Year	Median	Mean	Min	Max	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
2011	7	7.2	3	13	9	11	6	6	7	10	8	6	6	8	4	11	5	5	13	4	6	7	5	8	8	3	8	8
2012	7	6.7	3	12	4	11	5	4	9	9	6	8	3	7	4	8	7	8	12	4	3	8	4	4	10	9	10	4
2013	7	6.8	1	11	4	10	4	6	8	6	7	7	6	7	9	11	4	8	9	8	8	5	7	8	8	1	6	5
2014	7	6.5	1	13	7	6	8	4	7	7	7	10	13	6	7	6	5	10	1	5	8	3	6	3	6	5	8	8
2015	6	6.4	0	15	7	15	4	4	3	5	6	6	4	7	4	3	9	6	13	5	6	10	8	7	5	0	8	8
2016	7	7.2	2	12	9	3	8	4	11	5	5	9	9	6	12	10	7	3	5	12	7	11	7	7	2	5	9	7
2017	8	7.0	0	12	8	3	7	4	11	6	8	9	0	8	8	4	10	8	4	9	12	10	12	12	3	5	4	4
2018	7	6.5	3	11	4	7	4	7	4	11	7	7	4	10	5	9	7	7	8	3	6	5	6	9	7	5	5	10
2019	6	5.7	2	8	3	8	8	4	4	7	8	6	6	4	5	8	7	4	5	5	2	7	8	4	7	5	7	5
2020	7	7.0	4	10	8	6	8	6	8	6	8	8	5	6	9	6	8	4	6	6	10	4	6	10	7	5	8	10
2021	6	6.6	2	16	6	6	7	6	7	6	9	16	5	6	5	6	9	6	2	5	6	9	6	3	6	4	11	6
2022	7	6.9	3	14	3	7	11	5	14	8	8	7	6	9	5	8	7	5	8	9	4	11	4	5	6	3	5	7
2023	6	6.6	3	14	6	5	7	3	10	4	3	8	5	6	10	3	6	7	10	5	6	6	3	9	14	13	6	4
2024	6	6.8	3	12	5	11	4	3	11	12	10	12	9	5	5	8	5	5	4	6	6	5	8	8	7	7	3	4
2025	7	6.8	1	11	3	3	10	7	7	11	7	3	5	9	9	5	10	8	8	5	9	4	1	8	8	6	6	10
2026	6	6.1	3	10	6	6	4	10	3	5	10	5	5	10	5	5	5	6	4	7	7	8	5	10	3	4	8	6
2027	8	7.9	1	14	10	9	11	10	7	10	8	9	7	7	10	7	4	7	9	6	8	4	8	11	14	1	10	3
2028	7	7.4	2	16	6	2	8	5	6	4	4	6	9	7	8	6	7	16	13	6	12	7	8	5	7	9	7	10
2029	6	6.9	2	14	14	4	5	6	13	6	8	5	4	3	5	9	4	2	10	6	8	10	7	9	12	2	8	6
2030	7	7.0	2	14	11	6	4	10	7	6	14	7	10	6	8	5	8	5	7	5	8	2	4	9	4	8	3	10
2031	7	7.3	2	19	14	3	4	3	7	8	2	7	5	4	11	4	7	9	19	7	6	10	10	5	7	2	7	13
2032	9	8.5	1	15	1	10	14	7	6	6	10	7	9	8	9	5	10	2	13	6	11	10	9	15	11	5	9	12
2033	7	7.0	1	17	7	5	6	9	8	10	6	1	4	9	3	2	10	8	11	17	5	11	3	8	7	5	4	10
2034	7	7.5	4	13	12	7	9	7	10	7	11	6	4	7	5	6	5	6	7	9	9	5	9	13	6	5	10	5
2035	8	7.7	2	14	7	9	6	7	10	14	8	5	8	8	4	10	7	12	13	4	5	2	4	5	8	11	12	6
2036	6	6.8	2	15	5	10	5	8	6	7	5	5	4	7	2	5	4	8	6	8	3	11	3	11	4	15	15	7
2037	6	6.8	1	16	8	9	6	5	6	4	5	9	11	5	8	5	6	10	16	5	7	7	8	6	1	8	2	5
2038	9	8.8	2	18	12	8	11	14	9	5	13	7	3	9	14	6	7	2	10	18	10	9	12	6	6	10	6	4
2039	6	7.1	2	17	6	7	8	6	3	12	9	3	3	9	11	3	14	5	4	9	6	6	4	10	8	2	17	6
2040	8	7.6	2	15	12	4	11	10	10	6	6	2	4	5	11	9	8	7	2	15	6	9	7	10	5	12	4	8
2041	6	7.2	2	14	10	6	5	4	6	3	14	12	10	13	7	5	7	6	5	6	5	5	11	10	3	2	8	9
2042	7	7.8	2	17	2	13	3	15	3	8	5	5	5	3	5	9	3	7	9	15	12	10	9	15	7	4	17	3
2043	6	6.2	1	13	9	4	5	12	3	13	5	8	7	7	5	8	4	8	5	3	7	2	3	8	9	5	8	1
2044	7	7.4	3	12	7	5	6	6	6	9	6	12	5	9	8	10	12	3	5	12	5	7	7	10	4	7	11	6
2045	8	7.7	0	17	8	7	8	11	5	17	8	5	10	5	5	13	11	4	9	8	9	3	12	7	7	5	0	7
2046	7	7.0	3	12	5	10	5	11	6	9	4	9	5	10	9	7	6	5	12	8	3	4	3	11	5	11	8	3
2047	7	6.5	1	12	8	12	7	8	10	8	9	9	3	3	6	2	8	3	9	4	9	1	5	9	7	4	7	5
2048	6	6.7	1	14	2	1	10	6	9	10	6	8	11	6	6	14	7	9	12	1	6	5	4	5	5	11	5	2
2049	9	8.7	3	15	5	13	7	7	11	12	8	4	4	10	6	9	15	13	12	11	6	13	9	11	4	3	8	8
2050	8	7.3	1	13	8	12	2	11	12	5	4	13	5	8	7	4	8	1	10	6	10	9	9	7	4	4	6	10

2051	9	8.2	2	13	11	8	3	12	10	12	10	9	7	11	10	13	2	5	4	9	10	7	7	11	8	6	7	5
2052	8	7.8	2	14	6	9	6	4	10	10	10	13	2	10	7	14	4	8	6	6	13	5	8	9	6	9	6	6
2053	7	7.1	1	15	10	8	1	8	11	7	10	6	3	9	7	7	6	5	3	11	10	4	6	7	4	11	15	2
2054	8	8.5	3	17	8	12	9	9	17	10	5	9	7	6	6	6	13	4	7	13	15	5	6	5	5	16	9	3
2055	7	7.2	3	14	6	14	4	6	10	3	11	12	7	9	4	5	8	6	9	5	7	5	8	7	5	10	6	5
2056	6	7.1	2	13	6	5	7	10	2	6	6	4	5	5	6	10	10	5	6	12	13	8	12	8	10	2	9	4
2057	8	7.3	1	16	2	11	8	8	6	16	3	9	4	9	1	14	8	9	6	9	8	10	1	5	6	6	6	9
2058	7	7.3	4	14	5	5	9	10	5	4	8	4	7	8	5	10	7	10	8	13	7	8	5	14	7	5	7	5
2059	7	6.8	2	12	7	5	10	3	6	10	8	8	5	12	9	5	10	9	8	7	3	5	9	6	6	2	6	4
2060	7	7.2	2	14	10	5	7	7	6	6	2	8	12	6	2	7	10	8	4	8	4	9	12	12	4	5	14	5
2061	8	7.1	2	12	4	12	6	9	3	6	7	6	5	9	10	10	10	3	10	11	9	3	5	9	2	2	10	9
2062	9	8.4	3	15	5	15	10	13	10	9	5	7	5	7	3	8	10	7	4	11	5	9	9	13	11	9	12	5
2063	8	7.9	2	19	4	10	7	6	9	5	7	7	2	9	19	12	5	3	16	3	11	4	9	8	8	5	11	10
2064	7	7.5	2	13	5	2	12	6	13	6	7	10	8	3	6	5	8	7	7	6	11	7	10	13	6	12	3	6
2065	8	8.0	3	12	6	12	12	3	10	7	4	4	10	9	7	7	9	11	11	9	4	8	11	10	8	8	6	6
2066	7	7.1	2	16	4	16	4	11	5	5	5	7	7	5	2	7	12	5	10	9	6	7	8	8	7	8	9	3
2067	7	6.9	1	12	7	6	11	1	7	10	4	3	4	5	5	6	9	11	3	7	9	5	7	12	2	12	8	11
2068	7	7.4	3	14	8	7	7	8	10	7	6	9	3	9	3	4	14	11	3	6	6	8	14	6	14	3	4	8
2069	8	7.7	1	15	11	9	5	5	8	1	15	12	6	12	3	13	5	3	13	9	5	8	9	5	6	6	7	8
2070	8	8.0	1	14	7	10	11	5	5	7	8	7	2	9	9	9	7	6	1	14	10	6	10	8	11	11	10	8
2071	8	8.9	3	18	9	14	6	7	12	6	14	5	7	9	5	8	9	3	18	6	8	6	8	13	14	10	10	6
2072	9	8.0	4	15	13	8	9	9	10	5	4	7	4	4	11	15	9	12	10	7	6	9	9	6	5	5	10	6
2073	8	8.4	3	16	16	11	7	9	12	6	6	8	8	4	3	8	16	3	15	4	9	9	15	5	6	7	8	7
2074	9	8.7	2	15	4	11	9	13	9	9	9	12	2	4	5	9	12	4	9	9	14	12	15	12	4	9	7	5
2075	7	8.0	4	13	7	7	5	8	6	6	8	11	4	5	7	11	7	10	9	8	7	13	8	7	13	7	7	10
2076	7	7.8	2	14	7	12	7	7	8	14	11	5	9	7	3	7	11	2	8	9	7	6	5	13	4	4	12	8
2077	8	7.8	1	16	6	8	13	5	4	2	8	9	8	14	10	9	16	6	7	4	9	5	8	1	11	11	7	6
2078	7	7.4	0	17	5	9	15	10	10	4	4	17	15	4	7	5	4	7	7	5	8	4	9	6	0	7	8	8
2079	8	8.2	2	16	8	16	12	7	6	9	9	9	2	6	5	7	16	5	9	12	9	5	3	14	7	5	10	5
2080	8	8.4	2	17	15	17	7	10	15	3	8	5	2	13	10	7	9	7	11	11	10	10	7	7	4	3	5	5
2081	8	7.9	2	14	9	7	13	8	2	11	14	5	7	11	3	9	8	4	11	6	11	6	9	8	12	6	5	5
2082	9	8.7	4	14	7	12	5	9	4	7	4	8	11	12	14	6	5	7	9	8	14	10	6	12	7	10	9	13
2083	8	7.5	2	13	3	8	3	4	7	12	13	6	12	4	10	6	8	2	3	4	9	13	8	9	3	12	9	11
2084	7	8.0	2	16	11	11	11	5	2	5	7	11	6	7	6	7	16	3	6	4	6	8	7	14	15	10	5	8
2085	8	8.3	4	18	18	16	6	5	10	5	5	8	7	5	9	7	7	13	8	6	5	4	11	12	5	8	8	10
2086	8	8.1	2	16	5	15	10	11	8	12	6	9	5	16	6	5	8	6	2	9	8	8	10	4	7	10	8	7
2087	8	7.5	2	12	8	8	6	11	9	4	5	10	9	11	6	5	8	6	9	11	4	9	6	12	2	12	5	5
2088	6	6.3	2	13	13	4	11	6	10	10	6	6	4	10	5	4	6	3	7	2	5	5	6	11	4	6	4	4
2089	8	7.8	1	14	10	5	11	5	7	4	12	10	3	14	10	1	7	7	12	13	11	2	4	12	5	8	8	6
2090	9	8.7	2	15	11	7	7	2	6	11	9	14	6	9	10	9	15	14	8	12	4	6	10	10	7	4	10	8
2091	9	8.1	1	13	9	6	10	7	8	9	7	7	8	9	10	3	10	8	13	9	9	10	11	9	2	1	7	13
2092	9	8.4	3	17	6	7	5	17	6	11	7	6	10	6	8	9	9	9	7	8	10	11	9	11	9	3	8	9
2093	8	8.0	3	14	11	11	3	7	6	8	14	6	6	9	10	8	9	6	9	7	10	6	3	11	7	10	6	9
2094	8	8.0	2	18	10	9	8	8	8	7	10	4	2	12	8	7	8	5	7	8	5	18	5	18	3	8	9	5
2095	6	6.8	3	12	6	11	4	9	6	5	3	10	8	6	10	3	8	5	11	7	6	12	6	5	5	9	5	4
2096	6	6.4	3	11	6	10	3	11	4	10	8	7	4	6	5	6	5	6	7	3	4	10	5	8	8	7	4	7
2097	8	8.1	1	15	4	10	10	14	8	6	5	8	9	1	6	8	7	8	15	7	7	8	6	15	2	12	11	8
2098	7	8.0	5	12	6	7	9	7	9	5	9	7	7	11	9	5	10	6	9	7	12	7	12	9	7	9	6	6
2099	8	7.8	3	16	6	9	5	8	8	9	15	3	6	6	10	6	16	10	5	5	9	3	10	11	6	7	9	4
2100	8	8.3	1	14	3	12	14	7	4	4		11	12	12	11	4	9	7	8	10	13	12	8	6	7	1	9	7

RCP4.5

Day with Daily Precip (mm) ... **>25**

Year	Median	Mean	Min	Max	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
2011	0	0.5	0	2	0	2	0	1	0	1	1	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1
2012	1	0.7	0	3	0	1	1	0	1	0	1	1	1	0	1	0	0	0	3	0	1	2	0	1	0	1	1	0
2013	0	0.4	0	3	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	3	1	0	1	1	0	1	0
2014	0	0.6	0	3	0	2	1	2	1	1	0	0	3	0	2	0	1	0	0	0	0	1	0	0	0	0	1	0
2015	1	0.7	0	3	1	1	0	0	1	0	3	0	0	2	1	1	0	0	0	0	1	1	1	1	1	0	2	0
2016	0	0.7	0	3	0	1	1	0	1	0	1	1	0	0	3	0	0	0	0	1	0	3	1	0	0	2	1	0
2017	0	0.5	0	2	0	1	1	0	2	0	0	1	0	1	0	0	1	1	1	0	1	0	0	0	0	1	0	1
2018	0	0.4	0	2	0	0	0	2	1	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	0	1	0	1
2019	0	0.3	0	2	0	0	1	1	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	1	1	0	0
2020	0	0.6	0	3	1	1	1	1	1	0	0	0	2	0	0	0	0	0	0	0	1	0	0	1	1	0	3	1
2021	0	0.5	0	1	0	0	0	1	0	1	0	1	0	0	1	0	1	0	0	1	0	1	0	0	1	1	1	1
2022	0	0.5	0	4	1	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	4
2023	1	0.7	0	4	1	0	0	1	2	0	0	0	1	0	1	1	0	0	0	1	1	0	0	1	4	1	1	1
2024	0	0.4	0	2	1	0	0	0	2	2	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	1
2025	0	0.3	0	2	0	0	1	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
2026	0	0.5	0	2	1	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1	0	2	0
2027	0	0.5	0	2	1	0	2	0	0	1	0	0	0	1	0	1	1	0	2	0	0	0	0	1	1	0	0	0
2028	0	0.4	0	3	0	0	1	0	0	0	0	1	0	0	3	0	0	1	0	0	2	1	0	0	0	0	0	1
2029	0	0.5	0	2	2	0	0	0	1	0	1	0	1	0	1	1	0	0	1	0	0	0	0	0	2	0	0	1
2030	0	0.5	0	2	0	0	0	1	0	2	2	0	1	0	0	1	0	0	0	0	1	0	0	0	2	0	1	0
2031	1	0.8	0	4	2	1	1	0	0	1	0	1	1	0	1	0	4	1	0	2	0	0	1	0	0	0	1	2
2032	1	0.8	0	5	0	2	5	1	0	1	0	1	0	2	0	0	1	1	0	0	1	0	1	1	0	1	1	0
2033	0	0.5	0	4	0	0	1	0	1	0	0	0	0	1	0	0	1	0	1	4	0	2	0	0	2	0	0	0
2034	1	0.7	0	2	1	1	1	0	0	0	2	1	1	1	0	0	1	1	1	1	0	0	0	2	1	1	1	0
2035	1	1.0	0	4	2	0	2	3	2	1	0	0	4	0	0	2	1	0	1	1	0	0	0	0	0	0	3	2
2036	0	0.7	0	3	0	2	1	1	1	0	0	0	0	1	0	1	0	0	0	2	0	3	0	0	0	1	2	1
2037	0	0.5	0	3	1	1	0	0	2	1	1	1	0	0	0	0	3	1	0	0	0	0	1	0	0	0	0	0

2038	1	1.0	0	4	1	1	0	1	1	0	4	1	1	2	3	2	0	1	0	2	2	1	0	0	0	2	0	0
2039	0	0.6	0	3	2	1	0	1	0	1	0	0	0	0	1	1	2	0	0	1	0	1	0	0	3	0	1	0
2040	0	0.7	0	2	2	0	0	1	2	0	0	0	1	1	1	0	2	0	1	0	2	0	1	0	0	2	0	0
2041	0	0.6	0	2	1	1	0	0	0	0	1	2	2	0	2	0	0	0	0	0	0	0	1	2	0	0	0	2
2042	1	0.9	0	3	0	1	0	2	0	0	2	1	1	1	0	0	0	1	0	2	3	1	2	0	1	1	2	0
2043	1	0.8	0	3	0	0	0	1	0	2	0	0	2	1	3	2	1	2	1	0	1	0	0	1	1	0	0	0
2044	0	0.5	0	2	0	1	1	1	0	0	0	2	1	0	2	0	0	0	0	1	0	1	0	1	0	0	2	0
2045	0	0.6	0	3	2	3	0	1	0	1	1	0	1	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0
2046	0	0.5	0	2	0	0	0	1	1	1	0	1	0	2	2	0	0	0	1	0	1	0	0	0	0	1	0	1
2047	0	0.3	0	3	3	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	1	0.7	0	2	1	0	0	2	1	0	0	2	0	0	1	1	1	0	1	1	1	1	1	0	0	1	0	1
2049	0	0.6	0	3	0	1	1	1	0	0	3	2	0	0	0	1	0	1	0	1	1	0	0	0	0	3	0	0
2050	0	0.7	0	3	1	3	0	0	0	0	2	0	0	1	2	0	0	0	3	0	1	0	1	2	0	0	1	0
2051	1	0.7	0	2	0	2	0	2	2	0	1	1	1	1	1	0	0	0	0	2	0	1	1	0	1	0	0	0
2052	1	0.8	0	4	1	2	0	0	1	0	4	1	1	0	1	0	2	0	0	2	0	0	0	1	1	1	1	1
2053	0	0.4	0	3	0	0	0	1	3	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	1	0
2054	0	0.7	0	3	0	1	2	1	2	1	2	1	0	0	0	0	1	0	0	1	3	0	0	0	0	0	1	0
2055	0	0.3	0	2	0	1	0	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2056	0	0.5	0	3	0	0	0	2	0	1	0	0	0	0	0	0	1	0	0	1	2	0	3	2	1	0	0	0
2057	0	0.5	0	2	0	1	0	2	1	1	0	1	1	1	0	0	0	0	0	2	1	0	0	0	1	0	0	0
2058	0	0.5	0	2	0	0	0	1	0	1	0	2	0	0	2	1	0	0	1	1	1	0	1	0	2	0	0	0
2059	0	0.4	0	2	0	1	1	0	0	0	1	0	2	1	0	0	1	0	0	1	1	0	0	0	1	0	0	0
2060	0	0.7	0	3	2	0	0	1	2	1	1	0	1	0	1	2	1	0	0	0	0	0	0	3	0	0	1	0
2061	0	0.5	0	3	0	1	0	2	0	0	0	0	1	0	0	1	2	0	1	3	0	0	0	0	1	0	0	0
2062	1	0.5	0	2	0	1	1	0	1	1	1	0	0	1	0	1	1	0	0	1	0	0	0	1	1	0	2	0
2063	1	0.8	0	4	0	1	3	0	0	1	1	0	0	1	4	1	0	0	1	0	1	0	3	2	0	1	0	0
2064	0	0.7	0	3	0	0	2	0	3	1	1	0	0	0	0	1	0	1	0	1	0	0	0	2	0	3	0	1
2065	0	0.4	0	2	1	1	0	0	0	0	1	0	1	1	0	0	0	1	0	2	0	0	0	0	0	1	0	1
2066	0	0.8	0	3	2	1	0	3	0	0	0	0	1	2	0	3	1	1	0	0	2	2	0	0	0	2	0	0
2067	0	0.4	0	2	0	0	1	0	0	2	0	0	0	1	1	0	0	1	0	1	0	0	0	2	0	0	0	0
2068	1	1.0	0	4	2	0	0	0	1	1	0	2	1	0	1	1	2	0	0	0	3	0	3	1	0	1	0	4
2069	1	0.7	0	2	2	0	0	0	2	0	1	1	0	2	0	1	1	0	0	2	0	0	1	0	0	2	1	1
2070	1	0.6	0	2	2	1	0	1	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	2	0	2	1
2071	1	1.0	0	4	1	0	0	3	4	0	2	0	0	0	0	0	2	0	1	0	2	0	1	2	3	0	1	1
2072	1	0.7	0	2	1	1	0	0	0	0	0	1	0	1	2	2	2	0	1	1	0	1	1	0	0	1	1	1
2073	1	0.7	0	2	1	2	1	0	0	1	2	1	0	0	0	1	1	0	0	1	0	2	1	0	0	1	1	1
2074	1	0.8	0	3	0	0	0	0	2	3	1	1	0	1	0	0	2	0	0	0	1	1	2	1	2	0	1	0
2075	1	1.0	0	3	0	1	0	0	1	0	3	1	1	0	1	0	1	1	1	1	2	0	0	1	0	3	3	2
2076	0	0.5	0	2	0	2	0	0	0	0	0	1	0	0	0	0	2	0	0	1	0	0	1	2	0	1	1	1
2077	1	0.8	0	4	1	1	4	1	1	1	1	0	1	3	1	0	2	0	0	0	1	0	0	0	0	0	0	0
2078	0	0.6	0	3	1	0	3	2	1	2	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
2079	1	1.0	0	3	1	2	2	0	1	2	0	1	0	0	1	0	0	0	3	2	2	1	0	2	0	1	1	1
2080	1	0.8	0	2	2	2	1	1	1	2	0	0	1	1	2	0	1	0	0	2	1	1	1	0	0	0	0	0
2081	0	0.8	0	4	1	1	0	2	0	1	4	1	2	0	0	2	0	0	0	0	0	0	0	0	3	0	1	0
2082	0	0.5	0	2	0	2	0	1	0	0	0	0	1	0	1	0	0	0	1	1	1	1	0	0	2	0	0	2
2083	0	0.5	0	3	1	1	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	2	1	0	0	2
2084	0	0.6	0	5	0	1	1	0	0	0	0	0	0	0	1	0	5	0	0	0	1	1	1	1	2	0	0	0
2085	0	0.5	0	3	1	3	1	0	1	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	2	0
2086	0	0.5	0	2	0	1	0	1	1	0	0	0	0	1	0	0	1	0	0	1	1	1	2	0	2	0	0	1
2087	0	0.3	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0	0	1	1	0
2088	0	0.3	0	2	1	0	0	0	2	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0
2089	1	0.7	0	2	2	0	1	1	2	0	1	1	0	0	1	0	0	1	1	1	2	0	0	0	1	1	1	0
2090	1	1.0	0	3	2	1	0	0	0	2	1	1	0	3	3	0	0	1	1	2	1	2	1	1	0	1	1	0
2091	0	0.5	0	2	2	0	1	1	0	0	0	0	0	0	1	0	1	1	1	2	0	0	0	1	0	0	1	1
2092	0	0.8	0	3	0	2	0	2	0	1	0	0	0	0	0	2	0	0	1	3	1	0	0	2	2	0	1	1
2093	0	0.8	0	3	3	0	0	0	1	2	0	1	0	0	3	1	2	0	0	2	0	0	0	1	0	2	0	0
2094	1	0.9	0	5	0	1	1	3	3	1	0	0	0	0	1	0	0	1	1	1	0	5	1	2	0	0	0	0
2095	0	0.5	0	2	0	1	0	0	1	1	0	0	1	0	0	0	0	2	2	0	0	0	0	0	0	1	1	1
2096	0	0.3	0	2	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	2	0	0	0
2097	1	0.8	0	5	1	0	2	1	1	1	0	1	1	0	0	1	0	1	5	0	0	0	0	1	0	0	1	1
2098	1	0.8	0	3	3	0	0	1	1	0	1	0	1	1	2	0	1	0	0	0	1	0	1	2	0	1	2	0
2099	0	0.5	0	2	0	1	0	0	0	0	2	1	0	0	1	0	1	1	0	1	1	0	1	0	0	0	2	0
2100	0	0.6	0	2	1	0	2	0	0	1		2	0	0	1	0	2	0	0	0	0	2	1	1	0	0	0	0

RCP8.5

Total Annual Precip (mm)

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp85 (kg m-	pr MIROC-ESM-CHEM historical rcp85 (kg m-	pr CNRM-CM5 historical rcp85 (kg m-	pr MRI-CGCM3 historical rcp85 (kg m-	pr MPI-ESM-MR historical rcp85 (kg m- 2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m- 2 d-1)	pr HadGEM2-ES historical rcp85 (kg m- 2 d-1)	pr HadGEM2-AO historical rcp85 (kg m- 2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m- 2 d-1)	pr FGOALS-g2 historical rcp85 (kg m- 2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m- 2 d-1)	pr GFDL-CM3 historical rcp85 (kg m- 2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-	pr CanESM2 historical rcp85 (kg m- 2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-	pr IPSL-CM5A-LR historical rcp85 (kg m- 2 d-1)	pr MIROC5 historical rcp85 (kg m- 2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m- 2 d-1)	pr NorESM1-M historical rcp85 (kg m- 2 d-1)	pr BNU-ESM historical rcp85 (kg m- 2 d-1)	pr NorESM1-ME historical rcp85 (kg m- 2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-	pr CCSM4 historical rcp85 (kg m- 2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-
2011	448.9	450.6	323.4	555.3	404.6	483.0	484.2	343.7	542.3	323.4	416.8	410.4	486.9	519.0	448.6	472.0	405.3	444.2	441.2	449.2	555.3	460.5	434.8	395.7	537.2	470.3	489.1	396.7
2012	429.7	456.9	341.4	636.0	392.3	384.8	486.2	421.5	423.0	450.5	589.6	458.4	504.5	468.0	636.0	424.6	434.9	614.6	404.1	386.3	370.7	397.0	409.0	482.0	387.2	616.5	481.5	341.4
2013	470.2	461.1	340.6	542.9	487.2	511.5	490.5	414.5	513.2	442.1	456.2	470.4	464.2	518.4	518.7	470.1	354.2	407.5	422.0	520.2	483.6	392.4	415.9	340.6	483.8	459.5	486.3	542.9
2014	493.7	490.8	369.6	619.3	492.2	437.5	417.4	593.3	619.3	369.6	463.4	465.5	500.4	427.8	396.0	487.1	532.9	612.4	536.3	497.4	570.5	528.9	429.4	550.1	495.3	449.2	410.2	496.4
2015	455.8	454.2	337.9	617.9	617.9	383.6	469.4	376.1	394.1	337.9	439.4	463.0	609.0	465.0	469.8	446.7	378.6	483.0	407.9	411.9	520.0	520.0	373.1	485.2	467.5	448.5	515.1	417.6
2016	498.2	476.8	320.5	582.8	527.8	320.5	448.2	463.2	499.8	503.7	582.5	518.9	365.1	393.4	582.8	442.4	524.6	526.0	496.6	413.0	471.7	509.1	428.3	527.0	547.5	509.3	433.2	409.5
2017	485.6	486.2	342.0	711.2	597.9	342.0	463.6	476.2	564.5	433.8	345.1	386.9	496.5	394.9	581.4	401.6	352.1	348.5	711.2	642.8	509.6	505.5	570.8	445.7	577.3	601.4	423.7	495.0
2018	445.5	461.6	368.6	623.3	368.6	406.2	418.4	384.8	503.8	571.0	435.9	490.0	431.6	473.4	377.2	441.6	400.0	481.4	467.2	418.4	495.0	537.1	449.5	601.2	385.9	513.5	623.3	403.2
2019	456.3	455.2	326.2	594.7	473.9	372.4	499.8	378.7	510.8	472.0	530.1	480.4	569.0	505.1	425.3	326.2	462.2	439.2	567.4	427.4	377.0	481.2	418.3	339.3	447.0	375.7	594.7	450.5
2020	468.5	476.0	358.3	632.9	410.2	480.4	433.1	546.5	417.1	490.0	436.0	439.1	527.6	504.9	431.5	376.8	506.3	520.4	491.5	425.7	497.7	415.2	625.0	358.3	456.7	436.0	564.7	632.9
2021	477.8	465.8	337.7	540.2	468.6	478.2	399.1	474.1	402.4	477.2	502.0	458.3	516.8	497.3	502.7	540.2	414.0	337.7	492.9	394.4	481.4	493.7	497.9	376.9	469.4	477.3	513.8	514.1
2022	478.2	457.7	302.1	580.9	348.4	385.0	437.5	380.8	532.5	377.3	377.0	498.1	515.5	579.3	302.1	505.5	428.5	510.9	580.9	496.2	396.2	339.0	413.4	479.6	517.5	539.4	476.8	568.3
2023	459.0	474.7	327.3	596.2	573.6	511.9	560.9	398.9	444.3	534.5	430.1	553.3	561.7	423.9	450.3	512.1	376.1	443.7	501.9	501.8	435.3	408.2	545.9	397.3	596.2	467.7	327.3	436.8
2024	463.2	477.7	379.6	655.8	461.9	492.5	517.9	476.1	655.8	384.2	379.6	541.9	450.4	502.4	464.5	457.3	433.4	506.3	560.2	418.4	496.6	443.4	585.5	416.6	429.6	543.9	410.9	435.5
2025	476.2	480.6	370.5	600.0	526.5	481.2	592.7	381.9	581.9	491.1	496.6	451.4	599.7	451.7	433.9	413.2	475.9	442.5	465.1	476.6	487.6	370.5	432.3	557.3	600.0	495.2	412.5	417.9
2026	467.1	462.1	330.0	589.6	439.8	546.3	492.0	589.6	475.6	429.3	442.9	510.4	433.8	399.1	568.4	361.5	399.6	337.5	482.2	534.9	399.3	466.1	529.3	469.9	330.0	464.5	468.1	519.7
2027	449.6	462.9	365.1	588.4	436.8	515.9	588.4	372.8	441.7	510.3	580.1	427.5	412.1	484.9	517.9	501.2	387.5	420.4	378.6	365.1	493.8	429.8	391.9	452.5	526.9	446.6	545.7	481.3
2028	456.5	466.3	340.1	663.4	509.7	352.2	511.9	394.4	623.4	663.4	473.3	609.5	567.1	525.7	497.0	407.8	351.9	424.5	440.2	472.8	487.0	408.9	363.1	414.5	542.9	423.4	340.1	387.7
2029	463.0	471.6	365.2	615.6	455.0	393.9	487.9	552.9	515.1	459.6	424.9	470.7	615.6	397.0	491.9	365.2	509.6	497.1	584.1	378.5	597.0	435.2	459.3	410.0	413.0	545.0	393.0	466.4
2030	508.8	517.4	421.0	733.2	437.0	494.8	454.6	733.2	462.7	574.4	421.0	514.8	535.4	521.2	469.8	488.2	481.7	573.6	541.8	453.4	511.7	462.7	468.5	552.5	505.9	642.8	586.1	529.5
2031	504.1	516.4	304.0	687.1	605.6	304.0	517.8	620.7	468.0	635.7	480.3	526.8	481.5	388.6	450.0	546.2	420.7	459.3	479.5	574.9	626.6	591.3	416.1	609.9	490.4	523.1	489.6	687.1
2032	481.7	473.1	318.9	585.0	581.7	475.5	379.0	566.0	492.1	579.7	487.8	438.1	540.1	441.7	441.0	418.1	389.8	318.9	410.9	494.7	417.5	499.5	520.1	559.7	585.0	420.6	339.6	556.7
2033	454.8	459.4	299.0	596.8	396.1	537.9	464.6	593.8	447.8	494.6	466.2	422.0	567.0	517.4	596.8	393.6	377.5	581.4	523.3	299.0	461.9	408.9	418.0	425.5	424.8	354.6	384.7	467.4
2034	509.0	508.0	381.6	634.8	416.4	557.1	541.5	590.6	487.3	533.8	497.3	418.8	625.0	479.0	526.8	452.5	571.9	434.2	472.0	537.0	520.6	485.6	566.5	381.6	634.8	474.1	589.1	397.8
2035	492.0	490.4	358.6	637.4	546.0	523.3	448.7	494.2	567.0	571.4	378.6	516.2	434.1	474.9	435.1	637.4	480.2	428.0	358.6	411.1	448.8	504.7	489.9	528.4	563.7	572.2	413.2	543.2
2036	448.3	474.3	320.7	645.4	490.2	478.7	414.4	645.4	440.1	544.5	558.6	534.0	442.9	561.7	431.8	382.4	446.8	449.9	396.3	547.2	422.0	543.9	381.8	520.1	588.1	320.7	435.1	406.0
2037	516.5	522.2	400.3	670.6	503.2	562.6	420.5	590.0	400.3	611.6	401.3	511.6	626.1	670.6	521.4	542.1	499.1	426.8	464.2	553.9	490.9	503.7	549.8	462.2	543.6	508.4	590.7	577.9
2038	501.5	506.2	422.2	626.1	626.1	477.2	505.9	469.7	482.4	489.0	422.8	497.1	463.9	517.0	511.7	514.8	472.4	490.0	524.8	492.6	536.3	476.3	542.7	519.2	602.2	422.2	545.4	546.3
2039	519.9	495.9	339.1	601.5	562.2	453.0	551.7	394.6	591.1	452.2	439.6	410.2	590.5	525.1	532.5	558.8	519.6	422.2	520.2	482.1	400.6	433.8	468.4	526.0	561.8	339.1	601.5	564.8
2040	481.5	478.9	326.3	678.4	479.0	590.2	678.4	489.3	484.0	326.3	352.8	598.9	565.2	488.0	551.6	405.8	451.7	463.3	430.3	496.2	538.5	337.9	466.0	535.6	368.9	410.3	545.2	440.5
2041	493.5	490.0	367.5	667.4	410.6	433.4	464.9	440.2	424.4	600.6	511.5	667.4	392.7	521.8	507.0	574.7	402.0	515.9	472.3	465.4	367.5	555.9	424.3	508.8	518.4	518.1	581.9	479.9
2042	499.6	517.2	368.3	676.7	473.2	502.3	530.6	465.0	588.9	499.8	499.3	485.1	609.2	593.7	474.6	441.5	498.0	427.8	537.3	630.3	599.2	481.1	676.7	469.6	494.3	508.5	557.5	368.3
2043	490.3	501.9	342.5	667.3	432.4	624.1	550.7	468.7	452.3	355.4	470.9	530.8	546.0	548.9	427.5	585.3	475.6	474.5	518.1	597.8	403.1	398.7	491.3	661.1	532.9	667.3	489.3	342.5
2044	476.3	498.7	376.1	750.0	500.4	399.2	681.2	416.4	603.5	483.1	433.0	456.4	439.9	750.0	534.4	540.3	376.1	448.4	446.2	481.8	498.4	573.6	470.8	621.9	452.2	513.0	399.5	449.6
2045	489.0	506.8	378.5	644.8	577.7	598.2	475.1	644.8	604.3	483.8	407.9	477.4	610.9	603.6	389.0	450.2	574.3	432.0	509.2	464.8	494.2	584.5	517.1	551.1	452.9	463.4	378.5	419.1
2046	481.9	496.5	385.4	624.7	521.0	624.7	467.6	464.6	385.4	537.6	434.3	507.0	445.4	430.1	561.4	591.2	454.3	422.7	444.6	545.9	450.8	538.8	540.3	446.9	587.1	415.0	603.8	496.3
2047	487.9	490.6	378.1	624.3	427.8	555.8	387.4	520.7	495.3	496.9	478.7	555.9	485.6	624.3	469.9	472.8	490.3	475.9	520.2	456.1	455.0	498.8	445.8	515.6	540.5	455.0	378.1	572.1
2048	502.5	505.3	370.9	605.4	370.9	599.5	430.2	526.0	605.4	560.1	474.9	596.8	397.5	583.0	594.4	456.1	502.2	485.1	516.3	408.1	486.1	535.0	439.6	576.3	457.0	538.5	485.5	502.8
2049	490.7	485.5	376.6	615.5	456.0	527.5	488.3	535.3	515.3	456.8	406.2	488.2	538.9	424.2	580.1	506.6	493.4	517.5	545.4	434.3	414.9	493.0	512.5	483.9	459.8	615.5	382.6	376.6
2050	460.2	463.5	360.4	632.3	523.1	459.6	531.2	468.4	451.4	393.5	476.3	543.2	404.2	587.0	467.8	376.0	632.3	418.3	419.5	360.4	460.7	399.6	412.6	538.1	386.1	548.3	466.4	399.7
2051	505.4	495.5	347.3	597.8	580.5	440.5	503.5	569.3	549.6	571.6	556.3	583.0	497.1	507.3	502.1	381.5	427.3	546.9	532.7	413.1	440.4	423.6	597.8	541.9	558.5	347.3	453.2	368.0
2052	486.2	498.8	329.2	661.4	590.4	352.1	661.4	478.3	451.6	421.0	518.9	484.4	503.8	561.3	441.2	534.2	329.2	541.4	454.6	488.0	473.7	615.1	618.8	444.7	576.8	558.2	455.8	415.8
2053	514.5	508.3	388.0	620.5	600.7	491.9	501.1	558.6	460.5	523.8	393.1	412.8	475.9	611.7	421.3	525.1	555.9	388.0	424.6	513.1	620.5	503.7	547.2	541.5	535.1	597.3	515.9	480.4
2054	517.9	517.9	384.7	630.7	572.4	412.1	523.1	484.0	527.1	630.2	487.2	481.8	601.1	465.9	587.2	521.4	384.7	459.4	501.8	464.7	532.5	514.4	525.5	493.9	630.7	584.0	510.3	533.0
2055	460.9	477.5	361.5	601.9	559.3	436.2	425.8	556.9	463.6	551.2	438.8	526.3	601.9	373.8	548.9	493.1	544.0	458.3	506.2	361.5	419.9	533.5	429.1	423.6	433.2	571.1	391.4	412.7
2056	505.3	511.5	366.2	784.6	784.6	424.6	377.0	500.1	407.9	382.2	366.2	549.0	556.3	521.6	703.3	452.1	553.3	486.5	399.6	509.7	447.0	590.3	547.8	619.4	639.8	501.0	421.6	534.3
2057	476.0	494.4	367.3	666.0	666.0	457.4	388.2	592.3	472.5	367.3	428.9	450.5	651.2	395.8	534.8	435.9	416.0	540.8	445.6	552.1	479.5	644.6	517.2	438.2	505.0	503.8	470.7	511.0
2058	480.8	496.0	342.3	680.2	362.6	596.4	586.1	623.8	536.7	465.5	538.6	430.1	537.5	519.8	482.9	454.7	478.4	447.8	680.2	451.6	486.8	520.1	473.1	455.8	443.9	478.8	342.3	511.3
2059	526.0	520.3	360.4	703.6	556.6	529.9	458.5	608.4	583.5	495.2	570.7	462.7	522.2	703.6	564.7	377.3	360.4	422.1	618.9	598.2	432.9	421.8	557.0	447.1	666.5	661.6	364.2	502.7
2060	471.3	485.3	337.8	689.4	689.4	436.2	601.8	572.3	454.6	341.7	337.8	481.7	597.6	420.6	636.9	409.4	593.8	364.3	483.1	460.9	484.8	417.7	389.1	403.5	552.6	553.7	529.9	433.5
2061	512.9	533.5	389.4	704.2	704.2	457.3	582.9	486.8	609.6	670.5	432.2	636.2	595.0	491.9	454.3	520.3	547.5	445.1	576.4	654.1	477.7	490.3	588.7	492.8	417.5	577.4	389.4	505.4
2062	502.0	500.7	341.8	632.6	592.0	506.8	536.5	611.0	497.2	564.9	484.2	432.6	441.8	522.5	507.2	427.4	341.8	459.4	632.6	542.5	560.2	455.5	631.2	531.0	476.1	363.8	431.4	467.2
2063	498.3	491.0	359.1	677.0	505.5	639.6	382.7	677.0	431.3	505.2	359.1	522.1	450.7	383.5	472.0	445.9	524.6	502.3	497.5	522.4	482.8	519.5	460.9	444.1	513.5	495.4	499.1	546.1
2064	508.1	521.2	403.7	780.4	508.3	507.4	467.5	539.5	528.9	616.2	519.5	532.7	780.4	403.7	579.4	513.8	438.6	479.9	481.6	442.1	503.6	555.3	442.6	507.9	637.7	502.0	555.1	464.4
2065	507.1	506.7	370.4	656.9	405.0	525.0	503.1	548.0	532.6	569.6	476.7	449.1	570.7	393.2	473.5	495.8	477.8	370.4	570.4	493.8	511.0	637.4	656.9	469.7	523.6	404.0	569.5	533.9
2066	524.5	504.3	318.3	651.0	439.0	562.6	588.3	576.8	470.9	544.1	529.5	437.0	512.4	318.3	609.5	576.2	574.5	525.5	561.9	393.8	351.9	526.6	518.1	385.8	651.0	430.4	496.0	523.5
2067	496.0	493.5	379.0	665.4	460.2	498.6	595.7	449.9	525.9	514.0	435.1	379.0	563.7	467.3	444.5	380.1	552.6	390.9	414.2	541.1	545.8	665.4	538.0	463.8	572.1	423.2	493.4	530.0
2068	519.8	541.5	415.0	814.9	483.1	614.5	600.0	612.4	420.2	507.1	415.0	472.0	558.9	638.5	688.7	505.1	483.0	610.9	569.2	513.9	477.8	477.3	578.9	525.6	814.9	423.6	475.8	528.6
2069	541.3	552.0	431.8	826.7	631.6	432.6	470.1	633.2	539.1	448.5	634.4	435.9	598.2	557.2	826.7	543.5	580.7	570.7	536.9	533.9	431.8	570.7	571.1	525.7	780.3	462.5	442.8	488.9
2070	504.9	537.8	350.5	757.8	651.6	464.1	490.3	639.4	455.7	488.1	633.9	455.6	658.8	494.1	536.3	562.1	491.9	620.1	515.7	476.2	489.7	530.1	639.3	627.2	757.8	418.2	460.8	350.5
2071	536.7	512.0	305.9	659.1	621.2	659.1	305.9	562.9	502.9	555.1	546.4	451.0	539.2	437.9	380.0	573.4	602.2	370.5	526.2	381.0	491.8	535.4	643.5	411.4	647.1	538.0	601.1	403.8
2072	519.6	516.8	385.8	698.5	684.9	418.7	524.2	534.9	580.0	433.9	650.2	570.3	520.3	385.8	474.6	402.7	524.7	404.4	443.2	632.5	582.7	490.6	698.5	450.3	518.9	574.9	441.6	460.9
2073	486.3	504.4	342.4	739.4	514.2	473.0	619.1	406.4	566.7	539.9	534.2	490.0	541.9	507.3	482.7	460.5	461.1	413.7	521.7	552.5	461.4	471.6	644.1	464.1	739.4	479.9	418.0	342.4
2074	518.2	532.3	338.7	758.3	507.5	549.6	636.6	500.7	588.9	546.5	492.3	556.6	734.7	528.9	471.5	383.1	478.4	466.2	645.1	547.6	392.6	758.3	498.5	338.7	471.0	549.5	484.1	647.1
2075	479.4	505.8	331.0	667.6	611.8	549.4	501.8	457.8	665.3	644.8	445.4	416.7	632.0	331.0	635.5	404.3	473.9	460.6	500.6	667.6	366.8	482.7	615.2	435.5	476.2	531.3	410.5	421.6
2076	510.3	518.1	381.3	765.2	613.9	417.4	599.8	576.0	520.6	559.6	412.0	765.2	493.7	474.3	509.2	454.5	509.2	479.8	546.5	546.9	610.6	560.5	511.4	381.3	544.7	426.8	431.5	488.1
2077	475.3	482.7	336.6	661.8	613.3	456.9	364.9	564.2	559.8	345.3	432.2	500.1	554.4	508.5	544.8	336.6	458.4	486.7	366.2	589.7	435.9	508.6	519.5	445.9	661.8	427.4	439.7	463.9
2078	528.0	528.4	301.5	804.7	490.7	301.5	539.3	450.8	804.7	584.1	457.5	418.5	723.2	527.8	638.6	558.5	528.3	423.7	653.4	627.2	452.6	507.0	584.2	527.7	373.8	540.5	394.9	572.4
2079	506.3	500.1	374.8	650.4	544.1	597.9	610.9	433.1	603.6	650.4	420.2	405.4	611.5	384.1	457.9	487.6	438.6	526.6	434.3	535.3	530.4	471.5	530.0	568.4	428.5	432.9	374.8	525.0
2080	497.8	510.1	365.8	688.8	636.6	423.0	688.8	541.8	396.8	498.3	443.8	485.4	476.2	618.7	426.9	519.1	429.9	447.7	365.8	562.9	637.0	445.5	639.6	440.9	497.4	529.7	579.1	512.2
2081	482.1	496.1	332.8	698.1	698.1	482.4	561.3	481.8	583.9	575.9	463.7	516.2	645.8	408.7	392.2	409.9	510.2	440.7	574.8	433.0	394.2	573.3	549.4	550.7	475.6	332.8	472.4	379.0
2082	496.7	530.1	408.6	732.2	704.4	539.0	580.4	732.2	603.9	444.4	493.0	410.1	481.3	519.0	472.5	469.9	418.8	728.4	558.8	493.2	423.8	688.8	561.0	530.6	472.7	500.2	488.2	408.6
2083	544.3	534.0	376.1	668.4	668.3	539.6	530.4	613.2	574.7	534.6	425.4	564.0	569.9	558.2	528.5	376.1	427.2	668.4	520.1	455.4	585.3	421.5	548.9	580.4	599.6	586.2	404.5	535.4
2084	517.1	525.8	370.1	719.9	488.5	446.4	536.7	599.1	489.6	515.1	470.5	534.8	519.1	610.3	424.4	388.3	582.8	545.4	464.6	536.7	620.7	488.8	719.9	482.7	635.1	689.4	459.4	370.1
2085	509.5	512.0	417.0	625.4	534.4	595.8	533.3	508.2	433.7	575.8	417.0	452.7	453.6	619.0	523.9	509.8	447.5	506.6	475.6	516.9	509.3	484.0	625.4	523.3	555.2	600.6	437.3	448.0
2086	502.2	503.9	346.9	654.6	588.4	508.2	654.6	496.2	417.8	549.4	346.9	444.8	407.7	542.5	606.0	461.0	626.3	496.0	642.3	412.1	458.0	520.7	613.0	372.7	531.8	444.8	428.8	523.5
2087	530.3	524.8	363.8	647.3	609.8	558.9	580.6	519.7	516.1	380.8	605.6	504.3	635.2	492.8	637.7	402.9	525.5	378.9	533.4	363.8	527.1	568.0	633.6	467.0	561.5	647.3	374.8	570.2
2088	529.4	541.8	395.5	832.0	832.0	731.7	533.3	556.3	395.5	603.2	444.3	620.2	559.8	577.1	566.0	518.3	596.4	509.6	484.5	500.7	491.5	513.3	601.5	405.9	453.1	528.9	449.3	530.0
2089	510.6	505.0	367.8	691.9	421.9	421.9	562.6	691.9	412.3	567.2	376.0	367.8	480.2	483.6	510.0	426.4	528.4	586.6	473.3	511.2	526.5	554.0	529.3	638.4	557.4	508.5	426.8	557.0

2090	494.0	502.6	280.3	674.1	547.5	466.2	559.1	429.3	463.1	475.6	344.0	502.2	674.1	448.5	561.5	534.1	607.0	427.8	534.9	491.6	651.1	492.2	491.8	280.3	482.0	556.3	495.7	546.5
2091	499.9	497.5	335.4	692.0	603.7	488.0	506.9	688.4	559.5	335.4	394.6	444.1	440.0	582.2	527.4	392.8	493.0	540.9	692.0	426.2	474.7	542.3	507.5	353.9	543.4	488.4	357.7	557.3
2092	552.6	555.2	457.3	685.2	685.2	549.3	632.4	512.7	642.5	478.5	485.6	457.3	579.3	553.4	597.0	506.3	490.3	555.8	560.3	551.7	537.8	499.9	581.3	551.7	628.4	582.0	498.3	608.8
2093	498.2	510.6	370.3	734.8	734.8	401.3	699.5	511.8	419.4	414.1	483.5	567.7	503.1	392.8	480.4	522.7	493.3	432.4	461.2	462.3	518.2	545.9	540.2	680.6	564.8	624.5	370.3	429.8
2094	506.5	518.6	335.1	660.3	552.0	463.2	523.2	471.8	563.8	536.4	440.2	507.9	644.6	496.8	505.2	451.4	483.3	561.5	643.3	463.7	555.3	559.5	660.3	478.8	502.3	585.5	335.1	460.8
2095	523.1	526.3	345.8	687.0	553.6	687.0	555.8	345.8	625.1	625.2	417.6	531.3	365.7	491.8	540.0	586.0	625.1	518.4	521.0	464.0	430.2	523.8	630.9	472.6	674.5	471.7	522.5	451.2
2096	496.9	522.2	395.1	680.0	557.1	655.8	464.1	680.0	497.2	424.0	581.2	445.5	603.9	496.7	450.2	452.4	475.9	512.7	395.1	437.7	534.9	482.3	630.7	609.9	630.9	476.2	440.0	599.0
2097	531.6	523.1	328.4	724.7	518.6	509.3	724.7	543.1	538.8	625.6	416.4	328.4	630.3	366.7	437.8	376.8	548.3	524.3	522.8	544.3	471.0	506.7	593.7	576.9	572.9	490.5	601.6	584.2
2098	545.9	544.1	410.2	850.4	551.4	436.4	540.5	702.1	410.2	576.2	413.6	475.0	558.1	485.1	458.8	481.6	602.2	551.2	521.2	597.0	563.7	565.9	850.4	631.2	522.5	581.7	531.3	451.1
2099	502.8	523.0	361.4	732.9	488.0	461.6	612.0	635.8	589.0	642.0	491.1	501.6	416.4	421.8	493.2	518.4	424.0	374.2	480.2	504.0	609.3	562.3	600.5	614.9	732.9	568.0	448.3	361.4
2100	507.4	536.0	399.5	692.3	639.3	455.0	623.0	660.4	622.2	689.8	501.8		505.1	594.8	419.1	503.1	487.1	548.7	399.5	507.4	491.9	515.9	692.3	440.4	516.2	498.0	427.7	588.4

RCP8.5

Max Daily Precip (mm)

					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
2011	21.3	23.3	13.1	45.9	26.0	22.8	17.8	25.2	17.7	13.6	24.2	45.9	39.8	18.0	17.3	22.3	18.9	20.3	19.9	18.9	13.1	23.1	32.2	15.1	24.1	26.6	38.1	18.6
2012	17.9	21.9	12.5	38.6	17.4	16.8	17.6	14.0	33.2	31.8	30.7	29.1	14.0	26.4	31.5	27.0	15.1	30.6	15.0	13.5	23.0	16.3	12.5	15.5	20.6	38.6	18.1	16.4
2013	25.3	27.3	13.0	62.0	29.3	23.4	23.9	15.2	36.5	18.4	26.7	20.3	32.2	26.6	28.3	13.0	20.3	17.5	14.2	23.3	35.1	13.5	52.6	29.8	29.1	62.0	47.4	17.6
2014	24.8	27.7	13.3	56.1	16.4	14.9	31.0	20.3	20.2	18.8	24.0	40.7	41.5	22.9	13.3	25.6	51.0	31.8	28.5	19.1	40.6	37.7	26.3	31.3	13.6	20.4	18.2	56.1
2015	22.9	25.3	12.9	59.5	59.5	12.9	35.5	23.9	15.7	19.1	30.3	22.3	23.4	23.3	19.4	19.5	22.9	47.2	19.7	23.5	33.1	21.6	16.0	26.6	33.5	22.9	20.3	14.1
2016	23.8	26.4	15.6	55.7	30.4	25.4	24.2	16.2	19.6	16.6	55.7	42.6	15.6	19.8	35.5	39.3	23.8	39.0	23.8	19.5	16.7	37.6	18.2	17.0	30.7	24.9	18.2	23.8
2017	24.2	25.5	11.2	67.0	32.0	27.3	18.3	15.1	28.9	24.4	21.9	21.6	32.6	15.7	47.9	13.3	14.5	11.2	67.0	32.7	25.0	19.8	29.5	25.8	24.1	29.7	19.5	15.2
2018	19.8	21.7	13.3	37.9	19.2	17.2	22.7	15.1	25.2	16.6	16.0	18.3	15.9	25.0	34.9	22.3	15.1	25.6	17.3	18.8	32.9	20.5	22.7	27.1	13.3	24.9	37.9	15.7
2019	19.9	21.6	14.1	38.3	19.8	16.2	18.9	14.1	15.9	20.5	38.3	31.3	21.7	23.8	34.5	17.6	14.2	26.6	19.1	19.9	14.6	16.1	23.0	21.9	16.1	23.2	32.3	18.3
2020	24.8	25.1	11.8	47.6	11.8	20.3	14.4	27.4	27.4	19.4	31.9	22.7	25.1	39.0	24.5	20.7	30.8	30.9	13.3	18.9	27.0	19.9	30.7	32.8	16.4	30.6	47.6	19.3
2021	22.4	23.0	14.2	39.5	22.6	22.4	14.8	14.2	29.1	34.1	22.3	15.8	28.1	39.5	20.3	25.7	14.4	17.1	18.2	19.9	28.5	25.9	25.8	26.9	22.3	30.9	18.5	15.5
2022	20.4	23.3	10.6	41.5	13.0	18.9	14.7	28.7	31.0	15.4	19.0	40.4	19.8	31.9	18.1	19.8	28.7	22.2	23.2	13.4	20.0	10.6	29.7	20.8	18.4	27.5	33.0	41.5
2023	24.3	25.6	16.4	45.0	41.0	28.5	27.7	19.4	21.7	24.3	24.3	30.7	27.2	34.8	18.3	21.8	19.2	27.9	25.4	17.9	18.8	16.4	36.7	31.1	45.0	20.4	18.1	17.5
2024	20.0	21.5	11.4	39.6	17.9	20.9	21.2	19.1	38.1	12.1	14.9	39.6	12.2	18.2	21.2	18.0	23.4	34.8	15.9	22.2	18.5	29.1	24.6	30.7	11.4	21.1	16.5	15.6
2025	23.3	24.2	14.5	55.9	23.8	19.3	27.7	29.5	20.6	23.8	32.4	24.8	55.9	25.7	20.1	15.7	26.3	14.5	15.6	14.5	22.8	15.5	31.5	18.9	31.4	21.9	26.7	22.4
2026	23.8	25.6	14.6	63.3	17.6	24.1	27.2	23.9	25.4	21.9	18.8	30.8	17.1	18.1	56.6	17.5	26.5	15.4	23.8	24.5	63.3	23.8	36.9	27.3	14.6	22.3	18.6	19.5
2027	24.0	27.3	14.1	64.7	24.7	23.3	37.9	15.9	22.1	34.1	62.5	16.9	22.4	33.0	35.2	27.5	17.8	16.0	14.9	18.2	26.3	14.1	29.6	22.0	30.3	25.8	20.6	64.7
2028	20.3	21.4	12.9	35.8	23.3	20.6	35.8	18.8	26.9	16.2	24.2	25.3	16.6	31.8	19.7	22.2	14.5	28.0	25.9	21.1	18.1	15.1	12.9	17.9	17.2	24.1	18.2	19.9
2029	26.7	28.8	14.5	57.2	43.9	49.7	30.0	31.0	27.5	29.4	40.1	26.7	18.4	26.7	23.1	17.2	52.5	16.9	15.9	19.0	57.2	21.9	21.4	18.3	14.5	29.8	21.9	38.8
2030	27.1	27.4	16.1	49.8	16.8	16.1	18.2	37.0	25.9	28.1	17.6	30.2	38.9	20.7	24.3	27.4	26.7	30.6	22.9	19.9	31.2	30.9	30.6	26.6	28.7	49.8	33.8	25.4
2031	26.5	28.4	10.5	65.6	31.1	10.5	21.3	29.9	17.0	29.9	29.6	23.4	16.6	18.0	13.3	30.2	24.8	23.3	45.0	19.8	50.7	36.5	19.9	21.6	28.2	29.0	46.7	65.6
2032	21.8	23.5	9.5	42.5	41.0	27.7	17.6	28.9	22.3	22.5	18.1	26.0	34.1	20.4	19.7	20.7	28.7	9.5	13.9	20.3	25.1	21.2	25.0	20.9	25.7	21.1	11.9	42.5
2033	23.9	25.0	9.4	51.4	20.7	29.1	16.3	25.1	36.6	29.4	24.7	16.8	28.4	19.2	33.6	17.9	9.4	51.4	37.4	17.7	20.3	25.5	20.9	27.6	31.6	23.0	19.1	17.3
2034	25.7	26.5	12.3	63.7	18.0	63.7	26.0	27.4	29.2	23.1	16.9	21.6	19.1	16.8	27.0	12.3	28.9	30.0	25.9	19.9	24.1	18.6	34.1	27.1	21.4	49.5	29.8	25.5
2035	24.0	24.9	11.6	47.2	17.2	45.5	20.7	21.5	24.2	47.2	16.7	25.4	13.8	39.5	21.9	39.7	11.6	24.0	12.8	18.8	30.7	24.2	29.7	24.3	24.0	25.7	15.1	23.8
2036	24.8	27.2	11.5	63.1	15.0	41.2	15.0	19.5	26.5	63.1	31.8	24.0	23.4	33.0	20.8	11.5	31.2	17.4	12.3	55.9	38.6	38.2	12.9	25.6	28.2	22.4	27.5	17.8
2037	23.8	26.0	15.0	56.9	30.7	26.6	15.2	16.6	17.7	39.5	18.7	25.1	36.2	48.7	18.7	19.8	24.7	15.7	16.7	17.9	36.5	27.6	25.8	15.0	56.9	29.2	22.4	22.9
2038	23.7	25.6	13.0	52.2	35.4	18.3	34.2	13.0	20.2	32.8	24.1	40.2	17.6	52.2	37.4	21.2	23.7	31.2	17.7	19.8	29.2	13.0	23.0	25.0	25.3	19.0	18.2	23.6
2039	22.5	23.9	14.0	42.9	22.1	18.2	31.4	19.6	27.8	25.2	17.3	20.1	34.6	42.9	21.5	23.9	25.7	14.0	20.7	16.8	22.9	16.1	18.0	24.4	28.9	18.3	24.0	40.3
2040	23.0	26.9	10.9	93.7	13.0	27.7	42.1	22.9	29.6	25.8	16.6	93.7	23.8	38.2	22.8	21.4	18.4	23.1	33.4	20.0	18.7	10.9	24.9	33.0	17.1	30.0	18.9	19.7
2041	25.7	27.7	12.7	65.8	26.2	15.7	35.9	24.1	22.4	24.2	26.8	34.0	22.8	31.3	39.6	18.3	30.1	65.8	22.5	12.7	25.1	36.5	13.4	31.9	15.8	28.0	42.6	19.7
2042	25.0	27.1	15.6	63.5	18.3	31.6	19.0	34.3	32.4	23.9	33.2	25.3	42.6	30.9	41.4	20.4	15.6	18.5	24.7	63.5	20.1	17.5	17.3	28.2	26.7	31.2	17.5	16.8
2043	24.3	25.7	9.9	49.1	16.8	32.0	26.1	23.5	32.4	12.9	16.1	42.8	31.0	29.2	21.3	22.0	22.8	24.0	24.5	32.6	21.8	14.7	32.1	29.8	49.1	33.3	15.5	9.9
2044	23.3	25.4	15.0	49.1	23.4	26.5	46.3	16.0	30.7	26.5	49.1	31.0	15.0	39.2	23.3	20.8	17.3	19.7	17.9	20.2	21.0	23.8	25.5	22.8	25.4	32.4	16.8	19.1
2045	24.0	25.0	15.6	46.9	20.8	27.0	18.9	19.9	29.4	27.6	25.6	28.8	46.9	20.5	29.3	24.5	32.9	16.5	15.8	20.0	23.5	32.9	21.9	30.7	15.6	33.2	17.6	20.9
2046	23.8	23.8	12.5	35.5	29.8	27.7	20.9	14.9	29.9	19.0	13.4	28.4	26.3	12.5	25.4	23.9	35.5	22.5	20.4	19.0	23.7	25.0	32.9	17.3	20.2	31.7	27.8	23.6
2047	24.3	27.9	11.6	85.5	11.6	21.1	18.3	39.4	21.7	25.2	21.3	29.8	27.6	56.1	28.7	24.7	20.5	30.8	18.7	25.6	31.5	18.7	30.4	24.0	23.9	20.2	15.1	85.5
2048	29.5	30.3	12.9	49.4	12.9	35.6	49.4	29.2	29.9	35.6	26.0	28.6	16.4	41.0	23.1	32.0	42.6	41.5	23.1	21.9	23.4	20.7	45.3	34.0	39.1	18.6	20.5	35.8
2049	26.0	25.0	11.2	40.3	19.4	15.5	34.2	18.1	40.3	32.4	21.3	32.8	18.8	26.7	28.4	27.6	14.3	28.9	11.2	20.3	29.0	39.4	29.8	16.9	28.7	24.6	25.2	16.6
2050	23.3	23.6	10.7	41.9	39.0	24.9	29.2	24.7	25.1	17.0	15.5	25.8	19.9	41.9	25.5	22.0	30.1	39.1	18.2	20.7	10.7	13.3	15.2	16.5	16.2	33.4	16.1	27.6
2051	23.9	27.0	13.2	63.2	25.5	17.5	23.9	21.3	41.9	21.8	33.8	37.4	22.2	48.7	63.2	24.0	13.2	21.4	17.5	30.0	16.9	24.8	28.6	25.6	26.8	21.7	21.0	18.8
2052	24.2	24.5	14.9	48.8	33.6	19.3	23.2	27.0	31.9	23.0	18.6	20.2	31.0	48.8	15.8	24.2	14.9	21.4	21.7	26.0	28.3	25.6	26.1	24.1	26.9	25.1	15.7	15.5
2053	26.0	27.4	17.9	60.9	26.4	27.0	27.1	23.5	18.7	23.4	17.9	26.6	22.5	45.8	21.3	29.1	38.1	29.6	18.9	20.2	29.3	20.9	19.8	25.6	33.2	60.9	24.9	27.3
2054	29.2	30.9	15.2	74.9	33.6	30.9	26.7	21.5	15.6	27.1	23.0	34.5	28.9	31.4	32.5	19.7	15.2	29.5	24.2	16.5	34.6	26.4	36.9	34.6	26.7	40.0	55.7	74.9
2055	21.1	22.9	12.7	55.9	18.9	22.3	18.9	33.0	23.4	17.4	25.7	32.7	22.1	18.0	32.8	18.8	55.9	20.2	23.0	15.2	14.6	32.9	13.7	22.5	13.8	17.4	12.7	24.2
2056	23.1	25.0	12.3	45.3	37.7	26.5	14.4	20.8	19.1	20.0	12.3	41.9	21.1	45.3	28.8	18.3	26.2	15.6	16.2	21.9	24.7	31.4	26.7	34.5	23.0	23.2	14.3	35.5
2057	25.8	26.2	14.9	49.5	28.4	18.8	19.5	32.1	20.4	16.3	25.7	17.1	21.6	24.7	34.4	17.1	21.4	49.5	30.4	34.0	31.1	22.6	40.5	25.9	26.1	27.6	14.9	27.7
2058	25.0	26.2	10.4	56.3	19.7	42.3	34.0	30.0	29.7	20.8	40.2	22.4	26.5	19.1	20.3	22.0	26.1	15.0	56.3	25.8	14.4	18.8	17.5	26.7	24.2	39.8	10.4	27.4
2059	25.1	28.5	12.4	88.4	30.3	29.5	21.3	48.6	28.4	26.5	32.8	26.0	21.9	88.4	39.0	18.1	18.8	12.4	37.4	22.7	26.7	18.3	22.8	22.3	24.3	30.8	13.4	23.3
2060	22.2	24.3	13.5	48.1	48.1	29.0	41.0	32.0	16.0	29.5	18.7	13.5	22.9	15.9	39.9	13.9	27.7	20.7	20.4	21.8	20.6	21.8	23.7	22.6	26.6	23.7	15.0	18.2
2061	23.8	28.9	14.2	67.1	53.0	20.3	35.1	16.2	29.8	24.5	20.7	67.1	56.7	41.3	14.2	20.6	32.8	20.5	23.2	30.6	21.7	19.8	38.4	25.6	14.3	31.5	16.7	19.6
2062	24.9	28.6	16.3	70.3	19.7	16.3	19.3	24.1	19.7	33.8	35.0	21.7	25.8	43.3	26.4	21.1	47.3	19.6	39.3	27.8	70.3	26.6	36.8	20.3	32.0	19.7	23.6	17.6
2063	24.3	25.6	14.4	45.7	24.5	43.9	19.6	18.9	44.6	25.2	14.4	15.5	24.1	24.7	21.5	24.8	33.5	32.7	45.7	20.9	29.3	26.1	20.8	17.0	18.1	22.0	17.2	28.6
2064	26.7	28.0	13.7	50.8	29.4	41.5	21.7	24.7	40.9	30.3	39.0	28.7	50.8	34.4	22.7	20.2	21.1	13.7	33.1	20.4	35.9	20.2	24.1	30.0	29.3	22.1	19.4	18.4
2065	23.7	27.8	13.0	66.8	28.7	27.0	36.9	18.7	31.5	24.3	18.9	16.6	31.0	23.1	21.3	57.1	30.0	13.0	23.2	32.4	22.4	20.3	28.9	22.4	35.9	14.7	66.8	22.0
2066	25.0	28.9	15.6	68.4	15.6	22.3	68.4	30.6	24.9	21.5	52.0	31.6	25.0	25.0	25.5	40.8	49.8	38.9	29.3	16.3	21.0	29.7	18.9	22.3	23.1	16.4	15.7	28.5
2067	28.4	30.0	17.5	49.3	18.7	22.9	36.4	34.4	24.8	22.3	22.3	25.1	18.4	34.4	17.5	29.2	26.6	19.5	26.2	28.7	49.3	44.5	28.1	31.8	48.6	29.6	42.6	38.1
2068	24.8	26.9	15.3	55.7	27.2	25.9	17.3	19.7	30.8	30.2	17.9	39.7	22.8	55.7	31.4	32.1	19.4	45.5	36.3	20.0	16.7	16.9	19.2	24.4	25.1	32.8	15.3	22.5
2069	25.7	28.4	15.3	58.0	28.7	15.3	15.4	33.7	31.9	42.5	48.2	20.5	19.2	34.2	58.0	25.8	25.5	35.0	17.9	17.7	16.2	20.4	52.8	18.3	31.5	17.5	20.7	35.2
2070	24.0	25.1	12.3	38.2	34.1	19.6	19.5	36.5	21.9	38.2	21.4	23.4	19.8	14.9	23.6	34.5	24.3	31.8	20.4	19.3	22.0	29.5	33.8	25.6	25.3	25.3	25.6	12.3
2071	25.2	26.7	14.9	72.0	26.3	30.1	15.2	27.9	34.3	27.7	21.8	20.9	31.3	14.9	26.8	31.9	72.0	24.9	22.9	16.2	23.9	15.2	21.4	31.6	22.8	33.4	21.3	25.5
2072	26.7	29.7	15.6	61.4	38.4	25.6	19.2	61.4	35.3	25.0	55.3	27.8	18.2	32.3	20.4	20.3	27.9	34.3	21.7	41.8	34.9	24.5	44.0	20.7	15.6	18.5	21.2	29.4
2073	23.7	27.1	14.6	58.6	16.4	42.5	19.1	21.1	24.5	30.9	19.5	26.0	17.4	24.8	19.7	21.3	45.1	19.9	29.8	52.5	24.8	58.6	33.4	22.6	23.6	23.9	14.6	18.9
2074	26.7	27.2	9.9	72.7	21.1	22.9	27.0	30.7	38.5	29.7	15.4	27.4	28.1	16.5	24.3	17.0	15.7	26.4	32.1	19.5	31.7	30.3	39.4	9.9	24.2	31.9	21.2	72.7
2075	29.0	27.8	10.5	48.6	48.6	29.8	16.8	16.6	40.9	37.3	19.0	28.2	27.6	10.5	32.5	24.9	36.0	14.4	21.4	33.9	35.1	22.4	30.2	19.9	24.5	33.6	33.4	30.2
2076	23.4	26.6	13.5	57.6	51.7	18.2	41.0	30.3	35.9	27.8	17.5	57.6	27.2	23.1	24.7	18.4	22.2	15.8	21.5	32.4	17.1	20.4	21.6	24.8	23.7	13.5	22.2	29.0

2077	25.4	26.4	13.5	50.7	42.9	24.7	18.8	33.4	50.7	13.5	25.8	24.7	15.8	27.6	17.8	16.3	15.8	22.8	15.0	34.1	26.4	43.7	32.5	24.9	26.0	31.0	18.9	30.5
2078	24.3	26.0	13.5	47.7	20.4	22.0	42.8	23.1	34.2	32.6	34.5	33.7	24.7	24.1	24.2	23.6	16.2	24.3	26.0	27.6	13.7	20.8	47.7	27.7	13.5	33.7	15.0	17.5
2079	24.6	28.3	13.5	59.4	16.3	59.4	36.7	25.2	23.6	44.0	19.2	30.6	25.6	13.5	46.3	23.1	19.5	24.0	17.7	56.2	32.0	16.2	30.5	32.8	20.0	16.9	19.6	30.0
2080	24.5	29.5	12.6	93.6	33.2	19.4	43.7	30.0	16.4	27.6	24.8	31.3	12.6	93.6	20.2	23.4	19.8	16.1	16.2	38.9	57.5	20.5	33.5	23.2	16.3	28.8	24.2	36.3
2081	23.9	24.8	12.7	51.6	51.6	34.8	34.9	20.4	33.2	18.8	25.7	23.8	25.6	18.4	14.3	12.7	50.8	14.5	22.0	25.2	13.9	25.0	25.7	25.2	24.0	19.6	21.1	13.4
2082	25.0	29.0	14.8	61.1	32.8	61.1	53.7	36.3	35.6	21.6	21.7	29.9	18.5	27.8	20.6	21.6	17.8	21.5	31.2	24.9	20.0	59.5	18.6	34.5	25.1	22.3	25.5	14.8
2083	24.4	27.1	11.2	48.6	23.4	23.0	24.2	22.6	26.5	27.5	25.8	48.4	27.7	44.0	48.6	11.2	24.5	27.2	19.8	19.6	23.4	17.1	27.8	18.8	45.7	24.3	14.1	34.5
2084	24.7	28.2	16.1	56.3	36.6	19.9	34.0	28.1	30.6	31.6	21.6	21.8	34.2	54.9	19.5	19.9	19.1	25.5	24.0	36.5	56.3	16.1	22.5	20.8	27.9	30.8	23.5	20.4
2085	23.3	26.1	15.1	55.2	31.1	18.0	55.2	17.3	15.1	52.9	25.8	22.9	25.9	43.4	25.4	23.4	19.7	19.0	15.4	40.6	29.0	19.1	25.4	18.2	23.2	24.6	18.1	18.8
2086	26.4	29.6	16.3	58.9	29.6	20.6	42.1	21.9	17.4	37.1	18.6	20.6	34.9	49.5	58.9	21.0	43.3	40.3	26.3	16.3	21.5	17.9	31.2	20.0	40.5	25.1	26.6	28.2
2087	25.4	24.2	14.9	34.3	27.5	33.5	31.4	28.3	21.7	15.2	26.9	32.6	19.0	26.9	19.4	23.9	29.3	16.1	15.4	19.3	22.3	14.9	30.3	29.2	17.3	34.3	15.6	29.4
2088	27.3	30.7	15.2	72.5	72.5	33.9	21.8	22.7	35.3	37.8	17.3	31.9	27.8	69.2	18.1	23.4	34.4	24.7	26.7	19.5	29.1	15.2	34.2	16.4	17.3	49.6	32.4	25.5
2089	24.4	27.2	12.3	78.8	16.2	14.0	22.6	25.0	25.1	17.1	12.3	20.4	27.4	33.6	18.1	31.0	26.7	35.5	36.2	78.8	31.4	23.9	20.3	30.9	22.1	41.7	18.3	23.5
2090	24.7	25.4	14.5	46.4	27.6	24.9	36.2	18.1	46.4	27.4	14.5	25.2	27.2	18.8	24.2	23.0	37.1	16.3	20.5	25.9	33.6	17.2	21.5	15.0	24.5	26.6	22.8	34.2
2091	22.1	24.0	14.4	49.0	49.0	22.5	19.7	28.5	19.3	23.7	25.0	23.0	15.7	27.0	24.2	20.2	19.7	40.2	21.6	37.2	17.8	20.2	14.7	19.5	23.5	20.0	14.4	29.3
2092	21.9	28.3	15.8	100.0	63.0	21.8	100.0	17.7	31.5	15.8	25.7	19.8	16.9	22.0	26.2	51.4	17.1	20.5	21.9	19.6	18.8	18.4	33.2	23.3	26.1	23.3	18.9	25.5
2093	24.4	24.6	14.7	36.8	25.7	17.9	35.5	16.7	23.4	21.6	26.6	36.8	33.2	27.5	17.9	23.3	26.2	19.9	14.7	28.9	24.8	17.2	25.5	24.5	24.4	36.7	17.8	23.4
2094	25.0	24.7	10.2	39.4	30.3	19.5	27.3	21.1	20.9	36.6	15.4	18.1	26.6	31.5	17.9	23.6	27.6	36.3	28.5	39.4	25.0	16.2	29.3	28.6	20.3	24.9	10.2	18.9
2095	27.1	28.6	10.1	55.8	38.1	25.3	24.1	10.1	27.8	41.5	19.5	30.9	29.0	35.0	25.0	31.5	26.3	38.7	12.8	35.4	22.1	24.3	55.8	20.4	26.1	32.1	31.0	23.8
2096	25.7	26.8	13.9	59.1	36.5	24.0	26.0	29.5	19.6	13.9	22.0	20.6	31.8	59.1	31.4	24.1	28.6	24.1	23.9	35.3	22.3	14.7	27.3	27.5	26.9	33.5	14.0	25.5
2097	25.5	27.5	15.2	62.9	31.4	22.4	62.9	35.2	37.4	36.8	19.3	30.4	53.2	16.4	16.9	17.4	24.6	18.9	27.8	26.6	17.2	17.0	30.3	33.5	24.3	17.4	15.2	26.4
2098	23.0	28.0	15.1	77.5	22.2	18.2	17.1	44.0	34.2	47.0	22.3	19.9	19.3	28.2	23.8	19.8	31.8	21.6	19.9	27.2	32.3	21.5	77.5	33.2	15.1	33.6	19.3	23.8
2099	23.8	26.3	15.7	49.3	28.7	31.6	23.8	26.8	32.4	19.7	23.7	23.8	17.3	23.2	22.0	24.0	15.8	15.7	38.5	20.7	49.3	35.9	27.6	45.9	26.0	20.0	18.7	19.6
2100	24.7	25.5	11.2	40.0	29.4	21.4	36.9	36.5	34.1	32.9	21.7		24.7	26.2	16.7	22.7	24.7	26.3	12.0	23.8	40.0	33.0	23.5	11.2	15.6	26.6	16.8	30.4

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Year	Median	Mean	Min	Max	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
2011	114	114.5	90	155	105	122	119	90	131	97	107	104	118	127	124	119	102	112	108	109	155	100	96	116	128	110	127	122
2012	112	113.5	101	140	101	103	140	107	112	125	123	107	115	110	127	106	104	132	102	116	107	117	115	112	105	112	123	102
2013	117	115.1	86	135	110	124	135	123	129	100	115	119	110	118	131	120	101	107	117	126	116	106	110	86	127	101	121	110
2014	115	116.5	82	144	131	114	111	130	144	82	111	122	120	109	117	115	116	131	115	112	104	120	113	124	122	113	106	113
2015	112	111.9	83	140	114	103	112	92	115	83	110	111	140	119	115	123	97	113	104	111	120	133	105	118	111	108	122	107
2016	116	116.0	88	134	123	88	124	116	125	128	112	111	106	111	134	108	133	115	124	93	116	117	110	132	119	131	114	94
2017	117	116.8	79	146	130	79	113	127	116	112	103	91	115	97	126	108	110	97	126	146	118	120	144	118	144	122	110	130
2018	114	114.8	92	141	108	94	101	105	121	141	120	135	121	106	92	107	108	112	113	108	115	123	117	129	117	122	130	110
2019	113	114.6	90	142	130	102	123	107	127	121	107	110	142	105	116	90	121	121	136	110	95	131	98	96	110	101	135	117
2020	112	115.3	92	149	113	109	117	129	105	126	103	108	122	112	105	100	108	137	113	100	140	105	136	98	112	92	128	149
2021	119	116.5	90	138	124	107	110	121	108	116	125	120	118	121	131	124	113	90	105	98	126	138	124	90	118	116	123	131
2022	109	112.9	84	141	93	107	108	93	141	102	101	107	115	140	84	118	109	129	136	125	109	104	84	116	129	123	108	129
2023	114	113.2	93	137	117	118	137	104	116	117	100	121	110	101	120	122	107	104	126	133	112	104	115	101	125	109	93	105
2024	115	119.5	100	152	123	122	140	116	145	113	105	113	113	119	122	114	105	120	135	114	114	111	136	100	121	152	112	102
2025	115	114.4	84	137	122	130	119	93	137	119	113	107	115	108	115	112	96	126	113	131	120	84	100	123	130	115	103	114
2026	115	115.3	95	143	111	121	115	136	123	105	104	122	107	117	123	97	105	101	120	131	96	143	115	111	95	107	119	142
2027	115	114.8	95	137	108	117	137	95	115	115	134	102	99	119	127	132	102	110	103	99	126	122	104	112	127	115	132	102
2028	109	114.1	96	144	140	108	102	112	130	144	101	144	140	101	116	96	97	97	104	109	134	113	104	104	134	111	99	98
2029	114	114.7	90	142	113	90	121	118	123	112	99	94	134	99	141	93	113	118	142	108	134	126	119	114	111	116	104	111
2030	119	120.7	105	144	118	127	110	144	130	125	116	110	121	134	113	126	115	120	130	114	111	109	105	129	115	129	116	129
2031	123	121.0	87	159	122	87	126	138	115	137	105	133	124	99	121	131	113	116	95	126	128	137	104	159	124	118	119	127
2032	118	116.4	91	144	128	102	91	133	131	144	125	106	119	98	110	103	111	104	117	129	103	118	131	129	132	107	103	120
2033	112	111.8	85	137	102	137	120	130	107	114	102	104	117	131	120	90	109	127	125	87	130	85	114	104	110	90	102	126
2034	118	119.3	101	144	106	120	117	123	105	118	118	113	132	125	124	126	134	118	110	129	116	122	144	102	135	111	113	101
2035	118	117.1	101	146	127	119	107	123	127	112	104	120	101	111	116	146	129	108	101	101	107	131	115	122	125	124	111	124
2036	114	114.9	70	146	127	118	109	146	110	105	121	108	113	136	114	114	111	116	116	129	105	106	103	138	138	70	101	104
2037	123	121.5	100	140	121	129	102	119	100	132	105	113	129	135	130	126	125	116	113	137	115	125	135	119	126	111	140	113
2038	123	121.6	103	137	137	115	120	112	124	104	110	110	129	123	123	135	131	103	132	115	127	127	113	135	136	110	125	123
2039	122	118.0	77	132	132	126	130	109	127	108	110	102	114	116	128	122	127	114	128	108	113	116	128	126	124	77	127	121
2040	116	115.5	88	145	112	126	127	115	119	88	91	127	140	122	133	99	112	116	104	122	133	99	108	117	101	102	145	113
2041	115	116.3	92	138	103	108	133	109	110	137	120	124	92	110	108	124	106	106	120	134	100	138	108	127	116	117	128	113
2042	120	120.1	97	142	138	122	129	104	122	120	126	115	137	120	103	115	141	105	122	117	127	116	142	97	118	102	128	116
2043	117	116.0	86	145	115	140	124	116	94	104	125	118	117	109	108	117	122	116	121	118	107	104	114	134	112	145	119	86
2044	115	115.7	89	148	139	103	135	109	133	104	97	125	98	135	115	115	89	110	104	116	111	130	118	148	119	118	103	102
2045	122	121.0	91	147	136	147	135	145	144	119	98	129	128	135	103	120	130	110	134	128	121	123	119	107	107	91	94	102
2046	121	120.9	96	139	113	124	118	115	96	135	117	119	105	118	131	139	105	106	120	131	136	122	134	121	139	103	130	124
2047	117	117.4	90	133	108	132	90	128	111	133	108	131	112	124	120	115	114	121	117	113	117	116	106	127	128	124	108	115
2048	113	115.7	95	139	98	134	111	110	131	139	112	128	95	113	132	97	120	106	111	102	112	127	108	131	99	131	116	113
2049	119	117.6	97	145	111	135	122	119	118	112	108	115	126	97	129	117	124	133	145	112	100	121	107	124	121	125	101	101
2050	112	114.8	96	137	119	120	124	111	111	111	115	113	105	109	110	102	137	96	104	104	131	115	113	134	110	123	129	108
2051	119	118.3	77	144	130	109	119	144	131	118	129	113	116	104	122	93	123	135	133	108	112	116	144	122	132	77	115	95
2052	116	117.2	88	146	145	95	136	117	101	106	120	112	121	126	114	130	88	130	107	127	112	135	146	103	122	107	115	97
2053	119	119.0	94	139	134	116	121	113	115	132	106	102	112	124	106	131	118	94	113	125	131	120	131	129	139	108	123	112
2054	123	123.6	101	152	115	101	125	116	134	152	122	113	141	104	142	127	103	111	126	123	122	134	133	128	142	120	116	116
2055	115	117.5	96	142	142	108	99	134	111	136	107	113	140	97	112	120	112	117	125	99	114	136	123	103	115	139	122	96
2056	121	120.2	98	145	136	103	123	127	104	113	101	112	120	108	145	112	124	128	118	128	109	143	121	136	134	124	118	98
2057	115	116.3	86	144	126	108	86	131	127	106	105	113	132	104	126	112	111	125	119	125	98	144	111	115	124	112	117	115
2058	118	118.3	91	149	91	125	132	136	132	121	105	118	119	123	118	122	111	106	149	115	132	115	116	100	114	119	101	118
2059	122	118.3	91	141	134	113	134	126	130	120	125	102	115	136	124	91	92	115	126	134	102	107	123	112	141	123	105	109
2060	117	116.8	93	138	138	113	118	123	124	93	99	122	134	115	120	107	134	96	120	106	111	111	101	114	125	128	137	114
2061	122	123.2	105	153	153	119	124	123	129	144	106	132	105	115	115	121	131	116	128	139	129	122	118	122	116	116	112	122
2062	118	117.4	85	137	130	122	131	133	136	119	109	110	95	110	132	109	85	137	134	137	111	101	130	120	106	100	105	116
2063	115	115.7	95	150	130	150	107	146	95	103	98	120	115	98	117	112	109	111	96	122	113	104	127	122	119	116	114	133

2064	121	121.5	98	156	126	118	128	120	126	129	102	122	156	98	145	121	110	129	104	110	127	132	101	116	138	120	120	117
2065	118	119.4	99	144	100	122	112	142	126	134	105	116	126	100	115	112	111	99	133	109	125	136	144	114	131	119	115	119
2066	117	115.8	78	142	110	138	138	121	116	129	111	104	126	81	123	128	114	117	130	78	99	120	112	99	142	105	124	114
2067	116	115.4	83	145	126	116	125	104	125	125	105	95	131	103	122	99	122	102	103	120	111	136	141	115	145	83	104	112
2068	125	124.0	99	165	109	134	138	143	103	113	107	113	131	116	135	116	116	129	127	129	114	128	139	125	165	99	123	124
2069	120	125.0	107	167	125	117	107	146	110	110	120	110	127	115	167	116	116	115	138	131	124	128	134	143	156	113	112	119
2070	125	124.3	96	152	128	107	126	152	118	110	135	108	133	115	137	124	115	125	133	123	124	135	137	137	139	106	121	96
2071	119	117.5	90	153	135	153	90	132	114	134	121	120	101	125	96	123	117	97	119	93	110	118	132	108	146	108	133	95
2072	118	119.2	99	158	130	101	133	106	136	104	128	124	121	101	119	99	117	109	115	110	129	116	158	117	127	133	119	108
2073	116	117.6	84	159	123	111	132	111	123	128	126	114	120	112	117	116	110	109	123	134	113	107	121	108	159	115	107	84
2074	122	123.5	100	151	130	134	147	122	130	117	121	119	138	124	117	114	122	107	144	132	100	151	122	113	115	110	113	121
2075	118	119.4	94	147	111	123	114	106	139	132	107	107	140	94	133	103	115	128	130	147	94	123	141	114	120	120	113	112
2076	121	120.6	98	140	133	107	129	121	113	136	102	140	112	116	121	117	114	128	133	120	128	128	128	98	135	115	114	107
2077	116	116.9	86	164	136	116	98	140	116	100	99	107	128	110	141	91	125	119	107	134	111	121	124	103	164	86	109	121
2078	119	120.3	88	167	117	88	116	111	167	122	115	104	134	121	138	117	127	113	150	113	126	122	137	121	109	107	91	120
2079	116	115.4	88	134	134	109	131	106	134	124	109	99	127	88	112	123	107	124	113	117	124	122	117	129	114	114	91	101
2080	120	119.8	82	144	136	112	144	125	97	136	111	110	116	124	108	124	115	120	82	125	122	118	136	122	117	119	138	117
2081	116	118.6	88	139	134	113	129	116	138	139	107	127	137	88	116	121	112	119	136	106	114	118	112	139	115	94	113	104
2082	118	119.5	94	165	142	114	130	135	132	109	110	94	121	106	118	117	104	165	117	124	103	131	127	118	130	101	115	104
2083	124	121.4	102	137	127	137	120	131	132	121	106	126	134	112	131	106	103	134	110	118	127	119	124	133	124	131	102	106
2084	120	121.8	97	146	121	118	114	124	119	125	103	118	129	117	109	107	117	140	109	131	126	116	137	130	146	144	126	97
2085	121	119.4	93	150	119	150	121	129	115	121	98	109	93	125	123	122	93	128	120	121	111	123	125	135	130	131	112	112
2086	120	118.7	87	148	138	121	140	125	112	125	94	100	87	115	130	110	128	115	148	100	120	123	127	107	137	111	116	119
2087	121	120.2	91	148	137	113	128	118	130	101	112	109	133	108	148	105	123	99	127	91	128	142	138	116	142	124	95	117
2088	120	121.6	100	148	148	142	118	128	102	140	120	108	123	100	145	113	119	125	112	104	116	134	128	126	127	115	108	117
2089	117	119.9	96	149	112	121	130	149	102	135	104	96	109	109	132	104	129	134	112	108	117	127	137	138	130	110	117	115
2090	120	117.9	87	153	120	119	121	113	98	109	91	112	137	106	153	127	128	113	136	96	134	124	117	87	128	124	124	113
2091	122	119.0	77	153	127	123	122	150	122	77	86	106	108	121	133	110	128	134	153	97	121	130	126	96	135	116	112	123
2092	125	124.9	107	142	134	121	117	120	142	122	117	128	125	107	136	122	128	132	127	120	125	130	125	126	134	115	124	120
2093	122	118.4	85	141	141	114	127	121	91	98	112	127	114	85	128	134	109	119	122	122	137	125	112	138	122	133	103	107
2094	123	121.9	95	134	117	122	123	134	130	123	116	127	131	108	129	116	121	125	130	100	122	132	134	133	132	119	95	107
2095	120	118.8	90	155	126	148	125	99	131	134	108	107	90	116	128	122	128	127	128	100	97	120	120	120	155	103	112	106
2096	121	121.8	94	147	133	140	112	137	118	114	136	110	119	94	114	123	109	127	112	104	131	129	147	143	123	110	122	115
2097	122	121.1	84	157	121	112	143	115	131	127	101	84	134	85	121	110	129	135	129	115	112	122	134	128	131	108	157	122
2098	127	123.2	90	153	133	118	129	141	107	109	97	115	133	97	118	126	130	128	113	125	137	128	153	143	136	123	128	90
2099	115	120.5	81	156	105	106	146	133	140	156	114	106	107	102	108	134	111	99	108	125	114	116	132	138	155	137	118	81
2100	120	124.3	105	164	130	119	144	141	135	142	127		115	113	113	132	108	138	109	120	111	129	164	123	119	105	105	118

RCP8.5

Day with Daily Precip (mm) ... **>10**

Year	Median	Mean	Min	Max	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
2011	5	5.6	1	10	6	5	10	4	10	1	5	4	5	7	2	3	5	8	7	5	6	7	9	5	9	5	5	1
2012	5	5.9	1	15	1	5	7	3	4	4	13	5	6	5	15	5	7	7	6	2	1	5	6	9	3	13	7	2
2013	6	6.1	2	13	8	6	3	2	9	6	7	6	6	11	8	5	4	5	5	7	7	2	5	4	5	5	7	13
2014	8	7.5	4	11	5	5	5	11	11	10	5	5	9	5	4	8	7	11	9	11	9	10	5	10	9	5	5	6
2015	6	6.2	2	13	13	3	11	5	2	6	8	6	7	6	9	3	2	6	7	2	8	6	2	6	7	6	10	7
2016	7	6.7	1	12	7	1	5	4	6	9	12	7	5	2	12	5	6	8	7	8	8	7	5	9	10	6	4	8
2017	7	7.2	2	14	9	7	8	5	14	7	3	5	8	6	9	4	3	3	14	10	9	8	12	5	5	12	2	5
2018	7	6.2	1	13	2	4	4	3	9	11	4	4	3	9	5	8	5	7	7	4	8	9	7	13	1	7	7	7
2019	6	6.5	2	11	6	2	6	5	10	10	11	9	9	7	6	4	6	4	8	5	3	6	7	3	7	3	11	7
2020	7	6.5	3	13	4	6	3	9	4	5	6	7	6	10	8	5	9	3	8	8	4	7	13	4	7	4	8	8
2021	6	6.1	2	11	2	8	4	7	6	6	9	7	8	9	7	11	2	3	7	4	4	6	5	6	5	5	10	6
2022	8	6.8	1	12	6	1	6	4	6	3	2	10	9	10	2	12	8	8	9	10	4	1	9	9	6	9	8	10
2023	7	6.8	3	15	8	6	6	4	5	9	8	9	15	5	5	7	3	8	7	7	5	5	10	5	10	7	3	7
2024	6	6.6	1	13	6	7	6	5	13	1	4	9	7	11	5	5	7	8	10	4	12	6	6	7	4	4	6	6
2025	7	7.4	2	13	10	5	12	6	12	9	7	6	9	9	7	3	9	2	4	4	9	9	5	13	10	7	6	4
2026	7	6.5	2	10	8	9	7	9	8	9	6	5	7	5	9	5	3	3	9	10	3	5	9	7	2	8	5	6
2027	7	6.9	2	12	5	8	8	5	7	11	12	8	8	8	10	5	5	7	2	5	6	4	5	6	8	7	7	8
2028	7	6.8	1	13	3	1	8	4	13	13	7	13	7	11	11	7	5	6	7	10	5	3	3	7	7	6	4	2
2029	6	7.0	2	15	4	6	6	13	8	7	6	9	15	5	5	5	8	9	12	3	10	3	7	4	2	10	6	5
2030	8	8.1	4	17	6	8	6	17	5	11	4	10	5	9	8	4	9	10	9	7	8	8	10	8	6	9	10	8
2031	8	8.0	2	14	9	2	6	12	8	13	10	7	6	4	6	9	3	8	10	11	10	12	6	10	4	6	6	14
2032	8	7.0	0	14	11	11	5	8	8	7	10	6	11	8	4	7	2	0	2	4	6	9	9	10	14	5	3	9
2033	7	7.1	0	15	7	7	8	14	5	9	9	8	9	10	15	6	0	8	7	3	5	6	3	9	5	5	5	7
2034	7	7.9	2	15	7	5	11	11	9	9	7	5	12	4	9	4	12	2	7	11	6	7	6	6	12	6	15	7
2035	8	7.6	2	12	8	7	8	8	12	11	7	12	9	4	5	10	4	4	2	4	7	8	9	8	12	12	4	8
2036	6	6.0	1	11	9	4	7	9	5	9	7	8	3	7	4	1	7	6	1	6	6	11	3	4	10	7	6	4
2037	8	8.6	3	16	5	10	6	16	6	13	6	8	13	15	7	9	6	3	6	10	8	7	9	5	6	8	10	15
2038	9	7.8	3	11	9	8	7	8	10	10	6	6	4	8	10	9	4	9	7	10	10	3	9	6	11	6	9	9
2039	8	7.8	2	14	7	4	7	3	14	8	7	8	12	12	7	10	5	4	9	9	4	2	4	9	12	6	13	10
2040	7	7.3	3	17	8	8	17	6	8	5	4	10	7	5	9	5	4	6	6	9	11	3	12	11	4	5	6	7
2041	7	7.2	2	19	6	8	2	8	5	9	8	19	6	9	8	8	4	6	6	4	2	11	6	6	10	7	7	8
2042	9	9.1	2	18	2	5	10	9	13	7	8	9	9	12	7	6	4	4	9	12	15	9	18	12	9	12	13	4
2043	8	7.8	0	14	5	11	10	7	8	2	10	8	12	8	5	14	5	6	6	14	6	3	7	13	8	13	6	0
2044	8	8.0	4	16	7	4	13	5	14	7	8	4	7	16	10	10	7	8	5	6	9	9	6	11	8	8	4	7
2045	8	7.4	3	15	9	9	3	10	10	5	8	7	9	8	4	3	8	5	4	7	7	10	12	15	4	9	4	8
2046	7	7.2	3	14	9	14	6	8	6	9	3	7	7	4	7	8	7	8	5	9	3	10	6	6	9	3	14	5
2047	7	6.7	4	11	4	8	8	7	11	5	8	5	9	8	4	7	8	5	10	8	4	5	6	6	8	4	4	9
2048	9	8.5	3	12	3	10	5	11	12	6	9	12	4	11	11	7	8	6	11	7	11	11	5	11	9	8	6	10
2049	7	7.2	3	15	8	7	5	10	6	4	3	7	9	9	9	10	4	7	4	8	7	7	10	10	5	15	4	4
2050	7	6.5	1	14	8	4	10	10	8	4	7	13	5	11	7	2	14	6	9	5	4	2	3	8	1	10	3	3

2051	7	7.0	2	12	12	5	7	9	7	10	7	10	9	8	6	4	2	7	7	7	9	2	7	7	10	5	6	4
2052	8	7.9	4	16	6	4	14	5	9	7	8	11	8	7	6	7	4	11	5	6	9	10	10	8	9	16	5	4
2053	9	7.8	1	15	9	7	9	13	8	9	1	5	10	9	2	4	10	6	5	9	15	7	8	9	4	14	9	6
2054	8	8.3	4	13	12	5	9	7	9	13	7	10	11	8	8	8	4	8	6	5	10	8	6	8	11	12	6	8
2055	7	7.4	3	14	7	5	6	9	6	14	7	7	11	7	11	9	12	7	5	6	6	9	3	5	5	9	3	8
2056	9	8.8	2	17	17	5	4	9	8	2	5	10	14	8	15	6	11	3	5	9	9	8	10	14	14	6	5	15
2057	8	8.5	4	20	20	7	7	12	5	4	8	6	14	6	9	8	5	7	5	10	8	14	11	4	8	11	7	8
2058	8	8.0	1	13	4	13	10	12	10	8	9	5	7	9	8	6	8	7	11	7	7	10	9	8	7	4	1	13
2059	10	9.2	2	19	6	9	7	15	12	7	10	11	11	16	8	6	5	3	15	11	6	3	10	11	10	19	2	8
2060	7	7.0	1	14	14	5	10	11	6	5	1	5	7	3	12	4	10	5	5	8	10	7	5	3	9	10	7	6
2061	9	8.7	3	15	14	4	10	5	13	12	7	11	12	6	6	6	8	7	10	15	6	10	14	7	4	9	3	9
2062	8	7.8	2	13	10	8	12	10	9	9	8	8	8	7	9	2	3	5	13	7	8	4	13	11	5	4	5	8
2063	8	7.3	2	14	7	10	2	14	6	10	4	9	5	5	8	4	8	6	10	8	6	10	4	4	7	10	10	8
2064	9	8.8	4	15	6	9	5	11	10	14	12	6	15	4	5	10	9	6	9	9	4	7	11	7	13	8	13	7
2065	8	7.5	2	13	6	7	8	7	9	9	8	5	12	6	7	7	8	3	5	8	4	10	12	8	8	2	9	13
2066	8	8.1	3	13	6	7	9	12	7	8	11	5	7	4	12	10	12	5	11	10	3	7	9	4	13	8	5	9
2067	7	7.0	2	12	2	7	10	5	8	7	5	5	8	7	5	4	9	6	6	10	11	12	6	6	6	7	7	8
2068	9	9.6	5	19	8	13	12	12	6	8	7	10	9	13	15	8	7	13	6	9	10	5	10	9	19	6	5	10
2069	9	9.3	3	17	13	3	9	9	10	6	16	6	13	9	17	13	11	10	10	4	6	10	9	9	13	7	5	5
2070	8	9.1	3	17	15	6	5	12	10	7	16	8	17	8	7	9	8	14	3	4	8	6	10	13	17	4	8	4
2071	9	8.4	2	14	13	12	2	7	11	11	12	6	12	3	5	9	9	2	7	9	6	12	14	3	10	9	13	5
2072	9	8.5	4	15	15	6	9	9	11	9	15	13	5	4	6	6	7	4	5	12	9	9	11	10	6	11	6	6
2073	8	8.3	5	17	11	5	12	5	10	8	11	6	10	9	10	6	5	6	5	9	6	6	15	8	17	7	7	6
2074	8	8.5	0	20	7	9	10	7	9	9	9	8	15	8	7	4	6	10	8	10	5	20	7	0	8	12	9	8
2075	7	7.4	1	13	11	11	11	5	13	12	8	6	13	1	12	5	8	4	4	8	5	7	9	3	5	7	4	5
2076	7	7.9	2	16	13	6	16	9	10	9	7	12	9	3	6	3	7	3	7	12	12	10	6	6	8	2	6	7
2077	6	6.9	1	13	13	5	3	9	11	4	6	9	9	9	8	5	6	5	1	9	6	6	6	5	10	10	5	5
2078	8	8.9	2	19	10	2	9	8	16	9	6	2	15	7	17	7	9	5	7	19	7	7	10	7	3	14	6	12
2079	7	8.1	3	13	9	13	11	6	11	13	5	4	11	6	9	6	7	13	3	7	7	4	10	12	6	4	4	13
2080	7	8.1	3	14	12	5	11	10	6	3	7	8	5	14	9	7	7	4	6	12	13	6	14	4	7	9	7	8
2081	9	7.6	1	16	13	7	9	11	9	9	9	6	10	10	6	2	7	1	11	6	3	8	16	10	4	4	9	2
2082	8	8.9	4	18	16	4	9	18	16	7	8	7	8	6	5	7	4	13	9	9	6	13	11	7	4	12	7	7
2083	9	8.6	1	17	14	8	9	15	13	6	5	9	9	12	6	1	2	17	11	5	9	2	10	9	10	9	5	11
2084	9	9.2	3	18	7	5	9	12	9	7	13	10	4	14	5	3	15	6	7	9	13	9	18	8	13	13	6	5
2085	8	8.4	3	15	9	3	10	8	7	6	8	7	8	12	11	6	11	8	5	6	11	6	15	10	9	14	7	5
2086	8	7.3	3	11	8	8	8	6	4	10	5	11	10	10	9	5	11	7	10	5	6	4	10	3	4	6	5	10
2087	10	8.8	2	14	10	11	13	9	9	3	12	10	10	11	10	2	7	4	8	5	10	7	9	7	10	14	9	11
2088	9	9.0	3	18	14	18	10	14	5	8	6	14	9	14	7	6	10	7	7	11	10	4	9	3	5	10	7	8
2089	7	7.2	1	14	4	1	6	14	4	7	3	5	9	8	12	5	6	8	6	8	8	9	6	13	7	6	6	12
2090	8	8.4	2	14	14	6	12	6	8	6	4	12	14	10	7	7	9	7	8	12	13	8	9	2	3	8	5	11
2091	8	7.6	1	14	10	8	7	11	12	5	7	7	5	14	9	4	8	5	12	7	9	11	6	3	9	5	1	8
2092	9	9.7	5	16	11	9	6	7	13	7	9	5	11	16	9	7	6	8	13	10	10	5	16	7	12	15	8	13
2093	9	8.6	4	17	17	5	14	11	8	6	9	11	9	6	7	6	10	7	4	4	10	7	9	12	13	13	4	4
2094	8	8.3	1	19	8	8	7	6	15	10	4	8	11	10	7	7	6	8	9	6	12	7	19	5	4	10	1	10
2095	9	9.4	1	17	9	17	11	1	14	15	6	13	4	8	9	10	14	6	8	10	7	6	8	9	12	10	9	9
2096	7	8.2	3	16	7	14	5	16	9	4	13	6	15	7	8	5	5	7	5	6	8	3	10	9	10	7	6	12
2097	9	8.0	3	15	10	8	15	9	9	13	3	4	13	6	3	3	7	6	9	9	7	10	9	11	7	6	7	9
2098	10	9.4	4	17	11	4	7	13	6	12	6	8	11	11	4	6	15	6	11	14	7	9	17	11	7	13	6	11
2099	9	9.0	4	14	7	6	13	14	10	11	9	9	6	8	8	4	4	4	9	8	14	13	14	14	13	7	6	6
2100	8	8.5	2	16	14	4	10	11	11	16	10		8	16	7	5	7	5	2	6	10	6	11	2	8	8	6	13

RCP8.5

Day with Daily Precip (mm) ... **>25**

Year	Median	Mean	Min	Max	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
					std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
2011	0	0.4	0	3	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	3	0	0	1	1	0
2012	0	0.6	0	4	0	0	0	0	2	1	1	1	0	2	2	1	0	1	0	0	0	0	0	0	0	4	0	0
2013	1	0.6	0	2	2	0	0	0	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	1	1	1	2	0
2014	1	0.7	0	3	0	0	1	0	0	0	0	1	1	0	0	1	1	1	2	0	1	3	1	1	0	0	0	2
2015	0	0.5	0	3	3	0	1	0	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	1	1	0	0	0
2016	0	0.5	0	3	1	1	0	0	0	0	3	1	0	0	1	1	0	2	0	0	0	1	0	0	1	0	0	0
2017	0	0.7	0	5	2	1	0	0	1	0	0	0	1	0	2	0	0	0	5	1	1	0	1	1	0	1	0	0
2018	0	0.4	0	2	0	0	0	0	1	0	0	0	0	1	1	0	0	1	0	0	1	0	0	2	0	0	2	0
2019	0	0.2	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0
2020	1	0.7	0	3	0	0	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	2	1	0	2	3	0
2021	0	0.5	0	2	0	0	0	0	1	2	0	0	1	2	0	1	0	0	0	0	1	1	1	1	0	1	0	0
2022	0	0.6	0	3	0	0	0	1	2	0	0	3	0	2	0	0	1	0	0	0	0	0	2	0	0	1	2	1
2023	0	0.8	0	3	3	2	1	0	0	0	0	2	1	2	0	0	0	1	1	0	0	0	3	1	2	0	0	0
2024	0	0.3	0	2	0	0	0	0	2	0	0	2	0	0	0	0	0	1	0	0	0	2	0	1	0	0	0	0
2025	0	0.5	0	3	0	0	1	2	0	0	1	0	2	1	0	0	1	0	0	0	0	0	1	0	3	0	1	0
2026	0	0.4	0	2	0	0	1	0	1	0	0	1	0	0	2	0	1	0	0	0	1	0	2	1	0	0	0	0
2027	0	0.5	0	2	0	0	1	0	0	1	1	0	0	2	1	1	0	0	0	0	1	0	1	0	1	1	0	2
2028	0	0.4	0	4	0	0	4	0	2	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
2029	1	0.7	0	2	2	2	2	1	1	1	1	1	0	1	0	0	2	0	0	0	1	0	0	0	0	1	0	1
2030	1	1.0	0	3	0	0	0	2	1	1	0	3	1	0	0	2	1	2	0	0	1	1	1	1	1	3	2	1
2031	1	0.8	0	3	2	0	0	3	0	2	1	0	0	0	0	3	0	0	1	0	1	1	0	0	1	1	1	1
2032	0	0.5	0	2	2	1	0	1	0	0	0	1	1	0	0	0	1	0	0	0	1	0	1	0	1	0	0	1
2033	0	0.5	0	2	0	1	0	1	1	2	0	0	1	0	1	0	0	1	1	0	0	1	0	1	1	0	0	0
2034	1	0.6	0	2	0	2	1	2	1	0	0	0	0	0	1	0	1	1	1	0	0	0	1	1	0	1	1	1
2035	0	0.5	0	2	0	2	0	0	0	2	0	1	0	1	0	2	0	0	0	0	1	0	1	0	0	1	0	0
2036	1	0.7	0	3	0	1	0	0	1	3	1	0	0	1	0	0	1	0	0	1	2	3	0	1	1	0	1	0
2037	0	0.7	0	3	2	1	0	0	0	2	0	1	2	1	0	0	0	0	0	0	2	1	1	0	1	3	0	0

2038	0	0.6	0	3	3	0	1	0	0	2	0	1	0	1	1	0	0	2	0	0	2	0	0	1	1	0	0	0
2039	0	0.5	0	3	0	0	1	0	1	1	0	0	3	1	0	0	1	0	0	0	0	0	0	0	1	0	0	2
2040	0	0.6	0	3	0	2	3	0	1	1	0	2	0	2	0	0	0	0	1	0	0	0	0	2	0	1	0	0
2041	1	0.7	0	3	1	0	1	0	0	0	1	3	0	1	2	0	1	1	0	0	1	1	0	1	0	1	1	0
2042	1	0.7	0	3	0	1	0	1	1	0	1	1	1	2	1	0	0	0	0	3	0	0	0	2	1	2	0	0
2043	0	1.0	0	3	0	2	1	0	3	0	0	2	3	2	0	0	0	0	0	2	0	0	3	3	3	1	0	0
2044	0	0.5	0	3	0	1	3	0	1	1	1	1	0	2	0	0	0	0	0	0	0	0	1	0	1	1	0	0
2045	0	0.6	0	2	0	1	0	0	2	1	1	1	1	0	1	0	1	0	0	0	0	1	0	2	0	2	0	0
2046	0	0.5	0	2	1	1	0	0	1	0	0	2	1	0	1	0	1	0	0	0	0	1	1	0	0	1	1	0
2047	0	0.7	0	2	0	0	0	1	0	1	0	1	2	2	2	0	0	2	0	1	1	0	1	0	0	0	0	2
2048	1	1.0	0	3	0	1	1	2	1	2	1	1	0	3	0	1	1	2	0	0	0	0	2	1	2	0	0	2
2049	1	0.8	0	3	0	0	1	0	3	1	0	2	0	1	1	1	0	1	0	0	2	1	2	0	1	0	1	0
2050	0	0.7	0	3	2	0	1	0	1	0	0	1	0	3	2	0	1	2	0	0	0	0	0	0	0	2	0	1
2051	0	0.5	0	2	1	0	0	0	2	0	2	1	0	1	1	0	0	0	0	1	0	0	1	1	1	0	0	0
2052	0	0.5	0	2	1	0	0	1	1	0	0	0	1	2	0	0	0	0	0	1	1	1	1	0	2	1	0	0
2053	1	0.8	0	3	1	1	1	0	0	0	0	1	0	2	0	1	2	1	0	0	2	0	0	1	1	3	0	1
2054	1	1.0	0	2	2	2	1	0	0	1	0	2	1	1	1	0	0	1	0	0	1	1	1	1	2	1	2	2
2055	0	0.4	0	2	0	0	0	2	0	0	1	1	0	0	2	0	2	0	0	0	0	2	0	0	0	0	0	0
2056	0	0.9	0	6	6	1	0	0	0	0	0	2	0	1	3	0	1	0	0	0	0	1	2	2	0	0	0	2
2057	1	0.7	0	2	1	0	0	1	0	0	1	0	0	0	1	0	0	2	1	1	2	0	2	1	1	1	0	1
2058	1	0.6	0	2	0	2	1	1	1	0	1	0	2	0	0	0	1	0	2	1	0	0	0	1	0	1	0	1
2059	1	0.8	0	3	2	1	0	1	1	1	1	1	0	3	3	0	0	0	1	0	1	0	0	0	0	3	0	0
2060	0	0.7	0	4	3	1	4	2	0	1	0	0	0	0	3	0	1	0	0	0	0	0	0	0	1	0	0	0
2061	0	0.7	0	2	2	0	1	0	2	0	0	2	2	1	0	0	1	0	0	1	0	0	1	1	0	2	0	0
2062	1	0.7	0	3	0	0	0	0	0	1	1	0	1	3	1	0	1	0	2	1	2	1	1	0	1	0	0	0
2063	0	0.5	0	2	0	1	0	0	2	1	0	0	0	0	0	0	1	1	1	0	1	1	0	0	0	0	0	2
2064	1	0.8	0	3	1	1	0	0	1	1	3	1	3	1	0	0	0	0	2	0	1	0	0	2	1	0	0	0
2065	0	0.7	0	3	1	2	1	0	1	0	0	0	2	0	0	1	3	0	0	3	0	0	1	0	1	0	1	0
2066	1	0.6	0	2	0	0	1	1	0	0	2	1	1	1	1	1	2	1	1	0	0	1	0	0	0	0	0	1
2067	1	0.9	0	2	0	0	2	1	0	0	0	1	0	1	0	1	1	0	1	2	1	2	1	2	1	1	2	2
2068	1	0.8	0	3	1	1	0	0	1	1	0	1	0	3	3	2	0	2	1	0	0	0	0	0	2	1	0	0
2069	1	0.9	0	3	1	0	0	2	3	1	3	0	0	1	1	1	1	2	0	0	0	0	2	0	3	0	0	1
2070	0	0.6	0	3	1	0	0	1	0	3	0	0	0	0	0	1	0	1	0	0	0	1	2	1	2	1	1	0
2071	1	0.6	0	2	1	1	0	1	2	1	0	0	1	0	1	1	2	0	0	0	0	0	0	1	0	1	0	1
2072	1	0.9	0	3	2	1	0	2	1	0	2	1	0	1	0	0	1	1	0	3	2	0	3	0	0	0	0	2
2073	0	0.5	0	2	0	2	0	0	0	1	0	2	0	0	0	0	1	0	1	1	0	2	2	0	0	0	0	0
2074	1	0.9	0	3	0	0	1	2	2	1	0	1	3	0	0	0	0	1	2	0	1	1	1	0	0	2	0	3
2075	1	1.2	0	4	3	2	0	0	4	4	0	1	1	0	4	0	1	0	0	3	1	0	1	0	0	1	1	1
2076	0	0.8	0	5	1	0	1	2	3	1	0	5	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
2077	1	0.6	0	2	1	0	0	2	2	0	1	0	0	2	0	0	0	0	0	1	1	1	1	0	1	1	0	1
2078	0	0.7	0	4	0	0	2	0	4	2	1	1	0	0	0	0	0	0	1	2	0	0	1	1	0	2	0	0
2079	1	1.0	0	4	0	4	2	1	0	2	0	1	2	0	1	0	0	0	0	2	2	0	3	1	0	0	0	2
2080	0	0.6	0	2	2	0	1	1	0	1	0	2	0	1	0	0	0	0	0	1	2	0	2	0	0	1	0	1
2081	0	0.7	0	3	3	1	3	0	1	0	1	0	1	0	0	0	2	0	0	1	0	1	1	1	0	0	0	0
2082	1	0.9	0	3	2	3	1	2	1	0	0	1	0	1	0	0	0	0	2	0	0	3	0	3	1	0	1	0
2083	0	0.5	0	2	0	0	0	0	2	1	1	1	1	2	1	0	0	1	0	0	0	0	1	0	1	0	0	1
2084	1	0.6	0	2	1	0	2	1	1	1	0	0	1	2	0	0	0	1	0	2	1	0	0	0	1	1	0	0
2085	0	0.6	0	2	1	0	1	0	0	2	2	0	1	2	1	0	0	0	0	2	2	0	1	0	0	0	0	0
2086	1	0.8	0	2	2	0	2	0	0	2	0	0	1	2	2	0	1	1	1	0	0	0	2	0	1	1	1	1
2087	1	0.7	0	3	1	1	1	1	0	0	3	1	0	1	0	0	1	0	0	0	0	0	1	1	0	2	0	2
2088	1	1.0	0	5	5	2	0	0	1	1	0	2	1	2	0	0	4	0	1	0	1	0	1	0	0	1	1	1
2089	1	0.7	0	2	0	0	0	1	1	0	0	0	1	1	0	1	2	2	1	1	2	0	0	2	0	2	0	0
2090	0	0.6	0	2	1	0	1	0	2	1	0	1	2	0	0	0	2	0	0	1	1	0	0	0	0	1	0	1
2091	0	0.3	0	1	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1
2092	0	0.6	0	5	3	0	5	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1
2093	0	0.5	0	2	1	0	2	0	0	0	1	2	1	1	0	0	1	0	0	1	0	0	1	0	0	2	0	0
2094	1	0.5	0	2	1	0	2	0	0	1	0	0	1	1	0	0	1	1	1	1	1	0	1	1	0	0	0	0
2095	1	0.9	0	3	1	1	0	0	3	1	0	1	1	1	0	3	1	1	0	1	0	0	3	0	1	1	2	0
2096	1	0.8	0	3	2	0	1	1	0	0	0	0	1	3	2	0	1	0	0	1	0	0	1	2	2	2	0	1
2097	1	0.9	0	3	1	0	2	3	2	3	0	1	2	0	0	0	0	0	1	1	0	0	1	2	0	0	0	2
2098	0	0.5	0	3	0	0	0	1	1	1	0	0	0	1	0	0	1	0	0	2	1	0	3	1	0	1	0	0
2099	0	0.5	0	3	1	1	0	1	3	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	0
2100	0	0.6	0	2	2	0	1	1	2	1	0		0	1	0	0	0	1	0	0	1	1	0	0	0	1	0	1

RCP4.5

Total Monthly Precip (mm)

Year	Month	Median	Mean	Min	Max	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
						std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
2011	1	21.8	23.2	7.1	43.6	37.7	19.4	23.7	22.6	35.1	10.0	23.0	14.4	14.3	27.3	17.1	31.3	20.5	39.9	10.2	24.1	20.1	43.6	16.0	32.4	29.5	17.3	7.1	20.9
2011	2	20.0	21.5	0.6	51.2	6.4	8.7	20.4	19.5	15.3	23.6	19.3	14.3	22.2	51.2	8.3	16.4	40.9	41.7	24.2	7.9	13.0	13.9	28.9	0.6	34.6	36.8	23.4	24.9
2011	3	20.5	20.0	6.9	44.1	21.4	6.9	44.1	8.8	28.9	36.2	13.0	29.1	21.1	20.8	8.6	19.4	16.2	24.2	9.4	18.7	13.5	20.9	21.4	13.8	20.2	26.4	22.5	14.2
2011	4	21.6	23.3	8.1	50.6	36.8	41.8	10.7	28.9	22.0	25.9	15.3	11.3	12.7	29.8	35.9	32.2	16.9	8.1	15.7	14.6	9.7	31.5	8.6	40.2	50.6	21.1	13.4	26.2
2011	5	45.4	45.3	1.2	89.1	51.6	64.7	36.9	19.3	1.2	46.7	42.1	29.5	61.6	32.4	89.1	51.2	78.4	25.5	56.2	25.5	26.7	46.7	64.6	14.5	85.0	35.5	44.2	58.8
2011	6	43.3	48.1	8.8	118.2	72.8	26.3	46.7	31.2	8.8	41.6	58.6	45.6	100.5	104.5	34.9	47.1	47.2	18.5	118.2	40.4	31.5	74.6	19.3	26.9	45.1	23.5	37.9	52.5
2011	7	81.9	77.8	17.1	123.3	55.1	120.9	17.1	93.4	85.2	91.8	121.8	70.4	120.2	36.9	40.5	113.5	84.7	48.0	123.3	39.7	75.1	56.2	63.6	116.4	79.3	35.1	84.5	95.0
2011	8	64.9	61.6	11.6	94.3	55.8	67.5	63.2	66.6	73.4	48.4	11.6	62.8	40.2	86.9	20.0	94.3	45.3	89.9	83.1	51.3	93.5	71.2	93.0	66.8	27.4	32.6	89.7	43.7
2011	9	48.5	56.7	23.5	101.0	48.3	101.0	32.9	42.1	99.2	85.5	23.5	35.2	47.8	39.1	81.6	62.0	56.9	44.9	89.9	52.7	39.3	78.8	55.4	47.6	34.6	48.8	67.1	46.8
2011	10	33.1	31.5	10.5	58.8	37.5	32.9	58.8	30.2	10.5	53.8	18.7	12.5	21.9	37.5	38.5	40.5	27.3	21.8	19.6	20.9	48.3	13.7	40.6	47.9	36.8	33.3	34.8	18.8
2011	11	33.7	37.0	13.0	85.1	27.7	27.5	49.6	29.2	33.9	85.1	48.9	37.8	21.8	17.6	13.0	34.4	17.7	41.9	30.8	33.5	62.7	30.1	37.5	36.3	16.2	26.5	70.7	58.1
2011	12	24.2	24.5	13.7	45.0	34.1	24.7	24.4	24.1	36.3	30.6	27.9	22.5	15.6	17.9	30.1	21.6	16.6	23.8	33.6	17.4	25.1	27.3	13.7	24.5	14.6	19.4	45.0	16.9
2012	1	25.8	26.2	14.9	47.2	31.3	15.5	20.5	15.6	36.5	19.4	19.3	26.2	33.5	25.4	14.9	15.6	31.8	17.6	29.3	21.9	33.8	47.2	16.0	19.6	43.3	27.8	39.6	26.7
2012	2	21.9	22.0	8.1	40.5	26.4	26.9	21.4	29.7	12.3	22.7	40.5	35.9	12.3	24.0	19.2	19.9	20.4	8.8	40.4	35.7	19.1	8.4	8.7	24.6	11.7	28.7	22.5	8.1
2012	3	23.8	23.3	4.5	43.9	8.9	23.3	14.2	29.6	27.4	31.2	15.1	24.8	4.5	27.0	15.6	33.9	31.7	12.5	18.5	43.9	20.4	36.5	24.2	10.7	27.1	18.2	37.8	21.7
2012	4	18.7	18.7	3.8	35.4	10.6	35.4	23.1	3.8	21.5	24.1	10.4	17.3	22.5	22.4	10.8	22.9	11.7	33.9	10.4	17.2	18.6	31.7	25.7	11.6	16.9	18.7	20.8	6.6
2012	5	32.5	35.7	8.8	78.5	29.0	8.8	12.2	21.7	46.2	31.9	38.1	48.0	22.1	62.4	11.9	73.9	14.8	29.2	44.8	47.4	40.6	20.9	24.0	25.9	78.5	47.5	44.7	33.1
2012	6	53.1	56.6	19.0	117.5	38.4	69.4	82.4	22.8	54.0	49.0	41.0	29.7	75.5	48.4	67.8	87.6	78.1	24.7	96.5	20.2	19.0	87.0	54.0	52.1	117.5	37.3	68.6	36.8
2012	7	85.4	83.1	28.8	143.8	39.4	118.0	114.2	88.3	130.7	93.0	79.4	121.9	89.2	108.8	59.2	88.9	53.5	63.8	143.8	43.6	87.6	70.1	28.8	83.2	58.4	65.2	108.5	57.6
2012	8	62.9	69.6	12.1	199.1	29.8	83.3	53.1	61.3	82.9	83.7	100.5	33.1	44.2	32.1	34.8	72.9	89.9	123.4	145.1	12.1	23.5	78.5	36.2	53.7	43.9	199.1	88.1	64.6
2012	9	57.2	56.4	10.0	98.7	76.6	49.2	32.7	34.7	72.9	54.2	64.9	43.4	28.9	47.6	62.6	10.0	42.3	38.2	60.2	87.4	34.0	68.4	64.5	81.8	41.7	76.6	98.7	81.2
2012	10	29.8	30.2	10.7	58.0	27.2	37.4	38.8	24.1	19.4	42.7	21.9	58.0	15.6	18.2	31.4	38.4	41.1	12.5	45.1	54.0	14.3	18.9	28.5	31.2	40.6	23.1	32.1	10.7
2012	11	28.1	27.7	8.6	47.5	10.8	14.6	19.1	24.4	29.0	47.5	43.4	28.5	26.4	43.2	24.6	25.8	30.5	31.5	29.6	8.6	31.1	30.7	20.2	25.8	33.2	36.0	27.6	23.4
2012	12	23.9	25.6	9.7	50.9	50.9	17.4	24.0	46.4	26.4	21.1	38.4	31.8	20.3	13.6	11.7	21.7	29.4	23.0	25.6	28.3	32.5	23.9	20.1	36.3	9.7	14.3	24.3	23.5
2013	1	24.6	24.0	4.7	39.7	28.2	20.4	26.7	10.2	28.1	31.0	23.5	32.8	4.7	34.6	15.6	28.1	11.7	39.7	26.1	20.4	25.0	22.3	16.7	28.5	24.1	21.1	24.2	31.4
2013	2	17.3	20.0	6.5	44.5	32.1	22.9	6.5	11.7	26.7	21.3	11.1	44.5	31.8	39.6	41.1	8.6	17.6	16.2	13.7	17.0	23.0	18.6	13.8	10.1	16.5	7.3	21.5	6.7
2013	3	14.4	18.1	4.5	44.6	21.7	13.0	18.4	12.6	10.3	39.4	12.9	12.3	10.3	16.7	16.1	9.8	39.9	18.7	21.2	44.6	12.8	32.7	15.7	4.5	9.2	17.6	12.6	11.2
2013	4	16.5	23.4	9.4	48.0	12.9	38.6	32.3	13.9	29.2	9.4	15.8	10.8	15.4	17.1	37.6	48.0	9.5	22.7	12.6	37.2	45.8	12.5	11.7	46.7	22.8	13.2	12.3	32.4
2013	5	35.4	39.8	15.9	78.9	75.5	17.2	30.7	36.7	32.3	41.8	56.3	17.8	25.0	16.4	53.8	78.9	34.1	20.4	24.5	50.9	58.9	26.6	15.9	38.4	68.6	32.9	36.7	64.0
2013	6	58.6	56.5	18.3	110.9	47.3	33.6	39.4	60.4	25.1	18.3	66.1	77.9	67.7	56.8	24.1	61.4	56.2	28.1	60.8	96.1	96.8	93.8	73.2	39.6	110.9	37.2	21.0	63.8
2013	7	78.3	79.9	30.3	155.6	32.9	155.6	91.5	60.0	105.9	103.3	59.5	64.1	72.6	43.8	86.1	83.9	40.4	117.5	45.7	144.7	104.3	92.6	118.7	110.7	62.4	30.3	32.9	59.0
2013	8	65.3	66.6	24.1	118.6	24.1	67.9	75.5	60.5	92.3	70.2	91.5	41.0	67.5	91.4	114.1	60.9	46.4	48.3	90.3	69.3	118.6	45.5	61.2	66.3	36.8	38.2	64.3	56.3
2013	9	57.7	57.5	11.2	103.4	55.6	57.1	42.7	75.5	48.0	77.4	81.4	11.2	95.2	77.8	56.8	45.7	42.3	65.4	103.4	38.0	58.4	30.0	22.5	77.7	67.9	24.9	60.3	65.1
2013	10	27.9	32.2	11.6	57.5	21.0	11.6	48.6	27.8	32.5	57.5	34.0	40.6	21.3	28.0	27.7	23.2	18.1	26.4	18.2	54.0	13.7	21.9	37.3	50.2	27.7	47.3	49.7	35.6
2013	11	28.0	28.9	9.5	52.4	39.4	23.7	42.8	28.2	27.8	23.6	25.5	30.6	44.7	52.4	9.5	30.4	24.4	29.1	27.4	39.1	19.6	18.6	29.3	17.6	19.1	31.8	26.9	32.8
2013	12	31.6	29.9	8.1	58.1	19.6	37.9	58.1	44.5	31.0	33.5	41.9	19.6	10.7	36.4	49.4	25.5	35.2	19.1	11.2	19.0	37.0	8.5	48.5	32.2	22.5	25.3	8.1	44.1
2014	1	21.0	22.4	7.2	46.1	15.6	18.8	23.8	33.3	34.4	23.2	24.1	32.2	7.2	32.2	18.0	21.1	21.0	24.0	18.0	9.5	16.8	46.1	18.4	20.3	12.5	24.4	25.6	18.0
2014	2	19.1	20.2	4.7	38.6	9.7	4.7	28.2	13.0	25.5	20.4	10.3	24.1	29.8	14.5	10.4	14.9	22.1	32.4	23.9	32.8	20.6	17.8	38.6	10.5	8.9	16.2	38.4	17.1
2014	3	20.6	18.4	3.1	33.6	26.8	16.7	21.9	22.3	19.8	9.0	12.5	12.7	24.3	33.6	13.7	27.8	3.1	22.1	7.6	12.2	21.4	5.5	28.8	10.2	21.8	25.9	19.1	21.8
2014	4	23.8	22.9	2.3	47.5	13.3	23.7	26.3	12.0	27.2	2.3	41.5	17.3	46.8	23.8	32.6	35.5	25.2	47.5	24.8	33.3	19.2	28.4	18.5	9.9	8.6	7.4	17.0	6.8
2014	5	33.3	34.2	4.4	93.1	9.8	15.1	13.6	25.6	39.1	49.1	50.7	93.1	20.2	4.4	55.4	25.6	12.7	59.1	37.2	48.6	29.4	18.8	17.4	47.6	43.9	38.8	22.1	43.8
2014	6	65.3	62.4	9.7	114.3	73.6	94.6	63.0	60.7	44.4	21.9	83.9	97.2	112.0	29.0	39.5	28.3	77.0	92.5	24.3	82.9	67.6	48.6	69.7	9.7	114.3	58.3	11.1	92.5
2014	7	72.2	74.4	27.0	132.4	69.5	98.7	47.3	132.4	98.9	49.2	62.2	47.8	71.0	50.7	122.5	43.1	73.4	27.0	65.7	31.0	100.5	95.8	85.0	100.2	57.6	102.2	75.2	78.2
2014	8	54.2	65.9	13.9	140.8	34.5	37.0	116.6	52.7	96.9	104.4	42.8	77.1	140.8	43.7	33.7	66.0	70.2	53.4	24.6	90.6	70.7	55.1	37.2	13.9	125.2	31.8	110.1	52.5
2014	9	54.6	54.1	10.1	101.2	98.8	60.7	27.1	26.1	43.9	74.2	86.4	52.8	58.5	87.5	56.4	60.1	61.6	40.1	10.1	57.7	20.2	49.7	44.3	51.4	57.4	27.0	101.2	44.9
2014	10	35.3	36.4	8.5	70.6	41.6	31.8	34.6	15.4	38.4	63.6	43.2	31.5	22.4	24.9	8.5	70.6	35.0	40.9	35.5	31.7	35.4	28.4	52.5	35.2	35.4	36.7	27.6	51.8
2014	11	31.4	30.3	8.7	47.6	32.9	29.2	34.3	18.4	19.3	36.1	33.2	34.2	28.2	22.1	47.6	35.4	27.7	39.0	38.9	31.1	18.0	36.8	39.1	31.1	29.5	31.8	24.9	8.7
2014	12	26.8	28.1	10.6	47.4	27.6	37.2	39.3	20.8	19.0	47.2	34.6	10.6	23.9	40.3	39.9	11.1	25.9	14.0	33.6	16.2	24.9	21.0	41.2	33.3	12.6	47.4	28.4	25.2
2015	1	28.3	29.2	9.2	68.6	27.4	31.3	68.6	44.5	30.8	33.3	9.2	19.4	62.3	23.9	21.4	28.0	30.1	28.6	13.3	13.5	21.3	40.1	31.3	35.8	32.8	9.8	24.1	20.0
2015	2	18.1	19.9	8.8	49.3	14.3	31.7	24.1	26.4	22.4	26.7	8.8	49.3	31.5	14.9	13.9	9.6	17.4	14.5	10.2	16.6	11.2	10.1	29.9	26.1	9.0	19.8	18.8	20.5
2015	3	17.7	16.9	2.3	32.6	20.1	32.6	20.9	30.4	22.6	18.0	12.6	11.2	14.8	4.2	9.3	17.4	3.8	19.6	27.8	18.0	10.9	2.3	11.4	23.5	15.4	14.5	24.8	19.4
2015	4	15.4	17.7	1.0	45.6	16.5	13.9	21.4	25.6	21.2	15.7	14.8	4.7	15.1	12.9	8.7	15.0	27.5	35.5	29.7	12.8	17.5	45.6	3.2	20.4	8.8	8.5	1.0	29.6
2015	5	36.1	36.4	11.6	86.6	31.6	24.6	14.4	51.2	11.6	20.4	23.9	40.1	12.1	36.9	41.3	37.3	35.4	41.2	62.2	41.4	27.5	62.1	56.7	86.6	14.0	34.2	38.8	27.3
2015	6	56.9	59.1	18.2	119.8	63.1	70.5	18.2	49.6	58.3	38.7	61.7	45.8	55.5	54.5	48.4	63.5	74.6	46.9	84.8	80.3	30.3	85.7	119.8	32.9	42.9	65.0	55.0	72.5
2015	7	79.2	79.3	28.2	157.9	94.8	149.2	28.7	28.2	78.5	56.5	92.4	50.2	81.9	80.0	100.9	59.0	63.1	53.8	157.9	34.5	36.8	99.7	92.0	66.6	119.9	61.3	80.5	137.9
2015	8	60.2	68.5	24.0	145.1	119.2	126.5	43.2	40.5	58.8	92.4	79.7	58.4	24.0	145.1	42.4	35.8	74.8	57.9	42.4	53.7	72.1	86.6	76.0	79.5	46.3	53.8	72.7	61.6
2015	9	53.7	53.6	25.7	110.9	70.8	56.8	39.1	55.3	57.1	68.7	66.1	110.9	79.1	25.7	33.2	48.0	69.5	29.2	35.3	37.7	44.8	28.1	64.1	75.3	28.3	43.8	66.7	52.0
2015	10	26.6	28.3	6.6	59.7	18.8	25.5	34.6	22.9	21.6	26.6	18.6	25.6	29.9	59.7	32.7	6.6	34.7	26.5	29.3	35.9	33.5	53.5	21.2	14.1	23.3	31.9	30.1	22.2
2015	11	32.3	32.9	17.0	61.9	29.3	32.3	37.1	41.1	19.1	32.4	33.9	61.9	21.0	32.3	17.0	22.8	34.1	28.7	26.2	22.2	48.6	30.8	44.2	34.2	22.0	36.4	34.7	47.4
2015	12	23.1	24.9	9.3	44.2	9.3	27.0	32.6	20.7	35.0	25.9	41.9	20.4	34.5	22.5	44.2	23.5	18.5	17.6	22.1	39.4	20.4	13.0	13.5	22.8	25.2	24.6	23.7	20.4
2016	1	23.9	23.2	8.1	37.6	30.6	14.3	19.9	11.2	14.5	26.9	17.2	33.4	30.5	27.0	30.2	29.2	8.1	21.2	21.9	14.8	12.3	37.6	26.9	21.8	35.7	27.0	18.5	25.9
2016	2	21.8	23.1	6.7	49.0	20.4	33.4	13.4	16.5	21.9	24.9	17.0	34.9	14.6	49.0	26.5	6.7	37.2	27.2	20.3	32.0	33.5	14.2	25.5	14.3	10.9	21.8	22.4	17.0
2016	3	17.5	18.4	7.4	44.7	44.7	23.2	23.2	11.3	17.4	13.0	13.4	26.9	34.0	21.4	17.6	9.1	7.4	14.9	20.8	12.2	13.1	14.5	12.0	8.1	21.3	19.2	18.4	22.9
2016	4	17.1	19.5	0.5	49.7	17.3	16.7	32.8	6.4	15.6	23.4	23.9	26.1	29.3	14.3	27.5	18.0	15.6	19.3	11.3	0.5	16.9	7.6	35.4	10.0	23.4	14.2	49.7	13.6
2016	5	35.1	31.1	10.2	65.0	49.4	37.1	22.4	39.6	23.7	42.7	20.7	10.2	36.8	34.0	39.4	37.3	10.4	13.5	47.1	65.0	16.5	46.8	43.7	13.9	36.2	20.4	14.7	24.6
2016	6	61.8	60.2	7.8	130.5	75.2	57.5	31.7	68.8	71.8	41.1	24.9	130.5	64.6	87.0	42.5	63.2	94.1	37.6	28.2	112.0	54.7	66.9	7.8	32.9	65.1	91.6	34.7	60.4
2016	7	76.7	83.6	43.8	155.3	108.2	116.1	155.3	77.0	75.3	45.7	72.3	43.8	60.2	53.2	49.8	74.5	92.8	83.9	81.0	111.9	76.3	60.7	96.4	72.9	73.8	122.8	108.2	94.4
2016	8	56.2	65.2	19.5	181.3	43.1	40.4	43.0	59.5	56.9	67.6	68.0	42.7	66.5	60.8	119.3	124.4	31.7	34.0	19.5	33.3	26.4	181.3	55.5	32.1	36.8	103.9	137.5	79.9
2016	9	56.9	63.8	12.2	137.7	49.7	35.0	51.0	12.2	137.7	58.9	69.8	108.5	67.2	55.0	113.5	51.8	43.9	33.7	54.0	87.8	44.5	58.9	73.6	131.1	19.4	45.2	66.9	60.8
2016	10	37.0	35.8	7.0	67.0	67.0	30.2	51.5	26.3	41.3	42.9	40.6	29.6	60.8	24.9	7.0	27.3	43.0	40.7	37.9	29.9	22.6	47.2	29.2	25.3	42.0	13.9	36.1	41.7
2016	11	33.9	32.0	7.7	64.3	33.8	25.2	34.0	32.7	20.6	39.3	38.5	51.5	27.3	35.3	23.7	38.6	38.9	35.6	7.7	64.3	22.3	42.6	37.1	44.1	24.2	19.8	14.4	16.8
2016	12	25.7	25.4	5.6	50.5	16.1	16.1	50.5	17.4	32.4	33.3	31.3	13.5	39.0	28.6	21.3	32.8	27.0	32.7	24.9	35.4	43.9	11.8	26.5	13.9	21.0	14.8	20.8	5.6
2017	1	20.8	20.9	5.4	45.1	8.4	16.1	5.4	14.5	22.4	32.3	11.6	19.3	28.3	10.2	15.2	24.5	11.6	27.7	21.3	42.2	27.6	21.3	17.0	45.1	10.8	28.3	20.3	21.3
2017	2	17.4	16.8	4.2	41.9	13.2	15.0	8.5	14.1	20.1	22.5	17.5	41.9	4.2	17.2	7.0	25.9	8.5	10.8	19.9	11.3	17.6	10.6	25.2	18.5	13.8	18.3	18.6	22.5
2017	3	16.8	19.8	7.4	46.8	9.1	11.5	33.3	17.1	35.2	7.4	11.2	14.8	12.9	21.0	12.1	31.8	24.5	9.4	17.5	8.1	7.6	28.3	11.9	24.7	29.7	16.6	46.8	32.2
2017	4	16.8	18.8	2.1	41.5	18.6	4.9	4.6	21.3	35.7	23.9	22.4	13.7	12.7	3.7	10.9	38.7	15.3	41.5	14.3	18.4	21.2	12.9	37.1	2.1	8.3	19.3	41.4	7.3
2017	5	33.0	39.6	8.8	87.4	87.4	33.2	25.3	11.0	37.1	59.4	86.9	28.5	26.8	36.9	61.4	59.1	8.8	34.8	9.3	56.6	17.3	9.6	73.3	80.6	23.6	32.7	26.4	25.4
2017	6	55.7	59.3	18.1	118.3	60.2	21.6	111.0	57.0	118.3	53.6	26.4	72.6	36.6	43.3	72.8	54.3	75.3	59.9	66.3	49.3	74.7	40.0	45.9	41.9	50.2	104.3	18.1	68.6
2017	7	74.0	74.4	13.3	147.6	57.9	83.4	55.4	13.3	76.6	43.7	86.7	64.6	31.0	143.8	55.4	45.6	110.9	72.7	43.3	82.5	147.6	96.0	75.4	121.9	60.5	112.6	28.0	77.6
2017	8	67.7	67.1	17.5	150.5	71.7	27.5	66.7	68.2	76.3	33.4	93.0	72.4	42.1	42.8	73.6	65.2	84.5	150.5	17.5	30.9	149.7	78.4	68.3	43.1	67.2	44.0	94.9	48.8
2017	9	59.9	59.0	4.8	134.1	43.6	134.1	87.6	61.7	71.0	58.2	68.5	69.9	27.0	4.8	74.3	39.5	32.4	40.8	80.9	88.3	39.2	71.3	83.2	92.4	31.2	33.8	26.8	54.9
2017	10	30.2	32.0	6.4	63.5	45.2	10.4	26.0	25.6	63.5	36.1	21.5	20.7	6.4	40.2	50.1	43.6	33.1	27.7	54.7	12.1	29.0	23.9	40.1	45.2	16.9	31.4	38.1	25.6
2017	11	32.8	33.2	12.9	59.6	59.6	41.7	39.1	44.4	19.3	34.3	48.3	16.7	12.9	39.5	42.2	16.0	31.2	35.6	30.2	28.6	30.1	25.4	35.7	45.7	26.5	45.3	20.7	26.8

2017	12	26.6	26.1	9.3	39.3	34.7	26.9	20.3	26.7	19.4	19.2	38.0	9.3	39.3	22.3	18.8	19.1	33.1	19.9	25.3	17.8	26.4	34.3	33.7	30.8	30.3	15.4	35.3	30.4
2018	1	21.9	22.7	7.0	47.5	29.8	33.2	18.6	26.2	15.1	20.0	12.4	47.5	23.4	30.2	14.1	22.9	11.7	35.9	20.9	32.3	30.1	9.9	9.9	33.5	7.0	23.8	17.0	20.0
2018	2	17.8	17.4	5.0	32.7	19.1	13.3	10.0	6.8	25.2	13.5	12.2	22.9	5.0	19.9	11.9	21.7	32.7	24.8	24.5	22.6	10.1	25.4	17.4	6.7	10.4	18.1	28.6	15.7
2018	3	14.9	17.3	1.8	53.0	10.1	14.4	11.2	42.6	27.6	11.4	6.1	27.1	13.0	19.2	13.4	18.3	4.6	3.7	16.8	25.3	16.1	14.9	8.0	1.8	14.9	15.4	53.0	25.9
2018	4	16.5	19.4	1.2	53.1	19.9	4.9	3.7	41.5	15.9	38.6	11.8	1.2	34.4	18.8	16.0	31.9	12.1	53.1	19.9	17.0	17.5	14.7	15.4	10.5	8.7	26.0	18.8	13.1
2018	5	38.1	40.8	4.9	77.7	25.5	67.4	26.4	26.5	53.6	56.4	37.2	4.9	38.9	73.1	13.0	77.7	52.4	27.3	40.3	23.4	6.2	32.0	72.0	73.6	14.4	60.8	15.9	60.9
2018	6	47.4	53.7	20.2	124.7	81.5	49.4	46.0	124.7	25.1	71.5	39.1	59.7	54.6	20.9	41.2	20.2	76.6	48.8	90.1	39.1	86.1	73.5	33.2	39.2	74.6	28.0	29.8	36.4
2018	7	69.4	76.8	29.0	146.2	61.7	118.9	37.2	109.5	87.3	83.8	48.3	94.7	46.9	91.9	46.5	112.9	29.0	58.2	71.5	65.7	81.3	63.7	56.1	103.9	67.3	56.8	146.2	104.7
2018	8	53.5	59.7	22.9	107.3	34.1	43.5	57.3	101.6	37.6	22.9	68.6	39.8	75.0	45.9	48.4	86.8	54.9	58.4	52.0	44.8	61.1	37.2	32.7	107.3	98.9	99.4	44.4	81.0
2018	9	57.2	58.1	11.8	89.1	11.8	37.9	69.8	22.3	57.0	60.7	77.6	56.9	64.4	84.9	71.2	53.6	69.0	77.6	89.1	58.1	48.1	57.4	47.6	87.8	46.0	44.9	43.6	56.7
2018	10	31.9	33.2	2.2	63.6	12.5	63.2	24.0	13.5	44.3	63.6	55.2	42.8	35.7	27.2	31.6	50.2	30.1	21.7	40.4	18.0	30.7	19.2	2.2	32.7	31.2	40.4	32.3	33.7
2018	11	28.5	30.6	11.3	53.3	26.7	28.7	11.3	53.3	27.0	26.9	31.4	40.7	16.8	41.3	24.2	21.3	38.9	28.3	28.3	34.3	17.6	49.4	24.6	29.1	30.6	32.4	22.6	48.1
2018	12	28.1	30.2	11.0	52.3	19.7	29.1	27.3	24.4	27.7	49.1	28.5	24.6	13.5	15.7	45.4	31.9	14.6	20.4	11.0	35.7	24.8	40.4	52.3	45.0	23.7	45.0	39.8	35.3
2019	1	28.8	26.5	8.1	44.1	14.6	29.7	18.0	44.1	8.1	28.6	15.0	35.8	35.9	33.6	16.1	37.0	9.2	30.7	32.4	24.6	15.1	37.0	25.0	25.6	15.3	40.9	34.9	29.0
2019	2	15.7	18.0	5.2	42.4	28.4	5.2	23.9	12.1	8.2	21.5	42.4	28.2	11.3	26.1	26.8	9.8	24.4	15.3	13.3	18.3	13.9	16.6	15.4	16.0	13.1	12.0	16.9	12.4
2019	3	17.6	18.2	1.9	47.8	28.1	13.0	7.7	14.7	11.5	2.9	21.4	23.7	4.2	6.1	8.8	47.8	17.0	18.1	23.2	13.6	20.7	18.9	28.7	27.5	42.5	18.6	15.0	1.9
2019	4	18.2	18.7	5.1	37.7	9.1	33.0	5.1	10.9	17.5	19.3	15.9	21.0	12.3	8.0	21.3	13.9	35.9	15.8	21.2	28.2	8.2	15.5	21.4	7.4	18.9	22.3	37.7	27.9
2019	5	25.3	35.1	9.6	94.9	30.6	19.9	9.6	57.4	23.2	26.8	49.5	52.3	56.3	14.1	14.0	20.0	94.9	11.6	32.9	88.8	16.1	12.2	52.2	40.7	23.9	55.3	16.6	23.8
2019	6	39.2	43.9	15.0	102.0	38.2	34.8	70.1	60.6	18.6	31.3	86.5	31.0	25.0	41.9	20.1	38.5	72.6	18.0	40.1	33.5	40.1	102.0	39.8	50.4	53.2	31.5	60.0	15.0
2019	7	66.5	64.6	7.2	120.6	65.3	110.8	77.3	72.8	37.5	82.3	45.1	7.2	60.9	22.9	61.7	120.6	55.9	16.8	66.7	69.3	58.6	98.2	96.7	69.1	72.6	66.4	27.3	89.1
2019	8	62.9	65.9	19.7	124.3	19.7	19.8	114.5	35.3	77.7	114.4	67.9	57.1	54.3	124.3	75.5	70.2	56.5	90.5	83.3	67.2	65.0	47.1	60.6	84.2	59.1	52.9	23.6	60.8
2019	9	54.0	52.8	21.6	113.4	59.7	78.7	36.7	25.6	56.2	34.1	42.2	87.7	31.5	37.3	71.9	38.4	57.2	65.2	51.8	41.7	24.0	56.4	21.6	60.2	26.8	72.0	113.4	76.2
2019	10	32.8	34.6	10.8	60.8	16.5	18.6	32.1	42.1	54.1	30.6	37.5	34.4	45.1	31.1	60.8	53.6	45.2	26.9	33.5	19.5	30.2	40.5	27.2	31.5	33.8	10.8	46.8	27.3
2019	11	33.0	32.4	13.8	55.5	44.4	44.7	49.1	47.4	26.3	18.9	32.9	33.1	34.7	13.8	15.7	18.9	47.7	28.5	18.7	28.1	36.0	22.7	55.5	33.8	33.0	37.6	25.7	30.2
2019	12	24.3	24.9	10.2	40.2	16.3	40.2	25.6	23.3	37.7	23.7	30.9	34.0	31.1	31.1	24.4	30.2	18.9	32.6	17.3	28.7	22.2	10.2	17.0	17.2	24.3	12.1	21.3	28.1
2020	1	27.2	30.7	12.5	62.8	37.4	47.8	37.1	44.3	32.9	12.5	19.9	22.9	22.7	13.9	18.2	31.1	18.5	41.8	25.3	22.2	25.9	15.5	54.3	38.4	62.8	28.6	38.4	25.2
2020	2	18.8	21.2	4.7	42.8	20.9	10.0	19.1	25.8	15.9	13.2	30.8	28.7	36.7	36.3	16.4	31.0	11.5	14.0	6.0	33.3	29.9	9.1	4.7	14.5	18.4	16.4	23.5	42.8
2020	3	19.1	20.5	7.3	47.6	13.5	18.6	7.3	14.0	10.1	13.6	26.9	14.9	12.3	37.1	19.5	27.9	8.7	47.6	33.4	30.5	25.0	14.7	11.6	26.6	27.2	20.5	22.8	7.7
2020	4	14.7	17.2	3.4	38.0	18.2	6.5	3.4	31.3	31.3	21.3	38.0	5.7	24.0	13.7	8.9	28.9	15.1	14.1	5.3	7.6	22.9	16.1	3.6	20.2	13.6	14.3	35.3	13.8
2020	5	36.8	39.6	7.4	103.6	22.6	14.7	40.3	23.9	74.9	65.3	26.8	64.9	25.8	34.1	7.4	10.8	103.6	13.3	34.8	41.7	43.4	38.9	33.0	42.1	84.6	21.6	40.1	41.8
2020	6	56.6	60.9	26.2	117.8	73.9	41.4	55.0	117.8	107.4	49.2	97.4	86.3	88.0	55.8	26.2	31.8	59.0	31.6	57.4	42.3	45.2	61.6	37.6	72.9	45.1	60.0	74.8	44.2
2020	7	68.1	76.5	25.9	141.6	85.4	74.0	78.3	95.4	119.7	59.4	68.7	60.4	104.0	62.5	88.1	25.9	29.5	67.5	54.6	66.6	66.8	58.7	49.0	141.6	108.0	85.6	139.9	46.3
2020	8	67.0	68.7	11.4	133.0	133.0	69.3	102.4	64.6	58.9	63.6	40.9	25.8	64.5	38.3	76.5	53.5	28.5	91.6	27.5	48.0	87.6	93.6	92.8	74.7	11.4	95.1	91.6	113.8
2020	9	61.7	64.4	24.3	133.7	76.0	31.0	44.4	59.5	34.0	51.7	60.6	68.9	103.8	85.8	67.5	58.2	67.7	53.6	83.4	62.7	37.1	50.4	80.7	105.7	24.3	65.7	38.3	133.7
2020	10	32.2	34.3	18.6	58.9	34.5	32.2	44.4	27.2	47.1	32.3	51.1	25.2	25.0	42.8	21.9	21.3	58.9	30.6	41.0	26.3	42.0	19.2	38.0	28.0	18.6	22.5	49.7	44.0
2020	11	30.9	31.1	10.7	75.4	36.2	20.0	28.9	18.9	35.3	15.7	55.2	41.9	22.5	10.7	22.3	14.6	33.8	37.7	19.9	34.1	33.0	75.4	24.9	33.1	26.3	38.6	39.2	28.4
2020	12	19.7	23.9	7.3	63.2	20.3	14.0	14.0	32.6	17.7	12.2	53.6	9.1	23.0	17.1	19.1	27.8	7.3	9.8	33.0	16.8	63.2	17.9	31.1	34.6	27.5	17.8	29.6	25.2
2021	1	21.4	22.7	10.5	37.3	23.3	27.8	20.1	18.9	22.7	13.0	18.7	18.5	15.9	27.6	27.7	10.5	22.7	30.5	16.9	19.5	17.8	32.7	37.3	15.4	27.7	24.0	36.8	19.5
2021	2	20.3	22.5	6.7	59.8	28.7	13.7	28.0	28.4	26.2	32.7	38.0	21.5	31.3	59.8	19.8	7.1	27.0	20.8	16.3	30.1	10.6	15.2	6.7	14.1	19.6	16.3	16.4	12.7
2021	3	17.4	19.3	3.2	49.3	4.7	16.1	10.9	41.5	8.4	13.0	19.3	26.1	8.2	7.5	24.6	5.2	9.2	23.1	9.7	42.1	3.2	5.6	18.8	25.0	43.2	22.6	49.3	26.0
2021	4	19.3	20.5	2.2	49.7	10.1	7.9	19.0	32.0	2.2	9.2	33.6	25.8	25.4	26.6	27.2	12.5	21.0	49.0	12.8	23.9	3.3	11.0	3.5	19.5	16.9	9.3	40.6	49.7
2021	5	28.7	33.8	4.4	99.3	74.1	4.4	99.3	24.3	27.2	11.8	15.9	20.4	32.3	54.9	89.1	7.6	39.6	27.3	9.5	54.4	30.1	35.0	12.7	38.6	11.9	6.4	39.0	45.4
2021	6	63.1	61.9	8.8	123.9	69.4	48.1	94.3	123.9	111.1	64.0	32.2	108.8	38.8	73.2	37.2	34.8	38.2	8.8	44.1	18.5	47.7	80.5	67.7	75.2	62.1	49.1	64.8	93.1
2021	7	68.7	69.5	27.0	113.6	63.4	81.9	73.7	56.4	73.4	86.3	98.4	97.2	69.8	53.2	55.7	33.6	105.5	27.0	90.9	113.6	88.5	67.6	60.5	56.2	73.5	43.3	60.0	38.7
2021	8	54.0	55.4	16.7	111.1	33.8	27.2	55.7	41.0	111.1	35.3	60.8	73.7	47.0	41.7	66.5	68.4	69.8	98.0	52.3	32.8	78.2	35.9	16.7	42.5	57.7	73.5	79.1	30.5
2021	9	53.4	57.2	29.5	101.1	34.8	48.4	50.4	31.9	35.1	79.5	98.2	91.1	67.3	29.5	50.4	101.1	65.1	75.8	63.9	56.3	37.0	93.7	62.2	68.5	30.2	32.3	33.2	36.7
2021	10	33.8	36.0	14.6	72.1	21.9	42.4	38.9	39.2	61.7	34.7	26.5	15.8	32.3	72.1	31.5	22.1	32.9	29.0	24.7	40.0	47.2	52.2	14.6	18.7	52.6	19.2	41.4	53.2
2021	11	30.5	34.4	13.5	61.9	55.8	19.2	23.2	51.1	31.8	39.4	14.8	48.3	29.2	24.2	19.3	26.2	61.9	26.4	13.5	22.4	48.9	43.1	56.5	23.4	52.1	24.7	38.4	32.1
2021	12	25.9	29.2	7.3	50.0	46.5	28.2	16.4	41.3	40.7	20.3	31.3	40.9	22.9	15.6	7.3	25.6	40.7	22.8	26.2	36.0	50.0	35.0	25.6	24.2	22.3	36.5	22.7	22.6
2022	1	21.6	24.1	4.1	45.5	8.3	17.7	42.6	17.9	45.5	30.2	17.2	13.9	23.4	39.8	14.2	29.6	4.1	20.2	34.3	12.3	40.4	16.2	21.6	22.2	30.4	37.9	21.6	17.0
2022	2	19.2	20.2	7.3	52.5	24.2	25.8	24.2	15.8	28.2	23.8	24.9	11.9	17.3	26.3	15.0	11.2	9.4	37.1	52.5	14.5	11.7	19.0	21.2	7.3	20.5	9.9	19.5	12.3
2022	3	16.2	16.8	0.9	31.2	19.5	22.0	10.2	10.4	22.7	25.0	0.9	14.0	27.7	6.6	15.4	22.8	13.5	26.1	31.2	17.1	11.2	17.7	8.8	3.5	13.2	27.6	12.0	24.7
2022	4	19.5	21.1	3.6	49.6	24.9	13.4	3.6	17.6	17.3	49.6	26.5	16.0	26.8	9.2	20.1	13.4	26.7	19.0	43.0	20.9	35.3	10.0	14.2	24.8	22.1	25.6	9.7	16.5
2022	5	26.5	33.1	10.0	82.6	25.3	27.7	67.2	17.7	43.5	10.0	33.7	29.1	29.3	48.9	12.3	21.1	40.8	13.1	21.1	15.8	65.8	58.4	19.0	82.6	10.7	15.9	24.9	60.9
2022	6	42.1	47.7	5.1	139.9	37.3	63.1	41.8	78.6	93.2	32.2	62.5	60.5	65.2	53.9	19.6	64.6	22.0	42.3	20.7	139.9	49.0	5.1	5.1	31.8	70.0	27.7	32.7	26.5
2022	7	75.4	81.0	40.4	170.2	65.7	83.3	115.5	59.9	79.3	114.0	61.9	69.5	62.9	133.0	49.5	170.2	73.8	107.4	84.6	40.4	67.7	77.0	56.0	83.3	86.9	51.1	73.6	77.2
2022	8	70.1	74.6	30.1	192.8	30.1	47.7	67.0	74.2	131.9	68.0	74.0	75.7	69.5	55.7	39.9	70.7	77.1	128.9	77.4	86.7	35.4	74.0	64.6	53.1	49.7	64.8	81.1	192.8
2022	9	60.5	62.2	26.8	102.6	53.3	73.2	65.6	55.2	60.9	70.1	90.3	65.8	49.6	42.7	93.9	40.1	76.7	51.6	102.6	46.5	60.1	94.3	61.9	85.5	36.1	34.8	26.8	56.5
2022	10	34.7	33.6	7.9	63.2	14.3	20.5	13.5	28.5	35.6	40.3	47.1	47.0	48.1	33.9	48.2	50.9	63.2	17.2	13.9	39.9	55.2	29.2	15.3	20.6	39.2	59.0	18.8	7.9
2022	11	27.1	29.4	15.6	49.3	31.6	25.8	49.3	23.3	25.5	48.9	36.4	27.0	15.6	27.8	26.5	41.9	41.3	21.5	23.2	33.1	21.6	30.6	19.7	23.3	29.3	27.8	27.3	26.1
2022	12	24.8	26.2	9.5	58.1	32.0	35.4	12.9	27.7	18.2	29.9	15.0	43.2	25.5	24.0	43.4	28.0	22.2	28.2	36.2	58.1	20.6	14.8	41.4	13.8	23.8	9.5	12.4	13.1
2023	1	27.1	25.7	7.4	46.7	20.0	14.0	34.2	40.0	38.6	33.2	26.3	46.7	7.4	38.4	22.6	28.5	31.2	13.7	42.1	20.0	16.6	31.3	10.8	8.9	15.9	27.9	32.8	14.5
2023	2	14.5	17.2	4.5	35.3	9.1	13.0	9.3	4.5	33.1	11.3	12.7	35.2	12.2	18.7	26.0	35.3	20.5	32.8	14.7	7.7	15.5	8.0	19.8	16.9	20.8	14.4	12.8	7.7
2023	3	16.3	18.8	5.5	42.2	16.1	8.8	5.5	38.0	13.1	16.5	32.5	27.3	11.3	7.4	42.2	15.0	11.3	24.3	20.7	14.2	12.6	18.2	20.3	10.6	18.4	31.3	21.9	14.3
2023	4	22.1	23.0	2.4	56.8	11.8	20.7	11.1	29.9	20.4	22.1	56.8	26.4	35.7	24.7	5.1	22.1	27.3	40.1	18.0	28.8	14.7	13.9	2.4	16.3	22.3	31.9	35.4	13.5
2023	5	38.6	42.4	20.8	70.4	35.9	21.8	70.4	21.5	51.4	51.6	34.6	40.4	65.1	54.1	70.3	25.6	23.0	21.9	27.5	63.8	53.6	30.5	65.2	60.7	36.7	20.8	22.2	48.3
2023	6	58.4	55.5	27.4	80.0	64.6	60.2	54.4	56.0	66.0	62.6	31.3	34.8	59.3	80.0	36.8	35.6	72.2	57.3	75.2	29.6	65.4	67.4	27.4	51.4	69.9	64.8	57.5	51.6
2023	7	67.1	73.6	23.8	164.3	115.2	58.7	71.0	88.2	124.8	34.5	23.8	32.7	72.8	38.5	135.3	93.8	38.7	40.8	42.8	116.6	61.3	62.1	63.2	94.9	76.5	164.3	80.5	35.4
2023	8	75.8	67.7	18.8	121.2	45.8	18.8	121.2	34.3	83.3	21.1	54.9	77.1	42.7	67.0	79.6	74.6	93.2	105.6	81.9	34.3	97.2	28.7	33.4	77.9	119.3	93.0	56.1	84.4
2023	9	51.3	55.5	16.4	106.0	50.5	58.5	29.1	38.0	45.6	69.8	16.4	67.4	36.8	75.1	38.3	52.1	79.1	46.2	106.0	68.6	30.5	52.2	37.1	105.7	36.7	84.8	63.0	44.3
2023	10	31.7	31.1	6.8	64.2	6.8	19.6	44.1	15.8	31.5	32.5	20.8	37.2	32.9	31.2	34.2	34.0	63.0	29.7	26.1	17.0	34.5	31.8	41.6	17.4	31.4	64.2	32.8	16.0
2023	11	37.5	41.1	22.8	82.1	30.0	36.7	30.0	28.3	36.5	50.5	55.6	37.6	50.3	51.0	50.9	51.8	34.1	47.6	41.9	22.8	33.2	48.3	26.8	35.3	82.1	37.4	27.8	39.1
2023	12	29.2	30.1	10.4	52.3	22.0	50.9	31.2	22.2	33.6	31.3	25.3	39.0	13.4	16.8	35.4	29.2	52.3	10.4	31.6	26.8	26.8	36.4	40.1	25.5	27.0	28.4	38.6	29.2
2024	1	26.7	26.1	9.0	44.1	39.2	16.3	12.2	13.7	29.6	27.1	37.4	29.4	38.2	13.5	23.2	15.1	30.0	44.1	21.5	19.9	33.0	18.3	9.0	40.3	38.8	15.8	35.5	26.3
2024	2	19.0	21.4	10.3	45.1	25.5	17.1	23.3	13.0	22.9	18.7	21.4	45.1	36.5	22.7	20.6	17.4	34.9	15.7	33.2	16.8	16.7	14.7	22.9	14.3	19.3	14.8	15.9	10.3
2024	3	18.1	17.0	4.8	27.6	17.6	14.2	27.6	13.9	13.3	21.4	18.5	8.4	21.3	19.7	5.6	13.3	12.5	23.2	21.0	22.1	21.5	12.0	8.3	27.0	21.3	21.5	4.8	17.5
2024	4	16.9	19.2	3.7	51.8	35.1	17.1	32.4	51.8	41.4	7.2	13.8	15.7	12.9	10.1	3.7	27.4	13.9	7.1	22.3	17.7	20.1	13.9	19.4	17.8	13.5	16.7	23.4	6.6
2024	5	27.2	32.6	4.9	87.4	31.2	87.4	24.6	13.8	58.4	36.6	47.4	43.2	40.9	11.4	4.9	43.4	55.8	20.2	21.9	16.5	12.0	27.5	53.3	7.3	22.1	56.8	26.8	17.6
2024	6	50.2	54.8	24.2	96.2	37.1	59.7	75.5	39.8	85.7	43.1	47.6	83.8	47.7	38.4	47.7	56.7	46.5	24.2	62.1	55.4	79.4	63.7	29.0	80.8	96.2	32.9	28.6	52.7
2024	7	74.1	84.7	18.2	174.7	127.5	52.3	59.7	74.5	169.9	100.2	59.9	119.6	74.0	174.7	93.2	86.8	50.8	64.8	66.5	84.8	70.6	18.2	78.8	73.2	67.4	128.6	63.7	74.2
2024	8	63.3	63.0	39.6	101.2	39.6	86.7	47.7	60.8	63.9	101.2	66.1	64.6	54.2	59.0	46.3	50.2	54.6	64.8	69.4	70.1	65.3	44.3	56.5	70.3	75.6	62.8	53.6	83.9
2024	9	64.2	64.4	24.3	139.5	77.7	139.5	58.4	30.5	24.3	106.6	41.6	85.1	100.1	42.7	61.8	77.1	30.7	84.5	88.7	40.9	74.3	39.1	66.5	106.4	37.2	38.0	68.1	25.7
2024	10	29.6	34.7	12.8	71.4	12.8	24.8	32.3	17.7	15.7	25.6	55.9	37.2	21.7	20.1	42.1	48.3	31.0	27.4	57.2	18.6	25.5	48.3	60.2	28.2	34.1	26.0	50.9	71.4
2024	11	28.8	30.4	12.7	57.5	22.0	21.8	26.1	15.1	17.3	35.1	33.1	27.0	23.9	34.3	56.8	29.7	24.5	16.9	12.7	22.2	57.5	27.8	46.1	41.4	36.9	31.3	35.6	33.7
2024	12	26.2	28.4	8.3	55.5	26.6	16.8	33.3	41.2	37.9	48.0	21.6	26.1	26.3	35.1	20.8	55.5	28.0	36.9	22.2	17.8	20.5	38.0	21.8	35.5	8.3	26.2	24.5	13.3
2025	1	26.6	27.7	4.7	47.2	31.3	26.2	4.7	36.3	38.8	26.7	24.4	29.2	26.4	33.0	22.8	20.3	11.4	15.0	36.0	5.1	38.1	43.2	23.1	21.6	47.2	37.2	46.2	21.3
2025	2	14.7	17.8	3.6	52.5	14.5	15.0	19.7	18.6	23.9	31.0	6.6	14.5	15.8	27.5	10.0	14.4	52.5	12.1	10.4	12.8	3.6	26.4	23.4	17.4	29.9	12.0	6.8	8.7
2025	3	20.1	21.4	5.1	54.1	16.8	21.7	31.3	16.1	8.4	45.6	7.3	5.1	7.3	25.1	24.9	16.1	54.1	33.0	19.5	15.2	25.9	17.1	11.1	20.6	30.0	6.9	29.0	24.6
2025	4	18.3	22.2	3.8	59.1	13.4	18.7	16.2	3.8	26.4	11.5	59.1	9.9	21.4	14.0	22.7	48.0	11.4	31.8	17.8	31.7	34.9	37.8	25.4	17.4	7.6	11.5	26.7	12.7
2025	5	39.0	39.3	3.6	93.2	20.7	31.6	18.5	39.8	41.4	93.2	25.8	29.0	8.1	38.1	53.4	22.6	3.6	53.6	68.2	6.8	63.3	89.5	49.8	21.2	25.1	42.5	47.7	48.4
2025	6	50.3	53.2	21.5	103.5	39.2	26.4	84.9	36.1	34.5	76.8	50.2	49.4	21.5	61.0	35.6	50.4	68.6	45.6	34.1	34.1	62.0	68.8	28.1	71.3	59.3	71.4	103.5	63.2

2025	7	72.7	72.1	3.1	137.6	77.7	89.9	91.7	103.0	119.1	80.7	38.3	69.4	56.2	116.3	87.2	38.0	100.1	52.7	80.5	42.6	72.3	34.1	44.7	73.0	51.3	69.5	3.1	137.6
2025	8	55.6	56.6	19.1	120.9	30.4	58.9	56.0	61.9	94.5	66.9	55.2	36.3	63.7	44.3	45.3	84.2	31.3	120.9	36.7	65.4	40.2	19.1	48.4	67.5	81.7	50.0	36.0	63.8
2025	9	61.3	64.7	27.9	121.1	74.9	27.9	76.8	47.3	30.9	69.7	121.1	51.4	73.5	101.7	32.3	63.7	72.0	73.2	56.1	75.8	111.1	48.2	47.1	58.9	56.5	78.3	55.2	49.0
2025	10	34.8	33.6	8.6	74.7	28.8	33.3	39.0	8.6	26.4	49.2	39.7	26.5	22.6	17.9	15.9	39.8	58.8	24.2	41.4	8.7	37.2	54.3	40.3	29.8	14.3	36.4	38.9	74.7
2025	11	34.2	35.1	8.5	61.5	32.9	44.1	52.0	17.5	53.9	61.5	22.7	23.0	33.9	38.8	59.8	21.9	8.5	51.3	46.4	19.2	28.8	15.5	41.8	48.6	26.2	34.4	36.2	22.1
2025	12	23.4	25.9	2.3	50.0	21.3	45.7	20.0	24.2	38.4	31.7	33.5	28.0	6.2	20.6	44.4	22.5	30.8	10.5	20.8	48.9	26.9	12.5	19.6	50.0	19.3	24.7	2.3	18.4
2026	1	23.7	25.3	13.2	44.2	27.4	23.0	25.0	42.6	22.6	13.5	29.1	13.5	15.0	16.7	23.6	25.1	20.0	13.2	23.5	36.1	23.8	26.7	25.4	44.2	42.3	14.5	17.2	43.8
2026	2	20.1	21.4	9.1	51.7	16.8	14.7	15.2	35.0	10.1	29.8	19.9	24.9	25.9	51.7	10.3	23.3	28.8	27.2	9.1	22.4	20.3	10.5	16.9	15.6	17.5	33.6	11.8	22.9
2026	3	21.1	21.0	3.8	39.7	36.4	23.5	34.2	15.6	18.7	25.1	22.4	18.1	28.4	28.0	25.9	16.5	30.6	31.7	11.3	3.8	12.3	12.4	21.1	7.1	39.7	21.0	14.3	4.8
2026	4	19.4	19.5	2.8	43.2	28.7	36.4	31.9	7.6	9.6	4.7	21.1	30.9	17.1	8.3	23.0	2.8	18.7	20.2	18.6	43.2	23.8	31.8	24.4	17.1	7.8	29.0	5.7	6.2
2026	5	27.5	29.9	5.3	57.3	50.8	22.2	35.5	29.7	19.0	8.8	57.3	25.0	54.5	16.2	6.7	47.3	32.0	42.2	47.7	25.3	42.4	27.1	27.2	9.6	5.3	22.1	36.9	27.9
2026	6	42.1	43.5	15.3	107.6	24.9	35.3	29.3	83.5	58.2	54.4	53.0	21.7	30.2	45.6	59.4	20.2	15.3	20.7	29.1	40.6	43.6	107.6	66.9	25.3	60.1	17.5	56.2	46.3
2026	7	78.7	78.5	30.3	186.2	30.3	39.7	75.4	99.0	84.4	79.0	84.4	41.9	78.3	88.6	68.1	61.7	76.8	79.0	86.0	32.3	43.4	68.8	82.1	186.2	77.5	129.8	100.2	90.2
2026	8	51.2	55.3	18.5	134.5	34.2	82.0	18.5	74.4	57.0	47.7	62.6	40.3	50.6	134.5	37.0	52.2	45.8	41.9	75.8	51.9	57.7	72.0	55.4	33.7	45.3	63.2	47.2	46.5
2026	9	61.1	61.9	22.5	116.6	97.4	42.8	29.3	78.4	92.9	68.0	31.3	74.5	35.8	22.5	107.9	47.1	58.2	61.4	73.1	64.7	67.0	60.7	44.8	87.1	22.9	41.5	116.6	59.3
2026	10	32.7	36.9	13.2	64.5	13.2	15.8	27.5	60.1	39.1	28.3	34.4	32.1	24.6	25.9	48.5	23.3	50.3	26.6	64.5	42.2	59.3	33.3	24.0	48.0	47.0	29.6	31.0	57.4
2026	11	25.9	27.5	12.6	40.9	20.7	25.2	17.3	36.1	40.9	33.4	38.3	24.1	35.0	29.1	39.0	17.7	38.2	12.6	33.1	35.0	21.2	23.3	18.2	19.2	22.6	22.9	30.7	26.6
2026	12	26.1	26.5	6.9	51.2	51.2	38.4	29.5	6.9	28.2	28.9	35.4	14.0	22.0	36.0	17.7	20.9	40.0	14.7	25.6	17.8	31.0	26.4	26.5	23.1	25.8	23.3	30.2	22.0
2027	1	23.3	24.2	11.1	50.4	30.8	50.4	13.9	26.2	20.7	40.7	21.9	27.2	19.6	11.3	14.9	21.7	26.5	42.4	27.5	19.5	13.1	25.3	11.1	24.7	26.2	33.0	14.8	16.9
2027	2	18.3	19.3	1.0	59.2	59.2	6.1	1.0	10.5	24.8	18.7	21.7	16.1	5.0	18.2	25.1	38.1	13.9	18.7	16.9	17.1	19.0	10.9	18.8	30.1	14.3	15.4	18.3	25.5
2027	3	20.3	20.8	2.4	49.2	18.3	2.4	18.2	29.0	13.7	20.8	18.8	5.7	27.0	25.0	21.4	17.3	25.8	11.2	8.2	7.0	21.0	15.8	19.9	35.2	45.1	21.1	49.2	21.0
2027	4	15.9	20.3	3.8	59.4	26.9	55.0	17.0	20.6	19.7	12.9	16.2	10.1	13.2	12.7	13.1	14.4	9.9	15.9	23.5	24.9	12.4	3.8	59.4	54.4	22.4	15.9	6.3	6.3
2027	5	45.4	44.7	15.7	89.0	49.4	43.5	23.8	15.7	16.8	74.3	64.9	89.0	31.3	38.9	65.1	47.3	19.2	63.9	57.0	55.3	48.6	40.6	32.7	49.3	62.1	17.9	34.4	30.7
2027	6	45.5	50.9	24.1	89.6	43.1	43.5	51.3	66.6	66.3	32.0	24.1	24.2	49.7	24.4	71.3	85.7	41.2	47.5	56.1	34.4	60.5	43.5	39.3	75.1	89.6	30.7	83.2	38.6
2027	7	80.5	84.1	37.5	165.8	111.6	77.6	165.8	98.4	69.5	82.7	110.2	75.7	56.5	88.6	54.7	63.9	95.9	44.7	129.7	52.6	108.0	68.4	93.7	75.2	78.2	37.5	82.9	97.1
2027	8	65.5	69.0	35.5	110.5	97.8	69.6	61.1	56.9	91.3	108.4	72.8	67.9	86.2	53.3	61.6	51.8	53.0	51.4	81.2	35.5	110.5	41.7	80.0	40.9	63.0	70.1	96.1	52.9
2027	9	46.9	55.4	13.0	111.8	36.2	60.8	74.9	81.3	25.5	97.6	45.8	30.2	46.9	111.8	79.2	38.7	53.7	40.6	89.3	78.7	32.5	46.8	61.8	65.5	39.0	41.2	38.5	13.0
2027	10	33.0	37.0	17.0	69.7	25.1	32.3	46.3	27.0	60.5	32.6	59.1	26.1	22.8	25.7	33.4	43.4	38.5	21.9	49.6	34.9	17.0	69.7	36.3	28.5	46.3	25.0	57.1	29.3
2027	11	28.2	30.6	12.0	72.9	23.2	29.9	43.3	16.8	12.6	19.6	31.1	33.3	35.8	22.9	54.8	28.3	22.8	24.7	22.1	28.1	41.5	27.6	29.7	41.7	72.9	12.0	21.6	38.5
2027	12	26.5	27.7	9.6	48.9	42.4	48.9	21.5	36.1	37.9	28.2	17.6	28.8	20.6	35.4	25.6	24.1	9.6	27.6	25.8	42.0	39.8	32.9	12.4	19.6	27.1	17.0	25.4	18.1
2028	1	23.9	25.5	11.3	50.7	17.0	33.0	29.6	17.6	19.1	15.9	23.7	30.5	28.5	50.7	37.9	13.4	33.9	29.0	23.2	17.1	27.9	11.3	18.8	32.6	22.6	40.0	24.1	15.8
2028	2	18.6	21.4	3.4	38.3	28.9	16.2	18.2	18.9	38.0	7.5	26.8	30.4	26.6	15.0	3.4	10.9	10.5	38.3	20.8	17.3	14.5	29.2	37.4	16.1	13.0	30.0	28.9	17.5
2028	3	16.2	20.1	2.9	50.5	27.3	2.9	16.1	13.5	43.8	22.3	9.6	12.7	10.7	14.0	16.3	37.6	8.9	12.3	24.9	24.8	26.5	20.2	23.1	8.1	30.0	15.2	50.5	11.7
2028	4	22.3	20.7	0.7	45.1	28.8	45.1	22.6	22.4	3.8	8.3	27.4	31.5	25.4	9.3	21.2	21.3	12.1	31.9	25.0	0.7	27.7	16.5	33.5	10.5	22.6	18.4	8.6	22.3
2028	5	35.6	37.1	4.0	75.1	20.6	47.1	56.6	16.8	18.5	34.0	26.4	41.7	36.7	52.8	34.5	74.1	21.1	50.0	24.5	4.0	6.7	58.7	55.8	36.8	47.6	31.9	19.4	75.1
2028	6	52.6	56.2	20.3	115.5	28.1	35.9	45.6	60.9	46.0	56.7	44.7	56.3	115.5	47.7	24.9	61.3	49.2	112.0	106.3	20.3	67.1	53.0	35.3	52.2	85.0	55.6	28.0	61.3
2028	7	62.0	74.8	15.2	153.4	93.5	49.1	118.0	53.5	92.1	55.6	35.9	57.6	64.1	52.0	32.4	50.4	109.8	101.0	153.4	15.2	102.3	50.6	58.9	66.3	59.9	103.1	109.2	111.4
2028	8	46.0	59.2	15.9	196.3	16.0	36.7	110.0	40.5	63.4	37.7	65.1	95.1	56.1	37.4	196.3	60.9	39.6	43.6	45.8	96.9	51.6	76.4	42.1	15.9	40.2	76.4	46.3	31.0
2028	9	63.3	62.1	20.4	92.3	68.7	28.4	57.1	42.1	52.6	50.0	52.5	59.4	67.1	47.1	24.0	74.1	72.8	88.5	91.4	68.8	84.8	85.0	91.0	92.3	20.4	71.7	49.3	51.5
2028	10	33.0	36.2	12.2	70.1	32.9	33.1	33.5	45.2	27.7	22.9	60.8	70.1	23.4	44.3	16.7	32.0	40.3	18.7	40.7	12.2	57.8	31.9	26.0	16.7	31.0	53.8	42.8	55.1
2028	11	39.1	36.2	13.0	71.7	20.3	36.8	45.5	18.5	26.3	21.7	58.5	43.9	17.4	71.7	15.6	41.4	37.5	57.7	41.4	50.5	48.9	13.0	16.6	39.3	51.5	17.3	39.0	39.5
2028	12	26.4	27.5	11.5	64.4	28.8	11.5	13.2	19.8	37.5	41.4	40.2	26.1	13.5	17.1	16.0	35.0	12.2	43.2	35.5	64.4	33.2	15.5	37.5	38.1	23.1	11.8	18.5	26.7
2029	1	24.9	27.5	12.8	59.7	18.1	28.0	25.6	14.7	16.7	24.5	14.9	14.2	45.1	25.2	16.6	46.7	42.5	33.2	24.2	17.2	12.8	59.7	19.7	36.8	37.0	13.7	38.7	34.8
2029	2	18.0	19.4	8.4	44.7	16.0	17.3	44.7	19.4	12.1	25.7	19.7	32.3	13.0	29.0	17.1	18.7	25.3	12.2	24.2	8.4	14.2	8.7	27.2	10.8	16.5	19.7	14.4	19.6
2029	3	18.7	19.4	6.8	44.4	9.8	20.8	20.3	29.2	19.4	22.1	25.0	17.6	10.1	10.3	44.4	8.7	21.0	15.2	20.7	12.0	18.0	16.3	31.6	36.3	20.8	14.9	6.8	14.6
2029	4	20.8	23.4	7.5	48.7	42.2	22.9	27.0	22.1	16.2	27.4	7.5	34.9	30.4	19.5	19.4	39.0	32.1	11.1	48.7	25.9	17.1	10.5	19.1	8.8	12.9	17.0	16.0	33.7
2029	5	39.1	38.8	4.4	71.0	27.6	4.4	23.4	24.8	52.9	45.8	49.8	24.0	37.8	34.5	29.5	59.8	54.9	14.8	50.4	48.0	41.8	40.0	38.2	28.4	71.0	52.9	43.6	31.7
2029	6	53.6	51.2	17.1	103.0	17.1	22.6	27.9	57.5	61.4	70.6	73.3	54.3	36.9	21.0	59.2	61.6	53.0	33.8	60.6	29.4	44.1	80.6	41.1	81.6	103.0	17.4	50.7	69.7
2029	7	72.0	77.1	25.7	159.5	122.0	100.6	39.2	37.7	159.5	58.4	94.4	46.3	25.7	68.9	117.1	62.1	51.8	43.9	108.8	122.8	75.7	63.7	103.4	87.0	65.1	45.5	75.1	76.0
2029	8	62.3	66.2	25.5	127.4	127.4	25.5	73.8	64.0	78.1	61.6	47.2	33.2	75.4	44.7	28.7	101.1	28.6	59.7	113.8	63.1	117.4	85.0	59.0	93.6	51.2	34.0	57.6	65.5
2029	9	58.2	63.2	28.2	120.6	117.4	45.1	42.6	50.6	53.2	71.3	79.6	53.6	76.8	62.7	36.3	108.9	39.6	40.7	68.8	49.4	28.2	68.1	39.6	79.3	71.0	43.8	120.6	68.7
2029	10	33.5	32.2	12.4	61.2	61.2	16.7	40.7	21.4	31.1	25.4	34.0	34.7	51.2	14.7	33.2	46.7	38.6	28.4	12.4	21.2	25.6	38.8	25.7	23.0	35.9	33.9	41.3	38.2
2029	11	32.3	33.7	9.8	73.6	58.3	73.6	38.2	26.7	52.1	31.3	14.4	41.7	23.7	22.2	43.6	33.3	27.7	20.1	12.6	17.2	48.1	33.4	9.8	33.8	52.9	23.7	27.9	43.2
2029	12	24.5	25.5	10.1	54.1	37.4	29.9	31.7	27.5	22.1	27.9	25.5	22.9	10.1	12.8	54.1	14.2	40.5	31.0	18.7	19.1	27.2	23.5	27.8	23.1	20.3	15.7	20.1	29.2
2030	1	24.2	24.1	4.7	47.6	21.8	17.4	23.9	33.7	16.7	24.7	19.4	47.6	19.6	24.5	25.6	16.2	26.8	31.0	25.3	38.2	4.7	31.9	28.1	20.8	20.7	6.0	42.5	11.1
2030	2	18.9	21.0	8.1	37.3	18.6	14.9	13.0	14.0	18.9	19.0	37.3	24.7	17.3	19.9	21.8	17.1	36.0	15.7	36.7	23.0	8.1	28.9	22.1	17.6	12.1	24.5	24.4	18.6
2030	3	18.1	17.9	2.5	33.7	4.7	20.3	23.5	29.5	24.7	17.2	9.5	20.2	24.2	2.5	29.1	5.9	9.0	16.9	3.0	15.9	12.7	10.7	19.1	33.7	14.9	21.8	27.5	32.6
2030	4	21.7	20.7	2.3	34.9	5.8	34.9	8.5	20.8	21.5	11.1	24.6	8.6	33.9	12.9	17.9	26.2	32.6	26.5	20.9	11.6	15.3	22.2	21.9	25.9	28.4	33.6	2.3	28.3
2030	5	41.3	41.8	12.1	82.9	26.6	43.3	26.6	39.2	59.5	59.6	32.8	18.6	31.1	53.7	58.0	43.4	37.4	48.3	12.1	53.8	29.8	44.5	80.9	60.8	15.6	82.9	28.9	15.7
2030	6	52.5	56.3	17.5	110.2	64.8	46.8	66.3	27.9	61.4	69.9	79.8	83.7	110.2	29.2	78.4	46.4	46.0	50.9	17.5	76.8	33.6	39.7	54.2	74.6	35.7	31.2	81.4	45.3
2030	7	83.4	85.0	38.6	166.2	157.6	104.3	70.5	89.0	97.4	110.6	135.6	91.2	85.5	42.2	79.8	108.5	45.7	72.5	44.3	72.2	82.2	53.3	70.4	96.1	38.6	166.2	41.1	84.7
2030	8	55.8	64.3	20.3	103.9	72.1	20.3	55.1	97.4	56.5	103.1	93.5	35.5	47.1	93.7	47.9	54.4	75.3	50.9	53.1	75.6	89.8	61.8	49.8	65.2	103.9	49.2	47.6	43.7
2030	9	55.1	56.0	6.2	115.9	55.1	47.0	6.2	72.0	37.9	85.2	84.7	15.4	15.2	69.2	27.2	62.7	55.0	45.5	115.9	94.2	71.4	60.1	23.7	75.1	51.8	28.1	46.2	99.9
2030	10	26.3	30.7	9.6	60.8	43.1	29.2	33.5	21.7	22.0	25.3	9.6	40.2	54.4	19.8	26.2	30.2	60.8	34.8	16.4	25.5	26.4	58.9	11.3	49.2	38.6	22.2	21.0	17.5
2030	11	32.8	34.7	7.7	67.8	32.0	27.1	17.6	50.2	38.9	30.0	31.2	67.8	51.1	21.0	22.6	38.8	51.2	28.1	50.0	20.1	7.7	33.7	41.6	28.7	40.2	42.0	43.9	18.3
2030	12	26.1	27.4	13.7	58.9	28.6	17.1	21.1	33.4	26.6	27.9	39.0	13.7	13.8	20.3	39.4	16.7	38.4	15.8	25.7	21.0	31.2	28.2	20.6	19.7	41.4	58.9	34.4	23.7
2031	1	24.8	26.8	5.7	54.6	19.8	12.5	28.3	5.7	14.7	54.6	37.2	22.1	35.9	45.2	24.3	15.8	44.2	29.2	11.3	37.1	25.3	39.0	37.0	23.0	30.2	11.0	22.0	16.9
2031	2	21.8	22.9	8.5	49.8	11.5	34.0	14.3	38.7	19.3	14.8	16.1	31.4	35.0	28.3	27.4	35.4	34.9	9.0	12.5	12.9	26.6	8.5	24.2	9.2	49.8	14.5	32.4	9.5
2031	3	18.2	22.1	5.8	54.7	21.3	5.8	14.8	34.4	47.2	31.4	6.3	15.3	30.1	10.0	20.2	40.0	10.9	12.0	54.7	27.9	13.4	11.5	14.6	28.4	21.6	11.1	31.4	16.2
2031	4	13.9	16.9	4.0	42.4	20.6	42.4	4.9	23.9	7.6	11.3	33.4	17.0	22.2	5.3	33.5	11.3	21.8	25.5	16.6	4.0	6.4	22.2	6.3	10.6	11.1	8.5	6.3	32.1
2031	5	33.0	33.3	10.8	70.1	55.4	13.9	46.7	38.1	36.4	47.1	20.2	47.8	10.8	47.5	70.1	45.5	15.3	23.8	29.8	31.9	30.4	13.2	26.7	41.4	15.6	38.5	34.1	19.9
2031	6	48.2	62.0	15.3	124.7	107.2	46.7	15.3	44.1	30.6	56.6	57.4	55.3	68.3	41.6	96.0	48.3	104.0	40.8	120.9	37.1	47.9	75.0	48.0	43.2	48.1	39.3	92.6	124.7
2031	7	69.9	83.4	16.8	164.4	70.4	50.7	48.7	52.4	61.7	56.2	44.3	105.4	128.3	45.2	79.1	16.8	136.7	119.0	114.0	162.3	110.0	55.5	164.4	68.9	59.9	69.4	71.1	112.3
2031	8	59.3	74.6	30.8	162.5	162.5	120.5	106.2	64.6	30.8	139.3	48.0	58.2	44.8	37.1	46.0	39.5	60.4	115.8	116.8	38.6	67.2	136.4	42.3	47.0	58.1	31.7	88.1	91.4
2031	9	55.0	57.5	24.8	122.3	122.3	40.5	56.9	47.4	24.8	68.0	48.0	75.5	25.2	28.3	32.4	93.8	53.2	38.1	85.7	73.1	32.1	73.0	51.6	67.9	64.8	40.1	59.7	78.6
2031	10	29.3	32.1	13.7	58.8	27.8	15.6	50.3	36.0	58.8	32.8	13.7	23.0	40.9	19.0	58.8	30.0	53.1	34.4	44.7	23.6	31.4	28.6	37.7	14.5	22.4	25.5	19.5	27.7
2031	11	29.0	32.2	13.9	79.3	26.3	28.3	23.8	21.7	25.9	23.9	20.1	30.6	16.8	29.6	79.3	42.1	32.4	13.9	19.2	51.8	19.8	39.2	37.2	18.4	33.9	34.0	45.0	58.5
2031	12	22.7	24.7	7.2	52.4	8.8	23.8	19.5	13.0	19.1	22.6	17.8	18.3	23.3	52.4	25.1	7.2	34.5	22.8	32.8	16.5	29.8	22.3	23.5	45.7	40.1	13.6	40.0	21.2
2032	1	21.8	23.5	6.0	55.4	34.3	19.1	20.6	13.4	22.2	16.3	26.4	17.5	36.6	55.4	6.0	15.6	23.7	12.5	45.4	13.3	23.5	22.4	19.7	32.9	30.5	21.3	26.3	9.0
2032	2	22.2	23.0	7.3	51.7	24.1	13.8	22.2	25.9	22.6	12.9	9.0	15.8	26.6	15.0	22.1	22.2	14.5	16.3	35.0	34.5	7.3	25.3	33.7	51.7	31.6	18.6	19.5	31.0
2032	3	19.9	23.3	4.3	45.8	12.1	11.8	4.3	19.9	31.8	8.9	19.2	12.4	6.2	26.6	22.0	36.9	41.7	25.4	34.6	17.5	19.3	18.9	20.0	31.8	45.8	15.3	45.6	30.3
2032	4	20.7	23.1	3.1	52.9	29.9	15.3	11.9	34.8	13.7	6.6	15.0	16.6	28.4	16.6	23.9	32.8	19.4	18.8	34.5	33.6	8.3	21.9	18.3	24.8	3.1	24.6	52.9	48.0
2032	5	32.6	33.5	10.4	67.3	23.8	31.7	21.9	10.4	10.4	39.0	65.0	45.5	67.3	46.0	32.8	14.8	28.9	44.8	45.9	32.3	36.0	33.5	22.6	41.4	21.4	57.0	14.4	17.0
2032	6	56.3	69.1	22.9	133.3	45.0	32.3	101.8	133.3	53.9	57.5	83.8	55.1	50.5	97.2	22.9	91.8	68.4	48.2	129.8	26.0	61.1	112.6	118.6	91.8	44.7	39.2	47.5	45.8
2032	7	79.4	88.1	45.8	161.5	74.1	145.4	147.6	78.8	71.0	92.5	61.0	62.4	50.4	62.5	88.0	79.2	144.7	45.8	71.1	82.7	79.6	91.5	84.2	110.1	161.5	69.0	73.4	88.3
2032	8	69.9	71.3	21.7	142.4	51.2	21.7	142.4	50.8	65.9	72.5	59.5	132.6	79.5	72.3	96.5	22.9	67.5	75.7	82.5	44.0	92.8	47.9	52.8	97.3	51.9	94.5	82.0	55.2
2032	9	50.8	56.0	23.0	115.7	34.3	115.7	61.9	53.5	28.7	51.0	38.1	45.6	50.5	70.6	104.4	38.3	23.0	48.1	53.9	77.3	49.1	39.9	25.6	72.5	60.5	32.6	65.8	102.3
2032	10	28.4	31.2	12.4	56.3	20.6	27.9	49.3	28.9	44.0	34.7	53.2	26.9	33.8	32.0	13.5	24.3	56.3	23.3	28.0	23.9	21.6	24.7	12.4	47.9	33.3	29.5	26.7	31.2
2032	11	28.2	31.2	9.4	64.4	34.3	26.9	22.8	9.4	20.7	20.5	28.6	27.2	28.3	14.3	57.8	17.1	17.9	14.5	51.6	22.9	30.6	40.3	60.2	28.1	37.8	38.7	64.4	33.6
2032	12	25.9	29.1	12.5	48.0	21.0	24.5	23.1	31.5	25.2	13.4	42.1	24.3	37.9	27.9	26.2	32.5	21.5	16.6	44.8	16.6	47.3	37.6	48.0	31.7	25.5	47.3	12.5	20.2
2033	1	25.6	25.8	8.3	38.9	31.4	31.8	38.6	30.3	8.3	17.5	18.2	18.3	28.7	24.1	25.2	26.0	24.1	31.8	33.7	17.3	38.0	33.0	19.8	17.7	22.5	26.2	17.8	38.9

2033	2	18.7	20.1	8.8	36.9	14.3	12.7	19.4	24.2	11.0	17.1	15.0	8.9	28.5	8.8	29.1	21.7	36.9	25.3	26.4	15.0	11.3	10.0	25.7	25.0	35.1	18.1	18.0	24.7
2033	3	20.8	20.4	4.3	39.7	39.7	27.9	22.7	28.2	29.4	19.4	26.1	17.2	22.8	13.3	15.0	8.0	34.4	22.1	39.2	4.3	6.7	22.5	13.1	7.9	8.3	9.3	34.8	18.0
2033	4	17.6	20.2	4.1	46.8	25.7	32.0	24.5	11.7	6.5	30.0	8.0	9.6	4.1	46.8	18.8	7.3	18.7	44.9	15.8	28.1	14.3	16.5	30.3	12.6	9.6	8.0	30.3	30.7
2033	5	32.8	37.8	8.1	95.2	20.4	12.6	45.1	33.5	41.6	25.3	52.0	17.2	56.6	29.4	44.1	17.3	41.7	21.7	52.4	86.3	57.4	16.4	23.3	95.2	17.0	8.1	60.2	32.0
2033	6	48.5	53.5	20.6	108.7	45.1	24.7	51.1	104.9	20.6	50.7	46.3	60.9	62.2	36.5	35.9	31.2	74.0	33.2	61.9	62.9	46.3	108.7	63.6	37.8	39.7	51.7	36.6	96.6
2033	7	75.2	80.6	44.1	167.2	68.8	74.4	44.9	62.3	58.9	77.8	97.1	44.1	89.4	67.4	69.9	59.3	111.6	94.9	167.2	129.0	91.0	107.5	53.2	95.0	76.1	89.3	52.1	53.1
2033	8	70.2	69.0	13.3	120.1	87.3	20.5	43.6	59.4	87.7	82.4	77.8	74.7	50.0	120.1	13.7	51.1	106.3	57.5	58.1	116.9	36.3	89.7	51.8	117.7	98.8	13.3	68.1	72.4
2033	9	60.3	63.2	24.7	108.8	63.8	62.5	49.1	94.8	60.0	100.3	55.6	41.5	71.6	88.0	37.3	50.6	83.9	61.4	42.8	108.8	41.8	51.6	24.7	27.6	102.3	60.5	82.0	55.1
2033	10	33.1	33.6	15.1	64.6	39.5	16.4	43.0	19.2	28.1	36.1	26.4	21.7	34.4	47.3	53.9	17.7	50.2	33.0	33.2	47.9	64.6	33.5	16.0	28.9	28.3	15.1	47.1	25.9
2033	11	30.4	32.8	9.6	63.2	30.5	26.5	25.0	34.3	45.3	63.2	54.6	48.7	23.8	15.7	23.0	14.1	30.4	25.0	36.9	35.1	48.8	45.7	30.0	31.0	24.7	9.6	35.5	30.4
2033	12	27.5	27.0	7.1	40.3	26.7	22.9	39.7	40.3	7.1	25.0	33.1	20.1	35.6	34.7	35.6	32.7	24.3	33.4	14.9	26.0	30.7	28.2	22.1	37.8	11.0	9.8	33.5	23.4
2034	1	24.5	24.0	7.0	50.1	24.1	22.0	34.2	18.2	36.0	25.2	7.0	31.3	30.7	24.9	10.3	31.3	7.5	11.6	33.7	11.6	33.7	21.4	50.1	21.0	21.4	29.5	12.0	27.8
2034	2	21.4	21.9	4.0	41.1	13.0	18.5	24.4	19.3	21.0	30.6	15.0	29.6	41.1	21.8	22.7	22.8	28.5	4.0	23.6	16.8	13.3	10.1	29.8	16.3	36.7	17.6	29.7	19.1
2034	3	17.0	21.0	2.5	67.1	16.3	28.9	27.0	8.2	12.8	34.8	31.1	14.0	2.5	20.0	20.2	46.2	7.7	15.5	12.6	17.8	10.6	16.1	16.0	21.6	24.5	22.2	67.1	9.7
2034	4	22.5	22.3	2.8	48.3	22.5	29.0	34.4	36.6	46.9	2.8	13.8	22.4	6.3	8.8	6.9	3.2	18.5	28.6	5.9	35.1	30.0	48.3	36.7	14.8	8.3	12.8	37.0	25.6
2034	5	35.4	41.5	9.3	113.8	113.8	32.3	38.4	31.9	65.3	12.1	27.5	9.3	30.7	42.8	47.3	52.0	22.0	14.3	45.8	49.3	25.8	47.7	25.7	82.8	79.3	20.7	49.1	30.5
2034	6	46.3	52.5	16.5	97.4	55.4	61.1	26.0	84.1	76.5	19.0	88.6	23.1	52.6	16.5	42.7	37.7	47.4	97.4	45.1	45.2	35.3	85.8	26.2	76.0	67.8	22.3	32.2	96.4
2034	7	81.4	85.5	40.3	135.0	114.4	115.5	85.5	51.5	69.7	86.6	113.5	40.3	58.8	124.5	50.4	85.4	124.6	81.0	47.1	135.0	128.8	81.7	79.2	105.9	55.0	78.5	79.6	60.3
2034	8	72.8	71.1	23.3	120.2	88.9	38.2	73.6	42.2	114.3	53.9	72.5	85.6	76.7	49.6	23.3	40.3	55.8	73.0	105.3	78.4	73.7	51.5	67.0	120.2	57.7	100.6	102.1	62.2
2034	9	45.1	49.9	18.7	82.9	68.0	53.6	59.0	24.7	55.0	45.6	68.4	79.4	37.3	60.4	38.2	64.3	43.7	40.7	82.9	38.4	18.7	37.3	41.3	66.4	43.1	51.1	44.6	35.3
2034	10	31.9	33.8	13.0	67.2	25.3	56.3	15.3	28.5	20.8	41.8	24.8	58.8	33.3	32.8	38.9	48.0	30.8	20.8	13.0	20.2	32.7	13.7	67.2	50.8	48.5	21.8	31.1	36.5
2034	11	33.5	35.2	14.8	66.4	44.0	41.3	26.9	42.1	58.0	33.3	48.7	36.1	14.8	40.2	46.3	19.6	26.1	30.6	40.7	22.7	25.3	66.4	40.7	30.3	29.5	19.0	33.8	28.5
2034	12	22.2	26.5	10.1	62.9	13.9	39.3	46.0	30.7	16.7	19.2	32.6	19.1	10.1	26.4	40.0	62.9	15.1	23.6	25.9	17.0	44.1	19.1	21.5	16.1	23.0	14.6	44.3	13.9
2035	1	20.5	22.1	6.7	38.8	16.6	17.2	32.0	15.6	29.6	31.5	24.9	27.8	6.7	20.2	20.6	29.7	11.5	12.0	22.1	22.5	31.4	29.6	19.2	38.8	14.5	17.4	20.5	18.7
2035	2	18.0	20.5	8.8	44.0	20.5	19.2	11.7	18.8	18.2	8.8	31.9	25.8	13.6	15.9	17.8	44.0	16.8	36.5	16.1	17.2	11.8	16.3	14.7	27.9	28.0	11.2	22.0	26.9
2035	3	20.5	19.8	7.9	43.0	27.6	25.3	22.1	21.5	11.9	13.1	12.4	21.9	24.4	43.0	15.3	22.0	7.9	13.1	27.0	19.5	10.3	9.0	23.2	19.4	15.3	12.0	26.2	30.8
2035	4	11.8	15.4	3.3	61.0	12.4	11.2	7.5	5.6	15.4	26.4	31.6	18.3	14.3	23.8	17.5	17.4	9.9	61.0	16.6	3.3	4.8	5.2	7.0	3.9	9.9	4.5	30.9	11.0
2035	5	37.9	43.0	13.3	101.2	15.1	13.3	27.9	46.1	33.0	101.2	25.3	49.7	18.1	16.2	24.9	83.4	56.3	89.9	78.6	43.3	54.0	21.4	41.6	20.6	34.6	72.9	41.3	24.3
2035	6	51.4	51.9	10.2	94.1	37.9	46.9	85.8	10.2	38.1	43.8	69.3	34.0	51.2	78.0	30.1	94.1	62.7	60.9	63.4	75.0	54.7	31.1	22.9	47.4	57.6	46.3	51.5	53.0
2035	7	90.6	88.4	38.0	143.9	128.4	108.0	106.9	110.0	82.3	65.8	84.0	65.4	138.3	65.9	43.5	104.9	74.2	97.2	109.0	46.3	52.7	38.0	97.9	79.0	104.3	111.6	143.9	62.9
2035	8	70.8	72.5	18.2	177.9	110.5	103.4	101.3	128.2	177.9	77.0	86.7	79.2	43.5	54.1	69.0	92.9	20.0	70.9	87.0	55.0	49.3	18.2	53.4	33.5	21.3	47.6	70.6	90.3
2035	9	52.0	58.4	7.4	129.5	46.3	40.2	38.2	60.1	53.0	106.2	97.7	35.4	91.5	33.7	51.0	26.5	23.0	58.4	68.0	31.1	78.5	68.4	26.0	88.7	91.9	7.4	129.5	50.2
2035	10	30.7	34.7	11.8	70.1	25.5	61.9	29.8	23.2	57.8	43.5	31.2	23.4	30.5	38.6	35.2	24.2	41.7	16.5	11.8	20.9	20.9	43.9	30.9	54.3	15.4	29.4	53.0	70.1
2035	11	34.3	36.8	20.7	61.4	47.2	35.0	26.4	39.8	42.1	29.8	29.6	49.8	32.4	33.6	50.9	61.4	51.6	47.6	28.6	23.9	28.0	37.5	28.6	41.9	28.2	36.5	31.7	20.7
2035	12	30.6	33.1	8.1	80.0	48.1	40.1	33.8	43.9	65.4	37.1	25.7	43.4	25.1	29.6	46.2	24.1	80.0	19.9	16.9	15.9	34.1	31.5	33.3	13.5	25.2	26.2	8.1	27.9
2036	1	22.3	25.3	8.4	54.8	12.5	34.4	8.4	14.2	17.2	54.8	21.8	25.7	10.0	18.9	23.1	51.7	41.9	31.5	16.6	16.7	25.7	21.9	33.3	45.8	10.5	33.0	22.7	15.0
2036	2	18.3	22.4	10.1	46.1	18.4	12.9	15.2	16.4	25.4	13.1	41.5	17.0	18.8	46.1	11.9	18.2	17.3	10.1	42.6	13.3	36.3	13.0	25.5	18.3	19.7	32.2	22.4	32.6
2036	3	19.9	20.9	3.0	33.7	11.1	33.7	18.6	26.2	17.8	18.4	21.1	14.1	33.3	3.0	21.9	19.7	19.1	20.6	32.1	20.1	18.8	28.4	26.9	18.3	10.1	21.1	17.9	28.9
2036	4	22.6	24.3	9.9	54.9	15.3	10.5	32.7	29.2	25.1	27.6	9.9	16.9	33.5	33.5	15.9	22.7	12.2	45.8	13.9	14.7	26.6	31.2	22.5	30.2	16.5	18.4	54.9	22.4
2036	5	33.4	37.0	16.8	110.7	19.3	22.1	29.3	64.7	36.3	22.5	44.7	36.7	56.5	41.1	33.8	28.2	18.3	42.8	27.6	24.1	30.3	50.3	40.6	24.4	32.9	16.8	34.4	110.7
2036	6	48.3	54.5	14.3	138.4	50.7	67.1	19.8	62.5	40.5	42.4	39.9	28.4	33.4	138.4	63.4	56.9	52.0	31.7	14.3	80.2	45.9	131.6	33.6	79.0	38.5	58.0	62.2	36.3
2036	7	74.0	85.7	26.3	154.3	76.6	154.3	82.3	121.1	49.1	103.5	62.8	47.7	31.2	26.3	54.6	131.7	60.4	56.5	143.0	138.9	90.1	124.1	59.4	71.5	65.8	108.0	153.5	44.7
2036	8	64.7	68.8	23.9	146.1	50.9	80.8	69.8	76.9	27.7	56.2	23.9	48.8	82.3	74.7	42.4	57.8	59.3	91.0	65.8	119.1	50.2	83.1	74.8	63.6	38.7	146.1	129.0	39.1
2036	9	55.8	59.0	12.7	101.6	92.8	76.8	46.0	55.9	101.6	96.6	79.4	29.3	51.3	90.1	44.9	13.6	49.5	75.8	29.0	88.3	13.0	48.5	49.1	69.4	12.7	76.8	55.7	70.8
2036	10	34.1	35.3	7.3	56.2	23.5	31.2	42.5	15.3	40.6	27.1	27.6	36.2	51.9	19.6	7.3	46.8	56.2	28.2	49.5	32.1	30.2	51.8	44.4	40.7	28.1	33.8	48.2	34.4
2036	11	33.4	33.8	10.5	56.1	34.0	23.8	47.0	34.1	22.3	32.1	28.0	56.1	35.9	25.2	29.9	25.8	42.0	20.3	46.3	10.5	41.2	20.1	47.3	32.9	34.9	47.3	52.4	22.7
2036	12	23.4	23.8	9.2	37.6	37.6	31.3	14.4	26.0	21.4	32.8	22.2	20.9	17.0	26.1	33.3	23.4	24.5	23.4	21.3	24.5	18.0	9.2	26.5	22.5	28.4	19.8	17.9	28.7
2037	1	25.0	23.7	9.2	44.8	9.2	33.6	27.6	9.3	23.7	30.2	11.7	35.0	24.4	25.7	18.2	28.0	12.7	20.2	44.8	9.6	33.0	22.6	28.0	12.4	17.2	37.4	26.0	29.1
2037	2	14.2	16.0	4.8	36.1	17.1	7.9	11.9	13.1	15.1	5.5	6.3	30.6	22.2	25.8	8.9	18.0	11.1	20.8	12.4	36.1	8.6	24.1	22.8	4.8	6.4	17.6	24.7	13.3
2037	3	16.6	17.3	0.9	33.6	17.9	13.8	7.8	14.3	16.8	26.2	26.1	33.6	28.8	18.6	12.2	10.7	0.9	6.2	11.8	24.1	17.4	15.8	12.5	16.3	20.8	27.0	13.5	22.4
2037	4	15.4	18.3	2.6	43.2	12.3	33.1	6.4	10.7	24.1	9.9	4.8	7.0	31.2	30.6	43.2	26.9	25.0	34.1	8.2	7.5	9.9	29.4	26.2	15.9	3.3	22.8	2.6	15.0
2037	5	33.5	33.5	1.0	68.8	17.0	27.6	33.5	28.1	20.7	33.9	53.5	29.8	62.0	41.6	19.2	41.9	43.8	68.8	41.6	7.4	21.7	51.6	53.2	26.4	1.0	6.2	41.2	33.6
2037	6	51.5	54.0	24.0	111.4	57.9	51.1	52.1	73.5	39.4	47.9	46.2	111.4	37.1	49.4	51.9	32.7	64.5	59.1	89.6	25.2	59.3	55.5	77.5	48.5	26.5	71.8	24.0	43.4
2037	7	84.1	89.6	22.2	161.5	125.9	154.4	54.2	94.3	104.4	52.6	77.0	22.2	92.7	72.0	78.9	87.0	161.5	148.3	148.4	106.1	81.2	99.3	63.0	101.0	35.1	63.8	66.5	59.5
2037	8	58.8	68.1	29.0	174.9	106.5	52.0	97.9	64.7	44.9	42.6	41.7	58.1	78.6	36.3	69.0	51.7	86.4	79.5	174.9	47.3	29.0	54.1	101.7	98.9	31.2	59.5	39.4	88.8
2037	9	51.3	56.1	15.7	146.9	30.4	65.5	69.4	73.9	74.7	82.9	45.7	38.7	45.7	60.6	29.6	15.7	28.9	67.5	146.9	44.0	79.1	55.5	63.0	78.6	28.1	40.7	34.5	47.0
2037	10	35.5	36.3	9.7	85.4	85.4	9.7	29.7	36.3	41.6	26.1	20.8	29.5	39.0	48.4	45.5	43.0	32.3	21.5	26.9	44.2	43.9	25.8	30.9	35.0	53.7	36.2	31.0	36.0
2037	11	31.8	34.8	18.0	69.0	48.9	22.4	48.7	41.9	28.8	69.0	24.2	32.7	27.7	40.7	27.4	18.0	19.9	51.3	36.1	39.6	43.5	24.9	37.5	30.6	30.2	26.0	32.9	31.0
2037	12	31.2	29.0	8.4	44.6	39.5	31.5	8.4	30.9	39.0	10.9	33.4	34.4	26.1	28.9	33.7	28.1	25.4	19.6	44.6	23.3	13.3	39.7	34.2	34.8	19.1	42.2	21.6	33.7
2038	1	23.9	26.5	11.4	58.7	31.0	19.6	38.5	24.1	46.5	27.5	32.0	16.5	23.7	11.4	23.7	12.2	33.0	34.4	23.5	13.9	15.9	58.7	31.4	15.9	20.9	18.9	39.4	24.4
2038	2	19.6	21.4	6.8	61.6	25.0	27.6	26.1	19.7	16.6	8.3	16.7	18.3	38.9	61.6	14.8	6.8	13.6	22.0	21.4	21.3	15.2	12.0	12.1	19.6	33.1	19.6	12.2	32.0
2038	3	22.1	22.3	3.1	48.9	38.0	21.9	22.4	32.0	26.3	18.5	16.7	17.0	25.8	11.3	8.4	24.5	28.8	16.1	24.4	7.6	26.6	18.7	33.7	37.6	48.9	3.1	18.8	7.1
2038	4	22.6	22.1	2.6	42.5	36.3	31.0	19.2	8.2	37.7	18.8	7.2	20.4	11.7	27.3	23.2	2.6	29.3	25.4	13.3	31.8	22.0	28.0	5.5	42.5	28.0	4.1	40.5	16.2
2038	5	39.9	41.3	10.7	79.3	38.2	36.2	54.6	50.9	53.4	48.8	79.3	31.5	38.3	18.9	17.7	70.2	51.5	25.8	72.9	50.4	34.0	41.9	23.6	10.7	47.1	19.0	41.5	35.5
2038	6	63.3	64.6	25.1	133.9	54.6	85.5	74.4	105.7	32.6	64.4	101.2	25.1	82.3	74.7	58.5	86.7	66.8	62.3	25.1	61.6	64.3	38.6	104.7	39.5	43.0	133.9	32.3	32.6
2038	7	89.2	95.4	27.9	196.5	140.4	27.9	115.9	105.8	92.2	48.1	196.5	99.4	37.2	148.9	135.9	53.7	86.2	59.8	53.8	129.8	184.7	132.5	123.5	56.6	81.2	63.3	56.1	59.7
2038	8	65.6	69.4	13.8	131.3	67.0	119.2	23.3	122.0	83.1	64.3	43.5	63.3	71.0	76.2	131.3	32.9	83.1	55.6	90.9	97.9	101.8	33.7	71.8	54.9	62.8	45.1	13.8	57.9
2038	9	55.4	57.7	7.0	141.1	41.9	101.2	68.9	61.2	77.8	39.7	87.4	28.0	55.4	22.9	89.5	84.7	39.3	14.6	55.5	141.1	7.0	28.8	50.6	66.2	56.8	87.6	43.6	36.1
2038	10	32.3	34.1	10.7	61.0	30.2	10.7	15.9	52.8	48.4	23.7	61.0	11.0	40.8	39.4	48.2	20.9	27.5	32.7	48.6	30.7	32.0	46.5	36.1	25.6	23.5	29.0	46.9	37.8
2038	11	34.8	34.3	12.5	67.8	49.2	44.0	12.5	19.0	50.7	39.3	16.4	50.7	21.2	23.0	38.6	15.6	59.6	25.2	67.8	43.9	40.4	28.6	37.2	21.8	49.3	32.3	23.1	13.2
2038	12	23.7	27.0	5.7	52.6	42.4	44.4	17.9	38.3	20.3	23.1	24.3	32.1	11.4	42.0	13.2	22.5	34.1	18.5	52.6	31.5	39.0	33.8	5.7	20.0	22.8	26.3	18.8	13.3
2039	1	25.9	27.0	5.9	56.6	46.7	32.4	17.8	13.6	34.8	30.1	17.0	21.2	27.9	26.5	17.3	21.6	56.6	23.0	38.2	17.5	25.5	39.3	26.4	16.8	5.9	16.5	38.6	37.2
2039	2	21.7	23.2	11.4	54.0	19.7	21.2	16.1	24.4	19.6	15.7	36.5	23.4	22.2	30.8	31.5	18.1	19.9	12.2	24.0	28.2	14.9	16.1	15.5	35.7	54.0	11.4	23.4	23.0
2039	3	14.9	18.4	2.1	40.8	10.9	12.9	2.6	40.8	22.9	12.3	30.8	2.1	14.0	19.2	15.5	19.2	12.5	5.7	12.5	25.2	14.4	8.9	9.8	38.2	17.3	24.4	38.9	31.3
2039	4	19.8	23.0	5.4	65.3	8.8	5.6	20.9	31.2	14.6	26.6	40.7	13.2	29.6	15.8	18.7	22.2	65.3	21.3	25.0	5.4	11.8	50.0	8.8	15.2	12.3	12.7	41.0	35.0
2039	5	36.5	42.6	8.3	127.0	22.0	62.6	75.1	26.0	11.1	36.5	36.6	37.5	27.9	67.4	77.9	8.3	18.9	49.7	33.7	16.8	40.0	35.8	64.4	127.0	58.0	27.6	10.4	51.0
2039	6	50.3	55.0	11.9	93.6	93.6	76.1	75.3	69.3	26.0	90.4	44.9	38.6	40.0	68.9	43.3	30.6	48.3	52.3	36.9	83.9	46.7	66.2	11.9	80.8	69.3	30.0	45.0	52.7
2039	7	73.8	76.7	14.0	138.4	125.8	104.2	113.8	14.0	50.4	45.7	111.2	47.6	58.2	73.2	49.5	39.0	80.0	113.0	97.7	99.1	81.0	70.8	94.8	74.4	65.7	30.4	138.4	62.5
2039	8	56.1	61.7	20.8	164.4	64.7	36.1	31.0	20.8	66.3	136.8	24.3	54.6	41.3	50.6	81.2	26.9	164.4	61.1	64.2	29.9	60.5	57.7	45.3	24.5	109.1	68.1	111.5	51.0
2039	9	52.0	60.1	23.7	113.8	50.6	88.8	56.5	94.5	50.9	68.9	37.7	63.5	45.8	47.4	98.5	86.0	113.8	32.9	52.3	109.7	34.3	51.2	23.7	51.8	33.8	24.9	71.9	53.7
2039	10	36.7	38.6	15.6	67.0	45.3	67.0	31.9	28.9	60.7	35.3	38.1	32.9	43.7	50.9	20.7	30.8	45.6	28.9	22.9	24.3	45.1	49.6	46.5	28.3	30.4	41.7	61.0	15.6
2039	11	28.4	30.4	6.9	57.2	27.3	37.1	18.7	30.0	32.1	34.7	57.2	24.0	18.1	53.9	25.5	26.0	34.8	21.9	17.2	22.1	45.6	25.8	29.6	23.4	33.1	52.7	31.4	6.9
2039	12	25.8	28.6	13.6	58.6	40.7	25.1	42.5	13.8	20.0	31.2	58.6	15.3	37.0	15.7	42.6	38.4	50.8	26.5	18.0	20.5	13.8	30.6	21.5	13.6	25.1	35.3	26.9	23.4
2040	1	22.9	25.0	10.8	50.8	41.9	25.8	42.5	20.2	13.6	28.2	25.3	15.0	16.8	43.8	22.9	12.6	27.3	16.8	13.8	16.1	35.3	24.4	23.0	20.4	22.0	10.8	31.3	50.8
2040	2	18.7	18.9	4.2	45.4	13.1	26.6	18.6	19.8	4.2	14.6	35.4	23.3	8.3	45.4	11.9	27.6	6.2	8.3	18.8	27.6	5.7	21.5	21.6	39.1	25.1	13.2	8.2	10.4
2040	3	21.5	21.3	3.6	41.7	14.9	15.2	12.1	36.6	28.6	11.2	41.7	17.5	25.4	14.1	24.0	23.1	10.1	23.8	33.6	12.4	15.8	36.2	3.6	27.9	22.2	20.8	26.2	14.0
2040	4	19.0	19.8	6.8	39.3	28.7	10.0	9.9	12.4	13.3	16.4	39.3	13.4	19.1	14.7	20.7	26.1	6.8	22.0	18.9	32.6	31.3	18.2	7.6	25.4	19.9	28.5	13.1	27.3
2040	5	31.5	41.0	13.8	97.2	29.8	20.4	57.7	33.2	83.2	48.2	47.6	29.8	13.8	26.2	31.4	18.1	19.0	66.0	14.5	97.2	66.3	47.5	31.6	56.9	19.7	86.0	14.5	24.8
2040	6	50.5	49.8	13.4	108.7	25.9	41.6	68.0	108.7	26.8	57.6	86.4	63.9	24.8	59.5	93.2	44.9	51.9	42.8	13.4	50.3	24.1	50.7	27.2	30.9	60.4	67.4	19.6	54.5
2040	7	81.4	81.6	38.4	140.1	113.3	85.7	140.1	81.2	102.3	56.3	38.4	72.8	40.7	114.8	128.5	62.5	113.4	51.2	59.8	127.1	81.6	87.3	92.3	40.0	66.4	56.7	50.8	94.6
2040	8	59.4	63.9	14.1	121.9	101.7	14.1	56.3	91.8	57.6	25.5	28.0	27.7	41.8	73.4	45.3	100.8	71.2	42.0	20.2	105.1	68.4	55.2	106.1	77.4	18.9	121.9	61.1	121.0

2040	9	53.6	58.6	18.1	118.4	118.4	61.7	48.7	54.8	54.3	41.9	72.8	33.2	89.9	18.1	94.5	84.0	37.0	58.1	40.5	52.1	34.3	53.2	47.9	54.0	52.2	93.8	68.7	42.2
2040	10	35.7	36.9	20.2	59.1	36.3	59.1	48.9	37.8	50.3	22.9	31.0	21.3	28.3	23.6	32.1	51.4	50.7	42.8	26.2	47.0	21.8	39.4	35.2	28.9	30.9	20.2	48.6	50.8
2040	11	30.9	34.4	12.9	57.4	35.4	20.3	12.9	24.2	55.1	27.9	31.5	27.7	30.2	41.4	37.6	33.8	24.6	57.4	41.8	21.9	30.2	45.9	43.6	57.4	49.8	29.7	22.6	23.4
2040	12	23.7	26.4	15.9	55.1	21.0	22.0	16.4	22.3	21.6	55.1	37.0	28.3	18.2	16.9	28.6	29.6	24.5	23.3	46.5	30.7	40.3	21.9	15.9	16.5	17.4	32.4	24.0	24.2
2041	1	23.6	23.8	4.2	50.6	32.9	8.1	24.6	22.6	29.5	6.2	29.4	50.6	24.9	8.1	28.2	41.2	21.3	25.9	19.2	4.2	5.9	39.5	19.9	12.6	35.2	21.3	15.8	44.8
2041	2	20.7	23.3	6.9	55.2	17.8	17.5	32.3	24.4	35.9	21.1	55.2	10.4	11.2	24.6	15.6	20.1	12.8	27.5	6.9	26.2	45.9	8.2	18.4	11.2	24.8	21.2	49.2	20.3
2041	3	19.6	18.9	5.2	48.5	20.6	5.6	26.4	16.9	48.5	26.1	29.8	5.2	24.3	18.1	13.3	24.2	7.0	6.5	19.3	8.0	13.3	14.5	20.0	20.9	32.6	21.7	22.2	8.3
2041	4	15.9	18.8	0.9	40.7	27.4	14.0	5.8	29.6	36.1	21.4	8.1	1.4	40.7	39.0	12.3	11.4	10.3	32.3	5.8	5.5	11.6	29.9	32.0	0.9	17.9	3.1	31.9	22.0
2041	5	31.8	35.5	6.9	87.9	64.5	28.4	26.2	30.7	30.9	38.4	9.9	87.9	33.8	35.3	29.3	23.5	33.3	70.9	32.8	70.9	12.5	14.7	32.8	24.4	19.2	6.9	40.3	55.6
2041	6	52.4	60.0	11.4	149.0	109.8	55.5	45.1	36.0	66.7	59.0	57.8	35.7	22.8	121.9	93.7	24.2	54.0	50.8	11.4	79.0	28.0	45.1	99.7	101.7	12.1	44.3	37.3	149.0
2041	7	84.3	83.6	24.6	164.1	52.2	131.8	81.3	54.9	92.3	79.1	119.3	97.9	164.1	83.8	108.8	28.0	97.9	84.7	95.4	24.6	63.0	70.7	102.4	105.3	28.1	75.0	89.8	75.0
2041	8	62.1	69.3	27.4	145.2	92.8	68.7	32.2	51.6	56.5	71.0	76.4	145.2	135.8	81.3	57.5	55.5	66.7	53.1	100.4	27.4	50.7	38.7	93.8	77.1	47.6	52.3	49.7	80.2
2041	9	58.1	59.4	17.1	99.5	83.8	44.6	76.3	36.7	62.2	53.7	99.5	67.8	62.8	71.1	98.9	52.7	46.7	38.7	17.1	95.0	34.8	66.6	57.2	78.2	58.9	41.7	50.8	30.6
2041	10	34.1	36.4	12.8	69.9	32.2	29.8	54.5	51.1	36.1	16.0	43.1	35.3	18.8	59.5	32.0	51.3	19.7	28.1	23.3	33.9	43.6	69.9	38.5	32.9	29.1	34.4	47.0	12.8
2041	11	32.7	32.8	11.6	54.7	43.4	16.8	35.5	16.2	24.1	13.9	36.4	42.6	31.7	29.5	47.8	21.3	30.3	30.4	26.4	37.1	54.7	11.6	54.4	26.1	40.1	33.7	48.1	35.0
2041	12	27.8	30.3	12.0	49.3	14.0	27.8	44.5	42.3	32.6	12.0	40.2	23.5	20.8	34.2	46.6	49.3	26.8	21.5	27.9	27.8	26.7	34.3	41.0	24.1	27.7	22.7	31.1	27.0
2042	1	27.4	29.1	11.5	57.5	16.5	57.5	21.2	27.0	31.6	14.2	28.5	30.4	25.6	56.0	18.0	54.0	29.0	23.3	30.8	11.5	34.8	27.3	36.4	22.6	38.2	11.6	26.2	27.5
2042	2	23.7	23.2	8.2	42.2	32.1	27.7	8.2	14.2	20.2	19.4	34.7	42.2	27.2	31.6	13.2	25.6	9.2	14.6	18.7	26.4	22.0	16.6	39.4	11.2	24.2	27.7	23.2	28.6
2042	3	21.9	22.6	8.2	48.8	25.1	30.5	10.6	9.5	48.8	29.0	13.7	17.3	22.5	8.2	21.3	33.8	16.6	18.5	24.1	35.5	23.6	31.5	20.6	13.0	24.6	21.0	19.1	23.8
2042	4	18.8	20.7	4.5	48.3	12.6	11.4	16.8	21.5	12.2	28.5	48.3	23.8	22.1	17.9	18.4	37.9	25.3	17.2	12.9	15.2	19.2	24.4	21.1	4.5	18.4	11.9	24.1	31.6
2042	5	36.7	36.4	6.9	65.0	37.4	45.2	48.5	40.4	36.0	30.6	6.9	54.2	40.3	28.7	62.7	53.1	9.9	29.2	40.2	31.7	65.0	19.9	23.8	44.7	30.2	21.2	56.7	17.5
2042	6	60.4	68.1	11.2	142.4	38.5	66.5	60.2	135.7	40.3	74.5	50.5	57.7	36.6	29.7	76.1	54.0	11.2	30.5	129.7	108.4	107.3	25.8	142.4	60.7	114.7	62.7	107.0	13.7
2042	7	73.0	87.1	38.6	211.1	72.1	211.1	55.0	124.1	50.1	73.9	38.6	68.8	91.5	51.1	68.9	91.1	45.9	59.0	71.9	151.3	104.6	86.6	127.5	132.5	62.4	73.9	122.5	56.1
2042	8	60.4	71.9	23.1	145.9	32.0	65.4	35.0	115.1	43.2	80.6	29.1	48.2	55.5	87.5	23.1	43.4	32.3	129.1	48.8	128.7	145.9	100.2	79.5	47.4	82.8	111.2	133.1	28.7
2042	9	60.6	63.3	16.1	120.6	22.2	52.5	38.1	66.2	36.8	59.8	110.7	38.1	97.7	46.2	53.3	91.7	63.9	43.2	104.5	70.8	39.8	90.5	16.1	120.6	19.2	61.3	94.4	80.5
2042	10	27.5	34.6	11.5	79.4	11.5	78.9	60.4	18.2	46.3	25.8	27.5	27.4	34.6	25.5	32.4	16.3	42.2	17.4	22.7	23.9	33.6	34.8	23.9	79.4	50.4	16.3	55.5	26.5
2042	11	28.2	32.5	9.2	73.0	22.9	22.7	27.0	49.3	25.0	14.9	61.5	29.4	48.6	18.4	25.6	9.2	29.7	51.7	12.8	73.0	16.2	36.1	22.6	17.5	35.6	29.3	56.4	45.3
2042	12	26.3	26.4	7.9	46.0	39.3	44.4	39.0	9.8	7.9	24.2	8.7	21.9	28.0	26.5	24.4	28.5	29.1	25.8	39.1	46.0	33.7	35.9	14.2	26.0	24.9	7.9	38.3	8.9
2043	1	24.0	25.6	13.5	38.9	34.1	38.9	24.8	36.4	14.4	30.1	30.7	34.0	14.4	36.8	26.8	13.5	17.9	33.8	19.2	20.9	23.2	15.4	34.3	20.6	38.3	22.4	14.3	20.2
2043	2	18.7	20.5	7.8	39.2	11.5	21.3	22.2	12.4	29.7	16.6	39.2	15.5	23.5	20.3	28.9	16.5	7.8	19.3	18.1	18.0	16.8	23.3	28.5	15.9	17.0	13.5	23.3	32.7
2043	3	18.5	19.2	2.4	38.7	34.1	20.0	31.9	38.7	15.4	13.2	11.7	19.2	22.3	15.3	28.3	8.1	2.4	32.4	23.1	24.8	17.8	8.9	4.9	16.2	28.4	19.3	14.4	11.0
2043	4	15.2	17.5	0.7	42.1	19.6	8.3	14.1	42.1	15.2	8.8	29.5	9.1	6.9	5.6	17.2	16.1	15.2	23.3	29.4	0.7	22.1	28.3	12.0	19.3	10.3	14.0	41.4	10.8
2043	5	30.1	34.3	10.7	81.5	31.1	41.4	28.0	31.6	27.5	15.1	33.7	41.9	22.6	30.1	30.1	42.3	26.5	28.0	27.6	22.1	63.5	43.2	18.8	51.5	81.5	10.7	11.1	63.5
2043	6	46.7	51.2	8.9	121.9	56.6	73.1	71.4	22.2	42.3	81.0	46.9	79.4	17.7	112.0	38.8	73.8	14.7	66.6	50.6	23.7	59.5	43.7	46.4	8.9	34.9	24.3	121.9	18.2
2043	7	71.1	85.0	34.2	217.2	82.5	55.4	81.3	159.6	89.3	68.3	60.9	74.0	217.2	55.5	51.2	46.4	171.3	100.1	130.6	44.9	117.1	34.2	57.0	56.7	50.8	77.9	109.1	48.5
2043	8	53.6	57.4	19.4	118.0	46.3	50.8	70.0	118.0	82.1	77.4	36.0	19.4	24.1	46.4	57.2	60.7	51.2	41.9	64.8	51.1	37.2	27.1	62.8	84.4	90.1	91.4	56.0	30.4
2043	9	58.1	58.5	24.6	114.0	77.6	24.6	36.2	36.3	30.1	82.0	26.7	58.9	110.9	40.9	114.0	102.0	30.8	45.1	40.1	41.1	57.7	70.8	42.3	71.1	58.6	63.8	67.7	74.6
2043	10	36.0	35.9	15.9	61.1	15.9	50.8	43.2	45.9	40.8	61.1	21.6	44.7	31.0	28.1	33.8	26.5	30.5	21.4	16.4	28.6	52.7	17.2	43.7	53.1	40.0	50.4	26.8	38.1
2043	11	32.6	32.8	17.1	58.1	23.5	53.2	32.3	41.3	37.0	51.1	58.1	24.1	20.2	32.8	17.1	38.6	41.2	21.8	38.9	25.5	38.9	35.5	36.8	23.9	20.1	26.6	21.1	28.1
2043	12	25.3	27.4	8.8	54.4	37.5	14.4	32.8	20.9	8.8	15.2	29.1	24.5	28.5	54.4	38.8	26.0	16.8	41.2	24.5	24.4	43.1	41.1	12.2	9.3	46.6	32.7	21.5	14.2
2044	1	24.3	25.6	8.9	62.9	27.1	30.6	15.1	8.9	24.3	20.6	26.4	20.6	25.3	28.4	17.7	15.9	62.9	24.3	25.1	14.4	15.7	36.0	23.4	21.2	37.6	18.5	44.1	29.1
2044	2	16.1	19.9	5.7	70.9	22.5	16.3	25.5	29.0	21.6	7.1	17.2	24.4	13.0	9.2	28.2	6.1	70.9	15.8	8.3	7.4	6.4	27.2	15.0	38.5	5.7	11.3	15.1	35.8
2044	3	17.8	18.5	7.4	39.9	18.5	24.4	16.4	16.6	7.4	25.2	14.4	39.9	10.7	25.2	9.6	17.0	13.2	21.1	10.5	20.9	22.3	10.8	24.7	15.7	9.1	25.3	24.9	20.3
2044	4	20.4	21.2	5.1	43.8	19.0	25.8	21.9	30.8	5.1	14.0	39.3	43.8	31.2	12.0	15.3	31.1	7.7	24.9	10.2	7.2	22.7	13.6	29.3	32.8	15.8	14.7	29.8	9.8
2044	5	32.6	33.9	11.0	70.8	31.2	21.4	27.9	46.4	38.6	13.4	37.8	70.8	22.9	57.1	35.2	20.1	11.0	29.9	11.7	31.8	33.4	54.3	33.7	47.8	24.2	23.0	40.6	48.8
2044	6	52.4	65.9	22.4	156.6	54.6	46.7	108.4	154.0	54.1	102.1	51.5	99.1	26.6	104.4	40.6	50.2	86.9	23.1	25.3	87.1	36.4	22.4	41.5	42.0	30.3	85.2	156.6	53.3
2044	7	84.5	77.0	22.0	131.8	84.5	110.4	95.9	61.4	65.1	65.8	86.2	25.8	131.8	84.4	107.7	93.3	100.0	44.4	88.6	45.3	48.9	22.0	125.9	53.5	101.2	57.6	86.4	62.1
2044	8	55.0	61.2	24.3	109.0	84.6	37.9	56.2	52.2	39.3	42.2	78.0	109.0	53.8	29.4	96.5	77.5	72.2	79.0	73.9	45.3	24.3	99.2	26.0	85.5	45.5	82.7	43.4	34.2
2044	9	52.9	56.6	7.9	121.2	59.0	7.9	38.6	33.7	90.1	71.8	35.0	30.6	28.6	48.9	41.6	71.9	32.5	91.5	74.6	121.2	24.0	79.9	75.7	118.1	13.1	32.0	81.7	56.8
2044	10	40.0	38.3	8.2	64.4	8.2	21.1	48.0	22.2	15.4	30.0	40.8	39.0	45.8	39.1	52.4	64.4	49.0	21.0	46.4	22.7	40.9	44.4	37.7	43.8	60.0	36.2	35.2	54.3
2044	11	33.6	35.5	12.9	62.2	21.8	35.8	43.6	24.0	37.0	54.9	58.4	27.3	29.7	21.8	29.4	42.8	33.5	32.6	30.9	39.0	33.7	12.9	40.8	39.4	26.6	62.2	47.1	25.9
2044	12	29.8	28.6	14.2	58.7	21.7	40.4	14.5	24.9	38.7	33.9	34.1	32.8	26.0	58.7	15.0	25.2	34.8	33.1	36.2	17.9	35.0	30.7	14.3	28.9	33.5	20.4	14.2	22.8
2045	1	23.2	25.8	9.5	49.8	44.2	23.2	21.3	19.6	9.5	12.6	42.1	29.2	12.5	10.5	19.5	33.8	23.1	41.4	13.1	18.8	32.8	23.9	15.1	35.0	39.0	31.4	49.8	17.5
2045	2	18.8	20.7	6.4	47.8	18.6	28.5	16.7	29.1	6.4	19.5	27.8	18.7	8.7	23.5	10.2	47.8	7.5	17.8	18.9	13.5	20.1	17.8	32.5	8.4	23.2	13.9	37.1	31.0
2045	3	19.2	21.3	7.2	48.1	16.1	12.2	22.4	45.9	28.8	16.6	32.7	12.7	18.7	48.1	13.7	23.9	14.1	7.2	24.7	14.9	16.7	19.9	27.0	19.8	20.8	14.4	30.2	10.4
2045	4	16.6	17.7	4.1	46.2	14.7	8.0	14.5	21.0	13.3	6.3	12.4	19.7	18.6	31.7	35.9	21.4	11.8	46.2	19.6	11.4	4.1	14.6	19.9	21.1	19.1	21.0	9.6	9.0
2045	5	40.4	38.3	3.5	91.5	26.8	44.1	53.3	35.5	17.4	79.7	42.7	47.3	45.9	46.1	6.7	26.5	38.0	15.6	33.4	11.4	31.9	3.5	91.5	61.9	55.3	14.3	44.4	45.0
2045	6	53.2	52.9	11.0	93.4	65.1	42.7	53.9	51.7	38.7	74.7	55.8	70.4	48.8	60.1	79.6	59.9	57.1	52.4	66.6	44.1	37.7	52.1	56.1	11.0	93.4	50.2	24.4	22.5
2045	7	94.3	96.6	27.3	201.5	201.5	125.4	108.3	55.5	116.0	103.0	83.6	27.3	103.7	92.4	96.2	141.5	165.0	45.0	123.5	90.6	81.0	79.1	75.5	62.8	45.6	113.6	71.3	110.1
2045	8	69.8	72.1	18.4	156.3	68.8	110.4	48.8	114.6	85.4	156.3	49.2	31.1	74.3	48.0	42.8	42.8	79.7	44.1	74.7	91.3	114.1	44.1	128.3	62.7	51.9	78.5	18.4	70.9
2045	9	75.7	64.2	8.7	114.3	76.4	8.7	114.3	75.0	29.7	78.1	83.7	79.3	80.6	41.8	46.2	98.3	84.5	38.4	51.9	83.3	55.0	102.8	82.9	76.5	45.4	18.5	24.5	65.3
2045	10	30.5	34.7	13.4	66.1	22.1	50.7	24.5	22.8	36.8	25.7	42.0	13.4	26.2	21.3	38.9	30.5	53.7	30.5	66.1	27.6	30.7	17.3	20.6	44.9	28.2	47.4	47.8	64.0
2045	11	26.9	28.5	7.9	64.7	32.6	26.8	31.7	43.1	27.5	64.7	23.5	26.7	19.7	26.1	34.4	31.2	24.2	21.2	20.9	8.3	27.1	9.2	16.1	7.9	42.1	41.7	43.1	33.3
2045	12	29.5	29.4	8.7	54.1	22.9	26.4	34.4	29.9	29.6	31.3	23.4	41.0	43.7	29.3	36.4	19.4	54.1	26.4	37.2	8.7	24.8	35.8	20.0	29.8	19.3	26.9	21.8	32.8
2046	1	28.1	31.8	15.2	62.4	21.2	27.0	29.2	26.0	24.1	38.4	21.1	48.2	40.6	49.3	62.4	37.8	32.7	37.7	24.8	20.2	26.7	54.0	32.8	21.4	15.3	15.2	23.5	33.0
2046	2	22.2	21.0	6.6	38.2	20.7	9.8	16.2	37.3	26.1	15.4	38.2	27.7	23.2	22.0	31.4	25.2	32.6	8.2	37.6	13.0	6.6	7.5	15.4	7.3	12.9	22.3	24.3	23.1
2046	3	20.3	20.0	3.5	35.1	10.2	35.1	28.1	15.4	9.8	14.8	28.0	9.7	21.7	7.6	16.5	30.9	18.8	29.3	34.2	15.8	3.5	32.4	26.7	3.5	22.9	22.1	16.9	26.6
2046	4	18.2	20.9	3.0	70.4	16.5	14.8	26.9	14.5	6.0	28.9	37.3	27.4	12.0	16.5	21.0	20.3	26.1	9.6	18.0	3.0	12.1	18.3	9.0	17.2	19.8	33.7	70.4	22.3
2046	5	37.6	37.0	8.3	62.6	37.0	48.8	40.8	21.5	51.6	38.8	10.0	32.4	28.6	58.9	62.6	19.0	40.8	56.4	60.9	37.9	49.6	31.2	8.3	17.7	14.4	37.3	55.2	28.7
2046	6	50.4	54.7	9.8	135.4	46.1	85.7	21.4	44.1	48.3	58.4	68.0	74.6	36.3	62.5	66.1	77.2	47.3	45.2	22.8	63.0	42.3	41.7	73.3	69.9	21.9	135.4	52.5	9.8
2046	7	75.4	79.3	34.0	143.6	34.2	92.4	54.0	101.8	96.2	114.4	63.8	34.0	75.7	77.5	75.0	100.5	93.3	64.0	143.6	70.7	42.1	71.6	60.3	128.7	49.6	103.9	58.5	97.0
2046	8	61.8	65.4	24.8	157.3	34.0	69.1	24.8	145.5	35.5	78.2	28.2	100.2	68.0	157.3	42.3	45.5	62.0	63.5	104.4	78.2	110.2	32.0	29.8	39.7	52.1	71.0	61.7	35.4
2046	9	46.3	51.3	18.9	128.5	37.2	82.3	47.5	52.5	59.0	86.6	30.5	27.3	128.5	73.2	30.9	31.5	25.2	55.2	78.7	45.0	36.6	76.5	29.9	59.1	33.1	18.9	34.5	50.8
2046	10	29.1	35.9	19.1	74.9	28.6	21.1	19.1	35.9	33.8	30.8	22.6	23.8	29.5	35.4	26.5	27.2	57.1	26.5	49.5	44.6	25.6	27.2	39.1	27.2	67.3	74.9	25.9	63.1
2046	11	37.0	37.2	10.3	89.6	59.2	32.0	22.7	25.6	27.6	27.5	89.6	39.6	44.9	19.0	42.2	13.3	37.0	23.1	42.2	39.9	31.9	24.4	10.3	54.9	53.2	59.0	37.1	37.4
2046	12	28.8	30.1	8.9	78.6	22.0	31.9	78.6	11.7	54.7	32.0	19.8	34.1	25.7	31.1	25.7	32.2	35.6	26.5	38.2	20.3	23.8	14.0	39.7	20.1	8.9	37.7	48.0	9.9
2047	1	24.4	27.8	14.9	61.4	23.3	19.7	21.8	46.3	61.4	19.6	21.8	30.8	20.8	25.4	39.5	41.7	26.0	36.2	28.4	17.6	25.9	20.9	15.2	39.6	20.2	34.3	17.0	14.9
2047	2	21.5	21.3	4.4	46.0	31.2	24.1	17.4	19.7	23.0	10.9	46.0	25.4	21.2	34.5	30.3	26.9	33.9	20.0	7.7	22.9	13.5	8.7	8.7	4.4	21.9	24.0	20.1	15.2
2047	3	18.6	20.7	3.3	49.2	20.1	10.3	15.6	42.8	40.1	22.5	37.9	27.2	3.5	15.5	24.2	12.2	13.9	18.5	4.4	6.1	26.9	18.7	36.4	3.3	28.6	14.6	3.3	49.2
2047	4	20.9	20.3	4.4	43.5	21.7	26.8	17.6	24.8	43.5	10.8	12.4	36.5	21.8	13.5	12.8	4.4	22.7	19.6	24.5	5.5	24.2	8.3	34.2	20.1	12.1	24.4	26.6	18.4
2047	5	31.4	33.8	5.4	64.0	30.4	28.7	63.6	39.6	48.4	47.9	64.0	31.4	16.4	34.9	17.3	48.5	60.1	42.8	25.1	5.4	50.3	12.0	17.5	26.0	34.3	11.9	31.4	23.7
2047	6	51.2	56.0	8.9	100.0	47.8	52.6	50.8	44.3	76.4	63.3	45.6	68.6	46.4	83.0	49.8	54.3	100.0	51.6	8.9	77.3	78.9	43.5	25.4	47.4	66.4	47.7	75.2	39.2
2047	7	69.0	75.1	32.5	225.2	225.2	117.6	49.0	96.4	67.1	42.7	123.5	81.0	37.1	32.5	55.0	50.4	43.1	57.7	79.8	35.3	105.6	41.0	71.0	95.7	49.5	89.1	80.8	75.9
2047	8	54.2	57.6	27.5	104.5	46.1	52.4	43.8	95.5	81.9	51.4	27.5	79.2	50.4	56.1	39.4	38.4	59.7	57.7	104.5	61.5	57.7	77.7	50.7	43.9	33.4	74.0	68.1	30.6
2047	9	50.4	58.8	31.0	104.9	41.5	104.9	66.5	54.1	51.1	85.1	69.5	77.4	64.9	49.0	46.1	39.1	35.0	46.9	104.3	49.6	46.1	98.7	38.1	73.5	52.6	48.3	31.0	36.9
2047	10	36.6	35.6	15.9	60.2	36.1	38.3	39.7	15.9	40.9	21.7	37.0	28.3	43.5	29.8	60.2	56.2	27.9	30.8	48.7	19.7	24.4	19.1	40.3	39.1	59.2	21.8	47.4	27.6
2047	11	30.5	32.4	14.2	53.6	43.6	22.8	28.8	24.1	50.6	30.0	21.7	51.8	14.2	36.6	25.6	33.2	53.6	39.9	14.3	24.2	30.9	36.5	41.2	24.4	26.2	24.8	40.1	37.9
2047	12	28.2	32.2	19.8	57.7	53.7	26.2	22.7	28.6	31.8	19.8	35.5	51.6	22.1	22.2	38.1	23.1	21.8	25.9	28.4	52.0	57.7	34.1	22.4	32.8	45.1	27.9	21.3	27.9
2048	1	23.8	25.9	7.7	47.0	24.2	20.9	29.0	38.7	24.9	7.7	47.0	39.8	44.0	8.9	16.4	21.1	17.6	34.5	24.9	30.2	22.6	17.7	23.4	43.7	16.8	26.0	21.6	20.7
2048	2	17.1	18.3	7.1	37.0	29.9	29.2	15.5	14.1	22.8	8.6	32.0	7.1	37.0	13.0	24.2	8.4	18.3	8.6	13.8	11.4	25.9	15.9	13.4	18.9	18.8	23.6	20.8	7.7
2048	3	20.3	22.4	3.6	50.0	29.9	16.1	28.1	50.0	22.5	20.5	40.5	19.4	20.1	15.0	19.9	31.2	11.4	3.6	20.9	14.3	30.3	30.6	17.4	14.7	22.0	11.9	18.9	28.9

2048	4	23.1	22.4	6.6	58.8	39.6	23.3	7.1	28.8	11.6	35.5	23.5	35.7	27.1	7.5	16.6	58.8	18.4	13.0	24.8	34.5	11.6	6.6	14.5	25.3	10.6	11.9	27.3	22.9
2048	5	29.9	35.3	11.6	70.0	13.3	19.0	29.0	64.1	30.3	11.6	52.7	23.3	28.9	70.0	48.3	58.3	49.2	32.1	17.2	52.1	44.2	40.8	33.2	19.4	28.1	29.4	24.1	29.3
2048	6	54.0	56.8	22.5	117.9	74.2	37.8	57.0	66.7	68.0	45.1	40.2	62.5	102.0	54.1	53.9	41.9	75.2	26.9	36.8	35.2	53.3	117.9	76.1	59.1	72.0	22.5	42.1	42.2
2048	7	83.8	83.1	26.9	226.0	90.6	45.3	82.6	92.0	94.0	85.0	94.9	90.6	70.8	45.5	86.0	105.6	52.6	114.6	226.0	26.9	79.4	53.7	87.4	63.6	48.5	128.4	48.5	81.1
2048	8	68.2	67.2	15.2	147.1	23.1	29.1	139.9	79.4	100.2	80.4	44.1	96.4	43.8	73.9	31.7	147.1	59.9	45.9	97.8	61.5	75.5	15.2	41.3	66.1	70.4	89.4	82.3	18.3
2048	9	45.5	48.8	8.2	97.9	45.8	19.6	8.2	44.9	70.9	86.2	35.1	58.4	67.0	32.4	59.2	27.6	42.7	57.7	97.9	34.1	52.0	60.6	56.0	40.3	36.7	51.7	45.3	40.4
2048	10	30.3	30.5	15.8	51.7	22.9	15.8	41.6	41.4	51.7	45.6	20.5	29.1	29.0	16.6	23.8	23.5	23.4	38.8	30.3	30.2	37.4	25.3	31.7	32.1	31.4	32.3	24.9	31.9
2048	11	31.6	30.8	14.9	54.6	43.1	17.8	32.1	36.3	44.3	31.4	20.1	27.7	25.3	20.9	14.9	42.3	32.5	38.4	27.0	32.8	25.9	30.3	16.9	33.2	33.7	31.8	27.0	54.6
2048	12	28.4	30.7	12.5	62.1	28.9	33.9	18.5	56.6	29.5	20.5	12.5	15.9	38.1	20.5	17.7	33.6	62.1	27.5	17.0	42.8	52.8	33.2	33.8	17.4	48.5	27.8	25.0	21.4
2049	1	21.9	25.2	9.3	42.8	35.8	23.6	24.3	17.2	33.8	42.8	21.4	33.9	16.6	19.8	14.6	20.9	20.5	35.8	35.8	12.6	17.7	20.3	38.3	9.3	40.1	27.0	22.4	20.4
2049	2	19.2	22.7	5.4	46.1	31.2	46.1	9.4	17.3	22.0	33.6	26.2	16.2	33.6	12.3	30.3	18.7	8.2	12.9	43.8	18.7	7.8	32.0	34.8	5.4	17.0	19.7	32.8	15.6
2049	3	13.9	15.4	0.6	34.7	5.5	13.2	7.4	27.9	29.9	12.9	14.6	6.9	0.6	9.9	27.3	5.5	9.5	6.8	21.8	4.2	20.4	16.2	34.7	20.5	19.1	0.8	26.3	28.6
2049	4	15.9	21.3	4.4	63.0	18.7	25.8	12.0	15.8	36.5	61.9	13.4	13.0	19.6	13.2	37.7	16.0	25.0	26.0	11.5	10.0	7.2	63.0	8.8	14.2	24.3	4.4	20.2	14.1
2049	5	28.4	33.2	7.8	99.4	13.1	19.8	39.1	18.8	55.8	45.1	23.8	16.9	15.1	38.9	43.5	65.4	99.4	10.8	14.6	20.1	12.1	50.1	46.7	7.8	44.4	33.1	42.6	20.1
2049	6	52.8	58.1	16.5	134.6	22.2	86.6	65.3	52.6	66.1	80.9	28.7	52.9	79.2	16.5	53.2	102.1	54.3	108.8	134.6	45.3	33.6	43.2	48.6	99.7	31.1	17.8	34.1	37.1
2049	7	103.8	99.4	18.7	170.5	52.7	133.7	121.7	111.8	98.4	108.2	170.5	110.5	110.2	93.1	101.7	106.0	104.5	18.7	71.8	103.2	106.9	79.7	99.8	90.5	59.9	123.2	151.3	58.2
2049	8	57.1	65.7	26.5	114.3	29.1	67.0	50.5	94.8	54.7	108.8	54.9	37.7	73.5	105.6	26.5	53.7	91.8	96.1	93.3	114.3	57.2	67.6	39.9	44.4	28.9	57.0	53.1	76.7
2049	9	63.5	68.0	16.7	112.1	16.7	37.8	40.1	52.8	61.9	107.4	101.5	63.5	43.2	88.8	67.0	97.5	86.9	112.1	101.6	97.4	86.7	95.8	63.4	59.3	33.9	27.0	43.0	45.4
2049	10	37.5	36.3	16.5	66.5	66.5	41.1	50.3	21.7	43.7	47.2	16.5	18.7	31.9	46.5	42.7	24.9	41.2	25.5	51.5	19.5	17.1	32.2	45.6	33.9	62.3	21.8	19.2	50.0
2049	11	32.4	35.2	16.4	53.2	33.0	23.3	26.1	46.8	16.4	35.3	50.1	42.0	31.6	31.8	46.0	52.7	27.8	53.2	19.6	19.5	41.1	43.3	28.8	52.8	28.8	31.5	18.6	45.3
2049	12	27.2	27.0	7.2	45.7	27.0	41.1	22.8	25.1	21.8	32.4	31.8	29.0	7.2	24.2	31.2	45.7	33.3	31.4	25.7	31.9	30.8	29.2	13.9	23.4	18.2	23.6	27.4	19.5
2050	1	25.5	25.7	3.0	44.0	21.7	28.6	32.7	22.5	23.6	16.1	18.8	16.2	14.7	36.3	25.4	44.0	40.8	32.0	28.1	13.8	36.9	35.0	25.7	3.0	29.4	16.6	24.4	30.1
2050	2	19.2	19.1	5.1	35.8	24.3	11.6	13.2	19.2	8.1	9.1	31.8	26.1	15.2	25.8	35.8	33.4	14.3	24.4	20.2	13.8	12.7	19.1	9.7	5.1	24.9	13.4	25.2	22.6
2050	3	20.9	21.3	0.6	54.3	26.7	1.7	18.3	18.2	54.3	20.7	21.1	26.2	21.8	9.5	28.8	9.6	0.6	23.7	26.6	43.3	22.7	28.9	18.5	7.8	28.0	13.5	20.6	20.6
2050	4	26.3	28.2	2.1	62.8	53.8	15.2	16.6	2.1	43.0	26.7	24.7	52.3	27.9	33.8	43.5	23.2	29.6	33.8	35.2	26.9	17.6	10.8	62.8	24.2	19.7	3.4	25.8	23.9
2050	5	37.4	40.0	12.2	91.3	18.1	12.2	17.6	37.5	18.9	53.3	38.3	50.6	22.0	46.3	33.1	39.7	32.1	37.3	13.2	40.4	91.3	31.8	68.2	77.2	30.5	25.7	42.7	81.3
2050	6	45.3	47.6	8.4	103.1	55.9	44.4	8.4	54.6	30.8	65.3	47.8	68.8	65.2	38.8	38.4	44.0	28.9	22.5	103.1	46.2	34.2	52.5	32.3	96.4	40.5	47.1	49.2	27.2
2050	7	66.9	83.0	34.4	187.5	170.4	187.5	40.2	125.8	59.2	64.7	62.5	51.6	85.6	98.5	64.8	56.0	88.1	34.4	143.2	76.8	65.3	123.7	49.1	68.4	62.2	89.3	69.6	55.0
2050	8	66.4	71.5	15.8	155.6	53.4	155.6	77.1	66.0	102.6	68.7	83.1	114.7	45.8	42.0	21.7	88.4	143.3	30.7	66.7	38.1	152.1	59.3	39.9	43.0	68.2	53.9	15.8	86.1
2050	9	57.6	61.6	15.7	130.4	77.7	45.5	37.7	54.7	50.6	29.3	70.6	81.5	82.5	94.0	130.4	43.1	58.9	57.2	80.8	65.4	46.0	98.9	103.4	58.1	15.7	20.4	33.4	43.6
2050	10	27.8	29.7	8.2	55.5	29.3	26.4	28.6	37.1	23.0	32.6	50.3	51.6	23.7	27.3	40.4	55.5	21.1	19.7	31.7	27.9	38.8	25.0	8.2	24.3	27.7	16.1	30.0	17.6
2050	11	31.8	32.3	9.5	50.1	31.6	42.1	46.7	46.2	49.0	22.2	27.3	44.0	9.5	23.2	31.7	35.8	25.2	23.8	38.3	14.9	48.2	31.9	24.8	18.2	35.7	50.1	32.1	23.0
2050	12	26.6	29.0	14.6	60.8	22.7	41.9	27.2	40.7	60.8	22.0	31.8	24.6	17.1	28.1	26.0	18.9	30.4	39.5	42.3	16.5	22.5	21.0	24.5	16.1	27.8	14.6	51.6	28.1
2051	1	24.6	25.0	8.0	42.8	8.0	16.9	34.8	16.8	16.5	36.8	28.8	19.0	23.4	29.4	28.2	23.9	42.8	25.2	18.6	32.4	15.0	31.6	12.9	42.4	26.3	16.3	33.7	20.1
2051	2	17.1	18.0	5.1	38.3	22.5	19.2	17.4	25.3	13.0	37.8	28.1	11.7	38.3	6.1	25.9	5.6	7.1	17.7	13.9	11.8	15.5	11.7	21.2	27.9	10.8	16.8	22.6	5.1
2051	3	17.9	21.4	2.0	60.0	14.8	32.4	29.3	18.8	2.0	15.7	23.1	29.0	5.2	17.0	9.1	60.0	22.8	9.1	24.2	20.7	14.4	33.0	15.2	5.8	50.3	15.6	29.3	16.9
2051	4	21.0	22.5	2.9	57.0	41.2	20.6	44.8	20.9	11.7	23.9	26.1	57.0	15.1	12.8	11.4	46.4	21.0	21.8	16.4	24.9	5.9	34.9	7.2	8.6	21.1	16.9	25.5	2.9
2051	5	33.5	39.3	11.3	83.0	29.0	16.6	20.7	69.5	51.7	23.4	83.0	66.0	32.4	44.3	34.6	82.4	11.3	22.8	50.9	19.7	62.6	25.1	34.8	69.5	15.0	17.5	45.5	14.5
2051	6	62.3	66.8	22.1	148.5	44.5	35.7	66.2	106.4	68.4	55.1	114.3	84.3	65.0	30.2	35.3	46.5	49.8	28.8	22.1	109.1	79.9	59.7	109.1	74.0	148.5	44.3	70.4	56.4
2051	7	82.4	86.1	37.3	164.7	57.8	109.5	86.9	136.5	104.8	64.6	150.0	92.5	45.1	164.7	80.1	107.8	51.1	71.7	37.3	97.5	46.3	118.7	84.6	120.9	65.0	69.4	57.7	45.1
2051	8	65.3	68.3	13.6	123.4	115.8	64.1	66.6	54.2	67.6	123.4	63.5	62.3	80.0	60.9	88.2	59.9	46.2	66.5	83.3	75.9	80.3	59.5	13.6	47.1	44.0	91.7	56.1	67.6
2051	9	63.6	64.5	20.8	113.7	63.3	108.7	50.8	23.8	69.3	108.1	24.5	27.9	54.4	97.7	91.0	76.2	64.6	51.6	76.1	60.4	54.5	61.9	63.8	113.7	20.8	74.2	72.9	36.7
2051	10	29.6	31.5	14.8	59.7	16.2	16.9	26.8	43.3	36.1	35.0	18.8	24.5	39.8	30.1	30.9	20.3	37.0	55.0	24.7	21.1	29.1	49.7	44.9	28.4	59.7	30.0	23.7	14.8
2051	11	33.9	36.9	18.8	66.4	30.9	66.4	42.7	47.8	32.5	39.9	41.1	28.5	45.7	56.9	34.0	51.3	32.0	25.3	27.2	24.4	24.9	33.9	32.8	20.2	54.4	37.4	18.8	35.9
2051	12	29.0	29.6	13.3	51.3	28.9	49.3	29.2	18.3	22.6	33.2	32.2	21.1	13.3	25.3	51.3	35.0	25.3	51.0	35.5	26.4	40.6	30.4	22.0	17.3	18.5	22.8	30.8	29.6
2052	1	26.1	27.8	15.1	49.9	35.3	25.1	17.9	17.3	49.9	29.7	33.9	27.0	15.1	19.6	29.4	27.2	49.2	42.7	21.8	23.4	34.1	27.4	21.4	24.9	35.3	23.9	19.7	17.0
2052	2	21.0	21.8	6.5	55.4	18.8	31.2	20.6	19.9	19.9	27.5	55.4	21.4	12.1	25.3	13.5	6.5	29.5	22.1	30.3	10.8	14.3	21.8	28.2	22.7	18.2	9.5	20.3	23.6
2052	3	15.0	16.9	0.9	31.5	21.3	15.3	24.8	30.4	23.5	31.5	25.1	13.3	14.2	14.6	5.7	26.1	25.5	17.7	10.6	17.2	16.2	0.9	14.4	14.0	7.1	10.9	13.3	12.8
2052	4	25.7	28.1	6.5	68.7	31.7	22.2	30.6	39.6	6.5	68.7	43.2	38.9	24.3	32.1	9.1	12.9	26.0	41.0	31.0	24.1	18.8	25.5	23.0	44.4	16.1	34.6	22.2	8.6
2052	5	31.6	38.4	11.2	75.3	43.7	27.4	23.5	25.3	31.9	46.1	45.6	72.9	11.2	72.6	32.2	75.3	31.4	28.6	29.9	39.3	49.6	31.0	24.6	70.7	52.7	12.7	17.2	25.0
2052	6	53.0	56.1	14.6	132.9	38.6	75.1	47.4	39.9	132.9	41.2	77.9	24.1	81.8	14.6	61.3	65.6	32.4	53.1	58.8	40.1	41.4	57.9	52.8	61.0	110.9	49.0	31.5	57.8
2052	7	65.9	71.7	18.5	148.3	65.0	87.6	93.7	63.2	39.4	18.5	48.7	126.6	43.8	66.7	46.0	125.9	148.3	78.0	63.8	26.7	121.0	66.8	30.2	95.5	27.7	54.5	77.3	106.2
2052	8	69.8	70.1	22.3	150.8	50.8	74.4	62.6	35.0	60.8	88.5	150.8	79.2	28.7	82.7	38.8	68.5	42.8	87.1	22.3	123.3	29.5	38.3	71.1	81.7	31.8	148.1	115.6	71.0
2052	9	56.2	62.1	13.4	138.5	57.6	138.5	48.6	54.4	92.2	103.3	49.3	54.8	65.2	53.4	32.9	86.3	49.0	61.3	64.7	72.5	88.4	29.5	76.8	88.6	14.6	46.4	13.4	48.8
2052	10	35.5	35.3	10.7	70.3	37.6	26.5	22.0	24.0	49.4	35.8	31.8	25.4	41.5	36.0	70.3	52.2	41.6	33.2	41.1	20.7	30.3	10.7	36.7	17.0	18.7	45.9	63.3	35.3
2052	11	34.0	37.2	17.6	69.8	25.5	38.3	49.4	27.6	35.1	33.3	44.9	61.8	24.5	69.8	52.5	30.4	17.6	53.0	29.0	21.1	41.6	23.4	27.0	34.6	62.0	27.7	27.5	35.5
2052	12	28.0	30.0	11.7	56.6	56.6	27.2	30.8	26.8	18.3	27.2	18.0	32.6	40.0	50.1	39.8	32.9	11.7	15.7	19.0	35.7	53.2	42.3	22.1	28.9	26.1	24.1	11.8	28.8
2053	1	26.5	25.8	13.5	44.7	26.3	15.5	13.5	20.6	27.8	26.7	24.8	15.0	19.3	32.3	23.2	28.6	23.8	35.8	19.1	30.9	26.6	26.9	21.7	42.0	28.3	30.1	16.7	44.7
2053	2	21.1	20.9	4.9	40.4	13.4	14.2	16.5	24.5	27.8	21.4	23.7	12.0	29.5	4.9	12.0	11.6	29.5	17.1	15.5	40.4	20.8	26.0	24.3	17.7	30.6	23.9	24.2	20.6
2053	3	16.7	16.4	2.9	37.1	6.9	22.0	2.9	30.5	13.5	15.7	9.1	4.5	4.7	4.7	20.0	28.2	18.1	37.1	4.0	11.7	19.7	6.8	23.7	19.9	17.7	27.4	12.6	32.5
2053	4	16.7	19.5	5.4	41.8	18.7	30.1	22.6	28.8	7.3	7.3	16.0	15.6	19.1	8.8	24.2	39.4	16.5	41.8	16.6	19.8	36.5	8.3	11.6	8.0	16.8	14.4	34.8	5.4
2053	5	42.9	43.6	4.6	77.0	36.0	27.4	17.9	61.0	45.2	58.2	66.4	57.1	41.8	73.4	39.4	51.2	15.2	44.3	38.3	77.0	36.1	48.4	4.6	64.9	20.6	41.1	44.0	37.6
2053	6	49.8	56.0	22.1	152.2	90.6	50.0	27.6	152.2	45.8	47.9	55.6	56.8	36.2	38.5	54.7	48.3	71.2	88.6	57.4	30.6	59.8	49.7	25.3	35.9	33.9	89.1	75.2	22.1
2053	7	73.6	75.9	23.8	129.5	95.1	85.2	35.6	74.0	38.1	103.9	129.5	49.7	79.0	124.4	74.1	23.8	56.2	48.5	60.9	114.4	86.7	73.2	68.6	98.9	68.3	124.0	53.8	55.0
2053	8	61.7	70.1	27.8	122.4	100.3	96.7	40.1	66.9	111.4	46.7	81.4	101.8	55.7	58.0	35.5	34.2	64.8	51.0	56.1	31.3	122.4	27.8	88.0	58.7	86.2	105.0	121.0	41.4
2053	9	57.3	62.4	11.5	152.2	59.0	60.2	29.6	42.2	106.9	72.3	71.2	40.8	55.5	41.5	102.7	46.4	91.0	71.6	48.7	74.5	36.5	68.5	93.5	21.8	11.5	50.5	152.2	48.4
2053	10	31.8	31.2	5.6	71.3	7.1	5.6	46.2	48.4	35.4	71.3	37.2	31.4	22.1	33.2	33.3	22.9	33.3	22.6	21.0	43.1	32.1	23.0	46.6	10.9	19.9	27.1	21.0	53.8
2053	11	28.8	33.0	14.2	69.9	19.2	37.9	37.4	21.6	67.0	28.0	34.0	30.6	21.5	19.5	35.6	48.6	26.4	15.0	56.2	21.9	38.6	42.4	14.2	27.9	22.2	27.5	69.9	29.6
2053	12	30.8	33.3	17.5	84.6	41.2	24.8	21.2	27.5	84.6	27.2	35.9	48.6	30.1	32.3	35.4	31.5	17.5	17.5	44.8	26.3	26.4	20.1	21.1	38.1	43.9	35.0	25.5	41.6
2054	1	25.0	29.0	12.8	56.9	42.3	23.2	23.3	20.9	34.0	19.2	21.7	24.9	36.2	19.0	16.2	56.5	21.8	25.1	38.0	56.9	18.0	28.5	26.2	14.2	36.7	39.9	40.6	12.8
2054	2	21.7	21.4	8.8	33.5	24.0	28.6	13.8	26.4	26.5	19.1	33.5	12.1	29.0	22.0	26.7	19.1	8.8	11.2	18.4	21.4	8.9	27.7	19.2	23.2	29.3	15.1	17.5	33.0
2054	3	22.4	22.7	9.2	56.3	11.8	26.7	21.6	23.9	19.9	17.2	35.5	14.0	17.5	10.9	19.9	9.2	25.2	24.9	32.7	23.1	13.7	56.3	33.3	26.0	12.2	23.4	11.8	33.6
2054	4	17.0	18.1	3.2	40.9	23.2	21.2	6.4	4.0	20.0	17.8	26.4	8.4	16.1	5.9	40.9	18.9	23.6	10.2	33.7	7.4	3.2	31.8	29.5	13.7	16.2	24.9	14.9	16.1
2054	5	31.7	42.2	1.6	94.5	50.4	48.6	78.5	33.9	57.1	19.4	29.4	79.5	34.6	52.7	1.6	25.4	24.8	94.5	73.9	71.3	16.5	20.3	7.9	28.9	26.6	91.5	20.2	26.3
2054	6	59.1	61.4	21.2	119.1	78.1	75.1	34.9	71.0	77.2	72.3	113.8	34.4	38.0	61.1	38.6	79.0	54.9	29.9	56.9	81.8	67.2	32.3	57.2	51.6	51.8	76.7	119.1	21.2
2054	7	80.0	84.0	31.2	149.8	79.4	102.1	71.6	138.3	138.7	149.8	44.2	97.0	103.4	103.4	45.6	50.1	86.7	68.5	80.5	87.2	76.9	36.6	79.3	125.1	79.6	43.3	96.8	31.2
2054	8	73.4	77.8	19.9	148.8	71.1	84.8	133.1	65.2	118.3	69.0	75.7	60.4	127.8	52.9	30.2	43.0	92.8	57.9	90.9	102.7	148.8	104.4	76.9	60.7	36.7	115.3	27.9	19.9
2054	9	58.0	63.5	20.6	156.0	90.2	156.0	108.9	59.0	64.3	43.3	51.3	36.3	63.4	64.0	48.7	42.0	97.3	20.6	57.0	53.1	63.3	54.2	69.0	44.7	36.3	70.2	86.9	44.4
2054	10	33.3	37.2	8.9	71.9	35.2	25.9	37.1	10.0	68.8	31.2	8.9	36.9	52.7	19.8	71.9	48.7	52.3	26.4	35.1	29.8	55.2	31.5	23.9	27.1	49.8	70.5	30.1	14.6
2054	11	34.8	36.5	17.7	62.6	31.9	36.3	27.3	19.1	25.3	47.0	62.6	30.3	17.7	53.0	41.1	19.2	43.6	23.5	30.4	56.9	42.2	23.0	26.9	33.3	40.1	43.0	60.1	42.8
2054	12	29.0	30.0	11.4	50.6	13.6	21.9	47.0	39.0	50.5	50.6	15.9	15.7	37.6	13.5	50.4	29.8	41.5	36.0	20.4	26.5	31.1	27.1	11.4	19.9	28.2	33.3	34.5	24.3
2055	1	26.2	27.1	12.8	49.9	36.3	26.7	20.2	28.1	25.7	36.3	16.6	12.8	16.9	15.5	32.8	24.9	39.0	49.9	17.1	27.2	26.8	45.7	37.6	13.6	15.6	46.0	17.1	20.8
2055	2	21.3	22.3	11.4	37.4	21.3	36.3	18.4	19.1	16.9	16.1	11.4	37.4	24.1	29.7	13.3	15.3	14.4	22.0	25.6	28.2	31.2	14.4	21.3	12.7	32.6	27.2	17.9	27.1
2055	3	19.5	23.3	4.0	48.8	13.0	31.3	41.7	35.6	48.8	34.0	21.2	17.3	16.3	5.4	17.8	25.1	44.2	13.3	13.2	34.2	12.2	37.1	25.7	11.7	4.0	17.4	30.6	8.1
2055	4	22.8	23.2	3.9	51.2	16.4	41.4	23.4	4.7	37.6	26.2	6.2	34.2	20.1	33.4	11.0	51.2	25.4	20.2	3.9	7.3	27.0	15.2	20.9	21.0	35.9	22.6	23.1	28.5
2055	5	34.2	37.5	13.4	80.0	64.4	45.9	59.2	47.6	13.4	27.4	25.9	37.2	24.1	28.6	33.9	29.7	38.0	27.1	45.7	16.4	44.3	17.4	13.5	46.2	69.2	80.0	30.5	34.5
2055	6	52.8	60.0	17.0	134.9	22.6	90.2	21.1	53.0	113.3	36.6	89.8	37.0	44.1	134.9	69.4	54.8	64.1	17.0	96.0	106.7	52.6	44.7	33.0	104.3	40.3	58.3	32.1	24.4
2055	7	65.7	72.1	26.2	177.4	61.7	177.4	27.4	55.8	83.8	26.2	95.9	37.9	62.8	47.3	65.5	90.9	63.9	76.2	81.0	100.6	54.9	37.9	113.0	65.8	76.4	124.2	37.1	67.0
2055	8	59.4	61.6	26.0	104.5	59.4	46.5	37.9	59.4	59.0	104.5	59.3	77.0	66.3	35.9	34.2	41.6	84.3	79.3	48.9	82.5	59.9	77.1	76.8	27.9	76.8	26.0	55.9	103.1
2055	9	53.4	55.3	20.9	98.3	38.5	61.9	31.2	57.2	84.5	28.2	91.6	74.7	60.2	66.2	25.7	38.0	42.3	60.7	38.1	46.5	36.9	72.0	89.3	98.3	20.9	24.2	49.6	91.1
2055	10	39.3	36.9	6.7	62.7	28.5	51.0	27.7	17.2	10.4	38.6	58.9	36.3	43.6	48.1	20.2	50.9	40.1	12.9	50.5	13.5	24.9	6.7	24.6	54.0	62.7	56.0	56.6	52.3

2055	11	35.5	33.5	8.3	56.9	48.4	38.8	38.4	24.1	19.9	32.6	50.0	36.6	38.5	24.3	36.0	35.1	50.9	33.1	29.4	8.3	45.9	22.5	9.1	38.7	23.2	42.9	56.9	20.0
2055	12	32.2	30.5	7.1	51.7	22.4	34.1	46.4	32.5	51.7	36.9	51.1	48.7	23.5	17.9	26.5	45.7	7.1	11.5	33.7	23.5	32.4	20.0	32.7	34.4	16.4	32.0	28.0	21.5
2056	1	26.7	24.8	9.0	52.4	28.3	18.6	19.8	31.2	26.3	17.3	27.4	27.3	27.4	31.8	9.0	27.0	12.5	20.9	19.1	17.4	12.7	52.4	29.0	43.2	34.0	18.3	27.7	17.3
2056	2	22.4	24.2	5.7	48.8	40.1	30.1	14.2	23.7	18.3	14.3	24.2	48.8	48.1	41.2	21.4	18.9	6.3	24.0	21.5	14.1	5.7	21.2	29.4	12.6	23.4	14.4	40.3	24.5
2056	3	21.2	21.8	6.9	54.7	32.0	12.4	22.6	26.5	36.7	30.1	15.1	13.6	16.4	27.6	13.0	11.1	54.7	6.9	23.4	20.2	20.0	24.1	22.3	18.1	25.0	13.7	26.3	11.9
2056	4	15.3	21.8	3.2	74.5	41.2	10.5	22.2	12.4	16.3	30.2	4.8	3.3	15.7	14.9	23.5	6.3	3.2	18.6	37.0	3.6	14.2	12.1	63.9	74.5	7.4	37.3	13.7	36.1
2056	5	33.1	37.5	0.0	91.2	27.6	42.3	21.1	91.2	29.2	32.9	24.3	18.7	33.3	22.2	17.7	71.9	59.8	0.0	38.6	5.1	40.1	70.7	31.9	48.6	60.0	13.5	45.6	52.8
2056	6	53.0	58.4	10.3	113.8	54.0	56.3	108.3	50.8	10.3	30.3	77.4	44.9	41.3	51.1	76.6	48.7	36.1	36.9	94.8	77.6	58.6	80.6	113.8	23.5	71.4	51.9	72.7	34.1
2056	7	85.5	81.6	11.2	210.9	95.5	91.4	65.9	119.7	49.5	74.7	101.5	33.2	88.8	62.7	93.9	131.0	87.8	90.6	34.1	83.2	210.9	11.2	109.1	90.4	64.5	67.5	54.8	45.4
2056	8	53.4	57.7	5.6	138.5	45.3	95.4	54.8	99.7	5.6	40.8	22.0	44.0	44.6	40.0	21.3	38.5	60.9	42.2	60.3	99.8	138.5	78.5	52.0	43.4	72.7	62.0	63.8	59.4
2056	9	62.2	62.0	13.6	121.6	41.2	88.0	95.6	74.8	23.7	30.6	45.8	77.6	44.8	97.7	109.6	34.7	121.6	67.3	68.9	41.7	77.2	43.8	94.0	60.7	63.6	13.6	34.6	36.3
2056	10	34.0	36.5	13.2	66.4	13.2	50.2	63.8	33.7	25.9	34.2	39.0	28.6	44.2	30.5	43.2	32.7	16.7	23.8	17.2	42.6	26.2	66.4	55.6	42.5	45.8	28.6	42.7	29.1
2056	11	29.6	30.7	7.5	63.8	45.2	32.8	26.1	20.6	25.2	38.0	36.2	63.8	35.7	32.0	25.4	34.7	21.2	37.5	29.1	18.8	29.7	29.5	34.9	7.5	50.0	25.0	19.3	18.9
2056	12	28.5	28.5	15.2	61.3	30.1	21.6	16.4	30.6	27.9	19.0	41.6	38.6	28.1	16.4	28.8	29.2	16.5	33.6	16.0	30.0	37.5	15.2	34.7	18.5	22.5	28.1	61.3	40.9
2057	1	23.5	28.5	11.6	58.7	40.3	11.6	23.6	20.4	39.8	23.4	39.0	23.7	17.8	37.1	14.8	38.8	20.9	25.3	17.7	19.8	37.8	58.7	20.2	19.3	56.1	20.7	23.3	34.0
2057	2	20.6	20.4	6.2	50.0	22.4	7.6	24.6	21.4	18.6	38.4	22.3	13.3	33.6	14.0	9.7	15.0	23.2	17.4	50.0	6.2	25.7	22.3	8.4	10.2	29.0	28.7	7.4	19.7
2057	3	17.4	20.6	2.8	45.3	37.2	17.5	8.4	13.8	22.3	16.4	17.3	27.8	16.5	23.0	23.5	45.3	16.2	7.6	16.9	43.4	2.8	15.9	28.7	18.4	8.4	32.7	12.9	21.1
2057	4	20.6	23.3	4.1	66.0	66.0	12.2	30.0	12.5	18.4	21.4	52.1	18.4	26.0	21.0	29.1	22.7	20.2	22.0	18.7	5.5	4.1	19.4	16.8	29.9	24.9	19.8	42.9	6.2
2057	5	46.9	45.2	9.3	102.9	44.5	17.0	19.8	82.1	83.3	50.6	51.2	49.5	24.2	18.1	21.7	81.7	11.2	62.8	19.1	73.6	56.4	28.8	33.0	30.1	64.3	102.9	49.4	9.3
2057	6	55.3	56.2	15.3	137.0	24.7	58.2	76.5	65.3	31.8	54.1	29.5	21.7	91.6	80.8	49.6	50.9	43.9	24.8	62.5	137.0	45.5	97.6	56.6	39.0	60.3	62.8	15.3	68.0
2057	7	71.0	71.0	14.4	143.4	50.4	143.4	82.8	126.5	80.7	83.0	32.6	101.3	31.3	101.2	53.3	115.4	41.5	74.5	59.6	67.6	97.6	50.9	41.8	47.0	14.4	16.0	93.8	97.6
2057	8	67.9	67.8	26.4	117.4	27.8	79.7	26.4	68.8	45.3	83.6	36.5	63.3	42.6	117.4	43.8	92.0	91.0	74.2	90.2	58.8	79.1	108.5	50.1	47.5	97.3	66.3	70.4	67.0
2057	9	62.4	64.4	11.0	147.5	32.2	85.1	93.2	66.7	58.1	147.5	29.1	53.7	73.1	23.0	36.2	106.3	105.5	112.4	82.8	48.8	49.8	85.5	34.9	75.9	48.6	16.9	11.0	68.7
2057	10	34.7	34.2	12.5	60.3	36.9	12.5	60.3	22.2	20.5	40.9	16.0	49.2	49.1	35.9	25.9	38.1	40.9	33.5	42.0	31.1	53.9	31.4	25.4	27.6	39.1	16.8	53.1	17.6
2057	11	31.2	31.6	14.3	52.8	39.6	30.7	17.9	52.8	31.6	43.7	37.4	32.3	14.3	42.9	24.6	35.3	28.8	18.6	45.8	30.8	29.0	35.1	20.2	39.6	46.0	17.9	20.3	24.3
2057	12	29.3	32.3	11.4	67.5	38.5	38.9	41.9	27.1	39.5	26.4	25.0	67.5	28.8	29.5	11.4	33.1	24.2	19.8	32.6	11.4	54.3	26.3	39.0	29.1	29.6	51.7	22.6	26.2
2058	1	25.3	27.5	12.5	50.6	30.8	33.8	44.5	25.9	19.0	33.0	19.1	14.6	43.7	16.4	35.5	18.1	24.7	50.6	22.4	33.7	28.0	23.0	38.8	27.1	12.5	23.6	19.4	20.8
2058	2	17.8	20.5	0.8	42.9	17.5	22.4	16.6	14.3	8.0	29.5	27.0	13.9	15.7	12.7	42.9	22.1	14.1	20.7	2.9	41.3	0.8	23.6	7.6	35.4	16.6	27.7	18.2	39.9
2058	3	22.5	24.4	8.6	50.9	15.9	24.5	25.1	47.5	17.8	30.0	24.0	19.3	17.7	28.5	22.4	13.2	24.2	17.4	16.0	32.6	8.6	19.6	14.8	28.4	50.9	15.2	50.3	22.6
2058	4	23.1	23.8	8.5	50.5	15.9	35.5	8.5	13.0	41.9	20.1	17.4	16.7	15.0	28.8	26.6	50.5	29.2	14.6	16.3	24.0	36.5	28.7	22.8	24.2	30.7	10.6	23.5	19.8
2058	5	30.5	34.2	10.9	86.2	11.8	30.6	58.3	63.6	11.0	47.0	35.4	19.2	31.1	27.7	39.3	66.2	10.9	19.9	20.2	38.9	33.2	86.2	26.8	32.6	30.5	27.8	27.2	26.2
2058	6	42.6	47.3	18.7	90.2	49.9	51.4	23.4	24.3	39.9	37.2	83.3	42.8	36.9	61.5	29.1	18.7	59.4	19.6	57.9	77.6	23.4	64.5	42.5	90.2	38.5	54.2	84.5	24.3
2058	7	80.1	85.3	38.5	160.1	81.5	38.5	71.8	112.3	78.6	135.9	39.6	63.5	94.7	109.9	50.4	77.2	111.1	87.5	85.7	136.1	78.8	89.8	127.8	160.1	69.1	44.9	39.8	62.2
2058	8	62.7	67.6	21.7	128.0	93.4	60.1	70.6	37.0	51.4	49.1	45.7	81.2	63.9	87.6	128.0	85.3	43.9	111.0	86.1	56.6	61.5	45.3	47.5	91.7	94.7	21.7	73.7	35.7
2058	9	60.3	58.6	19.4	131.0	65.3	55.2	69.5	103.5	69.1	67.5	46.9	63.0	63.6	36.9	43.7	54.5	68.5	65.3	57.6	131.0	37.9	73.8	48.8	63.7	19.4	35.1	32.8	33.0
2058	10	33.1	33.5	9.8	59.4	48.4	27.8	57.5	19.0	37.3	25.5	19.8	15.8	59.4	33.0	21.8	42.0	36.6	37.8	9.8	36.9	25.3	29.1	23.6	33.3	40.8	53.1	40.7	30.2
2058	11	33.7	34.5	2.6	56.1	33.5	33.9	2.6	29.4	30.7	38.5	49.2	36.4	32.9	54.0	23.7	19.7	28.7	25.7	27.8	26.4	42.7	45.2	35.9	30.3	38.6	47.8	56.1	39.4
2058	12	31.4	32.5	8.1	54.3	31.6	41.3	13.2	44.8	36.8	40.3	46.6	24.9	21.5	47.4	17.5	22.2	25.4	26.5	54.3	26.0	28.5	43.8	31.2	48.8	8.1	24.1	32.4	41.7
2059	1	24.0	26.8	5.2	60.9	60.9	35.4	20.9	35.9	24.0	31.2	38.9	10.9	17.2	19.7	17.7	24.7	23.8	17.2	33.4	25.4	21.5	46.4	29.1	5.2	19.5	39.6	24.0	21.8
2059	2	19.8	19.8	4.8	49.3	11.6	4.8	20.8	18.9	7.8	11.3	49.3	36.6	12.9	25.4	25.9	10.5	21.1	10.5	15.5	6.6	15.9	32.6	24.6	20.9	29.7	9.3	32.3	20.8
2059	3	18.4	19.3	7.1	38.0	21.2	10.9	16.9	17.6	19.8	38.0	16.7	21.3	18.6	29.1	14.2	7.1	18.1	19.3	14.5	9.0	9.8	26.9	10.3	24.2	22.3	15.7	29.1	32.5
2059	4	19.6	20.7	0.9	48.3	19.1	26.5	13.2	11.3	33.3	17.6	9.1	20.5	31.1	8.7	4.0	25.4	19.3	31.0	5.0	13.5	0.9	6.0	26.8	36.6	45.5	19.9	25.4	48.3
2059	5	41.4	44.2	8.9	83.7	15.2	57.1	53.8	83.7	25.4	46.1	51.5	41.2	38.5	37.2	38.1	38.9	41.5	60.7	71.5	21.5	26.6	35.3	67.0	19.9	74.1	52.6	8.9	54.1
2059	6	60.9	59.5	16.1	129.1	32.6	47.3	75.4	47.6	69.9	91.6	68.5	129.1	57.3	53.9	42.0	30.6	72.2	32.1	64.5	51.7	48.1	67.2	78.4	76.5	71.2	16.1	35.3	68.2
2059	7	66.1	73.0	38.2	145.5	57.9	96.3	92.1	55.9	66.9	65.9	68.1	64.2	100.0	114.6	90.2	91.6	145.5	64.0	49.7	61.4	38.2	76.1	57.4	77.1	66.2	52.9	41.3	58.6
2059	8	57.3	62.9	13.7	126.6	57.6	54.6	87.4	28.4	65.1	97.0	13.7	50.7	53.9	126.6	68.3	56.9	88.9	88.2	53.8	86.8	101.4	53.5	34.0	19.4	45.3	68.0	72.3	39.0
2059	9	47.4	50.0	12.5	98.6	46.8	12.5	55.5	18.8	48.0	40.8	31.2	31.1	60.4	88.4	77.7	98.6	43.3	49.4	51.3	52.3	15.5	37.8	65.6	94.4	28.6	42.3	74.5	36.3
2059	10	28.0	30.9	10.4	79.8	79.8	21.3	28.0	29.8	32.6	25.8	40.6	28.0	33.2	29.2	57.8	17.7	73.5	22.9	20.2	35.8	10.4	18.1	19.9	17.0	34.3	28.2	13.7	24.6
2059	11	40.2	39.8	16.5	69.2	22.4	26.1	23.8	43.4	40.1	53.1	63.1	45.2	35.2	43.8	37.9	38.5	16.5	52.0	69.2	32.8	46.6	40.3	47.3	46.0	26.7	34.8	42.0	29.1
2059	12	26.1	27.7	9.6	45.2	9.8	22.8	18.7	43.4	17.2	26.6	20.0	30.2	9.6	42.1	45.2	14.4	26.9	30.4	33.3	40.4	25.6	41.0	41.2	20.4	24.4	37.1	23.0	19.9
2060	1	25.5	26.2	8.3	47.2	47.2	25.9	24.0	15.5	36.5	25.4	27.6	23.2	40.8	25.5	18.5	28.6	15.7	20.9	27.6	8.3	32.9	40.4	15.4	43.6	27.4	15.4	22.7	20.5
2060	2	21.9	20.8	3.8	41.1	5.7	23.9	21.0	35.5	12.7	26.2	12.8	9.7	23.9	34.7	36.4	24.0	18.1	41.1	24.3	7.9	13.3	22.9	29.9	19.0	13.5	3.8	28.9	9.1
2060	3	18.9	21.1	6.7	46.0	16.4	6.7	9.7	31.0	18.4	14.0	19.4	46.0	14.6	35.4	22.4	6.8	31.1	8.4	26.4	20.7	17.6	16.5	8.5	25.0	34.1	19.3	18.4	38.9
2060	4	18.6	19.3	8.1	33.0	11.9	12.2	11.9	10.0	20.3	8.1	18.5	15.1	32.6	24.9	11.3	33.0	24.9	20.7	18.7	15.3	27.1	12.5	32.4	15.1	21.3	14.9	24.4	25.7
2060	5	40.0	41.2	1.3	101.2	55.7	48.4	50.4	56.2	33.5	10.0	44.6	48.2	26.4	31.9	31.0	36.1	101.2	49.9	28.0	3.3	1.3	34.5	59.6	41.8	36.5	71.1	52.2	38.2
2060	6	53.5	55.9	23.4	105.6	83.4	23.4	70.5	90.0	43.8	70.1	49.0	60.5	105.6	52.6	29.3	35.7	75.3	48.3	50.4	55.6	79.0	33.0	30.9	59.0	54.5	47.0	67.5	26.1
2060	7	76.8	75.7	22.3	138.7	87.5	37.3	80.6	60.8	131.6	76.5	62.1	78.4	69.0	55.5	118.7	22.3	44.3	77.1	79.1	24.5	73.8	59.7	127.2	138.7	78.7	79.2	71.9	83.4
2060	8	65.0	74.0	19.1	154.7	64.7	68.9	65.2	59.1	89.7	146.0	44.9	19.1	129.7	53.6	30.2	59.7	54.0	49.4	61.8	85.6	39.4	122.1	65.3	154.7	71.8	79.8	123.6	38.3
2060	9	47.9	55.0	23.2	135.2	31.1	96.2	39.2	27.1	47.1	47.8	63.3	37.0	135.2	65.3	23.2	40.4	72.3	47.3	48.1	53.3	67.2	59.7	56.7	41.4	46.8	58.6	85.3	30.3
2060	10	41.4	41.0	17.6	65.2	58.4	25.2	61.4	43.0	45.0	44.5	26.8	30.8	42.7	48.5	36.5	65.2	37.4	19.0	24.2	45.2	17.6	40.1	26.6	62.0	39.7	48.8	60.7	34.1
2060	11	33.3	33.7	14.4	66.3	66.3	35.0	31.5	30.9	34.5	18.8	30.1	56.5	24.6	36.0	22.9	23.4	22.3	34.0	27.3	18.3	36.8	33.6	40.7	14.4	43.2	33.1	42.5	52.4
2060	12	26.4	27.5	13.3	45.3	24.4	21.8	45.3	15.7	26.7	26.2	18.9	31.7	29.4	32.8	33.0	21.9	32.6	25.0	23.6	13.3	21.6	32.0	40.8	31.5	37.9	33.4	19.9	20.7
2061	1	27.9	24.9	2.4	45.3	28.5	31.3	11.1	29.1	11.9	10.0	37.5	45.3	34.2	32.4	27.3	18.1	23.0	39.5	29.5	2.4	9.3	32.7	15.9	29.7	29.2	27.3	19.0	22.7
2061	2	20.0	22.7	8.3	51.3	28.0	16.5	34.4	26.6	14.4	32.9	25.5	51.3	15.9	8.6	11.7	15.8	28.5	31.5	20.0	16.8	8.3	17.3	15.3	16.7	23.5	27.0	39.0	20.0
2061	3	23.6	22.6	4.5	45.5	32.5	20.4	16.3	45.5	16.8	25.7	23.3	21.0	7.9	23.9	40.5	24.6	14.5	30.0	11.8	25.2	4.5	8.2	29.2	31.7	25.5	32.0	16.6	15.2
2061	4	26.3	25.8	7.4	49.9	12.9	13.5	27.7	40.7	7.4	39.8	39.0	33.7	39.5	28.4	49.9	12.6	14.9	25.0	12.4	27.5	12.7	10.1	41.2	9.3	18.9	37.6	42.1	22.3
2061	5	33.4	37.9	5.4	73.2	59.7	59.4	38.9	73.2	38.2	71.7	50.9	32.5	24.6	10.0	55.6	18.1	19.7	45.2	42.5	70.8	31.3	31.4	5.4	27.9	16.1	34.4	31.2	21.4
2061	6	46.7	52.3	22.4	107.1	37.1	77.7	45.2	54.7	28.1	32.7	51.0	44.8	34.5	22.7	48.3	73.2	107.1	24.6	97.3	83.5	42.4	28.0	56.2	82.7	22.4	66.4	35.1	59.1
2061	7	82.5	87.6	42.7	165.9	42.7	155.1	105.7	137.7	45.3	68.2	70.1	44.5	124.9	81.4	104.4	53.5	91.5	61.3	90.2	165.9	51.2	48.4	83.6	104.0	58.2	101.6	76.8	135.4
2061	8	63.0	63.8	15.1	130.7	23.6	66.0	59.9	28.0	37.1	61.8	48.0	28.4	86.6	108.1	15.1	130.7	68.1	42.7	70.3	96.1	120.7	60.5	66.8	70.9	100.4	64.3	22.2	54.0
2061	9	53.5	60.2	25.9	109.3	28.0	80.2	74.0	52.0	107.2	71.3	65.9	30.4	56.5	36.4	84.4	47.0	109.3	77.7	43.5	48.5	72.9	38.8	55.1	105.2	25.9	43.1	47.0	43.5
2061	10	36.6	38.0	9.4	90.3	70.7	45.5	40.9	37.0	62.0	21.3	9.4	29.2	36.3	24.8	18.1	90.3	21.3	34.2	38.9	42.0	46.2	44.8	43.0	20.7	25.8	33.4	33.3	41.6
2061	11	36.5	38.7	4.9	88.9	30.6	23.2	74.9	48.0	37.0	41.6	42.7	43.6	18.8	41.5	42.5	42.6	31.7	30.0	36.1	25.5	57.5	35.5	41.7	4.9	26.4	28.7	88.9	35.3
2061	12	34.0	34.0	18.9	54.6	31.1	25.5	35.9	23.4	44.7	47.1	54.6	44.2	26.9	47.3	34.8	49.2	39.5	41.5	20.3	23.5	20.6	28.4	33.3	25.8	39.8	24.3	18.9	34.6
2062	1	19.8	26.1	13.0	49.8	36.9	14.9	29.2	18.2	42.2	13.0	19.7	37.5	24.0	19.9	29.2	39.3	19.4	15.3	18.2	33.0	49.8	19.2	31.5	19.6	48.2	19.6	14.3	14.7
2062	2	20.3	22.2	5.0	46.1	9.1	11.7	11.2	18.2	23.5	25.9	46.1	22.9	18.1	29.4	40.0	39.1	33.4	19.0	15.0	8.9	17.0	33.3	39.0	5.0	31.0	7.9	6.4	21.5
2062	3	17.6	20.0	6.0	52.2	9.5	26.4	11.4	52.2	46.1	9.1	18.5	15.5	21.7	6.0	17.8	13.2	18.5	13.7	13.3	21.1	16.4	9.3	26.5	27.4	17.1	20.5	17.5	31.0
2062	4	22.2	21.6	0.9	39.8	32.6	10.9	4.2	36.6	25.2	0.9	17.1	13.0	17.2	24.6	13.2	17.6	5.9	23.1	30.1	25.9	39.3	13.2	37.0	27.7	39.8	21.4	31.4	9.9
2062	5	36.8	42.5	4.5	103.1	44.4	72.8	25.2	99.8	62.2	17.9	20.3	75.3	45.3	44.1	23.5	51.3	30.5	19.3	33.6	75.6	4.5	40.0	17.7	103.1	56.9	15.5	31.3	11.1
2062	6	58.7	63.2	27.1	112.2	27.1	67.7	54.7	71.8	61.7	45.6	51.8	74.5	55.8	41.7	53.6	64.9	96.8	46.5	66.2	38.2	104.8	112.2	46.9	100.3	62.0	73.1	47.5	50.7
2062	7	87.1	88.1	38.0	134.2	78.9	126.3	129.0	85.3	134.2	101.0	81.7	60.4	88.9	91.1	76.6	69.2	123.0	102.9	55.5	76.1	38.0	92.7	85.0	91.1	48.5	99.3	108.7	71.7
2062	8	55.3	64.5	24.2	125.7	53.2	28.9	89.0	38.7	73.5	74.8	39.5	36.1	86.1	90.7	24.2	121.9	125.7	104.6	30.9	93.2	64.9	44.8	47.5	66.4	56.4	53.0	54.2	50.7
2062	9	54.7	59.9	18.1	176.4	25.9	57.6	22.5	40.5	77.7	70.4	38.6	23.4	63.1	48.9	71.3	23.2	94.0	48.5	84.3	49.4	76.1	63.5	18.1	113.4	51.8	31.3	176.4	67.1
2062	10	33.5	41.9	7.4	107.8	35.2	49.4	82.1	18.4	31.3	30.4	7.4	31.0	22.4	56.3	26.2	107.8	54.7	18.4	32.1	73.1	32.2	49.7	31.7	36.0	60.3	34.7	31.0	53.3
2062	11	36.4	36.9	11.8	73.2	15.0	64.1	38.7	32.0	45.4	28.5	46.0	14.3	30.3	50.4	34.4	47.2	31.5	45.7	38.3	40.1	11.8	27.7	41.3	17.4	73.2	51.7	32.3	28.9
2062	12	23.3	28.4	12.6	67.1	29.3	52.6	22.8	26.8	16.5	21.1	22.3	32.5	28.0	22.3	33.6	13.1	51.3	20.6	29.5	14.3	23.2	12.6	23.7	23.1	67.1	23.4	50.4	22.6
2063	1	20.5	23.3	10.3	53.9	17.5	31.7	16.2	19.9	32.5	22.0	21.8	17.8	10.3	21.2	17.0	31.6	23.0	38.5	35.0	17.5	23.1	18.0	16.3	19.8	25.8	53.9	15.4	14.1
2063	2	21.5	24.8	11.9	59.0	19.3	29.9	17.6	18.1	21.1	13.8	21.9	31.0	21.1	12.7	14.4	34.3	11.9	21.9	28.5	37.4	16.4	17.3	59.0	31.5	12.0	34.4	32.7	38.2
2063	3	20.9	21.6	1.9	58.5	13.5	21.4	15.5	22.4	14.7	20.6	18.9	24.5	21.2	11.8	13.3	3.7	22.4	1.9	33.5	36.9	18.3	23.7	23.5	9.8	15.5	36.1	58.5	37.3
2063	4	21.3	23.4	5.6	55.0	25.9	14.2	13.9	55.0	22.8	23.8	18.5	40.1	5.8	5.6	21.6	29.6	34.6	17.4	39.8	35.3	21.1	18.9	25.7	26.6	15.3	18.7	20.5	9.8
2063	5	40.1	42.5	2.7	84.1	33.8	43.9	60.6	34.5	45.1	29.2	24.2	29.8	29.6	82.4	46.5	44.7	23.2	54.0	79.6	2.7	84.1	28.0	43.9	79.0	51.0	5.9	36.3	28.4

2063	6	65.5	64.6	26.8	93.0	76.2	45.6	92.8	27.9	69.3	57.6	70.0	57.4	62.3	26.8	39.2	86.7	66.4	37.9	93.0	70.3	62.7	85.1	92.8	85.0	53.5	64.7	60.3	66.2
2063	7	74.7	91.9	39.3	236.8	53.5	159.4	77.5	69.8	43.9	144.4	70.3	83.4	98.8	81.2	236.8	59.1	55.2	39.3	152.4	58.8	93.0	69.2	71.3	149.1	67.0	71.9	105.6	95.9
2063	8	62.8	61.8	15.7	110.8	34.8	58.5	63.1	79.8	56.2	39.2	73.3	22.9	66.9	93.3	100.0	74.9	68.3	37.9	110.8	15.7	25.2	63.1	62.6	61.8	53.0	76.1	94.7	52.2
2063	9	51.7	57.8	24.5	135.7	78.7	63.1	42.6	37.6	90.9	38.9	65.5	51.4	47.7	135.7	74.3	63.2	51.9	32.5	68.7	27.6	32.1	24.5	27.1	69.4	42.0	50.3	106.8	64.7
2063	10	31.9	37.4	14.1	82.2	25.2	31.7	33.9	16.6	43.2	38.9	31.2	23.4	14.1	35.5	60.4	56.2	47.8	20.5	30.1	27.5	53.7	26.9	58.1	25.2	32.2	18.1	82.2	63.8
2063	11	35.9	37.3	11.0	63.5	32.4	52.0	32.3	25.6	11.0	52.3	22.9	63.5	30.5	24.8	42.1	53.0	12.5	26.2	44.3	34.8	45.8	37.0	18.8	45.7	60.4	44.6	54.9	27.8
2063	12	31.6	28.8	4.7	48.3	44.0	36.4	37.7	11.1	48.3	16.3	37.3	18.9	27.0	19.3	33.8	26.9	31.0	15.2	32.2	24.5	32.2	39.1	33.3	38.7	27.0	4.7	19.6	37.0
2064	1	27.6	26.5	8.6	68.2	21.9	29.3	24.8	19.3	30.2	38.5	12.3	29.3	32.7	15.1	29.5	20.2	68.2	27.2	32.9	31.0	25.2	13.8	21.4	18.9	29.5	28.0	28.3	8.6
2064	2	22.0	22.9	12.6	40.2	30.2	21.3	26.9	21.9	31.0	24.0	22.3	27.8	19.5	32.3	15.5	15.1	17.0	27.3	22.2	29.1	17.2	13.7	40.2	18.6	16.6	30.4	12.6	16.0
2064	3	26.3	24.3	9.4	40.8	14.7	21.5	23.7	36.3	14.6	36.2	34.1	10.4	34.5	40.8	10.7	32.4	31.1	12.6	12.0	9.4	10.0	13.4	32.6	34.9	34.4	22.5	31.7	29.0
2064	4	17.3	20.0	6.9	46.0	45.3	28.6	20.4	8.3	36.4	15.6	12.9	46.0	18.1	6.9	19.2	11.1	34.3	10.1	11.1	16.5	29.6	14.2	18.8	8.4	15.2	21.0	20.6	11.1
2064	5	33.9	37.9	5.9	69.3	60.3	63.1	33.3	19.2	11.7	21.5	69.3	34.0	25.8	34.4	33.8	54.1	66.9	48.5	53.9	5.9	48.3	36.4	24.0	66.3	23.8	22.3	21.2	32.3
2064	6	49.2	51.8	15.9	110.8	34.7	58.0	30.8	52.6	78.3	49.6	67.2	38.8	90.3	17.5	40.5	49.5	110.8	53.4	48.9	38.9	15.9	47.9	26.0	68.7	96.4	40.1	28.0	61.5
2064	7	77.0	77.1	29.3	153.1	40.3	53.5	129.3	44.2	153.1	93.4	51.5	46.6	55.3	83.8	82.5	83.9	79.6	91.4	94.2	74.3	91.4	49.5	72.7	136.2	59.4	114.4	29.3	39.7
2064	8	65.8	73.8	13.5	169.0	63.0	62.2	169.0	68.2	109.7	90.9	40.8	106.1	76.2	59.1	42.5	13.5	44.7	58.5	104.3	65.2	97.1	32.9	100.5	52.9	66.4	130.7	38.1	79.2
2064	9	56.7	58.7	22.6	99.7	53.0	22.6	46.0	64.1	45.3	40.4	94.4	55.6	59.5	52.4	46.0	99.7	24.5	40.6	30.3	56.6	83.8	73.3	56.8	72.6	58.6	85.5	79.5	67.3
2064	10	35.2	37.8	11.2	60.5	22.2	22.0	60.5	42.3	52.5	34.3	45.9	52.8	33.0	33.8	32.5	35.7	50.2	34.6	48.3	32.7	17.4	30.4	31.4	47.3	11.2	36.6	51.0	48.8
2064	11	33.1	32.8	11.7	61.5	49.5	35.3	33.3	21.7	12.7	21.1	42.9	24.9	32.9	25.8	22.9	36.7	44.2	34.6	29.9	13.2	57.7	11.7	39.0	61.5	40.1	29.6	46.9	18.4
2064	12	33.0	34.1	12.3	75.6	23.7	36.0	21.8	18.1	32.0	59.5	12.3	22.9	19.7	37.5	48.2	44.2	26.4	35.8	51.1	75.6	43.4	17.5	34.1	39.1	21.4	56.8	19.4	21.9
2065	1	23.9	26.9	2.4	70.6	9.9	18.9	2.4	23.4	24.3	40.7	32.5	22.2	17.4	43.8	22.4	27.7	46.9	70.6	11.1	28.1	19.1	19.6	27.3	22.7	5.0	38.4	35.5	36.4
2065	2	22.7	23.8	13.1	42.1	20.2	32.7	14.3	14.6	22.0	23.0	25.5	13.1	23.6	38.3	42.1	16.0	17.6	25.7	27.8	21.7	22.4	18.3	36.0	15.5	24.1	29.5	17.5	28.7
2065	3	19.8	22.3	1.2	45.5	33.9	31.9	25.8	16.0	36.2	15.2	15.2	12.2	19.4	14.2	20.1	17.7	29.8	14.4	25.9	45.5	22.4	16.9	20.4	16.4	25.1	18.5	41.7	1.2
2065	4	14.8	19.2	0.7	49.7	20.3	13.0	5.5	45.1	11.3	10.8	8.9	19.2	19.0	10.6	12.8	21.0	49.7	19.0	25.7	3.6	7.9	16.6	47.1	33.4	7.3	10.4	0.7	43.2
2065	5	32.7	34.9	4.4	101.9	26.1	14.9	12.5	33.5	38.2	66.4	19.5	19.3	11.1	17.7	56.5	42.5	33.6	65.8	51.6	24.6	24.4	33.9	101.9	14.0	32.0	4.4	40.4	53.0
2065	6	53.1	61.7	17.3	123.9	52.4	65.4	116.7	35.2	67.2	36.4	73.0	50.8	88.7	40.9	83.8	117.2	36.8	48.2	59.1	123.9	26.9	21.7	83.8	21.4	45.8	53.7	17.3	115.2
2065	7	87.1	85.4	19.4	162.5	87.4	88.5	110.0	48.3	64.7	130.1	72.5	19.4	118.6	162.5	119.7	81.2	88.7	70.4	109.2	86.8	48.4	77.8	69.1	99.5	42.6	116.0	97.3	40.8
2065	8	61.1	60.4	23.2	113.7	38.2	74.9	45.0	44.8	63.2	42.0	29.3	79.5	73.2	64.2	52.4	37.4	69.6	59.0	94.3	102.0	36.9	42.5	76.1	81.0	65.0	113.7	23.2	42.5
2065	9	53.2	60.1	5.1	108.9	91.7	53.9	55.2	46.7	78.7	47.7	92.9	42.1	108.9	65.4	52.1	43.3	37.4	52.6	50.3	36.7	84.6	99.4	5.1	83.3	69.5	39.0	50.5	56.4
2065	10	29.1	36.3	6.2	106.7	11.3	26.3	17.2	39.8	88.7	23.8	49.7	30.4	27.8	17.1	35.7	16.6	21.9	24.3	37.1	48.4	23.5	56.1	6.2	36.5	26.8	106.7	51.0	48.6
2065	11	31.3	36.6	18.5	91.6	40.5	54.0	49.0	44.2	26.1	40.3	32.4	42.7	47.7	30.1	26.7	28.2	91.6	24.9	37.8	22.4	25.9	18.5	35.7	27.9	55.8	26.4	26.1	24.4
2065	12	31.1	30.2	12.9	56.1	31.8	56.1	35.7	23.2	30.3	30.1	13.9	26.9	19.2	40.7	35.6	38.4	29.3	13.1	26.0	45.2	33.9	17.2	17.6	36.0	12.9	39.4	38.7	33.5
2066	1	26.9	26.2	10.3	46.9	27.1	36.4	29.5	33.8	28.9	20.2	31.8	46.9	24.0	31.2	26.8	29.5	10.3	14.1	23.9	10.6	11.9	38.1	23.2	18.7	21.7	32.4	31.7	25.4
2066	2	20.8	22.9	11.0	40.7	24.1	18.9	19.5	19.2	24.6	11.7	14.8	35.5	39.0	38.4	17.6	11.0	25.4	21.6	19.9	18.4	11.6	31.0	22.3	12.0	28.2	25.8	18.7	40.7
2066	3	19.0	20.8	5.4	53.9	12.8	32.5	22.5	18.0	15.3	24.1	24.9	9.6	37.9	7.5	6.3	11.4	21.4	5.4	14.1	53.9	20.0	13.6	10.1	42.4	23.3	14.4	30.8	27.4
2066	4	25.0	22.7	2.2	48.9	18.2	25.5	19.7	15.8	24.8	6.4	27.9	18.2	33.9	2.6	16.2	26.3	14.8	25.9	44.6	48.9	32.8	30.8	2.2	33.9	12.8	11.4	25.1	25.8
2066	5	37.9	39.9	4.9	92.0	70.3	43.6	36.5	92.0	42.8	12.2	45.3	17.9	60.9	39.9	16.4	29.6	38.5	36.1	33.4	63.2	26.9	4.9	37.9	63.2	28.0	48.6	30.6	37.9
2066	6	62.2	64.2	21.2	120.9	51.5	90.8	58.9	120.9	59.6	66.1	42.5	65.8	51.7	117.2	80.3	72.0	87.0	54.1	105.3	46.4	31.7	21.2	80.2	64.8	69.5	22.0	31.7	49.1
2066	7	60.2	75.3	28.1	177.9	56.2	177.9	52.9	79.2	56.5	39.4	47.6	28.1	116.1	115.3	61.4	162.4	81.5	51.0	95.8	60.6	59.6	100.8	52.2	51.7	86.6	59.8	47.4	68.1
2066	8	57.7	65.2	23.5	183.4	23.5	63.7	84.4	64.5	67.1	74.0	51.2	48.6	50.5	42.1	41.0	31.9	67.7	94.4	100.7	37.9	134.2	55.0	58.5	65.4	29.0	183.4	56.8	39.1
2066	9	45.1	51.9	10.0	102.3	71.2	61.3	10.0	51.1	19.2	85.6	65.5	77.5	42.7	43.4	25.6	38.5	102.3	34.8	82.3	36.5	52.9	64.3	26.9	44.2	45.9	27.1	94.5	42.0
2066	10	34.8	35.6	2.5	82.1	14.7	45.4	2.5	21.0	39.3	45.5	31.6	82.1	36.1	23.0	31.6	33.7	58.7	23.5	31.0	38.7	44.1	27.4	46.7	36.0	50.7	19.3	41.2	30.7
2066	11	29.7	31.9	6.6	64.6	41.0	31.9	10.7	39.8	17.7	35.8	6.6	22.1	27.8	27.9	61.5	20.9	21.9	16.3	24.3	34.0	35.8	29.4	64.6	35.8	58.8	18.6	30.0	53.3
2066	12	31.7	29.3	4.7	55.6	18.2	34.6	35.6	29.3	23.2	34.6	19.1	7.7	55.6	25.1	53.0	39.0	25.8	34.1	43.1	35.5	41.0	27.3	38.3	11.0	15.7	14.9	4.7	36.3
2067	1	22.0	24.0	11.7	46.2	33.2	21.3	18.0	27.9	21.2	17.4	24.6	23.5	19.2	26.5	24.1	21.1	14.8	20.4	21.8	46.2	22.2	33.7	11.7	29.8	31.6	30.1	17.4	18.0
2067	2	24.8	24.3	5.9	50.9	30.3	30.1	30.2	29.6	11.3	5.9	41.4	27.4	25.2	37.6	15.3	32.8	8.2	19.4	15.2	10.8	16.9	13.6	50.9	42.6	24.4	13.3	12.0	38.5
2067	3	16.7	20.8	2.9	53.3	53.3	7.9	2.9	3.7	33.7	13.2	27.2	17.2	29.0	17.2	16.3	24.3	29.2	40.5	36.5	8.8	13.9	13.8	31.1	15.2	11.7	12.8	13.8	27.0
2067	4	18.0	19.6	4.1	48.1	18.5	16.4	17.8	8.1	17.2	23.9	7.8	23.0	18.2	9.7	30.0	24.8	30.9	27.8	15.5	7.9	4.1	16.3	48.1	23.0	13.9	30.7	17.1	19.8
2067	5	36.2	41.8	14.7	95.4	36.7	38.8	49.6	17.6	16.4	35.1	23.5	21.1	34.2	40.1	23.1	46.1	14.7	54.5	55.2	18.6	83.0	53.9	68.0	77.7	28.5	95.4	35.6	35.2
2067	6	40.5	51.7	13.5	120.3	53.0	40.6	40.4	59.9	99.2	44.3	33.4	35.4	33.6	37.9	120.3	21.6	77.2	31.5	96.3	31.5	57.6	37.9	13.5	76.6	26.0	31.9	50.5	91.9
2067	7	73.1	71.4	20.3	143.2	76.2	107.0	84.7	72.4	29.9	112.9	33.8	28.6	24.9	143.2	44.7	112.1	65.6	78.2	85.8	36.7	57.9	48.0	73.8	129.2	45.8	20.3	92.4	108.4
2067	8	65.2	72.0	25.9	148.0	86.3	67.0	113.4	26.4	54.9	133.0	49.0	55.4	93.8	63.2	25.9	64.2	65.7	148.0	46.0	31.1	92.9	53.0	72.6	77.8	64.8	71.0	56.9	114.6
2067	9	55.3	56.6	25.8	111.7	32.0	71.4	75.2	26.2	82.9	25.8	31.6	63.7	28.6	70.2	65.4	26.4	42.5	47.9	46.7	94.3	32.7	81.7	50.7	61.0	59.9	111.7	49.3	79.7
2067	10	29.4	31.5	13.6	70.1	30.3	45.5	27.5	38.6	29.9	28.9	22.2	25.3	70.1	30.8	13.6	36.9	50.9	26.1	28.0	18.4	20.4	18.0	36.5	46.3	34.8	15.3	36.5	26.0
2067	11	36.6	37.0	6.5	72.3	36.5	34.1	6.5	20.4	23.7	43.2	61.3	27.3	44.2	21.2	40.6	19.9	72.3	43.6	36.7	45.3	56.1	40.9	65.3	29.9	40.6	28.1	19.2	32.1
2067	12	30.5	28.4	6.8	47.8	47.8	30.4	38.7	30.7	38.3	12.0	23.9	38.6	28.7	14.6	13.4	40.7	43.5	39.3	16.2	32.5	42.5	6.8	18.8	36.4	35.8	19.1	8.8	24.6
2068	1	25.2	26.3	12.4	48.8	38.7	23.5	12.6	35.0	25.2	15.1	17.7	45.4	22.4	25.5	12.6	22.4	26.5	42.3	12.4	30.1	39.8	15.0	25.2	25.5	31.6	48.8	17.4	20.4
2068	2	17.3	19.1	5.2	64.0	30.1	20.8	13.3	8.7	18.4	24.4	22.9	15.7	11.9	20.3	24.7	17.1	5.2	8.4	64.0	8.4	9.9	25.6	16.2	7.4	17.5	15.5	26.8	25.1
2068	3	21.0	20.4	2.0	47.8	13.5	21.5	21.1	20.9	16.4	27.2	35.6	24.4	2.0	12.2	24.8	13.6	15.3	12.8	21.6	9.6	25.3	27.5	27.3	10.3	15.4	18.3	25.6	47.8
2068	4	19.7	22.0	2.3	53.0	10.1	21.5	53.0	20.3	9.8	34.2	26.0	29.7	6.5	15.3	29.1	7.9	14.4	29.2	9.8	13.9	19.0	45.4	41.4	2.3	18.8	30.3	31.9	9.4
2068	5	31.9	34.0	2.9	69.3	32.7	35.6	29.7	34.9	13.9	11.9	30.5	54.8	40.6	15.1	33.3	2.9	27.9	69.3	23.4	31.2	30.1	68.0	24.4	43.2	41.2	41.3	11.2	69.1
2068	6	55.2	65.1	24.6	158.9	64.7	26.9	30.9	32.8	94.8	92.7	89.4	58.9	24.6	83.2	37.0	50.0	101.0	62.1	28.4	96.3	47.9	51.4	158.9	38.4	38.0	60.4	37.9	155.5
2068	7	74.9	73.4	22.4	132.1	90.9	76.3	78.4	86.1	115.2	43.8	30.7	42.3	126.0	88.3	48.2	40.0	41.4	132.1	70.0	48.6	92.1	99.6	105.2	100.5	73.5	22.4	41.5	69.1
2068	8	66.8	74.9	24.5	179.6	97.7	34.4	63.0	93.1	56.0	42.2	70.6	105.1	49.9	46.4	24.5	104.7	179.6	102.8	88.4	47.6	141.2	36.8	55.1	122.7	87.2	75.2	48.1	24.8
2068	9	66.5	65.7	19.3	128.4	94.7	69.1	63.6	98.7	55.1	128.4	19.3	85.8	66.5	73.9	53.4	40.5	72.1	63.8	68.0	71.7	28.2	32.0	61.9	52.8	78.1	66.0	67.0	66.6
2068	10	33.6	35.1	13.2	64.7	20.3	18.9	49.2	20.3	61.5	40.0	20.7	19.5	32.9	34.2	46.9	27.4	49.5	22.7	37.7	13.2	34.4	23.6	64.7	26.1	62.1	29.7	53.0	35.1
2068	11	30.6	31.2	10.1	56.2	21.5	28.2	56.2	30.9	19.6	48.9	25.2	34.4	30.3	37.0	43.9	26.6	10.1	32.8	30.3	17.7	31.4	29.8	31.1	36.1	45.7	38.5	26.2	15.6
2068	12	29.8	29.0	13.5	49.3	49.3	48.0	19.0	32.2	36.7	37.3	37.4	17.8	28.6	27.8	38.7	19.7	16.9	25.0	18.7	31.6	36.2	30.9	19.1	13.5	32.2	36.4	25.9	17.4
2069	1	24.1	27.8	11.5	61.8	43.9	30.1	18.4	11.5	26.6	17.9	20.3	24.7	29.5	22.2	37.5	50.1	20.3	23.4	23.3	26.0	18.7	45.3	61.8	28.1	17.8	14.6	40.0	14.7
2069	2	18.1	20.5	0.0	43.7	15.9	30.0	39.2	7.2	19.9	12.8	24.7	18.4	17.9	19.2	27.6	43.7	15.4	13.7	12.7	10.1	17.7	23.4	11.8	38.7	22.0	33.3	0.0	16.4
2069	3	20.2	23.0	6.2	49.6	15.3	9.0	19.6	23.4	49.6	7.0	39.1	9.8	14.3	8.2	8.3	11.6	9.5	48.2	25.5	44.2	40.3	38.9	6.2	25.4	41.3	20.8	22.5	15.1
2069	4	12.5	16.0	6.4	46.0	26.1	14.4	15.4	12.2	6.7	12.9	35.2	8.5	17.3	11.0	6.5	25.0	6.4	11.0	9.5	6.4	10.8	9.9	46.0	11.2	14.2	23.1	12.9	32.6
2069	5	38.3	40.7	8.2	83.8	34.0	44.7	33.2	53.3	35.2	15.8	52.5	48.7	40.9	44.2	58.1	40.1	30.2	31.8	76.1	83.8	50.2	64.1	15.2	31.9	35.2	8.2	36.5	12.4
2069	6	54.9	56.7	12.9	126.1	36.3	44.5	12.9	73.0	45.9	32.5	126.1	91.7	38.0	73.5	64.9	39.9	26.0	83.3	27.4	101.5	43.2	55.1	83.3	54.6	64.6	60.8	14.6	66.1
2069	7	73.5	65.7	8.0	126.3	126.3	103.1	17.4	35.7	75.7	8.0	52.5	89.2	45.2	33.2	59.9	82.9	72.4	35.1	76.2	74.7	37.3	60.4	89.2	85.0	43.2	83.3	104.6	86.1
2069	8	65.9	74.9	24.1	171.6	100.8	64.8	47.2	68.3	106.5	38.2	30.4	109.0	64.1	171.6	44.4	60.4	67.0	43.0	118.6	166.2	45.2	40.6	85.1	24.1	27.5	111.1	80.6	84.1
2069	9	48.4	61.9	25.3	128.2	48.7	114.9	46.1	25.3	41.9	31.6	74.8	39.5	52.1	128.2	27.4	127.0	63.3	29.1	116.0	56.0	104.2	25.6	38.8	37.7	55.4	48.1	113.5	40.8
2069	10	36.7	35.7	5.5	68.0	40.1	40.4	68.0	33.4	43.5	24.1	21.4	17.2	41.8	29.1	42.5	46.5	40.8	32.2	31.2	8.9	15.5	61.1	63.5	62.3	5.5	13.1	57.5	16.8
2069	11	30.1	31.2	10.7	64.6	21.0	40.1	42.1	10.7	57.4	44.8	41.2	15.5	14.2	36.4	30.1	16.0	33.6	30.2	26.9	22.0	16.3	64.6	56.6	33.4	25.3	19.5	17.4	34.1
2069	12	24.3	25.0	5.9	53.5	49.2	5.9	26.8	17.1	28.0	29.9	18.9	13.9	36.7	14.0	14.7	16.3	6.9	21.1	33.3	20.0	28.7	30.2	36.3	33.0	17.9	23.6	25.0	53.5
2070	1	17.3	20.2	10.3	44.1	18.9	13.0	11.4	19.0	14.7	14.0	18.0	17.6	15.0	17.0	10.3	15.8	44.1	33.8	13.1	18.3	27.2	26.8	16.4	36.9	20.1	36.2	11.3	16.6
2070	2	18.0	20.5	7.4	45.4	14.2	14.0	23.7	11.6	7.8	22.5	18.9	19.0	14.2	45.4	17.0	35.2	8.9	29.5	9.6	23.7	10.4	10.9	42.1	13.1	41.3	7.4	28.0	23.2
2070	3	15.8	17.1	3.1	50.5	26.1	10.5	16.1	11.4	15.6	50.5	5.7	15.7	14.9	40.2	20.6	18.5	8.6	4.3	17.3	11.7	30.3	16.1	7.0	3.1	15.6	15.9	17.1	17.3
2070	4	21.1	24.4	7.1	51.1	23.0	22.4	22.2	33.1	24.6	17.8	43.8	11.2	20.0	35.2	17.1	45.0	16.1	37.2	16.1	51.1	9.9	16.9	10.7	19.7	7.1	29.5	37.8	17.2
2070	5	41.8	44.5	8.8	96.1	8.8	57.0	48.6	26.1	14.3	51.1	29.6	42.4	34.2	38.3	96.1	11.8	33.0	37.9	50.5	41.2	58.5	49.9	54.0	23.2	80.2	58.5	85.1	37.2
2070	6	46.6	58.6	11.8	122.0	38.9	117.1	118.6	38.0	45.2	32.7	42.5	26.8	44.4	55.7	59.8	67.5	47.9	31.9	40.2	45.9	31.5	84.4	90.1	11.8	61.2	47.2	122.0	106.3
2070	7	77.1	85.5	12.8	145.1	145.1	72.1	65.1	123.1	66.7	56.8	112.0	12.8	70.5	142.2	139.2	50.8	75.1	19.4	43.0	137.8	82.3	75.2	81.5	126.3	79.0	103.0	50.4	121.9
2070	8	59.0	65.3	29.7	136.6	31.1	57.1	67.0	69.5	29.7	51.1	40.6	43.3	60.9	41.1	46.2	106.5	77.7	99.5	78.3	136.6	65.4	48.1	52.5	40.7	82.4	97.7	91.0	52.3
2070	9	59.5	60.9	17.1	131.9	61.3	90.3	29.9	17.1	39.8	52.5	66.8	131.9	27.9	90.7	43.9	116.0	19.2	52.7	37.5	42.4	62.1	66.2	57.6	80.9	64.2	76.6	56.4	77.8
2070	10	37.5	41.5	6.3	79.3	35.4	33.6	53.3	34.6	36.3	66.0	54.4	72.9	23.3	55.1	46.0	32.6	54.4	23.2	38.6	16.7	24.0	52.3	6.3	49.6	79.3	53.3	34.3	19.4
2070	11	33.5	35.0	12.4	65.6	33.2	12.4	34.1	25.1	31.2	53.3	25.0	65.6	23.2	23.8	49.1	34.2	29.9	32.3	23.7	16.5	44.5	26.8	33.7	44.7	43.2	40.1	51.8	42.2
2070	12	25.2	27.3	12.8	59.8	32.0	25.2	15.9	26.2	26.1	29.6	27.2	23.2	44.1	31.9	46.5	23.1	34.0	15.5	19.1	25.3	59.8	17.2	12.8	17.5	24.3	23.3	15.2	40.2

2071	1	29.2	31.7	6.9	63.8	63.8	42.2	19.3	22.6	42.1	19.2	19.5	12.9	32.1	30.9	29.8	22.4	52.2	28.3	54.9	24.7	26.1	34.1	6.9	30.6	63.2	20.3	28.6	33.5
2071	2	27.6	26.2	10.3	42.2	19.7	28.0	28.0	27.0	40.3	23.6	42.2	33.4	18.8	41.1	23.0	28.7	27.3	15.9	13.6	29.5	10.4	10.3	17.0	32.4	33.6	31.8	27.9	24.5
2071	3	21.5	23.6	3.7	89.6	30.9	22.1	3.7	37.1	24.6	34.4	89.6	20.9	9.9	20.2	11.9	13.6	27.0	8.5	24.3	25.7	12.2	14.2	12.8	12.0	30.9	17.3	36.9	25.9
2071	4	20.9	25.0	6.9	75.0	21.0	75.0	18.2	28.3	9.8	11.3	35.4	64.5	8.2	18.9	20.8	23.4	14.1	10.0	7.5	29.1	28.0	45.0	40.5	15.2	25.0	6.9	16.7	26.5
2071	5	44.3	47.4	6.9	155.5	6.9	44.4	25.5	85.6	53.4	21.1	25.2	24.8	42.7	70.8	13.2	52.6	57.3	16.6	34.4	19.4	45.5	44.9	48.4	155.5	121.1	44.1	74.0	10.8
2071	6	64.8	71.2	28.8	144.3	44.0	63.3	57.6	101.5	79.2	70.3	144.3	60.0	47.4	56.3	94.3	51.4	134.5	28.8	62.6	66.4	50.0	82.6	81.5	74.3	54.7	75.7	69.2	58.1
2071	7	86.6	87.9	21.9	182.7	85.4	144.1	21.9	50.1	148.1	59.9	104.9	45.5	70.3	75.7	63.7	89.9	107.0	32.5	182.7	87.7	120.6	56.0	104.2	103.4	143.6	61.7	47.8	101.6
2071	8	63.4	66.3	24.8	108.1	101.5	66.1	52.1	95.9	108.1	42.7	72.4	38.7	56.0	48.5	27.4	60.7	77.1	93.0	55.4	39.2	38.2	87.7	101.2	95.2	76.1	75.0	58.5	24.8
2071	9	43.8	49.2	10.8	124.0	36.2	46.0	67.6	39.3	58.6	62.3	59.7	14.9	27.3	51.5	25.9	81.9	18.1	62.3	124.0	48.1	10.8	41.7	29.6	31.5	32.1	88.7	89.9	31.9
2071	10	40.2	40.8	5.6	79.6	51.8	41.4	40.0	40.4	34.2	42.3	33.6	52.5	53.1	34.9	17.4	79.6	22.8	17.7	65.0	42.7	58.8	23.0	31.3	35.9	61.8	5.6	28.3	65.9
2071	11	36.6	36.2	14.9	62.3	24.1	45.2	37.7	25.3	36.2	24.7	39.7	54.5	22.3	27.9	31.0	28.2	47.8	53.9	41.0	27.7	38.4	14.9	20.1	62.3	53.2	36.9	42.6	33.9
2071	12	29.3	30.9	10.7	62.4	45.2	36.4	25.3	26.8	36.2	18.2	44.3	13.4	20.8	26.5	31.5	29.3	38.3	37.3	20.6	24.2	42.7	30.3	28.2	10.7	47.8	16.4	62.4	29.2
2072	1	27.2	30.3	4.5	88.5	41.1	11.0	43.7	18.4	17.8	41.9	14.9	35.3	19.9	31.1	44.8	29.1	26.0	26.5	37.2	38.2	27.9	14.6	88.5	22.4	19.5	4.5	50.6	22.6
2072	2	21.2	22.9	8.1	53.2	26.1	17.2	9.5	18.1	34.1	17.1	32.4	27.9	37.2	21.2	38.4	12.9	8.1	21.2	22.1	12.4	23.1	25.4	53.2	17.5	17.7	16.0	28.9	12.9
2072	3	22.1	21.5	3.0	40.2	14.0	33.4	23.6	32.5	39.7	27.3	3.7	12.7	20.6	24.0	16.5	24.3	25.6	40.2	8.7	13.5	16.8	3.0	27.0	30.7	17.8	14.6	27.9	18.7
2072	4	20.6	22.0	3.8	50.5	50.5	21.3	11.5	20.0	15.5	7.1	40.4	29.5	24.9	33.6	15.3	16.5	29.3	24.1	14.9	8.2	22.6	30.6	31.4	12.3	3.8	19.5	26.2	19.5
2072	5	33.9	40.5	16.0	100.6	78.1	42.7	20.7	100.6	22.7	21.0	16.8	58.3	32.7	30.2	53.7	81.2	29.1	16.4	35.0	16.0	37.7	20.6	26.4	87.0	43.5	43.8	37.1	20.2
2072	6	57.5	57.4	25.1	116.7	62.7	79.3	35.7	54.4	75.2	81.8	27.7	45.9	25.6	50.8	87.5	71.7	60.7	25.1	50.3	49.9	68.6	33.0	67.9	79.2	32.3	31.9	116.7	63.6
2072	7	81.6	87.8	34.1	149.8	114.9	133.8	63.0	72.9	66.7	80.4	52.5	77.9	45.7	82.9	105.0	117.0	67.1	140.6	84.9	99.7	46.2	142.0	78.5	83.7	34.1	149.8	72.3	96.8
2072	8	56.0	64.0	22.7	150.2	55.5	55.9	22.7	30.3	79.5	53.9	57.3	50.3	57.8	53.4	31.2	79.9	150.2	66.9	92.4	121.4	107.6	56.0	63.1	36.3	68.1	53.9	46.7	45.8
2072	9	58.6	64.8	10.8	132.8	55.0	42.9	109.4	107.5	75.5	62.3	51.4	92.0	43.1	44.2	45.4	81.2	132.8	92.7	15.5	42.7	10.8	76.9	63.8	44.2	51.1	34.7	111.0	68.5
2072	10	31.2	36.9	15.3	99.5	24.3	26.3	53.8	29.6	26.1	16.6	51.3	23.0	40.0	16.8	42.6	15.3	44.6	27.0	99.5	30.1	44.6	54.6	27.8	28.7	42.8	32.4	37.5	49.3
2072	11	39.3	38.0	12.7	87.1	31.0	46.3	43.3	45.9	38.9	49.3	26.8	30.0	39.8	27.2	47.6	33.8	43.3	44.5	87.1	16.6	12.7	25.5	40.5	32.0	21.4	49.2	34.8	45.4
2072	12	32.0	31.1	8.2	56.9	46.1	16.4	17.5	20.0	56.9	38.2	27.0	21.7	21.3	32.2	43.4	55.8	33.4	17.2	30.4	32.1	40.5	8.2	33.7	32.0	40.0	15.9	36.8	29.4
2073	1	25.3	24.3	6.5	48.2	33.3	33.7	12.2	9.6	26.0	42.8	14.1	18.1	12.8	7.6	13.0	34.3	13.7	25.6	28.3	43.9	48.2	27.8	33.5	21.8	27.2	23.3	6.5	25.0
2073	2	18.6	20.4	8.0	45.3	22.1	30.9	28.8	24.1	11.4	15.2	14.5	31.0	30.6	11.8	45.3	17.4	8.9	13.3	8.0	11.6	11.1	19.6	31.9	25.6	19.6	17.6	17.4	21.3
2073	3	17.1	18.4	3.8	37.8	14.0	19.7	14.8	15.1	22.2	18.5	6.1	12.1	28.0	23.5	8.3	17.0	3.8	37.8	17.2	16.0	24.0	17.7	31.7	32.2	26.8	11.7	13.5	10.3
2073	4	13.2	18.1	1.2	60.6	60.6	16.2	34.0	4.6	11.7	4.1	14.6	35.1	18.5	13.0	20.0	31.7	26.6	10.2	10.1	3.9	8.3	44.0	7.1	13.4	11.8	1.2	12.0	21.8
2073	5	29.8	40.3	10.7	86.0	25.1	44.1	21.6	28.7	27.1	10.7	28.7	30.1	30.0	56.5	21.9	56.7	86.0	21.3	75.4	35.9	71.0	69.4	74.4	29.0	21.2	29.6	50.5	23.0
2073	6	61.1	57.9	15.3	113.8	73.0	113.8	82.1	35.1	89.4	73.4	33.5	29.1	39.8	78.0	62.5	25.1	71.4	40.3	59.6	15.3	63.1	77.8	51.1	68.2	55.9	33.4	84.3	34.4
2073	7	86.2	86.7	48.7	139.8	119.4	97.8	96.4	54.1	54.5	66.7	107.9	104.2	69.2	59.9	50.2	112.9	112.2	54.1	133.5	67.8	81.1	48.7	139.8	94.5	57.6	124.7	87.2	85.2
2073	8	68.1	70.2	22.3	139.4	90.0	68.7	72.7	123.5	124.8	38.2	56.2	41.7	51.5	67.4	62.4	94.1	52.7	45.1	79.4	106.8	34.5	76.9	139.4	22.3	42.8	56.3	69.4	69.4
2073	9	59.7	63.2	27.0	120.1	81.4	50.3	36.3	73.6	98.2	94.7	65.2	27.0	78.9	41.8	54.2	47.9	120.1	36.9	99.8	66.3	47.4	73.4	86.0	27.1	42.5	50.8	33.5	83.3
2073	10	37.4	36.0	12.5	65.8	43.7	37.3	18.8	22.6	24.6	23.7	37.4	49.8	43.4	41.3	44.5	65.8	59.8	49.6	38.0	19.5	30.4	29.2	35.9	45.2	25.8	12.5	25.2	39.9
2073	11	35.6	35.0	12.3	53.4	30.7	50.3	12.3	35.7	49.6	31.8	45.2	42.2	13.2	36.2	45.5	38.9	25.3	31.3	50.9	42.8	42.3	26.3	53.4	21.7	16.6	27.4	34.7	35.5
2073	12	29.9	30.6	14.6	54.5	19.4	22.3	31.4	20.5	19.3	42.7	22.5	35.6	30.1	29.3	40.6	22.5	50.2	14.6	41.9	35.0	33.2	54.5	29.6	24.1	18.7	26.6	35.2	33.5
2074	1	23.7	25.8	13.4	45.2	23.1	42.5	29.7	42.0	23.9	20.7	34.7	18.2	20.3	31.9	34.7	16.9	21.1	25.2	25.8	27.9	13.4	13.7	23.5	18.4	19.1	27.8	45.2	20.4
2074	2	18.2	19.0	4.9	46.6	39.6	19.4	9.3	9.0	19.8	25.2	6.7	21.5	12.0	28.4	20.3	10.5	18.1	16.8	26.9	12.0	16.2	4.9	46.6	8.2	18.4	21.2	29.9	16.2
2074	3	21.0	22.2	1.3	42.8	1.3	9.7	14.7	19.6	24.2	15.1	40.4	37.4	13.1	21.3	29.5	24.8	20.6	18.0	42.8	8.8	21.7	29.8	18.6	27.0	11.0	31.5	34.2	18.1
2074	4	20.7	25.1	7.1	63.1	44.8	15.7	32.0	34.4	12.7	22.2	19.0	14.0	16.2	21.8	7.1	7.9	9.3	19.6	17.2	35.8	16.2	26.3	53.2	63.1	7.7	27.0	37.9	42.2
2074	5	44.7	50.5	13.0	129.9	24.7	55.3	64.4	108.8	20.4	23.2	69.4	61.6	13.0	41.9	25.6	129.9	35.2	53.5	76.5	32.6	62.0	28.6	99.4	47.5	34.7	49.3	24.0	30.0
2074	6	50.7	64.3	16.1	150.6	26.0	51.7	60.6	132.3	36.7	95.7	50.4	102.1	37.2	33.3	31.8	30.1	104.9	43.7	21.2	16.1	104.8	59.4	150.6	124.2	91.6	41.1	50.9	47.2
2074	7	81.3	79.7	17.9	147.8	57.1	109.1	96.0	68.6	124.3	77.2	79.9	82.7	75.0	41.1	95.7	37.4	41.9	84.2	93.2	116.2	29.3	147.8	128.6	114.9	54.5	17.9	50.2	90.1
2074	8	63.5	74.4	29.5	209.2	65.1	67.6	50.7	29.5	127.6	209.2	37.3	61.8	33.1	114.0	40.1	66.6	169.7	45.1	67.4	92.1	104.0	96.7	48.6	48.0	46.8	70.1	47.4	47.0
2074	9	49.7	61.1	16.4	123.2	48.6	96.4	23.5	108.1	123.2	47.8	50.3	69.4	80.7	48.1	46.1	41.4	16.4	50.9	58.7	49.2	48.7	36.4	48.3	74.5	60.6	119.7	81.8	38.1
2074	10	37.9	39.9	17.1	74.2	48.2	39.1	32.5	21.9	57.2	28.9	45.3	35.8	32.5	27.2	41.1	30.3	28.6	17.1	32.5	51.0	38.7	32.2	44.2	74.2	38.3	37.5	72.4	50.0
2074	11	35.8	36.4	17.6	64.8	47.9	24.8	33.3	28.1	44.6	64.8	35.8	39.5	37.9	58.2	28.5	17.6	35.4	34.3	34.1	22.7	36.9	25.4	38.0	21.4	35.8	41.7	46.2	41.4
2074	12	26.2	27.1	8.6	47.6	18.8	37.0	24.0	39.3	40.7	8.6	30.6	11.5	38.1	23.3	18.6	33.0	37.7	25.8	20.3	30.3	47.6	18.9	21.8	28.5	26.6	21.5	10.2	38.5
2075	1	28.4	26.9	12.3	40.3	24.1	39.9	28.9	26.8	39.3	14.0	26.1	40.3	18.9	33.1	30.0	14.5	34.0	40.3	12.9	32.4	27.9	17.1	37.0	15.0	20.6	31.2	29.0	12.3
2075	2	22.5	22.4	8.6	42.3	36.0	16.8	13.3	26.3	19.6	24.2	23.6	13.9	24.0	21.5	11.9	20.6	42.3	15.6	16.1	13.5	23.4	9.2	26.6	8.6	36.2	24.1	34.1	34.9
2075	3	23.1	21.9	4.5	49.0	33.1	14.7	43.7	14.4	12.5	4.9	22.6	33.6	20.2	24.9	25.2	4.5	9.4	24.2	19.8	26.2	23.6	27.9	28.2	14.5	49.0	24.0	10.1	13.6
2075	4	21.8	23.2	5.3	51.9	37.8	19.8	34.2	13.2	12.7	47.8	16.3	15.1	22.3	6.5	16.9	29.3	21.7	5.3	6.2	6.9	23.2	33.1	21.9	51.1	10.0	25.6	27.4	51.9
2075	5	34.8	41.7	14.0	84.8	35.2	35.8	38.2	25.3	34.3	59.2	29.6	20.1	26.2	26.5	19.3	81.0	25.5	63.9	25.7	29.7	14.0	38.4	84.8	68.8	79.9	64.2	41.9	33.3
2075	6	56.7	58.7	8.8	125.0	34.5	72.6	8.8	83.4	65.4	37.9	125.0	56.0	24.2	10.2	47.3	77.7	40.1	57.4	105.8	93.0	46.7	29.6	78.1	91.5	68.9	33.7	66.9	54.7
2075	7	89.5	89.8	28.3	127.5	90.7	83.4	28.3	127.5	114.8	47.1	113.5	113.7	102.6	88.3	84.2	127.4	59.8	79.0	81.3	124.1	78.4	85.9	60.3	94.3	110.5	106.4	47.7	106.4
2075	8	63.6	71.3	19.0	154.6	43.3	78.1	19.0	80.3	47.2	62.4	42.1	62.3	102.4	63.5	63.6	40.4	154.6	129.4	100.0	74.2	52.9	59.1	44.5	98.0	66.8	114.7	41.2	70.7
2075	9	59.3	60.9	20.1	147.6	62.0	67.2	27.1	52.8	20.1	55.2	55.6	67.1	33.2	72.5	60.6	37.3	50.1	23.1	85.2	86.4	147.6	102.1	39.5	58.1	62.5	33.1	97.6	66.0
2075	10	34.1	37.9	12.9	87.3	53.8	21.2	87.3	30.6	25.8	41.3	23.0	38.5	35.5	44.7	26.6	40.4	48.5	32.6	12.9	55.6	23.7	23.1	31.0	27.7	52.9	26.3	55.2	52.1
2075	11	29.6	30.2	15.3	56.3	29.3	16.2	15.9	21.2	40.6	43.4	23.5	35.8	45.9	15.9	56.3	26.8	20.2	32.5	33.4	29.8	15.8	45.1	18.8	15.3	30.1	37.7	45.4	28.9
2075	12	29.6	30.5	12.3	52.4	29.9	19.2	27.6	21.6	19.0	16.4	29.4	27.9	24.6	36.2	52.4	47.6	34.7	33.1	12.3	20.9	17.2	35.9	30.1	47.0	44.2	44.1	32.8	27.6
2076	1	23.1	25.0	8.3	51.2	35.8	51.2	14.1	28.5	22.5	10.9	21.8	21.9	24.1	23.7	25.7	47.5	19.2	42.8	34.9	31.4	21.6	8.3	32.4	10.0	13.0	13.5	13.0	33.4
2076	2	22.9	21.3	2.9	47.6	24.5	21.1	14.5	25.1	31.4	27.6	21.7	25.5	24.0	24.5	24.4	20.7	10.3	14.3	9.4	16.1	2.9	15.0	34.1	3.0	26.6	11.4	47.6	35.0
2076	3	17.9	19.5	3.1	43.7	16.7	14.8	9.2	29.5	25.1	43.7	12.3	22.3	16.3	43.7	19.9	13.1	36.9	21.3	24.0	18.0	6.8	19.3	17.7	3.1	9.7	8.9	22.4	13.9
2076	4	18.4	20.5	6.8	83.5	18.3	18.9	14.4	13.9	40.2	43.8	8.3	22.3	18.6	18.4	8.7	15.5	18.5	10.7	6.8	24.9	7.6	7.9	19.2	20.2	21.3	7.2	83.5	23.0
2076	5	31.3	34.3	9.7	94.0	32.0	18.1	49.7	24.4	31.2	58.3	67.3	35.6	23.9	34.0	19.1	44.5	39.2	9.7	21.9	94.0	15.6	31.2	21.8	38.3	31.5	35.7	22.1	25.3
2076	6	55.6	56.5	9.2	122.6	68.4	122.6	40.3	76.5	24.9	62.7	37.4	59.6	53.2	38.9	9.2	37.3	67.6	40.6	51.5	61.4	39.3	18.1	85.7	98.3	63.4	58.0	49.3	90.9
2076	7	80.0	89.8	41.6	155.4	71.1	149.5	55.4	77.4	79.1	120.1	95.1	75.6	56.2	62.4	80.4	79.6	111.0	41.6	155.4	112.5	90.2	88.3	116.4	97.2	53.9	61.5	151.0	74.7
2076	8	64.0	61.1	18.9	127.4	76.1	35.1	29.7	64.0	75.0	65.2	52.9	69.7	45.2	47.8	18.9	65.3	64.0	48.5	84.4	71.7	38.0	62.4	56.0	127.4	47.6	79.8	66.2	75.4
2076	9	55.0	60.6	13.6	131.4	52.8	63.3	49.6	57.1	62.0	110.7	91.0	13.6	124.8	75.0	43.0	64.9	131.4	29.1	57.2	46.8	19.6	39.5	46.3	49.5	37.4	69.7	74.0	46.8
2076	10	34.5	38.9	14.1	66.1	33.8	66.1	49.1	23.0	56.6	57.1	18.8	14.1	60.2	58.2	26.6	23.7	27.9	29.5	29.9	19.7	14.7	46.2	35.2	32.0	41.7	59.5	49.1	59.9
2076	11	33.0	36.1	7.1	67.9	24.4	32.9	7.1	16.5	30.2	32.0	67.9	30.3	65.7	22.9	53.4	34.7	47.1	33.9	45.3	13.0	56.6	33.1	23.4	40.8	31.0	58.6	38.9	27.0
2076	12	26.4	28.8	14.0	68.1	44.0	32.8	20.0	23.1	23.3	36.4	30.4	22.7	23.8	19.1	43.9	27.1	25.7	27.0	31.3	38.4	42.1	31.9	15.2	17.9	14.7	68.1	18.2	14.0
2077	1	25.7	26.8	11.3	50.1	19.7	41.3	34.6	16.2	42.0	19.8	31.5	35.0	50.1	27.6	23.8	33.3	27.7	23.3	36.8	11.3	17.8	27.7	13.8	23.7	19.3	38.3	14.2	14.4
2077	2	21.3	21.8	8.5	42.8	35.1	42.8	25.8	18.6	19.2	8.5	28.0	13.4	28.4	23.2	21.3	28.8	9.5	35.7	20.2	15.5	10.1	22.9	19.2	12.0	21.4	25.2	25.5	13.7
2077	3	14.5	20.2	2.1	48.4	32.7	15.8	44.9	30.8	34.3	11.5	5.2	9.5	7.7	13.2	29.3	18.9	8.6	10.8	48.4	9.3	12.5	12.7	18.8	12.0	2.1	27.1	23.8	44.3
2077	4	14.2	17.6	5.2	42.8	8.4	16.5	7.4	24.9	27.9	12.8	14.4	13.6	28.9	10.0	37.6	14.1	13.6	42.8	10.4	5.2	15.4	7.0	25.4	13.8	23.0	23.1	9.5	16.5
2077	5	38.1	43.1	5.6	86.3	33.7	27.0	38.6	78.8	30.9	37.6	72.6	56.3	86.3	34.3	41.2	45.9	59.4	27.8	49.2	15.4	69.2	5.6	29.1	6.3	72.4	60.5	31.5	25.0
2077	6	49.5	51.0	8.9	96.9	33.9	43.5	96.9	67.4	44.6	18.7	71.5	51.5	66.1	18.7	82.5	18.9	62.1	29.7	87.4	82.2	66.8	37.0	8.9	39.6	69.7	20.3	47.6	58.8
2077	7	76.9	76.2	28.0	120.1	107.4	49.6	71.7	48.2	78.9	51.8	97.7	42.2	85.6	120.1	71.5	68.2	81.6	103.4	75.7	54.9	104.8	115.1	63.1	79.7	78.1	112.3	28.0	39.7
2077	8	63.9	79.3	10.8	222.8	80.7	117.1	222.8	72.7	70.2	45.0	23.2	32.7	106.3	184.7	48.8	56.7	193.8	74.2	75.9	35.9	43.7	78.1	42.9	10.8	53.1	121.0	56.0	57.6
2077	9	59.7	63.0	18.4	123.6	31.9	61.7	68.2	41.1	25.9	39.7	18.4	99.6	57.7	84.6	123.6	87.9	43.6	50.5	33.1	63.2	56.9	63.7	109.8	24.4	82.5	44.5	93.7	106.1
2077	10	41.7	43.2	10.6	81.3	67.3	67.1	53.7	41.2	52.2	25.8	45.0	81.3	10.6	28.1	48.0	23.3	35.8	20.2	41.4	33.5	64.4	16.7	52.0	42.1	34.8	56.1	56.4	38.7
2077	11	35.4	38.6	18.8	72.5	31.5	32.8	26.6	45.9	40.0	25.7	72.5	38.0	22.1	31.2	46.5	51.0	45.8	22.9	18.8	38.4	31.8	26.6	51.5	24.2	63.5	32.7	57.4	48.5
2077	12	28.5	29.0	7.4	60.0	59.8	27.6	12.8	34.9	12.0	38.6	53.7	31.8	29.6	60.0	21.8	14.8	38.0	15.6	7.4	48.1	29.4	22.7	33.1	19.6	14.3	33.9	19.2	18.2
2078	1	26.5	24.1	3.8	40.1	35.6	24.8	28.1	30.9	5.2	16.3	3.8	36.0	11.6	35.9	33.3	33.1	15.0	40.1	29.7	34.2	10.2	11.0	28.6	38.0	10.3	20.0	22.5	24.8
2078	2	18.3	20.6	7.4	48.3	13.9	10.5	20.7	15.7	8.9	11.8	32.3	48.3	23.6	32.2	16.3	15.5	20.2	39.2	7.4	23.2	29.0	21.9	8.1	33.3	8.2	9.1	29.9	16.3
2078	3	17.5	20.9	1.8	60.5	17.5	10.1	11.7	16.1	12.4	38.1	1.8	39.4	11.6	23.3	7.6	25.8	15.4	24.0	23.3	27.4	18.0	3.9	60.5	17.4	14.4	16.4	20.4	44.3
2078	4	21.2	22.3	6.3	54.4	26.6	34.7	27.9	17.8	15.6	6.3	22.4	28.2	54.4	9.2	17.0	16.0	8.3	33.9	21.3	19.4	17.0	12.6	10.0	34.2	34.2	21.1	22.0	24.3
2078	5	33.9	40.9	7.9	112.3	33.7	43.8	112.3	64.6	41.2	25.0	26.7	34.1	29.4	34.5	55.9	32.1	22.8	28.8	45.5	30.8	23.7	7.9	8.0	55.4	30.4	71.9	58.4	65.1
2078	6	49.8	49.7	8.9	104.5	30.1	49.8	104.5	49.9	54.5	8.9	53.7	33.3	85.6	61.9	57.6	33.0	60.7	50.8	15.9	40.0	61.1	23.4	34.9	85.4	40.3	33.8	75.5	49.0
2078	7	70.0	80.3	22.5	177.4	120.1	74.9	90.4	177.4	66.9	60.7	60.6	125.3	157.7	22.5	40.8	46.6	38.8	99.0	118.2	32.1	116.7	68.9	91.3	76.0	62.2	71.1	58.5	50.2

2078	8	57.6	61.7	15.4	148.6	15.4	83.4	148.6	49.4	109.7	106.1	15.9	86.6	53.3	65.5	28.0	23.8	50.8	44.8	93.4	62.0	77.2	64.7	78.7	34.6	30.3	24.8	37.3	97.6
2078	9	56.5	61.7	18.2	110.8	67.7	31.6	110.8	37.0	95.4	43.7	67.6	90.9	107.2	56.8	32.5	90.7	79.1	43.7	107.6	65.2	75.5	31.6	36.6	56.3	18.2	51.5	52.4	32.0
2078	10	34.3	38.5	17.3	77.0	27.1	26.4	44.5	36.0	58.1	26.0	31.7	23.4	36.8	33.3	77.0	65.5	43.2	28.2	54.1	60.3	32.3	17.3	56.8	18.3	22.9	47.8	20.4	35.2
2078	11	33.9	36.3	7.3	66.6	45.3	29.7	26.1	40.9	59.0	29.2	32.4	40.6	26.4	31.5	26.6	29.3	43.0	49.5	42.2	27.1	66.6	22.6	33.0	44.4	40.0	7.3	34.8	43.6
2078	12	26.8	28.9	7.3	63.6	40.2	27.1	23.8	21.0	42.1	47.2	23.2	29.4	30.5	63.6	39.9	48.0	15.7	11.0	19.1	11.8	25.6	15.7	36.5	7.3	29.8	26.5	20.2	38.3
2079	1	25.0	26.1	11.8	48.4	45.3	17.3	21.2	18.9	40.6	25.0	20.1	41.6	25.0	32.2	15.2	11.8	33.7	24.1	13.5	17.1	32.6	28.2	26.8	26.5	48.4	13.4	13.6	35.2
2079	2	16.4	21.5	8.5	57.4	15.2	23.4	20.3	16.6	42.8	13.7	57.4	13.7	43.8	16.1	11.4	28.7	14.1	15.3	15.7	15.9	23.8	17.8	15.6	16.9	29.1	16.1	24.0	8.5
2079	3	19.9	20.8	5.7	51.4	19.4	17.9	30.3	20.4	21.1	11.7	5.7	13.5	22.2	7.2	16.9	21.7	51.4	25.5	6.6	18.5	13.9	22.5	16.9	32.5	22.3	20.7	41.6	19.3
2079	4	13.5	18.1	4.3	51.0	13.6	10.0	14.1	10.3	16.6	25.3	11.9	28.0	18.3	13.3	12.8	22.9	13.5	27.0	35.5	10.8	4.3	4.5	51.0	12.4	13.3	7.9	31.2	26.9
2079	5	34.5	37.2	10.6	84.9	55.8	84.9	22.3	20.1	56.4	48.4	32.5	17.4	40.2	36.4	10.6	37.4	45.1	55.5	48.8	10.8	14.8	32.3	24.7	28.4	63.7	28.4	55.7	21.2
2079	6	64.3	62.7	9.7	143.1	81.6	136.9	110.3	42.6	27.6	9.7	69.0	19.4	15.3	21.3	28.5	82.3	83.5	66.2	88.9	63.5	65.1	65.3	61.9	143.1	37.1	30.8	61.4	92.7
2079	7	70.5	72.9	22.3	151.5	33.5	109.5	85.7	106.6	71.7	94.6	22.3	39.4	69.2	100.7	85.3	39.5	94.8	22.9	60.6	151.5	97.4	33.3	64.4	128.7	59.4	34.4	48.3	95.6
2079	8	68.7	75.2	31.5	159.3	103.4	98.9	158.1	60.8	60.9	39.0	83.0	43.1	59.5	67.6	88.0	64.3	66.6	32.1	159.3	49.3	78.5	122.0	70.2	45.4	69.7	73.4	81.1	31.5
2079	9	63.1	67.8	28.3	115.9	28.3	58.9	79.9	68.0	75.6	115.9	75.5	84.5	49.7	44.5	53.1	111.4	105.2	51.9	58.6	110.5	64.6	61.7	53.3	73.0	48.1	29.4	83.8	41.1
2079	10	37.4	40.9	17.7	76.1	61.9	67.6	25.3	32.8	42.0	55.9	17.7	64.2	27.7	24.2	32.1	27.6	76.1	40.5	35.8	50.4	33.3	21.7	42.1	61.7	34.3	27.1	38.9	39.6
2079	11	36.4	35.0	12.8	54.1	37.8	39.5	39.1	24.9	44.8	12.8	43.3	33.2	25.0	45.3	31.2	22.9	52.1	31.5	44.4	54.1	42.0	24.8	19.5	23.3	21.2	42.9	49.7	35.1
2079	12	31.5	31.5	12.2	61.1	34.4	38.8	21.2	23.3	29.1	32.2	30.7	38.7	12.2	30.4	25.2	37.8	37.6	12.6	37.2	38.5	61.1	37.1	25.0	33.1	29.3	43.8	23.0	24.5
2080	1	23.1	25.8	8.8	54.2	19.6	35.7	19.4	23.4	22.4	21.5	38.2	31.8	14.6	23.1	45.0	12.2	16.3	25.3	38.4	12.1	8.8	23.0	28.4	13.6	54.2	34.1	22.7	35.8
2080	2	19.5	21.1	4.6	45.2	17.4	18.5	31.0	12.1	12.5	18.5	31.6	16.7	26.2	45.2	21.7	28.7	26.5	10.5	4.6	30.2	15.1	20.5	36.7	17.9	21.6	22.7	13.5	6.8
2080	3	22.4	22.8	4.6	46.0	20.9	22.7	9.4	44.2	4.6	34.3	28.6	15.0	7.4	28.9	8.7	18.5	25.9	12.0	39.7	22.1	25.7	46.0	30.4	14.0	20.2	27.4	24.9	16.1
2080	4	16.9	19.7	4.7	46.5	26.6	16.2	29.7	46.5	31.9	16.4	16.7	16.5	18.5	10.3	12.2	11.0	33.2	6.7	10.9	17.1	15.5	4.7	30.9	32.9	19.5	20.4	20.3	8.3
2080	5	28.4	32.3	3.0	81.5	21.9	26.5	42.2	81.5	10.9	24.9	39.2	3.0	13.1	49.0	8.9	13.2	33.4	16.3	45.6	52.5	35.3	32.7	77.9	26.3	5.2	30.2	60.1	25.4
2080	6	56.4	56.0	14.1	126.9	126.9	65.7	85.2	100.1	73.0	67.6	21.5	61.5	26.4	59.1	63.6	14.1	36.0	50.2	43.1	42.2	69.6	32.0	53.7	24.5	25.3	96.7	27.1	78.7
2080	7	85.0	90.8	27.0	204.1	150.7	204.1	53.9	81.1	72.9	104.9	30.4	71.8	27.0	101.6	110.4	75.4	108.7	93.7	149.7	136.5	88.8	93.5	79.4	54.9	81.0	89.5	48.3	70.8
2080	8	68.9	72.9	21.2	158.7	86.4	73.8	132.4	51.3	139.6	32.0	69.3	84.3	58.6	107.2	33.9	66.2	158.7	51.7	43.2	88.9	81.2	35.5	21.2	52.7	68.4	45.0	90.0	77.2
2080	9	58.7	57.2	18.9	106.6	39.6	25.1	27.1	51.0	93.0	35.5	65.3	66.5	76.0	106.6	92.2	76.5	18.9	31.9	103.1	35.8	45.6	69.2	52.1	68.6	19.1	30.2	76.3	66.6
2080	10	40.8	40.1	9.3	75.5	44.4	75.5	54.1	42.0	46.7	24.8	62.5	27.6	36.5	40.9	40.8	30.8	28.8	31.2	32.6	45.7	43.7	70.1	55.7	25.3	9.3	46.1	18.3	27.8
2080	11	34.1	35.6	8.7	75.0	36.5	36.3	13.4	54.2	13.8	51.1	37.7	28.3	16.1	37.6	75.0	30.5	34.3	8.7	24.0	24.4	33.3	41.3	28.2	49.4	43.0	72.5	32.1	33.9
2080	12	31.0	32.8	11.5	87.4	40.5	40.9	31.3	21.6	12.3	11.5	30.7	35.5	28.9	34.6	41.1	28.0	50.9	20.0	56.7	12.9	87.4	45.1	20.4	37.2	19.7	26.5	32.8	20.3
2081	1	25.8	25.3	14.3	38.4	25.5	21.3	14.3	15.5	16.4	21.2	25.9	27.2	26.1	31.2	18.2	33.6	21.3	22.7	18.9	30.0	32.0	25.6	28.8	38.4	30.9	27.8	24.5	29.9
2081	2	15.6	19.5	7.0	68.2	14.9	7.0	14.7	7.0	8.6	15.0	23.2	9.4	26.6	15.6	25.2	30.3	14.8	15.6	9.5	20.2	16.4	8.9	16.2	33.6	68.2	13.1	17.8	36.8
2081	3	21.2	21.2	5.6	46.1	14.4	20.8	14.1	32.9	5.6	25.5	46.1	24.9	31.0	9.8	12.6	21.6	23.7	27.0	12.1	8.3	11.0	24.5	8.0	17.3	33.6	29.4	19.8	35.2
2081	4	22.7	23.9	4.4	56.3	37.6	25.1	21.5	9.3	9.1	29.9	39.5	4.4	52.8	30.7	12.7	15.4	20.3	18.4	9.4	14.4	18.2	56.3	28.6	6.0	25.3	23.9	30.6	34.9
2081	5	38.8	38.3	5.8	96.4	43.4	49.6	11.0	53.0	50.0	24.2	56.7	60.3	36.7	12.0	47.1	96.4	49.1	36.0	5.8	24.9	37.4	9.2	9.7	65.3	60.2	40.2	15.9	24.3
2081	6	59.2	61.4	29.4	104.1	66.1	56.2	74.8	96.4	54.7	62.3	104.1	44.3	32.9	54.4	47.1	78.7	53.4	75.2	70.2	43.4	99.5	29.4	63.0	38.8	62.7	44.3	48.3	73.4
2081	7	74.7	88.7	42.8	170.9	51.7	142.4	150.6	104.8	42.8	55.6	170.9	61.2	121.2	130.5	56.7	104.3	61.7	67.7	99.8	123.2	115.5	64.4	81.1	48.4	70.6	54.0	77.4	71.9
2081	8	70.8	73.2	26.3	137.5	98.1	79.0	69.3	72.0	38.1	130.0	75.4	63.7	88.1	70.5	39.3	84.1	55.1	108.8	71.2	82.1	50.1	26.3	65.2	43.3	61.6	66.1	137.5	80.6
2081	9	57.6	58.0	14.7	116.1	76.5	33.0	52.9	48.1	24.9	60.9	87.6	74.0	35.6	80.2	57.7	57.4	59.7	57.5	86.8	116.1	32.1	14.7	64.1	77.4	37.9	70.2	37.2	50.7
2081	10	36.5	35.1	12.1	63.2	34.5	30.1	62.1	14.9	44.4	25.9	26.4	13.8	45.6	43.9	37.6	47.7	37.0	25.2	38.6	17.8	24.7	53.8	45.4	40.9	63.2	12.1	21.6	36.0
2081	11	27.8	34.1	8.4	72.1	37.2	42.3	59.6	22.3	24.7	21.8	28.6	39.0	19.4	19.6	22.0	16.9	26.9	40.4	44.5	16.5	62.7	66.2	44.8	24.4	8.4	37.4	72.1	20.7
2081	12	26.7	30.5	9.6	60.9	25.8	27.0	30.6	48.5	41.0	17.2	52.0	13.8	27.1	17.5	60.0	39.8	26.0	26.5	60.9	25.5	36.5	29.9	25.8	9.6	20.8	21.6	19.8	29.0
2082	1	28.6	28.4	10.3	59.3	41.9	36.5	22.1	19.8	15.5	40.8	19.0	32.4	28.5	30.9	15.6	31.7	28.0	25.7	31.5	22.4	37.6	30.7	10.3	28.8	35.1	12.6	59.3	23.8
2082	2	18.0	20.1	8.1	53.9	18.0	14.2	29.0	29.0	14.5	16.5	27.6	24.2	29.8	14.0	13.7	28.5	23.5	8.1	19.6	8.4	12.3	8.2	21.6	53.9	8.2	29.4	18.0	12.4
2082	3	27.6	25.4	8.2	55.0	35.9	16.4	31.1	35.2	16.7	9.2	15.8	26.4	23.7	38.4	31.4	35.2	55.0	8.2	31.3	9.9	28.9	32.4	15.8	19.5	10.1	10.0	39.0	33.7
2082	4	19.3	22.2	1.7	79.6	24.1	14.2	22.3	79.6	16.2	31.1	24.7	3.3	8.1	18.3	46.0	21.7	44.9	10.7	7.7	20.3	13.9	21.3	8.7	21.0	1.7	14.5	42.5	17.1
2082	5	40.3	45.0	12.0	103.8	39.5	28.6	41.7	80.6	12.0	31.7	34.5	33.3	41.1	44.6	48.0	45.9	26.3	39.4	23.6	84.0	73.6	63.0	23.9	22.7	59.6	103.8	17.2	61.2
2082	6	62.8	60.7	18.7	160.6	78.0	78.0	24.4	58.8	23.6	63.8	38.2	71.7	37.0	37.9	160.6	62.0	29.3	69.3	63.4	69.3	71.3	26.7	74.9	62.2	103.1	18.7	46.8	88.2
2082	7	86.4	87.7	22.3	170.2	39.8	89.6	82.4	106.7	90.5	92.2	54.5	59.2	63.8	106.8	121.4	88.5	83.4	80.1	166.1	60.5	107.7	170.2	42.2	118.1	22.3	84.3	46.4	127.6
2082	8	61.2	69.1	20.3	149.8	149.8	70.0	95.6	75.8	32.9	58.5	32.8	38.5	94.3	137.1	32.3	55.2	28.3	20.3	89.1	51.0	44.1	80.9	68.7	63.8	47.9	45.0	120.3	125.7
2082	9	58.2	62.7	24.0	139.4	50.7	123.3	24.0	31.6	45.2	71.2	31.7	139.4	89.9	40.4	50.2	67.6	68.9	69.8	43.9	28.8	54.1	30.2	69.2	87.0	46.3	93.4	85.3	62.2
2082	10	36.9	34.4	4.7	56.2	23.9	37.0	56.2	38.0	24.0	38.5	21.1	28.6	25.4	23.5	30.2	42.1	38.2	46.6	26.0	36.7	45.7	4.7	45.6	24.4	51.3	32.6	44.5	39.9
2082	11	40.4	42.7	19.5	71.9	47.3	36.4	50.7	19.5	45.9	40.7	36.9	41.4	22.3	71.9	70.5	56.4	41.8	37.2	27.4	35.7	38.8	40.1	27.7	38.3	54.1	34.7	57.3	52.2
2082	12	29.4	28.2	12.2	43.7	34.6	20.4	19.5	12.2	16.7	27.9	18.1	34.7	23.6	30.9	37.4	20.8	25.4	25.0	15.5	25.7	31.6	37.4	37.0	34.2	32.0	39.5	32.8	43.7
2083	1	19.8	21.7	4.0	39.3	27.4	26.1	20.1	19.4	16.8	32.6	35.4	17.1	21.9	8.7	28.9	39.3	18.0	19.7	19.9	34.9	7.7	29.5	19.7	4.0	37.1	12.4	15.2	8.1
2083	2	18.0	21.2	6.1	44.8	20.2	6.1	11.0	25.2	18.7	11.7	36.3	15.2	11.8	15.6	36.2	26.0	27.8	16.7	27.6	10.5	14.8	17.3	16.2	14.2	22.8	44.8	20.5	41.8
2083	3	16.1	18.7	6.2	49.0	10.3	13.0	12.5	18.8	13.0	49.0	21.9	10.8	18.6	9.4	8.9	28.2	6.2	28.6	29.3	11.9	20.2	35.2	15.3	35.8	8.5	17.6	17.0	9.3
2083	4	20.2	22.7	2.1	51.1	26.8	16.8	21.1	2.1	35.9	42.6	51.1	15.6	22.8	20.3	31.4	49.5	10.7	20.2	17.2	4.3	17.6	11.3	38.9	15.9	20.7	14.6	29.7	7.9
2083	5	51.2	50.3	15.2	91.1	39.5	73.6	59.1	25.5	27.1	91.1	55.6	70.2	56.6	15.2	62.6	60.5	20.8	38.5	29.8	39.3	30.6	23.9	40.3	85.9	81.1	75.9	58.0	46.8
2083	6	50.6	56.2	15.7	172.3	33.9	57.2	39.0	62.0	47.9	58.2	172.3	40.2	53.2	29.1	55.0	43.8	47.9	57.2	36.8	27.2	70.2	26.8	79.3	15.7	72.7	74.5	46.7	102.3
2083	7	64.6	64.5	30.1	107.9	30.1	71.7	78.3	58.0	71.4	107.9	77.4	49.8	79.8	53.2	80.4	41.1	86.8	50.9	32.1	65.4	63.8	51.6	68.8	75.2	40.6	106.0	60.4	46.8
2083	8	68.7	72.4	26.3	178.6	92.9	63.1	28.1	65.4	55.4	119.0	178.6	26.3	81.8	79.8	61.0	52.0	71.9	81.5	57.0	55.2	49.7	80.1	72.8	80.0	50.8	40.4	106.7	88.6
2083	9	53.4	57.4	12.7	115.5	34.2	45.9	29.4	32.8	68.3	68.2	70.9	55.3	47.7	58.3	91.8	86.7	93.6	48.1	31.4	51.5	40.1	115.5	68.2	62.6	12.7	47.4	78.7	39.0
2083	10	38.3	42.7	17.0	85.4	29.2	85.4	69.1	43.7	41.1	37.1	45.6	52.6	36.3	35.0	67.1	28.3	42.1	30.7	33.2	17.0	29.5	76.0	39.9	39.4	30.3	35.7	42.8	36.5
2083	11	31.2	32.9	14.7	63.2	29.0	32.8	36.6	28.9	45.1	24.3	30.3	33.9	28.6	24.6	39.9	14.7	26.3	23.4	47.3	31.0	63.2	31.4	40.3	36.3	41.2	32.1	18.2	31.0
2083	12	31.5	33.3	15.8	64.4	18.1	35.3	32.7	56.8	32.4	16.8	23.2	31.0	17.9	19.8	23.2	15.8	32.1	36.8	39.7	25.4	64.4	59.1	26.6	57.8	21.3	36.0	47.7	29.9
2084	1	28.2	26.0	6.7	46.0	23.7	30.1	29.6	12.4	38.3	36.7	34.5	32.0	23.3	26.7	18.7	14.9	46.0	45.6	39.2	13.6	11.4	33.6	31.8	14.1	30.7	6.7	20.8	9.7
2084	2	20.4	23.0	14.0	43.4	22.3	18.8	20.9	25.3	21.8	43.4	38.6	14.0	15.5	19.8	42.3	15.5	26.1	15.7	24.3	15.0	15.4	31.0	19.2	18.6	21.8	18.3	18.4	30.7
2084	3	22.4	23.7	3.8	42.2	30.1	3.8	34.0	14.0	13.0	42.2	19.2	13.3	26.4	15.2	11.0	37.8	32.2	21.3	20.2	19.9	23.4	40.7	19.1	28.7	27.1	21.0	26.0	27.8
2084	4	20.2	22.2	2.3	52.7	11.3	37.6	34.2	40.5	2.3	39.3	6.9	17.9	14.7	9.5	28.1	20.4	13.6	15.9	8.6	31.4	20.0	20.6	16.1	52.7	8.9	20.8	37.7	23.6
2084	5	43.6	40.6	10.7	69.8	10.7	31.2	47.6	53.5	42.8	22.2	20.6	69.2	23.4	68.0	44.7	45.4	44.5	48.5	44.4	69.8	31.7	19.0	36.2	27.6	66.5	58.3	30.2	19.0
2084	6	61.4	60.1	18.0	127.6	127.6	46.3	75.4	67.2	32.2	66.8	31.1	75.4	39.2	60.4	27.4	43.2	72.3	62.5	39.6	36.3	67.8	77.6	28.9	124.0	106.8	48.6	67.1	18.0
2084	7	62.8	66.6	16.1	167.2	91.1	58.2	64.6	75.2	51.7	32.3	60.3	68.3	87.6	25.1	76.5	78.3	92.6	45.6	50.4	16.1	49.1	69.8	167.2	50.6	109.7	41.9	61.0	75.4
2084	8	55.7	67.4	13.9	276.6	114.7	26.9	135.7	55.7	30.8	33.1	55.0	40.1	75.6	65.3	78.4	62.3	276.6	22.4	87.5	45.0	19.2	55.8	13.9	77.8	32.3	82.1	30.5	99.9
2084	9	67.5	62.9	9.8	122.5	49.0	122.5	71.2	78.4	9.8	88.7	67.9	99.4	64.1	47.7	38.7	41.2	76.3	76.8	68.6	27.5	30.6	76.7	53.0	93.9	59.8	67.0	30.5	71.3
2084	10	27.4	31.8	7.9	74.6	45.4	10.3	31.7	24.0	37.1	31.7	11.8	19.1	25.0	22.9	63.5	36.6	10.9	12.8	28.1	20.4	26.7	7.9	44.7	54.5	74.6	46.1	25.6	51.4
2084	11	30.6	33.6	13.2	64.5	37.1	55.0	36.7	15.8	30.2	49.7	64.5	36.8	24.7	31.9	36.2	26.0	31.0	22.7	28.5	40.7	26.4	28.5	35.2	13.2	28.8	23.5	57.8	25.4
2084	12	26.3	25.4	8.6	41.8	30.3	22.0	20.7	21.6	36.0	41.4	28.2	24.5	15.5	10.3	34.3	35.9	30.8	31.1	32.6	17.1	15.7	28.0	41.8	35.6	20.9	12.5	14.8	8.6
2085	1	20.2	22.7	7.2	47.8	11.3	47.8	21.2	33.5	7.2	18.4	16.1	23.0	18.7	26.5	23.3	20.1	45.5	18.4	22.3	19.2	20.3	13.4	38.7	16.2	28.9	11.4	25.6	18.5
2085	2	19.2	19.9	2.9	34.5	13.8	28.5	28.3	16.3	8.8	18.5	27.7	19.3	34.5	21.6	18.6	26.1	17.7	16.2	22.3	2.9	19.1	8.7	14.2	22.9	23.2	27.5	25.2	14.8
2085	3	20.3	20.6	5.5	44.2	23.9	35.0	5.5	27.3	34.7	17.2	20.7	9.5	17.9	10.5	12.5	21.0	44.2	20.1	10.8	20.4	30.4	21.6	15.0	26.2	16.4	20.2	25.7	8.1
2085	4	18.5	21.8	2.8	54.4	11.7	12.7	40.3	24.2	10.0	39.3	15.6	11.0	11.1	20.6	23.7	19.9	17.1	54.4	27.9	2.8	13.4	12.0	25.0	10.4	9.8	24.3	39.1	46.7
2085	5	37.3	42.7	14.5	76.7	32.8	36.0	34.8	72.1	41.5	72.5	30.7	39.7	50.8	25.7	17.7	74.7	35.2	26.1	56.9	42.0	53.0	26.9	76.7	14.5	19.3	38.1	36.4	69.9
2085	6	55.9	57.7	10.4	99.7	98.8	71.6	80.3	59.4	55.9	90.1	70.2	28.1	58.2	33.9	99.7	41.2	71.4	37.2	51.6	41.7	65.2	43.6	51.1	52.1	63.1	54.5	10.4	55.9
2085	7	59.7	75.9	11.7	210.9	210.9	98.9	30.7	73.5	126.6	48.3	60.0	37.1	85.7	38.7	58.1	59.4	57.7	108.3	75.9	57.4	42.1	41.5	99.7	161.3	67.4	11.7	49.2	122.2
2085	8	66.9	71.9	20.4	124.3	102.5	109.0	55.5	68.0	73.8	57.4	73.3	120.2	52.1	65.9	53.5	81.6	46.6	102.0	34.7	47.0	33.8	56.6	50.1	103.5	79.9	115.0	124.3	20.4
2085	9	61.1	65.8	5.7	152.8	124.7	152.8	47.3	33.5	100.5	66.4	114.0	20.3	68.4	37.7	31.9	49.5	75.9	112.8	59.9	81.9	35.7	39.9	62.3	73.0	49.1	5.7	57.5	77.5
2085	10	36.7	38.5	17.0	70.1	27.7	25.3	27.3	27.5	34.0	39.3	17.0	27.4	32.3	59.9	43.3	45.7	57.1	40.2	57.2	47.7	24.3	48.3	31.6	70.1	44.2	23.7	27.4	44.6
2085	11	37.9	40.4	8.4	74.7	27.0	38.8	31.6	28.3	32.2	38.8	33.4	42.4	22.9	37.0	74.7	42.1	29.5	54.9	8.4	36.3	50.1	65.4	35.7	52.9	50.7	61.2	26.5	50.2
2085	12	29.5	28.7	12.9	57.5	23.3	34.8	36.6	12.9	32.9	23.3	35.2	18.0	31.6	35.5	21.6	22.2	30.0	25.9	22.2	24.8	32.8	28.9	15.6	31.0	23.9	32.8	57.5	35.7
2086	1	21.7	24.3	9.3	45.5	30.8	20.3	16.8	28.1	22.3	21.0	17.3	9.3	23.3	20.6	19.5	19.0	27.3	17.1	42.4	15.7	29.5	29.1	12.0	45.5	35.3	24.1	20.0	36.7
2086	2	19.8	20.5	4.4	41.2	18.4	25.6	11.0	27.7	10.6	39.4	19.7	15.4	29.5	27.0	15.0	22.0	41.2	31.4	4.4	20.8	20.0	10.3	30.2	11.1	19.4	13.1	21.4	8.4

2086	3	23.1	23.8	6.5	52.4	22.1	23.6	37.2	42.2	35.9	28.3	8.6	8.6	11.8	18.6	17.5	7.0	46.4	7.9	21.5	27.2	24.4	32.7	15.9	24.5	27.0	6.5	52.4	22.5
2086	4	15.5	19.1	5.4	37.2	10.9	8.2	16.5	14.6	36.2	33.6	26.2	15.2	23.9	6.9	34.3	15.7	37.2	33.2	5.4	13.6	8.8	11.0	12.3	6.9	10.5	20.0	36.7	21.9
2086	5	42.8	43.3	1.6	88.1	12.5	70.9	33.4	44.4	48.6	67.7	79.3	47.7	42.1	44.3	43.4	88.1	28.6	33.4	25.0	54.4	32.1	32.5	1.6	38.6	11.1	64.7	54.0	39.8
2086	6	43.0	52.5	15.2	123.1	17.4	51.6	68.6	89.9	35.0	42.8	48.9	79.6	41.6	89.0	21.0	44.8	38.5	25.1	43.2	80.6	15.2	123.1	42.4	24.1	42.0	93.9	41.7	61.1
2086	7	80.0	88.2	31.4	183.0	85.0	141.6	68.3	112.6	106.5	111.5	70.4	76.7	98.2	130.1	109.5	72.1	39.6	82.5	49.6	77.4	44.5	31.4	183.0	121.0	106.5	56.2	73.3	68.8
2086	8	70.1	72.8	32.7	150.9	83.8	114.8	38.7	148.5	65.4	37.5	32.7	57.6	46.9	150.9	79.9	67.1	73.4	51.4	49.1	101.6	76.3	34.3	87.1	46.9	83.8	65.3	73.1	81.4
2086	9	43.4	51.3	25.0	90.1	25.0	42.6	84.7	33.8	73.2	54.3	27.5	39.1	77.3	74.3	46.3	31.2	60.1	60.5	42.5	85.8	42.3	90.1	25.8	61.4	40.5	27.4	44.3	40.8
2086	10	36.0	39.1	20.6	68.4	26.5	41.6	49.8	32.5	21.8	23.3	33.1	56.6	41.8	32.9	20.6	33.6	62.0	38.4	30.4	41.9	46.9	68.4	56.9	29.6	23.5	25.8	52.1	48.0
2086	11	32.4	33.4	9.2	57.8	57.8	42.2	39.3	26.3	43.9	57.7	28.9	22.6	40.0	38.7	9.2	34.6	34.4	48.1	15.1	29.9	27.3	34.5	42.5	29.5	30.5	21.0	23.8	24.7
2086	12	28.6	27.6	9.1	50.3	21.2	30.9	21.5	28.9	27.8	17.3	22.5	28.2	10.5	36.8	32.7	50.3	41.9	35.0	30.8	40.3	17.5	31.0	26.9	9.1	36.1	26.7	29.1	9.3
2087	1	24.7	25.8	11.6	55.6	25.1	31.2	20.0	31.1	15.0	26.2	24.3	30.0	27.0	22.9	55.6	27.9	33.8	28.2	23.7	26.0	19.8	21.5	34.3	23.0	15.7	23.5	22.6	11.6
2087	2	23.1	25.0	7.8	52.9	21.6	18.7	28.2	22.7	52.9	7.8	28.3	27.5	11.2	10.0	25.7	49.4	37.5	33.1	14.5	23.5	16.3	23.9	22.1	15.5	40.3	12.0	36.1	20.4
2087	3	17.3	23.5	2.5	93.2	4.5	10.7	2.5	93.2	49.5	11.6	23.2	47.5	15.7	42.5	6.5	21.3	9.3	10.5	22.1	39.5	18.9	15.4	19.7	14.0	42.4	13.0	23.3	6.8
2087	4	21.3	22.6	1.1	53.1	23.0	25.8	33.7	18.1	43.9	10.1	26.6	53.1	18.2	20.0	38.0	22.6	29.6	16.9	11.2	19.7	13.9	28.7	23.6	15.7	10.1	1.1	23.1	14.6
2087	5	38.4	43.6	10.1	103.0	29.7	30.5	46.4	24.3	38.6	13.6	55.8	28.2	24.7	38.2	10.1	69.8	77.9	70.3	40.6	64.1	58.0	10.8	20.7	76.0	16.9	103.0	34.5	64.6
2087	6	52.0	52.7	17.7	116.2	52.5	52.7	60.9	90.8	42.2	42.9	47.1	76.0	81.9	73.5	17.7	43.8	80.1	30.4	53.1	56.2	20.3	51.5	18.9	18.9	41.3	55.7	40.7	116.2
2087	7	78.0	78.4	13.4	160.2	68.0	63.9	85.5	76.6	51.9	79.5	63.0	66.1	106.5	81.5	91.2	67.2	83.5	85.3	86.1	108.3	66.4	122.0	59.5	100.7	46.3	160.2	13.4	48.2
2087	8	59.1	62.9	18.1	106.0	36.8	90.0	60.4	65.4	64.2	26.5	43.8	97.9	57.8	73.0	18.1	94.2	86.0	37.4	106.0	102.6	55.5	52.8	78.6	46.9	19.2	95.2	55.7	44.9
2087	9	65.3	59.9	17.6	102.9	70.3	77.5	52.0	89.6	78.8	55.5	58.8	36.6	100.2	67.6	65.0	32.0	54.1	72.9	65.7	73.4	36.4	102.9	30.1	68.7	17.6	22.1	90.1	18.7
2087	10	36.5	38.6	19.2	75.0	54.2	19.2	42.3	23.5	27.9	52.1	34.7	45.7	36.1	42.6	57.5	20.0	28.4	31.2	40.5	36.8	23.2	35.7	45.4	65.4	39.8	29.2	75.0	19.6
2087	11	33.2	33.7	10.2	57.4	27.1	38.8	34.5	31.8	31.8	37.7	13.7	35.7	23.7	39.6	16.4	49.1	40.1	22.8	10.2	13.8	49.5	53.7	50.1	29.8	27.8	57.4	31.2	41.8
2087	12	26.2	29.3	12.7	71.4	20.4	50.1	26.5	26.0	22.3	17.5	33.4	23.6	31.6	27.9	71.4	35.0	12.7	20.1	22.5	33.0	21.9	29.9	24.6	33.9	22.2	39.3	17.4	40.6
2088	1	25.1	27.0	7.7	59.0	25.8	22.1	18.8	29.5	44.4	9.6	27.3	59.0	39.9	16.0	20.5	21.3	9.0	18.4	24.5	37.5	21.6	41.6	25.7	51.7	32.2	7.7	11.1	33.7
2088	2	25.5	23.9	6.2	55.6	6.9	18.0	6.2	17.9	26.0	41.8	18.8	31.1	25.0	55.6	27.4	16.9	23.8	29.7	11.3	15.2	26.8	27.6	26.2	30.8	27.9	21.0	6.9	35.3
2088	3	14.9	17.4	1.4	38.2	16.7	13.3	4.6	11.0	25.2	26.3	14.6	11.7	15.1	12.3	31.4	34.7	13.3	21.9	7.4	19.5	24.9	1.4	20.4	38.2	7.7	13.3	24.5	8.8
2088	4	22.1	22.4	2.6	66.2	15.6	22.0	14.1	24.2	40.4	7.0	20.8	10.4	25.3	22.3	51.2	10.6	29.2	26.0	25.4	23.0	23.1	66.2	4.0	5.5	6.1	10.9	2.6	52.8
2088	5	29.4	34.2	8.1	96.7	24.7	25.7	69.8	95.2	8.1	32.5	96.7	29.1	27.8	29.7	16.9	11.1	30.1	41.7	34.6	19.8	10.2	33.6	10.7	22.3	51.8	25.9	36.8	36.4
2088	6	42.5	47.5	10.7	94.2	81.5	37.9	41.1	50.1	29.3	60.6	36.4	13.6	42.0	48.5	42.2	40.6	85.4	28.9	74.1	42.8	43.5	51.4	22.9	69.9	94.2	10.7	52.0	40.6
2088	7	62.7	66.8	14.2	154.6	94.8	83.7	94.1	87.9	90.1	78.5	53.3	38.7	34.3	70.4	60.5	25.4	14.2	33.9	147.9	44.1	41.0	70.0	154.6	64.5	46.6	60.8	38.2	76.6
2088	8	63.9	65.6	29.5	118.3	80.6	30.8	103.7	81.0	106.0	51.3	29.5	92.1	73.2	68.4	53.4	53.7	118.3	59.5	83.4	93.1	74.5	46.1	31.1	40.7	34.0	47.9	53.6	68.3
2088	9	55.9	51.1	9.4	97.9	97.9	44.1	58.1	35.4	63.1	65.1	50.3	12.9	61.6	92.5	39.5	56.8	9.4	38.6	60.0	29.1	23.5	70.9	55.0	76.3	35.3	20.8	64.4	65.2
2088	10	30.6	32.7	5.3	69.7	61.0	5.3	65.7	7.2	58.8	40.2	7.1	21.0	34.9	20.0	25.6	32.2	63.2	29.3	17.1	13.8	32.7	35.4	69.7	51.2	29.4	31.9	13.7	19.0
2088	11	28.3	32.1	15.5	70.2	33.8	20.7	37.4	34.5	43.1	17.9	51.1	70.2	43.3	21.5	44.2	22.9	28.1	15.5	28.5	26.5	40.3	26.8	25.6	26.4	34.1	24.9	18.6	34.7
2088	12	27.9	28.5	10.2	64.9	32.8	30.1	29.1	10.2	30.9	30.0	22.0	26.6	16.1	37.0	55.8	22.2	64.9	39.7	18.5	17.7	30.1	33.3	36.0	25.1	17.3	12.4	24.6	22.3
2089	1	23.9	24.0	6.2	46.5	24.3	24.2	17.9	23.6	24.5	37.4	41.2	20.3	25.5	46.5	11.1	21.9	27.9	21.0	13.4	29.6	19.0	6.2	33.4	35.3	13.7	28.3	16.7	12.5
2089	2	17.4	18.0	3.8	37.9	37.9	13.5	21.3	14.1	22.8	15.1	18.3	7.2	4.9	25.0	19.9	13.3	10.7	16.8	19.8	10.5	3.8	18.0	27.5	30.6	14.0	12.5	30.0	24.8
2089	3	21.3	20.3	9.5	29.5	9.6	21.3	14.9	18.6	25.2	14.7	26.4	25.6	29.5	10.7	21.3	28.2	25.8	21.7	9.5	21.3	12.8	24.5	15.9	28.7	24.9	21.8	15.0	20.1
2089	4	22.8	25.4	8.1	52.0	25.8	22.9	20.6	10.0	17.2	8.1	28.1	52.0	31.1	14.0	30.4	13.4	51.1	9.4	37.9	9.8	19.1	21.7	27.4	15.4	22.7	37.1	38.8	45.4
2089	5	34.9	39.1	2.9	118.0	65.8	17.2	42.9	36.8	34.4	26.7	51.7	118.0	25.7	37.7	73.7	33.5	35.3	43.3	58.4	32.7	51.7	2.9	55.4	25.4	33.8	14.7	17.2	3.1
2089	6	54.9	61.2	16.8	137.0	52.5	57.9	106.6	47.1	117.7	16.8	137.0	93.3	19.4	81.0	63.6	22.9	23.3	24.4	57.4	87.5	52.3	43.9	26.7	117.7	58.1	35.0	99.6	27.0
2089	7	77.0	88.8	26.7	194.1	186.7	66.7	102.5	99.3	73.7	45.4	60.2	53.8	37.6	86.2	74.9	26.7	72.4	98.6	117.3	194.1	167.1	49.3	39.8	125.3	55.1	89.6	79.1	129.2
2089	8	65.0	66.5	13.5	153.5	66.7	66.9	153.5	89.9	66.6	39.7	39.9	47.5	25.1	87.8	67.9	19.3	50.4	107.2	60.3	63.6	84.3	37.5	66.3	48.3	107.0	124.7	62.0	13.5
2089	9	44.3	51.0	21.7	128.9	60.0	41.3	26.7	21.7	23.3	43.7	30.6	23.0	58.1	121.4	44.9	22.7	55.5	27.9	128.9	72.1	41.6	48.2	50.0	41.2	35.8	62.1	79.5	64.7
2089	10	31.5	35.2	4.7	88.6	88.6	29.4	73.4	4.7	41.7	38.0	22.1	13.0	35.0	43.5	24.9	23.6	54.9	31.3	31.1	15.5	20.5	32.0	17.0	31.6	54.6	14.8	53.2	49.1
2089	11	30.2	34.4	16.9	60.6	16.9	36.9	25.6	46.1	46.8	58.0	32.4	60.6	36.8	24.3	56.3	26.1	46.5	24.9	37.2	25.6	25.2	28.7	23.2	26.0	22.4	44.5	31.7	23.4
2089	12	28.0	29.7	15.9	52.8	23.6	25.2	27.1	25.4	19.2	34.2	41.2	35.4	32.4	26.8	15.9	36.4	26.2	18.0	36.7	30.4	52.8	38.5	18.5	27.3	28.6	16.1	45.6	30.8
2090	1	23.2	25.5	1.3	54.2	12.6	14.8	38.1	10.7	28.9	45.7	19.5	12.7	34.1	20.5	23.1	14.3	20.6	54.2	41.0	15.9	35.3	24.0	1.3	23.3	32.5	42.1	26.2	20.4
2090	2	20.1	20.2	5.9	48.5	31.4	22.1	20.9	13.4	14.3	14.1	36.5	16.2	33.1	5.9	9.3	24.0	9.7	17.4	8.3	23.9	14.1	19.4	23.8	23.6	23.3	20.9	10.1	48.5
2090	3	17.1	19.7	5.1	46.7	11.4	12.3	8.6	19.9	20.2	46.7	23.6	15.1	9.6	17.5	19.8	30.1	40.5	14.8	9.1	19.8	14.2	11.3	5.1	15.3	16.7	26.5	30.5	33.4
2090	4	17.7	27.7	5.5	91.1	17.4	14.7	16.4	36.2	12.3	29.5	27.3	37.9	12.9	29.3	61.0	49.6	13.4	38.7	9.3	16.2	17.7	5.5	91.1	17.6	17.8	24.4	12.4	56.8
2090	5	41.2	46.9	23.2	95.3	34.7	52.4	29.7	31.2	52.3	57.0	84.0	40.7	41.6	44.0	37.9	95.3	32.0	47.3	78.8	73.2	32.0	24.6	31.0	47.9	75.3	23.2	30.2	29.5
2090	6	65.3	63.9	12.5	138.2	108.5	62.5	51.2	12.5	89.2	83.1	27.2	68.1	71.7	33.8	138.2	49.2	58.7	38.0	72.9	76.6	46.6	21.0	81.5	107.4	107.2	95.6	14.7	18.8
2090	7	74.4	80.5	34.8	167.7	167.7	65.0	72.7	37.9	47.0	83.4	72.6	64.6	93.5	99.1	67.6	89.5	137.1	102.9	122.3	62.9	51.5	34.8	64.5	103.6	87.0	39.6	76.1	89.7
2090	8	57.9	73.7	25.3	156.3	47.9	60.8	44.8	47.2	32.8	152.7	31.4	143.8	58.4	142.1	29.3	57.4	121.3	106.2	65.6	156.3	36.5	94.3	65.7	47.0	51.7	49.5	100.0	25.3
2090	9	65.3	68.5	26.3	112.8	54.7	103.7	62.9	51.9	80.3	42.2	90.1	37.3	31.0	74.9	103.1	26.3	83.1	65.8	88.3	54.1	111.3	91.7	77.1	64.8	28.8	54.6	112.8	52.0
2090	10	36.1	38.4	15.9	60.9	32.9	60.9	42.2	48.2	27.4	54.0	52.7	59.5	50.9	20.9	27.7	32.6	46.8	23.4	23.0	22.7	25.4	35.3	15.9	36.9	33.4	45.1	53.5	49.6
2090	11	31.0	33.6	13.0	62.1	36.3	43.1	33.5	24.7	19.9	59.4	46.6	57.6	21.2	24.8	43.0	14.9	38.0	62.1	25.5	13.0	30.7	30.6	31.3	39.0	23.0	37.4	25.1	24.8
2090	12	30.6	32.1	14.7	45.6	33.5	44.7	38.8	45.6	30.4	30.7	29.2	26.6	42.6	35.0	45.6	14.7	20.2	21.3	43.0	30.5	43.1	27.7	31.4	36.1	22.2	23.5	29.4	23.6
2091	1	27.0	27.7	13.4	63.8	30.5	17.2	63.8	13.4	45.4	27.2	14.1	32.4	27.4	26.8	28.2	14.1	18.7	32.1	25.9	39.8	32.8	31.1	24.8	17.0	45.4	15.5	19.5	22.6
2091	2	19.7	22.5	9.4	54.4	11.7	11.1	15.8	15.3	21.6	15.5	18.6	32.1	36.9	17.7	29.9	9.4	54.4	19.3	23.7	14.5	11.7	27.7	9.7	27.4	28.4	20.1	38.0	30.6
2091	3	22.2	23.1	5.6	43.9	5.6	23.8	27.5	10.7	36.8	36.7	26.8	12.8	13.1	11.6	12.0	35.4	20.6	7.4	8.6	35.7	13.0	19.0	41.2	43.9	38.0	28.3	25.2	19.9
2091	4	24.1	26.0	6.7	58.1	14.5	19.7	33.3	22.9	6.7	34.2	17.4	48.5	25.2	40.7	46.4	20.8	57.2	28.4	7.0	11.0	34.3	8.4	58.1	7.0	15.3	9.4	32.8	25.8
2091	5	33.0	39.2	3.8	98.7	19.2	54.5	24.9	11.2	3.8	54.6	28.9	86.7	35.1	48.4	98.7	46.1	15.7	30.7	44.3	28.5	41.8	78.8	15.1	30.8	19.0	11.6	65.0	47.1
2091	6	47.3	50.1	23.7	94.5	33.1	50.5	29.8	45.4	50.0	62.3	60.6	59.6	73.3	34.8	40.9	46.5	48.2	37.4	94.5	32.9	43.5	38.9	23.7	83.3	52.8	33.6	58.9	67.9
2091	7	78.7	84.2	33.9	189.5	66.1	53.3	136.3	87.9	78.5	57.7	59.8	42.4	49.1	104.7	118.0	43.3	146.5	96.8	82.0	78.9	130.0	33.9	46.3	121.9	54.6	57.4	86.3	189.5
2091	8	68.4	79.2	23.9	145.1	145.1	52.4	83.7	98.4	94.3	46.2	56.6	63.5	44.8	77.6	59.4	69.0	64.6	67.8	125.1	118.1	51.6	93.3	132.6	23.9	55.5	57.0	112.6	106.6
2091	9	56.8	57.0	3.7	124.9	35.6	79.2	88.3	60.8	59.7	38.6	62.5	58.8	124.9	49.3	89.1	38.3	24.0	62.9	100.1	58.3	3.7	111.1	55.3	28.5	13.6	20.8	55.2	48.6
2091	10	35.3	34.0	14.7	60.3	53.2	33.9	60.3	38.2	44.2	47.6	27.6	17.2	14.7	18.4	26.1	39.4	17.2	33.8	39.2	22.1	49.4	36.6	51.8	37.6	30.3	17.2	45.0	15.2
2091	11	33.8	33.9	16.6	68.4	46.0	41.7	35.9	36.2	36.8	26.1	68.4	41.4	25.8	32.1	48.7	32.3	27.7	19.2	35.4	18.6	17.3	19.4	46.3	16.6	25.0	25.8	51.3	40.4
2091	12	28.0	27.6	9.0	46.2	30.3	17.1	22.6	12.0	27.7	17.3	31.7	25.8	39.1	33.1	24.7	19.6	18.8	36.9	41.9	28.3	46.2	35.5	33.0	21.3	16.2	9.0	35.1	38.4
2092	1	30.4	28.8	5.0	51.1	15.2	50.4	30.7	18.8	31.2	29.8	51.1	24.5	8.7	43.5	17.4	42.7	16.6	35.7	37.1	5.0	33.8	31.0	21.1	33.8	30.1	24.8	31.2	26.5
2092	2	18.1	22.3	4.9	48.6	17.7	23.0	14.3	4.9	31.4	38.8	23.8	16.0	8.6	29.7	46.7	16.1	19.0	16.7	13.6	16.4	48.6	15.8	13.2	11.0	30.0	18.5	33.6	26.7
2092	3	18.7	20.6	3.7	53.1	17.3	35.7	23.6	8.4	29.4	16.6	25.0	4.0	13.6	20.1	20.1	27.7	11.7	17.4	23.8	14.0	28.1	32.0	21.1	16.4	53.1	15.8	16.4	3.7
2092	4	18.8	22.1	8.9	54.6	35.5	13.0	15.4	47.3	24.8	8.9	22.8	11.8	11.3	24.1	20.4	19.5	54.6	15.2	48.3	18.1	10.4	24.7	15.5	19.5	9.3	10.7	17.6	32.0
2092	5	34.8	35.9	11.1	76.2	32.6	34.5	25.9	14.2	13.8	32.0	52.9	37.0	35.1	24.2	46.0	38.2	38.6	27.0	53.4	23.4	55.5	29.8	76.2	11.1	48.8	40.3	48.5	23.6
2092	6	65.5	66.7	15.2	123.8	42.9	54.9	70.4	117.7	15.2	54.8	29.7	64.9	65.3	32.3	65.5	123.8	77.9	71.0	81.8	42.5	67.8	77.2	67.6	64.3	104.8	45.8	96.8	65.6
2092	7	76.4	80.7	15.0	182.1	124.1	17.6	73.1	182.1	36.9	77.7	72.7	58.2	75.1	91.1	105.8	98.0	120.6	82.2	45.2	145.7	93.0	56.7	91.6	94.3	59.3	50.6	15.0	70.1
2092	8	55.3	60.3	17.2	110.1	21.3	51.3	69.8	105.7	92.6	110.1	34.8	40.8	67.1	43.6	62.7	17.2	44.5	79.1	26.7	64.9	46.0	36.1	89.3	55.8	93.8	51.6	54.9	86.8
2092	9	67.2	73.2	27.5	172.4	91.4	110.2	46.1	65.5	74.8	103.2	29.0	51.9	46.7	58.1	73.0	172.4	55.2	27.5	54.2	141.5	74.0	68.9	88.4	118.2	34.0	55.5	76.7	39.4
2092	10	35.2	37.4	4.9	84.4	58.2	84.4	20.1	4.9	30.5	34.2	10.2	45.6	42.9	55.0	29.8	57.6	38.0	34.1	30.0	36.2	42.7	44.0	22.6	18.1	32.5	27.4	53.1	46.7
2092	11	32.7	32.9	6.8	61.4	55.0	29.9	39.0	32.2	29.1	61.4	49.0	33.9	26.0	27.1	34.1	22.4	38.1	17.9	33.1	32.1	50.0	50.2	13.3	17.3	22.1	36.1	6.8	34.4
2092	12	31.7	32.0	9.3	51.8	27.7	36.6	27.9	21.9	43.1	18.4	51.8	19.8	37.1	22.8	46.5	31.4	38.5	33.4	45.3	28.6	44.0	35.3	9.3	22.9	29.7	22.8	32.0	41.2
2093	1	25.0	27.8	9.1	55.1	28.5	18.9	17.8	24.6	55.1	38.7	10.1	28.3	30.4	23.4	9.1	35.2	25.4	23.4	44.2	16.6	11.8	34.2	48.4	18.7	22.5	47.3	41.1	13.3
2093	2	25.6	23.8	3.0	39.3	19.6	13.7	39.3	16.3	35.0	28.3	30.7	37.9	20.6	11.6	11.7	18.6	26.8	36.6	29.2	21.7	14.6	3.0	26.3	27.9	24.8	18.2	31.2	26.4
2093	3	22.3	23.5	1.4	50.5	50.5	7.8	8.7	24.4	32.8	46.5	33.1	14.9	14.4	24.5	43.8	22.5	46.7	9.2	5.2	27.2	31.6	11.4	1.4	13.2	13.5	18.6	22.0	40.4
2093	4	20.6	24.5	8.7	64.3	9.0	14.0	18.2	17.7	38.8	14.1	9.8	30.4	45.9	36.4	25.1	23.0	24.5	54.2	29.3	16.0	8.7	17.5	11.3	26.7	64.3	9.3	28.2	16.1
2093	5	30.8	33.9	9.6	78.7	44.2	28.1	32.4	48.1	43.7	26.9	11.8	28.9	16.8	9.6	34.2	41.1	21.0	41.8	30.0	78.7	69.4	14.4	21.6	58.3	31.6	36.5	22.1	21.3
2093	6	59.6	60.0	14.6	149.1	149.1	50.1	21.3	92.7	43.4	34.0	63.6	66.6	72.3	86.7	88.0	55.7	42.3	68.7	69.4	52.6	39.5	71.4	47.3	14.6	42.9	37.9	63.4	66.1
2093	7	69.2	76.4	30.1	152.6	114.2	114.0	47.4	99.5	83.4	82.5	85.2	85.4	57.4	104.1	54.9	50.0	152.6	70.8	45.8	150.4	52.5	84.9	30.1	49.2	67.5	41.0	62.3	48.2
2093	8	62.9	69.4	31.1	196.2	66.4	94.0	62.6	101.3	47.0	111.6	62.2	36.2	34.9	73.5	44.2	72.7	47.7	31.1	50.4	63.2	88.9	49.7	42.4	97.0	67.5	196.2	84.2	41.2
2093	9	61.3	61.5	15.5	156.9	71.1	60.8	34.2	54.4	74.3	46.9	156.9	15.5	70.7	46.2	101.4	40.2	78.9	53.6	85.2	71.0	37.0	25.4	34.6	46.1	70.0	61.8	64.5	74.4

2093	10	34.1	38.4	12.4	71.4	19.5	12.4	38.1	29.2	57.2	29.7	49.7	34.3	38.2	28.9	32.2	57.3	33.0	26.6	52.9	33.8	21.9	17.0	36.5	65.6	45.8	71.4	20.6	68.9
2093	11	32.5	35.3	17.5	60.1	32.5	25.5	19.6	20.4	20.9	47.4	37.6	57.1	39.8	50.2	30.6	37.0	50.1	32.4	55.8	29.4	20.8	17.5	45.7	60.1	27.6	32.2	18.4	37.9
2093	12	29.3	29.6	13.9	46.6	41.3	28.9	43.0	22.1	13.9	30.5	22.2	23.6	25.8	38.0	37.4	18.4	46.6	30.2	24.5	14.8	29.7	31.9	46.5	21.0	18.7	35.4	37.5	28.6
2094	1	27.7	27.4	9.6	49.2	49.2	29.0	19.5	41.9	25.7	27.0	23.1	15.8	12.8	38.7	38.8	29.4	27.5	28.3	19.9	30.2	30.2	21.5	18.2	9.6	44.1	19.0	29.2	27.9
2094	2	18.2	18.0	5.5	31.8	18.6	17.1	20.6	31.5	12.6	6.6	28.1	23.8	18.5	30.2	12.1	9.9	31.8	6.5	13.2	17.9	31.4	20.2	23.1	5.5	13.7	8.7	21.5	8.1
2094	3	23.6	24.3	5.0	78.2	15.1	22.6	27.2	33.2	26.6	28.9	78.2	34.9	24.5	14.9	5.6	37.5	13.9	15.5	25.1	28.0	5.0	26.0	15.8	10.6	36.5	18.4	21.6	17.7
2094	4	21.3	25.7	8.1	60.6	38.1	13.6	19.0	21.2	60.6	10.8	34.5	36.3	19.1	31.4	21.3	54.0	8.1	13.5	27.0	9.5	20.8	9.3	17.7	36.3	26.1	23.2	17.3	47.1
2094	5	33.3	36.7	13.2	80.9	64.8	16.4	40.8	13.2	24.2	49.6	64.4	35.3	15.2	36.6	36.9	15.5	24.9	42.5	55.4	31.3	29.7	19.7	26.4	80.9	20.1	37.8	80.4	18.7
2094	6	53.4	58.2	21.8	147.6	70.8	77.6	117.2	65.5	67.1	74.6	30.4	34.8	27.4	32.4	39.0	65.2	53.6	27.1	122.4	47.6	21.8	53.3	62.7	147.6	37.3	30.9	30.7	59.4
2094	7	75.4	84.7	24.9	181.1	38.8	157.3	76.0	154.3	65.5	97.6	33.5	24.9	33.6	158.3	88.7	84.0	50.0	74.9	58.9	181.1	73.0	101.2	50.4	126.9	35.4	138.6	83.3	46.7
2094	8	69.5	76.0	21.2	338.5	29.1	49.3	21.2	73.2	92.8	48.9	79.4	23.9	105.7	91.4	54.7	43.0	80.6	60.4	52.6	72.4	71.5	338.5	72.4	67.4	51.2	95.7	95.0	53.1
2094	9	62.8	65.9	17.6	117.2	81.5	42.6	64.9	29.0	108.9	101.6	90.2	60.3	27.3	91.5	92.6	51.8	110.4	34.8	79.2	36.6	17.6	60.6	73.9	117.2	27.3	38.3	49.8	94.7
2094	10	48.9	44.3	8.2	79.4	62.1	8.2	55.4	30.2	52.2	25.1	54.6	48.3	68.8	69.3	33.4	49.5	42.2	18.6	31.1	59.2	54.7	79.4	29.0	29.9	51.9	50.8	34.4	24.0
2094	11	29.0	29.4	12.7	67.3	30.4	12.8	28.8	29.2	24.5	40.1	19.8	28.6	14.9	36.2	37.7	67.3	12.7	38.4	31.9	17.2	23.2	21.5	26.6	35.1	44.9	37.4	30.0	16.8
2094	12	30.9	31.3	10.7	57.7	47.5	27.7	15.7	25.6	32.6	12.2	25.5	10.7	37.2	29.7	38.6	33.2	32.1	24.8	25.5	17.7	48.1	42.2	40.7	57.7	20.2	42.1	35.3	28.1
2095	1	24.1	25.0	2.3	47.2	41.1	16.3	15.3	33.3	23.6	27.1	23.0	17.3	20.1	26.2	10.5	30.0	2.3	9.5	24.5	22.7	12.2	43.5	25.7	41.5	25.4	47.2	38.5	22.6
2095	2	20.2	21.7	6.6	46.7	15.9	27.8	21.4	33.8	12.4	19.8	20.4	32.3	18.9	11.9	30.8	26.3	30.7	19.6	8.1	12.9	35.0	19.9	20.9	27.0	7.9	6.6	12.7	46.7
2095	3	17.5	20.5	0.0	45.4	45.4	21.9	10.2	25.7	13.9	0.0	22.7	27.3	34.0	10.5	18.7	10.3	22.6	16.3	36.7	7.6	15.0	14.6	8.5	9.7	44.6	36.9	29.9	8.6
2095	4	24.4	26.4	5.0	59.5	35.1	11.9	33.9	33.8	42.3	13.0	27.7	18.2	17.2	17.1	5.0	48.5	10.1	59.5	34.6	5.2	13.5	55.2	33.3	34.3	10.1	21.0	38.3	13.7
2095	5	34.6	39.4	9.9	92.9	21.8	63.9	30.4	63.1	13.1	92.9	9.9	66.6	26.9	43.2	28.1	44.9	20.2	49.6	53.3	27.1	34.2	74.4	24.1	35.6	21.0	50.0	35.0	16.0
2095	6	46.2	48.0	6.6	104.8	50.7	47.8	44.6	60.7	32.0	15.7	31.5	104.8	60.5	73.3	75.0	6.6	37.8	65.2	73.2	21.4	35.3	40.7	49.9	26.2	25.3	98.9	55.2	19.3
2095	7	70.8	79.1	41.5	181.5	66.4	97.7	85.1	134.5	43.1	75.6	45.7	65.7	141.4	48.6	90.6	71.3	78.5	41.5	181.5	70.3	80.5	111.7	63.5	49.4	70.3	86.3	50.8	48.4
2095	8	66.0	63.7	24.1	101.0	65.8	52.1	65.5	58.5	101.0	24.1	31.0	43.2	97.3	66.8	69.3	64.1	80.0	100.9	93.4	38.5	25.7	77.7	66.3	42.2	73.0	71.3	93.8	27.0
2095	9	40.9	51.6	4.3	112.4	38.9	112.4	42.4	35.4	39.4	46.2	39.5	92.4	104.9	4.3	35.3	62.3	59.1	21.4	70.2	76.3	51.8	75.2	38.4	24.1	32.5	34.2	28.3	72.4
2095	10	34.1	35.0	10.6	75.0	40.3	75.0	33.2	19.0	60.6	10.8	45.9	44.4	32.3	30.4	57.6	42.7	39.5	19.8	36.1	37.2	21.1	29.7	35.0	19.7	47.5	10.6	30.9	20.0
2095	11	35.8	40.8	19.1	80.3	40.0	45.3	27.7	80.3	33.3	32.1	19.1	32.5	22.2	49.1	42.2	31.7	57.3	20.7	26.3	38.1	44.4	33.6	20.0	62.5	53.7	28.3	66.0	72.4
2095	12	31.8	31.9	11.4	53.5	50.2	35.1	36.7	11.4	43.9	17.4	30.7	23.3	42.9	32.9	43.0	15.4	20.4	33.7	34.7	30.0	44.1	23.9	38.6	53.5	28.1	21.8	23.7	29.2
2096	1	26.6	28.3	7.3	54.1	25.0	41.3	11.6	29.2	31.4	47.0	32.3	24.5	54.1	52.6	33.0	35.6	38.6	19.0	28.0	25.3	12.8	40.6	9.5	7.3	20.5	21.0	23.1	17.1
2096	2	24.6	24.3	9.2	41.9	33.5	39.5	23.3	10.0	37.3	41.9	28.4	21.4	21.4	9.2	10.7	9.8	41.6	11.6	25.8	12.2	14.3	23.4	35.3	33.1	28.3	27.4	14.5	29.9
2096	3	16.1	18.2	0.9	41.9	36.3	12.9	16.2	28.1	41.9	26.7	20.3	11.5	13.5	7.2	31.4	6.1	4.5	8.8	18.2	25.8	14.1	26.5	12.9	13.2	18.5	15.9	25.7	0.9
2096	4	18.7	21.1	0.0	55.2	32.8	25.9	17.4	14.2	21.5	14.7	44.7	16.2	19.1	15.1	12.1	30.2	22.2	21.5	18.2	25.9	10.9	2.8	55.2	22.0	0.0	1.2	13.0	50.6
2096	5	33.0	37.0	8.2	107.4	107.4	31.1	26.7	35.0	17.0	40.8	23.0	36.1	26.2	44.8	37.0	58.8	21.6	20.6	83.4	8.2	14.7	43.9	22.8	39.4	39.7	65.9	23.4	19.3
2096	6	46.3	47.3	15.8	90.9	41.9	45.9	39.0	62.3	39.7	27.2	31.6	78.3	58.5	57.7	58.7	15.8	81.9	67.1	90.9	25.6	23.9	59.0	46.6	16.2	36.2	53.9	25.4	51.9
2096	7	61.4	60.0	5.8	129.5	40.7	82.6	91.0	67.3	27.4	46.1	74.5	34.8	28.9	66.6	41.3	69.5	40.4	59.8	67.9	5.8	63.0	68.7	98.8	129.5	58.7	26.5	56.8	93.2
2096	8	66.4	66.9	34.3	110.7	69.2	107.0	76.0	92.7	42.6	110.7	58.9	55.0	65.7	44.0	70.0	61.5	71.3	65.7	43.5	71.7	67.1	107.1	39.7	34.3	83.8	81.3	41.6	45.2
2096	9	62.8	62.4	21.0	117.6	74.4	117.6	70.0	104.0	65.8	61.6	40.3	70.1	21.0	75.8	64.0	53.8	27.5	46.1	90.3	75.3	36.3	38.4	52.1	42.6	56.1	76.2	59.3	77.9
2096	10	32.6	36.8	10.3	60.3	46.6	55.6	54.1	31.9	51.0	18.4	44.9	10.3	25.5	33.0	18.1	43.3	54.7	28.6	22.7	32.3	29.5	31.8	33.8	41.9	60.3	52.2	30.5	31.9
2096	11	30.4	32.5	13.9	59.3	32.4	18.4	32.9	53.5	27.3	29.6	15.5	47.9	19.2	40.2	38.2	21.3	59.3	37.9	14.8	25.6	24.2	37.0	28.5	24.5	31.2	53.2	53.5	13.9
2096	12	28.0	28.0	9.5	43.6	30.8	39.4	17.9	27.7	39.5	14.2	28.2	26.0	20.5	27.3	26.4	23.0	37.1	18.0	29.7	43.6	15.0	40.8	34.1	34.4	9.5	29.0	31.8	27.0
2097	1	33.3	32.9	4.2	53.8	4.2	50.9	33.5	35.4	22.9	47.5	26.6	37.9	44.3	22.7	18.2	46.9	33.2	53.8	49.3	26.1	27.1	32.6	24.5	23.2	34.0	36.1	18.4	39.9
2097	2	20.3	21.7	4.6	48.1	18.7	22.4	20.0	14.6	48.1	16.0	8.1	19.3	21.5	28.3	35.4	25.1	27.8	15.6	26.0	20.6	12.1	27.9	11.2	4.6	35.9	12.3	17.1	32.4
2097	3	19.6	20.3	3.7	54.1	13.4	11.7	18.1	22.4	30.5	20.5	18.6	17.4	26.4	25.4	16.3	25.3	7.8	20.5	3.7	17.4	14.0	15.8	22.1	21.5	11.5	22.0	29.8	54.1
2097	4	23.7	23.4	9.6	48.4	31.0	26.4	20.1	11.6	25.2	40.2	19.0	11.2	9.6	26.3	11.7	28.5	17.3	24.2	27.3	17.6	23.2	36.8	31.9	17.0	48.4	28.6	13.8	14.6
2097	5	38.0	43.9	12.1	94.1	42.4	30.3	51.9	36.3	25.9	77.4	28.0	39.8	45.4	64.5	12.1	33.8	24.0	71.7	60.7	94.1	28.6	33.7	62.7	23.3	22.3	71.3	43.7	30.3
2097	6	61.4	60.2	4.3	108.3	67.3	59.0	57.9	92.3	25.0	78.1	21.2	55.0	87.8	68.5	74.4	40.0	99.1	59.7	108.3	53.0	67.4	64.0	35.1	57.4	4.3	13.6	63.0	93.7
2097	7	78.7	84.4	43.1	162.5	98.3	68.1	125.8	130.1	86.4	51.4	60.7	90.2	57.5	43.1	43.2	74.7	91.4	77.9	150.2	95.7	56.0	71.5	104.3	117.2	47.3	162.5	43.7	79.4
2097	8	62.6	71.3	10.4	159.2	54.6	70.2	85.8	85.8	47.2	34.9	51.6	33.5	116.0	20.4	10.4	76.6	54.9	79.6	159.2	38.9	43.7	108.9	112.9	136.7	32.6	44.4	118.4	92.7
2097	9	59.4	61.2	16.6	115.8	63.8	74.7	59.1	87.3	97.3	39.1	16.6	88.6	39.8	71.5	26.4	32.3	34.5	90.4	115.8	82.1	56.5	36.2	29.2	93.0	59.7	59.0	61.3	53.4
2097	10	38.0	36.1	11.5	62.2	23.9	11.5	46.1	43.3	17.5	42.9	28.0	37.7	54.1	33.8	33.0	46.5	38.4	36.5	22.9	47.1	34.7	17.7	38.6	39.7	43.4	19.9	62.2	47.6
2097	11	33.4	33.2	8.3	72.3	13.9	19.8	37.7	32.9	22.9	33.9	72.3	41.8	20.3	37.8	36.9	39.8	47.7	26.5	18.6	10.4	24.7	25.9	41.1	63.3	25.8	8.3	53.7	40.8
2097	12	32.0	31.7	14.5	54.1	36.4	39.5	26.9	30.4	26.0	32.3	27.9	45.2	35.0	34.8	25.1	26.7	37.9	19.6	39.4	20.6	31.3	37.2	34.8	34.5	19.5	54.1	31.7	14.5
2098	1	24.1	25.5	3.6	46.5	17.7	20.0	26.6	41.2	28.5	3.6	31.9	20.6	21.3	19.2	32.9	12.0	11.2	29.2	23.9	40.2	20.8	38.5	46.5	29.6	24.3	15.6	34.2	23.4
2098	2	20.8	20.6	6.7	45.5	25.8	19.4	16.4	6.7	21.6	22.3	22.7	45.5	12.7	25.1	18.3	8.2	18.2	22.9	22.0	24.4	7.9	16.4	13.2	12.0	20.0	28.1	39.1	24.9
2098	3	19.4	21.5	5.5	51.0	25.5	5.5	43.2	14.2	43.2	6.2	30.0	7.9	51.0	8.2	9.2	40.2	13.5	18.6	24.7	17.8	9.7	20.3	34.5	23.4	22.5	9.3	12.9	24.2
2098	4	21.9	22.9	2.5	47.1	17.7	14.9	23.4	30.7	25.2	11.5	29.9	12.4	35.9	2.5	20.4	47.1	10.1	30.1	36.6	18.7	24.4	14.7	24.1	16.5	35.9	7.7	15.3	45.2
2098	5	28.2	33.1	14.2	66.0	28.8	61.2	18.6	26.7	25.9	27.5	37.9	30.8	15.1	20.2	66.0	18.8	51.4	53.0	40.6	47.3	44.1	14.2	21.4	15.9	26.1	33.6	44.8	24.0
2098	6	55.7	64.3	19.5	163.1	24.9	54.1	44.5	101.0	64.4	19.5	34.8	49.0	132.4	30.0	80.1	26.3	49.9	88.8	26.3	55.4	120.8	56.1	71.0	57.8	41.4	163.1	95.3	57.3
2098	7	87.0	83.5	19.5	167.7	167.7	87.0	78.6	110.3	92.7	29.2	96.4	29.7	110.3	40.8	97.0	57.9	49.6	80.8	154.3	19.5	122.6	55.4	113.3	106.8	45.7	78.1	92.9	87.1
2098	8	61.9	64.2	26.6	132.8	29.6	43.8	88.2	64.2	48.0	72.4	30.1	52.9	42.3	57.8	63.0	60.9	132.8	84.9	96.8	42.4	75.2	26.6	107.9	91.6	69.1	30.1	73.0	57.9
2098	9	50.8	55.6	14.1	151.7	16.4	52.2	42.4	33.1	108.0	78.3	44.2	49.4	52.3	151.7	65.7	51.2	19.1	46.4	94.0	73.6	14.1	38.5	32.2	72.9	50.5	34.2	59.6	53.9
2098	10	36.7	44.0	12.8	97.1	34.6	47.2	66.8	25.7	35.7	38.1	79.5	95.6	31.6	52.6	42.3	35.7	31.7	26.2	47.3	28.1	30.9	97.1	32.1	45.5	30.9	49.4	37.8	12.8
2098	11	29.6	32.4	14.9	56.4	24.0	42.1	16.4	56.4	33.4	39.0	46.7	29.9	28.7	31.6	35.0	49.3	19.1	38.9	14.9	22.2	21.3	24.5	41.9	27.6	29.1	29.3	55.3	21.9
2098	12	29.9	29.8	7.8	57.0	34.9	38.0	38.1	44.7	13.0	25.2	26.4	14.1	22.9	16.7	47.2	10.4	29.5	31.3	39.1	30.4	34.6	20.3	57.0	21.3	24.3	49.6	38.1	7.8
2099	1	25.4	24.2	6.2	46.9	34.6	33.3	26.4	24.5	12.4	29.3	12.8	23.1	14.0	6.2	13.5	12.8	32.0	26.8	17.4	17.5	27.0	46.9	20.1	32.9	40.2	23.8	27.1	26.7
2099	2	18.8	19.6	6.0	39.6	18.5	28.0	13.7	30.5	13.2	15.9	19.2	21.7	18.1	26.3	29.4	20.5	22.0	10.1	6.6	15.1	17.8	19.0	26.7	39.6	18.7	14.7	6.0	18.9
2099	3	19.0	20.4	5.3	41.5	34.5	22.3	5.7	14.7	19.7	35.0	30.4	35.0	18.6	19.5	20.2	5.3	41.5	18.4	38.8	12.9	14.0	22.3	24.1	13.3	7.7	12.2	7.4	16.8
2099	4	22.0	24.3	4.1	63.8	35.5	18.3	20.6	30.6	32.2	21.9	4.5	6.1	38.4	22.1	18.9	25.7	63.8	47.1	21.2	4.1	25.0	5.0	34.3	38.5	24.7	14.1	13.5	18.0
2099	5	36.9	42.5	11.8	98.7	31.5	62.6	59.4	98.7	27.8	88.3	69.7	27.4	17.0	16.8	77.7	21.7	55.9	28.2	55.6	19.7	14.1	22.0	47.6	60.1	20.3	42.7	42.2	11.8
2099	6	52.0	54.9	8.9	108.8	81.9	81.7	39.4	45.9	48.1	66.2	55.9	45.2	22.7	65.1	70.8	106.7	63.0	14.1	77.8	8.9	43.5	108.8	35.0	27.9	31.8	39.8	75.6	61.3
2099	7	77.4	75.1	24.2	154.6	82.2	72.6	33.8	29.6	70.1	134.8	109.3	38.2	98.3	26.3	83.8	67.9	88.1	89.7	57.2	36.1	154.6	55.2	88.5	123.1	131.8	83.1	24.2	24.2
2099	8	65.6	60.4	19.2	95.2	58.6	22.1	27.3	28.8	66.1	79.3	66.7	73.9	53.0	79.3	66.3	91.0	95.2	77.8	19.2	80.9	88.4	49.0	47.4	55.8	39.2	83.8	34.3	65.1
2099	9	69.1	70.0	32.0	109.1	46.3	39.5	95.7	92.4	73.9	99.1	97.5	53.2	63.2	43.8	84.1	70.4	78.5	61.1	62.2	71.5	67.7	32.0	85.6	57.6	48.0	51.5	95.4	109.1
2099	10	36.2	37.3	14.7	86.4	18.7	24.6	56.3	40.8	40.6	35.5	40.4	23.0	36.0	16.7	27.5	22.3	48.4	36.4	49.4	54.7	14.7	32.8	29.6	44.8	86.4	34.7	39.7	40.1
2099	11	38.1	42.6	10.7	75.3	48.6	31.0	22.7	23.8	10.7	59.3	74.3	61.8	39.7	22.8	28.9	66.2	39.5	64.4	33.5	33.0	55.2	27.0	75.3	32.1	43.0	36.6	69.9	22.4
2099	12	31.2	33.3	13.1	59.1	45.7	56.1	37.5	31.8	51.1	21.6	24.1	28.3	36.7	47.1	51.4	15.0	30.7	13.1	59.1	28.3	32.7	37.0	24.9	19.1	21.1	22.5	40.8	24.4
2100	1	22.1	23.9	4.8	55.8	42.8	26.0	22.1	12.2	17.7	55.8		26.8	22.6	32.8	31.2	21.3	16.7	23.9	18.2	21.8	20.6	25.9	10.5	29.3	19.0	4.8	21.2	27.4
2100	2	20.1	19.8	7.7	31.5	19.6	22.4	18.6	23.2	20.1	11.6		28.2	23.6	25.4	30.1	10.6	18.3	9.8	31.5	7.7	9.4	20.3	21.5	15.9	18.9	27.0	10.9	30.6
2100	3	20.7	24.1	3.4	56.9	3.4	20.8	29.1	11.3	31.6	30.2		43.8	45.3	16.0	20.0	20.4	21.0	10.3	56.9	41.2	18.7	13.6	17.0	25.0	14.0	20.7	20.3	23.3
2100	4	17.5	20.3	1.1	56.7	14.7	41.2	16.9	23.8	13.5	1.1		11.8	9.1	13.0	33.3	14.5	22.5	9.5	24.9	56.7	17.5	29.0	6.4	31.5	2.3	23.4	21.9	29.0
2100	5	42.9	41.4	0.0	83.0	53.0	53.2	1.8	50.5	44.1	31.8		64.7	31.5	75.7	83.0	30.1	23.2	0.0	39.5	50.6	71.8	26.9	69.6	27.2	42.9	5.2	31.0	44.3
2100	6	69.6	69.7	13.0	128.7	80.2	69.1	107.9	20.5	128.7	39.7		87.7	52.7	99.2	68.1	13.0	78.2	26.2	65.7	43.6	77.6	99.7	98.4	40.6	69.6	34.0	97.7	105.7
2100	7	90.1	91.8	21.3	176.0	85.8	115.0	148.1	96.4	72.7	49.6		77.1	158.3	116.1	79.7	51.3	176.0	96.0	59.4	106.7	78.9	93.5	71.5	99.0	90.1	21.3	94.7	73.9
2100	8	55.4	62.5	36.6	130.8	85.1	55.4	130.8	60.0	36.6	43.3		48.9	41.0	74.5	72.5	48.4	41.5	68.0	63.5	52.2	70.5	82.8	55.3	55.4	66.2	53.7	81.2	50.9
2100	9	54.0	54.2	15.8	136.0	66.3	49.6	136.0	68.3	54.0	68.2		49.4	73.1	77.9	25.8	46.9	65.7	57.2	32.1	56.4	25.0	62.3	15.8	45.1	17.6	40.7	24.2	88.3
2100	10	33.6	37.2	12.1	74.4	32.5	51.7	29.6	43.0	33.6	26.4		13.1	37.4	21.5	60.7	60.3	45.7	30.0	55.0	27.7	45.2	35.2	27.0	12.1	74.4	32.7	35.9	25.6
2100	11	30.6	35.5	18.2	63.6	22.2	60.6	38.4	37.0	43.0	35.7		25.7	30.4	18.2	30.6	28.1	57.9	21.9	37.8	27.0	21.0	27.9	63.6	24.4	58.3	26.1	43.0	37.4
2100	12	25.2	29.2	14.1	62.1	37.4	21.4	22.1	21.1	53.2	27.4		18.2	14.1	35.2	47.3	25.2	21.6	23.4	29.0	22.5	14.3	62.1	31.0	22.0	26.4	38.3	36.0	21.8

RCP4.5
Max Daily Precip (mm)

						std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Month**	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
2011	1	4.2	4.5	1.7	10.3	9.2	4.8	4.3	4.1	4.7	2.7	3.9	2.4	4.0	5.3	5.6	5.2	2.4	10.3	2.9	3.7	3.6	5.3	3.5	4.5	5.2	3.3	1.7	4.9
2011	2	4.3	5.1	0.3	14.1	2.0	2.0	4.9	3.8	3.9	3.9	4.9	3.2	4.8	8.7	2.5	3.4	5.2	14.1	4.8	1.7	5.4	2.8	6.1	0.3	13.0	9.7	3.1	8.7
2011	3	5.1	5.4	1.8	14.8	4.1	5.2	14.8	3.4	6.9	5.1	3.5	3.8	6.9	5.1	3.3	4.0	6.5	7.3	1.8	5.9	4.1	3.3	8.4	3.7	6.4	6.3	7.4	2.8
2011	4	6.3	7.3	2.2	17.4	6.2	11.7	7.6	6.5	5.6	9.0	5.4	3.8	2.5	12.7	6.9	17.4	4.3	2.2	6.2	2.9	2.7	9.1	2.3	10.4	16.0	4.3	8.6	10.4
2011	5	12.0	12.0	0.8	23.2	14.1	13.2	6.0	6.6	0.8	15.0	18.1	5.9	7.4	8.9	21.0	23.2	15.7	10.8	17.2	8.0	8.6	10.7	17.3	3.4	18.9	14.5	5.6	18.0
2011	6	8.5	12.3	3.5	34.5	17.9	7.5	6.5	9.3	3.5	11.5	13.7	15.7	31.6	31.2	7.4	13.5	6.7	6.2	34.5	13.3	7.1	15.1	4.1	5.7	7.7	6.2	7.0	11.8
2011	7	17.0	17.3	4.3	43.4	17.2	27.8	4.3	28.9	17.9	31.2	43.4	20.8	26.9	5.5	7.1	21.1	13.9	8.4	16.8	11.4	9.7	7.7	14.3	17.3	10.0	4.5	19.5	28.5
2011	8	14.0	13.6	2.8	22.6	12.4	15.3	18.4	13.4	16.8	4.8	2.8	14.7	10.8	18.2	7.0	22.6	9.7	17.0	17.7	12.2	16.2	13.9	12.0	20.4	6.5	8.9	20.3	14.1
2011	9	14.2	13.6	5.2	26.9	17.5	24.5	10.4	15.9	18.5	16.3	6.8	5.8	9.5	15.0	10.3	19.3	7.3	14.8	22.7	5.2	14.7	14.2	14.2	9.2	7.8	10.8	26.9	9.8
2011	10	5.8	7.3	2.6	14.8	4.9	4.8	14.8	5.5	2.6	5.6	4.4	3.8	7.6	10.0	13.3	12.2	8.5	6.7	3.3	8.3	11.1	5.6	4.1	13.1	6.1	3.8	10.3	3.6
2011	11	6.4	6.9	2.0	16.3	6.0	4.4	7.2	4.6	8.3	16.3	12.6	8.5	4.7	3.3	2.0	6.5	2.7	6.4	6.9	4.9	7.4	8.3	5.3	6.5	4.1	4.7	13.5	9.6
2011	12	3.8	4.5	2.4	8.8	5.1	3.5	5.5	4.2	6.0	4.9	4.6	3.8	3.8	3.4	4.6	3.7	3.8	3.6	8.3	2.4	8.8	3.5	3.0	3.6	2.9	3.7	7.8	3.2
2012	1	4.6	5.0	2.0	10.0	4.7	3.5	3.4	6.3	7.8	4.2	3.4	9.1	7.4	3.9	2.0	3.8	5.6	3.5	5.0	4.1	6.1	5.5	2.1	4.1	5.7	5.4	10.0	4.4
2012	2	3.9	4.6	2.0	12.3	3.8	4.5	4.4	9.1	2.0	3.4	5.1	7.0	2.4	4.9	3.3	3.7	2.9	2.5	12.3	5.6	3.7	2.8	2.3	6.9	4.0	6.0	4.3	2.5
2012	3	5.1	5.8	2.1	17.6	2.6	4.5	5.2	4.9	5.7	7.9	2.6	5.2	2.1	5.1	4.4	5.5	17.6	4.6	5.6	13.6	4.5	7.3	6.0	2.4	3.7	5.1	8.4	4.3
2012	4	5.6	6.0	1.2	11.8	3.3	11.8	5.8	1.2	4.0	7.5	3.9	6.2	9.2	5.8	2.7	9.0	4.8	11.3	5.3	4.8	5.3	9.2	8.5	4.8	5.8	5.0	6.6	3.2
2012	5	9.4	9.8	2.0	16.0	12.9	5.8	3.1	5.3	10.6	7.6	9.4	11.7	9.5	12.8	6.8	15.1	2.0	15.6	12.0	7.9	16.0	7.6	5.9	5.4	15.7	13.9	13.4	9.0
2012	6	11.3	13.7	3.7	31.6	11.6	26.6	13.0	3.7	8.0	10.9	5.5	7.1	13.5	8.0	5.7	14.1	20.9	5.5	29.4	9.4	7.8	31.6	13.3	27.7	17.2	4.9	26.8	6.1
2012	7	15.3	18.3	6.5	37.6	6.7	18.4	25.9	24.8	31.7	15.6	15.3	33.7	37.6	14.9	15.2	9.6	8.9	12.3	25.1	12.7	31.8	31.7	6.5	9.9	8.5	7.2	9.9	24.7
2012	8	14.6	14.3	4.3	28.3	5.7	10.6	17.7	17.7	16.9	18.4	28.3	4.3	12.7	5.2	15.0	12.3	22.8	20.4	22.0	4.4	7.8	15.1	7.1	14.2	10.7	25.1	18.9	9.9
2012	9	14.1	13.6	2.4	29.6	19.5	12.4	6.2	8.5	10.7	22.3	16.0	8.5	7.8	16.3	29.6	2.4	15.3	6.5	10.6	12.2	7.9	16.2	17.9	18.2	13.9	19.5	14.5	14.2
2012	10	7.2	8.2	1.6	16.0	8.3	12.9	16.0	4.8	4.6	5.8	6.2	13.1	6.1	7.4	12.5	5.3	13.4	2.7	6.5	14.6	1.6	9.2	12.1	7.6	13.0	4.7	6.9	2.1
2012	11	5.2	5.4	2.0	9.3	2.0	2.5	4.2	8.2	6.9	6.8	9.3	4.9	7.0	7.3	3.8	6.3	5.8	5.4	4.2	3.2	5.0	5.9	3.6	4.8	5.2	6.6	5.2	5.2
2012	12	4.2	4.7	1.5	11.8	7.9	2.3	5.8	11.8	4.9	3.9	6.1	4.2	4.9	3.2	2.7	3.7	3.9	3.6	3.0	4.2	9.2	3.2	4.6	6.9	1.5	2.5	4.3	4.6
2013	1	4.7	5.0	1.6	10.9	4.1	2.7	6.6	2.4	4.8	10.9	5.2	6.9	1.6	4.2	2.8	5.3	2.0	10.9	5.6	4.9	6.5	4.0	2.4	7.0	5.2	4.5	4.5	4.2
2013	2	4.2	5.1	1.5	18.0	4.3	3.4	1.7	3.2	6.0	2.6	3.4	17.5	4.2	6.1	18.0	1.5	4.1	3.7	4.8	3.0	6.7	4.5	5.4	3.0	4.2	2.5	6.3	1.6
2013	3	5.0	5.3	1.1	12.9	6.0	2.8	5.9	3.4	2.8	5.5	2.6	5.5	4.4	3.7	8.6	2.6	11.4	6.6	3.7	12.9	7.6	8.3	5.0	1.1	2.1	5.0	3.8	6.7
2013	4	5.2	5.7	2.3	11.8	5.9	8.2	6.3	4.9	7.9	3.3	3.4	3.2	3.2	4.2	6.2	11.5	2.3	9.1	3.9	4.6	8.6	5.5	3.2	11.8	6.4	2.5	4.8	5.9
2013	5	9.0	9.6	4.6	19.3	14.4	5.0	5.8	13.8	10.1	9.5	19.3	7.6	9.5	6.6	8.5	13.6	5.9	8.4	4.6	8.7	9.4	4.8	4.7	13.4	16.4	7.1	11.1	13.3
2013	6	9.9	12.5	3.2	28.8	10.3	7.9	13.1	7.7	5.7	3.2	9.5	14.2	17.2	7.8	3.9	12.3	7.5	11.6	23.3	9.1	25.9	26.3	24.6	6.5	28.8	5.3	4.3	14.5
2013	7	14.1	15.1	5.2	38.8	6.0	24.6	13.6	10.1	21.1	10.6	7.7	22.4	12.0	11.0	14.5	19.8	10.5	21.8	14.2	17.2	15.1	10.6	16.1	38.8	17.2	5.2	14.1	8.5
2013	8	13.4	16.5	6.5	45.7	7.1	17.8	9.9	9.2	37.6	28.0	17.5	11.3	13.9	17.9	20.9	10.3	11.7	13.7	18.8	9.6	45.7	13.1	10.4	16.6	9.9	6.5	31.2	7.8
2013	9	12.8	13.5	3.2	26.3	12.2	12.9	4.9	22.2	12.7	26.3	19.5	3.2	21.3	12.4	22.1	13.5	14.3	11.4	17.4	4.6	10.5	7.4	7.3	16.1	17.6	6.9	19.1	7.3
2013	10	7.7	7.7	2.4	12.3	9.2	5.5	8.4	6.3	6.1	11.6	12.3	11.2	3.7	8.8	4.5	7.1	4.3	7.6	3.5	10.8	2.4	5.2	12.1	10.2	7.8	10.3	7.2	8.1
2013	11	6.2	6.4	2.4	16.7	6.4	2.7	8.1	4.8	7.4	5.0	5.9	8.2	7.0	16.7	3.2	5.6	9.7	6.0	6.6	8.8	3.6	2.5	7.3	2.4	5.8	5.0	7.8	7.9
2013	12	5.5	6.2	1.2	18.4	2.9	7.5	8.5	14.1	4.1	2.7	8.1	7.8	3.5	5.8	18.4	7.8	6.0	4.2	3.6	2.4	6.9	1.4	6.3	5.2	3.3	3.3	1.2	12.7
2014	1	4.7	4.7	2.3	9.0	3.4	3.4	4.5	6.0	5.4	4.4	5.3	4.5	2.3	5.0	3.6	3.8	9.0	4.7	4.6	3.9	4.9	7.7	5.7	2.5	5.5	5.3	5.2	3.3
2014	2	4.0	4.4	1.3	12.7	2.5	1.3	4.5	2.3	8.1	3.7	1.3	5.6	6.5	4.0	3.8	3.9	2.4	5.5	4.9	5.1	5.4	2.5	5.8	5.3	3.1	3.1	12.7	2.7
2014	3	4.8	5.1	1.4	11.4	6.8	4.4	8.4	7.6	4.8	4.4	3.0	3.6	4.8	7.0	2.4	5.8	1.7	5.2	3.3	5.4	3.4	1.4	6.0	3.1	6.5	4.7	11.4	7.3
2014	4	5.8	6.7	1.3	14.8	5.9	5.4	7.4	3.1	6.6	1.3	13.1	5.7	14.8	3.8	10.4	11.5	9.3	11.7	5.9	12.7	5.2	7.9	5.2	2.8	1.8	2.5	4.9	2.0
2014	5	8.9	9.3	1.6	18.3	2.3	4.4	3.5	8.1	14.3	11.6	10.4	16.3	4.1	1.6	16.2	5.9	2.5	16.4	7.5	18.3	9.1	10.9	5.9	8.9	10.8	17.6	6.6	9.0
2014	6	14.4	15.4	2.6	38.3	15.8	38.3	14.3	19.5	6.5	5.7	16.7	19.5	34.3	7.3	6.0	7.1	37.4	18.0	6.7	13.0	14.0	7.5	17.5	2.6	18.1	14.5	5.9	22.8
2014	7	14.8	17.0	5.3	36.0	13.6	36.0	12.5	34.1	21.0	9.7	10.7	18.0	17.2	9.7	29.4	13.3	10.1	5.3	10.7	5.7	21.4	26.9	12.4	21.4	16.1	18.7	12.0	22.7
2014	8	13.0	15.4	4.4	35.6	8.8	13.6	27.9	15.5	35.6	15.5	6.0	23.7	33.9	11.3	10.6	11.5	18.1	10.6	6.4	12.3	18.4	9.7	5.7	4.4	20.8	7.0	23.1	20.2
2014	9	12.6	14.0	1.8	29.6	12.5	13.9	5.4	5.3	11.2	27.8	19.9	11.0	11.3	20.3	15.0	15.2	23.7	15.2	1.8	10.9	7.3	9.3	8.7	12.6	21.7	14.7	29.6	11.1
2014	10	7.7	7.5	2.0	13.9	8.1	6.4	9.5	2.3	9.0	12.3	7.3	7.7	3.6	5.3	2.0	8.9	4.9	8.2	3.3	5.5	10.1	9.5	13.9	9.3	5.5	7.8	7.6	12.0
2014	11	6.2	6.4	1.4	11.4	6.3	5.4	11.4	3.2	3.8	7.3	6.3	5.0	6.0	5.0	11.2	8.1	7.3	10.5	8.6	9.9	3.8	6.4	5.0	4.2	6.7	5.2	6.2	1.4
2014	12	5.2	5.8	1.6	18.7	4.6	5.8	12.4	4.1	3.7	9.7	7.9	2.8	5.4	18.7	5.4	1.6	4.8	2.2	5.2	3.0	5.2	4.6	7.1	6.5	3.1	6.0	4.8	5.6
2015	1	4.7	6.3	2.0	21.3	3.9	4.6	21.3	15.4	4.8	8.3	3.6	10.0	9.9	4.7	3.6	3.5	7.2	9.4	3.4	2.6	4.7	4.4	4.4	4.8	4.3	2.0	4.9	5.3
2015	2	4.5	4.5	1.3	7.9	4.8	7.8	6.8	7.1	4.0	4.5	2.0	7.9	6.6	6.8	4.5	1.3	2.6	5.0	4.0	5.7	2.5	2.1	4.5	5.3	1.5	2.6	4.7	4.3
2015	3	4.2	4.6	1.2	11.9	4.4	10.5	5.9	5.1	4.8	3.0	3.2	2.7	4.4	1.2	1.8	4.0	1.4	4.4	8.6	6.5	3.2	1.2	3.3	5.3	7.2	1.8	11.9	3.5
2015	4	3.7	4.9	0.8	12.0	2.9	3.8	9.1	7.6	5.4	4.6	4.6	2.1	2.9	2.6	2.4	3.1	6.9	9.7	10.7	3.0	3.6	12.0	1.5	6.0	2.8	2.4	0.8	7.9
2015	5	10.1	10.4	3.3	20.0	6.9	6.3	4.7	7.9	3.3	6.1	14.0	13.3	3.9	10.4	12.5	15.4	8.7	14.9	17.3	5.9	10.0	16.2	20.0	16.8	4.3	7.7	10.2	11.9
2015	6	11.3	13.8	5.3	29.5	11.0	26.2	5.3	7.7	10.1	6.0	7.0	6.7	9.9	11.6	10.4	25.8	14.4	17.4	17.6	16.7	13.6	16.6	29.5	10.9	8.5	9.2	23.3	16.4
2015	7	16.2	18.4	6.1	47.1	21.5	21.6	6.7	7.2	17.3	15.2	34.0	10.0	22.8	27.1	27.4	8.1	11.2	14.6	14.1	10.5	13.8	18.3	13.0	17.7	47.1	6.1	31.6	24.3
2015	8	13.8	18.0	4.9	49.5	28.5	18.6	14.1	4.9	9.4	21.3	25.6	21.4	6.1	49.5	7.3	8.7	16.9	10.5	7.6	10.6	29.7	37.3	10.1	27.5	13.5	8.6	31.9	12.8
2015	9	10.4	13.0	3.1	34.8	9.8	10.4	7.9	15.6	25.7	19.6	34.8	24.2	18.9	7.0	4.4	5.7	15.8	7.2	7.7	16.3	12.9	3.1	10.4	12.4	14.6	8.6	9.2	9.3
2015	10	6.2	7.0	2.7	15.6	2.8	10.5	11.9	5.0	5.5	3.9	2.8	6.8	5.6	15.6	5.4	2.7	6.5	4.9	9.7	9.2	6.0	6.7	7.1	3.1	11.8	6.0	10.4	9.4
2015	11	7.0	8.0	4.3	16.4	6.2	5.4	9.0	16.4	8.9	10.8	4.9	9.6	6.4	5.8	4.3	6.7	7.5	4.6	7.2	5.5	10.5	12.3	9.4	5.1	4.4	6.8	14.6	10.0
2015	12	4.3	4.4	1.9	8.5	1.9	4.8	7.8	2.9	4.1	2.7	8.5	4.0	4.3	4.5	5.6	3.2	4.9	4.6	4.0	4.4	4.3	2.4	2.2	5.5	5.3	3.5	3.6	5.9
2016	1	4.6	4.8	2.2	10.7	6.1	2.3	4.3	2.2	3.1	4.9	5.0	6.0	10.7	5.7	3.7	3.8	5.5	3.4	3.9	4.6	3.4	5.4	5.5	3.0	7.1	6.3	4.2	4.6
2016	2	4.8	5.4	1.5	10.9	10.5	6.7	2.8	4.0	4.1	4.9	5.9	5.8	2.7	8.4	4.3	1.5	7.0	8.9	3.5	6.4	10.9	4.0	5.7	4.3	4.7	3.8	5.1	2.8
2016	3	4.9	4.7	2.0	8.7	7.3	5.0	8.7	4.1	5.8	2.0	4.2	5.2	8.3	3.9	5.6	3.0	2.5	5.2	5.3	3.7	2.6	5.3	3.0	3.3	4.7	5.7	3.0	5.9
2016	4	4.2	5.4	0.5	18.3	3.8	4.4	10.2	3.5	7.9	7.2	3.9	4.5	9.5	2.4	11.2	2.7	3.2	6.9	2.6	0.5	3.1	2.0	18.3	2.0	4.6	3.0	8.4	4.7
2016	5	8.2	9.8	2.5	25.8	6.9	7.6	3.2	8.7	9.0	13.2	3.6	2.9	12.4	6.2	25.8	11.0	2.6	2.5	16.4	24.2	10.3	14.4	15.6	7.3	15.5	4.5	4.7	6.3
2016	6	12.5	14.7	3.3	37.3	22.7	11.3	4.4	12.7	13.8	14.1	9.3	35.0	17.2	19.7	10.6	14.4	21.1	6.5	6.5	37.3	7.8	21.6	3.3	12.4	12.1	19.0	10.0	10.6
2016	7	14.3	19.0	8.3	64.7	14.7	53.7	64.7	13.0	19.0	8.3	30.4	9.4	12.8	14.0	11.7	11.2	12.3	17.1	11.4	12.7	13.9	19.6	19.1	21.0	9.2	20.8	17.5	18.4
2016	8	11.0	15.3	4.6	51.4	7.2	8.6	16.3	12.1	8.3	14.7	21.8	8.3	10.3	10.0	25.2	13.2	9.2	5.6	4.6	6.9	12.4	51.4	25.3	9.5	9.2	32.2	33.6	11.8
2016	9	13.2	15.1	2.2	46.1	13.9	9.4	9.5	2.2	35.7	15.7	18.0	22.3	25.0	20.6	46.1	13.5	7.0	6.3	17.7	16.4	11.4	8.7	12.1	16.8	2.9	6.8	11.2	12.8
2016	10	7.6	8.7	3.1	21.9	21.9	7.3	14.4	4.8	12.1	16.4	6.8	5.5	10.6	6.9	3.1	4.6	7.8	8.4	7.4	5.2	5.4	9.0	12.1	8.9	8.6	4.0	6.2	10.3
2016	11	5.7	6.3	2.0	14.3	6.5	5.6	3.3	7.2	3.2	8.2	6.8	9.2	5.4	5.6	4.4	5.7	9.4	14.3	2.0	13.0	3.3	7.1	7.3	8.3	4.6	5.0	3.4	3.2
2016	12	4.5	5.2	1.1	18.9	4.7	4.4	10.0	3.2	11.0	6.1	3.9	2.7	4.5	4.7	5.6	4.4	4.7	5.7	3.5	4.6	18.9	2.7	3.4	3.4	3.2	3.8	4.8	1.1
2017	1	3.8	4.3	1.4	10.4	1.8	2.8	1.4	5.1	3.7	5.6	3.5	3.5	5.2	3.2	4.5	3.6	4.1	3.9	3.6	10.4	6.3	3.8	4.6	7.0	2.8	3.4	4.9	4.4
2017	2	3.8	3.8	1.1	7.3	2.1	5.2	1.6	3.9	7.3	6.0	3.9	4.9	1.1	3.3	1.5	4.3	3.5	3.3	5.4	3.9	3.8	2.5	6.5	3.1	3.2	3.1	4.1	4.0
2017	3	4.8	5.7	1.6	13.8	1.7	2.0	7.4	3.2	5.7	4.2	2.6	2.9	2.3	11.3	3.7	10.6	7.5	4.4	10.4	3.7	1.6	9.9	5.3	6.5	5.1	4.5	13.8	6.7
2017	4	5.1	6.2	1.2	19.5	3.5	2.8	3.1	5.4	7.7	5.1	6.9	5.2	4.8	1.5	3.1	8.2	6.8	19.5	2.4	6.3	7.3	3.6	17.7	1.2	3.4	5.1	14.3	3.1
2017	5	10.3	10.2	2.0	21.1	14.1	9.7	14.6	3.9	7.4	14.1	17.8	9.2	6.3	13.5	11.0	16.3	2.0	15.8	4.2	14.3	5.4	3.0	21.1	14.2	6.1	5.4	3.5	10.9
2017	6	11.4	13.8	4.4	42.0	9.9	4.9	42.0	11.2	33.1	12.1	5.2	14.9	8.3	7.6	16.0	8.8	15.8	17.5	11.9	7.8	14.8	5.0	10.8	10.7	16.3	11.5	4.4	30.5
2017	7	11.4	14.7	3.5	31.0	10.1	8.5	7.5	3.5	12.3	9.6	23.4	24.3	5.3	26.6	7.6	5.0	25.8	8.4	16.0	17.2	24.5	20.1	10.4	22.6	10.3	31.0	8.0	14.0
2017	8	11.5	17.0	5.5	58.1	12.2	6.4	9.1	22.8	37.5	7.1	19.2	24.3	6.5	11.9	9.4	8.5	14.3	53.7	5.5	10.1	58.1	17.5	15.4	11.1	9.1	11.1	22.4	5.9
2017	9	13.4	15.8	2.5	50.6	10.6	50.6	11.9	20.8	22.8	15.9	15.3	25.8	4.8	2.5	17.3	9.9	11.8	7.8	30.6	24.2	12.6	19.1	14.3	17.7	8.7	9.8	6.0	8.4
2017	10	7.8	8.1	1.6	21.8	7.9	1.7	8.5	6.4	9.5	21.8	4.5	4.5	1.6	7.1	13.9	12.3	14.5	7.3	9.4	1.6	5.1	5.8	8.6	9.8	4.5	7.7	12.0	9.4
2017	11	6.0	6.6	2.5	14.1	14.1	8.0	11.4	7.0	4.1	4.2	8.4	3.2	7.0	8.0	6.0	2.5	5.4	5.2	9.4	5.5	4.3	6.0	10.2	11.8	3.3	4.0	6.3	3.6
2017	12	4.8	5.0	2.5	10.3	4.8	6.8	3.1	3.6	3.5	2.6	8.8	3.8	6.0	4.8	3.4	4.4	3.8	3.4	5.8	2.5	4.4	10.3	5.2	5.9	6.9	4.7	4.9	5.7
2018	1	3.7	4.9	1.7	12.6	3.8	4.6	8.4	4.1	5.4	3.0	2.9	10.4	3.1	8.4	2.9	3.6	1.8	12.6	3.5	6.4	8.9	1.9	2.3	5.5	1.7	6.4	2.5	3.1

2018	2	3.8	4.1	2.2	9.1	3.1	2.6	2.9	2.2	5.9	3.8	3.5	4.4	2.2	3.9	2.3	5.3	3.8	7.1	4.1	4.4	3.1	9.1	3.2	2.4	4.2	2.4	8.0	4.5
2018	3	4.0	4.6	1.3	16.2	3.2	3.6	4.4	16.2	5.6	2.9	2.2	5.5	5.8	4.9	3.1	3.2	1.6	1.8	4.7	5.1	3.2	7.4	2.4	1.3	2.7	5.1	8.4	5.7
2018	4	5.7	7.2	1.0	20.5	4.4	1.5	3.0	16.5	8.8	11.8	4.1	1.0	9.5	13.1	8.2	20.5	5.6	11.3	4.3	10.2	4.7	4.2	2.8	5.7	5.0	5.9	5.9	5.7
2018	5	11.3	11.4	2.2	31.9	5.1	14.8	3.7	6.8	14.2	16.8	14.4	2.8	15.3	15.6	4.2	31.9	12.2	9.6	10.4	6.8	2.2	7.1	20.7	13.2	7.5	12.6	3.6	22.1
2018	6	9.6	11.4	4.4	31.9	15.4	16.3	10.9	31.9	6.1	15.5	7.4	12.4	7.4	4.4	8.8	5.5	18.0	9.1	15.6	7.1	10.7	10.0	7.4	9.2	20.4	5.6	7.1	11.5
2018	7	17.6	16.8	5.4	32.8	8.0	17.5	10.3	17.8	25.6	18.4	10.9	12.2	7.5	26.8	10.3	20.3	5.4	10.4	20.2	18.5	29.4	26.4	25.8	9.6	10.2	8.0	20.9	32.8
2018	8	12.7	14.0	7.1	30.9	13.0	8.6	18.8	29.0	8.5	9.3	13.9	7.1	16.4	13.4	10.7	20.0	12.3	10.5	8.1	7.1	17.5	12.3	7.8	14.9	17.2	30.9	11.1	17.6
2018	9	12.7	12.4	2.2	21.4	2.2	8.1	12.5	4.6	8.3	12.3	19.5	13.3	21.4	14.6	15.4	10.9	16.7	14.1	18.7	10.3	10.0	11.7	13.6	17.9	12.8	7.5	7.8	14.0
2018	10	5.9	7.9	1.1	21.4	2.1	21.4	9.0	3.2	17.1	13.3	17.4	5.1	5.3	5.8	5.9	17.7	5.9	3.9	6.0	5.3	5.6	3.9	1.1	7.9	7.4	5.7	8.2	6.1
2018	11	6.7	7.2	2.3	14.6	4.8	6.1	3.3	7.9	8.9	6.7	8.1	8.5	2.3	9.6	4.3	5.5	10.1	5.5	13.8	6.6	4.9	14.6	10.7	5.5	6.7	6.8	3.9	8.7
2018	12	5.6	6.2	2.2	15.3	3.2	3.6	7.4	6.6	5.2	15.3	6.3	3.9	3.2	3.5	7.9	4.3	6.9	5.2	2.2	8.3	4.1	7.7	13.4	7.5	5.7	5.5	6.2	5.2
2019	1	4.4	4.9	2.3	8.3	3.6	5.3	2.9	5.9	3.0	6.1	3.4	6.1	7.7	4.3	2.3	6.8	3.0	4.3	4.3	3.5	3.4	7.7	4.6	6.1	5.7	8.3	4.5	4.3
2019	2	3.5	3.9	1.4	10.7	5.9	1.6	5.8	2.6	1.4	4.3	10.7	4.9	3.4	3.8	3.5	2.4	9.5	2.8	1.8	3.7	3.9	2.6	3.0	3.6	3.0	3.6	4.4	2.3
2019	3	4.9	5.4	1.0	16.4	12.0	5.0	1.8	2.6	2.7	1.6	6.6	8.1	1.0	2.6	2.4	16.4	8.4	4.0	10.3	4.3	5.0	4.8	8.1	6.4	5.9	2.5	5.1	1.6
2019	4	5.3	5.9	0.9	15.2	3.7	15.2	0.9	4.3	5.4	8.7	4.3	5.1	3.6	2.0	5.5	5.2	9.8	4.7	5.5	6.0	2.4	6.0	7.6	2.9	4.8	8.4	8.4	12.0
2019	5	7.7	9.0	3.2	19.1	7.2	6.1	3.6	13.1	10.1	12.5	10.8	11.1	12.1	6.3	4.1	5.1	11.3	3.2	9.8	17.2	7.5	3.8	19.1	7.9	6.6	17.6	4.5	5.3
2019	6	10.0	11.1	4.1	25.5	7.1	9.8	19.6	16.7	6.6	7.9	25.5	7.1	12.4	4.9	5.5	10.2	14.6	4.1	8.3	12.3	7.2	16.8	14.1	11.7	14.6	9.0	15.7	5.5
2019	7	11.4	12.8	2.8	26.7	12.0	15.8	17.0	26.7	13.3	11.9	7.7	2.8	21.1	3.5	9.8	19.8	10.6	4.2	10.6	10.9	8.4	24.6	22.8	9.8	16.1	9.4	6.2	12.6
2019	8	13.1	15.6	4.1	29.8	4.1	8.2	29.8	14.1	23.7	20.7	18.0	10.2	5.3	27.5	21.3	10.5	12.1	11.9	10.0	20.4	10.4	14.6	19.3	24.1	28.2	11.9	10.7	6.6
2019	9	12.9	14.6	6.1	32.2	9.4	20.9	6.5	8.2	10.3	9.0	21.3	29.8	11.4	16.3	16.2	10.6	14.8	13.8	14.6	7.6	7.9	15.4	6.1	20.6	10.5	32.2	24.5	12.0
2019	10	7.5	8.1	2.1	17.2	2.6	3.7	5.7	7.6	9.0	9.4	7.1	7.1	16.6	5.8	17.2	9.2	8.3	6.4	5.1	4.5	10.5	9.2	10.2	7.5	11.2	2.1	12.6	7.2
2019	11	6.3	6.2	3.0	11.2	7.3	8.8	6.8	5.7	6.7	4.3	7.9	6.3	7.8	3.0	4.9	3.0	6.3	4.6	3.3	4.2	5.7	8.9	11.2	7.1	10.6	3.9	6.5	4.3
2019	12	5.1	5.2	1.4	9.5	2.6	9.5	3.8	4.2	5.6	3.3	4.9	5.8	5.0	5.6	5.6	5.2	9.0	6.2	4.4	5.2	5.4	1.4	4.1	4.7	4.7	2.0	6.2	9.2
2020	1	5.8	7.3	2.1	27.5	8.2	20.2	6.5	7.7	6.3	4.8	4.2	4.3	4.6	2.1	3.4	6.5	3.6	7.4	8.6	3.5	8.1	3.9	11.8	5.1	27.5	4.4	6.3	5.3
2020	2	3.9	4.3	2.1	7.8	2.8	2.5	5.8	6.0	3.5	2.5	4.9	4.0	6.1	7.8	3.3	4.8	2.7	4.8	3.2	6.1	3.7	2.2	2.1	5.2	3.3	3.0	5.8	6.5
2020	3	4.8	6.1	2.7	17.3	5.3	5.9	2.7	4.4	5.1	4.6	10.2	4.2	5.9	4.6	3.6	16.3	3.7	10.6	17.3	6.9	3.3	2.8	3.2	6.7	5.9	4.5	6.3	2.9
2020	4	4.7	5.4	0.8	12.1	9.4	2.5	2.8	6.1	12.1	5.8	6.0	2.4	6.5	3.7	2.6	11.2	4.1	4.7	2.1	1.7	7.8	6.3	0.8	7.5	4.7	1.9	12.1	4.6
2020	5	8.9	10.6	2.0	22.0	5.3	6.0	22.0	9.8	16.4	16.7	9.3	17.5	9.8	5.9	2.0	6.4	18.5	6.2	6.9	11.7	13.4	7.8	7.1	6.4	15.9	4.4	8.4	21.1
2020	6	14.3	17.2	7.2	55.3	24.8	11.4	14.1	55.3	20.4	10.1	19.6	16.1	14.6	9.6	11.0	21.6	10.0	10.4	7.2	11.3	10.9	13.0	14.0	27.8	18.8	14.9	30.5	15.3
2020	7	13.9	18.1	6.5	65.4	18.9	49.2	14.1	16.0	30.8	12.3	14.1	11.4	65.4	12.7	14.2	8.0	6.5	9.9	8.4	14.8	11.7	13.6	8.5	11.6	16.7	10.4	38.0	17.4
2020	8	13.2	15.4	2.5	36.5	36.5	11.5	26.8	9.3	9.2	15.6	10.1	6.6	14.7	7.9	19.8	13.1	6.7	11.6	9.6	6.5	26.3	15.2	23.1	13.3	2.5	14.7	27.0	31.5
2020	9	14.2	14.6	3.8	30.3	13.9	5.8	16.9	10.2	3.8	15.4	9.2	12.9	30.3	18.8	11.3	18.0	22.8	14.6	19.6	16.5	13.9	6.7	13.0	19.9	11.0	13.6	14.5	16.9
2020	10	5.9	6.7	3.1	12.5	5.7	7.6	8.2	3.1	7.8	6.0	10.3	5.5	4.4	10.5	4.1	7.1	12.5	5.5	10.9	4.3	8.5	4.3	5.2	5.5	5.0	3.7	9.9	6.0
2020	11	5.7	7.3	2.3	19.9	6.6	5.2	3.3	4.2	5.6	3.5	19.9	9.2	8.3	3.5	2.3	4.7	5.4	9.9	6.9	19.0	11.9	9.9	3.6	5.7	4.5	5.8	8.0	7.9
2020	12	4.7	5.5	1.4	24.8	3.6	2.5	6.0	5.7	4.4	1.4	8.8	2.6	4.9	1.9	5.8	7.9	1.7	1.4	4.4	3.5	24.8	4.7	4.2	5.1	4.7	8.1	7.5	7.0
2021	1	4.9	5.2	1.8	11.4	5.6	5.7	4.4	5.1	4.0	3.5	4.7	3.5	4.4	3.3	6.5	1.8	5.0	6.9	3.2	5.3	2.7	7.7	11.4	2.7	6.7	4.1	9.5	8.0
2021	2	4.2	5.3	1.6	22.0	6.0	2.8	5.8	8.7	4.3	6.6	11.0	5.5	4.0	22.0	3.0	1.6	5.5	5.2	4.5	6.1	2.7	3.5	1.9	3.8	3.7	2.9	3.3	2.7
2021	3	4.2	5.3	1.6	14.6	2.0	3.8	6.4	6.0	3.5	2.8	4.8	8.1	2.5	1.9	7.6	1.6	2.3	4.6	3.6	9.6	1.9	1.6	4.7	9.7	14.6	3.9	14.0	5.8
2021	4	5.2	6.6	1.6	16.6	3.8	3.9	3.4	8.7	1.6	3.1	5.9	11.4	11.4	5.2	16.6	3.6	3.7	15.5	5.2	7.2	1.7	3.8	2.2	5.2	7.6	3.3	12.1	11.5
2021	5	7.2	9.1	1.4	22.3	15.9	1.4	20.7	4.7	6.1	4.8	4.2	5.8	8.5	13.9	22.3	4.7	8.3	5.3	3.6	16.4	10.1	15.6	4.7	9.0	2.7	3.2	12.8	14.0
2021	6	12.1	14.9	2.1	34.5	19.4	13.0	13.6	29.2	23.0	22.7	9.7	34.5	7.3	8.5	7.1	8.9	10.6	2.1	8.5	3.4	7.0	16.5	14.0	11.1	10.3	25.2	20.7	32.1
2021	7	15.4	17.3	7.1	54.9	12.1	18.0	17.3	8.0	11.4	12.1	24.2	16.8	15.5	17.6	16.7	7.1	23.1	8.1	24.9	54.9	11.7	31.7	10.4	13.5	28.1	8.3	15.4	7.2
2021	8	11.6	13.7	4.9	27.9	8.2	6.2	11.0	9.8	17.1	15.6	8.5	12.3	7.6	15.9	26.9	19.8	27.9	15.7	9.2	10.1	12.4	7.4	4.9	8.3	17.3	20.0	26.8	11.0
2021	9	12.9	13.3	5.3	38.5	7.1	17.2	11.8	13.4	8.3	38.5	23.2	14.1	11.4	6.3	5.3	19.6	14.4	14.5	16.3	18.0	10.4	16.4	13.5	12.4	5.9	7.8	8.3	5.7
2021	10	7.6	8.6	3.4	19.4	3.4	10.0	13.4	10.3	9.6	19.4	6.4	4.8	12.4	11.0	7.8	5.2	5.8	6.8	7.3	5.2	7.3	12.5	3.6	4.7	12.3	4.8	10.1	11.6
2021	11	6.1	7.4	2.2	17.6	9.9	2.8	3.5	8.1	5.7	11.3	2.2	14.7	4.9	6.1	3.3	5.3	14.8	5.2	4.2	4.2	9.0	6.5	13.3	2.9	17.6	6.0	8.6	8.2
2021	12	5.3	5.5	1.1	10.5	9.3	6.3	2.9	6.0	5.9	4.9	5.1	10.5	5.2	3.5	1.1	3.4	6.0	5.3	3.6	5.1	6.1	5.3	4.5	6.0	3.1	10.0	7.9	5.9
2022	1	4.7	5.4	1.4	14.8	2.1	3.6	7.5	4.7	14.8	4.8	2.8	5.7	3.4	10.9	3.0	5.7	1.4	6.5	6.9	3.6	14.0	3.6	3.0	5.9	5.1	5.2	4.3	2.7
2022	2	4.3	5.1	2.0	18.0	6.7	7.7	6.3	4.1	4.4	5.0	5.5	2.2	3.5	6.8	4.5	3.2	2.3	8.4	18.0	2.3	2.3	7.0	6.9	2.0	3.8	3.4	3.4	3.3
2022	3	4.5	4.9	0.4	11.3	4.4	6.5	3.1	4.3	6.6	6.6	0.4	4.6	11.3	2.6	2.8	5.4	3.7	7.8	6.0	6.0	2.5	4.5	4.7	1.1	2.7	5.2	3.8	9.8
2022	4	5.1	6.6	2.4	18.4	5.0	3.7	2.4	7.3	5.1	7.0	18.4	9.0	4.0	5.1	5.9	4.3	7.4	3.2	16.8	8.3	5.9	4.9	2.4	3.7	12.5	6.3	5.1	3.9
2022	5	7.9	9.5	2.4	24.0	12.4	4.0	23.3	8.7	11.8	2.4	18.0	6.0	6.1	12.0	5.0	7.2	15.8	2.9	8.5	6.2	10.1	7.2	4.7	24.0	4.5	5.2	11.2	10.6
2022	6	8.7	11.0	2.3	28.3	8.3	14.2	13.1	18.6	16.8	7.6	15.2	19.8	8.7	18.9	6.1	8.9	6.0	8.4	8.7	28.3	7.5	3.5	2.3	8.8	15.9	5.0	5.4	8.4
2022	7	16.7	19.3	7.3	43.6	37.0	13.7	18.2	8.1	16.7	43.6	16.8	15.0	12.3	30.7	11.9	31.5	25.4	24.7	14.4	7.3	9.9	13.8	8.7	23.5	13.8	22.8	24.6	18.7
2022	8	13.1	16.7	7.0	56.7	7.0	8.2	16.8	13.4	20.4	16.6	8.5	40.5	22.5	7.8	9.4	12.9	13.5	41.0	8.6	18.2	7.6	14.4	11.2	7.7	10.3	12.1	14.9	56.7
2022	9	13.7	13.4	3.3	27.3	17.3	14.6	14.3	13.6	15.5	15.0	24.4	15.1	13.2	7.3	22.2	9.7	10.1	7.9	27.3	6.0	10.5	16.4	13.5	13.7	6.1	14.1	3.3	10.9
2022	10	6.3	7.8	1.9	17.8	3.9	4.0	3.5	6.4	8.5	7.3	11.1	15.8	11.0	9.3	5.3	15.0	17.8	6.1	4.6	8.1	11.2	12.3	5.1	2.8	6.0	6.1	4.5	1.9
2022	11	6.3	7.0	2.7	17.6	8.6	12.4	17.6	7.5	4.6	6.7	6.3	2.7	2.8	10.5	8.7	5.7	6.4	3.9	3.4	13.7	6.6	8.0	2.8	3.5	5.4	5.5	8.8	6.0
2022	12	4.4	5.4	2.3	24.3	4.1	5.7	4.4	5.4	2.7	8.7	4.4	6.6	3.9	3.8	7.7	7.6	2.6	4.8	4.6	24.3	5.3	2.4	5.1	3.2	2.9	2.3	3.6	2.8
2023	1	5.2	5.2	1.8	11.8	3.5	3.6	6.8	4.2	11.8	8.9	6.5	6.3	3.3	6.0	5.9	5.2	5.9	3.2	5.2	4.5	5.2	7.3	4.4	1.8	3.5	4.3	5.9	2.3
2023	2	3.4	3.8	1.5	9.7	3.6	2.7	2.0	1.5	5.4	2.5	3.6	9.7	2.9	3.8	5.6	7.9	3.0	6.6	2.7	1.5	3.3	2.0	3.8	5.1	3.6	4.1	2.5	2.7
2023	3	4.4	5.3	1.8	11.8	4.7	2.8	3.8	11.8	5.4	4.3	9.8	5.0	2.4	1.8	8.0	8.3	2.7	3.8	10.4	3.0	1.8	7.4	3.2	4.5	5.1	3.4	9.6	4.2
2023	4	5.7	7.0	0.9	18.3	5.3	3.6	3.6	5.3	8.0	5.4	18.3	14.8	9.3	6.6	1.7	4.9	8.2	12.5	4.2	10.1	4.6	8.9	0.9	6.0	4.0	5.3	9.1	7.5
2023	5	11.1	12.2	6.1	31.0	9.7	6.9	21.6	13.6	15.4	14.4	6.5	17.4	12.3	6.6	23.4	6.7	6.9	6.1	6.6	13.0	8.6	11.1	12.0	31.0	11.0	7.2	8.8	16.3
2023	6	12.3	13.3	6.7	26.9	17.0	19.9	8.7	9.5	21.1	9.7	7.1	8.4	12.3	12.9	6.7	6.8	12.3	11.9	17.4	6.9	18.1	17.3	6.7	12.1	26.9	23.0	13.8	12.8
2023	7	13.7	17.6	5.6	33.1	33.1	12.7	14.8	28.8	28.1	7.6	5.6	12.6	28.6	6.1	31.1	11.5	9.8	10.6	11.5	29.8	7.8	16.7	9.9	20.9	27.9	21.3	27.5	7.3
2023	8	15.4	16.3	3.5	32.3	9.1	3.5	21.2	4.5	23.0	7.6	16.8	13.4	11.5	11.6	13.4	25.9	16.7	23.3	15.4	8.5	27.9	4.7	5.9	19.3	29.9	31.2	15.4	32.3
2023	9	11.7	11.9	3.6	21.7	12.8	12.7	5.7	5.1	6.4	16.6	3.6	11.3	11.8	14.5	7.0	8.4	14.6	8.3	18.9	11.7	13.9	16.4	6.8	21.2	21.0	21.7	8.8	7.4
2023	10	5.4	6.3	2.1	15.1	2.1	5.6	6.5	2.6	7.8	4.5	3.3	10.2	5.3	5.1	4.7	8.5	15.1	5.1	7.5	2.9	4.2	9.3	10.7	3.7	7.2	7.5	8.0	4.9
2023	11	8.3	8.8	3.9	17.0	4.9	8.1	4.1	3.9	7.3	14.5	8.8	8.6	8.4	16.4	17.0	6.8	7.6	12.9	9.9	6.0	4.6	13.6	4.1	7.0	12.9	8.8	5.1	9.9
2023	12	5.2	5.7	2.0	11.0	6.3	11.0	4.8	4.5	6.6	9.7	5.2	5.0	3.5	3.2	5.5	3.5	8.7	2.0	6.4	4.4	5.1	6.3	7.4	5.2	5.2	6.2	8.5	3.2
2024	1	4.6	6.3	2.0	24.9	4.8	2.4	4.2	3.2	5.8	9.0	5.0	5.7	24.9	2.0	3.4	3.9	6.5	16.9	4.4	3.7	6.7	3.2	4.1	6.7	7.6	4.1	3.3	8.6
2024	2	4.1	4.8	2.5	8.6	4.0	4.0	3.2	4.7	6.8	2.8	8.6	8.4	4.6	5.3	8.2	5.0	4.1	2.9	6.7	3.0	3.4	3.9	3.3	7.3	4.7	3.4	3.9	2.5
2024	3	4.4	4.9	1.5	10.8	7.3	6.4	10.8	4.1	3.1	4.1	4.0	2.1	5.4	4.4	2.4	4.0	4.5	6.7	6.4	4.3	6.5	4.0	3.3	6.2	8.2	3.8	1.5	4.7
2024	4	5.0	5.9	1.6	13.9	9.4	3.8	8.4	13.9	12.7	2.1	5.9	9.0	3.8	3.5	1.6	6.7	4.8	2.1	4.3	3.1	3.6	5.3	10.8	5.8	3.8	7.1	7.4	2.7
2024	5	8.1	9.6	2.3	20.3	5.2	17.0	6.8	3.4	14.4	16.8	17.9	8.9	16.9	4.6	2.3	13.7	15.3	4.9	6.8	7.7	4.9	9.9	20.3	2.6	10.3	7.8	8.4	4.7
2024	6	12.8	14.3	4.4	28.7	6.8	15.5	14.7	8.5	25.8	7.4	11.5	11.0	14.3	9.1	9.0	12.2	17.8	4.4	27.2	14.1	11.8	13.3	6.0	27.8	28.7	4.9	15.6	26.0
2024	7	13.6	18.4	6.3	73.3	28.8	17.4	21.5	11.2	46.2	25.5	16.7	21.0	17.2	73.3	15.9	13.7	11.9	11.9	8.6	13.4	9.3	6.3	11.6	7.8	10.6	24.7	8.2	9.0
2024	8	13.7	14.8	7.4	27.7	7.4	18.3	10.8	9.7	20.2	27.7	12.8	19.3	15.8	12.9	13.6	8.8	12.6	12.8	14.3	18.2	18.1	7.5	14.0	13.7	17.2	12.3	11.6	24.8
2024	9	14.2	14.3	4.7	25.0	13.9	25.0	8.6	9.6	4.7	24.1	17.3	17.9	16.9	8.9	12.2	21.4	8.6	14.7	23.4	7.8	10.5	16.3	23.8	20.6	6.7	7.1	14.5	9.2
2024	10	6.6	7.0	2.9	16.2	3.4	4.1	8.5	7.1	2.9	3.1	8.4	10.6	3.1	5.4	7.0	7.5	7.2	3.2	7.0	5.9	4.7	13.2	13.5	5.2	6.1	6.3	8.9	16.2
2024	11	6.8	7.6	3.0	15.1	9.1	7.3	3.2	6.6	6.4	6.4	10.4	5.6	7.0	5.8	15.1	9.1	7.6	7.4	3.0	6.0	11.4	6.0	8.3	14.7	6.0	3.2	9.6	6.1
2024	12	5.2	5.7	1.7	9.9	4.1	8.3	5.3	6.0	9.0	9.9	5.1	4.5	3.6	7.0	3.4	6.8	6.1	6.0	4.3	3.5	3.8	8.1	4.6	8.6	1.7	3.9	8.1	4.0
2025	1	5.5	6.1	1.2	15.7	4.8	6.1	1.4	5.9	10.1	4.9	4.4	4.3	3.9	6.3	4.0	7.1	2.9	5.0	6.8	1.2	6.2	8.8	4.5	4.6	9.8	15.7	10.5	6.6
2025	2	3.4	4.1	1.3	11.0	2.8	6.7	3.2	3.9	3.4	11.0	2.3	3.1	3.5	7.0	1.9	4.8	9.4	3.6	2.2	3.9	1.3	6.1	3.2	3.9	3.5	1.7	2.5	2.3
2025	3	4.8	5.0	1.7	10.8	3.5	7.8	5.5	3.9	2.3	10.8	2.9	1.7	1.9	5.1	5.0	3.4	10.7	6.0	8.3	3.9	4.4	4.6	2.6	5.6	7.2	1.8	7.0	5.0
2025	4	5.4	6.1	2.1	17.6	7.2	6.8	6.1	3.0	5.5	2.6	17.6	4.5	3.5	3.6	5.3	13.7	2.8	6.3	4.0	7.3	10.0	9.0	4.8	6.3	2.1	3.2	7.3	4.7
2025	5	11.5	10.8	2.0	21.3	5.6	7.7	4.2	12.7	14.6	21.3	11.4	7.0	4.1	11.6	15.1	6.3	2.1	10.5	20.6	2.0	9.8	16.2	16.2	4.8	15.0	14.0	13.9	13.5
2025	6	12.0	13.3	5.3	42.2	6.0	8.8	42.2	15.9	6.5	12.2	8.7	13.4	7.3	5.7	12.3	7.6	13.5	11.1	5.3	17.7	13.0	9.2	5.7	15.4	12.9	18.0	38.4	11.9
2025	7	14.2	15.2	1.6	35.7	13.9	21.7	19.8	19.2	35.7	16.5	7.6	9.3	10.2	17.7	20.6	8.9	32.3	9.5	13.2	7.7	17.4	5.9	9.3	14.4	8.2	16.1	1.6	28.1
2025	8	10.6	13.4	5.2	34.0	6.1	17.5	13.6	10.3	34.0	22.0	10.4	7.3	14.4	11.8	9.5	13.7	5.2	16.1	6.0	24.1	6.6	5.2	8.4	10.8	22.8	6.8	10.5	28.4

2025	9	14.1	15.1	4.9	48.9	13.9	7.9	21.7	13.1	5.7	11.7	48.9	14.2	15.8	18.7	4.9	19.3	13.3	12.5	14.6	16.3	24.2	12.0	8.2	16.2	20.0	14.9	6.8	6.7
2025	10	7.8	8.2	2.7	19.9	13.1	5.7	12.1	2.8	8.6	9.0	9.4	7.8	4.5	5.4	3.4	15.6	19.9	5.1	10.3	3.3	10.5	9.1	5.4	4.7	2.7	7.3	7.9	13.2
2025	11	6.0	6.8	2.2	14.7	5.1	6.5	12.5	4.2	7.0	8.4	6.1	3.5	11.2	7.6	14.7	5.6	2.2	6.6	11.6	5.0	5.1	6.3	5.9	9.5	4.9	5.0	4.6	5.1
2025	12	5.0	5.3	1.0	10.3	5.6	6.3	7.5	3.8	9.1	5.3	7.1	3.7	1.7	3.4	9.4	2.4	8.3	2.7	4.3	7.8	10.3	4.4	3.6	7.2	4.7	2.9	1.0	5.2
2026	1	5.4	6.0	2.2	10.2	5.3	5.0	9.6	10.2	6.3	2.2	8.7	3.8	2.5	4.2	4.0	7.9	5.4	2.7	9.6	8.2	6.0	5.5	4.2	7.2	8.4	3.5	3.8	10.0
2026	2	4.2	5.8	1.7	15.3	4.2	3.4	2.6	15.3	2.8	8.4	4.1	5.4	14.2	12.2	1.7	3.4	7.4	3.7	2.5	5.6	9.3	3.3	3.6	3.9	4.2	7.8	4.4	5.7
2026	3	5.4	5.5	1.2	11.4	8.6	5.1	11.4	3.2	5.6	6.1	6.6	4.6	7.7	6.8	7.3	6.5	8.1	8.1	2.8	1.4	3.2	3.4	3.1	2.5	11.1	4.3	3.5	1.2
2026	4	5.3	6.1	1.0	14.3	13.6	11.4	7.6	1.8	2.0	1.5	7.9	9.4	5.9	3.8	3.5	1.0	5.2	8.1	4.8	14.3	8.6	7.9	5.9	5.2	4.3	5.4	3.2	3.4
2026	5	7.6	8.4	1.4	19.7	16.5	3.7	9.4	8.8	6.5	3.2	13.2	5.7	19.7	2.9	1.6	11.6	13.7	10.7	10.4	14.2	10.1	7.8	6.0	3.6	1.4	6.8	7.0	7.5
2026	6	9.5	12.2	5.2	28.7	7.7	16.6	8.2	28.7	8.3	14.9	10.4	7.2	8.6	8.9	15.2	5.2	9.3	6.8	11.8	18.2	8.0	20.4	19.2	6.6	9.7	5.2	20.9	15.5
2026	7	15.9	16.7	5.8	29.3	9.6	5.8	14.7	16.7	18.9	12.5	16.9	11.7	23.9	19.4	12.1	13.7	9.8	17.0	9.1	8.8	15.1	14.0	27.4	27.6	29.3	17.4	25.0	23.7
2026	8	9.9	11.8	4.8	31.2	4.8	20.1	6.4	10.7	8.8	9.5	19.8	7.0	6.9	31.2	7.1	14.4	10.5	15.1	11.5	10.1	24.4	10.8	8.6	7.5	8.6	9.8	9.2	10.4
2026	9	14.3	17.7	4.6	43.5	30.7	7.9	11.0	20.4	34.8	20.0	13.4	15.1	6.5	4.6	43.5	19.3	14.3	12.7	13.4	32.4	13.4	13.5	11.0	21.3	6.1	14.2	28.8	16.0
2026	10	8.8	9.0	1.9	15.9	1.9	5.2	6.1	5.7	9.3	6.8	12.4	12.5	3.0	5.8	9.8	7.8	14.1	4.6	8.8	15.7	11.2	13.8	5.8	11.6	12.9	7.1	8.8	15.9
2026	11	6.0	6.2	2.1	11.8	5.1	6.5	4.3	7.4	5.5	6.8	5.3	4.2	11.8	9.0	11.1	2.3	6.6	2.4	9.6	11.2	3.1	6.5	2.1	4.8	4.5	6.6	6.8	5.1
2026	12	4.6	5.4	1.5	13.1	13.1	6.2	4.0	1.5	8.7	9.6	6.0	3.3	3.2	10.3	3.6	3.5	7.3	3.4	3.6	4.9	5.4	7.3	4.6	3.3	4.8	4.2	4.7	4.5
2027	1	4.5	6.5	2.3	21.3	5.7	17.7	2.6	4.1	4.2	17.3	6.1	6.3	3.5	2.3	2.6	3.6	5.7	10.6	7.6	4.3	3.0	4.7	3.2	6.4	4.7	21.3	4.3	3.9
2027	2	4.0	5.4	0.4	27.1	27.1	1.9	0.4	2.2	5.4	6.2	4.1	3.8	3.1	4.1	4.0	9.9	3.5	6.9	5.2	3.8	2.7	1.9	4.0	10.4	3.6	1.7	6.0	7.4
2027	3	5.3	6.1	0.8	13.1	3.7	0.8	13.1	10.4	4.8	4.8	5.3	1.8	11.3	6.6	4.9	5.0	5.7	4.8	5.6	2.3	6.8	2.8	5.3	8.5	11.3	4.6	10.3	5.3
2027	4	4.7	6.4	1.5	20.6	5.9	14.0	5.9	4.4	7.6	3.6	8.2	2.1	3.9	4.1	3.9	5.6	2.0	3.2	4.2	4.7	5.6	2.7	20.6	19.3	10.8	4.9	4.6	1.5
2027	5	10.6	11.1	3.3	19.5	13.7	5.7	5.4	9.1	4.2	18.1	16.6	19.5	8.7	7.8	15.9	11.9	3.3	15.6	14.4	14.1	8.6	11.3	7.4	15.0	16.5	5.2	8.3	9.8
2027	6	10.8	13.9	3.0	44.8	8.4	9.1	24.5	10.3	13.9	8.3	5.4	5.2	14.9	3.0	11.5	25.9	10.4	8.5	11.8	13.9	19.8	11.2	9.1	25.3	44.8	6.9	20.3	10.1
2027	7	15.2	18.0	5.6	48.4	17.1	17.9	48.4	15.6	10.9	12.5	16.5	19.2	14.8	29.1	13.3	10.7	35.4	11.1	38.8	9.5	10.7	16.9	16.3	14.3	12.7	5.6	13.6	20.9
2027	8	12.9	14.5	7.4	26.7	12.9	18.2	15.1	10.4	21.0	26.7	20.2	23.9	12.0	13.7	12.8	9.9	7.9	12.8	11.3	10.5	24.5	8.9	17.4	9.7	13.1	8.9	18.2	7.4
2027	9	10.9	13.0	3.2	39.6	5.9	17.1	18.2	16.2	4.7	23.2	8.2	7.4	10.8	16.5	21.8	11.1	12.2	5.1	39.6	17.4	7.0	9.0	12.5	10.5	17.5	7.8	10.1	3.2
2027	10	6.3	8.1	3.3	16.9	4.2	16.9	11.2	4.7	5.9	9.5	13.3	15.5	5.1	6.0	4.2	6.5	5.1	5.6	5.6	4.9	3.3	16.0	7.4	8.7	12.7	3.6	9.9	7.7
2027	11	5.5	6.3	1.7	14.1	5.3	7.6	6.7	2.4	2.5	5.7	4.7	5.1	11.2	4.2	11.9	5.6	5.1	5.0	6.0	5.4	3.6	7.1	4.3	11.7	14.1	1.7	6.5	8.2
2027	12	5.0	5.8	2.6	14.4	4.8	8.4	5.3	4.7	14.4	6.6	3.7	10.3	4.9	5.2	11.0	4.4	3.9	7.6	3.9	5.9	5.8	3.9	2.6	2.7	6.8	2.9	5.7	4.2
2028	1	4.3	5.6	2.7	20.5	3.9	6.5	6.1	4.0	6.4	2.8	3.8	4.5	4.8	8.7	6.1	2.7	5.9	6.4	3.8	4.1	7.9	4.2	3.8	6.4	4.0	20.5	3.9	2.8
2028	2	4.9	5.5	0.7	27.4	4.8	7.1	3.9	5.0	5.0	1.7	5.2	5.0	5.0	3.6	0.7	3.8	2.5	27.4	6.3	6.1	1.5	4.8	5.5	3.9	3.2	7.4	7.2	4.3
2028	3	5.4	6.1	1.2	11.8	8.5	2.2	6.3	5.8	9.4	7.0	3.6	3.4	5.4	2.9	6.3	11.4	1.6	8.4	11.7	4.7	4.9	4.8	5.4	1.2	11.8	3.5	11.6	3.7
2028	4	6.0	5.8	0.3	14.5	9.9	14.5	4.9	3.9	1.6	4.1	6.7	6.8	9.5	4.6	5.5	6.9	3.8	6.5	7.2	0.3	7.5	4.7	7.2	3.0	6.3	6.1	2.8	5.8
2028	5	8.3	10.0	1.6	24.4	6.3	9.7	14.1	5.3	6.1	6.2	6.2	7.9	10.8	18.8	11.0	22.9	5.7	13.3	4.6	1.6	2.9	11.5	19.1	8.6	11.1	7.2	5.7	24.4
2028	6	11.8	12.7	5.2	20.7	6.2	12.1	6.6	15.4	18.0	14.3	7.5	18.0	19.3	11.2	7.5	17.6	10.0	19.0	13.6	5.6	11.5	9.7	10.1	15.0	20.7	10.8	5.2	19.0
2028	7	13.8	15.1	5.8	36.6	15.7	9.0	30.4	11.2	18.6	9.3	12.5	8.6	12.7	7.1	5.8	7.3	15.0	21.8	16.8	7.0	30.2	15.1	18.6	16.4	10.3	9.3	15.9	36.6
2028	8	12.5	16.2	6.7	51.0	7.3	8.7	20.8	11.6	14.7	6.7	17.0	40.3	17.5	12.9	51.0	8.9	7.2	11.0	14.2	22.7	25.5	28.4	8.3	7.7	12.1	16.2	8.9	8.6
2028	9	15.1	14.6	5.4	23.7	23.3	8.0	17.0	12.0	15.4	18.2	8.4	14.9	10.7	14.4	5.4	20.0	15.3	14.1	10.2	16.4	23.7	15.8	17.1	10.1	7.8	17.1	13.0	21.7
2028	10	6.9	7.4	3.0	14.3	9.0	5.7	5.2	9.3	5.7	7.2	14.3	14.1	3.3	7.3	3.5	7.5	7.1	5.8	6.7	3.3	13.9	4.8	3.3	3.0	7.8	6.4	9.5	12.6
2028	11	5.9	6.7	2.2	15.1	4.2	6.1	8.9	5.1	3.7	2.2	8.3	7.1	2.7	15.1	3.1	5.3	6.6	5.0	6.1	12.2	8.0	3.2	3.5	12.9	9.0	5.6	5.6	11.7
2028	12	4.7	5.3	1.6	9.8	3.2	4.3	5.2	2.8	6.4	6.7	7.6	7.0	3.4	1.6	4.5	4.4	2.1	9.8	4.1	8.4	9.0	2.5	5.0	5.4	7.7	2.8	4.0	9.3
2029	1	5.1	6.3	1.6	14.9	4.9	3.6	5.7	3.5	4.3	3.6	1.6	4.0	14.9	3.7	8.5	9.3	9.5	4.3	3.3	5.0	5.8	14.6	8.7	5.2	5.4	3.4	7.2	10.3
2029	2	3.7	4.2	2.0	10.1	3.2	3.8	6.3	2.0	3.4	6.5	5.5	4.2	2.6	5.2	3.1	3.7	4.8	2.3	4.8	3.7	3.4	3.3	10.1	2.6	5.1	3.4	5.1	2.9
2029	3	4.6	5.9	2.1	15.5	2.1	4.4	5.8	7.3	10.6	4.5	3.5	6.2	4.3	2.8	15.5	2.1	3.1	8.1	5.4	4.4	5.9	4.6	11.2	10.1	7.8	4.6	3.0	4.1
2029	4	6.5	7.2	2.4	17.1	9.3	6.9	8.5	6.6	9.4	9.1	2.5	13.0	7.1	6.5	5.6	4.9	11.8	2.9	17.1	13.9	4.8	3.1	2.4	3.4	4.2	5.2	8.4	5.7
2029	5	8.1	9.8	1.5	29.2	5.2	1.5	3.1	11.4	14.6	12.4	18.3	16.2	5.9	8.1	10.0	6.8	5.8	3.7	29.2	8.1	10.1	9.7	8.0	5.5	16.3	12.2	8.1	5.7
2029	6	10.9	11.7	3.8	30.1	3.8	5.7	11.6	14.5	10.7	11.1	13.3	9.9	7.5	7.1	11.9	14.0	10.6	7.4	21.2	5.1	7.9	13.9	21.7	15.9	30.1	4.0	14.7	8.0
2029	7	11.5	15.5	7.1	42.2	22.4	14.9	11.3	12.2	16.5	9.3	25.5	10.2	7.3	10.7	42.2	9.1	8.0	8.6	22.7	17.3	22.4	8.1	23.6	11.0	11.7	7.1	10.3	28.8
2029	8	13.4	15.2	5.8	47.2	47.2	6.5	14.0	11.2	29.0	13.1	18.3	5.8	10.1	15.5	5.8	12.2	13.2	21.9	13.5	6.6	17.6	21.4	15.3	18.3	10.3	9.1	13.4	16.1
2029	9	14.1	15.0	6.8	40.6	21.3	6.8	7.6	11.2	7.0	14.6	11.3	14.5	26.2	18.8	6.8	40.6	15.3	12.3	10.9	11.2	10.4	16.4	6.8	14.6	26.3	13.7	18.4	16.2
2029	10	6.8	7.0	2.2	14.3	12.1	6.9	10.8	4.5	3.9	6.0	9.3	8.8	9.8	3.6	4.7	14.3	8.6	9.1	2.3	2.2	5.2	6.8	5.0	2.6	10.5	6.9	7.0	6.4
2029	11	6.3	6.8	1.6	12.9	4.6	9.2	7.8	10.6	11.9	10.8	4.4	8.3	4.7	6.1	8.2	4.5	3.2	5.4	3.3	3.9	8.3	10.1	1.6	6.6	12.9	5.2	5.4	7.1
2029	12	4.9	5.2	2.7	10.6	4.5	10.6	3.3	5.9	4.4	3.2	6.7	7.7	2.7	3.2	8.1	3.4	6.6	5.2	5.0	5.9	5.3	4.8	5.6	3.4	3.4	3.6	3.2	9.1
2030	1	3.6	4.2	0.7	9.6	2.6	3.1	9.1	5.2	1.9	3.9	4.9	9.6	3.4	3.5	4.9	2.3	4.9	3.6	3.6	6.1	1.8	6.1	4.4	3.5	3.6	0.7	4.9	3.4
2030	2	4.4	5.0	2.5	8.9	3.1	6.0	3.6	4.2	4.1	5.7	8.5	6.7	3.9	5.9	2.9	4.7	8.9	4.4	6.3	5.2	2.5	4.2	5.6	4.0	4.0	4.3	8.4	2.9
2030	3	4.8	5.0	1.6	9.4	3.3	5.3	8.9	8.3	4.9	4.4	2.8	8.6	3.4	1.6	6.5	2.5	4.1	9.4	2.0	6.5	2.1	2.2	4.8	6.0	5.8	4.1	4.8	8.5
2030	4	6.3	6.5	1.4	14.5	2.6	6.5	4.9	13.5	4.9	4.9	9.7	2.2	6.2	2.3	7.5	3.9	14.5	4.2	6.7	3.6	6.3	7.3	7.3	5.1	13.7	8.1	1.4	10.0
2030	5	10.2	12.0	2.8	23.6	7.2	13.7	6.2	6.3	10.1	20.2	18.0	5.2	9.5	16.1	13.1	13.7	19.5	19.2	2.8	7.1	10.3	10.0	21.7	23.6	3.7	16.7	9.5	4.1
2030	6	11.5	13.1	4.2	37.2	12.9	9.5	7.8	15.2	20.9	9.5	14.3	21.6	27.0	7.1	13.7	10.2	12.8	9.4	4.2	8.8	7.8	6.5	15.3	14.4	8.1	5.5	37.2	15.2
2030	7	16.6	16.6	6.3	28.0	23.2	18.3	8.3	28.0	19.2	25.4	25.5	18.1	16.6	15.3	16.5	25.8	9.5	14.2	10.9	8.2	27.6	8.5	16.1	11.1	6.3	17.4	7.8	19.8
2030	8	12.4	14.3	4.1	30.0	12.6	4.1	18.0	18.6	8.0	27.1	30.0	10.0	8.3	21.0	15.9	11.2	12.1	6.9	10.2	20.8	16.9	9.1	9.7	15.1	28.2	5.6	14.8	9.5
2030	9	11.8	11.9	1.7	20.3	11.6	11.6	1.7	14.5	8.9	14.0	19.5	7.9	3.9	13.2	5.4	10.3	14.9	13.8	19.8	16.4	12.0	9.4	5.0	12.5	20.3	10.2	8.7	18.8
2030	10	6.2	7.2	1.8	21.7	6.0	14.6	11.9	4.4	7.8	2.7	1.8	8.4	21.7	2.9	8.8	6.4	9.9	6.5	5.4	5.1	4.2	10.6	5.4	7.9	7.3	3.2	4.5	4.7
2030	11	6.3	7.2	2.8	17.2	5.5	3.7	3.0	17.2	7.9	7.5	6.3	14.1	7.1	6.3	4.9	5.8	6.0	5.2	6.9	5.4	2.8	7.8	9.9	13.0	6.0	7.5	8.9	3.0
2030	12	5.7	5.4	2.3	9.2	5.7	3.2	8.2	5.9	6.1	5.4	5.5	2.8	4.9	4.6	9.2	2.8	7.2	2.8	6.4	5.8	6.5	6.0	4.7	2.3	6.2	7.8	5.9	3.4
2031	1	5.8	6.4	2.2	19.7	5.7	2.7	6.3	2.2	3.6	7.3	9.3	5.4	8.4	9.4	5.9	4.7	7.0	4.5	3.1	6.6	4.2	11.6	19.7	7.9	7.4	3.9	3.0	3.6
2031	2	4.4	4.6	2.1	10.9	3.7	6.7	2.6	8.1	3.7	2.2	4.5	6.4	7.0	4.9	4.6	5.3	5.0	2.8	2.7	4.4	2.7	2.1	3.8	2.4	10.9	5.7	6.9	2.6
2031	3	4.4	5.8	1.3	14.1	3.5	1.3	4.3	5.7	13.3	4.6	2.7	3.3	9.8	3.2	9.2	5.7	1.7	4.2	14.1	5.4	4.2	3.4	5.5	6.4	11.1	2.7	11.9	2.7
2031	4	3.8	4.8	1.4	13.3	4.0	13.3	1.4	8.8	2.1	2.9	4.8	3.3	11.4	2.2	9.6	2.4	5.1	5.4	7.1	1.8	2.6	5.0	2.6	2.7	4.7	1.8	3.5	7.2
2031	5	9.7	9.8	4.2	17.4	13.9	6.0	9.6	12.9	12.5	17.4	4.2	15.0	4.3	13.1	15.0	9.9	5.1	7.5	10.6	9.3	8.8	6.9	10.4	9.8	9.5	12.9	5.3	4.7
2031	6	11.0	14.5	5.0	38.7	21.1	6.8	5.0	7.3	7.3	19.9	7.8	14.2	10.9	12.2	16.1	11.1	38.7	7.3	23.2	8.6	8.7	16.3	10.0	9.0	12.2	9.5	33.1	32.3
2031	7	11.7	18.1	3.4	54.2	11.5	8.4	21.8	10.3	11.7	9.2	8.0	32.9	27.0	11.8	27.4	3.4	54.2	32.1	14.4	27.1	11.1	10.0	42.9	11.1	9.8	9.6	12.9	16.2
2031	8	13.9	17.2	5.6	57.2	31.3	29.7	57.2	8.9	5.6	31.1	14.0	12.7	9.7	9.9	15.5	6.1	12.5	21.9	23.2	7.1	14.6	19.3	11.2	7.3	24.2	8.0	13.8	16.8
2031	9	14.0	13.6	5.1	21.9	18.8	5.1	13.0	16.2	8.7	10.6	16.8	15.1	9.1	18.8	9.1	19.6	10.3	13.7	13.2	16.0	9.5	14.3	8.7	21.9	16.5	6.0	19.5	15.0
2031	10	5.8	7.1	2.3	23.4	6.2	2.3	7.1	7.4	23.4	9.1	3.9	5.4	9.6	3.5	13.7	7.2	7.1	5.0	13.4	3.2	9.0	5.1	5.4	2.5	6.4	4.9	5.2	4.4
2031	11	6.1	6.4	3.7	10.7	4.7	3.7	5.6	6.0	6.3	8.0	5.0	4.2	4.7	6.8	10.7	6.3	8.1	4.8	7.9	10.4	4.9	8.8	6.0	3.8	4.1	6.9	6.2	9.3
2031	12	5.0	5.2	1.2	12.2	1.6	6.3	4.2	2.9	2.4	3.6	3.4	2.9	6.4	7.8	4.8	1.2	7.9	4.4	8.4	8.3	5.1	3.4	5.3	12.2	5.6	2.7	7.8	7.0
2032	1	4.4	5.2	1.9	12.4	4.4	5.7	3.7	2.7	7.2	3.9	5.8	4.5	8.3	12.4	3.2	3.4	3.9	3.5	8.5	4.8	3.4	7.9	4.4	4.0	9.0	3.8	5.2	1.9
2032	2	4.7	6.4	1.7	18.8	5.3	3.7	4.5	2.9	3.5	2.5	1.7	3.6	4.2	5.1	5.6	8.3	3.2	5.8	18.8	17.5	2.9	5.0	14.4	8.8	10.0	3.8	3.4	9.5
2032	3	5.1	5.8	1.7	12.4	1.9	2.5	1.7	3.9	10.2	2.9	4.0	3.0	2.3	9.7	7.4	8.4	7.8	5.3	11.0	4.9	2.6	4.8	5.8	5.7	11.6	2.6	12.4	5.7
2032	4	5.6	6.7	2.3	15.0	6.0	3.9	4.7	10.9	2.8	2.7	5.0	8.2	12.6	4.1	5.5	11.5	5.7	7.1	11.3	7.2	3.2	4.3	2.6	4.6	2.3	6.0	13.7	15.0
2032	5	9.3	9.6	1.9	19.2	6.7	8.5	7.8	1.9	3.4	12.6	16.7	19.2	18.1	9.8	14.3	4.9	13.1	16.3	10.4	9.2	9.9	8.9	4.0	6.6	9.4	13.8	2.5	3.4
2032	6	13.4	15.7	5.1	36.7	15.0	10.2	36.7	31.5	18.0	12.0	22.9	6.1	12.6	26.1	6.2	12.9	20.9	7.9	20.1	7.2	13.9	15.2	31.6	15.9	10.0	5.1	7.0	11.5
2032	7	15.9	16.5	5.8	34.9	9.9	15.7	34.9	15.0	8.2	9.3	10.6	19.7	16.2	17.7	19.8	11.2	24.1	5.8	13.0	14.3	18.2	15.7	18.2	27.6	23.6	18.1	10.0	19.1
2032	8	16.0	19.4	6.7	43.2	7.0	9.4	25.5	9.7	12.3	26.2	15.8	29.3	21.3	27.1	22.1	6.7	27.0	43.2	17.4	7.1	42.4	11.8	11.4	16.1	12.7	35.0	15.4	12.8
2032	9	13.1	13.9	5.2	32.7	5.2	32.7	16.3	12.0	14.7	10.0	18.9	8.6	8.9	15.2	17.0	10.2	9.5	10.0	6.3	10.5	15.0	8.3	8.6	21.8	15.4	14.2	28.6	16.2
2032	10	5.6	6.3	2.3	12.6	3.3	5.8	12.6	8.7	7.6	6.1	10.6	4.1	7.8	8.0	2.8	4.9	7.7	5.3	3.4	4.5	5.2	4.9	2.3	11.2	5.3	6.9	5.2	7.8
2032	11	7.2	7.3	1.9	14.8	9.2	7.2	7.2	1.9	5.9	3.7	6.2	8.7	5.5	4.8	8.9	2.1	4.5	3.0	9.2	3.3	9.4	11.3	13.8	5.7	8.5	8.1	13.2	14.8
2032	12	5.8	5.7	3.1	9.9	4.1	5.2	6.0	4.9	7.2	3.6	8.0	5.9	9.9	3.4	7.5	5.8	5.8	3.5	8.0	4.7	6.8	5.9	5.8	4.4	5.0	7.1	3.1	4.0
2033	1	4.7	5.4	1.5	10.5	3.9	6.1	7.6	4.6	1.5	3.5	3.9	3.4	5.0	3.3	4.6	4.3	7.1	7.5	5.0	3.7	5.8	10.5	4.7	4.8	5.8	7.3	4.7	10.4
2033	2	4.2	4.7	1.8	10.6	4.8	2.1	6.3	4.1	3.5	3.2	3.2	1.8	5.2	1.9	4.3	2.8	5.4	8.3	7.5	8.1	2.8	2.4	3.9	7.3	10.6	3.1	4.5	5.0
2033	3	5.5	5.1	1.5	10.9	10.9	5.8	8.6	4.4	5.6	5.3	6.4	7.5	5.9	3.8	2.4	3.2	6.0	3.3	9.8	1.9	2.4	6.0	3.9	1.5	4.1	2.0	6.0	6.0

2033	4	5.6	6.4	1.1	13.0	4.8	10.3	7.0	3.8	1.8	7.8	4.3	4.8	1.1	12.0	9.0	2.6	7.3	11.0	5.7	8.8	4.0	5.4	8.0	2.5	3.6	3.1	11.3	13.0
2033	5	9.4	10.5	3.2	25.1	4.9	3.8	25.1	9.3	10.9	8.2	9.6	5.4	9.5	4.7	16.4	3.2	12.9	6.9	17.1	18.0	8.6	7.3	10.2	25.1	13.0	3.8	13.2	5.7
2033	6	8.9	11.5	5.3	24.5	10.6	10.5	15.4	22.4	8.5	8.7	8.6	7.2	9.0	5.6	6.6	5.3	10.5	7.3	11.7	14.7	15.4	23.6	24.5	8.8	6.4	7.7	7.0	19.8
2033	7	13.0	15.8	7.5	29.6	13.5	13.0	9.7	9.0	11.2	12.0	19.2	7.5	23.6	21.6	10.2	13.1	29.6	20.1	27.6	27.9	16.0	26.3	9.1	11.0	9.8	17.1	9.3	12.8
2033	8	14.9	16.9	4.2	36.7	20.5	4.2	13.2	11.2	36.5	13.0	16.6	19.8	7.9	27.4	7.0	22.2	17.7	12.7	23.9	36.7	5.5	12.4	9.9	26.8	9.8	4.3	23.0	22.5
2033	9	14.3	13.7	3.1	25.7	19.1	14.9	7.7	20.9	15.2	15.8	9.4	8.6	14.4	19.8	7.8	7.6	11.5	14.1	14.7	25.7	11.2	9.3	3.1	8.7	22.7	18.8	9.5	17.3
2033	10	6.2	7.6	2.6	16.8	11.6	5.9	16.8	6.0	5.0	5.7	6.9	4.1	5.8	10.0	10.3	2.6	14.7	13.8	6.7	12.2	7.6	4.2	4.6	4.7	6.4	3.8	9.9	3.9
2033	11	6.3	7.4	1.2	19.4	6.0	7.5	5.1	4.8	14.2	13.4	19.4	6.2	5.8	6.8	3.6	3.4	8.4	5.1	6.6	13.5	6.5	11.3	6.5	5.8	3.0	1.2	8.6	4.5
2033	12	4.9	4.8	1.2	7.9	4.4	3.2	7.2	7.9	1.2	4.8	5.1	4.6	6.1	5.0	6.7	5.5	4.2	4.9	4.3	6.6	4.2	5.9	4.9	4.0	1.8	2.7	4.8	5.9
2034	1	5.2	6.1	1.4	12.6	4.9	5.1	11.0	5.2	6.6	10.4	1.4	10.3	5.9	12.6	2.1	7.5	2.0	3.3	8.9	2.8	5.2	7.1	10.2	2.9	2.3	4.7	3.1	11.3
2034	2	5.0	5.3	1.9	10.3	3.8	7.3	10.1	2.7	3.8	6.6	4.9	4.6	5.2	5.1	4.2	6.6	10.3	2.5	6.8	6.3	4.3	1.9	3.9	2.8	5.7	6.5	4.6	6.4
2034	3	4.4	5.8	1.7	15.6	2.9	5.3	8.7	3.9	3.1	10.0	12.0	5.2	2.5	6.4	4.5	12.3	2.2	7.0	2.9	3.5	2.3	3.2	4.0	9.8	6.4	4.3	15.6	1.7
2034	4	5.2	6.7	1.6	14.9	11.9	6.8	13.5	12.5	9.8	2.6	4.5	4.5	1.7	3.0	2.1	1.6	5.2	8.7	4.1	14.9	3.8	8.6	14.1	6.3	3.2	3.3	9.8	5.3
2034	5	10.1	12.7	2.7	47.1	47.1	16.9	17.8	5.3	14.6	2.7	9.5	3.0	9.5	16.8	22.3	17.3	5.0	3.3	10.0	13.2	6.0	10.8	9.0	18.6	21.4	8.8	10.2	6.8
2034	6	12.0	13.7	5.0	31.1	15.5	11.3	7.3	20.0	23.5	7.1	22.9	8.0	17.9	5.4	11.9	10.5	6.5	31.1	18.9	8.0	10.6	13.1	12.0	18.5	9.9	5.0	13.8	19.8
2034	7	16.3	18.0	7.1	34.1	23.7	33.8	16.2	11.4	12.7	14.9	26.9	7.1	29.6	30.8	17.4	22.8	34.1	16.5	7.3	25.1	14.9	11.9	14.0	16.6	10.3	16.3	10.0	8.0
2034	8	16.2	18.5	5.4	38.5	18.0	7.6	32.1	10.9	21.3	15.3	31.4	29.3	17.9	8.3	8.3	5.4	9.6	12.6	30.5	10.9	17.1	7.0	13.5	38.5	25.4	28.2	33.8	10.2
2034	9	9.8	11.0	4.7	22.2	15.5	11.2	6.6	7.9	8.8	9.2	14.7	15.1	10.6	8.3	7.4	8.2	4.7	5.1	12.6	10.4	7.6	6.0	11.5	15.0	17.6	22.2	19.9	7.4
2034	10	8.1	8.9	2.8	16.7	14.0	13.3	8.4	3.3	5.2	6.9	8.4	15.2	8.8	14.5	7.7	6.6	14.3	5.0	2.8	3.9	13.0	3.8	11.0	16.7	10.0	7.1	6.3	7.4
2034	11	6.9	7.0	2.7	13.1	6.8	7.5	4.9	7.5	8.2	6.5	9.0	8.5	5.9	7.5	8.2	5.8	5.6	2.7	8.9	8.1	5.9	13.1	10.9	3.8	7.0	4.2	5.8	6.4
2034	12	4.7	6.2	1.9	17.9	2.6	6.5	14.5	6.0	1.9	5.4	6.6	2.8	1.9	5.2	10.4	15.0	3.2	2.4	3.8	2.2	12.7	5.4	4.1	4.9	3.8	4.2	17.9	4.5
2035	1	4.1	4.2	2.3	6.9	3.2	2.8	5.5	2.9	4.2	5.9	4.2	4.4	4.0	2.7	4.7	6.3	2.3	2.6	2.7	6.3	6.4	6.9	2.7	4.9	2.4	6.5	3.1	3.5
2035	2	4.4	4.6	2.5	8.5	5.3	3.7	3.0	4.2	4.1	3.2	5.8	4.1	2.8	3.8	2.5	8.4	5.0	5.8	4.9	5.7	2.8	2.8	8.5	5.8	4.8	2.6	4.6	5.7
2035	3	4.5	5.6	2.0	14.8	8.3	7.4	3.6	3.5	4.5	2.0	2.8	8.2	4.2	6.1	4.5	6.4	2.8	3.3	14.8	5.4	2.5	3.9	7.3	4.4	5.7	3.0	14.4	6.5
2035	4	3.7	5.2	1.4	20.3	3.5	2.5	3.9	1.6	5.0	5.2	7.7	5.3	2.8	11.3	7.8	6.5	3.3	20.3	6.0	1.4	1.6	1.9	2.3	1.7	6.3	3.5	12.0	2.3
2035	5	8.8	11.1	3.6	31.8	4.3	3.6	6.7	8.8	7.5	31.8	7.5	12.5	4.9	7.1	7.7	21.2	15.8	18.0	14.1	13.9	8.9	8.0	11.7	4.9	15.4	14.5	7.3	10.2
2035	6	11.9	14.5	4.6	42.1	8.7	8.5	20.2	5.2	6.9	7.5	19.6	10.0	21.9	12.1	6.5	22.2	13.0	18.6	23.2	27.4	10.4	11.8	4.6	15.3	9.3	14.9	9.4	42.1
2035	7	18.4	21.7	6.3	63.6	63.6	22.1	39.0	26.3	29.8	12.0	18.9	14.8	50.0	11.7	15.6	28.0	26.6	20.0	15.9	8.6	9.8	6.3	12.5	11.3	20.0	15.2	25.0	18.0
2035	8	17.0	21.5	3.5	57.7	34.9	22.5	37.6	50.0	57.7	17.6	19.7	18.2	10.4	13.0	11.6	36.8	3.5	16.5	16.4	10.5	24.4	7.6	8.5	8.9	6.9	10.7	33.1	37.8
2035	9	12.0	13.5	2.8	29.6	8.5	7.5	9.4	16.1	8.3	16.6	24.3	13.1	29.6	8.1	18.4	5.4	4.3	10.9	27.0	3.7	23.4	13.1	4.8	18.3	14.2	2.8	28.9	6.9
2035	10	6.8	8.1	3.6	18.8	6.5	18.8	5.7	3.7	7.5	11.0	6.6	6.3	8.2	4.6	7.4	4.5	5.9	5.2	4.6	3.6	7.0	8.8	13.1	9.5	4.3	8.5	18.4	15.0
2035	11	7.0	7.7	4.9	15.7	8.6	6.6	8.7	11.3	8.3	8.9	4.9	5.7	13.2	6.9	10.0	15.7	6.6	7.5	6.7	5.4	7.1	5.0	5.0	5.6	5.9	8.1	5.2	7.2
2035	12	5.6	6.7	2.1	20.1	18.1	6.3	6.4	5.8	20.1	4.8	5.5	6.3	4.2	4.8	8.2	6.4	16.7	6.3	2.5	2.6	4.5	5.7	5.1	2.2	3.2	8.0	2.1	5.2
2036	1	4.5	4.9	2.2	9.9	3.8	6.8	4.9	3.3	4.3	9.9	4.2	5.4	2.2	2.6	7.4	8.0	4.8	5.0	2.8	2.5	5.0	6.8	3.7	7.9	2.4	5.2	4.2	3.9
2036	2	4.2	4.4	1.6	8.5	4.8	5.2	5.3	2.9	6.0	2.9	5.5	3.5	4.0	8.5	1.6	2.6	3.5	3.0	7.3	3.0	6.9	2.6	5.5	3.7	4.2	5.1	4.6	4.1
2036	3	4.5	5.1	1.7	14.5	4.2	8.4	3.5	4.4	3.6	4.0	5.3	3.6	5.0	1.7	5.7	3.9	4.5	5.6	14.5	4.8	2.8	6.7	4.5	6.0	3.9	5.2	4.2	6.3
2036	4	6.5	7.0	2.7	15.7	2.7	3.4	8.4	15.7	9.7	7.2	3.0	5.9	6.4	8.8	7.1	5.6	5.2	14.0	3.8	3.1	5.9	8.8	7.7	11.2	5.0	2.9	10.7	6.6
2036	5	9.6	10.8	4.4	31.3	4.4	4.4	6.8	16.5	11.8	10.1	10.5	14.4	16.9	8.9	13.4	6.0	6.9	14.6	6.6	6.7	7.2	15.6	10.8	13.2	9.2	4.5	8.2	31.3
2036	6	10.0	12.5	3.9	48.9	8.5	22.6	5.1	9.3	11.1	9.8	7.8	4.7	6.8	17.9	12.5	14.2	9.8	6.5	3.9	18.3	10.1	48.9	8.4	18.9	12.7	11.9	13.4	5.9
2036	7	17.4	18.9	4.6	37.9	17.6	37.7	29.9	36.1	8.3	18.8	13.4	10.5	4.6	4.6	7.0	37.9	9.6	12.5	15.2	24.8	15.5	25.8	18.6	23.3	17.2	25.0	25.9	13.1
2036	8	14.0	15.3	5.2	33.0	10.4	14.9	16.6	15.4	5.2	19.6	7.3	12.3	22.3	27.2	8.9	11.5	11.9	17.5	13.6	28.0	10.4	17.5	7.1	12.9	12.7	16.4	33.0	14.5
2036	9	13.7	12.7	2.1	25.7	23.5	15.1	5.7	13.5	25.7	14.5	22.3	6.0	9.3	16.5	8.1	6.3	10.8	15.1	7.0	15.2	2.1	13.8	6.8	14.9	3.2	16.5	21.3	12.2
2036	10	9.2	9.1	3.4	16.0	4.2	15.1	11.1	6.3	10.3	10.3	9.2	9.2	13.0	4.3	3.4	6.5	11.9	7.6	9.9	8.9	6.1	16.0	11.0	10.5	8.1	6.4	7.9	9.9
2036	11	5.4	6.6	2.2	14.6	4.8	2.6	7.8	7.5	4.3	4.6	4.3	12.6	9.3	9.4	4.1	5.1	7.1	3.1	10.9	2.2	4.7	5.0	5.7	9.6	9.2	7.2	14.6	3.7
2036	12	4.5	4.9	2.7	9.4	8.5	4.9	2.7	4.5	6.3	4.2	4.4	5.0	4.6	7.7	9.4	5.4	4.3	4.5	3.3	4.1	3.2	2.8	3.7	4.4	4.2	4.4	6.4	4.8
2037	1	4.5	5.7	1.7	15.3	1.7	5.4	15.3	2.0	5.4	8.3	3.8	7.9	4.4	3.8	2.2	6.8	2.6	3.4	10.2	2.4	6.7	13.8	4.0	2.0	4.7	6.6	3.8	8.6
2037	2	3.2	4.2	1.1	11.2	3.1	2.1	4.7	2.5	5.1	2.3	1.5	10.3	7.8	3.1	1.1	3.6	2.6	5.4	3.1	11.2	2.0	8.2	4.2	1.8	3.2	4.1	4.6	3.0
2037	3	4.0	4.2	0.9	7.2	3.7	7.2	1.9	4.4	4.6	4.6	7.2	6.0	5.9	4.4	2.6	3.2	0.9	3.7	2.9	4.3	2.9	3.4	2.9	4.9	3.6	6.2	2.7	7.2
2037	4	5.6	6.4	1.1	18.1	2.5	11.1	3.2	6.1	9.0	7.2	1.4	2.5	18.1	9.0	10.3	13.8	6.1	8.4	4.7	3.7	3.6	9.4	4.8	4.4	1.1	5.1	2.2	7.0
2037	5	8.8	9.2	0.8	20.4	3.4	4.6	8.6	8.7	5.6	5.3	12.9	12.9	20.4	9.4	10.7	15.2	5.5	17.0	16.8	2.8	9.1	13.0	11.5	7.4	0.8	2.6	8.8	6.7
2037	6	10.1	13.2	4.6	28.5	10.2	10.1	19.5	16.5	9.7	6.8	20.8	28.5	4.6	7.3	14.7	6.0	25.7	12.2	9.0	6.6	24.0	7.8	12.9	17.5	5.1	24.6	7.7	9.5
2037	7	15.0	19.3	7.0	68.1	25.8	27.2	8.7	13.9	36.8	7.0	26.3	10.6	19.6	15.3	8.7	12.4	68.1	30.3	19.2	18.0	18.3	14.7	9.6	11.3	7.5	13.9	24.8	14.7
2037	8	12.1	13.7	4.7	36.0	10.6	10.9	18.1	8.4	13.7	10.9	8.0	10.1	18.4	11.2	17.7	11.6	17.3	16.0	22.1	11.3	7.7	12.6	36.0	16.0	4.7	13.2	6.1	17.1
2037	9	12.5	13.9	3.7	28.9	7.6	10.9	8.3	19.6	25.8	28.9	8.9	12.8	10.1	19.5	13.2	3.7	10.0	12.1	23.0	16.4	23.7	8.8	13.6	20.0	5.1	15.1	8.0	9.2
2037	10	8.1	9.7	4.3	19.6	19.6	4.3	11.6	7.0	8.9	5.4	7.9	5.4	11.3	15.0	18.3	6.2	5.0	4.6	9.2	9.8	13.4	8.1	7.4	6.1	17.4	14.7	7.6	8.1
2037	11	7.0	7.6	3.6	17.7	8.5	3.9	11.3	8.2	3.6	17.7	9.6	5.1	5.1	5.9	7.4	6.4	3.7	7.6	6.6	9.8	8.2	11.7	5.6	6.5	5.1	5.3	11.4	8.6
2037	12	6.0	5.5	2.1	8.1	7.7	4.9	2.7	4.6	6.4	2.1	6.8	5.6	6.5	4.0	6.8	6.3	4.3	3.1	8.1	7.5	4.2	6.3	6.9	6.5	4.1	4.1	6.6	5.7
2038	1	5.1	5.6	2.2	13.6	6.9	3.1	6.3	5.9	10.0	3.1	6.7	2.6	3.6	3.8	4.0	2.2	12.1	5.5	6.0	4.1	4.7	13.6	4.7	2.3	5.7	5.5	8.1	3.0
2038	2	4.9	5.3	1.6	15.8	5.7	8.0	5.5	3.8	6.4	2.4	5.1	3.3	4.9	15.8	3.4	1.6	5.4	5.1	4.2	9.1	3.6	3.7	4.6	2.6	9.0	4.9	2.7	7.1
2038	3	5.6	6.0	1.2	15.2	5.9	6.5	5.7	7.4	4.8	4.6	6.3	5.7	4.7	4.8	2.3	8.5	8.3	3.6	5.1	4.9	5.5	6.1	11.4	6.5	15.2	1.2	4.4	3.3
2038	4	5.3	6.8	1.0	16.2	10.0	13.0	5.1	3.0	12.0	4.8	2.8	4.2	3.7	6.9	6.2	1.0	5.8	4.8	5.3	9.4	5.2	16.2	2.8	13.0	9.5	2.0	14.1	2.9
2038	5	12.4	12.5	4.2	27.0	14.6	6.1	24.1	14.0	15.8	14.2	18.5	10.3	10.1	4.6	8.3	27.0	11.6	4.2	16.0	16.6	10.4	10.3	15.3	4.2	16.0	5.7	9.9	13.2
2038	6	14.5	17.1	4.9	55.6	12.4	10.9	20.1	15.9	5.0	15.3	21.1	4.9	26.2	13.6	9.4	30.8	18.1	29.4	5.0	22.5	13.5	8.0	23.5	13.3	11.3	55.6	9.1	16.1
2038	7	18.2	21.7	4.3	51.9	36.3	4.3	24.7	29.0	13.1	8.1	51.9	25.0	5.9	40.9	29.2	14.2	19.8	9.3	11.0	24.3	42.3	43.8	19.1	10.9	9.7	17.4	15.7	14.4
2038	8	14.7	17.2	4.5	45.0	11.0	18.4	8.2	24.5	45.0	12.5	9.0	12.3	21.0	14.4	35.6	7.5	17.4	16.4	22.2	30.7	25.8	10.0	18.9	11.2	12.2	8.6	4.5	15.0
2038	9	14.3	14.5	2.5	30.6	14.7	30.6	13.9	12.8	20.0	17.9	28.8	14.7	7.7	10.4	19.4	14.9	16.1	5.9	12.6	25.9	2.5	8.6	11.2	18.8	10.4	14.6	10.7	4.7
2038	10	7.3	8.2	2.3	19.7	9.8	2.3	3.5	10.9	8.6	2.8	19.7	3.6	6.5	13.4	6.4	5.4	4.2	4.4	13.2	11.4	6.5	11.7	8.7	7.1	6.9	11.1	11.6	7.4
2038	11	6.9	7.2	2.0	16.1	6.0	7.3	5.0	4.8	16.1	6.9	4.0	8.6	5.1	4.4	8.6	2.0	9.9	5.1	14.3	10.5	6.8	7.8	6.2	7.1	9.0	5.2	7.6	4.9
2038	12	5.0	5.0	1.4	12.9	6.1	5.4	4.7	5.4	4.9	3.8	5.6	12.9	2.5	5.2	3.3	5.7	5.7	4.3	5.2	7.6	5.3	4.7	1.4	4.0	4.5	5.4	3.1	3.1
2039	1	5.4	5.6	1.4	9.9	8.5	6.5	2.2	3.0	7.9	6.4	2.7	5.6	7.6	4.5	3.5	3.1	9.9	5.3	5.0	4.9	6.0	4.9	9.4	5.6	1.4	4.9	6.3	8.7
2039	2	4.9	5.7	2.2	17.5	2.7	3.7	4.1	3.9	4.8	3.4	7.6	11.2	8.7	5.3	3.8	4.8	3.2	5.4	5.6	5.0	5.5	3.5	6.3	9.0	17.5	2.2	3.6	5.7
2039	3	4.0	4.3	0.6	8.2	3.5	4.4	1.3	6.1	5.4	3.2	7.7	0.6	4.2	5.9	2.9	2.9	4.1	3.5	3.5	6.1	3.0	3.6	3.8	8.2	4.3	3.2	6.7	5.7
2039	4	5.9	6.6	1.8	28.8	2.2	2.3	5.8	6.7	6.3	7.9	14.6	3.2	6.2	7.2	4.1	6.1	28.8	5.4	6.0	1.8	2.3	11.2	2.9	5.7	3.1	4.3	8.3	6.0
2039	5	9.1	11.1	2.2	24.0	5.1	19.8	17.8	7.4	4.2	7.3	5.2	15.9	7.1	19.4	18.6	2.2	7.4	11.0	7.4	13.0	12.5	7.4	10.7	24.0	17.4	6.4	3.1	16.4
2039	6	12.9	13.9	3.7	28.4	25.0	20.6	14.7	28.4	3.7	16.6	23.9	6.4	13.2	15.3	12.7	6.8	10.6	5.9	5.2	14.4	10.5	26.6	5.7	13.9	28.1	5.8	11.2	7.6
2039	7	13.8	15.5	4.4	49.0	49.0	27.7	19.3	4.4	15.3	14.3	17.5	7.1	13.9	11.2	12.8	11.5	18.2	21.1	12.2	15.4	13.7	9.3	18.6	9.4	6.8	9.4	25.4	8.9
2039	8	8.9	14.8	4.9	71.5	9.2	7.3	6.8	8.5	7.6	32.7	7.7	6.9	11.6	8.1	27.4	6.7	71.5	15.8	11.3	7.1	18.9	14.7	7.0	4.9	28.0	8.6	14.0	13.6
2039	9	13.0	13.7	3.7	35.7	8.2	12.0	5.2	16.2	18.5	15.1	10.6	13.9	5.7	14.1	19.8	28.3	17.3	5.0	11.4	35.7	8.9	10.7	7.3	16.0	3.7	7.5	22.9	14.5
2039	10	8.2	9.4	3.0	21.2	8.5	21.2	6.4	5.0	19.7	10.1	8.2	8.2	7.8	14.2	3.0	7.9	8.1	4.3	8.2	7.6	9.8	14.8	11.7	5.2	6.9	9.6	15.1	4.1
2039	11	6.9	7.0	1.7	16.8	4.9	8.9	4.4	5.8	7.3	7.6	6.9	2.7	4.2	16.8	7.8	5.6	9.1	2.8	2.7	4.7	7.6	8.7	7.4	5.5	6.8	12.7	15.7	1.7
2039	12	4.8	6.2	2.1	18.3	5.0	6.5	7.8	3.6	4.5	5.2	16.5	3.2	4.6	3.2	11.5	6.9	18.3	3.1	3.6	7.7	2.1	4.9	4.4	2.4	4.7	10.1	3.6	5.2
2040	1	5.4	5.4	1.9	9.4	8.9	6.3	5.8	8.4	3.7	9.4	9.2	2.9	2.9	8.4	4.1	1.9	6.9	2.7	4.0	2.6	6.3	5.7	7.7	3.8	5.2	2.8	4.9	6.1
2040	2	4.1	4.8	1.2	13.6	4.1	6.1	5.0	6.2	1.2	2.7	11.0	8.3	1.8	9.6	2.9	4.2	1.6	3.0	3.9	6.3	1.8	4.4	3.1	13.6	6.2	4.3	2.9	1.5
2040	3	5.3	5.7	2.1	12.7	6.0	3.9	4.3	6.9	12.6	4.8	7.3	5.4	5.4	3.7	6.6	12.7	4.1	5.1	5.7	3.0	3.9	10.3	2.1	5.5	3.5	4.0	6.1	5.1
2040	4	5.3	6.3	2.0	12.7	9.5	6.4	3.2	4.9	4.5	4.3	12.5	5.4	3.2	5.1	4.4	9.6	3.0	6.1	3.8	10.0	6.8	5.1	2.0	8.1	9.4	5.5	4.5	12.7
2040	5	10.7	11.5	3.0	22.6	12.3	4.3	18.0	6.9	22.6	17.5	21.1	9.6	4.6	4.9	6.3	5.6	6.5	12.0	3.0	21.0	15.9	20.5	11.8	11.8	8.8	17.6	5.4	7.3
2040	6	11.1	11.7	4.2	34.6	9.2	7.7	10.9	34.6	4.3	11.5	18.1	10.9	5.3	12.3	16.2	11.3	13.6	10.2	4.2	11.4	4.9	14.3	5.8	18.0	19.7	13.7	4.5	8.8
2040	7	14.8	16.9	7.2	30.1	28.7	20.0	14.8	12.1	30.1	13.7	7.2	17.0	7.2	12.2	23.1	7.3	26.5	11.5	25.5	14.7	29.9	12.5	22.7	11.4	18.1	11.1	12.6	16.2
2040	8	14.3	16.5	2.5	30.8	10.6	2.5	15.7	10.9	28.3	9.8	8.4	7.4	12.7	28.6	8.7	19.1	30.8	16.5	11.9	18.6	30.0	8.1	26.2	13.0	5.5	28.7	24.5	19.9
2040	9	15.9	16.1	5.2	26.8	22.8	16.6	13.3	18.1	15.6	12.2	21.3	8.4	26.4	5.2	26.8	22.6	17.4	10.7	8.5	10.4	13.7	13.6	8.8	23.4	20.0	23.4	16.1	10.3
2040	10	7.4	8.2	3.4	17.2	7.7	14.6	7.5	7.7	11.2	6.4	6.0	9.2	9.7	5.8	6.9	5.8	7.4	6.8	7.0	17.2	7.8	10.8	7.1	7.9	6.3	3.4	7.4	8.5

2040	11	6.2	6.7	1.8	12.2	12.2	3.1	1.8	10.2	11.1	4.2	2.7	6.1	9.3	10.0	9.2	4.7	4.5	9.0	8.6	3.9	6.8	5.9	7.5	9.6	6.3	4.0	5.8	3.2
2040	12	5.5	5.5	1.9	13.3	3.6	3.8	3.0	5.4	5.3	13.3	7.5	6.7	7.8	2.9	4.8	7.0	3.7	3.6	9.0	5.9	6.3	2.5	1.9	3.4	6.4	5.9	5.5	6.7
2041	1	4.5	4.7	1.6	10.2	4.8	2.2	6.8	4.2	5.3	1.6	4.5	8.7	10.2	2.3	7.4	5.7	4.1	4.5	3.6	1.8	1.6	4.9	5.1	4.4	6.3	5.5	3.6	4.5
2041	2	4.1	5.5	1.8	19.2	4.0	3.7	3.2	4.3	7.8	4.0	13.5	2.8	2.9	4.3	6.8	7.1	3.5	4.1	1.8	4.5	10.2	3.5	3.2	3.5	3.7	6.0	19.2	4.1
2041	3	4.7	5.5	1.9	13.9	4.5	1.9	13.9	8.5	8.4	7.1	4.9	2.1	7.5	9.2	3.8	7.2	2.2	2.1	4.6	2.9	2.9	3.7	5.0	5.4	13.4	3.1	6.3	2.5
2041	4	5.0	5.1	0.3	12.3	6.5	6.3	3.0	6.5	4.9	9.0	2.4	0.9	7.8	12.3	4.6	4.8	4.0	5.8	3.0	2.4	1.9	6.5	9.2	0.3	5.2	1.0	8.7	6.0
2041	5	9.6	10.6	2.9	20.9	9.5	6.6	11.6	7.3	19.6	6.9	2.9	20.9	6.1	15.8	9.0	9.6	15.5	18.1	8.2	12.9	4.7	3.5	9.8	17.0	4.7	3.7	15.2	15.3
2041	6	11.3	13.9	2.4	43.9	25.5	17.0	6.9	5.8	18.4	8.5	15.8	7.2	6.0	16.9	14.0	4.9	9.1	15.5	5.9	13.4	13.6	4.8	31.9	30.3	2.4	6.7	8.3	43.9
2041	7	15.0	16.2	4.3	31.2	15.7	31.2	10.5	9.2	14.3	10.4	28.2	22.3	29.8	18.4	27.9	7.3	24.7	18.0	11.2	4.6	19.8	11.1	20.0	11.6	4.3	9.5	19.1	9.8
2041	8	13.4	18.0	4.4	63.0	12.0	8.4	4.4	13.1	13.6	22.4	17.8	63.0	56.6	20.4	10.4	15.8	14.0	7.0	21.0	7.6	10.5	11.0	13.3	29.9	19.8	9.1	12.6	19.4
2041	9	12.6	13.3	4.0	31.7	20.9	7.7	15.5	7.3	9.1	8.0	22.4	17.1	15.0	15.0	31.7	10.8	6.1	7.3	4.0	21.9	8.2	14.8	11.4	12.7	14.9	13.3	12.4	11.3
2041	10	7.5	8.3	2.0	21.1	11.2	7.5	21.1	12.1	6.2	4.7	7.5	4.9	8.7	11.1	5.3	18.1	3.1	6.1	7.7	5.5	6.3	8.5	10.3	4.2	5.7	11.7	8.9	2.0
2041	11	6.5	6.7	2.6	16.1	8.7	2.6	7.6	2.8	4.8	4.1	9.6	8.8	6.3	7.2	8.8	6.9	4.5	5.9	4.0	6.8	6.6	3.0	12.6	5.5	4.1	7.5	16.1	6.1
2041	12	6.3	6.6	1.7	17.1	2.6	4.6	8.5	17.1	10.6	1.7	10.7	4.9	4.2	6.9	6.3	5.6	6.7	8.7	4.0	3.9	7.5	6.3	6.4	3.5	4.8	2.5	8.2	13.1
2042	1	5.3	6.8	2.4	19.2	3.0	19.2	5.8	6.0	4.9	4.9	5.3	4.6	4.7	14.8	9.5	10.7	5.3	4.6	6.7	4.8	8.9	10.1	4.4	3.1	6.3	2.4	4.5	7.8
2042	2	4.9	5.1	2.0	9.4	4.9	6.3	4.1	4.5	3.2	6.4	4.9	5.6	7.1	7.1	2.3	5.5	2.0	4.6	5.7	7.6	4.0	2.5	9.4	3.1	5.5	3.6	4.0	9.3
2042	3	5.9	6.5	1.6	22.8	6.6	7.0	3.4	1.6	22.8	6.6	2.8	5.0	4.7	2.0	5.1	8.9	4.5	9.8	6.4	7.2	3.8	8.2	7.9	4.6	5.7	4.0	6.0	10.4
2042	4	5.6	6.8	2.4	17.9	2.6	2.9	4.4	5.0	5.9	12.4	17.9	5.7	6.2	5.1	5.2	8.5	5.5	7.5	2.6	6.3	3.4	11.3	5.2	2.4	9.3	3.6	17.1	6.2
2042	5	9.6	10.0	3.2	17.9	7.9	8.8	16.8	11.2	5.2	10.7	3.2	11.9	7.6	6.6	13.8	12.8	3.2	9.2	15.8	10.0	17.9	5.8	5.8	17.1	10.8	6.2	15.2	5.6
2042	6	11.4	14.1	2.3	39.1	7.3	11.4	8.0	27.2	7.4	11.4	7.2	12.9	9.5	4.4	15.3	7.3	2.9	10.2	17.2	14.7	27.2	6.7	30.0	12.6	39.1	20.0	25.3	2.3
2042	7	13.4	16.2	6.5	39.7	12.4	34.7	7.5	12.8	7.5	11.9	6.6	15.5	27.3	8.6	10.5	14.5	14.0	8.9	6.5	33.1	14.0	28.1	39.7	17.0	10.3	15.3	22.8	9.1
2042	8	12.7	17.7	5.1	49.9	6.4	9.6	5.1	12.4	14.5	16.7	7.5	26.9	9.4	28.9	6.3	6.5	7.1	32.1	12.9	26.6	45.0	12.4	16.3	6.3	21.7	49.9	38.6	5.6
2042	9	15.8	15.8	4.4	29.4	4.9	10.6	9.5	15.8	14.5	21.7	29.4	12.1	22.6	8.1	15.8	23.6	23.6	16.5	20.7	19.2	15.3	17.3	4.4	22.8	4.5	9.7	23.1	13.9
2042	10	6.3	8.2	3.0	24.5	3.0	11.3	13.5	7.6	6.3	4.9	6.2	5.7	4.1	3.7	8.9	6.4	15.1	4.3	4.7	8.0	6.6	8.8	5.2	24.5	9.2	4.8	19.7	5.7
2042	11	5.7	6.9	1.9	23.0	3.2	5.7	6.2	6.3	4.9	3.1	23.0	5.7	9.4	4.2	4.9	1.9	5.7	8.3	3.2	16.4	2.9	9.0	2.7	5.6	7.7	7.4	10.2	8.0
2042	12	4.7	4.6	2.0	8.4	4.8	5.5	8.4	2.8	2.1	5.0	2.7	4.5	5.3	4.0	3.1	5.9	3.8	8.2	5.9	4.8	6.3	4.0	2.7	5.4	3.4	2.0	6.8	2.4
2043	1	4.7	5.1	2.7	9.4	7.1	5.5	6.7	6.0	3.1	5.0	7.0	6.3	2.7	7.0	6.7	4.4	4.8	4.1	4.0	4.6	5.3	2.7	4.5	4.1	9.4	4.5	3.3	4.7
2043	2	4.1	4.4	2.0	8.5	2.3	5.4	5.8	2.6	5.8	3.4	7.0	4.4	3.5	3.5	5.3	2.6	2.0	6.8	3.3	6.0	3.7	5.9	8.5	2.8	2.5	2.5	5.5	4.6
2043	3	5.1	5.0	0.9	8.9	6.6	5.2	8.9	5.7	5.1	4.2	6.3	2.7	6.0	4.5	8.5	6.1	0.9	5.1	5.2	4.9	4.0	3.1	2.8	6.1	7.8	5.2	3.1	2.5
2043	4	5.0	5.8	0.4	11.6	7.6	2.8	3.4	10.5	6.0	5.0	11.6	3.4	3.1	2.3	3.3	5.4	6.2	10.9	9.4	0.4	7.1	9.7	5.0	4.9	2.5	5.1	11.2	2.2
2043	5	6.8	8.8	2.4	26.0	6.7	18.7	3.3	7.1	6.9	6.4	11.1	13.2	4.1	6.2	9.5	10.3	6.6	6.5	4.7	4.5	14.4	7.6	6.0	26.0	18.1	2.5	2.4	9.6
2043	6	10.2	12.6	2.9	37.0	10.7	13.0	14.6	11.6	9.6	37.0	9.7	15.3	4.1	25.4	7.1	13.1	2.9	28.2	7.0	5.6	30.2	7.3	11.3	4.3	5.3	6.9	19.8	2.9
2043	7	13.9	18.3	6.9	58.7	13.4	17.8	19.3	14.5	9.7	17.2	17.0	13.2	58.2	10.4	26.6	9.5	58.7	25.2	33.8	10.1	16.8	8.6	9.2	8.4	7.8	12.3	14.3	6.9
2043	8	12.8	15.8	6.0	32.3	15.4	9.2	11.4	31.7	13.7	27.6	19.3	7.0	9.3	11.6	32.3	27.3	9.3	15.3	24.0	12.0	6.0	6.5	11.2	17.0	25.4	18.2	11.5	7.2
2043	9	13.6	13.6	4.7	28.2	16.3	8.3	4.8	10.1	6.3	18.2	8.5	17.6	13.9	8.7	28.2	25.3	4.7	9.6	7.1	10.9	13.8	18.1	9.9	16.4	13.5	18.6	20.6	16.5
2043	10	7.0	7.6	3.5	14.4	4.0	7.2	9.2	7.3	6.8	12.3	6.9	13.1	6.3	7.3	3.8	4.0	6.4	3.5	5.5	9.6	8.6	6.6	9.3	14.4	10.4	8.6	4.8	6.1
2043	11	5.8	6.7	3.1	14.5	6.2	7.4	3.6	7.2	6.2	13.0	8.3	4.6	3.3	4.2	3.1	5.2	10.0	5.5	14.5	9.2	8.4	5.0	12.1	4.5	3.5	4.5	6.2	4.0
2043	12	5.0	5.4	1.6	11.0	8.4	2.8	8.3	4.2	1.6	2.3	6.4	8.5	6.2	11.0	8.3	6.5	4.5	7.2	4.4	4.8	4.8	5.2	2.4	1.7	8.3	4.6	5.5	1.9
2044	1	5.1	5.7	2.3	14.1	4.7	6.3	5.1	2.3	4.5	4.4	5.3	4.0	3.8	6.7	7.5	4.2	14.1	5.9	6.8	5.0	3.8	10.4	4.2	5.7	8.1	3.0	5.9	4.1
2044	2	4.2	5.2	1.1	18.8	2.9	4.2	5.2	6.2	4.3	2.2	6.6	7.9	4.5	2.8	7.9	3.7	18.8	2.6	3.2	1.1	2.2	6.5	3.4	10.4	1.1	2.3	4.1	11.8
2044	3	4.6	5.1	2.3	11.6	9.0	6.5	5.1	4.7	2.8	5.6	4.1	11.6	3.8	4.5	2.5	4.8	2.9	3.8	2.3	3.6	6.9	4.5	5.5	5.9	2.5	3.8	10.5	5.6
2044	4	5.2	6.8	1.7	17.7	8.9	11.6	5.8	14.8	2.7	3.2	17.7	13.4	10.9	4.5	4.2	7.5	2.4	5.0	2.3	1.7	3.8	3.4	5.0	8.6	7.1	5.4	10.3	2.8
2044	5	9.1	9.9	2.2	21.7	6.7	3.4	11.8	10.9	21.7	5.0	20.0	11.7	9.8	12.3	12.4	7.4	3.1	5.5	2.2	17.0	8.4	11.4	7.6	14.2	7.6	6.2	15.4	6.7
2044	6	11.2	15.1	4.7	51.5	10.8	12.2	28.6	41.8	10.4	15.2	9.3	26.8	9.0	14.1	6.8	8.1	16.5	5.0	4.7	17.1	11.7	6.0	7.6	10.1	12.5	17.6	51.5	7.8
2044	7	14.3	16.0	5.0	37.0	14.2	29.5	14.8	9.9	19.0	16.7	23.1	9.2	37.0	19.1	35.7	14.8	13.6	7.3	17.7	10.4	10.6	5.0	13.4	13.7	14.7	9.1	11.2	14.3
2044	8	14.0	16.9	5.6	49.8	11.7	8.7	13.4	15.3	9.7	14.5	15.2	49.8	15.3	10.7	30.6	18.0	22.2	17.9	9.3	12.1	17.9	38.9	5.6	28.5	11.4	10.6	9.1	8.4
2044	9	13.4	14.5	3.3	37.7	14.0	3.3	8.2	8.0	19.1	14.8	6.5	17.1	12.8	6.4	10.8	25.0	6.1	14.9	11.4	37.7	16.5	12.4	12.8	23.4	6.3	15.6	30.2	14.7
2044	10	7.5	7.9	2.3	14.6	2.3	6.9	8.6	5.5	3.2	5.8	6.4	12.7	5.9	12.3	9.2	11.8	9.5	2.7	7.0	5.2	10.3	10.4	7.1	8.2	6.0	8.0	9.8	14.6
2044	11	6.5	7.1	2.2	11.9	4.4	5.5	7.6	5.1	9.8	8.0	9.9	3.5	9.8	5.0	9.9	6.3	9.8	5.1	11.9	11.4	4.8	2.2	10.0	8.5	4.2	6.7	6.2	3.7
2044	12	4.8	5.6	1.6	13.3	4.0	5.1	2.4	3.2	9.3	6.5	6.1	5.7	4.4	10.0	6.1	4.4	8.0	6.8	13.3	4.8	4.3	4.8	3.2	4.9	7.4	4.4	1.6	4.7
2045	1	4.4	5.6	2.1	12.5	9.9	4.1	3.5	5.0	3.8	2.1	10.0	9.5	3.3	3.2	4.1	7.2	3.2	8.3	2.6	3.5	4.2	4.5	2.2	6.8	12.5	7.3	6.6	7.4
2045	2	4.8	4.7	1.8	9.4	5.7	6.6	3.7	5.4	2.0	4.9	5.2	6.5	1.8	3.7	4.6	9.4	1.9	5.0	5.4	4.8	4.8	3.1	7.2	2.4	4.7	2.5	6.6	4.3
2045	3	4.8	6.1	1.4	20.6	3.2	4.8	5.1	14.3	9.2	4.2	20.6	2.9	4.6	6.1	5.9	8.4	3.4	1.4	4.5	6.3	4.0	5.6	8.3	4.4	4.7	3.2	6.5	3.5
2045	4	4.0	4.9	1.7	16.1	3.6	2.4	3.3	6.2	4.6	1.7	4.3	4.5	2.5	8.3	9.5	3.7	4.1	16.1	5.6	3.1	3.2	4.0	6.0	5.0	3.6	6.9	2.7	3.1
2045	5	9.4	10.9	1.0	21.3	12.4	17.4	17.0	8.7	7.1	14.9	21.3	11.1	9.0	8.8	1.5	11.1	15.7	4.4	9.4	8.6	9.4	1.0	18.5	15.2	19.1	4.6	6.9	9.3
2045	6	12.6	12.7	4.5	24.3	13.5	8.8	8.8	10.2	10.9	19.1	16.8	14.7	13.7	11.1	19.4	18.4	11.7	15.3	24.3	9.6	6.9	9.7	16.1	4.5	14.4	15.9	5.7	6.7
2045	7	20.3	19.6	6.7	45.9	45.9	30.5	13.6	21.1	20.3	32.4	15.8	12.0	35.8	25.7	22.6	20.2	22.4	11.3	26.1	24.0	10.7	8.8	7.1	10.7	6.7	15.4	8.3	22.1
2045	8	16.6	17.0	3.4	43.7	18.0	43.7	8.0	27.2	22.7	17.1	9.9	9.6	13.8	8.7	11.7	11.2	13.6	8.9	16.1	31.5	18.1	9.9	27.3	17.3	17.2	19.0	3.4	24.5
2045	9	14.8	14.8	1.9	28.0	17.5	1.9	20.6	22.2	4.7	19.8	28.0	20.8	12.8	10.6	17.4	20.1	19.2	5.5	10.2	14.7	13.7	26.5	14.9	18.4	10.0	8.0	5.1	13.8
2045	10	7.0	7.5	2.9	16.9	4.5	9.9	10.5	5.5	10.3	4.1	5.6	2.9	8.2	3.4	7.1	7.0	7.7	4.4	11.3	4.9	5.2	4.0	4.8	15.9	8.6	8.4	9.4	16.9
2045	11	5.7	6.0	1.6	14.5	3.8	4.5	9.8	5.9	5.1	14.5	3.8	5.1	3.3	8.9	8.9	6.0	6.5	2.8	6.7	3.8	4.0	1.6	8.0	2.5	6.4	9.5	8.0	5.5
2045	12	5.8	6.1	2.1	13.2	4.6	6.0	8.2	7.2	9.9	4.2	4.5	6.7	13.2	10.6	6.1	2.5	5.6	4.5	4.4	2.1	4.1	5.1	4.5	6.8	7.2	6.4	7.2	5.0
2046	1	6.2	7.0	2.0	25.1	4.9	3.7	6.2	5.8	4.2	6.9	6.2	7.2	9.6	7.7	25.1	10.7	7.9	6.6	4.9	4.8	6.2	16.7	5.0	2.3	2.3	2.0	4.8	6.4
2046	2	4.1	4.7	1.3	11.6	3.2	4.2	4.1	9.7	5.5	2.3	6.4	11.6	5.4	3.7	6.6	4.9	8.6	3.5	5.9	6.2	1.4	1.3	2.0	2.5	3.1	2.9	5.5	3.3
2046	3	5.4	5.9	0.8	19.0	3.2	19.0	7.2	4.2	5.3	4.0	3.9	3.1	6.3	5.0	4.4	8.1	5.5	9.3	8.4	5.7	1.1	7.9	7.4	0.8	5.4	2.7	6.9	6.5
2046	4	5.0	5.9	1.8	14.4	4.0	5.2	5.1	5.9	2.8	14.4	8.4	8.8	2.8	9.3	9.8	4.5	5.5	4.9	2.6	1.8	5.0	4.7	3.1	5.0	4.2	7.1	11.8	4.7
2046	5	9.9	10.9	3.4	18.8	9.2	13.5	16.8	9.1	14.4	5.8	4.2	18.0	7.6	13.0	14.0	5.3	9.5	16.3	15.8	18.4	10.3	7.6	3.4	4.4	4.6	18.8	16.1	6.0
2046	6	11.7	12.9	3.3	39.0	11.7	23.9	7.0	11.3	8.7	14.1	20.8	11.6	5.1	10.7	12.2	12.5	10.0	12.7	4.3	16.9	9.3	6.2	22.3	13.3	6.1	39.0	17.6	3.3
2046	7	15.8	18.6	5.2	46.4	5.2	19.6	10.5	27.3	44.4	46.4	8.5	7.3	19.8	14.6	27.7	18.2	15.4	13.8	26.4	20.6	7.9	9.2	5.8	21.9	16.1	15.4	10.1	35.3
2046	8	13.3	16.8	4.7	65.6	7.3	9.5	4.7	21.6	8.0	22.6	5.4	29.9	9.0	49.4	17.6	14.0	19.3	9.8	21.2	15.6	65.6	14.1	5.0	12.5	9.4	14.9	8.8	7.0
2046	9	11.9	11.9	3.7	24.7	12.7	18.8	12.8	8.7	10.2	13.0	5.7	7.4	17.4	18.3	5.0	8.9	5.7	13.6	24.7	10.9	10.4	17.6	14.3	16.7	12.9	3.7	5.3	11.0
2046	10	5.8	6.7	2.8	16.5	6.0	6.4	3.2	7.3	4.6	3.6	4.0	4.6	4.8	6.1	2.8	2.8	8.1	8.6	7.0	8.7	8.4	5.6	5.4	5.6	12.3	16.5	4.4	13.9
2046	11	7.9	8.0	1.5	22.6	15.9	5.8	5.6	7.3	10.3	10.4	22.6	10.5	6.3	2.2	8.5	3.1	8.7	4.7	6.0	10.0	4.2	4.8	1.5	6.2	11.5	8.4	8.8	8.4
2046	12	5.4	6.3	1.4	22.7	4.6	7.1	22.7	3.6	10.1	5.2	5.6	5.3	3.9	5.5	6.2	3.1	12.1	11.0	7.4	3.2	3.2	3.3	6.4	6.6	1.4	4.7	8.0	1.5
2047	1	5.3	6.5	2.8	13.6	3.6	5.7	4.2	10.5	13.6	3.5	3.8	10.2	8.3	7.2	10.0	12.3	4.5	5.5	4.8	2.8	13.5	5.2	3.8	7.5	2.8	4.2	5.9	3.7
2047	2	4.3	4.8	2.0	11.2	6.1	4.3	3.7	4.1	7.0	2.4	11.2	4.3	4.3	7.3	4.4	6.3	5.6	5.2	2.9	7.0	3.7	4.0	5.6	2.0	4.3	3.6	3.1	3.0
2047	3	4.9	6.0	1.4	15.7	3.2	3.8	3.5	7.7	14.9	9.1	12.8	5.6	1.4	6.9	3.9	4.8	4.0	5.5	2.1	2.8	5.9	4.9	15.7	1.5	7.1	3.4	2.3	10.6
2047	4	5.6	6.3	2.2	15.1	4.2	7.2	5.5	4.2	15.1	4.6	3.1	6.6	8.2	2.4	4.4	2.3	10.0	5.8	10.4	2.2	7.1	2.3	8.1	8.8	5.3	5.1	10.8	8.4
2047	5	10.0	10.6	1.5	17.7	11.9	9.1	17.7	17.1	9.6	13.4	13.4	13.1	3.5	7.8	4.4	7.9	17.3	16.8	9.8	1.5	10.2	3.1	8.0	16.5	16.7	9.0	10.5	5.6
2047	6	10.5	10.9	3.2	18.8	6.9	11.2	10.1	8.1	14.9	14.1	6.0	11.0	7.7	8.1	13.8	18.3	18.8	7.3	3.2	11.7	13.2	9.6	12.2	14.4	16.0	8.8	10.1	5.0
2047	7	13.5	16.4	5.9	64.6	64.6	18.2	10.5	35.3	7.9	8.9	18.2	10.4	14.3	9.2	13.0	5.9	17.8	14.0	23.7	11.5	14.6	9.1	16.7	13.0	6.4	20.2	19.9	10.5
2047	8	11.4	13.1	7.1	32.0	7.5	10.9	14.2	17.2	32.0	10.4	7.2	14.2	8.3	13.6	9.4	7.1	9.8	9.8	18.3	15.8	20.6	9.0	13.9	11.9	7.8	13.2	24.4	8.8
2047	9	12.3	14.0	7.3	26.7	14.2	17.7	23.3	12.0	12.7	26.7	11.7	10.2	19.0	10.1	14.4	8.2	13.2	10.5	22.5	8.6	13.7	17.0	7.3	21.2	11.1	10.0	11.0	9.1
2047	10	6.4	8.1	2.9	22.6	10.1	5.8	6.4	3.5	6.9	3.2	22.6	5.5	10.3	4.9	16.2	8.6	6.2	6.0	6.0	2.9	6.4	6.7	9.1	5.5	17.7	5.8	6.4	10.9
2047	11	7.0	6.9	2.3	11.1	6.7	4.9	6.1	5.3	8.0	6.9	3.8	7.1	8.0	7.3	9.0	6.3	8.9	5.5	2.3	4.4	7.6	8.5	7.6	5.4	9.0	6.7	11.1	7.9
2047	12	6.0	7.0	2.9	20.0	8.6	6.3	4.3	4.2	5.6	4.6	7.6	20.0	4.0	6.5	7.3	6.2	4.3	2.9	7.4	8.6	17.6	5.0	5.0	3.8	10.8	4.8	5.7	6.4
2048	1	5.3	5.0	1.1	9.1	5.7	5.5	6.0	5.9	4.5	1.1	6.3	5.6	5.8	2.7	3.7	5.5	9.1	6.8	4.8	3.9	2.1	2.5	4.4	6.8	3.6	5.2	8.4	3.9
2048	2	4.3	4.6	1.4	11.9	6.3	6.3	3.8	2.4	4.5	1.9	6.8	4.3	11.9	1.6	3.9	2.7	6.3	1.4	2.7	4.6	6.6	4.6	2.3	8.3	3.7	4.2	6.3	2.7
2048	3	5.9	6.3	1.8	10.9	4.8	5.5	8.9	7.2	7.6	5.6	7.3	5.6	4.8	4.3	7.6	10.9	2.8	2.1	10.3	4.4	4.8	10.5	3.3	6.1	8.5	1.8	9.2	6.8
2048	4	5.1	6.5	1.6	15.2	7.7	4.7	5.1	5.9	5.1	11.7	8.6	9.3	4.7	2.9	4.6	15.2	8.6	3.0	4.6	10.0	5.0	1.6	3.0	9.9	4.0	4.6	10.8	4.6
2048	5	9.1	10.0	3.1	25.0	3.1	4.6	9.2	25.0	10.8	3.4	21.3	4.4	5.8	23.9	12.9	20.7	15.5	10.3	5.6	9.7	9.8	9.1	9.8	4.1	6.6	5.8	3.7	4.8

2048	6	10.8	14.6	4.8	38.1	33.5	9.7	13.0	13.4	20.0	15.3	8.9	26.9	17.2	8.4	10.0	9.1	28.8	11.0	8.9	7.9	8.9	38.1	13.8	10.7	17.1	4.8	7.7	8.2
2048	7	15.5	18.3	7.1	49.9	8.3	10.1	14.3	49.9	16.8	17.2	16.7	30.2	23.1	7.6	29.8	18.4	10.6	13.7	37.4	7.1	10.8	12.4	25.6	8.1	9.7	25.2	7.2	29.3
2048	8	16.0	16.0	6.8	31.2	7.1	8.4	15.4	15.7	30.0	22.1	18.9	19.7	6.9	17.8	7.0	25.8	20.9	10.0	18.2	31.2	20.2	7.1	6.9	24.5	16.2	13.8	13.9	6.8
2048	9	10.7	12.5	2.7	30.6	19.5	4.1	2.7	7.3	10.2	19.8	7.2	16.9	14.2	14.3	22.2	7.3	14.6	14.8	17.4	6.0	30.6	14.3	10.2	8.9	9.3	11.1	10.3	6.4
2048	10	6.5	6.7	2.4	15.6	4.5	2.4	9.1	10.1	8.3	6.6	8.8	8.6	4.3	3.9	7.3	7.5	3.8	8.8	4.7	5.3	8.5	6.3	5.3	5.3	7.4	15.6	2.9	5.2
2048	11	6.8	7.4	3.1	16.6	7.8	7.5	7.0	9.5	16.6	5.2	6.0	4.4	4.9	7.2	4.2	6.8	5.5	12.1	6.1	9.3	6.7	9.6	3.1	12.9	4.1	5.0	5.2	12.0
2048	12	5.5	7.3	2.5	24.4	5.7	8.0	4.9	6.0	4.5	2.5	3.2	5.2	15.4	3.2	2.9	3.5	14.8	10.2	4.4	8.3	11.6	7.1	9.7	4.2	24.4	7.0	3.6	4.4
2049	1	4.3	5.2	2.4	10.9	6.0	4.1	4.5	4.0	3.8	9.8	5.1	6.3	4.2	3.9	3.9	3.7	5.4	10.9	5.7	2.4	6.3	3.4	10.4	2.8	6.9	4.4	4.2	2.5
2049	2	4.6	5.6	2.2	15.4	4.6	9.8	2.7	3.1	2.4	6.9	5.0	3.4	5.8	2.3	5.7	6.1	2.7	4.2	15.4	9.0	3.0	10.2	6.8	2.2	3.7	2.9	11.7	4.5
2049	3	4.2	4.5	0.2	10.1	2.4	6.1	2.8	6.0	9.0	3.3	6.6	3.5	0.2	3.0	4.6	1.6	2.0	2.7	7.4	1.6	3.7	6.7	5.0	6.7	4.9	0.8	8.2	10.1
2049	4	5.7	6.4	2.0	15.3	10.4	6.7	5.0	3.0	11.5	10.0	6.2	7.1	7.4	3.4	8.3	3.7	5.2	10.1	4.2	6.5	2.6	15.3	3.1	4.7	5.2	2.0	7.6	3.7
2049	5	7.7	8.4	2.4	19.8	3.6	4.7	6.5	4.5	15.3	11.8	9.9	7.4	3.2	6.9	8.7	12.9	19.8	3.5	4.2	3.4	5.1	11.6	12.4	2.4	16.9	7.9	8.8	10.1
2049	6	11.0	12.4	3.6	27.4	7.5	27.4	17.6	10.2	24.5	10.8	8.3	20.1	15.8	3.6	5.9	11.3	13.7	15.5	24.2	12.7	5.4	11.4	8.9	19.8	8.4	4.7	4.8	6.1
2049	7	16.3	20.1	6.3	53.2	10.4	15.1	29.1	37.4	20.7	11.9	53.2	32.4	9.4	15.7	19.9	24.5	17.0	6.3	11.5	26.9	15.5	15.4	23.4	9.9	12.3	27.4	21.2	15.5
2049	8	15.4	16.6	5.8	35.0	5.9	12.2	14.8	16.8	22.2	16.8	10.7	7.4	15.0	17.1	8.5	29.1	15.0	35.0	14.8	20.9	15.8	20.0	11.1	12.7	16.6	30.2	5.8	24.4
2049	9	16.3	15.6	6.7	30.0	10.8	8.6	6.7	9.4	19.6	18.3	22.4	16.9	6.8	17.2	20.4	15.7	19.1	16.1	21.7	16.2	30.0	13.9	16.7	11.0	9.6	8.2	22.3	16.5
2049	10	8.5	8.8	3.9	23.9	23.9	10.2	10.7	3.9	14.2	11.0	5.4	5.0	5.5	9.4	11.4	7.9	7.5	5.3	7.8	5.2	3.9	4.7	9.3	13.8	11.4	9.0	4.4	11.3
2049	11	6.8	8.3	3.7	15.1	7.4	6.6	4.6	11.0	4.2	13.8	15.1	6.7	5.7	10.1	5.9	11.8	7.0	8.4	6.1	3.7	6.6	14.1	4.8	12.9	4.2	5.6	12.2	11.2
2049	12	5.0	5.3	2.7	10.6	5.4	6.5	6.1	5.7	3.8	5.4	4.3	5.9	2.8	4.3	6.7	7.3	4.8	8.3	5.3	4.3	10.6	6.0	2.7	4.7	4.5	3.5	4.0	4.7
2050	1	5.3	5.4	0.7	10.5	6.1	6.6	7.8	4.4	4.3	3.4	4.1	5.2	2.6	6.6	3.6	6.5	6.7	5.5	4.0	4.7	9.6	6.5	4.4	0.7	10.5	4.1	5.6	5.6
2050	2	4.4	5.3	1.9	19.8	4.5	3.4	5.8	5.7	2.6	2.0	5.5	9.3	4.1	4.1	19.8	7.2	4.2	4.5	4.3	3.4	3.1	4.9	1.9	2.3	6.9	3.1	9.6	5.2
2050	3	6.3	6.6	0.2	13.6	4.9	1.0	6.0	6.5	12.9	6.8	6.2	8.4	4.1	4.3	9.0	2.8	0.2	9.1	9.1	10.4	6.6	13.6	3.5	5.0	9.2	3.6	4.1	10.1
2050	4	6.9	7.5	0.9	13.1	12.4	7.0	5.1	0.9	11.6	4.8	8.0	12.6	6.9	6.3	10.6	6.1	10.5	9.0	13.1	6.1	2.1	4.5	12.5	7.3	3.6	1.2	6.6	11.9
2050	5	9.9	10.9	3.0	28.4	6.7	3.0	6.3	11.0	10.4	11.4	7.5	11.1	9.9	14.9	9.4	10.1	5.4	7.6	4.2	10.0	14.9	3.5	28.4	27.9	5.0	7.2	16.1	20.4
2050	6	8.9	11.5	5.5	32.9	9.2	11.6	5.8	12.8	8.3	16.3	9.2	20.7	8.2	7.8	9.6	8.6	5.5	5.8	22.4	11.4	7.5	8.0	15.1	32.9	8.2	8.5	15.0	8.7
2050	7	14.7	18.2	6.8	70.5	70.5	32.1	7.5	15.3	13.1	6.8	28.1	12.0	14.8	36.9	14.6	8.0	19.5	8.2	30.0	17.4	12.0	17.9	9.9	12.0	10.1	15.2	16.6	8.4
2050	8	14.6	19.2	2.8	74.1	9.2	46.8	11.7	16.5	20.7	20.2	35.2	24.6	9.0	8.7	6.7	17.9	24.3	7.0	33.6	8.3	74.1	11.3	18.3	12.0	18.7	10.1	2.8	12.7
2050	9	12.4	14.1	2.7	31.2	19.5	7.5	6.3	11.3	20.1	5.1	10.5	18.5	12.4	17.9	31.2	6.5	10.0	10.9	15.7	24.8	23.8	17.8	24.0	12.3	2.7	5.2	8.2	15.2
2050	10	6.6	6.6	2.5	15.7	7.2	6.8	6.6	6.7	4.4	5.5	7.9	15.7	8.5	5.2	9.1	9.5	5.5	6.9	6.0	8.2	8.0	4.2	2.5	3.2	2.8	4.7	5.4	7.1
2050	11	7.8	8.0	2.7	16.4	10.2	9.4	8.1	7.2	16.4	5.7	6.7	9.5	3.4	5.9	9.5	9.7	7.5	6.8	10.1	2.7	12.1	8.4	4.1	3.4	7.0	14.2	8.3	5.4
2050	12	4.9	6.2	2.2	25.5	5.4	6.8	4.3	4.8	8.0	6.4	10.4	4.2	3.7	4.0	6.8	3.7	5.9	9.4	8.2	3.7	2.5	3.1	4.8	3.5	6.1	2.2	25.5	5.0
2051	1	4.8	5.4	2.2	11.0	2.6	2.2	4.4	3.0	5.3	11.0	4.8	2.8	4.7	4.4	6.4	4.1	9.3	5.7	2.7	8.5	4.5	9.5	5.2	7.6	3.7	5.2	10.5	2.6
2051	2	4.2	4.5	1.1	11.5	6.0	5.7	4.4	5.9	4.8	6.3	7.8	4.1	11.5	1.1	5.2	2.0	2.3	2.2	3.2	3.1	3.7	1.6	6.2	7.0	2.6	2.7	6.6	1.2
2051	3	4.6	5.6	0.7	15.1	3.9	6.5	3.8	5.8	0.7	4.2	8.2	5.7	2.7	3.6	2.0	13.0	6.9	2.7	9.4	5.8	3.9	8.0	4.3	2.0	15.1	3.0	4.9	8.7
2051	4	6.7	7.1	0.7	18.7	15.6	5.6	9.8	6.7	3.7	6.9	7.8	18.7	9.0	3.5	4.4	11.1	6.8	6.9	3.1	5.7	4.5	10.7	4.2	2.1	9.9	6.2	6.9	0.7
2051	5	9.3	10.9	3.0	22.6	7.8	5.1	5.9	11.7	22.6	6.3	21.0	20.4	9.6	9.3	9.2	20.5	4.3	12.1	15.0	3.0	17.3	5.6	8.1	21.7	5.8	5.1	10.7	3.1
2051	6	15.7	18.6	3.8	79.7	19.2	5.9	9.2	26.1	17.7	15.7	40.2	14.2	15.8	3.8	8.9	15.7	7.0	5.3	4.2	41.4	19.1	9.2	28.6	21.8	79.7	7.5	15.7	14.7
2051	7	14.3	17.8	6.5	34.7	12.4	25.6	21.1	26.6	34.7	14.1	24.7	31.7	9.8	34.5	16.5	21.9	13.4	13.1	6.5	12.4	8.3	23.5	14.4	16.9	14.0	10.6	10.9	10.4
2051	8	13.8	15.8	3.1	37.8	24.0	13.0	12.8	18.1	19.2	17.7	9.4	11.9	27.1	7.6	37.8	14.7	6.2	11.4	7.6	18.7	16.7	28.8	3.1	6.1	12.6	23.5	8.6	23.2
2051	9	16.0	15.4	5.1	43.0	15.3	26.3	8.1	6.2	43.0	22.0	5.1	5.4	15.6	15.7	19.7	19.0	18.4	5.5	19.6	9.5	16.3	8.3	19.2	18.9	5.4	17.1	17.0	12.2
2051	10	5.7	6.5	2.7	15.0	4.3	4.5	3.2	7.7	8.6	7.8	5.5	5.7	9.3	8.7	5.7	5.8	5.1	15.0	7.6	2.8	5.0	6.2	5.0	5.0	14.5	6.4	3.9	2.7
2051	11	7.9	8.5	3.9	14.9	7.7	14.5	9.5	13.8	6.7	8.3	8.5	6.3	7.6	14.9	4.2	8.1	6.5	3.9	13.6	11.8	4.5	10.3	12.2	5.0	10.9	4.2	4.7	5.7
2051	12	4.4	5.4	2.0	11.3	4.4	9.8	3.8	2.7	4.2	4.4	6.2	5.6	3.7	6.7	9.8	6.0	5.9	11.3	3.8	6.3	4.3	4.5	4.3	2.0	2.8	3.1	9.7	5.0
2052	1	5.5	6.3	2.9	17.4	6.8	5.6	5.0	5.9	7.2	7.1	5.2	4.7	2.9	3.4	5.8	4.1	9.0	17.4	3.0	3.4	5.7	8.7	5.4	3.5	13.4	7.8	4.4	5.0
2052	2	4.6	6.0	2.6	26.1	3.6	5.5	4.3	3.7	11.5	4.8	26.1	4.6	3.0	4.6	4.6	4.2	5.3	7.2	7.7	2.6	5.9	4.1	6.6	4.4	3.7	3.8	7.6	5.4
2052	3	4.1	4.9	0.9	15.3	8.1	4.5	5.2	3.9	4.6	11.7	3.9	2.7	3.5	5.3	1.8	15.3	6.9	8.8	3.0	5.7	4.4	0.9	4.2	2.2	2.4	2.4	3.9	2.7
2052	4	6.0	6.8	2.1	13.7	7.9	6.6	5.9	5.5	2.1	13.7	9.2	10.2	4.7	9.7	4.7	4.0	5.0	10.2	6.1	4.7	4.9	8.5	5.1	11.0	4.4	6.2	8.6	3.2
2052	5	10.7	12.3	2.8	28.0	16.4	8.9	8.9	6.6	7.3	10.6	12.9	24.0	3.6	21.9	10.8	15.4	6.0	8.1	11.8	10.0	21.7	13.2	12.6	28.0	19.0	5.9	2.8	8.1
2052	6	14.3	15.0	3.9	28.2	14.9	18.1	12.9	9.1	25.7	10.4	18.3	3.9	27.2	6.4	28.2	9.9	8.1	17.3	18.2	5.4	14.7	13.4	23.1	14.7	28.2	13.8	7.1	10.2
2052	7	11.6	15.2	4.7	33.0	11.3	32.6	20.0	16.1	8.6	6.2	13.8	24.3	5.5	10.2	4.7	18.4	33.0	16.5	9.9	11.9	17.9	11.2	7.0	9.8	4.9	10.7	30.7	30.7
2052	8	14.0	16.4	5.5	45.3	7.5	12.3	14.1	5.9	12.3	15.4	36.1	17.6	9.3	15.4	14.6	9.4	9.4	12.4	7.2	45.3	5.5	12.7	15.9	21.0	13.8	36.7	23.3	19.9
2052	9	15.5	15.7	4.4	28.1	14.6	28.1	4.7	13.3	23.8	21.8	5.3	27.5	10.5	20.0	11.7	19.3	9.4	15.7	14.0	18.9	24.6	5.0	21.9	24.7	4.4	15.8	5.6	15.3
2052	10	7.8	8.0	3.5	17.6	9.3	8.0	7.5	10.6	8.1	6.9	6.1	5.4	4.6	5.2	17.6	11.8	9.6	5.1	11.3	3.5	8.1	4.7	10.1	4.5	4.1	12.3	11.6	5.1
2052	11	8.0	7.8	3.3	14.3	8.6	5.6	10.3	3.9	10.1	9.8	6.5	10.2	4.1	14.3	9.2	8.3	3.3	12.3	8.6	4.1	12.4	6.1	5.8	7.5	7.8	4.4	6.7	8.5
2052	12	5.9	7.9	2.1	25.4	25.4	5.5	9.8	5.6	5.7	7.7	3.5	13.5	8.2	18.5	13.7	4.1	2.1	4.5	4.3	4.8	10.4	9.8	4.7	3.7	7.2	8.4	2.1	6.1
2053	1	5.3	5.7	2.8	8.9	6.8	2.8	4.6	4.8	6.8	8.9	5.0	4.0	5.4	6.9	4.3	4.6	6.9	4.7	5.1	6.3	5.9	5.2	5.1	6.1	6.1	8.9	5.1	6.0
2053	2	5.8	5.3	1.1	10.8	4.3	3.3	2.6	5.8	5.9	4.3	10.8	2.8	5.9	1.1	3.3	2.3	7.4	6.3	3.6	10.1	5.9	5.8	6.0	6.3	4.7	7.0	6.0	5.0
2053	3	4.3	5.0	1.2	11.8	4.6	4.1	1.2	4.8	6.4	4.1	3.9	1.2	1.7	2.9	9.2	11.8	3.7	9.8	2.0	2.7	5.4	1.5	7.3	4.1	4.4	5.1	8.5	8.6
2053	4	5.4	7.0	2.7	16.3	3.9	15.6	8.9	5.8	2.9	3.8	4.5	8.0	5.7	2.7	8.1	15.2	4.1	16.3	5.2	13.8	6.8	3.8	3.6	3.8	5.6	4.2	12.1	2.7
2053	5	10.7	11.4	1.3	24.6	9.3	3.7	4.8	24.6	14.8	13.7	16.1	11.9	11.4	20.6	10.4	11.1	3.8	8.8	7.2	22.2	9.2	9.9	1.3	12.7	6.7	15.1	17.7	6.2
2053	6	11.8	12.1	3.9	28.6	16.8	21.0	9.3	28.6	7.9	8.9	12.4	12.2	7.7	11.0	15.4	13.2	16.3	15.0	9.8	13.9	7.8	5.7	4.3	12.3	10.3	15.3	11.5	3.9
2053	7	13.8	15.0	4.5	43.1	20.8	13.7	6.2	10.3	6.2	13.8	43.1	14.2	23.1	29.1	11.1	4.5	10.8	14.3	14.4	16.7	15.8	11.1	10.5	7.2	14.8	13.5	23.9	10.7
2053	8	12.6	14.2	5.2	35.9	12.4	18.1	9.4	7.2	35.9	10.5	16.5	24.0	6.9	24.5	6.7	6.8	11.2	15.6	7.8	5.2	14.6	5.5	18.8	12.9	19.7	23.5	20.1	7.5
2053	9	13.2	16.1	2.0	49.6	13.8	11.3	4.2	5.3	16.0	10.3	9.3	8.7	13.6	8.1	33.4	21.8	49.6	9.8	12.4	19.2	18.4	12.8	33.1	6.9	2.0	18.5	28.0	19.6
2053	10	6.2	6.9	1.3	14.5	2.7	1.3	11.8	8.5	7.4	10.7	7.7	5.0	6.2	14.5	5.9	6.3	4.2	8.2	5.5	9.6	9.3	5.7	8.7	2.4	5.6	4.9	5.9	8.4
2053	11	5.6	6.3	1.8	10.6	3.0	9.1	8.5	4.6	10.2	4.7	5.9	4.0	3.4	4.1	8.7	7.6	5.4	3.9	9.8	5.5	6.2	10.2	1.8	10.6	4.2	5.4	9.9	5.7
2053	12	5.9	7.2	2.4	25.4	6.8	4.1	6.9	5.9	25.4	5.7	11.2	8.8	5.6	6.5	6.7	7.8	2.8	4.2	5.4	11.8	2.4	4.6	3.5	11.2	5.6	8.7	5.9	5.1
2054	1	5.3	6.7	2.4	16.9	6.7	4.8	3.4	10.2	5.1	3.7	7.5	13.3	4.6	3.7	2.4	10.0	5.6	10.5	8.6	16.9	2.6	4.7	4.4	2.5	6.7	12.6	7.2	3.1
2054	2	5.2	4.9	1.9	10.0	3.1	5.5	3.8	4.6	6.7	5.0	6.5	3.8	5.5	7.7	5.2	6.6	2.0	1.9	2.1	5.2	2.0	3.7	5.1	5.7	7.6	3.5	5.5	10.0
2054	3	6.6	6.7	2.5	14.6	2.5	6.5	3.3	8.5	3.4	7.2	14.6	3.2	7.1	2.6	5.1	3.7	3.8	9.1	11.4	4.8	3.4	13.6	11.1	8.0	9.0	4.6	6.9	6.7
2054	4	4.6	5.8	1.2	18.7	6.2	8.5	1.2	2.1	3.2	5.3	9.8	3.3	7.4	1.5	18.7	8.1	4.6	4.1	9.0	3.3	2.5	7.5	9.8	4.4	4.1	4.6	3.6	5.8
2054	5	11.7	11.6	1.1	22.9	13.6	18.7	18.8	11.9	12.1	11.0	13.9	22.9	6.1	10.6	1.1	16.0	5.0	16.1	13.4	20.1	4.1	11.3	4.6	8.1	5.3	18.5	4.3	11.5
2054	6	14.2	17.7	3.9	68.3	14.8	20.1	9.8	11.6	19.0	14.1	68.3	7.7	5.4	21.1	11.5	12.3	14.2	3.9	13.8	40.1	26.2	7.4	18.2	12.5	10.5	21.8	25.0	15.8
2054	7	16.3	17.8	4.0	49.0	13.2	15.7	12.5	49.0	31.3	28.6	6.7	27.2	22.4	23.1	6.6	13.1	18.2	18.4	20.7	12.0	14.5	9.4	11.2	16.9	18.2	13.1	22.1	4.0
2054	8	14.2	16.6	6.4	46.1	14.0	8.9	46.1	14.5	25.5	12.2	34.0	15.6	15.1	10.4	14.0	7.4	18.3	8.7	12.4	21.5	34.5	14.5	14.9	10.7	16.0	13.8	9.6	6.4
2054	9	11.5	13.7	6.2	27.8	13.2	25.7	27.8	13.8	21.7	11.9	8.2	6.4	10.2	18.8	19.7	11.1	26.5	9.7	7.0	8.3	13.4	9.4	10.8	9.7	6.2	15.8	16.4	6.9
2054	10	7.1	8.5	1.9	18.0	8.7	4.7	5.9	2.3	15.3	7.0	1.9	4.9	6.5	5.1	16.6	18.0	14.0	4.8	7.3	12.5	12.5	8.5	6.4	9.6	16.5	9.0	3.3	3.1
2054	11	6.9	7.1	3.3	14.8	6.5	5.8	7.2	5.1	3.8	9.1	7.9	3.4	3.3	7.5	7.3	4.6	7.7	5.9	8.4	13.4	4.7	4.6	4.4	6.2	14.8	9.0	10.3	10.3
2054	12	5.0	6.7	2.9	21.5	2.9	3.7	6.7	7.8	18.0	21.5	6.2	5.2	6.1	3.7	8.9	7.0	10.9	4.0	3.7	3.7	3.6	4.9	3.0	3.0	4.2	9.0	9.0	4.2
2055	1	5.1	5.5	2.7	9.3	7.0	5.2	3.0	4.3	5.5	8.7	3.0	4.1	2.7	4.5	5.7	4.2	7.0	9.3	5.0	4.8	5.9	6.9	7.0	4.0	4.6	9.1	5.9	4.4
2055	2	4.2	4.9	2.2	12.1	6.4	12.1	3.5	4.1	2.2	4.3	2.6	6.8	4.3	6.1	3.1	3.5	2.8	3.3	6.2	4.2	7.9	4.1	3.1	2.4	9.3	5.2	3.9	6.9
2055	3	5.8	6.5	1.3	15.6	6.0	11.2	10.7	10.1	10.8	7.1	4.7	4.8	6.9	1.5	6.1	5.3	10.9	5.9	3.9	15.6	5.0	5.3	6.6	3.1	1.3	2.7	5.6	4.5
2055	4	6.0	6.3	1.2	14.3	4.0	14.3	7.4	1.2	10.3	6.4	3.0	11.1	5.3	9.1	2.9	7.8	7.1	6.2	1.8	2.8	9.2	6.3	5.9	4.8	7.7	5.2	5.6	5.8
2055	5	9.4	10.5	2.7	27.4	15.0	9.5	10.2	27.4	4.6	6.3	5.7	14.7	5.2	8.3	10.4	9.3	7.2	5.9	12.1	2.7	18.3	4.9	5.0	9.6	19.6	18.1	16.0	5.9
2055	6	11.8	13.3	4.4	37.9	6.4	12.4	4.8	12.4	29.2	7.0	14.9	5.5	13.9	37.9	16.0	9.4	18.9	4.4	12.3	20.4	9.9	10.3	10.1	24.2	16.2	11.4	5.5	5.4
2055	7	12.4	17.0	6.1	76.4	14.2	29.8	10.9	17.1	9.0	6.1	24.0	11.2	12.9	8.1	16.1	18.4	13.0	11.6	12.5	19.9	10.0	7.2	38.4	11.9	12.3	76.4	7.9	7.8
2055	8	14.0	14.6	6.7	33.5	10.3	16.7	14.1	13.2	10.2	33.5	14.2	16.5	9.3	15.1	11.4	8.4	15.1	19.5	13.8	9.9	23.1	17.7	20.6	7.3	9.7	6.7	13.9	20.1
2055	9	10.7	12.4	3.9	24.2	8.7	20.5	5.6	8.5	16.1	6.1	18.4	11.9	22.6	20.1	3.9	9.5	8.0	10.8	9.1	5.3	13.7	20.5	13.0	24.2	8.2	9.0	10.5	14.1
2055	10	8.6	8.5	1.2	15.8	9.7	12.8	9.1	2.9	2.6	5.4	8.8	15.8	7.8	14.1	4.1	11.9	8.5	2.6	12.7	1.8	6.3	1.2	7.7	7.3	11.1	13.9	10.8	13.9
2055	11	6.3	7.3	1.4	15.8	5.1	4.7	7.4	3.5	2.8	4.9	14.6	8.7	15.8	5.3	5.9	5.8	7.5	6.7	8.3	3.3	11.9	3.7	1.4	14.3	7.4	8.1	14.9	2.3
2055	12	6.3	6.4	1.2	14.6	4.7	4.8	7.4	6.7	7.2	9.6	8.2	14.6	2.8	5.4	5.7	6.7	1.2	3.7	5.8	5.9	8.4	6.8	6.8	8.3	3.5	12.2	4.5	3.4

2056	1	4.9	5.2	1.9	14.0	6.4	3.3	5.1	5.0	5.3	7.7	5.8	5.5	4.2	4.1	1.9	4.1	3.1	5.7	4.8	3.8	2.2	7.6	5.0	14.0	4.6	4.7	3.5	7.7
2056	2	4.0	5.2	2.0	21.0	9.1	4.8	2.8	3.8	5.3	4.7	3.5	6.4	21.0	7.1	3.2	3.2	3.2	7.0	3.3	4.2	2.7	3.6	5.8	2.0	6.4	3.0	6.8	2.6
2056	3	5.3	5.9	2.6	12.8	6.7	2.6	7.3	3.6	12.8	10.3	4.8	4.6	5.5	6.9	3.4	6.7	9.2	3.0	4.9	7.7	3.9	4.6	9.0	5.0	6.6	2.7	5.9	3.0
2056	4	4.4	6.6	0.9	27.8	10.8	2.3	4.7	6.5	9.7	9.9	1.9	1.1	3.1	4.5	3.8	2.1	0.9	4.3	4.3	1.4	4.8	3.3	22.4	27.8	2.3	11.4	4.5	11.9
2056	5	9.5	10.7	0.0	27.6	4.7	11.6	7.2	27.6	9.0	17.1	6.9	6.1	9.9	2.9	5.9	17.3	15.7	0.0	5.8	2.2	16.0	17.5	18.9	8.5	16.2	6.2	10.0	14.3
2056	6	12.8	14.7	3.2	40.9	11.7	14.9	17.3	10.6	3.2	6.7	13.9	7.7	10.9	7.7	24.1	19.8	6.5	12.6	18.2	23.7	13.1	23.6	40.9	3.6	26.1	9.8	13.7	11.6
2056	7	17.1	19.7	3.2	94.3	18.6	13.7	9.7	15.8	21.1	28.3	22.8	12.3	14.8	12.6	15.6	18.5	19.8	20.9	6.9	20.8	94.3	3.2	28.0	25.4	19.1	9.7	11.8	8.1
2056	8	12.1	13.3	2.9	35.4	9.2	10.9	13.0	11.9	2.9	10.2	4.1	13.6	11.1	12.5	4.8	9.5	10.6	7.9	16.3	35.4	27.6	24.2	13.3	12.9	14.0	12.3	22.7	8.6
2056	9	13.3	16.2	5.9	61.2	10.3	10.4	19.0	21.1	8.0	6.8	23.1	16.6	5.9	20.2	20.2	10.4	61.2	17.0	16.7	9.1	17.8	11.2	26.0	13.6	13.1	7.8	12.1	11.5
2056	10	7.6	8.0	2.8	17.1	2.8	9.4	10.5	6.3	5.5	14.7	7.5	5.4	10.1	7.8	5.6	5.0	5.2	3.7	2.9	11.5	4.8	17.1	11.5	6.9	8.1	7.8	14.0	8.5
2056	11	6.1	6.4	2.7	10.7	9.5	9.0	9.8	4.4	5.0	8.4	6.8	7.5	7.9	6.0	5.9	10.1	5.0	4.0	6.1	5.3	3.6	7.3	7.6	3.3	10.7	3.7	2.7	4.3
2056	12	5.5	5.7	2.5	13.7	6.8	4.6	4.0	6.7	6.0	3.3	5.9	8.7	3.7	3.5	5.7	7.1	5.3	6.4	4.0	4.9	6.2	2.5	4.4	4.8	4.5	6.1	13.7	8.0
2057	1	5.6	6.9	2.4	22.4	6.5	2.4	4.2	4.4	8.6	4.9	6.7	7.2	3.6	5.6	4.0	12.0	4.4	6.2	3.0	5.5	6.8	11.8	4.4	8.8	22.4	5.5	5.5	11.3
2057	2	4.0	5.3	1.9	20.4	3.5	1.9	3.7	4.5	3.6	6.3	8.7	4.0	4.0	5.2	3.6	4.4	6.9	2.5	20.4	2.2	5.1	5.9	2.7	3.5	4.0	7.2	2.9	9.9
2057	3	4.9	5.2	1.6	11.2	6.6	3.2	3.6	2.5	3.5	9.4	6.9	6.5	4.7	11.2	5.4	5.9	6.4	2.2	3.6	6.6	1.6	5.0	9.9	3.2	2.2	7.3	3.6	4.0
2057	4	5.5	6.4	1.5	16.1	10.5	2.9	6.9	7.8	4.6	5.6	10.5	7.2	4.1	5.2	9.1	10.1	5.4	6.3	5.2	2.3	1.5	4.8	7.0	3.9	10.4	3.8	16.1	2.6
2057	5	12.7	12.0	2.6	27.4	14.7	3.0	3.4	27.4	17.8	13.7	19.6	13.1	6.3	2.6	9.2	20.5	3.3	16.3	8.6	18.4	7.6	8.2	6.0	17.7	13.5	20.6	12.2	3.4
2057	6	9.5	12.7	4.0	42.9	4.6	12.4	11.7	7.8	6.3	12.4	4.0	4.7	42.9	14.0	9.5	9.5	12.7	4.1	9.4	38.0	15.5	17.3	8.7	6.9	9.4	20.5	7.0	16.1
2057	7	15.1	18.2	2.8	50.2	9.3	50.2	9.9	39.0	26.7	21.8	6.0	24.1	12.7	16.9	9.3	24.6	12.6	17.0	8.6	21.2	49.5	13.3	4.8	13.0	2.8	3.5	21.9	18.3
2057	8	14.4	15.6	4.9	34.1	6.5	21.6	10.1	11.5	8.8	17.2	4.9	34.1	5.0	28.0	16.2	24.7	11.9	19.0	17.2	10.1	13.4	17.6	16.4	15.3	32.2	9.9	10.9	11.2
2057	9	17.1	15.3	3.8	34.2	5.4	18.3	20.0	10.3	10.7	34.2	13.4	22.5	18.6	7.0	9.0	21.4	19.2	17.1	19.7	14.5	17.8	21.5	6.1	17.7	15.0	7.5	3.8	17.1
2057	10	5.9	7.0	2.6	22.7	5.1	3.5	22.7	4.7	2.8	9.0	2.6	8.6	9.8	10.5	4.4	8.9	6.8	4.1	7.8	11.5	7.3	4.8	4.8	4.2	9.3	3.5	8.9	3.2
2057	11	6.0	6.3	2.1	13.1	5.1	5.5	5.3	13.1	6.0	8.7	8.0	3.8	2.8	6.2	4.5	9.4	7.0	6.3	4.9	6.0	4.8	10.6	3.0	8.3	9.1	2.1	6.6	5.0
2057	12	5.8	5.4	2.0	11.2	6.0	8.1	9.1	3.1	6.0	5.7	3.7	11.2	3.7	4.2	2.2	5.9	5.9	3.5	4.4	2.0	6.9	4.8	6.8	5.9	6.8	7.6	3.1	3.4
2058	1	4.7	5.0	2.6	9.0	4.1	3.8	5.9	5.1	2.9	5.2	4.1	4.0	9.0	3.4	5.5	2.6	4.9	8.6	5.9	6.7	6.0	3.7	8.4	5.7	3.1	3.7	3.1	4.6
2058	2	4.7	5.0	0.3	11.2	5.9	4.9	3.8	2.6	2.2	8.2	11.2	3.9	5.4	2.3	6.9	4.4	2.9	3.5	0.9	8.7	0.3	4.5	1.5	5.3	4.9	10.6	5.1	10.1
2058	3	5.9	6.7	3.1	19.3	5.9	6.8	6.9	12.2	6.9	8.4	6.0	3.8	4.1	5.6	5.2	8.2	4.3	3.8	6.5	8.5	4.1	3.7	4.2	7.9	19.3	3.1	11.6	3.9
2058	4	6.1	7.0	2.7	14.7	4.2	14.7	2.7	3.9	9.2	4.2	6.6	5.1	3.7	5.1	7.4	12.0	12.0	4.4	5.6	4.4	7.7	7.7	12.2	5.3	7.9	3.7	9.1	8.7
2058	5	9.5	9.9	3.0	22.2	3.4	10.9	19.6	12.6	4.9	6.8	12.5	5.1	10.0	6.0	13.7	10.9	3.6	3.0	8.6	10.0	19.4	22.2	6.7	8.4	9.0	8.2	10.7	10.6
2058	6	9.0	10.9	4.8	23.8	17.2	5.5	8.6	6.1	7.4	6.1	17.8	6.8	6.5	16.3	4.8	4.9	15.9	7.9	13.9	18.4	5.4	13.3	10.4	23.8	16.6	9.4	12.2	5.5
2058	7	15.6	17.3	10.4	33.0	17.2	12.2	14.8	11.9	11.5	27.8	10.8	15.5	19.0	15.7	16.2	11.2	19.0	13.6	17.0	22.1	31.1	11.2	33.0	21.9	27.0	10.4	12.4	11.9
2058	8	13.3	16.1	4.6	39.4	13.9	12.0	20.2	5.9	10.6	5.5	8.1	32.1	19.6	16.8	35.3	26.2	4.6	19.6	26.3	19.5	12.7	9.9	9.6	15.9	39.4	6.7	9.8	7.1
2058	9	14.8	16.6	7.6	37.5	22.6	14.4	12.1	28.5	18.4	11.7	15.5	37.0	19.4	7.6	8.1	9.7	13.4	16.7	19.5	37.5	7.8	16.8	10.1	13.6	15.1	10.9	17.5	14.2
2058	10	6.6	7.7	2.4	15.6	7.8	6.5	11.6	3.3	6.5	2.4	6.4	6.6	14.9	8.2	8.2	11.0	7.3	13.8	3.6	11.5	3.1	5.7	5.3	4.5	9.2	15.6	6.2	5.2
2058	11	6.2	6.5	1.0	15.6	6.1	6.1	1.0	8.4	5.0	6.1	7.8	7.1	8.0	12.1	6.3	2.8	4.2	6.4	4.5	7.0	5.7	9.4	5.5	7.0	6.4	3.8	15.6	4.7
2058	12	5.7	6.4	2.4	12.7	6.5	8.6	2.4	11.6	12.7	9.8	10.4	7.1	5.1	6.2	2.8	3.5	4.2	3.8	5.0	4.0	5.3	5.9	7.1	7.0	2.4	5.4	5.5	10.9
2059	1	5.9	6.6	2.3	24.5	12.5	8.3	4.4	4.5	6.0	7.1	6.1	2.3	3.7	6.9	4.1	4.2	5.5	11.2	8.0	2.8	6.6	7.7	3.9	2.9	3.2	24.5	6.1	5.8
2059	2	4.5	4.7	1.0	10.1	2.4	1.0	4.7	4.7	4.2	2.5	10.1	6.4	4.1	6.1	8.3	3.1	5.1	2.9	2.9	1.9	5.6	4.4	5.8	3.9	9.4	4.6	4.5	3.7
2059	3	5.1	5.5	1.3	11.8	4.3	2.8	5.9	4.2	10.5	11.8	6.9	7.5	4.0	10.7	4.4	3.2	5.8	5.1	5.5	2.8	1.3	6.0	3.5	5.2	5.0	4.0	7.0	4.4
2059	4	5.9	6.6	0.9	20.3	6.0	11.0	6.5	3.4	8.4	4.2	3.3	9.8	7.2	5.7	1.3	5.3	5.2	6.1	2.8	4.6	0.9	2.0	5.8	11.8	20.3	6.2	6.0	15.1
2059	5	10.0	11.3	3.4	24.8	3.4	10.7	16.1	9.9	6.3	12.3	6.5	24.7	7.2	8.5	11.7	7.8	10.1	13.6	24.8	4.5	9.4	9.6	19.1	7.5	14.4	10.4	3.9	18.6
2059	6	15.0	15.3	4.9	29.9	7.1	10.8	25.5	10.7	12.2	17.2	19.6	20.0	25.7	15.6	7.6	6.7	9.4	8.1	14.6	15.4	29.9	12.4	21.2	23.0	27.0	4.9	5.7	15.8
2059	7	15.0	17.4	6.6	39.4	17.6	34.9	10.9	18.0	17.3	15.8	31.6	11.2	25.2	28.3	12.1	24.6	39.4	12.9	7.9	14.1	6.6	14.0	19.6	20.2	8.3	7.5	7.9	10.6
2059	8	11.2	12.6	3.4	37.4	11.3	9.9	12.4	4.3	12.4	15.7	3.4	9.1	14.9	14.8	17.3	22.6	18.9	11.5	20.3	37.4	10.6	8.4	5.7	7.2	8.4	9.6	11.2	5.9
2059	9	12.1	11.9	2.4	24.5	12.5	2.4	12.0	4.0	12.1	18.0	9.0	13.3	9.3	14.5	24.5	22.6	7.5	15.4	7.0	8.6	3.7	8.5	12.6	17.8	17.8	8.6	15.5	8.2
2059	10	6.7	7.4	2.1	18.1	16.2	7.0	6.2	7.1	6.4	9.7	10.0	7.2	9.3	5.2	16.2	3.5	18.1	3.9	6.0	8.5	2.6	6.1	3.0	3.4	3.8	7.1	2.1	8.1
2059	11	7.8	8.7	2.9	16.2	7.2	3.6	5.5	11.1	8.0	5.8	14.5	10.9	5.6	14.8	6.8	5.8	2.9	8.8	16.2	5.3	8.3	12.1	9.9	8.5	7.6	7.1	15.1	7.3
2059	12	5.4	5.9	2.4	11.7	2.9	3.5	5.2	9.1	3.3	7.1	4.2	5.8	2.4	11.0	11.7	5.3	4.7	3.2	4.6	6.7	5.8	5.5	10.5	7.4	3.6	6.5	8.3	4.0
2060	1	5.7	6.5	1.5	23.2	7.3	5.5	6.7	3.3	5.7	5.1	5.6	5.4	23.2	5.0	4.7	8.0	4.4	3.6	5.8	1.5	6.8	11.1	6.1	7.1	8.9	6.1	5.9	2.5
2060	2	4.6	4.7	0.9	12.0	0.9	6.6	4.5	5.8	3.0	3.7	1.6	1.7	3.6	8.2	6.1	4.2	5.1	12.0	4.6	2.1	3.2	9.2	7.9	5.7	6.2	1.5	4.9	1.5
2060	3	5.0	6.4	1.7	15.5	4.1	2.8	1.7	8.5	8.5	3.0	4.6	15.5	5.0	7.3	4.3	2.4	12.9	2.1	7.2	6.5	3.9	5.1	3.7	14.3	12.5	3.6	6.1	9.1
2060	4	5.6	6.2	1.8	15.0	6.6	7.4	4.3	3.3	6.0	1.8	5.3	4.2	12.6	7.2	4.4	13.4	5.2	5.3	4.1	5.5	6.1	7.5	15.0	3.0	5.8	2.9	5.7	6.1
2060	5	11.2	11.4	1.3	20.9	11.1	17.5	15.1	16.8	7.3	4.3	20.9	11.2	7.4	12.8	5.1	10.6	17.9	17.9	10.2	3.3	1.3	13.5	14.0	15.0	9.0	16.5	8.7	6.7
2060	6	12.6	16.0	6.2	43.5	33.6	8.5	10.7	27.4	9.7	14.1	7.1	18.2	43.5	8.5	8.9	28.4	13.2	8.8	7.8	10.1	21.7	6.2	16.7	25.6	16.2	8.7	19.1	11.9
2060	7	14.8	17.3	6.1	50.2	30.0	7.0	21.8	12.9	28.6	21.4	7.8	19.3	14.3	15.1	50.2	6.1	12.0	15.6	11.4	10.4	17.6	21.1	18.2	27.4	9.7	9.5	14.5	12.9
2060	8	15.7	18.0	4.7	55.6	19.0	11.5	12.9	14.1	30.0	55.6	6.7	4.7	24.2	18.8	8.9	11.2	9.4	23.9	11.9	20.8	7.2	20.7	17.3	32.1	19.6	7.6	32.1	10.6
2060	9	12.9	12.9	3.8	27.2	7.4	18.5	7.4	3.8	9.4	8.2	26.9	11.5	21.2	13.5	4.6	14.0	27.2	14.5	9.4	17.9	12.2	15.4	14.0	5.3	11.4	13.7	17.8	5.0
2060	10	8.3	9.5	3.1	26.1	23.7	6.6	8.4	7.3	10.6	6.3	8.8	5.7	6.3	11.5	5.7	26.1	9.9	3.7	4.7	8.3	3.1	17.6	5.4	9.3	8.2	9.2	13.5	7.4
2060	11	6.1	7.4	2.9	16.6	14.9	6.3	7.4	9.1	6.3	4.6	9.3	16.6	3.4	6.0	4.6	4.0	6.0	5.4	6.1	4.9	5.8	15.3	8.9	2.9	5.5	3.6	6.5	13.8
2060	12	5.4	6.0	3.0	22.9	5.3	3.0	22.9	5.0	7.2	5.7	5.6	5.1	5.4	4.6	8.8	4.7	5.6	6.4	4.1	3.7	5.8	6.6	5.9	4.1	3.8	6.0	3.2	5.0
2061	1	4.8	5.1	0.8	10.5	5.7	4.4	4.1	8.0	3.1	2.6	4.9	8.9	7.6	4.8	3.2	3.2	5.6	5.9	3.7	0.8	2.8	7.4	3.3	3.8	10.5	4.7	7.7	6.3
2061	2	4.9	5.7	1.5	11.8	5.4	5.1	6.3	11.8	4.2	9.3	4.5	11.0	2.8	1.5	4.6	4.2	5.0	5.6	9.7	2.9	1.5	6.8	4.7	2.1	7.6	4.8	10.4	4.7
2061	3	5.2	5.7	1.7	12.0	12.0	3.7	6.5	11.0	6.2	5.3	3.7	5.4	4.0	5.5	11.6	6.4	3.8	5.1	4.2	5.1	2.6	1.7	5.0	5.9	8.3	6.0	4.9	3.5
2061	4	5.6	6.9	1.7	17.4	4.0	4.4	7.0	6.7	1.7	11.5	12.5	6.1	12.3	9.0	17.4	2.3	3.8	5.1	2.5	12.2	2.8	3.4	11.3	4.3	6.6	5.1	10.4	4.4
2061	5	9.0	11.0	3.0	27.7	11.1	9.1	10.0	27.7	6.5	23.1	16.4	12.1	7.4	3.2	12.4	8.5	3.5	17.7	13.5	27.7	7.4	8.9	3.0	7.8	5.2	6.2	10.4	5.3
2061	6	9.3	11.7	3.6	33.7	9.1	12.8	7.1	9.2	5.0	8.0	8.8	15.2	9.4	4.2	5.3	13.7	33.7	7.0	26.3	19.5	7.2	6.9	10.0	16.6	3.6	10.0	11.5	20.1
2061	7	11.1	15.4	6.6	35.0	8.7	20.3	15.0	31.1	9.3	7.8	17.5	6.6	35.0	14.4	23.0	10.3	27.2	9.9	11.3	23.6	10.9	8.5	9.5	23.6	8.7	10.6	11.0	16.6
2061	8	11.9	14.0	3.2	37.0	6.8	10.1	9.8	5.1	6.4	16.2	7.4	8.9	9.8	16.0	3.2	37.0	11.7	12.1	12.4	34.1	17.9	15.6	18.9	20.4	25.0	7.7	8.1	15.2
2061	9	15.2	16.3	6.3	27.6	9.4	27.6	21.2	13.8	22.5	23.3	19.5	14.4	8.4	9.1	22.9	13.6	22.7	15.8	20.5	6.3	20.9	9.5	14.6	22.5	8.9	9.9	19.7	13.2
2061	10	7.7	8.8	1.7	23.4	23.4	9.3	6.8	6.8	8.2	4.9	1.7	13.3	8.2	5.3	4.0	19.8	6.1	9.5	13.8	6.9	5.8	7.1	8.6	7.1	9.1	4.9	9.2	10.2
2061	11	6.5	8.0	0.9	21.0	5.8	9.5	15.7	8.7	6.3	14.7	11.9	9.2	3.3	5.0	5.6	6.7	13.6	4.3	4.5	4.3	8.8	8.8	7.8	0.9	4.1	4.8	21.0	6.2
2061	12	5.0	6.4	3.0	16.2	3.3	4.8	5.7	4.4	5.4	11.4	11.0	16.2	4.7	14.1	6.4	7.8	5.3	6.5	4.9	3.0	5.0	3.9	8.8	4.7	4.5	3.4	3.4	4.4
2062	1	5.3	5.7	2.2	12.2	12.2	4.1	5.0	2.6	8.4	2.3	2.2	6.3	5.2	5.0	7.0	6.3	6.4	2.6	6.6	7.8	9.9	3.9	4.4	5.7	8.9	5.5	4.2	4.4
2062	2	5.3	5.3	1.2	14.9	1.6	5.6	6.1	5.9	6.0	4.8	7.5	6.2	3.2	5.6	5.2	8.2	9.0	6.7	2.4	3.1	5.1	5.3	14.9	1.2	4.7	1.8	1.7	4.4
2062	3	4.9	5.4	1.9	11.3	1.9	9.4	7.7	11.3	8.9	3.8	6.2	4.6	4.5	2.4	4.0	2.9	5.2	6.6	3.9	7.5	3.8	2.1	4.5	5.1	6.6	4.5	5.3	6.6
2062	4	6.5	6.9	0.7	18.2	6.6	2.5	1.8	7.9	6.6	0.7	8.1	5.1	6.8	5.5	4.4	6.2	3.0	7.8	7.2	6.4	9.6	6.3	18.2	9.1	9.6	4.1	17.7	4.2
2062	5	8.4	10.2	2.0	25.5	9.3	13.6	4.3	24.3	12.8	4.8	10.6	16.6	7.4	14.4	6.1	7.3	4.8	10.2	9.2	20.0	2.0	7.6	5.3	25.5	12.8	3.3	6.4	7.3
2062	6	13.3	13.7	4.7	24.3	4.7	19.7	20.4	15.6	7.9	14.9	12.0	21.7	12.7	8.7	7.1	18.2	14.6	9.2	12.1	11.1	16.9	24.3	13.9	11.9	18.0	14.7	9.4	8.2
2062	7	18.0	19.3	8.7	33.3	10.6	33.3	28.9	11.7	26.6	17.2	27.8	12.6	23.0	25.7	16.1	12.4	28.8	20.4	13.0	27.3	10.5	19.4	17.7	14.7	8.7	18.2	25.2	12.4
2062	8	13.0	13.8	5.8	31.2	12.1	7.5	18.0	8.3	22.7	26.6	9.7	8.9	12.9	16.1	6.8	31.2	13.8	15.4	5.8	17.5	13.1	11.2	13.9	14.0	14.0	12.1	10.6	8.8
2062	9	11.7	13.3	3.7	30.1	10.9	9.1	3.7	13.4	18.8	18.4	10.2	9.2	9.8	9.2	11.2	4.0	19.1	8.3	19.4	22.0	17.3	13.2	5.8	24.3	13.6	6.4	30.1	12.2
2062	10	7.7	9.2	3.3	22.4	6.9	10.5	17.9	4.4	6.4	5.2	3.3	5.8	3.8	11.8	8.5	22.4	9.9	4.9	8.8	17.7	5.0	17.1	7.7	4.9	12.5	7.7	7.0	10.8
2062	11	6.5	7.0	2.3	16.7	4.2	16.7	3.7	5.3	6.8	6.8	11.1	2.6	5.4	8.5	8.5	7.8	6.2	8.2	9.9	8.3	2.3	6.1	6.3	2.6	11.2	9.4	4.6	5.6
2062	12	4.4	6.6	2.1	36.6	8.8	11.0	4.0	4.3	2.7	3.9	3.9	6.1	3.9	5.0	5.8	4.2	5.9	4.4	6.5	3.8	6.4	4.2	8.2	2.1	36.6	3.1	9.7	3.2
2063	1	4.8	5.0	2.6	10.0	3.7	6.2	6.7	4.2	4.2	3.8	3.8	5.0	3.0	5.3	5.9	5.4	4.8	7.0	4.8	2.6	5.9	3.1	4.2	6.3	4.4	10.0	4.5	4.8
2063	2	5.1	6.6	2.0	26.8	5.8	5.0	4.0	5.0	6.9	4.9	5.1	5.2	5.5	2.8	2.5	6.5	2.0	3.3	3.3	14.0	4.3	3.5	26.8	8.8	5.3	6.8	10.9	11.1
2063	3	4.8	4.9	0.8	12.0	2.7	7.1	5.5	4.9	3.7	5.5	3.9	8.4	4.2	4.8	3.0	1.6	5.9	0.8	12.0	6.0	3.5	5.2	3.7	2.5	5.0	4.6	6.9	6.4
2063	4	5.8	7.0	2.4	16.4	9.4	6.3	5.1	16.4	5.1	6.3	5.4	14.0	4.4	2.4	5.0	9.2	10.8	4.4	12.8	8.6	9.1	4.1	6.7	5.8	5.3	3.0	5.7	4.0
2063	5	12.3	12.6	1.8	28.5	5.4	14.7	16.2	11.0	14.7	9.2	6.6	7.9	9.2	21.1	19.2	11.8	6.4	17.1	14.1	1.8	28.5	5.0	9.5	28.0	17.1	2.9	12.8	13.3
2063	6	12.8	15.5	6.3	28.7	21.4	10.9	28.7	6.3	12.7	9.8	16.8	11.0	22.2	6.7	11.8	28.0	11.8	8.3	11.7	11.5	14.7	19.4	25.9	10.9	18.9	17.8	21.8	12.8
2063	7	16.3	20.6	4.2	54.9	11.8	30.5	26.7	16.3	9.1	52.0	15.6	14.9	10.0	23.9	36.8	22.6	18.7	4.2	26.3	14.2	12.4	16.4	25.0	54.9	16.4	9.5	10.1	16.2

2063	8	15.6	17.9	5.4	39.4	8.8	19.5	32.3	16.9	14.2	22.1	16.8	8.7	14.9	29.1	39.4	16.2	14.9	10.3	12.2	5.4	8.5	22.5	26.9	12.9	12.3	30.8	18.9	14.5
2063	9	11.9	13.8	7.7	30.1	19.4	8.6	9.1	13.3	19.2	11.5	30.1	16.7	9.2	20.0	12.3	20.7	7.7	12.4	14.4	8.8	14.3	8.5	10.3	10.3	10.8	11.6	22.5	9.5
2063	10	7.3	9.0	3.3	23.6	4.8	8.1	7.4	4.9	4.3	8.4	11.5	6.7	4.0	9.6	18.3	16.1	7.2	3.3	6.3	9.4	11.0	5.8	14.6	4.8	4.5	5.4	23.6	15.1
2063	11	7.7	7.9	1.9	16.8	9.5	9.3	11.0	2.5	1.9	12.6	5.5	16.6	5.5	8.1	3.5	16.8	4.6	6.4	10.3	9.7	7.2	8.1	3.9	6.5	10.7	4.5	8.8	6.9
2063	12	5.2	5.4	1.3	10.4	9.0	6.3	6.9	2.9	10.4	1.9	6.4	4.6	4.4	3.1	5.7	6.2	5.4	4.4	4.8	6.9	5.0	5.1	5.1	5.4	7.4	1.3	3.9	6.1
2064	1	5.0	5.4	2.0	9.6	3.6	7.1	6.1	5.0	6.0	7.1	2.4	5.4	7.2	5.0	3.9	3.6	9.0	4.4	6.5	4.6	3.2	4.9	4.2	4.4	8.3	5.3	9.6	2.0
2064	2	5.1	5.5	2.5	15.4	15.4	5.7	5.4	3.9	5.3	2.5	3.0	7.6	3.7	5.9	2.6	3.9	3.8	6.4	6.8	3.9	4.8	4.1	11.9	6.0	5.6	4.6	3.5	5.7
2064	3	5.8	6.9	1.7	17.0	5.6	9.2	6.0	7.2	3.7	8.6	9.8	2.5	11.5	9.3	4.7	4.7	5.5	3.0	5.5	3.0	1.7	3.6	9.3	17.0	4.7	5.9	11.2	13.5
2064	4	5.1	6.2	2.0	17.7	13.0	9.4	8.0	3.8	9.8	4.1	4.2	17.7	4.1	2.0	6.7	2.3	7.8	5.7	2.6	7.2	5.2	5.0	8.7	3.3	4.3	6.4	3.3	5.1
2064	5	10.4	10.4	2.8	16.1	12.4	10.2	5.9	5.2	3.7	8.0	13.4	8.1	9.8	12.8	15.1	10.5	15.0	10.7	14.6	2.8	12.6	16.1	9.1	12.6	10.2	9.1	10.1	12.3
2064	6	10.9	12.6	5.0	27.7	9.4	10.8	7.7	11.8	20.1	9.0	27.7	10.5	12.9	7.7	14.9	9.9	21.6	17.9	9.7	16.7	5.0	12.4	5.9	22.2	11.6	11.1	6.7	8.9
2064	7	13.7	16.6	4.8	36.0	24.1	7.7	30.4	13.7	36.0	12.9	11.8	7.3	13.4	15.4	11.6	26.4	11.3	27.1	13.3	19.7	22.0	13.6	14.1	29.4	8.2	16.2	4.8	8.5
2064	8	14.0	17.3	6.1	39.6	9.5	9.8	39.6	15.1	36.5	25.3	7.4	19.7	10.2	6.1	10.9	7.1	11.6	18.1	10.7	20.5	18.2	10.3	22.5	13.0	24.0	33.0	7.2	29.3
2064	9	11.7	13.0	6.1	24.8	10.4	6.2	8.6	16.2	12.7	9.9	22.2	11.6	10.9	9.7	13.0	24.8	6.2	10.6	6.1	8.2	23.5	17.5	12.5	15.2	14.9	18.1	11.2	11.7
2064	10	7.5	8.3	2.3	18.4	9.3	3.1	10.9	11.1	8.2	6.5	7.2	10.2	12.8	9.3	12.0	5.6	7.5	7.4	6.0	7.6	4.5	6.0	6.5	18.4	2.3	8.4	6.9	12.8
2064	11	5.8	7.2	1.4	16.5	5.7	5.3	4.7	6.0	2.6	6.3	12.8	7.5	5.5	4.1	4.9	5.2	16.5	6.1	10.1	4.8	8.1	1.4	7.4	16.4	10.8	5.6	9.7	5.6
2064	12	6.7	8.0	2.8	31.5	5.7	6.3	5.6	3.0	4.2	17.1	2.8	8.0	3.6	8.4	8.0	7.5	9.6	3.6	7.0	31.5	11.1	5.0	7.7	9.0	4.0	16.2	3.9	4.2
2065	1	5.6	6.6	1.1	35.2	6.4	5.4	1.4	4.0	5.1	5.0	6.5	5.8	2.5	7.0	5.0	5.8	6.1	35.2	2.0	6.4	3.8	6.5	5.1	5.3	1.1	9.5	11.4	6.1
2065	2	5.4	5.8	2.4	15.5	5.6	13.3	2.4	3.1	6.0	7.6	5.5	2.5	5.5	8.2	5.4	4.3	3.9	15.5	7.0	4.8	5.0	3.2	5.3	3.8	5.7	3.8	5.2	7.7
2065	3	4.9	5.9	0.8	14.9	6.5	8.9	8.6	3.5	14.9	4.3	3.9	3.4	7.9	5.3	3.5	2.2	4.3	3.0	4.7	8.4	9.0	4.2	5.0	5.2	5.7	3.6	14.8	0.8
2065	4	4.1	6.1	0.7	17.5	4.1	4.4	3.5	17.5	3.1	2.8	2.6	4.6	4.1	2.4	3.6	5.5	17.2	7.9	13.3	1.1	2.4	12.3	13.1	5.8	2.6	3.6	0.7	8.0
2065	5	7.5	9.1	1.8	20.8	10.8	2.7	1.8	5.8	8.4	14.1	5.6	4.2	4.2	7.5	15.2	6.6	16.1	16.1	14.4	7.7	7.5	6.1	20.8	5.0	6.6	3.1	15.5	13.4
2065	6	10.1	12.8	3.6	39.9	7.9	20.1	13.2	9.0	10.9	9.9	23.1	9.0	12.9	9.1	14.2	22.2	7.7	11.6	8.6	39.9	5.2	3.6	10.3	6.3	12.5	8.6	3.6	29.0
2065	7	15.4	17.4	6.6	45.7	45.7	20.1	16.0	17.8	13.6	21.2	13.4	6.6	18.5	28.6	24.4	14.3	12.6	11.2	22.3	14.9	13.1	12.2	12.6	18.0	10.3	17.5	21.4	10.9
2065	8	12.9	13.7	3.8	33.6	11.4	27.7	11.5	10.0	12.9	9.3	5.3	13.7	12.9	14.5	11.0	11.2	13.5	9.3	20.1	19.5	8.6	14.1	21.1	13.3	14.3	33.6	3.8	7.5
2065	9	13.6	15.8	3.4	47.3	12.1	12.6	11.7	13.9	19.7	9.7	47.3	13.3	25.5	16.7	20.0	10.9	6.5	14.4	21.3	7.0	23.4	24.1	3.4	12.9	17.7	8.1	13.2	13.9
2065	10	7.0	7.6	2.0	20.3	2.4	5.7	3.6	5.6	20.3	3.8	8.5	8.4	6.3	3.2	9.8	4.0	4.2	13.5	7.6	8.3	5.9	11.2	2.0	4.4	7.8	13.9	10.3	10.9
2065	11	7.4	7.9	3.1	16.8	8.7	11.4	13.5	9.1	6.9	9.3	5.5	9.6	16.8	7.8	5.8	5.9	14.0	4.6	9.2	3.1	5.8	3.8	8.7	4.9	5.7	8.1	5.7	4.7
2065	12	5.9	6.0	2.5	11.3	9.6	11.3	5.8	3.5	5.2	7.9	4.0	4.9	6.8	11.1	6.7	6.0	6.5	3.3	2.5	9.6	5.4	2.8	2.5	7.9	2.7	7.2	6.2	4.6
2066	1	4.9	6.4	1.9	27.4	4.6	6.2	4.9	5.3	5.3	4.4	6.4	12.1	3.7	3.6	8.4	3.9	1.9	4.5	4.7	3.7	4.9	27.4	8.0	3.0	3.1	7.4	9.7	6.8
2066	2	5.3	5.6	1.9	13.0	4.8	6.4	5.8	5.2	3.0	2.0	3.1	13.0	11.0	4.7	1.9	2.6	6.0	6.1	5.5	3.5	2.4	5.7	4.8	2.9	11.8	7.7	6.2	9.7
2066	3	5.0	5.1	1.1	14.2	2.8	5.3	5.9	4.7	3.8	8.9	4.3	1.8	6.6	1.9	1.1	3.6	6.3	1.8	5.4	14.2	5.8	4.4	2.6	8.2	7.2	4.6	5.8	5.3
2066	4	5.9	6.2	0.7	12.9	5.9	5.8	8.8	3.8	5.0	1.6	11.4	3.9	6.3	1.7	5.2	9.4	3.6	6.4	7.6	11.5	5.7	12.9	0.7	6.8	3.4	6.4	10.5	5.0
2066	5	10.5	12.1	2.4	27.6	27.6	11.2	17.1	27.3	10.4	6.8	10.6	3.3	12.7	9.3	7.6	9.1	9.4	7.1	14.3	22.8	7.0	2.4	15.0	17.0	6.8	15.3	10.8	8.9
2066	6	15.8	16.2	5.4	38.0	10.5	24.9	22.2	26.5	17.5	16.7	19.0	15.4	8.2	38.0	16.1	13.7	13.5	11.8	18.6	12.0	7.9	5.4	11.9	22.8	20.4	6.2	13.3	16.8
2066	7	10.8	16.7	6.5	36.8	28.0	30.8	6.5	9.8	7.8	7.0	8.2	7.3	32.0	36.3	7.6	36.8	35.2	10.3	12.9	15.1	22.6	25.9	11.3	12.9	10.2	10.4	8.3	8.4
2066	8	14.3	17.5	6.3	68.5	9.4	13.7	21.6	15.1	15.2	15.4	14.9	9.9	9.0	7.0	7.5	15.7	20.7	29.5	10.5	8.3	58.4	7.8	21.3	12.2	6.3	68.5	16.2	6.7
2066	9	11.9	12.3	2.6	21.6	17.1	11.5	2.6	12.0	8.6	17.0	21.6	15.3	12.8	7.7	5.8	7.2	19.1	8.5	19.5	9.5	11.9	13.2	4.4	18.8	13.5	10.2	18.9	7.8
2066	10	7.8	8.1	1.5	14.6	5.0	7.6	1.5	5.4	14.4	9.3	4.5	13.1	7.9	3.1	9.8	11.1	12.6	5.5	9.2	9.5	7.2	8.7	14.6	6.9	10.8	3.2	6.6	7.5
2066	11	7.2	7.0	1.6	12.5	7.5	7.9	3.3	11.1	6.4	5.9	1.6	4.9	6.3	3.4	9.4	4.4	9.0	5.8	7.1	10.5	11.0	3.1	9.0	8.5	12.5	2.6	7.4	8.5
2066	12	6.5	6.0	0.9	12.9	2.7	4.7	6.7	9.0	4.7	3.8	7.6	3.1	9.2	4.2	6.8	6.5	6.8	9.9	8.2	7.1	6.6	4.6	7.1	2.9	4.6	4.2	0.9	12.9
2067	1	4.3	4.7	2.7	11.3	5.8	3.6	3.6	5.8	4.2	3.2	5.0	3.5	4.3	3.4	3.0	3.7	4.7	4.4	4.5	11.3	7.4	6.2	3.7	5.4	4.7	5.1	4.2	2.7
2067	2	4.4	5.3	2.0	14.6	4.3	6.3	4.2	4.5	2.4	2.0	14.6	6.8	4.1	7.9	4.9	6.9	2.8	4.7	2.1	2.7	7.0	3.6	7.9	7.3	3.5	3.3	4.2	8.6
2067	3	5.3	5.8	1.9	12.3	11.9	1.9	2.2	2.1	6.5	5.7	5.5	4.1	8.2	4.4	3.1	6.1	10.4	12.3	9.1	5.8	4.0	3.8	9.8	5.0	2.0	4.3	4.5	6.2
2067	4	6.0	6.9	2.0	15.1	5.1	10.0	7.4	3.1	8.7	4.0	4.3	7.7	3.3	2.0	6.8	15.1	12.2	10.1	6.1	2.7	3.6	4.6	14.4	5.0	5.9	4.6	11.2	6.4
2067	5	9.9	11.7	4.0	30.3	8.2	9.0	30.3	4.0	7.1	9.5	12.2	7.4	6.5	9.8	7.4	11.4	4.5	15.9	12.0	4.0	10.8	18.3	10.1	26.5	9.6	20.4	16.5	10.3
2067	6	9.6	11.6	4.5	26.1	17.0	9.4	7.0	9.2	15.8	13.3	10.2	6.9	5.3	8.1	26.1	4.5	24.4	5.7	23.3	14.2	14.1	9.8	5.1	15.1	8.2	4.8	8.0	13.6
2067	7	12.5	15.4	3.1	50.4	21.9	22.3	9.9	11.0	7.6	25.9	8.4	4.9	7.3	50.4	17.3	17.0	22.5	14.3	11.5	13.6	9.1	8.0	9.6	16.9	7.8	3.1	24.1	24.5
2067	8	14.6	17.9	5.0	50.4	16.2	9.5	22.5	9.5	19.1	27.6	7.3	13.6	14.6	13.8	5.0	19.4	12.1	48.3	9.4	8.4	21.8	14.6	14.7	50.4	16.2	11.8	19.6	23.4
2067	9	13.0	13.5	5.3	29.4	5.3	23.5	18.6	6.8	15.7	8.3	9.7	10.7	8.1	13.1	14.8	7.9	13.6	15.5	6.7	29.4	12.9	18.1	7.0	11.0	11.5	18.1	23.5	15.3
2067	10	7.2	8.1	2.7	16.1	5.9	8.5	10.4	4.7	8.3	6.3	4.0	4.9	15.9	8.2	5.3	11.7	16.1	5.9	4.6	2.7	6.6	5.7	12.3	14.6	8.2	6.7	7.7	8.4
2067	11	6.1	7.2	1.2	20.9	3.8	5.8	1.2	7.7	2.7	5.3	12.0	4.9	5.0	4.4	6.0	4.9	8.6	11.0	10.0	20.9	7.1	6.7	11.2	6.1	8.3	7.7	6.0	5.1
2067	12	5.5	6.0	2.0	16.0	6.5	6.1	7.1	5.0	7.1	3.5	5.3	9.7	6.3	2.7	2.4	5.4	11.0	10.0	2.5	5.1	16.0	2.0	5.1	5.0	5.9	7.3	2.5	5.5
2068	1	4.7	4.9	2.0	9.8	5.8	3.1	2.4	6.0	4.8	2.7	5.0	9.8	3.8	2.5	3.7	4.2	4.0	6.7	2.0	5.9	6.7	3.2	4.8	6.3	6.9	9.8	3.6	4.7
2068	2	3.6	4.0	1.1	7.1	5.4	6.3	2.7	2.4	4.0	4.5	6.4	3.4	2.7	3.2	4.2	3.8	1.1	2.3	4.8	3.5	3.2	5.6	3.1	3.3	4.1	2.6	7.1	5.7
2068	3	5.4	5.7	1.9	13.5	3.5	5.7	7.4	2.8	5.2	7.5	10.6	7.3	1.9	3.5	7.5	2.4	3.9	7.7	4.3	2.0	6.8	6.7	5.0	3.9	8.1	4.5	6.0	13.5
2068	4	6.8	7.3	1.2	17.0	5.6	7.2	16.0	6.4	5.4	5.7	13.3	8.9	3.1	2.2	9.3	3.0	4.3	10.6	2.5	8.7	2.9	8.9	17.0	1.2	8.8	7.8	12.3	4.2
2068	5	8.8	9.8	2.1	21.4	8.0	13.4	8.6	13.3	3.7	6.5	7.0	20.5	9.0	2.8	13.0	2.1	11.1	13.0	7.9	8.3	6.0	16.7	7.7	21.4	10.1	9.8	3.5	12.1
2068	6	14.0	15.7	5.3	42.0	17.2	11.4	9.0	6.8	13.7	20.0	17.9	17.8	8.2	14.2	5.3	6.4	27.2	14.4	6.6	19.7	15.9	22.2	37.7	7.7	12.5	10.4	13.3	42.0
2068	7	14.8	16.9	4.9	37.6	27.6	15.0	12.3	16.5	37.6	11.0	9.4	8.9	30.3	13.7	15.3	11.0	6.5	14.9	8.9	12.0	35.7	20.4	29.4	15.1	14.6	4.9	6.7	29.0
2068	8	16.4	18.7	4.6	40.2	27.3	9.4	15.8	24.0	11.8	5.7	20.8	27.7	8.1	13.7	4.6	27.0	28.3	16.6	16.2	14.2	40.2	14.2	13.1	30.0	19.3	37.5	19.1	4.6
2068	9	17.4	17.2	5.7	30.0	22.2	14.9	23.9	20.5	10.2	27.7	8.2	13.5	16.9	19.7	30.0	9.2	23.5	13.6	22.5	11.3	14.1	5.7	14.0	9.1	18.0	17.9	18.1	27.0
2068	10	6.5	6.9	3.1	14.0	3.9	3.3	7.1	7.8	9.8	8.1	7.7	3.8	5.3	9.6	5.6	6.3	11.4	6.4	8.1	4.3	3.1	6.7	10.0	4.6	14.0	5.8	8.1	4.3
2068	11	6.6	7.1	3.1	12.9	3.8	3.8	11.9	9.0	3.3	8.4	6.8	12.7	7.7	10.6	8.4	3.9	3.1	5.4	6.3	3.8	3.8	10.9	4.9	12.9	9.4	5.2	9.0	4.5
2068	12	5.7	5.6	2.5	11.5	5.8	8.7	5.3	7.5	11.5	8.2	5.9	5.4	5.9	6.1	8.3	2.5	3.3	4.5	2.8	8.1	6.0	3.9	2.5	6.3	4.1	5.6	3.9	3.0
2069	1	5.0	5.9	2.5	13.4	9.3	4.7	5.2	4.2	4.9	3.3	4.3	6.5	5.4	3.1	6.8	12.0	2.6	4.7	5.0	6.8	2.9	10.2	13.4	5.6	4.2	4.5	8.9	2.5
2069	2	4.1	4.9	0.0	15.4	2.6	6.3	5.3	1.4	4.3	3.5	10.9	5.3	6.2	6.2	7.7	15.4	3.4	2.5	3.9	1.6	2.5	4.6	1.5	10.2	3.9	5.6	0.0	2.7
2069	3	4.1	6.2	2.3	16.2	4.3	3.1	3.7	3.4	16.2	3.4	10.5	2.9	3.1	2.6	3.4	2.4	5.4	13.8	4.9	14.7	9.1	10.7	3.5	4.5	12.9	3.9	5.2	2.3
2069	4	4.9	5.6	1.4	13.6	5.9	6.3	10.8	4.0	1.4	2.8	13.3	5.6	4.7	3.8	4.1	7.1	1.7	3.8	2.1	1.6	6.8	3.2	13.6	4.5	6.9	5.1	6.0	10.4
2069	5	9.6	10.9	2.6	22.3	8.6	7.7	16.1	17.2	11.4	5.7	15.1	10.5	10.0	7.4	11.0	19.7	8.8	6.4	15.4	22.3	10.5	9.1	6.0	5.6	20.8	4.7	8.3	2.6
2069	6	11.1	12.8	6.0	31.2	10.4	8.2	6.3	23.1	12.2	8.7	17.2	17.0	7.9	13.0	9.9	13.1	8.6	22.0	6.0	10.8	8.2	9.0	31.2	12.9	16.0	18.7	6.4	11.4
2069	7	12.2	14.2	4.5	35.9	31.9	20.2	4.6	12.0	35.9	4.5	7.0	14.9	11.1	9.2	12.4	15.7	26.5	6.2	19.2	10.2	6.1	9.7	17.8	15.4	6.4	13.8	18.9	10.1
2069	8	14.3	20.1	4.2	58.0	28.0	13.8	8.5	10.9	35.4	13.9	4.5	26.8	24.2	34.1	12.6	13.8	13.1	12.1	18.4	58.0	14.6	13.3	18.4	4.2	13.0	38.2	21.7	29.8
2069	9	13.2	13.7	5.5	30.1	15.8	14.1	8.5	5.5	7.9	5.8	25.5	12.3	11.5	18.2	7.2	28.5	10.1	6.3	21.4	5.5	17.7	16.8	6.9	6.1	14.7	18.3	30.1	14.9
2069	10	7.2	9.5	1.4	21.7	10.3	6.2	17.5	7.1	21.7	6.4	4.2	6.3	13.2	9.9	5.8	16.3	15.7	7.3	5.3	1.4	5.3	18.0	12.7	15.1	2.9	2.7	13.8	3.6
2069	11	5.6	6.9	1.8	17.6	3.8	7.8	9.3	1.8	8.8	9.5	15.9	4.0	2.8	11.1	6.3	3.4	5.1	5.2	4.7	5.4	4.1	17.6	8.2	8.9	5.8	3.7	3.2	10.3
2069	12	4.6	5.2	1.8	10.4	7.8	2.2	7.8	6.7	4.3	6.0	4.1	3.6	5.4	3.0	2.7	4.2	1.8	3.5	9.9	4.9	5.9	5.9	8.5	5.4	3.9	2.6	4.2	10.4
2070	1	4.4	4.6	1.7	10.5	4.7	2.9	1.7	6.1	4.5	6.4	2.5	6.1	5.0	3.6	1.8	3.4	7.8	7.5	3.1	4.2	10.5	3.2	2.8	5.2	4.3	4.9	3.2	4.4
2070	2	4.0	5.0	1.5	11.5	3.2	3.3	5.2	2.0	2.9	3.1	9.7	4.1	4.7	8.9	2.4	9.9	2.1	6.4	2.1	6.2	4.0	3.4	10.5	2.3	5.4	1.5	5.7	11.5
2070	3	4.1	5.3	1.5	14.6	4.1	6.2	5.8	3.6	4.2	14.6	2.0	4.0	3.9	8.7	9.3	13.3	2.7	1.5	4.7	2.6	4.8	3.2	1.5	2.1	2.8	3.0	7.8	9.6
2070	4	6.5	7.6	2.3	17.6	5.1	16.2	6.5	10.4	11.6	5.4	9.1	2.3	6.9	7.9	5.9	5.7	4.2	7.4	4.6	10.6	5.4	10.4	3.0	6.4	3.0	10.5	17.6	5.2
2070	5	12.4	13.3	2.0	44.1	2.0	15.2	14.1	12.3	4.8	19.3	7.7	11.5	12.6	6.5	15.3	6.7	5.2	14.1	16.9	16.5	21.8	9.2	20.5	5.4	44.1	10.7	19.5	7.3
2070	6	12.2	14.5	2.8	30.6	13.6	30.6	24.6	10.8	10.6	8.1	16.1	5.8	6.7	16.9	13.8	11.9	7.8	12.5	8.1	10.2	8.1	22.8	20.9	2.8	14.3	11.6	29.9	28.6
2070	7	14.8	17.8	3.8	56.1	56.1	19.1	10.3	39.5	16.7	10.0	29.0	3.8	7.9	30.8	28.0	18.0	11.9	7.4	8.1	21.6	16.1	10.4	18.3	13.5	11.5	11.1	7.1	20.1
2070	8	14.0	16.5	4.3	35.0	4.3	10.0	13.7	7.9	6.3	9.5	10.8	15.9	21.3	8.6	13.7	25.9	14.3	22.5	9.6	35.0	17.2	23.2	25.0	10.3	28.9	21.2	30.8	9.8
2070	9	12.5	14.2	3.3	27.7	27.7	13.9	10.3	5.4	11.2	19.6	16.0	21.9	6.1	24.3	6.1	23.4	3.3	16.9	7.6	10.1	24.8	7.4	10.4	21.7	11.1	16.2	9.6	15.3
2070	10	8.9	10.2	1.2	21.7	20.4	9.4	15.5	6.4	5.5	10.6	15.9	19.2	6.4	8.6	8.8	4.6	9.0	8.3	6.8	10.7	3.9	10.0	1.2	21.7	15.6	13.8	6.5	5.1
2070	11	6.4	6.7	3.2	10.9	8.0	4.7	3.2	5.2	5.7	10.9	7.7	8.7	4.7	5.3	7.9	3.9	8.4	7.1	6.0	5.0	8.0	6.5	4.0	9.4	9.4	5.0	10.2	6.3
2070	12	4.7	4.9	2.4	8.6	5.7	4.7	3.8	4.4	5.1	4.2	4.7	4.7	6.6	5.3	7.7	4.8	6.8	4.2	3.4	4.2	8.6	5.7	3.2	3.9	4.3	3.7	2.4	5.4
2071	1	5.3	6.6	2.0	23.6	5.7	9.8	4.7	4.6	5.9	3.7	4.4	3.7	4.4	6.6	5.0	8.5	9.8	4.7	11.5	5.5	9.1	5.3	2.0	6.3	23.6	4.9	5.3	4.5
2071	2	5.6	5.7	2.2	13.1	2.2	4.5	4.0	7.9	5.8	4.3	6.8	5.8	10.8	6.2	5.5	6.4	5.1	3.6	3.1	6.2	5.1	2.7	6.3	7.2	5.4	13.1	4.0	5.9

2071	3	5.1	6.3	2.5	21.5	9.4	10.7	2.5	7.2	4.3	11.0	21.5	4.0	3.2	7.5	3.3	4.7	5.5	2.5	9.9	5.7	3.5	3.0	3.2	2.8	7.4	3.5	9.5	5.9
2071	4	6.9	7.9	1.5	24.3	10.1	17.3	7.8	13.3	1.5	3.3	5.7	24.3	4.2	14.6	3.7	6.3	2.9	5.0	3.7	7.6	6.7	14.3	8.8	7.2	7.1	1.7	5.3	7.9
2071	5	10.3	11.8	3.5	38.5	4.1	13.4	6.0	23.0	13.2	9.4	8.1	6.1	10.1	11.2	5.3	15.8	12.4	6.8	9.3	7.5	10.5	5.3	10.5	38.5	18.3	17.2	16.6	3.5
2071	6	13.0	17.2	6.9	41.6	11.8	15.4	19.8	41.6	32.2	13.4	28.7	9.0	7.5	15.1	12.5	6.9	31.6	8.3	11.2	18.6	22.4	11.6	26.3	11.1	8.8	11.2	26.6	11.9
2071	7	13.3	16.8	4.7	40.5	14.7	18.5	8.3	7.8	36.3	8.8	13.2	12.9	12.0	12.2	16.6	13.0	16.2	4.7	31.2	16.0	40.5	8.9	11.8	13.3	30.6	19.0	9.7	26.3
2071	8	19.3	19.3	4.6	48.2	25.7	22.4	20.5	48.2	32.7	14.6	27.6	12.8	21.2	7.1	10.8	8.4	29.0	14.6	11.5	8.9	14.6	18.0	21.5	25.1	30.1	24.2	9.0	4.6
2071	9	10.9	11.6	1.6	24.6	6.9	23.0	24.6	10.0	13.2	22.4	10.1	4.0	5.9	14.1	5.1	15.2	6.1	15.0	17.6	6.8	1.6	12.9	7.8	6.6	15.0	11.6	18.3	4.5
2071	10	8.1	9.4	1.7	19.7	14.4	7.5	16.2	8.2	9.0	7.8	9.3	7.2	12.7	16.1	5.0	12.9	5.8	4.6	19.7	13.4	7.4	5.2	8.1	6.2	10.5	1.7	5.6	11.3
2071	11	7.9	8.1	3.8	16.2	3.9	11.0	7.6	5.6	9.2	5.6	10.3	11.1	9.8	10.4	4.3	7.3	8.7	8.2	10.2	5.8	13.5	3.8	6.1	16.2	6.5	5.4	9.1	6.0
2071	12	5.4	6.0	2.1	20.6	5.3	6.4	4.6	6.2	8.0	4.0	10.3	2.1	4.6	2.7	6.3	6.3	5.4	9.4	3.6	4.1	6.8	5.7	3.0	2.6	7.3	3.3	20.6	5.0
2072	1	5.6	7.3	1.0	38.6	5.7	4.0	7.1	4.1	3.3	10.9	6.0	4.9	2.6	9.2	10.4	3.3	4.8	6.5	18.6	6.4	5.5	2.5	38.6	5.7	4.1	1.0	6.1	4.3
2072	2	4.2	4.9	2.1	11.8	6.9	3.8	2.1	4.2	5.9	2.8	10.8	3.4	6.1	5.4	3.6	3.5	2.7	6.7	5.9	3.6	4.1	3.6	11.8	4.2	5.3	3.9	4.9	3.1
2072	3	6.3	6.4	1.2	16.1	4.4	6.0	6.8	4.4	10.4	6.8	1.2	4.5	4.4	9.3	6.8	16.1	9.9	12.2	2.9	3.7	6.6	2.1	8.6	6.9	4.4	4.8	7.0	4.3
2072	4	5.5	7.5	2.6	21.3	20.5	3.5	6.8	4.8	4.5	2.6	21.3	16.8	5.9	12.7	3.8	4.8	7.5	5.6	5.4	4.9	6.4	4.0	10.9	4.3	3.1	8.0	8.7	3.6
2072	5	10.2	12.0	3.7	28.6	28.6	14.8	6.6	23.7	9.8	4.0	4.9	16.9	6.3	9.2	13.2	15.8	6.2	4.2	15.9	4.2	14.6	4.5	17.5	23.7	18.1	10.6	9.9	3.7
2072	6	11.9	12.7	2.6	26.2	13.7	19.1	9.0	16.6	17.7	15.8	4.5	7.8	11.6	12.7	26.2	25.1	7.2	2.6	9.0	9.4	16.1	6.3	15.3	10.8	5.4	8.8	21.9	12.2
2072	7	17.7	19.6	6.7	52.5	22.5	52.5	17.6	17.3	13.5	9.9	10.4	17.9	12.3	30.4	27.7	18.3	12.2	18.9	10.4	30.0	9.5	29.4	17.9	10.9	6.7	36.8	13.2	25.2
2072	8	12.9	15.0	5.9	47.8	11.8	14.4	11.2	5.9	21.3	12.1	9.7	9.2	14.5	8.2	7.8	19.8	47.8	12.4	22.9	24.9	17.2	6.6	13.3	8.3	22.2	15.6	16.1	6.8
2072	9	15.9	16.7	3.2	44.7	8.1	16.2	14.3	24.3	17.9	16.3	21.0	26.8	15.9	15.7	10.6	28.7	44.7	22.8	3.2	8.1	3.4	17.3	15.9	10.9	8.9	8.3	27.4	14.8
2072	10	7.1	8.7	4.2	25.0	4.6	6.6	13.3	6.2	6.0	4.2	8.8	9.3	6.6	5.5	8.3	4.4	14.2	6.3	25.0	10.8	13.2	13.9	6.0	7.5	8.3	4.2	6.3	9.4
2072	11	6.8	8.1	1.6	19.9	6.3	7.9	15.4	6.8	6.2	7.0	6.4	4.3	7.1	6.8	19.9	5.4	8.5	16.7	14.1	5.5	1.6	5.8	6.7	5.8	4.2	8.3	9.0	8.6
2072	12	6.0	6.8	1.5	18.7	6.8	4.0	5.8	3.9	18.7	3.7	4.2	9.6	4.1	4.0	7.2	9.0	4.9	3.2	11.9	7.6	11.7	1.5	7.1	6.3	10.7	3.2	8.5	4.7
2073	1	5.0	5.3	1.3	10.6	6.8	8.5	1.8	3.5	10.6	10.2	2.8	4.9	2.2	2.9	2.6	6.6	2.2	5.1	6.5	7.2	7.3	6.1	8.4	4.0	6.4	4.2	1.3	4.8
2073	2	4.6	4.7	1.5	9.3	4.6	3.9	6.4	5.9	1.5	3.5	4.6	6.0	9.3	6.4	5.2	4.7	1.5	3.9	2.3	6.5	2.3	4.0	6.3	5.7	4.5	3.7	3.3	7.1
2073	3	5.8	6.0	1.1	12.8	6.4	12.8	4.4	7.0	10.1	7.0	2.1	3.0	8.6	6.8	2.4	3.1	1.1	10.4	8.2	3.0	5.1	5.3	10.4	5.8	10.7	2.3	5.7	3.2
2073	4	4.2	5.6	0.9	17.2	17.2	4.6	6.7	2.9	2.8	0.9	6.0	10.4	3.7	3.3	8.8	6.3	5.6	3.6	3.0	1.9	3.8	14.2	2.3	4.8	6.1	0.9	3.0	10.9
2073	5	7.2	9.9	4.3	19.4	7.1	11.5	7.3	6.5	4.9	5.7	5.6	7.4	5.6	7.1	6.9	16.5	13.2	5.3	17.3	5.1	14.0	17.7	15.3	12.0	4.3	16.5	19.4	4.6
2073	6	12.9	14.8	5.5	33.4	12.8	33.4	25.3	6.3	9.4	19.4	9.4	9.2	15.9	24.5	14.8	5.5	17.0	8.7	13.0	5.6	11.0	32.4	14.7	23.3	10.1	7.3	19.1	6.2
2073	7	14.7	18.9	6.3	73.9	11.3	25.1	14.6	10.4	21.0	13.8	73.9	32.0	12.6	9.0	6.3	29.3	20.1	10.7	14.9	6.4	15.3	16.4	13.1	9.1	10.2	30.5	27.1	21.5
2073	8	15.2	17.8	5.3	65.7	25.4	9.1	15.9	19.0	17.4	8.7	12.7	10.1	11.2	19.1	7.8	16.0	10.7	10.2	13.7	32.1	17.2	27.6	65.7	5.3	14.5	9.7	19.2	29.6
2073	9	14.3	15.2	4.7	31.0	12.8	11.0	6.0	15.5	16.5	26.2	16.0	18.5	23.4	18.4	17.2	9.9	31.0	9.4	24.5	12.8	12.7	19.5	15.8	9.3	11.6	9.4	4.7	13.0
2073	10	7.8	9.3	3.3	21.3	7.5	4.9	5.1	4.6	5.4	7.8	10.1	20.0	21.3	8.6	5.5	14.7	12.7	9.4	7.8	3.4	19.0	3.3	6.1	14.8	10.6	4.3	7.1	9.4
2073	11	6.7	7.3	2.6	21.7	6.1	10.9	3.1	5.9	10.9	4.6	9.7	8.7	2.6	8.7	7.4	5.1	4.2	6.7	21.7	4.7	6.5	9.0	7.8	6.7	4.0	4.1	6.9	9.2
2073	12	6.1	6.2	2.2	10.2	3.5	5.4	6.8	6.1	4.0	5.6	7.2	7.8	5.2	6.8	6.3	3.7	9.0	2.2	5.9	4.7	7.0	10.1	6.1	9.0	2.6	10.2	7.2	5.2
2074	1	5.5	5.6	2.0	16.5	5.5	8.7	16.5	7.1	5.6	2.0	6.8	3.0	4.3	4.1	8.2	2.8	2.8	5.6	6.9	4.1	3.7	5.8	2.3	4.4	5.6	7.2	8.6	3.5
2074	2	4.4	4.8	1.3	14.5	3.9	4.8	2.7	2.3	4.4	5.6	1.3	5.6	7.3	4.5	3.8	4.3	3.4	4.9	9.7	3.6	4.3	1.9	14.5	3.7	4.5	4.2	5.7	5.6
2074	3	5.8	6.3	1.3	15.5	1.3	3.0	3.7	6.8	6.1	4.5	15.5	10.0	3.3	4.6	7.1	7.5	4.3	5.0	12.7	4.0	5.6	8.9	6.7	8.1	3.7	6.0	7.5	5.5
2074	4	6.1	7.3	2.8	20.4	9.4	5.4	10.7	11.0	6.7	3.3	5.6	6.3	4.2	6.2	3.0	2.9	2.8	3.9	4.5	11.8	4.2	7.5	17.7	20.4	6.1	5.6	9.5	7.6
2074	5	11.9	12.5	2.9	22.5	6.1	13.2	18.4	22.5	9.7	10.1	12.2	19.0	2.9	13.2	9.7	19.5	16.5	10.7	11.2	6.9	11.6	12.2	21.5	15.5	6.8	13.2	10.6	6.0
2074	6	12.7	16.0	4.5	41.5	6.1	12.2	16.5	18.4	6.7	32.9	18.5	20.7	11.2	8.1	6.1	11.0	26.0	9.7	5.0	4.5	22.3	13.2	41.5	26.7	38.1	8.1	6.6	13.3
2074	7	14.8	16.5	4.4	47.3	19.9	22.6	10.7	13.1	14.5	15.1	47.3	17.2	9.5	8.9	16.0	9.0	8.2	15.9	17.5	20.0	11.3	45.5	18.9	20.0	7.9	4.4	8.8	13.4
2074	8	14.5	19.2	5.7	78.5	17.9	8.7	10.4	6.5	31.4	78.5	16.7	14.5	5.7	39.4	22.4	16.1	37.1	12.5	14.6	14.6	32.0	22.2	11.0	8.7	7.7	13.8	10.7	7.7
2074	9	15.0	15.4	3.0	34.4	8.6	24.9	3.0	24.7	27.7	19.4	19.8	34.4	18.6	12.1	7.4	10.4	5.9	14.9	15.7	10.4	12.0	5.8	9.8	15.0	17.8	17.8	26.6	6.3
2074	10	8.6	9.1	2.9	16.5	16.5	16.2	11.6	2.9	8.0	8.1	10.1	10.3	4.5	8.7	11.9	4.8	4.8	3.0	3.9	8.4	8.1	10.8	12.2	6.3	6.1	13.0	15.8	13.0
2074	11	6.8	7.7	3.4	15.8	11.3	4.7	5.6	8.5	7.8	15.1	5.9	9.9	8.2	9.2	10.5	3.4	5.7	3.8	5.7	7.0	8.6	5.3	6.3	5.8	5.3	6.5	15.8	9.4
2074	12	5.1	6.1	1.2	16.2	5.8	10.7	3.0	3.9	5.7	1.2	10.5	3.9	7.9	6.9	7.3	3.8	8.9	5.9	4.5	4.3	16.2	2.3	4.1	9.4	4.1	4.2	3.7	8.9
2075	1	5.2	5.5	2.5	12.4	6.9	6.2	4.0	4.1	4.9	3.6	6.3	12.4	3.9	5.7	5.9	4.0	8.7	6.2	4.2	9.8	7.0	7.1	5.1	2.5	3.1	5.2	3.6	2.5
2075	2	5.1	6.4	2.0	32.2	6.4	5.2	3.3	7.7	5.5	6.0	5.9	2.7	3.6	7.9	2.0	2.8	9.1	12.8	3.8	3.9	4.5	3.7	3.7	2.1	5.4	4.9	32.2	9.4
2075	3	5.5	6.7	1.5	14.8	12.6	4.8	13.0	4.7	4.3	3.0	7.6	14.8	5.1	7.8	6.4	1.5	3.3	8.2	5.7	3.8	5.4	5.6	8.8	4.2	14.2	4.0	8.9	3.2
2075	4	7.1	8.1	2.0	23.5	11.4	8.2	15.1	3.6	6.5	12.8	7.3	5.1	4.4	2.0	4.1	11.9	7.6	2.8	2.9	2.3	9.1	14.3	8.3	23.5	6.5	6.7	6.8	11.7
2075	5	10.1	10.3	4.3	18.1	11.6	14.1	7.4	11.0	9.7	16.4	4.6	5.1	10.1	5.8	4.3	18.1	4.9	15.8	5.8	4.8	5.1	10.8	17.4	16.4	17.1	11.3	9.5	10.1
2075	6	10.2	13.9	4.0	33.2	8.1	24.3	7.6	19.5	17.7	8.2	33.0	8.7	4.0	4.4	9.8	16.2	7.1	15.6	18.1	33.2	7.4	6.6	12.4	9.9	17.2	7.5	25.7	10.5
2075	7	16.2	19.0	8.3	38.2	19.9	12.2	9.1	17.4	25.2	10.5	35.2	32.2	35.2	11.3	16.9	19.4	12.2	14.3	15.5	12.8	11.2	14.0	8.3	32.3	14.3	21.1	17.0	38.2
2075	8	13.7	18.6	5.7	61.6	8.6	11.6	8.7	14.4	6.1	19.2	8.9	21.4	22.4	10.5	14.7	5.7	57.9	61.6	32.2	11.4	13.6	18.6	13.3	13.8	13.2	30.4	9.7	19.3
2075	9	15.9	16.2	5.2	31.1	19.8	31.1	5.4	13.6	5.5	11.3	30.6	19.6	7.0	18.8	16.7	10.2	13.7	5.2	15.4	19.2	28.8	19.4	10.5	16.0	20.1	8.6	26.2	15.8
2075	10	6.8	8.5	4.0	17.3	13.9	5.9	10.9	5.1	4.3	9.2	5.0	15.9	6.6	9.5	6.6	9.0	17.3	5.4	5.6	10.3	4.2	6.0	4.0	7.9	6.8	6.9	15.7	11.2
2075	11	7.1	7.1	1.9	14.4	4.8	4.9	3.7	5.1	6.9	8.7	5.5	7.3	14.4	2.3	10.0	8.7	4.5	11.4	7.5	8.7	3.9	10.2	6.8	1.9	8.0	11.4	7.5	5.7
2075	12	5.7	7.0	1.9	25.2	4.0	4.9	5.9	3.4	3.0	3.3	6.9	6.1	5.7	5.7	25.2	16.3	4.8	8.4	1.9	8.4	4.2	4.6	5.7	9.2	11.0	10.4	6.3	3.7
2076	1	5.0	5.2	2.1	11.4	6.3	11.4	4.8	3.0	4.3	2.5	6.3	5.9	2.7	9.9	5.5	7.0	4.5	5.6	6.5	6.4	3.7	2.1	4.4	3.0	3.1	5.2	4.1	5.8
2076	2	4.6	5.4	0.9	16.9	5.1	4.6	3.7	4.3	4.6	6.3	4.6	4.9	6.1	5.8	4.3	7.4	2.4	3.2	3.7	3.1	0.9	2.7	7.2	1.0	6.5	3.1	16.9	16.9
2076	3	4.7	5.5	1.7	13.5	4.1	5.0	3.7	7.1	4.7	10.1	4.2	8.4	3.0	8.1	8.4	5.2	4.1	4.6	13.5	4.2	1.7	6.9	5.9	1.7	3.3	4.4	7.2	3.0
2076	4	4.7	6.2	1.7	17.8	4.1	4.3	4.3	5.2	8.2	11.0	4.6	5.2	8.3	3.6	2.3	5.7	4.3	2.8	1.7	14.0	2.2	2.7	4.9	8.4	13.5	3.0	17.8	7.4
2076	5	8.1	9.2	4.1	24.4	7.3	4.1	24.4	4.1	4.9	19.2	14.2	6.4	5.5	9.3	4.5	12.6	8.6	5.5	9.2	16.5	7.9	9.9	5.3	8.3	7.1	9.4	9.6	6.4
2076	6	13.0	13.6	3.0	32.5	18.1	32.5	14.1	13.4	5.3	12.1	9.1	11.3	12.5	7.7	3.4	16.1	22.7	9.3	9.8	16.5	11.4	3.0	15.4	15.7	8.8	13.7	17.7	26.2
2076	7	15.1	19.6	7.6	50.5	20.6	27.6	12.1	10.8	21.1	23.5	16.7	10.9	7.6	13.5	10.7	13.5	50.5	9.2	24.8	27.8	24.1	13.5	26.2	43.2	9.4	9.8	30.4	12.8
2076	8	10.9	13.3	3.9	26.7	10.9	7.5	10.6	13.1	10.5	15.6	19.6	26.3	6.5	9.8	3.9	20.5	14.0	10.9	11.4	15.7	19.1	17.4	9.6	26.7	10.8	10.5	8.8	8.9
2076	9	14.5	14.1	2.9	27.7	12.1	23.6	14.7	15.3	18.3	14.2	19.8	2.9	24.8	18.2	10.1	18.1	27.7	5.3	6.9	8.5	4.9	9.4	11.2	11.0	11.9	16.1	15.9	16.2
2076	10	9.6	9.9	1.9	20.2	13.0	13.4	12.5	5.0	11.3	9.7	10.2	3.6	19.3	11.6	8.9	4.5	6.0	7.4	6.4	3.0	1.9	17.0	7.8	8.9	12.2	9.4	20.2	14.8
2076	11	7.7	8.3	2.4	18.1	6.5	8.4	2.4	2.9	7.0	5.1	18.1	8.2	10.9	12.9	16.2	8.5	6.4	7.9	7.5	2.9	10.6	12.4	4.9	12.9	4.6	8.7	6.6	6.0
2076	12	6.0	7.4	3.4	27.4	7.5	7.8	3.4	6.0	5.9	6.3	6.6	10.0	6.1	4.2	6.4	7.6	5.7	4.2	5.4	6.5	21.5	6.0	3.5	7.2	3.5	27.4	5.5	3.7
2077	1	5.3	5.3	2.2	9.5	9.5	6.8	7.5	2.7	5.3	3.0	5.6	8.2	8.9	7.3	4.0	5.6	7.3	5.3	5.1	2.2	3.0	7.5	4.0	4.5	3.8	5.6	3.0	2.8
2077	2	4.1	4.4	1.7	7.8	6.1	6.7	4.2	5.2	5.9	2.4	4.9	2.3	6.5	4.7	3.2	4.1	4.2	7.8	2.5	2.9	1.7	7.4	3.8	2.7	3.9	3.6	6.2	2.1
2077	3	5.7	5.6	0.9	13.4	5.9	4.1	9.4	6.4	5.9	3.6	1.4	4.7	2.6	5.5	6.5	6.1	2.4	4.9	10.8	2.0	3.9	5.8	6.2	5.0	0.9	5.9	12.4	13.4
2077	4	5.0	5.9	1.3	15.5	2.1	3.0	1.9	6.0	10.3	3.3	5.1	5.7	6.7	4.7	15.5	4.9	3.1	14.4	5.2	2.4	4.3	1.3	15.2	3.3	6.8	6.0	3.1	7.9
2077	5	10.4	11.2	1.7	19.7	8.3	9.5	8.3	16.7	10.7	16.7	10.5	10.2	13.9	7.8	15.2	8.7	14.9	9.7	14.2	7.5	17.8	1.7	6.2	2.4	18.1	19.7	12.7	7.3
2077	6	11.5	12.8	1.6	32.1	4.8	10.2	29.2	32.1	7.0	5.7	11.2	21.8	13.3	4.1	15.8	4.7	11.8	10.4	24.1	18.4	11.9	6.9	1.6	8.4	21.4	6.0	12.8	13.1
2077	7	18.0	20.1	5.0	65.5	65.5	13.4	12.3	9.0	20.5	38.5	28.3	6.5	9.6	25.9	24.7	12.5	17.7	11.0	24.5	18.2	51.7	21.5	9.1	10.1	21.7	19.2	5.0	5.5
2077	8	13.3	16.7	3.6	45.1	13.1	17.7	45.1	12.9	29.8	5.8	4.7	8.4	26.6	31.1	6.1	13.0	42.4	13.5	15.4	8.3	17.3	15.3	11.7	3.6	7.3	23.5	10.0	19.2
2077	9	13.5	13.3	5.4	27.7	9.7	10.3	9.2	7.6	5.4	7.8	6.4	15.9	14.0	18.3	27.7	18.1	14.3	12.3	9.9	9.9	13.0	14.0	22.6	9.4	14.9	16.6	16.0	15.6
2077	10	9.2	9.9	3.7	25.8	9.8	25.8	10.8	7.5	9.5	6.6	19.8	12.4	3.7	5.2	7.8	4.4	12.0	4.3	9.5	18.4	9.7	4.9	8.3	9.3	13.4	6.5	9.2	7.6
2077	11	8.3	8.7	2.6	19.3	4.3	4.9	9.1	9.4	5.2	4.8	18.7	10.7	5.8	8.1	19.3	13.6	10.3	3.7	2.6	8.4	6.9	3.9	9.4	7.1	17.7	3.7	11.4	9.4
2077	12	4.9	6.3	1.4	20.1	20.1	5.1	4.8	3.5	2.7	6.2	10.0	5.2	5.4	15.0	3.4	3.4	8.5	3.0	1.4	10.3	5.4	3.1	4.6	4.5	4.6	10.6	6.0	4.1
2078	1	5.1	6.4	1.1	21.4	5.5	3.3	5.9	6.1	1.2	3.6	1.1	14.7	4.5	14.7	4.8	9.0	2.7	21.4	5.9	4.7	3.1	3.4	9.8	7.8	2.6	3.1	5.3	8.7
2078	2	4.1	4.9	1.3	20.8	2.3	2.7	3.7	2.4	1.6	2.6	6.1	20.8	7.9	5.7	3.3	4.5	5.6	5.0	1.4	9.4	5.0	4.9	1.9	6.4	2.0	1.3	7.0	3.5
2078	3	4.9	6.1	0.8	21.4	4.8	2.9	4.0	7.6	5.9	8.5	0.8	12.7	4.9	8.9	2.7	6.8	4.8	3.7	8.4	6.2	2.2	1.6	21.4	5.6	3.1	4.2	3.7	10.8
2078	4	6.0	6.5	2.3	14.6	4.6	8.9	9.3	2.8	5.6	3.9	8.7	8.6	14.6	4.8	3.7	6.9	2.3	7.4	6.5	5.6	4.3	2.5	2.9	9.6	9.1	7.1	11.5	5.0
2078	5	12.6	13.1	2.4	26.0	9.2	12.5	18.6	22.6	14.2	7.0	22.1	13.5	8.6	7.3	25.3	12.7	3.5	10.2	16.3	10.0	11.7	2.4	3.4	16.0	6.8	19.8	14.1	26.0
2078	6	9.7	11.2	3.5	29.2	12.9	10.1	29.2	13.8	7.3	4.7	10.9	5.3	15.3	8.7	19.8	6.6	14.9	7.8	3.5	11.4	14.8	6.2	7.0	24.4	6.7	9.4	10.7	7.0
2078	7	12.7	16.3	4.8	49.9	33.9	12.0	22.9	49.9	18.0	9.1	9.9	34.7	44.0	4.9	5.1	6.4	4.8	12.9	14.6	8.0	18.7	21.3	13.3	12.5	6.6	13.3	6.6	7.9
2078	8	15.8	16.8	4.3	43.7	4.4	17.6	43.7	10.8	32.4	33.6	4.3	24.5	16.1	17.8	11.0	7.6	14.6	15.5	9.8	18.8	22.4	21.5	20.8	5.3	4.7	5.9	9.5	29.7
2078	9	14.1	14.6	4.7	25.5	12.9	8.8	25.5	16.9	20.0	13.8	16.8	20.1	20.5	11.1	6.8	15.8	10.3	16.7	24.1	17.3	24.1	4.7	11.0	14.1	5.1	14.1	10.2	10.8

2078	10	8.1	8.3	3.2	18.7	3.5	8.7	9.1	8.2	11.7	5.7	6.5	3.2	9.8	4.4	18.7	10.2	8.1	5.2	9.9	9.9	7.8	7.3	11.0	4.2	6.6	14.9	4.7	10.9
2078	11	7.1	8.0	3.3	20.1	8.2	6.6	6.8	8.2	11.8	6.0	10.2	20.1	4.5	9.8	6.9	13.1	7.3	8.6	7.8	3.5	8.7	5.3	5.8	7.0	8.8	3.3	6.8	6.7
2078	12	5.7	6.4	1.7	22.9	7.2	3.3	3.4	4.6	9.8	9.6	4.8	6.8	5.6	12.7	22.9	8.3	6.7	1.7	3.7	2.5	7.4	2.6	6.2	2.8	3.7	5.8	4.8	6.6
2079	1	4.6	5.5	1.8	11.8	11.8	3.4	4.1	4.8	7.0	8.5	3.8	11.3	2.8	4.8	3.3	4.0	5.7	6.2	2.1	2.8	7.7	3.6	4.9	9.7	10.8	1.8	3.7	4.4
2079	2	4.6	5.1	1.7	10.8	6.0	4.8	3.0	2.3	8.7	4.0	10.8	1.7	6.6	6.3	4.1	4.7	2.5	9.9	3.7	3.9	3.6	3.8	4.6	4.6	4.7	6.3	9.6	2.0
2079	3	5.4	6.3	1.3	17.3	9.4	5.1	6.7	9.0	6.3	2.3	1.3	3.7	9.4	4.3	4.3	4.4	12.5	5.7	2.4	6.2	3.0	4.6	4.2	17.3	11.4	3.8	6.2	6.4
2079	4	5.3	5.6	1.9	12.4	5.7	6.3	4.0	2.7	8.5	4.7	2.5	10.6	4.9	6.2	6.8	7.6	2.4	12.4	6.1	2.3	2.9	2.1	9.7	2.7	2.6	1.9	11.8	6.4
2079	5	10.3	10.3	4.8	20.0	8.8	11.7	7.6	5.5	10.3	18.9	6.9	5.1	10.4	15.7	5.8	12.7	14.8	14.3	12.9	5.4	9.3	10.3	9.1	5.4	20.0	4.8	11.1	10.7
2079	6	15.6	16.0	3.5	37.9	16.7	26.6	24.0	14.0	19.3	3.5	18.1	5.0	4.7	4.1	5.3	9.0	15.5	15.6	33.1	15.6	17.1	17.7	8.2	34.8	6.6	10.5	19.9	37.9
2079	7	14.4	15.0	5.2	32.6	6.2	17.2	16.5	14.7	25.5	17.8	5.7	10.1	20.5	24.0	23.9	7.5	21.1	8.9	13.0	32.6	10.8	5.2	11.0	14.1	15.3	7.2	11.2	20.2
2079	8	16.9	19.9	6.7	51.4	34.4	26.0	33.2	9.9	12.0	8.0	22.4	14.9	9.9	22.2	51.4	20.7	14.5	6.7	42.5	9.3	14.1	32.2	18.9	7.3	8.8	25.5	26.4	7.0
2079	9	14.3	17.3	3.4	42.3	3.4	13.9	20.9	9.0	15.2	42.3	13.4	25.5	10.0	8.2	12.3	21.6	20.3	13.8	24.6	36.1	36.0	13.1	12.2	16.9	14.8	5.7	20.1	6.9
2079	10	8.9	10.1	3.6	20.2	19.9	15.7	4.5	5.0	8.3	20.2	6.7	10.9	6.8	3.6	17.1	9.9	12.0	8.3	7.1	16.1	11.7	6.5	7.9	10.7	9.8	6.5	8.4	9.4
2079	11	7.1	8.0	2.5	20.9	8.3	6.1	8.4	6.1	9.2	3.0	10.1	8.0	4.0	14.0	5.9	3.9	12.6	3.7	9.8	20.9	7.7	6.5	2.5	8.3	3.2	6.5	16.5	5.5
2079	12	6.0	6.9	2.5	25.8	5.4	6.5	3.7	7.7	6.5	6.0	4.3	10.9	2.8	5.1	5.1	5.9	7.3	2.5	4.1	6.0	25.8	6.4	3.1	10.1	7.3	13.9	5.5	4.2
2080	1	4.8	5.4	2.4	11.2	3.4	6.8	4.0	3.8	4.5	5.0	10.4	7.3	3.3	3.6	7.2	2.6	2.9	6.0	5.6	3.7	2.4	6.3	3.7	5.5	10.5	7.3	2.6	11.2
2080	2	4.6	5.1	1.4	9.1	3.9	7.6	6.1	2.9	3.4	3.7	8.1	3.1	6.0	6.5	9.1	4.2	7.6	2.7	1.8	9.1	4.7	3.8	6.9	4.4	7.7	5.0	2.0	1.4
2080	3	6.2	6.5	1.2	14.5	6.5	7.8	2.1	7.2	1.2	5.3	8.0	4.3	2.3	11.0	3.3	8.2	5.9	4.0	10.7	5.9	7.8	14.5	7.0	2.8	4.8	7.0	11.3	5.8
2080	4	5.4	6.0	1.3	13.1	12.7	5.4	7.0	6.1	13.1	5.4	4.8	6.4	6.8	2.5	5.0	3.5	10.0	1.3	3.1	5.4	5.4	2.0	8.3	6.3	5.1	8.9	6.4	3.6
2080	5	7.9	8.9	1.8	19.7	4.6	5.5	9.3	15.5	3.4	4.0	10.5	1.8	9.2	17.9	3.1	7.3	8.2	5.0	5.4	19.7	6.4	14.9	13.8	10.2	1.9	12.9	15.5	7.5
2080	6	10.6	14.4	3.4	45.6	43.0	22.8	13.8	45.6	13.5	27.2	9.4	8.7	6.1	12.9	30.8	4.7	6.3	12.7	8.2	10.2	17.2	7.6	11.0	5.6	3.4	11.6	5.5	8.5
2080	7	13.9	18.1	6.2	35.8	33.3	31.5	9.0	13.9	12.4	34.5	9.4	12.9	7.9	13.2	28.6	13.5	18.4	12.4	17.1	35.8	27.3	18.2	26.8	12.3	14.0	7.6	6.2	18.8
2080	8	14.0	18.8	6.0	75.0	13.0	13.0	59.6	7.7	32.4	8.6	16.5	12.0	15.8	16.4	12.0	16.0	75.0	12.1	10.8	25.4	15.0	6.0	6.2	12.8	18.8	6.2	20.6	18.9
2080	9	12.0	13.2	3.8	30.3	6.7	13.0	5.7	11.0	22.0	6.4	12.3	20.2	27.3	30.3	20.3	18.5	4.2	7.4	15.6	4.4	11.7	10.7	12.7	21.4	3.8	6.5	16.3	9.4
2080	10	8.6	9.4	2.8	20.2	15.8	20.2	14.8	5.7	9.4	3.9	10.1	3.2	5.7	19.3	9.8	7.4	4.3	8.2	5.9	18.8	10.4	14.7	11.1	5.2	3.1	7.1	2.8	9.0
2080	11	6.6	7.6	2.3	16.2	6.3	8.5	3.3	14.7	4.8	8.6	9.5	3.2	6.3	5.2	16.2	10.0	13.4	2.3	4.4	6.9	7.8	7.0	6.3	9.3	5.7	9.6	6.3	5.8
2080	12	5.5	7.6	2.2	25.5	5.0	7.6	6.6	3.4	3.1	2.2	5.8	9.5	6.1	5.1	7.5	4.1	13.1	3.6	23.2	3.7	14.8	25.5	2.8	7.6	4.2	3.8	9.4	3.9
2081	1	4.6	5.2	2.3	11.7	3.9	4.0	3.6	2.3	3.8	7.7	4.0	3.4	3.9	3.9	2.7	8.6	6.4	5.4	6.4	4.6	7.1	11.7	5.6	5.8	3.8	6.3	4.6	6.0
2081	2	4.3	5.2	1.4	30.4	5.2	1.7	2.9	1.7	1.4	3.4	6.7	1.9	5.0	4.2	4.2	6.6	2.2	6.8	2.1	5.0	5.7	1.7	4.5	5.8	30.4	3.4	4.3	6.9
2081	3	5.0	5.3	2.1	10.0	3.4	3.2	4.7	7.3	2.1	4.4	9.0	7.4	8.6	2.4	4.2	6.7	4.8	6.4	2.8	3.4	2.9	5.2	3.5	6.9	10.0	6.1	5.6	7.2
2081	4	6.6	6.7	2.4	17.8	6.8	9.0	6.0	3.1	4.5	6.5	7.6	2.5	10.6	8.8	4.0	2.4	5.8	8.4	2.9	5.7	7.3	17.8	6.9	2.5	6.2	7.5	9.5	8.4
2081	5	10.1	11.1	2.0	37.7	11.8	10.4	2.0	17.4	13.9	3.9	10.7	15.6	8.6	6.1	10.1	37.7	11.8	8.4	3.6	8.6	10.2	4.1	3.4	12.7	30.4	10.7	9.4	5.8
2081	6	11.2	13.7	5.1	35.7	14.5	18.8	14.7	31.4	6.1	11.5	24.9	8.8	10.8	8.7	8.9	20.6	7.0	14.9	12.5	9.0	16.0	5.1	11.6	10.1	35.7	9.6	7.7	10.5
2081	7	16.0	18.5	7.2	62.8	14.2	26.7	17.5	26.9	8.8	10.0	30.7	10.0	62.8	23.9	12.6	25.8	21.2	8.2	14.2	23.2	17.7	19.2	20.0	10.3	14.5	7.2	9.1	10.0
2081	8	16.0	18.6	7.3	60.0	27.0	11.9	14.6	18.8	11.8	27.0	16.8	29.4	25.7	14.6	7.3	9.1	12.2	21.5	11.8	15.3	11.8	13.4	10.1	17.7	16.6	17.9	60.0	24.8
2081	9	13.5	14.0	3.9	34.7	23.6	5.7	13.6	9.6	5.4	15.5	34.7	19.2	9.3	16.6	7.4	14.6	17.3	9.6	16.3	19.9	8.9	3.9	11.2	21.7	11.6	14.1	13.4	13.0
2081	10	6.7	8.2	2.2	22.2	9.0	6.4	8.4	2.2	7.5	5.6	6.7	6.4	22.2	12.3	6.7	6.4	6.2	7.6	14.1	3.2	5.1	13.9	11.5	4.3	12.1	3.4	4.8	11.6
2081	11	6.4	6.8	1.5	16.5	6.3	6.7	7.6	2.9	4.3	12.5	8.6	9.8	5.0	3.8	4.3	2.5	6.5	5.6	6.1	3.9	12.1	11.2	6.4	3.1	1.5	8.8	16.5	8.0
2081	12	5.5	7.1	2.7	26.2	5.7	5.2	5.9	15.1	5.1	4.5	26.2	5.2	10.0	3.2	9.7	11.6	3.2	6.0	6.0	7.0	4.9	5.2	6.5	2.7	5.3	5.2	5.3	5.7
2082	1	5.7	6.2	1.4	12.9	9.5	3.9	4.9	7.3	3.0	11.6	2.3	6.9	7.0	6.6	4.7	7.0	4.9	5.6	5.2	4.7	7.8	5.9	1.4	7.4	12.9	5.5	9.6	4.1
2082	2	4.3	5.6	1.3	17.4	5.3	3.0	10.2	4.3	3.7	3.9	7.8	7.2	17.4	3.8	4.7	7.0	6.2	1.3	3.8	2.5	2.7	1.7	4.3	13.5	1.7	10.1	3.7	4.3
2082	3	5.9	6.6	3.1	11.9	6.1	4.5	9.3	9.2	4.7	4.3	4.9	7.3	4.9	9.4	10.2	5.7	11.9	3.1	10.3	5.0	4.1	6.5	5.4	6.3	3.3	3.7	8.7	9.2
2082	4	5.8	6.8	1.0	23.9	9.4	3.5	9.2	23.9	13.1	6.5	7.2	1.2	2.8	7.8	14.0	3.4	7.3	5.8	2.3	5.8	4.8	5.5	4.3	4.1	1.0	6.4	9.5	5.6
2082	5	9.6	10.9	3.0	23.6	9.5	6.3	8.4	23.6	3.0	6.3	12.1	9.2	10.4	12.3	17.4	9.8	4.8	7.1	8.2	18.3	18.7	17.0	5.3	7.9	10.5	19.0	5.0	12.1
2082	6	15.8	16.4	4.2	32.2	13.7	26.2	8.5	16.2	4.3	15.8	12.0	24.4	8.7	5.4	31.0	9.0	6.1	15.7	21.5	32.2	25.4	4.2	16.4	24.3	28.8	7.6	14.3	22.9
2082	7	16.2	20.5	3.0	85.2	8.6	17.7	8.6	26.3	24.4	15.1	13.1	10.2	14.0	20.9	16.9	13.7	22.4	24.3	28.0	17.0	15.4	85.2	9.5	14.5	3.0	20.9	12.5	50.6
2082	8	15.6	15.7	6.2	27.2	18.9	18.5	23.9	18.6	6.4	9.9	8.2	15.4	27.2	24.0	6.7	16.0	6.3	6.2	15.2	13.5	14.8	15.8	12.6	24.0	17.3	10.4	22.9	23.4
2082	9	14.6	15.0	7.7	26.1	9.9	26.1	9.1	9.9	9.5	14.5	18.7	20.1	20.1	17.0	13.3	10.4	16.1	21.4	9.6	7.7	12.7	9.1	12.5	21.4	15.5	24.5	15.8	14.6
2082	10	7.6	8.2	2.5	15.8	4.8	13.1	15.8	7.6	6.2	9.5	5.4	8.5	4.8	4.8	6.3	7.9	7.7	7.1	9.0	6.7	13.1	2.5	10.4	3.2	15.3	4.1	12.2	10.1
2082	11	8.0	9.1	3.3	17.1	6.2	8.8	9.1	3.3	8.1	9.2	7.9	6.7	3.7	17.1	16.2	10.3	6.9	6.9	3.4	13.9	7.8	12.8	4.6	16.0	7.4	5.4	12.2	15.5
2082	12	5.6	6.2	2.8	14.4	3.9	3.2	6.0	2.9	5.4	4.3	2.8	8.7	4.0	8.5	6.2	8.0	4.4	5.3	6.4	4.4	4.9	14.4	5.9	6.1	6.9	8.9	5.3	11.9
2083	1	4.4	4.6	1.3	12.1	5.3	6.5	4.9	4.7	2.2	4.2	5.0	2.7	6.4	2.5	3.7	7.5	3.4	3.6	3.0	4.8	2.8	6.5	12.1	1.3	8.0	3.5	4.9	2.1
2083	2	4.6	5.3	1.3	15.3	4.0	1.3	4.8	6.1	5.6	3.1	5.8	4.3	1.8	4.6	8.1	4.1	4.7	3.9	6.5	2.8	2.9	8.4	2.7	3.0	6.1	12.3	4.6	15.3
2083	3	4.5	5.0	2.2	10.7	2.2	3.8	6.7	4.4	2.9	6.5	8.4	4.3	6.5	4.3	2.3	4.5	2.2	3.6	10.7	6.4	7.3	7.1	4.2	5.8	5.3	4.7	3.6	3.5
2083	4	5.6	6.7	0.9	18.0	7.4	7.8	6.0	0.9	11.5	18.0	12.1	3.7	4.4	5.2	16.2	9.7	4.3	5.3	6.0	1.0	4.7	3.5	6.9	3.2	4.4	6.9	6.8	4.7
2083	5	12.2	14.9	3.7	37.9	11.2	14.1	18.9	4.4	6.7	14.4	11.2	23.4	15.5	3.7	22.7	23.7	5.1	9.1	7.8	10.3	11.4	13.0	21.2	37.9	31.8	17.3	11.0	11.5
2083	6	11.2	13.1	4.0	32.0	5.9	18.6	5.6	17.5	11.5	15.2	32.0	5.6	12.5	4.9	11.2	7.8	11.1	21.4	9.2	5.5	21.1	10.5	17.8	4.0	10.2	15.5	10.4	29.8
2083	7	11.7	13.0	5.9	23.0	7.2	18.5	8.2	9.9	13.6	13.0	15.3	10.0	23.0	8.3	12.1	5.9	18.4	8.8	11.4	21.0	14.7	11.4	17.6	17.7	7.0	17.8	10.3	10.5
2083	8	13.7	18.7	6.4	99.6	45.0	11.5	6.4	10.2	10.0	15.8	99.6	7.7	23.0	16.9	9.2	15.7	13.3	13.9	8.4	22.2	17.1	16.4	9.3	17.2	8.9	9.0	13.5	28.0
2083	9	12.5	13.2	2.8	26.7	9.0	9.7	4.3	8.2	18.2	9.6	19.1	13.5	13.6	8.6	18.8	17.8	26.7	9.3	10.5	24.4	10.9	19.6	11.6	13.5	2.8	14.5	14.4	8.5
2083	10	9.4	10.4	4.7	21.9	4.7	9.9	21.9	12.0	14.4	6.6	9.5	9.9	7.3	13.5	18.7	8.5	15.9	6.6	8.3	6.0	4.7	16.8	10.3	8.7	6.3	8.3	9.4	11.5
2083	11	6.4	8.0	3.3	17.0	4.7	4.6	5.7	5.2	17.0	4.6	11.4	5.4	7.0	8.5	12.5	4.6	5.9	4.5	6.3	8.5	12.5	8.8	9.7	16.2	12.1	5.4	3.3	6.5
2083	12	5.7	7.7	2.5	25.8	3.6	25.8	8.6	8.9	9.6	5.5	3.9	6.4	4.5	3.8	7.4	5.2	5.3	4.2	5.8	2.5	8.6	20.3	5.2	7.5	4.5	4.4	10.7	11.4
2084	1	4.9	5.5	1.5	13.3	3.4	8.2	6.1	3.6	4.7	7.4	13.3	7.8	3.9	5.2	3.8	1.5	7.5	7.7	9.6	3.2	4.4	6.8	5.2	2.9	5.7	2.6	4.6	2.1
2084	2	4.3	5.2	1.8	9.8	9.1	3.1	4.1	5.9	3.7	9.8	7.0	3.5	3.0	5.0	6.9	1.8	4.3	7.3	5.9	3.8	3.5	6.3	4.2	3.3	4.2	4.8	3.2	9.8
2084	3	5.6	6.4	1.7	14.0	5.6	1.7	10.6	2.7	5.2	6.2	5.5	5.8	6.7	3.6	4.1	7.3	14.0	3.4	4.3	5.6	5.7	11.0	5.9	12.5	5.7	5.2	9.2	5.0
2084	4	5.8	6.3	1.2	17.0	3.1	12.4	11.3	6.7	1.2	10.9	3.5	4.9	5.8	3.1	5.7	5.7	5.8	3.5	2.3	9.4	4.8	6.0	3.7	17.0	2.9	6.8	6.0	7.6
2084	5	11.3	11.9	3.2	23.1	3.2	13.5	18.5	10.8	6.1	7.8	8.4	18.8	7.8	21.8	8.6	23.1	11.9	13.3	16.5	14.0	12.0	5.5	6.8	5.0	18.1	18.2	6.8	10.1
2084	6	11.4	14.6	5.8	31.0	20.6	11.0	18.8	11.7	5.8	10.0	6.3	12.0	7.7	11.1	7.3	11.2	16.0	21.9	9.9	10.7	31.0	26.0	6.2	28.5	19.7	24.0	13.5	10.4
2084	7	13.6	14.3	5.3	30.5	13.1	15.5	12.1	17.0	14.7	5.3	15.3	10.2	18.8	7.1	14.1	17.4	21.7	8.7	10.8	6.4	11.3	8.8	29.4	11.9	30.5	15.3	15.1	12.2
2084	8	10.8	14.7	2.7	50.3	17.0	4.2	38.1	10.3	7.9	9.8	10.9	11.5	16.9	14.9	27.9	10.7	50.3	8.7	13.9	9.6	5.3	8.2	2.7	16.6	8.2	18.1	10.0	22.1
2084	9	15.0	15.1	4.3	40.0	8.0	40.0	8.4	11.2	4.3	22.7	14.9	17.8	18.8	6.4	6.9	16.5	17.4	20.0	10.1	5.0	13.5	19.4	15.8	12.7	30.0	15.0	10.7	17.4
2084	10	7.7	9.1	2.0	23.0	10.6	2.0	23.0	7.7	6.1	9.2	2.2	6.3	6.7	9.7	19.2	5.0	5.7	2.4	8.1	7.7	5.3	2.6	10.2	14.7	18.4	14.1	4.3	17.2
2084	11	6.1	7.8	2.4	18.9	5.6	11.6	8.9	2.8	7.4	15.6	17.4	6.7	5.8	6.3	8.5	3.5	4.6	2.4	7.0	14.8	5.1	18.9	5.0	3.2	4.0	4.1	13.0	4.1
2084	12	4.3	4.7	1.9	11.4	3.9	4.0	3.6	4.5	6.3	5.0	5.3	5.9	3.8	2.1	8.1	4.3	4.1	4.3	7.0	4.4	3.3	4.4	11.4	6.7	3.7	2.8	2.3	1.9
2085	1	4.5	4.7	2.1	9.1	3.0	7.2	3.7	4.4	2.4	4.4	3.9	5.2	4.7	4.8	3.5	2.5	6.2	6.4	3.0	6.4	6.2	3.0	5.2	5.0	9.1	2.1	7.2	3.0
2085	2	4.3	4.7	1.1	11.0	2.2	5.0	9.2	2.5	3.2	2.7	6.1	4.2	6.5	11.0	4.2	3.4	4.3	4.9	4.3	1.1	4.4	1.9	3.9	7.0	5.6	4.2	7.4	3.7
2085	3	5.5	5.4	1.8	8.8	5.1	6.5	1.8	5.6	7.4	4.3	8.7	3.2	6.3	5.7	3.8	6.0	8.8	4.6	3.1	4.9	7.4	5.4	6.2	5.1	4.9	5.9	7.8	2.1
2085	4	5.8	7.3	1.0	17.6	6.1	2.8	8.9	5.4	4.2	14.9	4.1	2.7	3.2	8.4	5.3	8.0	14.4	17.6	6.5	1.0	2.1	3.3	11.7	3.2	4.0	8.7	16.1	11.3
2085	5	11.0	11.9	3.9	27.6	5.0	10.6	5.1	23.6	11.4	19.4	10.3	15.6	11.6	8.6	6.9	27.6	7.4	15.2	14.4	9.4	12.1	5.5	11.5	3.9	6.2	11.4	8.1	24.5
2085	6	13.6	13.5	6.2	23.4	23.4	14.6	16.6	13.4	9.6	11.5	17.1	7.0	11.9	9.1	14.9	14.1	20.3	7.4	8.8	12.4	15.0	18.2	20.2	13.8	14.4	11.2	6.2	12.2
2085	7	10.8	13.0	5.5	26.4	23.9	11.0	9.9	10.2	15.1	8.7	9.2	7.2	14.3	8.7	12.3	8.4	10.5	12.2	17.5	9.7	10.1	11.9	23.1	12.7	8.9	5.5	26.4	24.0
2085	8	14.6	16.2	5.0	38.6	12.6	29.6	27.7	15.8	16.6	10.7	17.7	15.3	7.9	10.4	24.5	27.3	6.7	14.4	6.8	7.5	7.9	9.9	14.8	13.9	19.4	27.6	38.6	5.0
2085	9	15.1	15.9	2.8	33.1	28.4	31.5	11.4	8.4	29.5	9.7	33.1	9.0	19.0	4.8	7.0	20.1	13.9	21.2	18.2	20.4	8.0	8.4	15.5	11.8	16.4	2.8	19.1	14.8
2085	10	8.4	9.7	3.2	23.9	6.6	6.4	6.8	3.2	9.2	7.8	7.4	13.6	4.3	14.6	6.4	15.8	11.7	8.3	23.9	15.7	5.3	10.3	11.9	15.6	9.6	5.0	6.1	8.5
2085	11	7.6	7.9	2.1	16.9	3.9	10.6	10.2	7.9	3.4	4.8	3.9	5.3	3.5	7.2	14.3	8.1	6.2	12.4	2.1	8.9	9.5	16.9	6.5	11.9	6.4	10.9	5.2	8.6
2085	12	5.0	5.5	2.9	13.3	2.9	5.6	10.6	3.8	4.8	6.7	5.6	5.4	5.7	5.8	4.2	3.1	7.4	5.1	3.6	4.7	5.9	4.9	3.3	5.0	3.8	5.0	13.3	5.8
2086	1	5.3	5.5	2.4	10.7	6.3	4.3	2.4	4.4	3.3	7.0	5.8	2.9	8.2	2.5	5.0	7.0	5.3	4.2	9.4	5.5	6.8	4.5	3.5	10.7	5.3	4.2	5.3	7.2
2086	2	4.5	5.3	2.4	15.6	4.7	7.7	3.0	10.5	2.8	15.6	5.1	3.7	5.9	4.8	4.2	5.3	8.3	9.2	2.4	4.3	3.2	3.7	5.0	3.0	6.2	2.5	3.6	2.8
2086	3	5.7	7.0	1.3	16.3	8.5	5.6	8.6	9.9	12.1	11.7	3.7	3.8	3.9	5.0	5.7	4.6	16.3	3.6	8.7	5.8	4.4	9.2	3.3	4.8	12.3	1.3	11.1	3.9
2086	4	4.6	6.1	1.4	14.2	2.1	2.4	6.6	4.1	9.9	8.8	9.0	4.7	5.4	3.6	14.2	4.6	12.5	8.8	2.4	3.1	2.8	2.1	6.4	1.4	4.3	4.1	11.2	12.9

2086	5	12.0	12.3	1.4	23.9	3.1	17.1	18.6	9.1	15.7	15.3	23.9	11.7	11.4	19.5	9.8	18.3	6.2	11.2	4.9	12.2	12.8	7.6	1.4	18.3	3.1	17.2	17.5	10.1
2086	6	11.5	14.0	3.8	55.4	3.8	11.8	13.2	17.3	4.3	15.0	12.4	24.5	8.5	11.3	6.1	5.8	10.5	9.8	9.6	35.9	6.3	55.4	12.4	8.9	13.5	16.0	13.5	9.5
2086	7	17.6	19.0	6.7	55.0	14.1	27.9	13.0	23.6	29.2	19.1	16.5	18.7	11.7	55.0	11.3	20.6	11.2	14.1	10.4	20.2	12.5	8.5	26.5	11.7	26.8	6.7	19.2	27.2
2086	8	15.8	18.4	6.4	56.5	10.5	18.0	16.5	56.5	9.3	14.5	8.0	19.0	7.4	17.3	10.7	11.6	46.0	9.3	6.4	10.2	28.9	18.2	31.7	7.4	25.3	24.9	15.1	17.5
2086	9	11.3	12.8	3.5	24.3	7.6	20.7	24.3	3.5	15.7	17.4	11.7	11.0	20.1	24.1	10.2	6.6	17.3	12.9	9.6	11.9	13.5	18.7	7.8	11.0	7.2	8.8	7.4	8.5
2086	10	8.7	9.9	3.9	16.8	8.6	11.2	13.1	7.9	6.6	3.9	7.0	14.6	6.0	6.0	6.8	8.7	16.1	10.1	12.6	13.2	15.1	16.8	10.8	8.3	6.3	5.0	15.7	7.7
2086	11	6.7	6.9	2.2	12.0	10.1	10.8	10.9	5.7	9.1	12.0	7.9	4.1	5.8	6.5	2.2	6.8	5.9	10.5	3.6	5.3	7.2	8.8	7.8	4.9	10.4	2.9	3.4	3.5
2086	12	5.1	5.2	1.3	14.7	3.8	5.9	4.0	6.6	3.8	4.3	5.0	6.6	2.6	5.2	4.2	6.7	5.8	5.2	3.7	14.7	2.5	6.7	6.2	2.7	6.0	3.9	7.2	1.3
2087	1	5.3	5.5	2.7	9.7	4.6	5.6	4.4	7.9	2.7	4.3	4.9	6.8	7.6	6.6	9.7	5.0	3.8	3.8	6.9	6.7	7.0	5.4	5.2	5.4	8.8	3.6	3.3	2.8
2087	2	4.6	5.3	1.5	22.7	4.7	3.1	4.8	5.2	22.7	2.4	3.3	6.1	2.4	2.6	6.7	7.3	4.8	5.8	2.5	3.9	3.9	5.9	3.7	3.2	8.6	1.5	7.8	4.4
2087	3	5.1	6.1	1.5	16.6	2.1	4.0	1.5	16.6	15.1	4.0	5.6	11.8	2.8	10.7	2.5	5.0	4.7	2.8	5.2	7.3	3.0	5.1	6.2	5.2	9.6	3.7	10.5	1.7
2087	4	6.4	7.6	0.6	22.6	10.4	7.8	11.2	8.9	13.1	3.3	6.1	22.6	5.4	6.1	12.7	7.0	8.5	3.9	4.2	3.9	5.4	6.6	16.5	3.7	2.8	0.6	8.1	4.5
2087	5	10.0	11.4	2.9	22.0	10.9	6.9	5.4	10.1	9.9	4.6	19.1	8.1	9.0	9.3	2.9	18.5	21.0	22.0	10.4	18.1	11.3	3.4	6.2	18.7	4.3	19.3	6.2	18.2
2087	6	10.7	11.3	4.1	22.7	15.3	11.0	12.7	10.5	6.3	5.3	12.7	12.5	16.0	14.0	4.1	9.0	16.5	9.5	10.0	16.2	4.6	13.9	5.9	8.5	18.1	7.1	8.3	22.7
2087	7	13.1	16.5	5.5	49.4	16.6	11.7	11.3	9.4	12.8	14.9	28.1	9.2	49.4	13.2	22.4	8.2	11.1	10.1	14.4	35.7	13.2	18.9	13.0	17.5	9.7	33.8	5.5	6.4
2087	8	15.0	15.2	3.4	37.4	6.7	19.2	20.4	12.1	17.9	9.6	7.6	20.9	12.2	16.3	5.6	24.9	20.3	9.2	37.4	21.0	13.8	16.3	17.0	8.0	3.4	22.4	13.5	8.5
2087	9	15.0	14.7	4.2	32.0	17.1	10.9	6.6	15.6	24.3	13.0	17.6	14.4	16.0	24.6	32.0	8.9	10.0	20.9	13.7	18.4	5.9	19.0	4.2	16.2	4.9	5.0	29.7	5.0
2087	10	7.3	7.9	3.1	14.8	12.4	4.1	9.6	4.7	5.6	9.3	7.6	14.8	5.5	8.6	10.0	6.5	4.3	3.7	9.6	7.0	3.1	6.1	13.8	12.2	11.2	4.3	9.8	6.2
2087	11	7.4	7.7	2.2	14.7	5.1	9.2	13.6	5.8	11.2	5.7	5.5	14.7	2.2	8.3	3.8	7.6	8.7	7.9	2.4	4.1	9.5	13.6	10.2	5.4	8.8	6.3	6.8	7.2
2087	12	6.1	6.4	3.2	12.8	5.0	9.1	7.4	9.2	6.4	3.6	7.0	4.7	6.1	6.6	12.8	5.2	7.1	3.2	5.0	5.2	8.1	4.8	5.8	6.1	4.6	4.9	7.2	7.7
2088	1	4.8	5.3	2.6	12.0	4.0	5.3	4.8	5.9	8.0	2.8	8.2	7.8	5.6	7.0	3.6	2.9	2.7	3.8	4.9	4.7	3.7	6.7	5.0	12.0	4.5	2.6	4.4	6.2
2088	2	4.6	6.2	1.3	23.5	1.8	7.1	1.8	4.4	5.0	23.5	3.9	11.3	6.9	16.6	3.8	6.6	4.2	4.6	3.9	4.5	3.2	4.8	4.6	8.0	5.6	2.7	1.3	9.7
2088	3	3.7	5.7	1.0	17.5	7.4	3.2	1.6	2.0	3.1	5.4	3.4	2.9	4.2	3.0	9.4	13.5	3.6	9.6	3.8	6.2	8.6	1.0	4.9	14.0	2.0	3.1	17.5	3.4
2088	4	5.4	6.5	0.8	22.9	2.8	8.2	4.6	8.4	6.7	3.8	10.3	5.6	5.3	9.3	12.6	2.6	7.6	5.7	3.6	4.7	7.8	14.1	1.6	2.6	2.3	3.0	0.8	22.9
2088	5	6.9	8.7	2.1	25.0	16.1	5.0	15.9	18.1	3.0	15.2	25.0	10.0	8.6	6.6	4.5	3.4	5.9	7.7	8.5	5.9	3.9	6.0	2.1	5.3	6.9	10.1	6.8	9.1
2088	6	9.7	10.6	4.0	19.0	19.0	8.7	7.4	15.9	12.4	12.1	9.4	6.8	8.2	8.7	12.0	6.3	14.6	7.4	6.7	15.8	12.4	7.6	6.0	16.2	14.6	4.0	10.0	13.1
2088	7	12.1	14.0	3.3	36.5	36.5	12.8	13.5	17.8	18.4	10.2	14.3	9.1	3.9	14.4	7.9	10.9	3.3	7.8	27.5	7.5	9.8	15.7	35.0	13.7	17.0	11.3	6.9	9.8
2088	8	12.2	14.8	5.4	35.6	10.5	13.3	16.6	19.4	29.5	11.7	6.8	24.5	20.4	15.6	9.4	13.3	31.4	12.7	11.2	35.6	15.1	7.4	5.4	8.0	6.6	10.8	9.4	9.7
2088	9	11.6	12.0	2.0	20.2	20.1	9.2	10.9	6.8	11.7	18.8	11.0	2.5	11.5	18.8	12.9	10.4	2.0	8.2	16.1	3.5	5.2	16.8	12.2	20.2	14.7	17.2	15.8	10.8
2088	10	6.9	7.7	1.6	18.6	16.5	1.6	11.5	2.0	18.6	10.8	1.6	4.0	7.6	3.6	4.4	6.5	14.3	5.9	7.7	3.5	6.0	6.7	12.4	9.4	8.1	10.2	7.0	4.0
2088	11	5.8	6.8	2.8	21.0	10.6	2.9	6.8	6.4	10.2	2.8	9.2	21.0	8.4	3.5	7.9	3.0	9.0	5.2	3.3	4.7	4.4	6.0	7.8	5.7	5.3	9.9	5.1	4.7
2088	12	5.4	6.4	1.9	22.8	5.4	5.0	3.4	2.2	7.0	6.0	2.5	3.4	3.1	6.0	11.7	4.1	22.8	19.5	4.3	1.9	7.1	5.7	8.4	6.0	5.3	2.6	5.5	4.7
2089	1	4.0	4.7	1.5	9.2	4.6	6.9	3.1	3.5	3.7	5.1	5.3	3.0	9.2	8.9	3.2	3.2	3.8	3.6	2.1	6.7	4.4	3.4	6.1	7.5	7.7	4.2	2.9	1.5
2089	2	4.2	4.5	1.1	10.9	5.0	4.5	4.4	5.5	5.9	3.8	6.0	1.4	1.6	3.0	4.3	3.6	2.2	4.6	4.0	2.1	1.1	4.2	8.0	10.9	5.7	4.1	9.2	3.8
2089	3	4.5	5.2	1.9	12.8	2.3	3.8	3.7	2.5	5.5	5.6	12.7	3.6	5.6	3.4	5.3	12.8	8.3	6.2	1.9	3.6	4.7	7.1	3.1	4.3	6.0	5.1	3.3	3.8
2089	4	5.7	6.7	3.5	14.9	4.3	6.5	8.4	3.6	4.1	4.6	11.1	8.6	5.3	3.5	10.3	3.7	14.9	4.0	8.0	5.2	4.6	5.9	5.6	3.7	6.9	7.0	11.1	10.7
2089	5	12.5	13.1	1.2	29.9	12.1	10.2	12.3	8.2	13.2	7.4	15.7	22.5	11.4	20.4	29.9	6.8	18.2	21.4	10.4	13.8	11.9	1.2	20.4	13.3	17.5	12.7	2.6	1.4
2089	6	10.9	13.6	3.9	27.2	9.5	14.3	10.9	10.9	26.7	3.9	26.1	25.8	4.7	17.3	15.9	9.1	6.1	8.7	10.6	22.7	8.6	6.0	5.3	17.8	11.0	9.2	27.2	18.1
2089	7	16.2	20.4	5.0	62.0	33.2	15.2	18.9	34.2	21.2	17.1	12.2	13.2	12.5	15.7	15.3	5.0	19.8	42.3	13.3	35.5	62.0	13.2	9.1	17.1	15.6	16.7	15.8	16.6
2089	8	12.0	17.0	3.8	63.2	9.8	12.9	59.0	13.8	30.0	11.8	17.6	8.7	9.7	11.6	21.5	3.8	12.3	19.4	15.7	6.4	17.3	7.4	11.0	8.5	63.2	25.3	7.7	3.8
2089	9	10.0	13.0	4.1	30.0	16.4	23.4	6.3	5.7	4.3	10.3	9.8	6.3	20.1	24.1	16.6	4.1	8.6	8.1	30.0	20.8	11.9	18.3	8.1	7.0	8.8	14.9	17.7	9.7
2089	10	6.8	8.5	1.1	19.2	15.9	7.6	19.2	1.1	10.7	7.0	3.8	3.1	5.3	15.7	7.3	5.9	13.0	6.2	6.5	10.2	4.8	6.5	5.3	5.7	16.4	1.9	9.3	16.8
2089	11	6.6	7.6	2.1	17.7	2.1	5.9	6.5	9.8	5.7	17.7	6.7	5.9	9.1	4.4	6.3	9.3	6.2	5.8	10.1	11.3	7.8	9.5	6.4	11.5	3.8	7.6	9.5	4.6
2089	12	5.4	6.5	3.2	15.4	3.2	5.4	3.7	4.2	6.4	4.7	15.4	6.3	5.1	4.7	4.0	9.7	4.8	4.1	13.9	5.3	11.7	6.2	4.6	6.0	5.2	5.9	9.0	7.1
2090	1	4.9	5.2	0.5	13.2	3.0	3.4	6.4	2.6	5.2	7.6	4.9	3.0	3.6	3.9	6.3	1.9	4.8	13.2	9.1	2.8	5.5	6.3	0.5	4.2	9.1	8.1	6.0	3.7
2090	2	4.1	4.4	1.6	12.0	5.5	4.2	4.0	4.2	2.2	2.8	5.7	5.2	6.2	1.6	2.4	5.9	3.2	5.7	1.7	4.1	3.9	4.5	4.6	5.3	3.8	3.4	3.7	12.0
2090	3	5.0	5.2	1.3	10.5	3.6	5.1	3.5	2.8	6.8	7.1	5.3	4.9	3.7	6.7	6.1	6.0	10.5	10.4	2.7	5.9	1.8	3.5	1.3	5.0	4.8	3.9	7.0	5.3
2090	4	5.3	7.2	2.0	21.4	4.1	5.1	6.9	7.1	3.8	6.3	11.3	11.4	4.0	4.3	14.8	12.7	3.5	10.4	3.2	4.8	4.1	2.0	21.4	5.6	7.4	4.7	2.6	11.7
2090	5	10.6	12.2	4.5	24.3	10.9	8.4	9.0	6.0	13.3	17.5	23.9	24.3	14.5	9.3	7.0	14.4	4.5	20.5	16.9	16.0	6.5	9.1	10.5	9.0	18.1	5.4	10.7	6.2
2090	6	13.5	14.8	4.4	34.2	25.9	10.0	13.9	4.4	13.1	20.3	7.3	16.4	16.0	8.2	30.3	12.8	17.2	16.0	14.1	12.4	5.3	8.0	12.1	34.2	14.5	32.0	5.1	4.9
2090	7	16.9	17.1	6.4	43.4	43.4	10.4	19.7	9.1	6.4	24.1	13.4	17.2	16.7	27.5	9.8	17.9	21.3	18.1	26.0	17.6	12.8	15.1	9.9	12.7	9.0	9.5	18.8	23.1
2090	8	13.2	19.3	5.9	55.6	10.9	13.8	13.0	8.4	9.2	55.6	8.0	39.6	10.4	30.4	5.9	13.4	24.4	40.4	9.0	32.8	7.9	33.0	11.4	15.0	17.2	9.7	38.2	6.0
2090	9	18.0	18.4	6.6	31.9	8.8	29.1	20.6	15.7	15.5	31.9	26.9	12.2	6.6	18.9	20.5	12.1	14.5	22.1	24.1	15.3	28.6	18.1	25.6	16.9	7.0	17.8	24.6	9.2
2090	10	9.0	9.4	2.7	19.8	6.8	18.3	9.6	15.0	3.6	9.8	10.6	19.8	10.6	2.7	6.4	7.8	7.3	6.2	5.6	11.4	9.1	9.0	4.3	7.7	11.6	5.3	16.5	11.8
2090	11	8.0	8.4	2.7	18.6	5.1	13.7	5.1	6.6	3.9	10.5	18.6	16.9	3.4	7.6	10.5	2.7	9.5	13.1	4.5	3.2	9.0	12.0	7.8	11.0	4.7	5.9	8.9	8.2
2090	12	6.0	6.8	2.3	21.9	9.9	9.2	11.3	5.3	3.7	3.7	5.1	9.0	5.9	7.1	21.9	2.6	2.3	6.2	8.7	9.4	6.3	7.5	7.8	3.2	3.5	5.1	4.3	4.3
2091	1	4.9	6.5	1.9	21.6	5.5	2.7	21.6	2.9	7.7	5.0	5.4	5.4	11.3	5.3	4.1	1.9	4.2	9.3	4.3	19.6	5.0	4.9	4.8	3.2	4.7	4.0	3.0	10.0
2091	2	5.6	5.9	2.2	11.4	5.6	7.7	5.9	6.1	4.2	4.9	8.3	7.3	8.6	3.5	8.3	3.0	11.4	5.5	5.1	2.5	4.4	4.8	2.2	7.4	6.4	4.5	8.9	5.0
2091	3	5.6	7.4	1.4	22.8	2.1	7.2	12.2	4.3	9.5	7.2	4.7	2.9	2.5	2.9	3.3	22.8	4.9	1.4	2.7	12.1	4.7	3.0	10.5	14.1	11.8	6.3	13.7	11.4
2091	4	7.1	7.8	1.6	20.4	6.5	3.5	18.8	7.6	1.6	10.6	3.0	10.4	8.7	10.5	10.0	3.4	17.2	6.9	1.9	3.4	7.9	4.9	20.4	2.8	7.3	2.6	11.4	5.5
2091	5	8.4	8.8	3.2	17.6	3.2	11.4	4.6	3.3	3.3	12.9	8.8	12.0	6.7	7.6	16.4	10.6	4.0	7.3	11.2	12.7	12.5	17.6	4.0	11.7	4.9	6.0	8.1	10.4
2091	6	12.6	12.7	4.1	23.5	8.2	14.2	11.5	19.3	20.0	15.0	23.5	13.1	17.9	11.7	12.5	6.0	14.8	7.8	18.7	7.5	16.1	12.8	4.1	18.1	7.6	7.3	9.4	8.2
2091	7	14.8	18.1	5.7	42.1	11.8	12.9	18.4	42.1	9.2	11.4	12.7	5.7	16.2	14.9	38.0	7.8	35.5	25.6	14.7	15.2	15.5	7.5	10.1	35.4	18.2	12.4	8.6	34.0
2091	8	14.0	17.9	6.5	49.9	49.9	11.9	34.4	22.1	21.8	10.1	19.3	13.5	6.5	16.9	9.8	11.6	9.7	11.4	13.8	35.7	14.2	24.1	19.5	6.7	8.2	9.3	29.1	19.9
2091	9	11.6	13.1	1.5	26.1	8.2	9.7	14.8	11.1	13.6	8.1	21.8	15.7	21.9	18.3	12.2	8.0	10.2	23.9	26.1	19.6	1.5	19.7	12.2	7.7	5.3	6.5	7.7	11.0
2091	10	8.4	9.1	2.0	23.6	20.0	9.5	23.6	9.4	15.2	17.6	9.8	5.9	2.0	2.6	4.6	7.8	3.5	7.1	4.7	2.2	12.7	10.3	10.1	18.1	5.2	4.9	9.1	3.6
2091	11	7.4	8.0	2.6	19.6	9.8	7.7	7.2	5.6	8.5	9.4	10.6	6.5	4.8	7.2	19.6	10.0	4.2	2.6	7.6	3.5	4.4	9.6	15.8	4.8	3.0	4.5	15.3	9.4
2091	12	5.6	5.5	1.5	9.6	6.2	3.5	8.5	3.0	5.1	6.3	6.9	3.4	4.4	4.9	8.0	2.7	4.1	7.1	6.7	6.3	9.6	4.5	6.0	5.2	4.9	1.5	6.4	6.0
2092	1	5.6	6.2	2.0	14.7	3.2	7.3	6.1	4.6	5.2	8.6	7.7	3.7	2.0	7.1	2.0	7.0	4.7	6.1	14.7	2.5	6.1	5.2	4.0	10.7	13.4	5.6	5.6	5.2
2092	2	4.5	5.2	1.1	13.8	4.0	3.8	3.6	1.1	5.6	6.2	5.3	3.0	3.8	9.0	6.6	7.0	5.0	4.6	2.7	3.8	13.8	4.2	4.4	1.6	6.2	2.2	10.0	8.1
2092	3	5.6	5.4	1.1	9.8	7.2	7.6	5.7	4.3	5.7	4.4	4.1	1.1	6.6	9.8	4.4	7.8	3.1	4.7	5.8	2.6	6.6	8.3	4.9	5.5	9.4	2.9	6.5	1.7
2092	4	6.1	6.6	2.4	13.4	6.3	5.9	9.2	9.7	6.9	3.0	11.8	4.7	2.4	10.5	4.3	6.7	11.0	7.7	13.4	5.3	3.9	4.3	3.3	6.6	3.9	3.1	4.8	10.5
2092	5	8.4	10.1	4.0	26.7	6.6	8.2	6.0	5.6	9.9	7.5	21.2	14.4	8.1	6.1	7.0	6.7	11.4	4.0	17.7	8.6	26.7	9.5	15.5	8.8	7.9	9.3	12.0	4.9
2092	6	14.3	15.1	4.2	31.9	10.5	18.6	11.4	17.0	4.2	15.4	4.5	19.0	11.2	5.9	14.6	29.4	12.4	18.0	31.9	9.3	14.6	11.8	9.8	14.1	25.5	8.0	15.2	30.0
2092	7	15.1	16.1	3.6	36.5	13.4	6.0	12.3	28.4	8.4	26.8	12.4	24.4	16.2	15.2	19.9	20.5	14.5	17.3	8.8	36.5	17.3	15.1	12.9	17.6	11.5	6.7	3.6	21.4
2092	8	16.1	16.3	5.3	31.8	8.4	7.9	10.9	31.8	16.3	20.0	7.6	7.1	15.9	13.2	21.8	7.1	18.9	19.4	5.3	24.3	21.5	11.5	13.5	26.4	28.1	11.2	25.1	18.1
2092	9	16.7	18.5	6.3	46.5	14.7	26.7	15.2	13.1	16.9	23.5	6.3	17.6	20.1	10.3	19.8	39.2	16.7	16.8	10.1	46.5	16.8	15.1	15.0	28.5	12.8	15.8	17.3	10.1
2092	10	8.2	9.6	2.6	31.2	10.5	31.2	4.2	2.6	12.9	15.6	2.7	9.9	10.6	14.1	8.4	8.0	15.6	4.8	5.9	6.6	5.5	18.5	3.2	3.6	7.0	5.8	9.0	13.0
2092	11	6.6	6.9	2.2	12.9	8.6	6.1	7.4	5.2	4.4	11.1	6.7	11.1	5.2	6.6	8.1	5.8	8.1	4.4	12.9	8.9	7.0	10.9	4.2	6.5	4.8	5.5	2.2	4.6
2092	12	6.5	6.5	2.4	13.0	5.5	5.0	7.4	4.8	10.9	3.7	10.6	4.2	13.0	6.4	6.5	6.6	7.4	4.6	6.2	6.6	6.1	6.9	2.4	6.6	6.9	3.9	5.2	9.1
2093	1	5.0	6.2	2.1	16.5	4.2	3.1	2.8	4.4	9.4	16.5	2.1	5.3	7.7	4.7	2.8	10.6	5.9	4.2	9.8	5.5	2.5	8.6	15.3	4.7	3.7	7.2	5.4	2.2
2093	2	5.0	5.0	1.4	9.7	4.5	4.0	7.0	4.2	5.2	5.1	4.9	5.1	7.1	3.1	1.7	3.6	6.9	9.7	4.7	3.9	3.6	1.4	6.9	5.2	6.1	4.7	6.1	5.4
2093	3	5.7	7.0	0.7	28.4	12.0	3.3	3.7	4.4	9.9	28.4	6.7	5.7	7.1	5.4	11.2	5.6	15.1	2.9	1.4	6.2	7.9	3.1	0.7	5.8	3.3	4.4	5.9	8.6
2093	4	5.6	7.3	1.3	18.9	7.3	3.1	6.6	4.9	7.7	3.0	5.6	13.7	5.4	18.9	4.9	3.7	6.8	17.3	7.3	5.4	1.3	11.8	4.0	7.2	16.1	4.2	5.7	3.9
2093	5	8.7	9.4	2.2	16.9	9.9	8.0	14.5	8.4	8.0	6.7	5.6	7.5	4.3	2.2	11.0	12.7	8.5	8.9	6.2	9.3	16.9	7.7	11.4	16.4	13.8	12.9	10.3	3.8
2093	6	12.2	13.9	3.3	40.1	40.1	8.7	3.3	24.0	9.4	5.4	16.7	11.0	15.9	13.1	31.1	16.0	9.4	16.5	11.2	13.2	9.7	15.3	10.1	9.0	8.9	6.7	13.4	16.2
2093	7	14.2	15.9	3.7	37.0	17.7	20.6	10.5	12.9	18.2	20.1	19.5	26.9	11.0	16.8	15.0	15.4	37.0	10.7	13.5	36.2	7.3	15.8	3.7	11.9	10.7	7.6	11.7	11.3
2093	8	15.8	18.7	8.2	76.4	20.7	17.0	11.8	24.1	10.5	30.1	12.6	13.0	15.4	10.5	16.7	26.3	12.5	8.2	10.4	11.0	18.5	10.3	8.6	34.1	16.1	76.4	16.7	16.4
2093	9	14.5	15.0	4.4	32.4	27.1	13.9	6.8	11.2	27.7	15.4	23.6	4.4	14.6	10.6	32.4	10.7	16.7	14.4	11.0	18.9	19.9	6.6	6.8	10.5	15.5	15.0	10.1	15.8
2093	10	8.2	8.5	2.0	16.5	5.6	2.0	6.8	7.4	10.7	4.3	11.4	10.1	6.3	4.0	4.3	10.8	9.1	13.8	11.8	7.0	10.3	3.6	6.0	12.8	8.9	16.5	4.8	14.4
2093	11	6.7	7.0	2.6	12.8	5.3	3.5	8.5	2.6	6.7	6.5	6.1	9.0	10.0	8.3	10.6	6.4	8.7	4.5	9.4	5.2	4.8	3.6	7.6	12.8	7.5	6.7	4.5	10.3

2093	12	5.6	5.7	3.3	9.7	5.5	4.8	4.0	3.4	3.3	5.6	4.6	3.7	6.0	5.6	9.0	3.7	9.1	6.7	5.2	3.3	4.6	5.9	7.3	6.6	5.8	6.8	9.7	6.0
2094	1	5.2	5.6	1.8	10.0	9.9	7.7	4.3	5.8	4.6	5.8	4.9	4.9	4.7	9.2	5.4	5.1	6.5	5.6	5.9	10.0	6.1	4.4	4.6	1.8	5.3	2.8	5.0	3.5
2094	2	3.4	4.3	1.2	11.0	3.5	3.3	5.4	8.9	2.1	1.2	6.0	6.0	7.3	5.2	3.0	3.1	11.0	1.7	2.1	5.6	4.8	3.2	5.2	1.9	3.0	2.8	5.3	1.9
2094	3	6.8	7.3	1.6	17.0	3.0	7.1	14.0	7.1	5.8	6.3	17.0	7.4	8.8	3.1	2.5	9.1	7.7	6.4	9.9	9.3	1.6	11.4	6.2	4.5	15.7	3.1	4.2	4.8
2094	4	6.4	6.6	2.3	13.3	12.4	3.5	9.4	6.4	13.3	4.8	6.5	6.8	4.8	6.4	4.9	9.6	3.9	3.7	5.1	2.3	7.4	2.7	4.7	8.3	7.2	4.0	9.8	10.2
2094	5	9.4	11.2	3.4	34.9	13.7	3.8	15.4	8.4	5.3	12.1	18.9	19.7	5.9	8.7	8.1	3.4	5.2	16.5	10.1	13.3	11.5	5.3	6.8	34.9	6.1	17.2	14.0	4.4
2094	6	11.3	13.4	4.8	36.3	10.4	12.9	29.1	12.4	16.1	11.0	11.7	12.0	9.8	7.6	10.7	10.7	12.2	4.8	28.4	8.6	5.1	18.2	18.7	36.3	7.3	13.3	5.9	7.8
2094	7	15.5	20.2	6.7	84.8	10.2	42.1	10.4	44.8	14.6	13.8	16.7	13.0	6.9	21.0	15.5	20.6	11.5	34.4	7.1	84.8	9.1	25.1	16.6	17.2	7.7	19.8	15.6	6.7
2094	8	15.4	19.9	4.7	101.5	9.4	12.9	4.7	45.2	28.0	11.7	14.6	6.9	17.9	24.0	12.9	8.1	17.8	16.2	7.9	19.8	16.8	101.5	29.5	8.4	12.1	13.3	18.5	19.0
2094	9	15.3	16.4	4.2	33.9	20.6	11.7	24.1	15.4	29.9	29.8	15.2	17.6	4.2	14.7	33.9	20.9	15.8	10.5	20.1	5.7	10.3	12.7	15.0	21.7	8.8	8.9	9.6	16.0
2094	10	8.0	9.3	3.1	19.6	11.7	3.1	8.1	6.0	8.3	5.2	10.8	7.4	14.4	16.5	6.5	6.9	9.1	4.8	5.3	9.4	12.7	19.6	7.9	16.4	15.7	6.7	7.1	4.0
2094	11	5.6	6.2	3.1	12.3	6.0	4.2	9.8	7.8	3.6	8.2	3.3	5.4	4.7	10.7	5.7	11.2	3.1	5.6	6.7	4.6	4.8	3.1	4.0	12.3	7.0	4.0	6.8	5.9
2094	12	5.5	6.9	2.5	22.7	8.7	7.7	4.3	12.0	5.2	2.5	4.2	2.7	9.2	7.0	6.2	5.7	7.3	5.3	5.2	2.9	8.9	13.4	5.1	22.7	3.4	4.8	5.6	4.9
2095	1	5.0	5.2	0.7	9.8	7.1	2.6	4.8	6.2	6.0	5.0	4.7	4.4	4.2	4.8	2.6	5.0	0.7	2.2	5.1	6.1	2.6	8.0	6.9	9.8	5.4	8.4	8.3	2.8
2095	2	4.1	5.1	1.1	13.3	3.9	5.8	3.0	6.2	2.8	3.6	3.9	9.8	10.0	3.5	5.9	3.7	6.2	4.2	1.4	3.2	5.8	6.3	3.4	4.9	6.8	1.1	3.4	13.3
2095	3	5.2	5.9	0.0	16.0	13.0	9.5	3.4	6.5	2.8	0.0	4.4	3.2	7.1	5.1	5.3	4.3	6.2	6.8	9.4	3.8	2.2	7.3	2.8	2.7	16.0	6.2	11.1	1.8
2095	4	6.4	6.7	1.7	15.2	7.1	2.2	6.6	6.5	9.8	4.6	9.5	5.1	5.6	6.3	2.9	12.7	3.8	10.2	9.6	1.7	2.8	15.2	10.6	7.2	3.7	5.0	8.0	4.7
2095	5	9.6	12.8	3.4	40.5	4.3	13.2	6.3	22.6	4.9	40.5	3.4	18.5	8.6	13.0	8.0	19.9	6.2	9.8	20.6	14.9	9.3	17.5	7.3	15.7	6.8	19.7	9.0	7.9
2095	6	11.7	11.7	3.1	25.0	13.4	16.8	8.8	14.9	10.4	5.6	13.3	15.9	9.3	11.4	17.0	3.1	5.4	23.3	16.1	6.4	12.1	9.1	12.1	6.0	8.3	25.0	13.5	3.7
2095	7	13.3	15.9	6.1	61.7	13.5	24.0	13.2	22.0	7.2	11.7	13.9	9.2	61.7	10.4	14.6	11.9	13.5	8.0	37.9	14.1	16.5	13.9	11.7	6.1	14.4	12.6	10.0	8.9
2095	8	12.5	14.4	5.2	39.5	11.9	14.1	14.2	8.2	32.4	5.2	6.0	8.7	13.8	10.1	14.9	9.1	13.0	39.5	11.1	9.8	14.8	13.0	16.7	7.6	16.2	12.0	34.1	8.6
2095	9	11.8	12.6	2.4	30.1	12.0	25.1	10.8	4.0	14.1	9.2	6.6	19.9	14.0	2.4	5.4	9.2	17.4	7.4	24.1	17.7	11.7	15.9	12.2	4.9	6.6	13.1	8.8	30.1
2095	10	6.6	7.4	2.5	17.8	5.8	17.8	6.4	5.0	11.6	2.5	11.7	10.6	5.4	7.0	12.6	6.5	8.6	3.1	4.8	6.9	3.8	6.7	5.5	6.3	10.5	3.3	7.1	6.9
2095	11	7.9	8.8	3.1	21.9	9.2	9.2	6.7	21.9	4.0	6.8	9.7	5.3	3.5	15.4	6.3	7.7	10.5	5.2	8.0	12.3	7.1	6.4	3.1	16.2	10.5	3.8	9.2	14.0
2095	12	5.6	6.5	2.3	18.2	5.8	7.6	4.8	2.7	7.3	2.7	7.5	5.2	8.8	7.7	7.5	3.9	2.7	5.3	5.2	18.2	9.6	2.3	6.5	16.0	5.3	6.2	2.5	5.3
2096	1	5.0	6.1	1.7	13.6	4.2	7.8	1.8	7.6	4.7	11.8	9.1	4.9	10.1	13.6	5.1	6.9	6.3	3.4	4.8	4.8	4.8	11.0	2.2	1.7	2.6	6.5	6.0	3.9
2096	2	5.8	6.2	1.9	13.2	7.3	13.2	5.6	1.9	8.8	6.5	5.6	3.6	9.1	3.3	3.5	4.2	8.8	2.1	4.4	3.5	6.0	5.6	6.1	10.2	6.5	8.8	5.3	7.8
2096	3	4.4	4.7	0.6	10.9	7.1	4.2	6.6	4.3	9.9	10.9	5.2	3.0	3.2	3.1	7.6	1.3	3.5	1.9	5.3	3.6	3.1	5.3	4.5	4.4	6.5	4.8	3.7	0.6
2096	4	6.2	6.6	0.0	19.2	9.4	9.0	4.0	4.6	5.2	6.5	15.0	6.1	3.7	2.7	4.0	8.4	9.2	7.9	5.1	7.6	3.2	1.5	19.2	6.2	0.0	0.6	7.5	10.8
2096	5	6.6	9.3	3.0	19.7	18.7	4.5	6.9	13.5	3.2	9.4	7.8	10.1	5.3	5.7	5.3	19.2	6.3	4.5	18.2	3.0	5.1	9.0	4.8	16.2	16.4	19.7	5.4	5.6
2096	6	11.4	12.3	3.6	32.4	5.2	6.1	9.6	12.2	10.6	11.3	11.7	16.4	22.4	6.8	13.6	3.6	10.6	16.0	32.4	15.0	8.7	12.4	16.9	8.8	11.3	17.5	3.6	11.6
2096	7	13.4	14.3	3.8	40.5	13.3	28.3	9.9	15.6	7.8	13.8	13.4	7.5	6.7	18.9	7.8	19.7	18.6	11.2	11.8	4.0	17.9	10.3	13.9	40.5	8.9	3.8	22.6	16.5
2096	8	15.3	15.5	7.7	28.1	11.5	14.8	12.7	28.1	21.3	24.5	16.1	17.1	12.2	9.3	15.7	19.7	17.9	19.6	8.5	9.3	12.6	20.4	9.8	9.0	25.7	17.9	7.7	11.4
2096	9	13.2	15.7	5.2	39.4	22.1	22.8	14.7	20.3	22.4	39.4	13.4	19.9	5.4	12.7	13.6	12.8	8.7	6.5	24.5	19.3	25.8	5.2	10.3	12.2	9.6	13.0	13.0	10.4
2096	10	6.2	8.0	3.1	20.1	6.3	19.7	20.1	5.0	11.7	3.3	10.0	3.1	4.4	11.5	5.2	6.5	9.1	4.1	3.7	6.2	5.5	5.9	5.3	9.6	17.9	5.4	6.2	6.4
2096	11	6.0	6.5	2.6	12.3	3.8	3.3	5.4	10.5	5.5	5.6	3.6	8.2	4.7	6.9	9.1	6.2	11.3	8.3	6.1	6.1	3.3	6.0	3.7	3.3	11.2	9.3	12.3	2.6
2096	12	5.4	5.5	2.4	10.1	6.8	7.7	3.5	5.4	6.4	2.4	5.4	7.3	2.7	8.2	5.7	3.3	6.2	3.6	3.0	8.9	4.2	10.1	4.7	6.1	3.7	7.0	4.5	4.7
2097	1	6.2	6.6	2.4	11.1	2.4	8.2	6.3	11.0	3.2	9.4	6.3	10.5	5.8	4.1	4.1	11.1	8.8	7.1	5.9	4.7	6.0	6.0	5.0	6.3	4.3	10.3	6.8	6.1
2097	2	4.1	5.0	1.3	9.2	3.8	4.0	4.0	4.0	9.2	9.1	1.5	5.3	7.1	7.1	6.1	5.3	5.3	3.4	3.5	4.0	4.1	6.3	4.1	1.3	6.5	3.6	3.2	7.8
2097	3	4.8	5.5	1.1	13.1	2.7	2.2	4.7	4.6	7.5	3.5	6.5	4.4	5.9	6.0	3.8	10.4	1.8	5.6	1.1	5.2	4.2	11.3	6.1	3.8	4.9	4.6	9.1	13.1
2097	4	6.6	8.0	2.6	20.0	8.0	6.7	10.1	6.0	8.4	20.0	5.7	6.5	2.6	8.5	4.1	8.8	5.6	17.2	11.9	6.4	4.2	9.9	6.9	3.6	14.1	6.1	4.3	6.3
2097	5	10.5	11.8	3.9	25.1	7.5	6.1	18.3	8.9	10.1	25.1	12.0	15.9	10.8	9.9	4.5	7.7	8.1	16.1	19.8	22.1	11.6	6.7	17.5	3.9	4.0	17.2	11.1	8.3
2097	6	13.0	13.5	2.0	28.6	22.6	13.8	11.9	21.6	9.3	15.6	4.7	13.1	19.3	8.1	18.9	9.0	14.0	28.6	19.9	7.3	12.9	14.0	8.6	12.4	2.0	4.0	20.0	12.2
2097	7	15.6	18.3	6.9	39.8	27.2	14.0	35.5	26.4	39.8	8.2	17.9	16.2	15.0	14.9	10.7	14.0	20.9	12.2	32.3	19.7	12.2	10.9	25.0	23.4	7.3	19.0	6.9	9.3
2097	8	11.5	16.3	2.9	53.1	8.4	13.2	12.1	18.7	10.8	5.9	10.3	7.8	26.1	8.1	2.9	25.8	8.4	11.9	53.1	7.4	11.1	23.9	17.3	46.3	7.4	6.7	22.7	25.3
2097	9	15.5	15.1	4.4	28.8	9.8	13.0	13.0	15.3	19.6	25.0	6.6	25.9	9.0	8.9	11.0	10.1	5.9	15.7	24.3	19.0	19.9	6.4	4.4	21.6	16.4	16.3	28.8	15.6
2097	10	7.5	7.6	2.6	15.7	3.6	4.6	9.3	12.9	10.7	8.7	6.2	9.1	15.7	5.9	5.2	10.7	11.3	4.8	3.6	8.4	6.1	3.2	7.4	6.4	8.7	2.6	10.4	7.6
2097	11	7.5	8.0	2.6	15.4	2.6	6.8	8.5	8.2	4.4	12.4	11.5	11.3	3.1	5.9	15.4	9.4	14.3	14.4	3.1	3.0	4.7	6.4	4.9	11.7	4.0	4.0	14.1	8.6
2097	12	5.0	6.1	2.7	18.4	8.5	10.1	3.7	4.5	5.0	5.0	4.5	6.7	4.5	3.3	3.6	5.8	5.6	3.6	5.8	9.7	5.5	4.4	3.6	5.9	4.6	18.4	11.6	2.7
2098	1	5.9	6.3	1.4	15.3	11.4	7.6	7.9	9.2	5.1	1.4	7.5	3.2	6.2	6.6	7.3	2.5	3.7	6.0	3.2	11.8	5.6	9.4	15.3	5.1	4.2	2.7	5.7	3.8
2098	2	4.3	4.8	2.3	11.3	4.8	4.0	4.3	2.4	3.6	4.0	9.8	11.3	3.0	3.1	4.5	2.6	5.6	4.4	2.4	6.7	3.8	5.5	2.7	2.3	6.3	4.3	6.2	8.1
2098	3	4.8	5.9	2.8	12.0	5.0	2.8	11.1	7.2	9.2	3.0	12.0	3.1	7.5	3.2	2.8	10.2	3.5	4.4	4.3	6.1	3.7	4.5	10.6	5.1	6.1	3.2	4.1	9.5
2098	4	5.8	7.3	1.8	21.4	5.5	3.7	11.5	5.7	5.9	4.1	10.1	4.3	6.8	2.0	6.1	21.4	1.8	6.4	6.8	4.7	11.5	4.3	5.2	6.7	15.2	3.9	2.8	19.2
2098	5	8.6	9.9	4.1	19.2	5.3	10.2	4.1	5.0	8.5	16.6	6.5	9.7	8.6	10.0	19.2	5.8	14.9	16.4	11.1	17.9	10.3	7.8	6.8	5.7	6.8	16.2	8.5	4.9
2098	6	12.6	15.1	4.3	41.4	12.3	12.9	10.4	25.0	13.7	4.3	7.6	9.2	34.9	8.2	13.2	5.1	11.6	19.9	6.0	11.6	25.0	10.7	18.8	13.7	10.5	41.4	18.1	18.9
2098	7	14.1	17.9	6.8	33.0	33.0	21.9	23.4	12.9	14.1	9.4	26.9	7.0	18.5	24.3	28.6	10.7	13.1	12.7	23.4	6.8	24.7	13.2	13.5	26.9	10.3	10.5	29.9	14.1
2098	8	13.7	15.7	5.3	34.7	5.9	11.5	22.7	8.9	22.6	14.0	5.3	19.3	5.7	18.4	31.8	10.1	34.7	15.6	12.0	20.1	10.1	7.1	26.4	13.4	16.2	6.7	29.6	8.9
2098	9	11.0	12.9	3.7	28.2	7.3	9.1	8.2	7.0	28.2	21.6	18.5	10.3	18.6	25.8	15.8	10.1	3.7	8.3	15.7	21.2	3.9	6.5	9.0	11.7	12.0	14.6	8.4	13.4
2098	10	8.7	9.7	2.6	22.8	9.8	15.8	11.5	5.7	5.1	6.4	16.9	22.8	5.9	15.9	9.0	7.1	4.1	4.1	6.9	6.4	13.3	19.6	4.1	8.6	9.7	8.8	13.0	2.6
2098	11	5.4	7.4	3.4	19.1	6.3	6.9	3.7	19.1	4.7	9.2	10.2	5.4	3.9	15.8	8.9	9.9	5.1	5.4	4.7	4.7	3.8	5.4	12.2	8.0	5.3	4.6	9.9	3.4
2098	12	5.8	6.0	2.1	11.4	8.7	5.8	6.1	5.8	2.1	3.5	11.4	6.4	4.5	3.1	9.1	2.1	3.9	6.9	8.6	5.6	7.3	3.2	11.4	3.5	3.7	11.1	7.4	3.8
2099	1	5.1	5.6	1.6	12.0	9.3	9.8	4.8	3.7	4.0	3.9	5.5	7.9	2.2	1.6	4.6	2.9	6.2	7.9	3.0	3.6	5.7	8.2	4.4	5.7	4.7	6.3	12.0	6.2
2099	2	4.2	4.3	1.7	10.1	4.8	5.8	2.6	6.1	4.6	3.6	3.3	4.8	2.7	3.8	4.5	4.7	4.7	2.7	1.8	3.4	6.9	4.0	4.9	10.1	3.6	2.9	1.7	5.7
2099	3	5.1	5.3	2.0	13.5	5.5	5.2	2.2	2.6	4.4	8.9	4.4	8.7	5.5	4.6	6.1	2.8	13.5	5.0	11.0	3.5	2.7	5.2	7.3	5.5	2.0	2.3	5.4	3.4
2099	4	6.0	7.8	1.1	22.0	6.0	4.6	6.6	12.0	9.2	4.1	3.4	5.6	5.8	18.9	5.5	6.0	13.7	22.0	6.7	1.1	7.3	3.2	7.7	18.1	10.4	3.7	2.6	3.2
2099	5	8.7	10.8	3.8	26.2	6.0	13.8	12.1	21.2	6.3	20.7	13.5	9.2	5.9	4.1	23.8	6.8	26.2	8.2	9.6	5.6	5.5	6.7	7.2	16.3	7.0	10.0	10.5	3.8
2099	6	11.5	12.5	3.0	31.1	14.0	17.0	10.1	16.5	7.5	15.7	11.9	9.0	4.7	22.4	9.8	11.6	15.5	3.3	13.5	3.0	9.1	24.6	7.2	11.2	6.9	12.1	31.1	11.3
2099	7	13.2	14.2	4.0	29.4	12.1	12.9	5.9	12.6	10.8	22.0	26.6	8.3	22.7	4.0	14.1	9.7	14.6	29.4	11.4	11.2	14.4	9.1	25.3	15.1	14.3	16.7	13.4	5.1
2099	8	11.8	14.0	4.4	37.5	5.9	4.4	5.4	7.0	18.4	10.9	10.7	31.1	12.8	17.4	8.9	19.3	14.5	14.7	4.6	20.6	37.5	8.1	10.1	17.7	6.3	20.6	20.2	9.8
2099	9	15.6	17.0	6.9	42.6	9.0	14.3	18.7	14.3	21.8	14.6	42.6	10.3	17.7	6.9	25.6	19.1	15.9	10.4	15.7	27.3	20.0	8.0	15.6	10.2	9.3	16.2	28.8	15.3
2099	10	7.7	8.2	2.5	20.0	2.9	7.9	12.3	5.2	7.0	7.7	20.0	6.4	9.3	4.2	9.8	6.5	7.7	4.8	9.2	6.1	2.5	6.8	7.8	10.9	16.1	7.7	13.5	5.4
2099	11	7.8	8.5	2.2	17.3	9.3	8.2	4.9	7.5	2.2	9.5	14.4	10.3	6.5	2.5	3.6	15.4	17.3	15.9	7.8	7.7	6.1	4.2	13.8	6.1	8.7	6.8	10.2	5.6
2099	12	5.7	7.1	2.2	29.0	12.8	29.0	6.8	5.7	10.2	4.5	5.8	5.6	4.3	6.9	12.4	4.0	5.4	2.2	6.4	7.2	7.6	5.3	4.5	3.0	4.5	4.0	7.7	5.2
2100	1	4.7	4.8	1.6	10.7	5.9	5.9	4.8	1.9	3.4	7.5		4.7	4.8	7.6	6.2	6.1	4.8	10.7	3.2	3.1	3.2	5.7	3.1	3.0	4.0	1.6	4.1	4.4
2100	2	4.8	4.7	1.5	8.1	3.5	5.9	4.3	6.7	5.9	2.1		7.7	4.8	4.8	7.4	2.1	2.8	2.6	8.1	2.2	1.5	4.3	5.4	4.3	7.2	5.1	3.3	5.2
2100	3	6.7	7.0	1.3	14.2	1.3	4.8	9.4	2.9	6.4	11.7		14.2	6.7	4.7	9.0	6.8	10.0	3.5	12.1	9.7	3.8	7.1	4.4	9.5	4.4	5.5	4.0	9.8
2100	4	6.0	6.4	0.6	17.2	3.0	17.2	6.0	11.3	2.9	0.6		2.7	2.7	3.1	10.7	8.8	6.7	2.8	7.1	10.3	3.4	10.1	2.1	13.0	1.0	5.8	9.4	6.2
2100	5	8.9	9.8	0.0	27.0	13.1	10.2	1.5	9.1	7.5	6.4		27.0	4.6	18.8	22.2	6.0	6.2	0.0	8.2	10.1	13.5	2.9	15.3	6.6	8.9	2.9	11.1	14.1
2100	6	13.5	16.0	4.0	35.9	9.9	13.5	35.9	4.0	23.6	7.9		30.7	11.0	11.1	13.7	4.0	9.2	7.3	9.4	12.0	22.3	26.2	27.5	26.3	20.4	10.3	13.8	17.8
2100	7	14.6	17.1	3.5	66.9	13.5	19.5	30.2	13.5	10.0	10.2		17.4	18.5	15.1	15.8	9.7	66.9	21.1	8.6	18.7	14.6	23.1	11.4	13.5	9.8	3.5	15.9	12.6
2100	8	13.4	14.7	6.7	32.5	32.5	7.8	20.6	21.6	7.3	8.0		14.3	10.4	24.4	28.6	21.2	7.1	14.2	10.1	9.3	16.8	19.5	14.6	10.9	13.4	8.8	10.2	6.7
2100	9	11.9	12.9	2.7	29.3	9.4	14.2	24.4	15.3	9.6	29.3		13.8	20.9	15.6	6.8	14.9	17.2	11.5	11.9	20.1	6.5	13.0	2.9	7.4	2.7	9.6	9.1	10.4
2100	10	7.7	8.8	2.7	15.1	7.1	13.8	13.2	11.1	8.7	5.7		3.0	7.7	2.7	10.8	13.7	6.0	6.6	15.1	15.0	4.9	11.1	5.4	3.3	14.5	5.5	11.0	7.0
2100	11	7.9	7.7	2.7	14.8	2.7	12.6	14.8	7.9	8.6	8.6		3.4	9.9	4.8	5.4	4.0	6.4	8.2	10.7	8.5	4.9	3.9	11.7	6.5	11.0	4.2	11.7	7.3
2100	12	5.0	5.6	2.7	10.3	5.7	4.2	4.1	3.5	9.4	6.8		4.2	3.3	8.9	10.3	4.8	4.5	5.1	8.1	2.7	3.2	6.9	8.9	4.1	4.2	6.6	5.4	5.0

RCP4.5

Day with Daily Precip (mm) ... **>1**

std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d

Year	Month	Median	Mean	Min	Max	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
2011	1	8	8.2	2	14	10	5	7	9	13	3	10	7	6	11	6	12	8	13	3	7	9	14	7	11	9	7	2	7
2011	2	7	6.8	0	13	3	4	8	6	6	10	8	3	7	13	3	6	13	11	8	2	4	5	7	0	9	11	8	8
2011	3	7	6.5	2	13	8	2	9	3	8	13	5	12	7	7	3	5	4	8	5	5	4	8	5	6	7	8	7	7
2011	4	7	6.5	2	11	11	9	2	10	5	8	5	4	7	7	10	5	6	2	5	6	4	10	4	10	7	8	3	7
2011	5	10	9.6	0	18	7	12	12	5	0	10	8	10	13	8	18	8	16	7	10	6	6	13	14	6	11	7	14	9
2011	6	12	10.9	4	19	12	9	12	8	4	12	14	8	12	16	13	9	14	5	19	8	10	15	6	9	13	7	12	14
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2095	1	9	8.5	0	15	13	5	6	11	8	11	9	6	9	8	6	12	0	3	6	8	6	15	7	13	9	13	11	9
2095	2	7	6.8	1	15	6	8	8	7	5	6	7	7	4	5	9	9	9	7	4	4	15	5	11	9	1	2	4	12
2095	3	5	6.2	0	12	12	3	4	10	6	0	9	10	11	3	5	4	7	5	12	2	7	3	3	3	5	11	9	5
2095	4	7	7.0	2	14	13	5	10	11	9	5	5	4	5	6	2	11	4	14	8	2	7	8	9	7	3	7	9	5
2095	5	8	8.3	3	16	10	11	9	16	4	13	3	13	8	8	9	6	7	13	7	7	7	12	5	9	6	5	9	3
2095	6	11	10.5	3	17	13	8	12	12	6	5	7	16	15	17	16	3	11	15	15	6	7	10	12	8	6	15	10	8
2095	7	14	15.3	9	22	13	16	18	20	15	18	10	14	20	9	17	13	13	11	22	14	14	20	14	14	17	21	14	11
2095	8	13	12.6	5	23	15	12	12	12	11	8	7	9	23	13	15	14	16	13	17	10	5	18	16	10	16	14	11	6
2095	9	11	11.4	2	21	9	19	14	11	10	12	12	12	21	2	11	13	8	8	14	18	9	19	10	8	11	5	9	9
2095	10	11	10.0	3	20	14	20	11	6	15	4	9	11	11	10	15	10	11	8	12	11	7	8	8	7	12	3	12	6
2095	11	11	11.1	4	17	9	11	9	15	10	12	4	11	11	12	15	11	14	7	8	7	12	13	8	12	14	11	14	17
2095	12	11	10.2	3	19	19	13	11	3	15	7	9	11	11	7	12	4	9	11	12	7	12	13	12	10	10	7	9	10
2096	1	9	9.2	3	17	11	13	5	11	15	15	9	7	17	15	11	9	12	8	9	8	3	10	5	4	6	6	7	4
2096	2	8	7.3	2	16	11	9	7	2	12	16	9	8	5	3	4	2	12	4	8	3	5	9	9	8	10	7	3	9
2096	3	6	6.3	0	14	14	5	4	9	13	8	7	5	7	3	7	4	1	5	6	10	5	10	5	4	4	7	9	0
2096	4	6	5.5	0	13	7	6	7	5	7	4	8	5	7	6	5	6	6	6	5	8	4	1	8	5	0	0	4	13
2096	5	8	8.5	2	18	18	12	9	7	8	8	7	11	6	13	11	11	5	7	11	2	5	10	7	9	6	10	7	5
2096	6	11	11.2	4	20	11	15	11	14	11	4	9	16	11	17	13	6	20	16	15	5	7	10	9	4	9	12	11	13
2096	7	12	12.3	2	20	9	11	17	12	8	11	14	10	8	12	11	16	9	13	15	2	8	15	20	19	16	11	11	16
2096	8	13	12.4	8	20	18	20	14	16	8	13	12	9	14	10	16	14	13	12	10	15	12	13	10	9	10	13	8	9
2096	9	13	12.7	4	19	15	19	14	18	12	9	8	10	7	16	13	12	7	11	16	17	4	13	14	10	12	16	13	19
2096	10	11	10.8	4	17	14	12	10	14	13	7	13	4	9	8	6	14	16	11	9	10	8	11	13	12	9	17	8	10
2096	11	9	10.0	3	19	13	7	10	11	9	12	5	19	6	14	9	5	17	9	5	7	11	9	14	8	6	18	12	3
2096	12	10	9.3	3	14	10	11	7	9	13	3	10	9	7	10	7	9	11	7	13	13	6	11	14	11	3	9	11	8
2097	1	9	9.4	1	17	1	11	8	8	9	9	6	9	15	8	8	13	9	17	17	7	9	10	9	6	10	10	4	13
2097	2	7	7.2	2	15	9	9	6	6	15	4	3	5	4	9	12	8	7	6	11	6	4	8	4	2	12	4	7	12
2097	3	7	6.7	2	12	5	7	6	8	12	8	6	7	10	7	7	6	4	6	2	4	5	3	7	9	4	6	9	12
2097	4	6	6.0	2	13	9	6	4	4	8	9	6	2	3	7	4	7	4	2	5	3	11	6	13	6	9	9	4	4
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2097	6	12	11.9	2	19	12	11	11	15	7	15	8	12	16	18	14	11	15	12	19	13	12	11	12	9	2	6	9	16
2097	7	16	15.6	6	21	17	16	18	19	11	14	12	19	14	6	10	18	15	16	17	20	12	15	16	21	15	21	13	19
2097	8	13	13.3	6	19	12	12	17	18	9	10	8	11	19	7	6	12	13	17	19	12	10	17	18	18	8	14	18	15
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2097	10	11	10.7	3	16	11	3	10	12	5	11	6	8	12	12	14	11	13	14	9	13	11	5	15	11	11	9	16	15
2097	11	10	9.9	2	16	4	6	12	9	9	11	16	10	10	14	9	10	11	6	8	5	10	8	13	16	10	2	14	15
2097	12	10	10.5	3	15	13	10	10	11	7	10	9	15	12	15	11	9	10	9	11	3	11	15	12	10	8	14	9	7
2098	1	9	8.0	1	12	2	5	8	12	10	1	10	8	7	8	12	4	4	9	10	10	8	12	10	9	9	4	11	9
2098	2	7	7.0	2	14	8	8	4	2	7	9	6	14	4	14	5	3	5	8	10	7	3	4	4	7	8	11	9	8
2098	3	6	6.1	1	12	9	1	10	4	11	2	6	3	12	2	3	11	6	7	9	5	3	8	7	7	7	4	4	5
2098	4	6	6.4	1	12	5	5	7	12	8	5	7	3	8	1	6	11	5	9	10	5	6	5	8	5	4	3	7	9
2098	5	8	8.3	2	17	10	17	8	11	7	5	11	6	4	5	10	5	11	8	9	7	12	2	5	4	7	7	16	11
2098	6	12	12.4	4	19	4	13	8	17	13	7	10	13	17	7	13	11	12	19	10	12	16	11	17	11	10	18	17	12
2098	7	16	14.4	5	22	18	13	11	19	17	7	14	8	19	9	18	14	9	17	22	5	17	9	19	16	15	18	16	16
2098	8	12	12.3	5	20	9	11	13	16	10	10	9	10	12	13	11	15	15	14	20	5	18	8	14	16	12	7	11	17
2098	9	12	11.4	4	18	5	14	12	9	18	12	9	9	11	18	13	11	7	12	18	8	4	13	8	16	10	9	15	12
2098	10	12	11.7	5	18	11	11	18	8	12	13	14	17	11	14	11	12	14	9	16	8	8	12	14	13	9	10	10	5
2098	11	9	9.8	4	17	7	17	4	13	12	13	13	9	12	6	9	15	6	14	4	7	5	7	13	9	9	9	15	7
2098	12	9	9.3	1	17	9	11	9	15	6	12	7	3	9	7	14	5	11	9	10	9	12	9	17	9	9	10	10	1
2099	1	7	7.6	3	16	10	8	9	10	5	10	3	5	6	4	5	4	9	7	6	7	8	12	6	13	16	5	6	8
2099	2	6	6.6	2	11	6	10	5	10	6	6	8	6	8	11	10	7	7	5	3	3	4	7	10	8	6	4	2	6
2099	3	7	6.6	2	12	10	6	3	6	8	7	12	9	6	8	7	2	10	8	12	5	5	6	7	3	4	4	2	8
2099	4	6	6.3	1	13	12	6	5	8	7	9	1	1	11	2	5	9	13	5	6	1	6	2	10	8	4	6	7	7
2099	5	9	8.8	4	18	10	9	14	12	7	18	12	6	5	5	12	5	9	8	13	6	4	7	12	9	7	7	9	5
2099	6	11	11.3	5	19	12	13	12	11	11	14	9	10	8	12	17	19	10	5	16	5	11	16	9	8	9	7	13	14
2099	7	13	13.8	5	25	15	13	11	5	13	25	14	10	15	11	12	17	14	12	14	5	24	13	12	24	23	16	5	9
2099	8	12	12.4	5	20	20	9	8	6	10	15	13	12	14	13	14	16	20	17	5	11	9	12	12	12	11	18	7	14
2099	9	12	12.9	9	23	9	10	17	16	11	17	10	11	16	12	12	11	14	12	13	9	11	11	12	14	10	9	19	23
2099	10	10	10.3	5	16	6	6	11	14	14	9	8	8	12	5	7	5	15	14	11	16	7	8	8	14	16	10	10	13
2099	11	12	12.3	4	21	14	8	7	9	4	13	18	17	14	11	13	16	6	15	11	10	21	9	17	10	14	11	18	8
2099	12	10	10.7	3	19	13	10	11	8	19	7	8	10	13	16	12	5	12	3	19	8	9	15	10	6	10	10	13	9
2100	1	8	8.1	2	18	13	8	8	4	6	18		10	8	9	9	7	4	4	7	10	9	11	3	12	7	2	7	10
2100	2	6	6.6	2	10	8	8	6	8	6	6		9	9	9	10	5	7	5	6	2	4	6	7	6	6	7	4	8
2100	3	6	6.6	1	13	1	6	10	4	10	6		8	13	6	3	4	5	5	11	9	7	4	6	6	5	7	8	7
2100	4	6	5.7	0	18	7	7	4	6	5	0		4	3	5	11	2	6	4	7	18	6	5	3	7	0	7	7	8
2100	5	11	9.3	0	15	11	12	1	11	12	8		11	11	15	11	9	7	0	10	9	13	12	13	8	11	2	10	8
2100	6	13	13.0	5	23	15	11	16	8	23	12		16	13	19	13	5	17	8	14	11	8	13	14	8	7	9	21	17
2100	7	17	16.3	10	21	16	19	19	20	19	10		11	20	18	17	16	17	20	13	16	13	15	14	15	21	10	18	18
2100	8	12	12.0	6	18	14	15	16	9	9	8		8	12	12	13	8	11	13	14	14	6	13	12	11	18	12	17	12
2100	9	10	11.4	6	21	14	9	21	15	15	10		7	21	13	7	11	9	11	6	8	7	16	6	12	8	10	7	20
2100	10	10	10.2	4	19	11	11	7	10	12	8		5	9	10	16	14	19	8	13	6	15	11	8	4	13	8	11	6
2100	11	11	10.7	5	21	11	15	8	13	11	12		8	9	5	11	12	21	8	8	8	6	9	13	10	15	9	11	13
2100	12	9	9.7	5	17	13	7	9	8	16	6		6	5	11	12	8	9	9	8	10	7	17	12	12	8	13	11	5

RCP4.5

Day with Daily Precip (mm) ... **>10**

			std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d

Year	Month	Median	Mean	Min	Max	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
2011	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2011	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
2011	3	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	4	0	0.3	0	2	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	2	0	0	1
2011	5	1	1.1	0	4	2	3	0	0	0	1	1	1	0	0	2	2	3	1	2	0	0	1	1	0	4	1	0	2
2011	6	0	1.0	0	3	2	0	0	0	0	1	2	2	3	3	0	1	0	0	3	2	0	2	0	0	0	0	0	2
2011	7	2	1.6	0	4	2	4	0	3	2	2	4	2	2	0	0	2	2	0	4	1	0	0	1	3	1	0	2	2
2011	8	1	1.3	0	3	2	1	2	2	1	0	0	2	1	2	0	3	0	1	2	1	3	1	1	3	0	0	1	1
2011	9	1	1.2	0	4	1	2	1	1	4	3	0	0	0	1	1	1	0	1	2	0	2	3	2	0	0	2	2	0
2011	10	0	0.3	0	2	0	0	2	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	1	0	0	1	0
2011	11	0	0.3	0	3	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
2011	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2012	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2012	4	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2012	5	0	0.7	0	3	1	0	0	0	1	0	0	1	0	2	0	2	0	1	1	0	1	0	0	0	3	1	2	0
2012	6	1	1.0	0	4	1	1	1	0	0	2	0	0	1	0	0	4	2	0	2	0	0	2	1	1	3	0	2	0
2012	7	1	1.6	0	5	0	5	2	2	4	5	1	4	1	4	1	0	0	1	3	1	2	1	0	0	0	0	0	1
2012	8	1	1.7	0	6	0	2	1	1	3	1	4	0	1	0	1	2	2	5	4	0	0	3	0	1	1	6	2	0
2012	9	1	1.1	0	4	2	1	0	0	1	1	1	0	0	1	1	0	1	0	1	1	0	2	2	2	1	2	4	3
2012	10	0	0.5	0	3	0	1	1	0	0	0	0	3	0	0	1	0	1	0	0	1	0	0	1	0	2	0	0	0
2012	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	12	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	1	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2013	2	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	3	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0
2013	4	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
2013	5	0	0.6	0	3	2	0	0	2	1	0	1	0	0	0	0	3	0	0	0	0	0	0	0	1	1	0	1	3
2013	6	1	0.9	0	4	1	0	2	0	0	0	0	2	1	0	0	2	0	1	2	0	1	3	1	0	4	0	0	1
2013	7	1	1.9	0	7	0	7	2	1	3	1	0	2	1	1	3	2	1	4	1	5	2	1	4	2	1	0	1	0
2013	8	1	1.2	0	3	0	1	0	0	3	1	2	1	1	2	3	2	1	1	3	0	3	1	1	1	0	0	2	0
2013	9	1	1.3	0	3	1	2	0	2	1	2	3	0	3	2	1	1	1	1	3	0	2	0	0	2	2	0	2	0
2013	10	0	0.3	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0
2013	11	0	0.1	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	12	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
2014	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2014	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2014	4	0	0.3	0	1	0	0	0	0	0	0	1	0	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0
2014	5	0	0.5	0	3	0	0	0	0	1	1	1	3	0	0	1	0	0	2	0	1	0	1	0	0	1	1	0	0
2014	6	1	1.2	0	4	2	2	1	1	0	0	1	4	4	0	0	0	1	4	0	1	2	0	2	0	1	1	0	2
2014	7	2	1.5	0	3	2	2	1	2	2	0	2	1	2	0	2	2	1	0	1	0	3	2	3	2	1	2	1	2
2014	8	1	1.4	0	5	0	1	4	1	3	3	0	1	5	1	1	2	1	1	0	1	2	0	0	0	2	0	3	1
2014	9	1	1.1	0	4	3	1	0	0	1	2	2	1	1	4	1	1	2	1	0	1	0	0	0	1	1	1	2	1
2014	10	0	0.2	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
2014	11	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
2014	12	0	0.1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	1	0	0.1	0	2	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	3	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2015	4	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
2015	5	1	0.8	0	2	0	0	0	0	0	0	1	2	0	1	1	2	0	2	2	0	1	2	1	2	0	0	1	1
2015	6	1	1.1	0	4	1	1	0	0	1	0	0	0	0	1	1	1	2	2	3	2	1	1	4	1	0	0	1	3
2015	7	1	1.8	0	7	3	5	0	0	1	1	3	1	1	1	2	0	2	1	7	1	1	3	1	1	2	0	2	3
2015	8	1	1.3	0	6	3	6	1	0	0	2	1	1	0	3	0	0	3	1	0	1	1	2	1	2	1	0	1	1
2015	9	1	0.8	0	3	0	1	0	2	1	1	1	2	3	0	0	0	2	0	0	1	1	0	1	1	1	0	0	0
2015	10	0	0.2	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2015	11	0	0.2	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0
2015	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	1	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	2	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2016	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	4	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
2016	5	0	0.5	0	2	0	0	0	0	0	1	0	0	2	0	1	1	0	0	2	2	1	1	1	0	1	0	0	0
2016	6	1	1.3	0	4	2	1	0	1	2	1	0	4	2	2	1	2	4	0	0	2	0	2	0	1	1	2	1	1
2016	7	2	1.7	0	3	3	2	3	2	2	0	1	0	1	1	1	3	3	2	1	3	2	2	2	1	0	1	2	3
2016	8	1	1.3	0	6	0	0	2	1	0	1	1	0	1	1	5	3	0	0	0	0	1	6	1	0	0	2	4	1
2016	9	1	1.5	0	5	1	0	0	0	5	1	3	5	1	2	3	1	0	0	2	2	1	0	1	5	0	0	2	1
2016	10	0	0.3	0	2	2	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2016	11	0	0.2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0
2016	12	0	0.1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2017	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2017	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	3	0	0.2	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0
2017	4	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	1	0
2017	5	1	1.0	0	4	3	0	1	0	0	2	3	0	0	1	2	2	0	1	0	2	0	0	2	4	0	0	0	1
2017	6	1	1.1	0	5	0	0	4	1	5	1	0	3	0	0	2	0	1	1	1	0	1	0	1	1	2	1	0	1
2017	7	1	1.6	0	6	1	0	0	0	3	0	1	1	0	5	0	0	3	0	1	3	6	4	1	3	1	3	0	2
2017	8	1	1.3	0	4	2	0	0	1	1	0	3	2	0	1	0	0	3	4	0	1	4	2	3	1	0	1	1	0
2017	9	1	1.3	0	3	1	3	1	2	2	2	1	3	0	0	2	0	2	0	1	2	1	3	3	2	0	0	0	0
2017	10	0	0.3	0	2	0	0	0	0	0	1	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	1	0
2017	11	0	0.2	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
2017	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2018	1	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2018	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2018	3	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	4	0	0.3	0	1	0	0	0	1	0	1	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0
2018	5	1	0.8	0	3	0	1	0	0	1	2	1	0	1	3	0	2	1	0	1	0	0	0	1	2	0	2	0	2	0
2018	6	1	0.9	0	3	3	1	1	3	0	2	0	1	0	0	0	0	2	0	3	0	1	1	0	0	2	0	0	2	0
2018	7	1	1.5	0	4	0	3	1	1	2	2	1	4	0	3	1	3	0	1	2	1	2	1	1	0	1	0	4	2	0
2018	8	1	1.1	0	3	1	0	1	1	0	0	1	0	1	1	1	1	1	1	0	0	3	1	0	3	3	3	1	2	0
2018	9	1	1.3	0	4	0	0	1	0	0	2	3	1	2	2	3	1	2	3	1	1	0	1	1	4	1	0	0	2	0
2018	10	0	0.3	0	2	0	2	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	11	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0
2018	12	0	0.1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
2019	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	2	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	3	0	0.2	0	2	1	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0
2019	4	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2019	5	0	0.7	0	3	0	0	0	1	1	1	1	2	2	0	0	0	3	0	0	2	0	0	1	0	0	2	0	0	0
2019	6	1	0.8	0	3	0	0	3	1	0	0	2	0	1	0	0	1	1	0	0	1	0	3	1	2	1	0	2	0	0
2019	7	1	1.1	0	4	2	4	2	1	1	1	0	0	1	0	0	3	1	0	1	1	0	2	2	0	2	0	0	3	0
2019	8	1	1.4	0	5	0	0	3	1	1	5	3	1	0	3	2	1	1	2	1	1	1	1	2	1	1	1	1	0	0
2019	9	1	1.1	0	3	0	3	0	0	1	0	1	3	1	1	1	1	1	2	2	0	0	1	0	1	1	2	3	1	0
2019	10	0	0.3	0	2	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	1	0	1	0	1	0	1	0	0
2019	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
2019	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	1	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
2020	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	3	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
2020	4	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
2020	5	0	0.7	0	5	0	0	1	0	3	1	0	2	0	0	0	0	5	0	0	1	1	0	0	0	2	0	0	1	0
2020	6	1	1.3	0	4	1	2	1	3	3	1	3	4	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1
2020	7	1	1.4	0	4	2	1	1	2	1	1	1	1	2	2	4	0	0	0	0	2	1	1	0	4	2	1	3	1	1
2020	8	1	1.4	0	4	4	2	3	0	0	2	1	0	1	0	3	1	0	1	0	0	3	2	2	3	0	1	2	2	2
2020	9	1	1.5	0	5	1	0	2	1	0	1	0	1	1	3	1	2	2	1	4	1	2	0	2	2	1	2	1	5	5
2020	10	0	0.2	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
2020	11	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2020	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2021	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2021	2	0	0.1	0	2	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	3	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0
2021	4	0	0.3	0	2	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	2	2
2021	5	0	0.6	0	3	3	0	2	0	0	0	0	0	0	1	2	0	0	0	0	1	1	1	0	0	0	0	2	1	1
2021	6	1	1.1	0	4	2	2	1	4	2	1	0	2	0	0	0	0	1	0	0	0	0	3	1	1	1	2	2	1	1
2021	7	1	1.2	0	5	1	2	1	0	1	1	4	5	1	1	1	0	2	0	1	2	1	1	1	1	1	0	1	0	0
2021	8	1	1.0	0	4	0	0	1	0	4	1	0	1	0	1	1	2	2	3	0	1	2	0	0	0	1	1	2	1	1
2021	9	1	1.4	0	4	0	2	1	1	0	1	4	4	2	0	0	4	2	2	1	1	2	3	2	1	0	0	0	0	0
2021	10	0	0.4	0	1	0	0	1	1	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1
2021	11	0	0.3	0	2	0	0	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	0	1	0	1	0	0	0	0
2021	12	0	0.1	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2022	1	0	0.1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2022	2	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
2022	3	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	4	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
2022	5	0	0.5	0	2	1	0	1	0	1	0	1	0	0	1	0	0	1	0	0	0	1	0	0	2	0	0	1	1	1
2022	6	0	0.7	0	5	0	2	1	2	1	0	1	1	0	2	0	0	0	0	0	5	0	0	0	0	2	0	0	0	0
2022	7	2	2.1	0	6	1	3	4	0	3	5	1	2	1	4	1	6	3	2	2	0	0	3	0	2	2	1	3	1	1
2022	8	1	1.4	0	6	0	0	2	2	6	1	0	1	2	0	0	1	1	3	0	2	0	3	2	0	1	1	1	4	4
2022	9	1	1.4	0	4	1	1	2	1	2	2	3	2	1	0	4	0	1	0	3	0	1	4	2	1	0	1	0	1	1
2022	10	0	0.3	0	1	0	0	0	0	0	0	1	1	1	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0
2022	11	0	0.2	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2022	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2023	1	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	3	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2023	4	0	0.2	0	2	0	0	0	0	0	0	2	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
2023	5	1	0.8	0	3	0	0	3	1	2	1	0	1	1	0	3	0	0	0	0	1	0	1	2	1	1	0	0	1	1
2023	6	1	1.0	0	3	2	2	0	0	1	0	0	0	1	1	0	0	1	1	3	0	1	2	0	2	1	2	3	2	2
2023	7	1	1.3	0	6	3	1	2	1	3	0	0	1	1	0	3	2	0	1	1	2	0	1	0	1	2	6	1	0	0
2023	8	2	1.6	0	5	0	0	2	0	3	0	1	3	1	1	3	1	3	3	2	0	4	0	0	2	5	2	2	1	1
2023	9	1	1.0	0	3	1	1	0	0	0	2	0	1	1	3	0	0	1	0	3	1	1	1	0	3	1	3	0	0	0
2023	10	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
2023	11	0	0.4	0	4	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	1	0	0	4	0	0	0	0
2023	12	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	1	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2024	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	3	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	4	0	0.1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2024	5	0	0.5	0	2	0	1	0	0	1	2	2	0	1	0	0	2	1	0	0	0	0	0	1	0	1	0	0	0	0
2024	6	1	1.1	0	3	0	1	1	0	2	0	2	1	2	0	0	1	1	0	1	3	2	3	0	2	3	0	1	1	1
2024	7	2	1.9	0	6	3	2	1	2	4	4	2	4	1	4	2	3	2	1	0	2	0	0	1	0	1	6	0	0	0
2024	8	1	1.3	0	4	0	4	1	0	3	3	2	2	1	1	1	0	1	1	1	1	2	0	1	2	2	1	1	1	1
2024	9	1	1.3	0	4	2	3	0	0	0	3	1	4	3	0	1	2	0	2	2	0	1	1	2	3	0	0	1	0	0
2024	10	0	0.3	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	2
2024	11	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
2024	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	1	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
2025	2	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	3	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2025	4	0	0.3	0	3	0	0	0	0	0	0	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
2025	5	1	0.9	0	3	0	0	0	1	1	2	1	0	0	2	2	0	0	1	3	0	0	3	1	0	1	1	1	1	1
2025	6	1	0.8	0	4	0	0	1	1	0	1	0	1	0	0	1	0	4	1	0	1	1	0	0	1	2	1	3	1	1
2025	7	2	1.6	0	5	1	2	2	3	3	2	0	0	1	4	5	0	3	0	2	0	2	0	0	2	0	1	0	5	5
2025	8	1	1.1	0	4	0	1	2	1	2	2	1	0	1	1	0	1	0	4	0	2	0	0	0	3	3	0	1	1	1
2025	9	2	1.3	0	3	1	0	3	1	0	2	2	2	2	2	0	1	1	2	1	2	3	1	0	2	2	2	0	0	0

2025	10	0	0.3	0	2	1	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	2
2025	11	0	0.2	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2025	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2026	1	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2026	2	0	0.1	0	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	3	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2026	4	0	0.1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2026	5	0	0.5	0	2	2	0	0	0	0	0	2	0	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
2026	6	0	0.8	0	4	0	1	0	2	0	3	1	0	0	0	1	0	0	0	1	1	0	4	2	0	0	0	1	1	1
2026	7	1	1.6	0	6	0	0	2	3	1	1	3	1	2	2	1	2	0	3	0	0	1	1	2	6	1	3	3	1	1
2026	8	1	0.9	0	6	0	4	0	1	0	0	2	0	0	6	0	1	1	1	1	1	2	1	0	0	0	0	0	1	1
2026	9	1	1.4	0	4	2	0	1	2	2	1	1	3	0	0	2	1	2	1	1	1	2	1	1	3	0	1	4	1	1
2026	10	0	0.4	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	1	1
2026	11	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2026	12	0	0.1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	1	0	0.2	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
2027	2	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2027	3	0	0.2	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
2027	4	0	0.3	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	0	0	0	0
2027	5	1	0.9	0	3	1	0	0	0	0	2	2	3	0	0	2	1	0	3	1	1	0	1	0	1	3	0	0	0	0
2027	6	1	1.0	0	4	0	0	1	1	1	0	0	0	1	0	2	4	1	0	1	1	1	1	0	3	1	0	3	1	1
2027	7	2	1.9	0	5	5	2	4	5	1	1	3	1	1	3	1	1	2	1	3	0	2	1	2	1	2	0	2	2	2
2027	8	2	1.7	0	5	3	1	2	1	4	3	2	3	2	1	1	0	0	2	2	1	5	0	2	0	2	0	3	0	0
2027	9	1	1.1	0	3	0	1	2	2	0	3	0	0	1	3	2	1	1	0	2	3	0	0	2	2	1	0	1	0	0
2027	10	0	0.3	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
2027	11	0	0.2	0	2	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	2	0	0	0	0
2027	12	0	0.1	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2028	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2028	3	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	0	0
2028	4	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	5	0	0.6	0	2	0	0	2	0	0	0	0	0	1	2	1	1	0	2	0	0	0	1	2	0	1	0	0	1	1
2028	6	1	1.4	0	5	0	1	0	2	1	2	0	1	4	1	0	2	1	5	3	0	3	0	1	1	3	2	0	1	1
2028	7	1	1.7	0	6	4	0	2	1	2	0	1	0	1	0	0	0	4	3	6	0	3	1	2	2	1	0	4	3	3
2028	8	1	1.5	0	7	0	0	3	1	2	0	1	2	2	1	7	0	0	2	1	4	1	3	0	0	1	4	0	0	0
2028	9	2	1.5	0	4	2	0	1	1	1	2	0	2	1	1	0	2	2	3	2	1	4	2	3	1	0	2	1	2	2
2028	10	0	0.3	0	2	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
2028	11	0	0.2	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1
2028	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2029	1	0	0.2	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1
2029	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2029	3	0	0.2	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2029	4	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
2029	5	0	0.5	0	2	0	0	0	1	2	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	2	1	0	0	0
2029	6	1	0.8	0	3	0	0	1	1	2	1	1	0	0	0	1	1	1	0	2	0	0	3	1	1	3	0	1	0	0
2029	7	2	1.7	0	5	4	3	1	1	5	0	2	1	0	1	3	0	0	0	3	4	3	0	2	2	1	0	2	2	2
2029	8	1	1.5	0	4	4	0	2	1	2	2	2	0	1	1	0	4	1	1	1	0	3	2	2	3	1	0	1	1	1
2029	9	1	1.5	0	5	5	0	0	1	0	1	2	2	2	1	0	3	1	1	2	1	1	2	0	2	3	1	4	2	2
2029	10	0	0.2	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
2029	11	0	0.2	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
2029	12	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	4	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
2030	5	1	0.9	0	3	0	1	0	0	2	1	1	0	0	1	3	1	1	2	0	0	1	1	2	2	0	2	0	0	0
2030	6	1	1.1	0	5	2	0	0	1	2	0	2	3	5	0	1	1	2	0	0	0	0	0	1	2	0	0	2	2	2
2030	7	2	1.9	0	7	7	3	0	2	3	2	4	3	3	1	3	1	0	2	1	0	1	0	1	1	0	5	0	2	2
2030	8	1	1.1	0	4	1	0	3	3	0	2	3	0	0	2	1	1	1	0	1	1	4	0	0	1	2	0	1	0	0
2030	9	1	1.5	0	5	1	1	0	2	0	1	4	0	0	2	0	1	3	1	5	4	2	0	0	2	1	1	0	5	5
2030	10	0	0.2	0	2	0	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2030	11	0	0.1	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2030	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
2031	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2031	3	0	0.2	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0
2031	4	0	0.1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	5	0	0.7	0	3	2	0	0	1	2	2	0	1	0	1	3	0	0	0	1	0	0	0	1	0	0	2	0	0	0
2031	6	1	0.9	0	3	1	0	0	0	0	1	0	1	1	1	3	1	3	0	3	0	0	2	0	0	1	0	1	1	3
2031	7	2	1.9	0	7	2	0	1	1	1	0	0	2	3	1	2	0	2	3	5	5	4	0	7	3	0	0	1	3	3
2031	8	1	1.7	0	5	5	2	2	0	0	4	1	1	0	0	1	0	1	4	4	0	2	5	1	0	1	0	3	4	4
2031	9	1	1.3	0	4	4	0	1	1	0	1	1	2	0	1	0	3	1	2	3	1	0	2	0	1	3	0	1	3	3
2031	10	0	0.2	0	2	0	0	0	0	2	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0
2031	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2031	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2032	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	2	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	1	0	1	0	0	0	0
2032	3	0	0.2	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	1	0	0
2032	4	0	0.3	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1
2032	5	0	0.5	0	3	0	0	0	0	0	1	2	1	3	0	1	0	1	1	1	0	0	0	0	0	0	2	0	0	0
2032	6	1	1.8	0	6	1	1	2	4	1	1	3	0	1	2	0	2	3	0	6	0	3	5	3	4	0	0	0	1	1
2032	7	2	2.1	0	6	0	5	5	1	0	0	1	1	2	2	3	1	4	0	1	3	4	2	2	3	6	1	1	3	3
2032	8	2	2.0	0	5	0	0	4	0	3	3	2	5	2	2	2	0	2	1	2	0	3	2	1	5	1	1	3	3	3
2032	9	1	1.0	0	4	0	4	1	1	1	1	1	0	0	1	3	1	0	0	0	1	1	0	0	2	1	1	2	3	3
2032	10	0	0.2	0	2	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2032	11	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	1	1	1
2032	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
2033	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2033	3	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	4	0	0.2	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1

2033	5	0	0.6	0	3	0	0	1	0	1	0	0	0	0	0	1	0	1	0	1	2	0	0	1	3	1	0	2	0
2033	6	0	1.0	0	4	1	1	2	4	0	0	0	0	0	0	0	0	2	0	1	1	1	4	2	0	0	0	0	4
2033	7	2	1.7	0	7	2	1	0	0	2	2	3	0	3	1	1	1	2	2	7	3	3	3	0	1	0	3	0	1
2033	8	1	1.5	0	5	1	0	2	1	3	2	2	1	0	5	0	1	3	2	1	4	0	2	0	4	0	0	1	2
2033	9	1	1.4	0	5	1	2	0	4	1	4	0	0	1	2	0	0	1	2	1	5	1	0	0	0	5	2	0	1
2033	10	0	0.3	0	1	1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0
2033	11	0	0.3	0	2	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
2033	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	1	0	0.3	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2034	2	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2034	3	0	0.2	0	3	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0
2034	4	0	0.3	0	2	1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
2034	5	1	0.8	0	3	2	1	1	0	3	0	0	0	0	1	1	1	0	0	1	1	0	1	0	2	2	0	1	0
2034	6	1	1.2	0	4	1	2	0	4	2	0	3	0	1	0	2	1	0	2	1	0	1	1	1	3	0	0	1	3
2034	7	2	1.8	0	4	4	2	2	1	1	3	3	0	1	4	1	1	3	3	0	4	2	2	2	2	1	1	1	0
2034	8	1	1.4	0	4	2	0	1	1	4	3	2	2	1	0	0	0	0	1	2	2	2	0	1	3	1	2	2	1
2034	9	1	0.8	0	3	1	1	0	0	0	0	2	2	1	0	0	0	0	0	3	1	0	0	1	2	1	2	1	0
2034	10	0	0.4	0	2	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	2	0	1	1	1	0	0	0
2034	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2034	12	0	0.3	0	2	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	2	0	0	0	0	0	1	0
2035	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2035	4	0	0.2	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	1	0
2035	5	0	0.9	0	4	0	0	0	0	0	3	0	1	0	0	0	3	1	3	2	1	0	0	1	0	1	4	0	1
2035	6	1	0.9	0	4	0	0	2	0	0	0	1	0	1	4	0	2	2	1	1	2	1	1	0	1	0	1	0	1
2035	7	2	2.1	0	5	3	3	2	2	2	1	2	1	3	1	2	1	3	3	3	0	0	0	2	2	3	5	4	2
2035	8	2	1.8	0	6	3	4	2	2	6	3	2	2	1	2	1	3	0	2	4	1	2	0	0	0	0	1	1	1
2035	9	1	1.3	0	6	0	0	0	2	0	6	3	1	2	0	1	0	0	1	2	0	2	1	0	2	4	0	4	0
2035	10	0	0.3	0	2	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
2035	11	0	0.1	0	1	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2035	12	0	0.2	0	2	1	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2036	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2036	4	0	0.2	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2	0
2036	5	1	0.6	0	3	0	0	0	1	1	1	1	1	1	0	1	0	0	1	0	0	0	2	1	1	0	0	0	3
2036	6	1	0.8	0	3	0	3	0	0	1	0	0	0	0	3	1	1	0	0	0	1	1	2	0	3	2	1	1	0
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2036	8	1	1.8	0	9	1	2	2	2	0	1	0	1	2	2	0	1	2	3	1	3	1	2	0	1	1	9	4	1
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2036	10	0	0.4	0	1	0	1	1	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0
2036	11	0	0.3	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0
2036	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	1	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
2037	2	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2037	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	4	0	0.2	0	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2037	5	0	0.5	0	3	0	0	0	0	0	0	1	1	3	0	1	1	0	1	1	0	0	1	1	0	0	0	0	0
2037	6	1	0.8	0	3	1	1	1	1	0	0	1	3	0	0	1	0	2	1	0	0	1	0	3	1	0	2	0	0
2037	7	2	2.0	0	5	4	5	0	2	3	0	3	1	3	1	0	2	3	3	4	2	3	2	0	1	0	2	1	3
2037	8	1	1.5	0	5	1	1	2	0	1	2	0	1	2	1	3	1	1	3	5	1	0	2	2	2	0	2	0	2
2037	9	1	1.1	0	5	0	1	0	2	2	1	0	2	1	2	1	0	0	2	5	1	2	0	2	2	0	1	0	0
2037	10	0	0.4	0	2	2	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	1	1	0	0
2037	11	0	0.2	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
2037	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	1	0	0.2	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0
2038	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
2038	4	0	0.3	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	0
2038	5	1	1.0	0	3	2	0	1	2	2	1	3	1	1	0	0	1	1	0	2	1	1	1	1	0	2	0	0	1
2038	6	1	1.4	0	5	2	1	3	5	0	1	2	0	1	1	0	2	1	1	0	2	1	0	5	1	1	3	0	1
2038	7	2	2.3	0	6	6	0	4	3	2	0	5	2	0	3	5	1	2	0	1	5	5	4	2	1	0	2	2	1
2038	8	1	1.4	0	5	1	3	0	1	1	2	0	2	1	2	5	0	1	1	4	2	3	0	2	1	1	0	0	1
2038	9	1	1.6	0	6	1	3	3	2	1	1	2	1	0	1	4	2	1	0	1	6	0	0	1	2	1	4	1	0
2038	10	0	0.3	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	1	0	1	0	0	0	1	1	0
2038	11	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2038	12	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	2	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2039	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	4	0	0.2	0	2	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
2039	5	1	1.0	0	5	0	1	2	0	0	0	0	1	0	2	3	0	0	1	0	1	2	0	1	5	2	0	0	2
2039	6	1	1.1	0	3	3	1	1	2	0	3	1	0	1	3	1	0	1	0	0	2	1	1	0	3	2	0	1	0
2039	7	1	1.5	0	5	3	2	5	0	1	1	4	0	1	1	1	1	2	3	2	2	1	0	2	0	0	0	5	0
2039	8	0	1.3	0	6	0	0	0	0	0	5	0	0	1	0	3	0	5	1	1	0	2	1	0	0	3	0	6	2
2039	9	1	1.3	0	4	0	1	0	4	1	2	1	1	0	1	2	2	4	0	1	4	0	1	0	2	0	0	2	2
2039	10	0	0.4	0	2	0	2	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	2	1	0	0	0	2	0
2039	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0
2039	12	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0
2040	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	2	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2040	3	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
2040	4	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
2040	5	1	1.0	0	5	1	0	2	0	2	2	1	0	0	0	0	0	0	1	0	5	2	1	1	2	0	3	0	0
2040	6	1	1.1	0	4	0	0	1	3	0	1	2	1	0	1	3	2	1	1	0	1	0	2	0	1	2	4	0	0
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2040	8	1	1.5	0	4	2	0	1	2	1	0	0	0	1	1	0	2	3	2	1	3	1	0	4	3	0	2	2	4
2040	9	1	1.4	0	5	5	1	1	2	1	1	1	0	3	0	3	4	1	1	0	1	1	1	0	2	1	2	1	1
2040	10	0	0.2	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
2040	11	0	0.2	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2040	12	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	1	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	2	0	0.2	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
2041	3	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2041	4	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	5	0	0.7	0	4	0	0	1	0	1	0	0	4	0	1	0	0	1	3	0	2	0	0	0	1	0	0	1	0	2
2041	6	1	1.0	0	3	3	2	0	0	1	0	2	0	0	3	1	0	0	1	0	1	1	0	3	3	0	0	0	0	3
2041	7	2	1.8	0	5	2	4	1	0	2	1	3	3	5	4	2	0	3	2	1	0	2	1	3	2	0	0	2	0	0
2041	8	2	1.5	0	4	2	0	0	2	1	2	3	2	2	2	1	2	3	0	4	0	1	2	2	1	1	0	2	2	0
2041	9	1	1.3	0	3	2	0	1	0	0	0	3	3	2	1	3	2	0	0	0	3	0	2	1	3	1	1	1	1	1
2041	10	0	0.3	0	1	1	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0
2041	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
2041	12	0	0.2	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2042	1	0	0.2	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2042	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	3	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2042	4	0	0.2	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
2042	5	0	0.6	0	2	0	0	2	1	0	1	0	1	0	0	1	2	0	0	1	0	2	0	0	2	1	0	1	0	0
2042	6	1	1.3	0	6	0	1	0	3	0	1	0	1	0	0	1	0	0	1	4	2	3	0	6	2	3	1	3	0	0
2042	7	1	1.9	0	8	2	8	0	3	0	2	0	1	2	0	1	3	1	0	0	6	3	2	1	4	1	1	4	0	0
2042	8	1	1.6	0	5	0	0	0	5	1	2	0	1	0	2	0	0	0	5	1	4	3	4	2	0	2	2	4	0	0
2042	9	1	1.5	0	4	0	1	0	3	1	1	3	1	3	0	2	3	1	1	3	1	1	2	0	4	0	0	2	2	2
2042	10	0	0.3	0	3	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	1	0	0
2042	11	0	0.2	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0
2042	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	4	0	0.2	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
2043	5	0	0.3	0	2	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	1	2	0	0	0	0
2043	6	1	1.1	0	4	2	2	2	1	0	2	0	3	0	4	0	3	0	2	0	0	1	0	1	0	0	0	3	0	0
2043	7	2	1.8	0	6	3	1	2	6	0	2	2	2	5	1	1	0	4	4	3	1	3	0	0	0	0	2	2	0	0
2043	8	1	1.2	0	4	1	0	1	3	3	3	1	0	0	1	1	1	0	1	1	1	0	0	1	3	4	1	1	0	0
2043	9	1	1.2	0	3	3	0	0	1	0	3	0	1	2	0	3	3	0	0	0	1	2	2	0	2	2	2	1	1	0
2043	10	0	0.2	0	2	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0
2043	11	0	0.2	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
2043	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
2044	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1
2044	3	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2044	4	0	0.3	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2044	5	0	0.6	0	3	0	0	1	1	1	0	1	3	0	1	1	0	0	0	0	1	0	1	0	2	0	0	1	0	0
2044	6	1	1.3	0	4	1	1	3	3	1	3	0	2	0	3	0	0	3	0	0	2	1	0	0	1	1	4	3	0	0
2044	7	2	2.0	0	6	4	3	1	0	1	2	2	0	2	3	3	3	5	0	2	1	1	0	6	2	2	0	3	2	0
2044	8	1	1.3	0	3	1	0	1	1	0	2	2	3	1	1	3	2	2	1	0	2	1	3	0	1	1	2	0	0	0
2044	9	1	1.3	0	5	1	0	0	0	3	2	0	1	1	0	1	2	0	2	1	5	1	1	1	3	0	1	2	2	0
2044	10	0	0.3	0	3	0	0	0	0	0	0	0	1	0	1	0	3	0	0	0	0	1	1	0	0	0	0	0	0	1
2044	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
2044	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2045	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2045	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	3	0	0.1	0	2	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	4	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
2045	5	0	0.8	0	3	1	2	1	0	0	3	1	1	0	0	0	1	1	0	0	0	0	0	3	3	2	0	0	0	0
2045	6	1	0.9	0	3	1	0	0	1	1	2	2	1	2	1	1	1	1	1	1	0	0	0	1	0	3	1	0	0	0
2045	7	2	1.9	0	6	4	2	2	1	2	2	2	1	2	2	2	5	6	1	3	2	2	0	0	1	0	2	0	2	2
2045	8	1	1.7	0	6	1	3	0	4	1	6	0	0	2	0	1	1	1	0	1	3	5	0	5	1	1	2	0	2	2
2045	9	1	1.6	0	5	1	0	4	3	0	2	1	2	3	1	1	5	2	0	1	3	2	3	3	1	0	0	0	1	1
2045	10	0	0.3	0	3	0	0	1	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	2	2
2045	11	0	0.1	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	12	0	0.1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2046	2	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	3	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	4	0	0.2	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
2046	5	1	0.8	0	3	0	1	1	0	1	0	0	1	0	3	3	0	0	1	1	2	1	0	0	0	0	1	2	0	0
2046	6	1	1.3	0	4	2	3	0	1	0	1	2	3	0	1	2	2	2	1	0	2	0	0	2	3	0	4	1	0	0
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2046	8	1	1.1	0	6	0	0	0	6	0	1	0	3	0	3	1	1	1	0	3	2	1	1	0	2	0	2	0	0	0
2046	9	1	1.1	0	4	1	3	1	0	1	2	0	0	4	2	0	0	0	1	3	1	1	2	1	1	1	0	0	1	1
2046	10	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	1
2046	11	0	0.3	0	2	2	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2046	12	0	0.2	0	2	0	0	2	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
2047	1	0	0.3	0	1	0	0	0	1	1	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
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2047	3	0	0.2	0	2	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
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2047	5	1	0.5	0	1	1	0	1	1	0	1	1	1	0	0	0	0	1	1	0	0	1	0	0	1	1	0	1	0	0
2047	6	1	1.0	0	3	0	2	1	0	2	2	0	1	0	0	1	1	3	0	0	1	2	0	1	2	3	0	1	0	0
2047	7	1	1.7	0	6	5	6	3	2	0	0	4	1	1	0	1	0	2	1	3	1	1	0	2	3	0	2	1	2	2
2047	8	1	1.1	0	4	0	1	1	3	3	2	0	2	0	2	0	0	0	0	4	2	2	0	1	1	0	2	1	0	0
2047	9	1	1.1	0	3	1	3	1	1	1	3	1	2	1	1	2	0	1	1	1	0	1	1	0	2	1	0	1	0	0
2047	10	0	0.3	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1
2047	11	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2047	12	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
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2048	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0
2048	4	0	0.2	0	2	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0
2048	5	0	0.5	0	3	0	0	0	2	1	0	1	0	0	3	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0
2048	6	1	1.0	0	4	1	0	2	1	1	2	0	2	4	0	1	0	2	1	0	0	0	2	1	1	2	0	0	0	0

2048	7	1	1.9	0	7	0	1	3	1	2	2	4	1	3	0	2	5	1	3	7	0	1	1	2	0	0	5	0	1
2048	8	2	1.7	0	5	0	0	5	1	3	2	1	3	0	2	0	5	1	1	2	1	3	0	0	3	2	3	3	0
2048	9	1	0.9	0	3	1	0	0	0	1	3	0	2	2	1	1	0	1	1	2	0	1	1	1	0	0	2	1	0
2048	10	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2048	11	0	0.2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1
2048	12	0	0.2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0
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2049	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0
2049	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2049	4	0	0.3	0	2	1	0	0	0	2	1	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0
2049	5	0	0.5	0	4	0	0	0	0	1	1	0	0	0	0	0	1	4	0	0	0	0	1	2	0	1	0	0	1
2049	6	1	1.4	0	6	0	3	2	1	2	1	0	1	2	0	0	1	1	5	5	1	0	2	0	6	0	0	0	0
2049	7	2	2.4	0	7	1	7	2	4	2	1	3	2	0	4	3	2	4	0	1	3	2	4	3	0	1	2	5	1
2049	8	2	1.6	0	5	0	2	2	1	1	2	1	0	2	3	0	2	4	2	2	5	1	1	1	2	1	1	0	2
2049	9	2	1.5	0	4	1	0	0	0	2	4	3	1	0	2	2	2	2	4	3	2	2	1	2	1	0	0	1	1
2049	10	0	0.4	0	2	2	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1
2049	11	0	0.4	0	1	0	0	0	1	0	1	1	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	1	1
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2050	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
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2050	6	0	0.8	0	3	0	1	0	2	0	2	0	3	0	0	0	0	0	0	2	2	0	0	1	3	0	0	2	0
2050	7	1	1.7	0	6	4	6	0	4	1	0	1	1	3	3	1	0	1	0	3	2	1	3	0	1	1	2	2	0
2050	8	1	1.8	0	5	0	5	2	2	5	2	1	4	0	0	0	3	5	0	1	0	5	1	1	1	2	1	0	2
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2050	10	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2050	11	0	0.2	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0
2050	12	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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2051	4	0	0.3	0	2	2	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
2051	5	0	0.7	0	3	0	0	0	2	1	0	2	1	0	0	0	3	0	1	1	0	2	0	0	2	0	0	1	0
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2051	9	1	1.3	0	3	3	2	0	0	1	3	0	0	1	3	3	1	1	0	2	0	2	0	1	3	0	1	2	1
2051	10	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
2051	11	0	0.4	0	2	0	1	0	1	0	0	0	0	0	2	0	0	0	0	1	1	0	1	1	0	1	0	0	0
2051	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2052	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
2052	2	0	0.1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2052	3	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2052	4	0	0.2	0	2	0	0	0	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
2052	5	1	0.8	0	4	1	0	0	0	0	1	1	2	0	2	1	4	0	0	1	0	2	1	1	2	1	0	0	0
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2052	8	1	1.4	0	5	0	1	2	0	1	1	5	1	0	2	1	0	0	1	0	3	0	1	2	2	1	5	4	1
2052	9	1	1.5	0	4	1	4	0	1	2	4	0	1	1	2	1	3	0	2	3	2	2	0	2	2	0	1	0	1
2052	10	0	0.3	0	2	0	0	0	1	0	0	0	0	0	0	1	2	0	0	1	0	0	0	1	0	0	1	1	0
2052	11	0	0.3	0	2	0	0	1	0	1	0	0	1	0	2	0	0	0	1	0	0	1	0	0	0	0	0	0	0
2052	12	0	0.2	0	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
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2053	11	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
2053	12	0	0.2	0	2	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
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2054	3	0	0.2	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0
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2054	9	1	1.3	0	6	2	6	2	2	1	1	0	0	1	1	1	1	2	0	0	0	3	0	1	0	0	4	2	0
2054	10	0	0.4	0	2	0	0	0	0	2	0	0	0	0	0	2	1	1	0	0	1	2	0	0	0	1	0	0	0
2054	11	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1
2054	12	0	0.1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2055	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2055	2	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2055	7	2	1.8	0	7	3	7	1	2	0	0	3	1	2	0	1	3	3	2	2	3	1	0	3	1	2	2	0	0
2055	8	1	1.4	0	4	1	1	1	1	1	3	2	4	0	1	1	0	2	3	1	0	3	3	2	0	0	0	2	2
2055	9	1	1.0	0	3	0	1	0	0	3	0	3	2	3	2	0	0	0	1	0	0	1	1	2	3	0	0	1	2
2055	10	0	0.4	0	2	0	1	0	0	0	0	0	1	0	1	0	2	0	0	1	0	0	0	0	0	1	1	1	1
2055	11	0	0.2	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0
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2056	2	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2056	3	0	0.1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2056	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
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2059	11	0	0.4	0	2	0	0	0	1	0	0	2	1	0	1	0	0	0	0	2	0	0	1	0	0	0	0	1	0
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2062	8	2	1.5	0	3	2	0	3	0	2	2	0	0	1	3	0	3	2	3	0	3	1	1	2	2	2	2	1	0
2062	9	1	1.5	0	8	1	0	0	1	2	4	1	0	0	0	2	0	3	0	2	1	1	1	0	4	2	0	8	2
2062	10	0	0.5	0	3	0	1	3	0	0	0	0	0	0	1	0	3	0	0	0	2	0	1	0	0	1	0	0	1
2062	11	0	0.3	0	3	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
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2063	11	0	0.3	0	1	0	0	1	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0
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2066	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
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2066	8	1	1.2	0	5	0	2	2	2	1	1	1	0	0	0	0	1	2	3	1	0	2	0	1	1	0	5	3	0
2066	9	1	1.1	0	3	1	3	0	1	0	3	1	3	1	0	0	0	3	0	3	0	1	2	0	1	1	1	2	0
2066	10	0	0.3	0	2	0	0	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	2	0	1	0	0	0
2066	11	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0
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2067	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
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2068	11	0	0.2	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0
2068	12	0	0.1	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2069	3	0	0.3	0	2	0	0	0	0	2	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	0	0
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2069	5	1	0.6	0	2	0	0	1	1	1	0	2	1	1	0	1	1	0	0	2	1	1	0	0	0	1	0	0	0
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2069	11	0	0.3	0	3	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	1
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2070	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2070	3	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2070	4	0	0.3	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0
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2070	10	0	0.5	0	3	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	3	2	0	0
2070	11	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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2071	3	0	0.3	0	4	0	1	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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2072	11	0	0.2	0	2	0	0	1	0	0	0	0	0	0	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0
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2073	3	0	0.2	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0
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2073	5	0	0.9	0	4	0	2	0	0	0	0	0	0	0	0	0	1	3	0	4	0	3	2	2	1	0	1	2	0
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2073	11	0	0.1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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2074	11	0	0.2	0	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
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2076	8	1	1.2	0	5	1	0	1	2	2	2	2	2	0	0	0	1	1	2	2	1	1	2	0	5	1	1	0	0
2076	9	1	1.7	0	7	1	2	2	3	2	4	3	0	5	3	1	2	7	0	0	0	0	0	1	1	1	1	1	1
2076	10	0	0.5	0	2	1	1	1	0	1	0	1	0	2	1	0	0	0	0	0	0	0	1	0	0	1	0	1	2
2076	11	0	0.3	0	2	0	0	0	0	0	0	2	0	1	1	1	0	0	0	0	0	1	1	0	1	0	0	0	0
2076	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
2077	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
2077	4	0	0.2	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0
2077	5	1	1.0	0	4	0	0	0	3	1	1	1	1	4	0	2	0	2	0	2	0	2	0	0	0	2	2	1	0
2077	6	1	0.8	0	3	0	1	2	1	0	0	1	1	1	0	1	0	2	1	1	1	2	0	0	0	3	0	1	1
2077	7	2	1.5	0	4	3	1	2	0	1	1	2	0	0	4	2	2	3	1	2	1	3	2	0	1	2	3	0	0
2077	8	1	1.7	0	8	2	3	8	1	1	0	0	0	1	6	0	2	6	1	1	0	1	2	1	0	0	4	0	1
2077	9	1	1.5	0	6	0	1	0	0	0	0	0	3	2	3	3	4	1	2	0	0	1	1	6	0	2	1	3	3
2077	10	0	0.4	0	3	0	2	1	0	0	0	1	3	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0
2077	11	0	0.4	0	3	0	0	0	0	0	0	3	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	1	0
2077	12	0	0.2	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0
2078	1	0	0.1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2078	2	0	0.1	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	3	0	0.2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1
2078	4	0	0.1	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2078	5	1	1.1	0	4	0	2	3	2	2	0	1	1	0	0	1	1	0	1	1	1	1	0	0	1	0	2	4	2
2078	6	1	0.8	0	4	1	1	3	1	0	0	1	0	4	0	2	0	2	0	0	1	1	0	0	1	0	0	2	0
2078	7	2	1.5	0	4	2	2	2	4	2	0	0	4	4	0	0	0	0	3	2	0	3	2	2	3	0	2	0	0
2078	8	1	1.5	0	5	0	4	5	2	2	3	0	4	2	1	1	0	1	1	0	1	2	2	2	0	0	0	0	3
2078	9	1	1.3	0	4	2	0	2	1	2	1	1	3	3	1	0	2	1	1	4	2	1	0	1	1	0	1	1	1
2078	10	0	0.4	0	2	0	0	0	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0	2	0	0	2	0	1

2078	11	0	0.2	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	1	0	0.1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2079	2	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	3	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	1	0	0	0	0
2079	4	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
2079	5	1	0.6	0	2	0	2	0	0	1	1	0	0	1	1	0	1	1	1	1	0	0	1	0	0	2	0	1	1	1
2079	6	2	1.8	0	6	3	6	5	2	1	0	2	0	0	0	0	0	3	2	2	1	3	1	0	5	0	2	2	2	3
2079	7	1	1.6	0	6	0	3	1	5	1	3	0	1	1	3	2	0	3	0	1	6	1	0	1	3	1	0	1	1	1
2079	8	1	1.3	0	4	3	2	4	0	1	0	2	1	0	1	1	2	1	0	4	0	1	2	1	0	0	2	3	0	0
2079	9	2	1.5	0	4	0	2	2	0	2	3	3	3	0	0	1	4	3	1	1	3	2	1	1	2	2	0	1	0	0
2079	10	0	0.5	0	2	1	1	0	0	0	2	0	1	0	0	1	0	2	0	0	1	1	0	0	2	0	0	0	0	0
2079	11	0	0.2	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0
2079	12	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0
2080	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
2080	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	3	0	0.2	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
2080	4	0	0.1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2080	5	0	0.5	0	3	0	0	0	3	0	0	1	0	0	1	0	0	0	0	0	2	0	1	2	1	0	1	1	0	0
2080	6	1	1.0	0	5	5	2	2	2	2	1	0	0	0	2	1	0	0	2	0	1	1	0	1	0	0	2	0	0	0
2080	7	2	2.4	0	9	6	9	0	3	1	2	0	1	0	3	4	1	2	3	6	4	3	3	2	2	1	0	0	2	0
2080	8	2	1.8	0	6	1	3	3	0	6	0	2	2	1	2	1	2	4	2	1	3	1	0	0	2	2	0	2	2	0
2080	9	1	1.2	0	5	0	1	0	1	5	0	2	2	1	3	2	3	0	0	2	0	1	1	1	2	0	0	1	0	0
2080	10	0	0.6	0	3	2	2	2	0	0	0	2	0	0	1	0	0	0	0	0	1	1	3	1	0	0	0	0	0	0
2080	11	0	0.2	0	2	0	0	0	1	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2080	12	0	0.3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	3	1	0	0	0	0	0	0	0
2081	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2081	2	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
2081	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2081	4	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2081	5	1	0.8	0	2	1	1	0	2	1	0	1	1	0	0	1	2	2	0	0	0	1	0	0	2	2	2	0	0	0
2081	6	1	1.2	0	5	3	1	3	1	0	2	3	0	1	0	0	1	0	2	2	0	5	0	2	1	1	0	0	1	0
2081	7	2	2.3	0	7	2	4	6	3	0	1	7	1	2	5	2	3	2	0	4	2	3	1	2	1	2	0	0	1	0
2081	8	1	1.3	0	5	1	1	2	1	1	5	1	1	1	2	0	0	2	2	2	1	1	1	1	1	1	1	2	1	0
2081	9	2	1.3	0	3	2	0	2	0	0	2	1	2	0	2	0	2	2	0	2	3	0	0	2	3	1	3	2	1	0
2081	10	0	0.4	0	2	0	0	0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1	2	0	2	0	0	1	0
2081	11	0	0.2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0
2081	12	0	0.2	0	1	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	1	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2082	2	0	0.2	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
2082	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
2082	4	0	0.2	0	2	0	0	0	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	5	0	0.8	0	3	0	0	0	1	0	0	1	0	1	1	2	0	0	0	0	3	3	2	0	0	1	2	0	1	0
2082	6	1	1.2	0	3	1	2	0	1	0	2	1	2	0	0	3	0	0	1	2	1	2	0	3	2	2	0	1	2	0
2082	7	2	2.3	0	5	0	4	0	3	3	2	1	1	1	3	4	3	2	4	5	1	5	5	0	2	0	2	1	2	0
2082	8	1	1.6	0	6	6	2	3	2	0	0	0	1	3	4	0	1	0	0	1	2	2	1	1	3	1	1	1	3	0
2082	9	1	1.5	0	5	0	3	0	0	0	2	1	4	5	1	1	1	2	2	0	0	1	0	1	3	1	4	3	2	0
2082	10	0	0.3	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0
2082	11	0	0.5	0	3	0	0	0	0	0	0	0	0	0	3	2	1	0	0	0	1	0	1	0	1	0	0	2	1	0
2082	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
2083	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2083	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2083	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2083	4	0	0.2	0	2	0	0	0	0	1	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	5	1	1.4	0	5	1	3	1	0	0	5	1	3	3	0	2	1	0	0	0	1	1	1	1	3	1	3	1	1	0
2083	6	1	1.2	0	4	0	1	0	2	1	1	4	0	3	0	1	0	1	1	0	0	2	1	2	0	1	3	1	3	0
2083	7	1	1.1	0	4	0	2	0	0	1	2	2	1	3	0	1	0	1	0	1	1	1	1	1	2	0	4	1	1	0
2083	8	1	1.2	0	3	2	1	0	1	1	2	3	0	2	3	0	1	1	1	0	1	1	3	0	1	0	0	2	3	0
2083	9	1	1.3	0	4	0	0	0	0	1	0	1	2	1	0	2	4	4	0	1	1	2	3	2	2	0	1	3	0	0
2083	10	0	0.5	0	3	0	0	2	1	1	0	0	0	0	1	2	0	1	0	0	0	0	3	1	0	0	0	0	1	0
2083	11	0	0.3	0	2	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	2	0	0	1	1	0	0	0	0
2083	12	0	0.2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0
2084	1	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	3	0	0.2	0	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	0
2084	4	0	0.2	0	2	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2084	5	1	0.9	0	3	0	1	1	1	0	0	0	3	0	3	0	1	1	1	2	1	1	0	0	0	2	2	0	1	0
2084	6	1	1.4	0	5	4	1	1	1	0	0	0	2	0	2	0	1	2	1	0	2	2	2	0	5	4	1	1	1	0
2084	7	1	1.5	0	4	2	2	1	1	2	0	1	1	3	0	2	2	4	0	1	0	1	0	4	1	3	1	2	1	0
2084	8	1	1.5	0	7	4	0	5	1	0	0	1	1	2	2	3	2	7	0	2	0	0	0	0	2	0	2	0	2	0
2084	9	1	1.5	0	4	0	4	0	1	0	3	2	4	1	0	0	1	1	1	1	0	2	3	1	3	2	3	1	1	0
2084	10	0	0.5	0	4	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	4	1	0	2	0
2084	11	0	0.3	0	2	0	1	0	0	0	1	2	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0
2084	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2085	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	4	0	0.3	0	2	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	1	0	0	0	2	1	0
2085	5	1	0.9	0	3	0	1	0	2	1	1	1	1	2	0	0	2	0	1	3	0	1	0	3	0	0	1	0	1	0
2085	6	1	1.3	0	4	3	3	2	1	0	2	1	0	1	0	4	1	2	0	0	1	3	1	1	2	2	1	0	1	0
2085	7	1	1.5	0	9	9	1	0	1	3	0	0	0	2	0	2	0	1	3	2	0	1	1	3	2	0	0	1	3	0
2085	8	1	1.7	0	6	2	5	1	1	2	1	1	6	0	2	1	1	0	3	0	0	0	0	1	3	2	5	3	0	0
2085	9	1	1.5	0	5	4	5	1	0	4	0	2	0	2	0	0	2	1	3	1	3	0	0	1	2	1	0	1	4	0
2085	10	0	0.6	0	2	0	0	0	0	0	0	0	1	0	2	0	1	2	0	2	2	0	1	1	2	0	0	0	0	0
2085	11	0	0.3	0	2	0	1	1	0	0	0	0	0	0	0	2	0	0	1	0	0	0	1	0	1	0	1	0	0	0
2085	12	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2086	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2086	2	0	0.1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	3	0	0.2	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
2086	4	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0
2086	5	1	1.2	0	4	0	4	1	0	2	2	2	1	1	3	0	2	0	1	0	1	2	0	0	1	0	3	2	1	0

2086	6	1	1.0	0	5	0	1	2	3	0	1	1	2	0	2	0	0	1	0	0	1	0	2	2	0	1	5	1	0
2086	7	2	2.0	0	6	3	4	1	3	3	4	2	2	1	2	2	2	1	1	1	3	1	0	6	1	3	0	1	2
2086	8	1	1.5	0	6	1	3	1	4	0	1	0	1	0	6	2	1	2	0	0	1	3	1	1	0	1	2	1	3
2086	9	1	1.0	0	3	0	1	3	0	2	1	1	1	3	3	1	0	1	2	0	1	1	3	0	1	0	0	0	0
2086	10	0	0.5	0	2	0	1	1	0	0	0	0	2	0	0	0	0	1	1	1	1	1	2	1	0	0	0	1	0
2086	11	0	0.3	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
2086	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2087	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	2	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	3	0	0.4	0	4	0	0	0	4	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2087	4	0	0.3	0	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
2087	5	1	1.0	0	6	1	0	0	1	0	0	2	0	0	0	0	3	2	3	1	1	1	0	0	2	0	6	0	2
2087	6	1	0.9	0	3	1	1	1	1	0	0	1	2	2	3	0	0	3	0	1	1	0	1	0	0	1	0	0	3
2087	7	1	1.6	0	5	3	2	1	0	1	3	1	0	2	2	1	0	1	1	2	4	2	3	1	5	0	4	0	0
2087	8	1	1.4	0	4	0	4	2	2	1	0	0	3	1	3	0	2	2	0	3	3	1	1	2	0	0	2	1	0
2087	9	1	1.3	0	4	1	1	0	3	2	1	1	1	4	2	1	0	0	2	2	2	0	3	0	3	0	0	3	0
2087	10	0	0.3	0	2	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2	1	0	0	0
2087	11	0	0.2	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2087	12	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2088	2	0	0.2	0	2	0	0	0	0	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	3	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	1	0
2088	4	0	0.3	0	2	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	2
2088	5	0	0.4	0	3	1	0	1	2	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2088	6	1	0.7	0	3	2	0	0	1	1	1	0	0	0	0	1	0	2	0	0	1	1	0	0	3	2	0	1	1
2088	7	2	1.4	0	4	3	3	2	2	2	2	1	0	0	3	0	1	0	0	4	0	0	2	3	3	1	2	0	0
2088	8	1	1.3	0	5	1	1	5	1	4	1	0	3	2	2	0	1	2	2	1	1	4	0	0	0	0	1	0	0
2088	9	1	1.1	0	3	3	0	1	0	1	2	1	0	2	3	1	1	0	0	2	0	0	1	1	2	1	1	2	1
2088	10	0	0.5	0	2	2	0	2	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	1	0	0
2088	11	0	0.2	0	2	1	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
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2089	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2089	3	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2089	4	0	0.3	0	2	0	0	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	1
2089	5	1	1.0	0	4	1	1	1	0	1	0	2	4	1	1	2	0	1	1	1	1	2	0	2	1	1	1	0	0
2089	6	1	1.3	0	5	0	1	1	1	3	0	5	4	0	2	1	0	0	0	1	2	0	0	0	4	1	0	3	1
2089	7	2	2.3	0	7	7	1	3	2	1	1	1	2	1	4	2	0	2	2	1	6	4	1	0	5	1	2	2	3
2089	8	1	1.3	0	4	0	1	3	2	1	1	1	0	0	3	2	0	1	4	1	0	3	0	2	0	1	4	0	0
2089	9	1	0.9	0	6	1	1	0	0	0	1	0	0	1	3	2	0	0	0	6	2	1	1	0	0	0	1	2	0
2089	10	0	0.4	0	3	1	0	3	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	1
2089	11	0	0.2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0
2089	12	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
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2090	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2090	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
2090	4	0	0.4	0	3	0	0	0	0	0	0	1	1	0	0	1	1	0	1	0	0	0	0	3	0	0	0	0	2
2090	5	1	0.9	0	3	2	0	0	0	2	2	2	1	1	0	0	3	0	1	2	1	0	0	2	0	2	0	1	0
2090	6	1	1.3	0	5	2	0	1	0	2	1	0	2	1	0	5	1	1	1	1	1	0	0	1	4	3	3	0	0
2090	7	2	1.8	0	6	6	1	2	0	0	1	1	2	2	2	0	2	5	4	3	1	1	1	0	3	0	0	2	4
2090	8	1	1.7	0	6	1	1	1	0	0	5	0	3	1	6	0	1	6	2	0	6	0	2	1	1	1	0	2	0
2090	9	2	1.5	0	3	0	2	2	1	2	1	3	2	0	1	2	1	2	1	2	2	3	2	3	1	0	1	3	0
2090	10	0	0.5	0	2	0	2	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	2	1
2090	11	0	0.4	0	2	0	1	0	0	0	1	1	2	0	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0
2090	12	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	1	0	0.1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2091	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2091	3	0	0.3	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	1	0	1	1
2091	4	0	0.4	0	2	0	0	1	0	0	1	0	1	0	1	1	0	2	0	0	0	0	0	2	0	0	0	1	0
2091	5	0	0.7	0	3	0	1	0	0	0	2	0	2	0	0	3	1	0	0	1	1	2	1	0	1	0	0	0	1
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2091	7	2	2.0	0	6	2	2	2	2	0	1	1	0	1	4	2	0	5	4	4	2	4	0	1	4	1	1	0	6
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2091	9	1	1.0	0	4	0	0	2	1	1	0	1	1	4	1	2	0	1	2	2	1	0	4	1	0	0	0	0	1
2091	10	0	0.4	0	2	2	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0
2091	11	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0
2091	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0
2092	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2092	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	4	0	0.2	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1
2092	5	0	0.4	0	2	0	0	0	0	0	0	2	1	0	0	0	0	1	0	1	0	2	0	1	0	0	0	2	0
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2092	8	1	1.4	0	4	0	0	1	2	3	4	0	0	3	1	1	0	1	3	0	1	1	1	2	1	3	1	1	3
2092	9	2	2.1	0	5	1	4	1	3	1	3	0	1	1	1	2	4	1	1	1	4	2	3	4	5	2	2	3	1
2092	10	0	0.5	0	2	1	2	0	0	1	1	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	2
2092	11	0	0.2	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
2092	12	0	0.1	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	1	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
2093	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	3	0	0.2	0	2	1	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0
2093	4	0	0.3	0	3	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	3	0	0	0
2093	5	0	0.5	0	4	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	4	0	1	2	1	1	1	0
2093	6	1	1.1	0	4	4	0	0	2	0	0	1	1	3	3	2	1	0	1	2	1	0	1	1	0	0	0	2	2
2093	7	1	1.8	0	5	3	4	1	1	2	3	3	2	1	3	1	1	5	2	1	4	0	3	0	1	1	0	1	1
2093	8	1	1.6	0	5	1	5	1	3	1	2	1	1	1	1	1	2	1	0	1	1	4	1	0	3	1	5	1	1
2093	9	1	1.5	0	7	2	2	0	1	2	1	7	0	1	1	2	1	2	1	4	1	1	0	0	1	1	3	1	2
2093	10	0	0.6	0	3	0	0	0	0	1	0	2	1	0	0	0	1	0	1	1	0	1	0	0	3	0	1	0	2
2093	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1
2093	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2094	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2094	3	0	0.2	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
2094	4	0	0.2	0	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2094	5	1	0.7	0	3	2	0	1	0	0	1	2	1	0	0	0	0	0	1	1	1	1	0	0	2	0	1	3	0
2094	6	1	1.3	0	5	1	2	4	3	1	1	1	1	0	0	1	2	1	0	3	0	0	2	1	5	0	1	0	0
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2094	10	0	0.4	0	2	1	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0	1	2	0	1	1	0	0	0
2094	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
2094	12	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
2095	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2095	3	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2095	4	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	1	0	0	0	0	0
2095	5	0	0.7	0	3	0	3	0	1	0	2	0	1	0	1	0	1	0	0	2	1	0	2	0	1	0	2	0	0
2095	6	1	1.0	0	5	1	1	0	1	1	0	1	5	0	2	3	0	0	2	1	0	1	0	1	0	0	3	1	0
2095	7	2	1.6	0	5	2	2	2	5	0	3	1	0	2	1	3	1	2	0	4	2	2	3	1	0	1	2	0	0
2095	8	1	1.3	0	3	1	1	1	0	3	0	0	0	2	1	2	0	3	2	3	0	1	3	2	0	1	1	3	0
2095	9	1	1.0	0	4	1	2	1	0	1	0	0	3	4	0	0	0	2	0	1	2	2	2	1	0	0	1	0	2
2095	10	0	0.3	0	2	0	2	0	0	1	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0
2095	11	0	0.4	0	3	0	0	0	2	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	3	1	0	0	1
2095	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
2096	1	0	0.2	0	1	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2096	2	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2096	3	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	4	0	0.2	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1
2096	5	0	0.6	0	3	2	0	0	1	0	0	0	1	0	0	0	2	0	0	3	0	0	0	0	1	2	2	0	0
2096	6	1	1.0	0	3	0	0	0	2	1	1	1	3	2	0	2	0	1	2	1	1	0	2	1	0	1	1	0	1
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2096	8	1	1.4	0	5	1	2	1	2	1	5	1	1	1	0	1	1	2	2	0	0	2	5	0	0	2	2	0	1
2096	9	2	1.4	0	3	2	3	1	3	1	1	1	2	0	2	2	2	0	0	2	2	1	0	1	2	0	2	2	2
2096	10	0	0.3	0	2	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2096	11	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
2096	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2097	1	0	0.2	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
2097	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
2097	4	0	0.2	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
2097	5	1	0.7	0	2	0	0	1	0	1	1	1	1	1	0	0	0	0	2	1	2	1	0	2	0	0	2	1	0
2097	6	2	1.4	0	3	2	2	1	2	0	2	0	1	2	0	3	0	3	1	2	0	2	3	0	2	0	0	2	3
2097	7	2	1.8	0	6	2	2	3	4	2	0	2	2	1	1	1	2	2	1	4	1	1	1	2	4	0	6	0	0
2097	8	2	1.6	0	5	0	2	2	2	2	0	1	0	4	0	0	2	0	1	4	0	1	3	2	5	0	0	4	3
2097	9	1	1.4	0	4	0	3	2	4	2	1	0	2	0	0	1	1	0	1	3	4	2	0	0	3	1	2	1	1
2097	10	0	0.3	0	1	0	0	0	1	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0
2097	11	0	0.3	0	1	0	0	0	0	0	1	1	1	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	0
2097	12	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
2098	1	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
2098	2	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	3	0	0.2	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
2098	4	0	0.3	0	2	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	0	1
2098	5	0	0.5	0	3	0	1	0	0	0	1	0	0	0	0	3	0	2	2	1	1	1	0	0	0	0	1	0	0
2098	6	1	1.4	0	5	1	1	1	2	2	0	0	0	3	0	2	0	1	2	0	1	5	1	1	1	1	5	3	1
2098	7	2	2.1	0	5	4	3	2	4	3	0	2	0	3	1	1	1	2	1	5	0	3	2	4	4	1	1	1	2
2098	8	1	1.3	0	5	0	1	3	0	1	2	0	1	0	2	1	1	5	1	1	2	1	0	3	3	2	0	1	0
2098	9	1	1.1	0	6	0	0	0	0	3	2	1	2	1	6	2	1	0	0	2	2	0	0	0	1	1	1	0	2
2098	10	0	0.6	0	4	0	1	1	0	0	0	2	3	0	1	0	0	0	0	0	0	1	4	0	0	0	0	1	0
2098	11	0	0.2	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2098	12	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2099	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2099	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2099	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
2099	4	0	0.3	0	2	0	0	0	1	0	0	0	0	0	1	0	0	2	2	0	0	0	0	0	1	1	0	0	0
2099	5	0	0.8	0	3	0	2	1	3	0	1	3	0	0	0	3	0	2	0	0	0	0	0	0	3	0	0	1	0
2099	6	1	1.1	0	3	3	3	1	1	0	2	1	0	0	1	0	2	2	0	2	0	0	3	0	1	0	2	1	2
2099	7	2	1.8	0	4	2	2	0	1	2	1	4	0	3	0	4	0	3	3	1	1	4	0	3	2	3	2	1	0
2099	8	1	1.0	0	4	0	0	0	0	2	1	1	1	1	4	0	2	2	2	0	2	3	0	1	1	0	1	1	0
2099	9	2	1.8	0	4	0	1	2	2	3	4	3	1	2	0	2	1	3	2	1	2	2	0	4	1	0	2	2	2
2099	10	0	0.3	0	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	0
2099	11	0	0.4	0	2	0	0	0	0	0	0	2	1	0	0	0	1	1	1	0	0	0	0	2	0	0	0	1	0
2099	12	0	0.2	0	1	1	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	1	0	0.0	0	1	0	0	0	0	0	0		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2100	2	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	3	0	0.2	0	2	0	0	0	0	0	1		1	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0
2100	4	0	0.3	0	1	0	1	0	1	0	0		0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0
2100	5	0	0.7	0	3	1	1	0	0	0	0		1	0	2	3	0	0	0	0	1	3	0	1	0	0	0	1	1
2100	6	1	1.5	0	4	0	2	1	0	4	0		2	1	1	1	0	0	0	0	1	4	3	3	1	3	1	3	3
2100	7	2	2.3	0	9	1	4	3	3	0	1		4	9	3	2	0	5	2	0	4	2	3	1	3	0	0	2	2
2100	8	1	1.3	0	5	1	0	5	1	0	0		1	1	3	2	1	0	2	1	0	4	3	2	1	1	0	1	0
2100	9	1	1.1	0	3	0	2	3	1	0	2		2	1	3	0	1	3	2	2	2	0	1	0	0	0	0	0	1
2100	10	0	0.6	0	2	0	1	1	1	0	0		0	0	0	1	2	0	0	2	1	0	1	0	0	2	0	1	0
2100	11	0	0.3	0	1	0	1	1	0	0	0		0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0
2100	12	0	0.0	0	1	0	0	0	0	0	0		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

RCP4.5

Day with Daily Precip (mm) ... **>25**

std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d

Year	Month	Median	Mean	Min	Max	pr MIROC-ESM historical rcp45 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp45 (kg m-2 d-1)	pr CNRM-CM5 historical rcp45 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp45 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp45 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp45 (kg m-2 d-1)	pr HadGEM2-ES historical rcp45 (kg m-2 d-1)	pr HadGEM2-AO historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp45 (kg m-2 d-1)	pr FGOALS-g2 historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp45 (kg m-2 d-1)	pr GFDL-CM3 historical rcp45 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp45 (kg m-2 d-1)	pr CanESM2 historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp45 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp45 (kg m-2 d-1)	pr MIROC5 historical rcp45 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp45 (kg m-2 d-1)	pr NorESM1-M historical rcp45 (kg m-2 d-1)	pr BNU-ESM historical rcp45 (kg m-2 d-1)	pr NorESM1-ME historical rcp45 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp45 (kg m-2 d-1)	pr CCSM4 historical rcp45 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp45 (kg m-2 d-1)
2011	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	6	0	0.1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2011	7	0	0.3	0	2	0	2	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2011	8	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2011	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	6	0	0.3	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1	0	1	0
2012	7	0	0.3	0	1	0	0	1	0	1	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0
2012	8	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2012	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2012	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0
2013	7	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2013	8	0	0.2	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0
2013	9	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	6	0	0.1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2014	7	0	0.3	0	2	0	1	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0
2014	8	0	0.2	0	2	0	0	1	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	9	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2014	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	6	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
2015	7	0	0.2	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1
2015	8	0	0.3	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0	1
2015	9	0	0.1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2016	6	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2016	7	0	0.1	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	8	0	0.3	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	1	0	0	2	1
2016	9	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2016	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	6	0	0.1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2017	7	0	0.1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0
2017	8	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
2017	9	0	0.1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2017	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2018	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2018	6	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	7	0	0.3	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1
2018	8	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2018	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	6	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	7	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	8	0	0.2	0	2	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2019	9	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2019	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2020	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	6	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2020	7	0	0.2	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2020	8	0	0.2	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
2020	9	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	6	0	0.2	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
2021	7	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0
2021	8	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0
2021	9	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2022	7	0	0.2	0	1	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
2022	8	0	0.3	0	4	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4
2022	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2022	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2023	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2023	7	0	0.4	0	2	1	0	0	1	2	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	0	0
2023	8	0	0.3	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2	1	0	1
2023	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	6	0	0.2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1
2024	7	0	0.2	0	1	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	8	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	6	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2025	7	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
2025	8	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2025	9	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2025	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	6	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	7	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0
2026	8	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	9	0	0.2	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0
2026	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	2	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0
2027	7	0	0.2	0	2	0	0	2	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
2027	8	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
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2027	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2028	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	7	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
2028	8	0	0.3	0	3	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	1	1	0	0	0	0	0	0
2028	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2029	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2031	7	0	0.4	0	2	0	0	0	0	0	0	0	1	1	0	1	0	2	1	0	2	0	0	1	0	0	0	0	0
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2032	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2032	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2033	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2033	5	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2033	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	7	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	2	0	0	0	0	0	0
2033	8	0	0.2	0	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0
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2033	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2034	7	0	0.3	0	1	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2034	8	0	0.4	0	2	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	2	1	1	1	0
2034	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2036	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2037	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2038	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2038	6	0	0.2	0	2	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	2	0	0
2038	7	0	0.5	0	3	1	0	0	1	0	0	3	1	0	2	1	0	0	0	0	0	1	1	0	0	0	0	0	0
2038	8	0	0.2	0	2	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0
2038	9	0	0.1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2038	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2039	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	4	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2039	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2039	7	0	0.1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2039	8	0	0.2	0	2	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2	0	0	0
2039	9	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
2039	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2040	7	0	0.3	0	2	2	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0
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2040	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2040	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2041	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2041	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2042	6	0	0.3	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0
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2042	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2044	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2045	7	0	0.3	0	2	2	1	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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2045	9	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2045	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2046	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2047	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2048	5	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	6	0	0.2	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0

2048	7	0	0.3	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	1
2048	8	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
2048	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2048	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2055	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2055	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2055	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2056	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2056	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2069	7	0	0.1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2069	8	0	0.4	0	2	1	0	0	0	1	0	0	1	0	2	0	0	0	0	0	2	0	0	0	0	0	2	0	1
2069	9	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
2069	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2070	6	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2070	7	0	0.2	0	1	1	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	8	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	1	0
2070	9	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
2070	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2071	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2071	6	0	0.3	0	2	0	0	0	2	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0
2071	7	0	0.3	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	2	0	0	0	1
2071	8	0	0.3	0	1	1	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0
2071	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2072	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	5	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	7	0	0.3	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	0	1
2072	8	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2072	9	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0
2072	10	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2072	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	6	0	0.1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2073	7	0	0.3	0	2	0	1	0	0	0	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
2073	8	0	0.2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1
2073	9	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2073	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	6	0	0.3	0	2	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2	1	2	0	0	0
2074	7	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2074	8	0	0.3	0	2	0	0	0	0	1	2	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
2074	9	0	0.1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2074	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2075	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	6	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
2075	7	0	0.3	0	2	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
2075	8	0	0.3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	3	0	0
2075	9	0	0.2	0	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0
2075	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	6	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2076	7	0	0.3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	1	0
2076	8	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2076	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2076	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2077	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	6	0	0.1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	7	0	0.2	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2077	8	0	0.4	0	3	0	0	3	0	1	0	0	0	1	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0
2077	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	10	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	5	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
2078	6	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	7	0	0.2	0	2	1	0	0	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	8	0	0.2	0	2	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2078	9	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2078	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	6	0	0.2	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	1
2079	7	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2079	8	0	0.4	0	2	1	1	2	0	0	0	0	0	0	0	1	0	0	2	0	0	1	0	0	0	1	1	0	0
2079	9	0	0.2	0	2	0	0	0	0	0	2	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2079	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2080	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	6	0	0.2	0	1	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	7	0	0.3	0	2	1	2	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0
2080	8	0	0.2	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2080	9	0	0.1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2081	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2081	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	5	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
2081	6	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2081	7	0	0.3	0	2	0	1	0	1	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2081	8	0	0.2	0	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2081	9	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	12	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	6	0	0.3	0	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	2	0	0	0	0
2082	7	0	0.2	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2
2082	8	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	9	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2083	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	5	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0
2083	6	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2083	7	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	8	0	0.2	0	2	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2083	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2083	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2084	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0
2084	7	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
2084	8	0	0.3	0	5	0	0	1	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0
2084	9	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2084	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2085	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	7	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2085	8	0	0.2	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0
2085	9	0	0.3	0	2	1	2	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2086	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
2086	7	0	0.3	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1
2086	8	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0	0	0
2086	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	7	0	0.2	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
2087	8	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2087	9	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2087	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	7	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
2088	8	0	0.2	0	2	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2088	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2088	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2089	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2089	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2089	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2089	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2089	6	0	0.2	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2089	7	0	0.3	0	2	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0
2089	8	0	0.2	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
2089	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2089	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2089	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2089	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2090	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2090	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2090	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2090	6	0	0.3	0	3	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	1	0	0
2090	7	0	0.1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2090	8	0	0.4	0	2	0	0	0	0	0	1	0	1	0	2	0	0	0	1	0	2	0	2	0	0	0	0	1	0
2090	9	0	0.2	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
2090	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2090	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2090	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	7	0	0.3	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	1
2091	8	0	0.3	0	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0
2091	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2091	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2092	6	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1
2092	7	0	0.2	0	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
2092	8	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0
2092	9	0	0.2	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0
2092	10	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	3	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	6	0	0.1	0	2	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	7	0	0.2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0
2093	8	0	0.2	0	2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2	0	0
2093	9	0	0.2	0	2	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2094	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2094	6	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
2094	7	0	0.3	0	2	0	1	0	2	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0
2094	8	0	0.3	0	4	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0
2094	9	0	0.2	0	2	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	5	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2095	7	0	0.1	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
2095	8	0	0.2	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0
2095	9	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2095	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2096	7	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2096	8	0	0.1	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2096	9	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2096	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	5	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2097	7	0	0.3	0	3	1	0	2	1	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
2097	8	0	0.3	0	2	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0	0	0	0	1	0	0	0	1
2097	9	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2097	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	6	0	0.2	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
2098	7	0	0.3	0	3	3	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	1	0
2098	8	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	0
2098	9	0	0.1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2099	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2099	7	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
2099	8	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2099	9	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0
2099	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	12	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	1	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	2	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	3	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	4	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	5	0	0.0	0	1	0	0	0	0	0	0		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	6	0	0.3	0	2	0	0	1	0	0	0		1	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0
2100	7	0	0.1	0	2	0	0	1	0	0	0		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
2100	8	0	0.1	0	1	1	0	0	0	0	0		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	9	0	0.0	0	1	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	10	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	11	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	12	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

RCP8.5

Total Monthly Precip (mm)

						std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Month**	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp85 (kg m-2	pr MIROC-ESM-CHEM historical rcp85 (kg m-2	pr CNRM-CM5 historical rcp85 (kg m-2	pr MRI-CGCM3 historical rcp85 (kg m-2	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2
2011	1	18.9	22.0	7.5	60.7	21.5	14.2	7.5	16.8	60.7	10.3	31.9	35.4	16.9	12.0	34.9	20.8	40.5	26.1	9.0	10.4	21.4	21.0	25.4	16.5	13.1	17.0	29.1	15.6
2011	2	22.5	23.1	7.2	70.8	10.8	17.9	38.0	7.6	11.1	18.2	13.3	22.6	22.2	20.4	25.0	22.4	7.2	29.2	15.4	23.1	30.2	70.8	23.1	23.3	12.8	28.5	39.1	22.7
2011	3	19.5	20.7	7.9	39.6	11.1	24.7	23.0	11.2	11.5	12.0	7.9	16.5	21.8	13.6	21.5	25.6	24.5	19.9	14.8	32.3	39.6	18.9	18.0	19.0	31.1	11.2	35.2	31.2
2011	4	14.8	15.0	1.0	39.1	4.8	16.1	15.9	13.6	22.2	6.7	4.5	1.0	11.6	31.3	17.3	36.4	19.2	22.1	39.1	15.9	18.2	4.3	7.4	13.1	6.6	3.1	18.8	11.6
2011	5	33.7	34.5	9.6	71.0	33.9	56.2	9.6	22.2	34.3	39.7	26.2	41.0	17.4	35.3	24.4	68.0	71.0	10.4	30.2	67.6	41.2	10.9	24.0	16.6	46.7	33.5	23.1	44.9
2011	6	48.7	49.8	26.0	69.3	45.3	66.9	58.1	28.7	47.7	49.7	37.0	29.9	60.2	69.2	67.7	45.9	59.3	60.4	47.5	42.9	69.3	66.8	31.3	50.3	62.8	28.2	43.1	26.0
2011	7	78.9	78.5	25.4	128.3	55.8	102.6	105.3	25.4	111.3	46.5	107.1	32.1	128.3	82.5	48.6	81.7	80.3	67.6	50.6	54.9	100.2	74.3	77.4	83.5	107.7	123.8	73.5	63.6
2011	8	57.4	58.6	13.3	127.5	74.6	59.3	56.4	64.6	91.2	26.1	44.9	39.9	60.5	58.3	61.1	32.1	13.3	37.9	64.5	52.3	55.9	93.5	127.5	33.6	98.7	70.7	55.4	33.5
2011	9	58.4	61.2	19.0	125.1	78.8	19.0	77.6	106.2	55.2	22.6	56.0	125.1	60.7	80.7	69.5	28.3	25.6	83.7	50.6	45.6	56.9	39.2	60.4	58.6	65.1	58.3	109.6	35.8
2011	10	25.5	26.5	7.5	45.9	22.2	19.6	16.2	7.5	25.8	23.1	14.5	9.9	38.9	44.4	27.1	41.5	26.7	25.1	45.9	29.8	41.7	17.0	18.6	24.1	30.6	38.5	11.7	36.3
2011	11	33.5	33.3	8.7	60.3	33.7	51.2	40.6	13.7	34.1	34.0	39.1	33.3	20.6	27.5	26.3	60.3	15.7	38.8	43.0	42.4	50.6	22.9	8.7	31.1	28.0	33.2	27.3	44.3
2011	12	27.0	27.3	9.0	43.7	12.2	35.4	36.0	26.2	37.1	34.5	34.3	23.6	27.7	43.7	25.2	9.0	22.1	23.1	30.6	32.0	30.2	20.9	12.8	26.1	34.1	24.4	23.2	31.1
2012	1	20.0	24.1	9.6	57.5	17.4	25.9	19.6	12.3	18.3	15.6	36.2	49.8	22.0	16.8	18.7	57.5	18.2	31.4	17.9	16.7	21.6	31.1	18.4	26.7	22.3	20.3	34.0	9.6
2012	2	16.3	19.7	5.5	75.5	21.3	10.9	15.6	13.0	12.2	17.7	27.6	17.0	5.5	23.0	75.5	12.0	10.7	13.2	25.4	9.7	10.1	17.4	24.7	26.1	17.2	14.7	40.1	11.7
2012	3	18.9	20.3	1.2	51.4	1.2	30.4	25.2	23.3	20.0	24.5	15.2	3.5	14.6	16.9	29.3	22.3	22.6	17.2	10.5	32.6	17.8	9.4	5.5	51.4	26.1	14.7	37.3	14.8
2012	4	20.4	21.1	2.5	46.9	20.7	11.6	29.5	35.4	25.3	15.2	16.8	17.2	24.2	20.1	10.5	33.4	17.3	36.1	24.4	11.1	25.6	22.7	23.3	2.5	8.3	46.9	18.0	9.5
2012	5	32.5	36.4	15.9	77.9	39.4	40.8	19.6	18.9	39.4	29.8	25.8	22.0	77.9	45.3	56.3	30.5	31.7	36.4	42.9	19.1	15.9	39.8	24.2	31.3	31.5	72.4	49.6	33.3
2012	6	48.9	54.5	27.5	107.4	27.5	30.9	80.3	44.0	43.6	38.2	70.0	61.9	66.8	36.1	107.4	64.1	29.8	92.6	55.6	39.1	51.8	65.0	90.4	43.3	32.1	48.3	49.5	39.9
2012	7	58.4	63.3	21.0	146.3	21.0	29.3	56.7	40.0	33.7	60.9	75.4	102.5	42.2	64.3	95.2	51.9	99.9	146.3	30.4	69.3	60.0	32.8	46.7	67.7	40.3	134.1	67.7	51.8
2012	8	63.2	63.4	24.7	102.5	87.5	70.9	62.6	82.8	69.6	60.3	93.9	62.4	68.6	102.5	80.0	63.7	83.6	52.1	67.5	37.2	39.3	61.0	35.2	78.3	51.2	41.2	24.7	45.0
2012	9	54.2	54.5	11.6	136.4	32.1	31.0	62.0	74.0	55.8	82.4	84.9	47.7	56.5	52.6	59.1	11.6	22.3	62.4	48.6	34.3	52.0	29.7	40.1	59.8	89.6	136.4	62.1	20.8
2012	10	36.5	36.2	12.0	55.0	45.6	12.0	33.1	19.0	46.9	48.3	44.2	23.7	36.2	33.7	34.8	17.2	44.0	28.1	44.5	48.0	19.1	49.9	28.9	36.8	34.9	55.0	42.2	43.2
2012	11	32.4	36.1	17.7	69.9	41.6	48.9	35.4	34.3	47.8	30.3	58.7	33.5	69.9	26.7	25.7	22.1	25.8	62.7	21.1	28.4	41.7	29.1	42.8	31.3	23.3	17.7	29.6	38.0
2012	12	27.0	27.3	9.1	46.6	37.0	42.3	46.6	24.7	10.3	27.1	40.9	17.1	20.1	29.9	43.6	38.3	29.1	36.1	15.4	40.6	15.8	9.1	28.8	26.8	10.5	14.8	26.5	23.9
2013	1	28.0	25.5	9.3	38.3	15.7	20.4	31.0	28.6	31.4	19.3	30.6	35.5	35.5	9.3	30.7	35.3	22.6	13.5	28.4	38.3	27.6	20.7	32.2	25.3	17.8	28.8	20.9	13.0
2013	2	19.9	18.4	6.2	27.8	27.1	12.9	19.2	20.1	22.4	11.1	24.3	27.8	21.1	19.3	11.9	12.5	24.7	20.8	21.6	19.8	23.2	23.5	7.4	6.2	18.8	8.7	15.3	21.6
2013	3	17.9	18.8	2.3	43.9	17.1	17.9	36.0	21.9	13.6	26.0	20.8	23.1	10.4	12.1	12.2	25.8	14.6	17.9	2.3	35.7	43.9	5.8	5.1	9.2	28.6	11.8	18.1	22.4
2013	4	17.9	18.1	3.3	32.2	25.6	21.0	28.1	20.4	18.6	10.2	6.9	24.4	7.4	17.3	16.3	22.2	3.3	9.0	24.1	30.3	11.6	32.2	25.2	23.6	13.9	11.8	13.2	16.7
2013	5	29.6	31.1	8.0	65.4	20.7	22.0	22.1	26.6	41.3	28.5	46.7	40.6	43.9	28.8	30.3	24.3	38.2	33.8	35.4	19.8	19.3	23.5	8.0	39.9	33.8	37.4	15.7	65.4
2013	6	53.3	55.8	16.9	101.2	54.7	60.4	56.5	50.5	82.0	98.5	29.9	27.3	87.3	37.9	62.4	77.6	59.9	28.6	16.9	101.2	30.7	52.0	97.6	31.0	21.9	38.7	41.6	93.5
2013	7	62.3	78.5	41.9	147.9	137.9	105.2	97.1	42.8	92.7	44.8	61.7	60.7	51.8	137.1	143.7	58.0	45.3	62.9	87.9	81.1	89.8	41.9	78.1	60.9	46.5	59.8	147.9	49.2
2013	8	64.1	63.5	23.6	99.1	29.3	86.5	70.7	56.7	86.7	79.8	63.5	38.1	58.4	99.1	76.1	62.4	41.5	92.4	65.6	66.2	80.1	35.0	23.6	46.3	93.9	45.7	61.9	64.8
2013	9	48.0	55.9	13.6	123.1	83.6	29.2	29.1	47.4	13.6	60.6	45.1	75.8	75.2	43.1	29.0	48.5	36.7	46.2	57.0	32.6	80.4	57.0	36.8	30.8	100.2	123.1	68.0	93.7
2013	10	32.7	32.7	12.4	64.3	28.3	52.2	35.6	64.3	47.2	16.1	12.4	28.6	34.8	32.9	23.6	42.0	17.2	23.0	36.0	32.4	13.1	35.5	50.5	26.9	42.1	34.2	28.6	27.0
2013	11	33.2	34.9	11.1	77.1	22.8	48.5	32.5	11.1	29.7	29.6	77.1	71.2	23.9	58.4	43.2	24.4	26.7	44.2	26.1	34.6	14.7	36.0	18.4	11.5	40.9	36.5	33.8	41.3
2013	12	26.8	27.9	14.4	49.2	24.4	35.4	32.5	24.1	33.8	17.6	37.2	17.4	14.4	23.2	39.2	37.1	23.6	15.1	20.8	28.0	49.2	29.3	33.0	29.1	25.5	23.2	21.3	34.3
2014	1	24.4	26.4	11.6	66.0	14.0	50.5	25.7	37.0	66.0	17.1	38.7	20.4	21.4	32.5	33.8	26.9	18.7	20.7	23.0	34.4	13.8	11.6	13.7	11.7	27.2	18.4	28.9	27.9
2014	2	18.8	19.3	6.7	35.9	17.1	23.2	22.1	22.7	31.5	6.7	12.1	22.7	20.6	18.4	35.9	19.6	19.1	22.7	13.6	14.2	16.2	28.2	8.1	9.6	15.8	30.3	15.8	16.1
2014	3	15.5	19.0	4.7	45.2	9.5	45.2	14.2	23.5	43.1	12.3	23.4	14.2	23.7	20.8	22.9	15.9	13.4	14.2	25.4	31.4	15.5	14.0	12.5	15.1	15.6	4.7	16.3	10.0
2014	4	17.2	19.7	7.5	61.3	7.5	15.6	21.7	18.1	21.5	10.2	35.3	10.3	14.7	11.4	17.6	16.8	13.1	23.4	61.3	13.6	37.8	23.5	14.2	8.0	14.8	23.7	19.6	20.1
2014	5	33.1	40.4	6.3	126.4	68.3	6.3	14.6	80.1	34.9	25.2	51.8	25.0	58.8	19.8	24.9	38.0	49.1	112.4	19.8	36.0	34.2	21.7	27.4	126.4	36.8	32.1	8.1	17.8
2014	6	56.1	58.4	18.8	124.0	55.6	18.8	41.0	53.7	62.6	41.1	47.9	52.1	113.1	62.9	20.7	72.1	77.7	53.0	124.0	56.9	59.3	61.7	66.3	41.7	56.7	35.0	21.1	105.3
2014	7	72.7	81.4	39.6	189.5	76.9	44.2	54.3	67.3	93.6	83.2	73.1	134.2	47.9	39.6	50.1	65.4	142.1	153.5	64.8	82.4	75.2	189.5	112.4	52.8	72.2	45.0	59.9	75.1
2014	8	59.8	60.1	15.7	124.6	73.5	67.3	59.3	124.6	32.6	64.6	60.3	20.2	47.1	41.6	56.7	86.3	36.9	67.0	15.7	71.3	66.8	47.2	42.5	84.3	20.6	103.5	51.9	100.1
2014	9	68.3	68.1	10.3	147.6	51.6	61.1	70.1	75.7	74.4	29.4	58.5	70.6	67.4	84.7	69.2	54.2	72.5	55.5	53.5	69.9	147.6	17.4	59.5	102.4	116.1	64.2	99.2	10.3
2014	10	33.8	34.1	4.7	74.9	45.5	49.4	21.7	36.8	74.9	4.7	34.7	18.6	23.9	35.1	19.7	36.7	22.4	55.5	66.4	26.8	63.5	26.9	13.6	39.3	22.3	9.5	32.9	38.1
2014	11	32.1	33.7	5.1	63.8	33.9	22.2	28.5	25.4	31.5	35.9	14.9	43.4	25.1	50.0	26.0	19.4	34.0	30.8	52.1	34.6	5.1	63.8	32.7	36.5	61.7	46.1	24.2	31.5
2014	12	33.7	30.1	3.9	52.6	38.6	33.7	44.3	28.6	52.6	39.2	12.6	33.9	36.7	11.0	18.4	35.7	33.7	3.9	16.8	25.8	35.6	23.4	26.6	22.4	35.5	36.7	32.2	44.2
2015	1	19.8	22.1	1.7	44.4	33.7	27.5	14.7	18.5	29.9	12.9	16.8	14.8	30.2	13.7	9.6	31.2	1.7	41.1	20.3	14.5	44.4	36.7	20.5	34.3	19.3	22.4	14.1	8.2
2015	2	18.5	20.5	6.7	38.6	23.4	12.4	13.6	30.3	13.8	14.0	18.2	28.1	33.3	18.8	6.7	12.0	19.7	33.5	29.8	7.3	18.9	17.7	10.1	24.7	31.8	18.0	38.6	17.8
2015	3	16.9	19.8	6.3	45.1	12.1	11.3	20.2	13.6	40.1	9.0	9.9	7.7	45.1	21.6	7.6	8.4	13.5	22.8	33.1	24.6	38.3	6.3	19.9	13.0	44.8	16.0	19.2	17.8
2015	4	20.2	21.6	7.4	40.4	32.2	19.2	14.6	16.0	10.2	20.0	24.2	8.7	16.0	32.6	40.4	20.4	20.3	15.3	16.5	24.0	34.9	32.0	27.6	18.1	24.3	17.9	7.4	26.3
2015	5	28.7	33.5	9.9	73.3	32.0	19.2	22.4	33.0	15.1	12.9	16.2	54.8	59.2	56.2	35.9	25.3	18.1	9.9	13.3	73.3	21.2	22.9	44.3	54.5	12.0	35.2	72.5	45.7
2015	6	53.6	56.3	5.8	142.3	94.1	46.8	142.3	5.8	55.4	19.0	60.5	43.8	102.7	53.2	53.9	32.8	63.5	23.9	24.9	66.8	75.9	72.4	19.1	122.2	48.7	22.5	67.5	34.5
2015	7	64.2	75.4	23.7	163.8	163.8	38.2	56.5	55.6	52.0	44.7	83.4	115.0	82.7	54.8	116.6	85.5	53.3	74.6	59.9	59.0	68.5	141.4	57.7	23.7	84.3	98.4	111.7	29.4
2015	8	52.4	58.1	14.0	148.9	50.8	58.1	75.8	39.0	33.6	64.2	54.0	43.8	80.2	43.9	46.8	45.7	54.5	148.9	59.5	46.4	83.9	41.4	69.0	61.3	14.0	32.4	48.6	99.3
2015	9	56.2	57.2	21.3	90.7	85.6	50.2	26.3	90.7	41.7	51.7	70.8	76.8	77.4	77.3	83.7	80.3	36.0	26.0	90.2	21.3	61.3	31.0	30.9	25.5	53.1	85.7	59.3	40.5
2015	10	31.2	30.7	10.7	61.5	33.4	48.2	10.7	25.1	30.0	19.9	32.2	16.6	31.3	23.4	20.0	42.3	17.4	46.8	34.5	18.3	17.9	40.9	15.1	44.3	61.5	33.3	31.1	42.6
2015	11	33.8	34.7	17.4	52.7	30.7	35.2	52.7	32.6	41.3	38.2	33.7	39.7	21.7	21.5	25.2	45.0	48.9	35.4	17.4	24.1	31.1	49.3	28.9	34.8	52.4	27.2	33.9	32.3
2015	12	23.6	24.0	4.7	48.1	26.1	17.2	19.6	15.8	31.1	31.5	19.5	13.2	29.4	48.1	23.6	17.8	31.8	4.7	8.6	32.4	23.6	27.9	30.2	28.7	21.4	39.4	11.2	23.2
2016	1	25.1	26.5	12.8	43.2	43.2	31.2	29.9	30.5	36.2	20.7	18.7	13.6	22.9	40.2	22.7	15.7	25.2	12.8	29.8	37.8	15.9	25.1	39.5	23.2	30.7	27.7	23.6	19.2
2016	2	19.1	20.5	5.9	46.8	20.5	13.8	36.3	15.3	14.5	46.8	36.7	21.7	8.7	7.0	16.5	21.3	45.0	18.2	20.0	8.6	25.8	21.3	7.1	24.4	5.9	8.0	31.6	16.3
2016	3	15.0	18.9	6.7	40.3	16.6	10.6	11.7	14.4	22.7	26.9	11.9	7.8	13.3	6.7	23.4	29.0	26.4	15.6	26.7	23.8	10.9	37.6	14.1	40.3	12.2	7.9	29.8	13.2
2016	4	15.7	18.5	4.6	37.9	11.4	15.0	17.3	25.5	30.3	15.9	4.6	35.6	13.8	4.8	7.2	12.2	25.7	14.8	37.9	12.2	23.6	33.0	25.4	22.8	12.8	16.1	15.6	11.5
2016	5	30.3	36.4	9.9	113.9	42.4	28.6	43.7	54.7	17.3	15.8	14.0	22.8	23.7	20.3	9.9	40.3	77.0	11.5	14.4	41.7	11.6	42.9	31.9	86.8	50.7	113.9	16.7	41.1
2016	6	60.8	60.0	16.4	151.5	64.0	16.4	69.5	67.2	26.1	27.8	114.4	151.5	52.3	39.3	77.3	71.4	90.3	38.9	66.1	54.1	59.2	37.5	49.8	62.3	75.4	90.2	17.8	20.6
2016	7	77.8	73.7	33.1	139.8	96.7	41.0	72.0	78.5	82.1	35.2	64.1	44.1	41.5	33.6	88.6	84.6	45.4	98.8	103.6	33.1	78.9	139.8	77.6	78.1	125.7	58.1	50.8	117.0
2016	8	69.0	66.1	11.5	113.0	79.8	45.2	62.1	37.2	79.4	107.8	83.4	46.9	28.8	60.0	105.2	90.0	67.5	113.0	35.8	11.5	70.9	48.9	70.5	79.3	89.9	50.8	49.0	74.3
2016	9	67.4	66.0	8.9	128.5	84.6	67.9	44.4	63.9	80.4	97.8	128.5	74.2	82.3	66.6	127.3	16.2	8.9	70.8	66.9	50.3	68.0	57.4	25.6	36.2	71.8	46.0	111.6	36.2
2016	10	33.8	35.3	8.2	85.6	35.1	8.2	15.5	8.9	40.0	43.0	34.1	31.1	43.5	53.5	29.0	24.0	58.1	57.3	54.9	85.6	21.5	39.7	21.3	33.5	15.3	49.7	32.4	11.1
2016	11	24.6	29.4	16.6	67.4	19.5	26.0	21.1	21.3	30.8	49.3	41.6	34.9	17.4	31.1	44.8	21.4	27.9	33.0	23.1	18.5	67.4	18.7	42.3	18.1	38.0	16.6	22.1	20.5
2016	12	24.6	25.6	7.0	45.8	13.9	16.6	24.8	45.8	39.9	16.7	30.6	34.6	17.0	30.3	30.8	16.3	27.4	41.4	17.4	35.9	17.9	7.0	23.2	22.2	19.3	24.4	32.3	28.4
2017	1	20.5	22.5	6.7	57.4	41.6	7.7	21.6	31.3	20.9	23.7	20.8	13.0	11.5	15.1	28.2	23.8	17.5	16.6	6.7	44.2	16.5	10.8	57.4	13.5	20.2	24.7	33.7	19.2
2017	2	19.3	19.7	10.6	49.7	10.9	15.6	18.1	22.3	16.8	16.2	22.8	10.6	14.2	16.3	22.8	22.1	12.1	23.2	49.7	21.0	20.8	20.5	16.3	11.2	25.9	30.2	12.0	22.0
2017	3	20.1	19.6	1.7	44.3	10.7	1.7	20.8	44.3	24.8	10.5	12.0	9.9	11.7	26.4	20.5	38.7	20.0	8.4	25.4	35.4	12.9	21.8	22.9	20.2	38.2	10.3	15.1	7.9
2017	4	20.5	22.9	4.5	76.6	29.6	11.7	11.4	14.7	11.3	21.5	10.8	8.2	44.3	21.3	19.2	25.2	14.1	12.5	76.6	48.2	19.6	23.5	6.6	40.0	28.3	4.5	22.7	24.4
2017	5	40.8	40.5	14.0	61.5	34.6	36.0	43.2	43.4	14.0	27.1	17.6	49.5	26.6	38.3	58.1	32.7	52.2	29.4	58.3	24.7	55.8	30.2	61.5	42.1	59.0	49.5	39.5	47.4
2017	6	51.7	59.3	8.9	141.5	22.4	8.9	47.2	65.5	52.1	60.1	51.3	44.5	65.4	14.0	92.8	22.2	37.9	64.3	99.0	141.5	99.0	43.2	121.9	51.1	47.4	55.6	83.5	32.7
2017	7	76.6	81.4	31.2	174.9	79.9	63.4	109.5	68.0	90.2	84.7	38.4	48.8	86.6	83.2	90.8	39.6	45.8	41.7	73.4	67.9	73.2	174.9	71.4	101.7	111.7	141.0	31.2	135.6
2017	8	48.9	63.0	20.8	151.2	145.3	27.5	30.9	56.0	109.7	38.8	61.3	48.9	88.4	48.9	85.1	29.2	42.6	47.0	151.2	60.7	43.1	20.8	66.7	37.7	69.0	135.0	26.7	40.3
2017	9	55.3	58.8	16.8	105.7	92.6	68.6	49.1	57.8	105.7	69.5	51.5	74.7	65.3	47.9	55.8	46.3	23.2	16.8	48.0	96.1	85.4	55.8	54.9	38.9	58.6	50.2	54.4	44.3
2017	10	35.4	38.4	15.1	63.1	50.9	56.4	62.3	30.4	62.4	15.1	22.1	22.0	41.5	55.7	25.3	44.4	33.5	34.4	63.1	36.3	19.3	26.4	46.6	18.5	48.6	29.4	29.9	46.2
2017	11	32.2	32.6	7.2	60.4	27.8	7.2	17.4	15.8	32.3	28.1	20.8	35.9	17.1	21.6	60.4	46.7	20.2	44.7	37.4	33.2	37.1	59.3	23.1	50.0	35.0	32.0	47.2	31.8

2017	12	26.8	27.6	6.4	51.6	51.6	37.2	32.2	26.8	24.3	38.4	15.6	21.0	24.0	6.4	22.2	30.7	33.0	9.7	22.3	33.4	26.9	18.4	21.6	20.6	35.4	38.9	27.8	43.1
2018	1	26.6	27.4	5.0	55.0	30.3	21.4	6.1	16.8	55.0	19.6	47.7	17.7	32.4	33.6	17.0	39.5	33.3	16.4	25.9	19.7	34.4	27.2	5.0	22.2	33.8	51.0	36.0	16.7
2018	2	17.6	18.5	4.9	36.1	4.9	11.4	12.9	19.3	25.5	16.2	26.7	28.8	18.4	11.4	16.9	24.5	14.0	36.1	10.9	18.2	17.6	14.6	28.6	19.8	16.2	6.8	27.4	17.6
2018	3	19.2	20.7	2.1	47.5	14.4	18.6	29.5	7.2	27.8	47.5	18.2	32.3	16.1	2.1	20.7	24.7	8.0	19.4	29.2	23.1	18.6	4.9	38.9	16.8	21.7	15.7	19.0	23.5
2018	4	18.6	18.9	7.1	40.5	9.1	26.9	40.5	20.4	19.3	17.1	13.2	23.9	27.4	9.5	20.0	7.1	21.7	15.0	33.5	25.1	18.8	13.3	16.3	18.4	14.9	9.5	20.0	12.2
2018	5	30.3	32.4	6.3	64.4	24.6	55.1	34.9	18.7	30.2	13.7	7.0	45.1	31.8	44.5	28.7	51.1	64.4	30.3	6.3	11.1	38.5	27.2	20.7	64.4	25.6	40.4	28.9	33.4
2018	6	48.4	47.8	17.1	105.2	42.7	43.1	17.1	38.5	49.4	79.8	59.5	29.6	18.3	27.2	73.9	48.2	60.2	41.2	24.7	51.6	30.7	105.2	53.9	48.7	53.6	50.6	53.6	46.8
2018	7	63.1	75.3	33.0	154.2	49.9	33.0	40.1	61.2	50.7	110.8	86.0	58.5	35.1	123.4	71.1	37.7	48.4	80.8	79.7	65.0	124.4	137.0	40.5	154.2	50.5	89.6	121.5	58.5
2018	8	63.4	64.6	20.0	145.1	55.5	28.9	59.4	81.3	117.8	97.9	43.3	47.1	71.6	74.4	20.0	55.7	26.7	100.2	83.9	27.5	48.7	79.0	67.8	37.8	35.7	79.0	145.1	67.3
2018	9	61.0	63.5	22.5	111.8	50.4	108.5	76.3	58.3	53.9	54.4	42.9	69.0	89.2	60.9	24.6	61.0	22.5	65.8	66.8	70.5	50.9	43.0	92.1	111.8	56.7	77.8	85.8	31.7
2018	10	34.2	30.9	2.4	53.5	35.6	2.4	41.2	14.5	14.6	25.0	17.7	53.5	40.6	28.5	28.1	33.6	43.0	34.7	42.0	25.3	39.6	16.9	16.8	41.5	25.7	37.5	45.6	37.0
2018	11	33.9	34.8	12.2	50.1	12.2	41.9	39.7	34.8	23.3	49.5	46.0	44.1	33.0	26.2	30.7	35.5	29.5	22.2	35.7	46.6	50.1	42.4	32.2	42.9	27.3	29.2	29.3	31.9
2018	12	26.4	26.6	11.0	40.5	39.0	15.0	20.4	13.7	36.3	39.5	27.7	40.5	17.8	31.5	25.4	22.9	28.2	19.2	28.6	34.8	22.7	26.4	36.8	22.8	24.1	26.4	11.0	26.6
2019	1	20.2	25.2	8.1	48.9	17.7	36.9	43.9	9.2	18.2	12.6	32.0	20.6	48.9	8.8	38.7	8.1	39.3	16.8	38.2	17.1	24.0	19.2	19.8	36.4	22.9	15.0	16.8	43.2
2019	2	17.9	20.0	6.9	34.9	9.1	23.6	34.9	31.5	16.1	18.7	12.2	24.2	10.8	14.8	32.1	16.0	23.6	15.9	21.6	6.9	32.5	24.4	17.2	28.4	28.6	13.8	10.1	14.1
2019	3	21.2	20.4	5.2	42.5	26.8	22.4	23.9	26.2	31.0	20.3	25.3	29.4	16.5	12.5	6.5	17.2	12.7	5.2	42.5	24.9	23.0	32.8	6.3	18.5	22.2	13.3	20.3	9.2
2019	4	17.4	21.2	3.0	73.3	17.7	6.9	21.1	23.6	10.8	16.7	37.0	10.3	28.7	22.7	16.6	25.9	17.0	25.2	3.0	31.5	25.1	15.9	9.4	6.6	37.6	15.5	73.3	9.8
2019	5	38.4	39.9	18.4	76.8	62.7	18.4	30.5	23.5	54.1	19.4	45.5	76.8	24.8	33.2	24.1	46.0	41.3	27.6	50.5	21.3	41.6	25.5	51.4	37.9	62.5	38.9	28.3	70.8
2019	6	50.0	49.6	7.0	81.7	45.4	24.8	36.9	44.8	76.5	81.1	32.1	47.3	81.7	79.2	43.3	14.1	61.5	64.5	52.6	52.7	26.0	63.8	58.8	7.0	45.2	59.9	25.5	66.4
2019	7	66.0	70.7	27.4	128.7	70.2	28.5	103.9	34.6	76.2	69.6	91.8	40.8	62.5	128.7	45.6	54.0	57.2	61.6	102.5	102.5	27.4	104.5	60.1	77.1	53.4	84.7	114.6	46.1
2019	8	60.7	65.7	20.2	127.6	52.8	77.6	25.8	58.8	83.3	96.3	61.4	89.2	85.4	59.5	117.6	20.2	54.5	76.0	95.0	45.1	69.9	59.2	60.0	27.1	36.0	31.4	127.6	67.3
2019	9	46.4	51.5	15.1	118.6	72.5	47.3	86.2	38.5	19.5	21.8	118.6	43.2	100.9	56.7	15.1	37.9	45.6	64.9	47.8	51.7	28.8	43.5	57.6	35.9	44.3	50.0	62.5	45.3
2019	10	31.6	34.1	14.9	73.5	31.2	22.4	37.3	25.3	31.8	46.0	29.3	20.8	42.7	27.1	29.2	41.8	35.9	29.0	73.5	23.2	35.5	49.1	34.4	31.4	14.9	25.7	46.6	33.6
2019	11	31.2	29.9	8.2	52.6	39.8	37.1	35.7	33.3	45.6	42.0	8.2	48.2	34.0	19.7	29.1	22.8	36.1	26.0	26.0	33.4	18.7	17.5	10.0	17.0	52.6	19.0	42.9	22.5
2019	12	26.6	27.0	8.5	47.8	28.0	26.3	19.9	29.4	47.8	27.6	36.8	29.7	32.2	42.5	27.4	22.2	37.5	26.5	14.2	17.0	24.4	25.9	33.4	16.0	26.8	8.5	26.2	22.0
2020	1	26.8	26.7	10.3	43.4	33.5	22.3	10.3	27.7	22.5	32.2	32.6	35.9	29.6	40.1	23.5	20.5	32.5	43.4	13.3	24.0	36.5	15.5	12.6	11.2	16.5	25.9	35.1	43.3
2020	2	18.5	20.8	4.3	52.8	23.7	39.9	44.3	18.5	15.1	25.2	15.1	25.7	17.6	26.3	20.1	17.6	52.8	17.5	18.9	9.0	25.7	18.5	8.7	10.0	4.3	14.6	23.1	7.4
2020	3	20.4	20.6	3.9	32.2	16.1	18.3	26.1	15.5	23.3	17.1	26.7	32.2	11.7	16.5	17.3	25.9	14.0	27.9	19.8	3.9	13.7	26.8	31.7	26.2	27.5	24.7	9.7	21.1
2020	4	17.6	20.2	5.2	53.4	31.1	7.2	16.3	12.2	10.6	13.7	14.9	10.2	21.4	28.6	14.2	20.3	13.7	53.4	26.6	5.2	26.4	36.4	35.4	13.6	20.2	20.5	14.8	18.9
2020	5	41.9	44.8	11.1	91.5	11.1	54.9	45.0	12.6	45.5	32.7	40.8	27.4	55.7	87.3	66.2	22.5	91.5	25.4	32.3	43.0	28.1	26.2	91.5	14.7	67.3	19.3	57.7	76.2
2020	6	44.7	49.3	4.5	110.4	54.5	79.8	37.2	41.8	52.5	73.7	16.9	92.1	94.8	4.5	69.0	19.9	110.4	33.9	58.7	68.8	30.9	21.9	12.0	31.5	45.1	47.3	44.3	42.7
2020	7	71.9	72.8	20.7	132.5	74.5	79.6	52.0	118.1	54.2	67.4	36.3	50.2	81.0	76.8	20.7	65.5	24.7	132.4	74.3	68.4	127.0	78.1	94.4	46.3	74.7	69.5	132.5	47.8
2020	8	52.6	63.6	20.3	135.4	25.0	30.0	54.6	118.8	49.9	60.9	135.4	43.2	43.1	62.7	36.0	38.1	23.7	50.7	118.1	48.3	55.5	103.1	119.6	20.3	56.1	50.2	102.9	79.5
2020	9	61.0	59.5	16.1	114.8	36.8	59.3	69.9	65.8	39.9	39.8	16.1	64.3	72.3	37.5	54.8	49.3	57.4	31.4	46.9	73.1	64.6	29.7	106.2	79.5	62.6	84.6	72.3	114.8
2020	10	36.1	35.9	10.9	72.2	42.4	26.8	30.4	45.5	29.0	51.8	36.5	23.0	36.1	39.2	72.2	47.8	36.1	47.5	26.7	26.7	40.4	22.5	38.7	32.6	10.9	24.2	18.9	55.3
2020	11	32.8	33.8	15.6	68.0	41.9	40.0	20.2	32.8	42.7	51.4	32.2	16.0	30.1	29.6	23.8	35.0	31.7	33.0	42.3	27.0	21.4	24.5	35.0	49.8	32.7	34.0	15.6	68.0
2020	12	25.4	28.0	11.8	57.9	19.4	22.4	26.8	37.2	32.0	24.1	32.3	19.0	34.1	55.7	13.8	14.5	17.7	23.8	13.7	28.3	27.4	11.8	39.4	22.7	38.8	21.2	38.0	57.9
2021	1	22.9	23.8	12.8	46.0	22.7	25.7	19.3	12.9	21.5	25.4	32.8	25.0	32.7	27.9	17.6	26.6	14.2	19.5	16.9	32.8	23.1	21.3	34.8	27.0	17.6	12.8	46.0	15.6
2021	2	16.1	18.6	7.3	37.5	37.5	12.6	8.7	20.5	10.8	18.1	25.0	18.2	7.3	14.2	34.5	8.6	31.0	16.2	14.7	7.6	29.9	16.1	13.9	8.2	32.1	24.5	26.8	9.2
2021	3	20.0	22.0	5.9	49.1	18.1	11.6	7.7	5.9	49.1	23.4	13.2	16.3	8.1	15.5	23.7	38.6	39.1	19.9	27.6	23.6	18.1	31.9	33.1	37.7	28.1	11.0	7.7	20.1
2021	4	19.6	22.2	3.5	51.9	5.9	9.5	37.4	31.9	37.1	19.0	37.1	12.7	31.8	25.4	3.5	51.9	3.5	20.8	46.2	19.5	22.5	19.8	16.6	4.9	12.6	12.3	18.0	34.2
2021	5	31.7	31.4	9.0	60.6	48.2	30.7	37.5	32.6	29.6	13.0	38.4	22.7	34.2	47.6	34.3	38.6	40.4	18.1	9.0	21.0	20.9	46.7	11.9	53.3	25.4	13.1	25.7	60.6
2021	6	56.3	56.1	6.3	118.0	51.5	90.4	67.4	42.0	55.3	27.9	46.9	67.1	20.3	57.6	78.1	59.5	32.2	6.3	75.7	12.9	48.5	57.3	118.0	49.5	60.5	99.9	52.5	68.1
2021	7	77.0	80.6	20.6	146.6	80.1	76.8	43.6	120.0	55.0	63.3	74.8	20.6	97.3	40.2	114.5	131.0	71.2	79.2	72.1	96.5	146.6	79.2	72.4	64.5	99.1	64.0	94.7	77.1
2021	8	62.0	64.6	27.8	123.9	75.6	123.9	73.7	27.8	80.9	69.2	88.2	86.4	82.0	104.3	72.5	84.3	43.4	41.9	44.8	62.4	42.3	54.6	56.7	29.1	36.5	47.1	60.9	61.6
2021	9	52.8	54.9	10.0	113.5	55.6	41.9	25.5	77.7	10.0	106.6	54.0	59.0	74.0	49.8	50.2	29.7	28.8	40.3	70.4	58.2	51.5	45.1	51.7	22.5	68.2	113.5	70.3	62.6
2021	10	32.6	31.7	8.7	50.1	24.2	20.8	37.0	35.8	8.7	26.3	25.5	50.1	33.9	32.8	37.1	16.1	34.9	32.1	45.8	28.6	21.6	33.4	47.9	24.5	48.4	31.0	32.7	32.4
2021	11	31.3	30.6	7.8	63.0	39.5	7.8	20.1	38.0	32.7	43.7	38.3	35.0	63.0	38.2	11.4	31.9	17.2	23.9	26.3	12.3	24.6	62.8	23.7	14.8	21.5	31.3	44.8	31.2
2021	12	27.1	29.3	9.9	58.2	9.9	26.4	21.1	28.8	11.9	41.2	27.9	45.1	32.5	43.8	25.6	23.4	58.2	19.5	43.3	19.0	31.6	25.5	17.1	41.0	19.2	16.7	33.7	41.3
2022	1	23.4	23.8	8.5	41.9	41.9	22.6	32.5	11.3	21.3	32.0	27.8	19.5	19.4	15.1	26.1	27.9	18.6	26.0	36.8	31.6	21.5	15.3	10.1	19.1	36.1	8.5	25.5	24.3
2022	2	17.4	19.1	4.9	42.0	16.5	23.1	4.9	17.7	18.1	16.5	25.3	40.8	12.1	17.5	24.1	19.6	17.3	32.6	42.0	10.1	19.5	16.4	5.7	11.1	13.4	12.6	14.0	26.5
2022	3	17.2	18.7	3.1	58.1	9.2	27.3	4.1	18.3	24.8	24.5	16.9	15.9	19.3	18.3	16.9	14.6	18.7	11.8	58.1	9.9	13.2	17.5	3.1	30.8	9.4	18.3	33.9	13.8
2022	4	20.3	21.9	5.2	46.5	5.2	12.4	26.1	24.9	18.1	37.0	29.0	21.6	8.1	28.9	8.2	17.7	9.1	37.0	18.9	15.6	30.1	10.7	35.6	35.1	9.3	46.5	25.1	15.3
2022	5	30.5	38.2	13.2	97.6	22.5	13.7	50.8	47.3	44.2	24.8	18.2	30.8	37.1	53.1	30.1	86.3	49.2	64.8	28.8	46.4	18.8	21.0	14.5	27.5	97.6	50.3	13.2	27.0
2022	6	46.9	50.2	12.4	95.5	38.1	12.4	95.5	35.2	32.4	33.5	22.6	67.9	66.4	75.0	26.1	85.9	47.7	47.2	46.7	78.5	30.0	43.6	42.2	52.9	23.7	84.5	50.9	66.9
2022	7	68.5	68.0	26.0	113.5	67.7	75.0	27.1	62.5	60.0	47.9	43.9	36.3	80.9	57.2	26.0	79.1	48.3	33.3	113.5	77.6	69.4	64.1	109.4	72.9	84.4	90.9	94.5	111.2
2022	8	66.1	68.2	13.7	158.7	34.7	53.3	97.2	13.7	51.3	24.6	65.0	88.0	82.5	158.7	57.6	30.9	38.4	78.7	71.1	97.8	67.2	50.0	67.7	56.7	64.8	91.8	68.8	125.5
2022	9	57.3	61.9	5.6	154.0	44.5	43.2	30.0	80.8	154.0	70.7	40.2	108.3	87.6	36.3	22.5	63.9	59.6	85.9	50.8	47.8	33.1	5.6	59.0	63.0	84.5	49.9	108.6	55.6
2022	10	29.0	31.9	10.1	55.7	10.1	40.8	23.0	28.1	44.3	24.8	24.7	20.1	55.7	26.0	23.8	27.2	30.7	43.2	55.1	16.4	34.7	34.6	27.0	38.5	36.9	29.9	21.7	48.3
2022	11	25.0	26.3	8.6	53.2	25.0	34.1	17.0	17.8	33.3	17.1	32.5	24.9	27.6	53.2	17.9	37.2	50.0	17.8	29.8	20.5	13.9	30.6	8.6	35.4	17.6	39.7	8.7	20.3
2022	12	30.0	29.6	11.9	44.6	33.1	27.1	29.3	23.2	30.6	23.8	30.9	24.1	18.9	40.0	22.9	15.2	41.0	32.6	29.3	44.1	44.6	29.6	30.4	36.7	39.8	16.5	11.9	33.7
2023	1	20.8	22.1	3.5	53.5	21.7	22.0	33.5	13.4	21.2	53.5	28.3	12.5	6.0	32.0	29.7	24.6	18.9	12.6	25.7	20.4	17.7	33.9	19.3	11.7	37.0	3.5	20.0	10.8
2023	2	18.0	19.8	8.0	59.6	8.0	24.6	19.5	14.0	14.1	16.7	16.5	18.9	10.0	29.4	59.6	14.2	28.6	22.0	19.4	19.3	17.1	27.0	12.6	26.3	16.7	19.1	9.0	11.3
2023	3	19.1	18.6	2.2	42.8	28.3	29.8	15.0	25.0	20.0	20.0	20.3	16.1	23.3	2.2	18.1	28.1	15.8	2.6	22.1	42.8	30.8	5.8	30.2	8.8	9.9	5.5	11.7	13.9
2023	4	20.9	21.2	2.6	53.9	29.1	17.0	31.5	12.2	23.9	20.6	26.3	21.5	29.7	10.5	9.3	22.4	14.7	9.8	25.9	35.6	9.0	17.1	15.7	21.2	14.9	53.9	34.2	2.6
2023	5	31.6	39.9	15.4	103.8	20.5	15.4	103.8	55.6	31.7	44.0	16.0	91.6	83.0	51.6	73.1	21.6	29.7	24.6	31.6	50.0	36.0	25.3	35.6	15.9	21.6	15.9	25.4	37.8
2023	6	51.9	50.0	15.8	86.4	52.5	35.4	42.4	15.8	47.6	32.5	68.7	51.2	70.2	55.2	39.3	86.4	28.6	71.0	82.0	53.8	72.7	69.3	30.0	53.5	20.8	55.3	33.0	33.4
2023	7	76.1	86.3	29.3	193.5	152.2	67.8	112.7	47.0	60.0	93.8	75.1	107.8	133.7	29.3	59.6	126.8	47.6	31.7	76.9	55.6	33.1	83.7	193.5	78.8	180.2	93.6	54.7	75.4
2023	8	59.6	62.8	25.2	126.0	67.7	126.0	60.2	99.2	58.9	95.1	34.7	41.3	73.9	49.0	57.3	42.3	25.2	47.8	61.4	61.5	41.8	40.2	88.7	83.1	100.7	65.7	39.7	45.4
2023	9	42.4	57.7	13.6	127.8	56.8	74.8	31.6	36.4	97.8	31.4	13.6	90.1	41.2	66.2	16.0	30.3	39.0	127.8	22.3	94.1	112.2	24.6	33.3	43.5	106.5	76.4	20.2	97.8
2023	10	31.1	34.7	12.4	68.0	22.8	41.7	34.3	12.7	12.4	18.5	40.4	27.5	40.9	49.2	28.4	66.2	61.8	32.5	68.0	16.0	18.5	49.5	27.6	20.5	40.4	29.5	29.7	44.0
2023	11	27.2	30.9	16.4	68.6	24.4	40.3	34.0	30.0	25.5	68.6	64.6	20.8	24.8	23.9	31.0	27.8	28.4	24.2	21.5	27.1	16.4	18.6	39.1	18.6	25.2	35.8	27.2	44.0
2023	12	25.6	30.9	13.0	89.5	89.5	17.1	42.5	37.6	31.3	39.8	25.5	54.0	25.1	25.5	28.8	21.2	37.7	37.3	45.1	25.7	29.9	13.0	20.3	15.2	22.3	13.6	22.7	20.3
2024	1	23.3	26.6	12.8	53.8	23.4	17.4	32.7	20.7	48.2	32.5	23.1	15.3	20.0	33.1	36.2	23.5	22.3	31.3	22.7	19.8	14.5	16.7	14.6	30.4	12.8	47.1	53.8	25.3
2024	2	20.6	23.4	5.0	48.6	16.2	17.2	48.6	36.4	23.4	9.1	19.6	35.5	5.0	19.3	35.8	16.9	21.4	27.5	39.5	10.3	41.4	24.9	10.7	19.3	21.0	17.0	20.1	25.5
2024	3	15.6	18.1	4.3	49.1	12.3	35.1	22.9	11.8	49.1	4.4	11.6	16.0	19.1	9.4	4.3	28.8	17.2	17.0	48.9	20.8	15.2	8.5	5.0	8.1	25.8	19.1	13.9	9.9
2024	4	20.2	19.3	2.8	34.7	22.6	22.5	19.3	17.8	14.4	21.6	9.6	14.4	33.3	5.3	21.1	25.6	7.5	30.0	21.5	20.4	10.8	34.7	33.6	3.1	18.4	2.8	33.6	20.1
2024	5	37.3	44.2	12.9	112.2	57.3	26.0	53.1	20.7	73.0	35.0	38.8	39.4	33.1	75.8	26.7	41.4	32.7	46.6	12.9	23.6	67.2	23.5	77.0	32.8	35.8	112.2	41.4	35.0
2024	6	53.6	60.9	26.6	141.4	61.0	37.7	58.0	85.9	59.9	52.7	26.6	109.9	53.6	76.0	38.5	47.6	53.6	141.4	50.8	64.5	37.4	51.9	81.7	36.8	41.3	85.5	36.7	72.7
2024	7	68.2	69.6	34.7	130.0	81.3	130.0	72.8	48.3	79.7	44.4	47.2	56.6	63.6	57.7	76.1	87.3	77.5	58.3	83.3	57.5	85.0	34.7	49.1	89.0	91.6	50.9	62.7	85.9
2024	8	62.5	61.1	23.2	97.0	54.1	62.4	25.0	86.7	91.2	50.5	66.7	78.9	53.3	46.5	97.0	31.8	62.6	29.6	91.2	60.8	69.9	86.7	70.6	39.4	65.8	71.3	23.2	51.7
2024	9	53.7	58.4	28.6	126.7	28.6	63.6	82.7	73.3	65.1	46.9	48.6	78.9	54.2	55.9	33.6	60.8	53.2	39.0	70.3	50.1	74.7	49.4	126.7	66.0	43.8	51.4	36.6	48.2
2024	10	33.1	35.5	11.5	101.2	30.2	24.6	27.9	16.7	101.2	39.5	16.8	57.1	48.7	35.7	23.9	44.0	41.6	34.6	50.7	43.9	35.7	31.7	35.5	28.4	11.5	28.0	16.1	29.1
2024	11	31.0	31.6	14.8	58.5	19.0	24.0	35.9	34.4	26.5	31.7	31.3	30.7	41.4	58.5	30.3	23.3	35.1	31.3	42.2	19.1	14.8	49.4	48.0	30.1	24.7	21.4	32.1	22.2
2024	12	29.5	29.0	8.7	55.8	55.8	32.0	39.2	23.4	24.2	16.1	39.5	9.3	25.0	29.0	41.0	26.3	8.7	19.7	26.1	27.7	30.0	31.4	32.9	33.2	37.1	37.3	40.7	10.0
2025	1	22.7	25.7	6.1	44.3	22.2	37.7	41.6	19.6	23.8	13.6	23.3	21.3	34.0	30.4	33.4	20.6	6.1	15.7	19.7	35.5	19.6	18.1	32.6	44.3	37.7	31.8	15.7	19.2
2025	2	17.7	18.9	6.8	30.4	22.1	14.7	25.6	6.8	29.4	30.4	15.3	13.6	17.7	16.9	26.1	13.6	12.8	17.7	14.8	26.9	25.5	9.2	28.3	22.3	21.4	8.5	20.8	13.2
2025	3	18.0	18.6	2.1	30.9	23.2	25.2	30.9	12.6	24.1	19.2	2.1	14.7	13.0	14.3	13.1	26.3	10.3	29.5	29.2	12.3	22.3	7.5	8.3	16.9	26.4	14.1	20.4	30.2
2025	4	19.9	23.0	6.4	74.4	21.5	20.2	8.0	15.7	12.1	33.6	41.6	6.4	74.4	13.4	19.9	11.2	7.1	39.7	11.8	16.6	17.8	19.8	21.9	22.1	24.7	47.5	18.9	25.8
2025	5	43.9	39.8	6.9	93.6	50.9	48.5	11.8	6.9	22.9	32.6	54.9	43.6	52.7	51.3	23.9	13.5	10.9	39.4	61.6	44.1	54.4	55.1	10.3	65.9	52.6	93.6	10.8	42.3
2025	6	43.0	48.8	5.6	142.0	71.6	41.0	142.0	28.1	74.7	42.6	39.2	68.0	35.8	20.1	19.3	46.4	77.2	51.1	62.6	43.5	48.3	15.6	79.8	33.6	68.5	5.6	20.8	35.4

2025	7	63.8	75.8	27.6	186.8	41.6	27.6	111.8	115.3	93.8	77.4	94.0	39.9	186.8	142.9	41.5	76.7	113.0	60.6	50.7	74.5	66.2	61.3	54.3	49.9	50.2	44.0	105.7	40.5
2025	8	71.4	68.4	32.5	113.6	82.5	96.8	37.7	38.6	107.6	88.6	84.5	56.6	37.8	34.3	44.6	59.2	113.6	59.3	72.0	80.0	47.7	77.2	32.5	70.8	79.9	95.5	69.4	75.9
2025	9	58.7	66.3	23.9	140.3	95.6	44.2	74.1	55.1	72.1	42.3	62.3	36.7	79.0	45.0	120.3	51.0	23.9	43.8	38.3	40.9	102.5	27.1	66.0	140.3	128.8	83.8	71.8	46.7
2025	10	37.5	36.1	5.4	73.4	31.1	73.4	71.8	5.4	52.8	46.6	24.3	53.6	39.0	23.2	37.0	48.5	7.9	42.8	39.6	39.8	27.7	38.0	49.1	35.1	26.3	19.2	18.2	16.6
2025	11	29.7	31.8	9.7	67.2	38.5	25.1	23.2	34.0	23.7	42.7	39.9	67.2	9.7	25.9	29.1	32.2	43.5	28.4	30.0	41.0	32.2	29.4	24.2	31.4	44.7	17.6	25.2	24.6
2025	12	25.4	27.3	12.1	49.6	25.8	26.8	14.3	43.7	44.9	21.6	15.0	29.8	19.7	34.0	25.8	14.1	49.6	14.4	34.7	21.4	23.3	12.1	25.0	24.8	38.6	34.0	14.9	47.4
2026	1	17.6	21.7	4.6	54.4	11.3	24.8	16.6	23.0	17.7	17.4	16.6	17.5	54.4	23.9	16.2	47.6	17.5	29.9	26.6	30.1	4.6	23.8	18.3	29.8	13.5	15.2	6.7	17.3
2026	2	13.6	17.3	5.5	39.6	17.5	20.8	28.5	39.6	26.0	14.3	30.4	22.0	5.5	20.1	9.9	13.0	10.1	10.9	12.0	13.8	10.6	32.9	25.7	12.7	8.9	7.5	13.3	9.1
2026	3	17.0	20.3	3.8	67.5	18.0	9.1	20.8	67.5	38.4	9.3	18.9	27.5	7.9	8.4	3.8	37.0	15.9	23.6	47.9	20.9	14.7	12.0	20.2	19.5	13.9	7.9	9.0	16.0
2026	4	19.2	19.8	8.3	42.1	17.7	21.3	15.9	17.6	30.0	28.5	10.7	18.2	25.2	13.0	22.3	8.3	21.6	16.6	18.8	22.5	14.5	20.7	16.7	21.2	21.0	10.8	42.1	19.6
2026	5	37.1	36.1	8.4	67.5	35.1	25.6	26.6	26.7	36.8	58.4	15.4	20.4	8.4	29.7	51.8	31.6	57.9	37.6	37.5	47.4	40.6	45.4	41.1	24.7	20.7	38.0	40.8	67.5
2026	6	47.9	47.0	9.7	91.3	33.4	73.0	91.3	60.0	59.0	48.9	52.5	52.9	44.5	44.4	27.4	16.4	32.5	17.9	57.9	77.5	46.9	9.7	71.3	57.4	17.2	44.6	42.2	49.0
2026	7	71.0	71.6	18.1	183.8	23.2	71.6	65.3	42.2	22.4	47.7	70.3	93.2	95.2	79.2	183.8	19.1	63.5	18.1	67.3	77.9	138.7	47.6	92.9	84.3	43.5	97.2	86.8	87.9
2026	8	62.0	65.9	16.6	130.8	79.1	42.7	86.3	130.8	79.1	22.4	53.1	94.9	56.4	61.3	81.9	27.8	62.7	38.5	59.0	66.4	16.6	55.6	77.4	91.2	60.0	95.9	104.2	37.1
2026	9	56.1	59.9	22.2	141.5	51.9	141.5	65.4	48.8	68.4	89.0	71.3	83.3	43.5	49.3	64.2	52.4	54.8	54.1	59.9	68.2	22.9	98.5	57.4	22.2	32.6	49.6	28.7	59.8
2026	10	36.6	38.1	15.1	77.6	77.6	52.1	28.8	42.7	47.2	45.3	20.2	33.8	37.8	15.1	40.0	33.9	34.4	23.6	51.6	26.4	43.6	49.7	28.8	36.1	37.0	31.7	22.1	55.8
2026	11	33.3	33.4	9.7	59.1	27.4	53.7	24.9	38.2	9.7	34.2	52.7	40.0	16.3	24.0	29.9	40.2	11.8	38.4	18.1	32.3	31.2	34.8	59.1	52.2	29.1	16.3	42.3	45.2
2026	12	30.6	31.0	6.7	55.5	47.7	10.2	21.4	52.2	40.8	14.0	30.8	6.7	38.8	30.5	37.2	34.3	16.9	28.2	25.6	51.4	14.5	35.5	20.3	18.7	32.6	49.9	29.9	55.5
2027	1	22.6	23.2	11.9	41.4	27.4	22.2	41.4	23.7	26.5	16.1	34.4	21.5	31.4	15.0	27.8	22.9	24.0	22.0	29.2	11.9	12.4	35.6	13.8	14.8	16.8	33.7	16.2	16.5
2027	2	19.2	19.8	9.0	37.9	23.4	14.9	37.9	23.1	14.6	16.1	30.0	21.4	10.0	28.4	24.9	21.8	20.8	32.5	12.1	11.3	19.9	15.8	9.8	11.9	15.4	18.5	32.7	9.0
2027	3	19.4	20.1	8.0	43.0	22.4	19.7	19.2	17.0	28.5	17.7	12.4	20.2	27.1	26.4	19.7	34.5	14.2	8.0	8.7	17.3	19.7	20.7	8.0	13.7	16.6	28.0	43.0	19.1
2027	4	14.0	15.5	3.7	41.0	8.7	15.9	26.1	6.9	24.7	13.9	16.1	31.5	4.0	3.7	41.0	5.9	11.0	7.5	3.8	30.4	19.6	18.5	12.5	17.9	29.7	4.7	14.0	4.0
2027	5	31.6	33.4	1.0	86.6	21.0	21.7	20.8	17.2	8.8	52.2	33.6	47.5	33.2	28.4	54.3	45.4	26.5	35.2	60.6	8.6	86.6	19.3	22.6	30.2	44.8	33.0	48.2	1.0
2027	6	48.6	54.6	6.4	155.9	76.6	107.1	86.8	21.7	48.4	31.6	50.4	47.0	6.4	17.2	84.5	31.9	39.7	48.9	20.5	18.8	60.5	39.6	58.1	87.5	25.7	51.3	94.6	155.9
2027	7	78.6	78.3	19.6	120.4	100.8	80.7	106.9	120.2	79.4	71.5	74.3	56.7	92.2	51.7	59.9	112.0	64.8	98.8	39.6	60.1	39.5	89.2	91.8	120.4	111.1	60.8	77.7	19.6
2027	8	52.8	60.3	24.0	118.2	51.2	83.1	80.8	47.1	76.7	86.0	56.3	24.0	46.3	118.2	65.3	66.6	34.9	24.0	45.1	44.1	109.0	54.4	29.5	25.3	49.6	98.7	49.7	81.3
2027	9	62.4	65.9	24.1	171.5	24.1	76.5	42.7	33.2	41.9	101.0	171.5	69.6	83.9	91.5	67.7	50.6	72.2	63.5	76.1	33.0	55.4	47.1	61.3	49.0	97.6	45.9	59.5	67.4
2027	10	29.6	32.6	12.6	73.9	12.6	24.8	44.4	18.2	25.4	26.4	22.9	40.6	30.2	22.3	28.9	23.5	42.8	34.2	38.8	73.9	29.1	43.1	25.1	35.8	49.2	33.5	30.1	27.3
2027	11	28.4	32.1	14.0	58.0	33.3	33.0	52.6	26.3	22.2	44.9	51.0	24.3	15.9	45.6	25.8	58.0	20.5	14.0	21.4	30.4	23.2	27.7	29.0	18.9	42.3	17.8	54.9	37.0
2027	12	27.2	27.1	16.2	44.7	35.2	16.4	28.6	18.4	44.7	33.1	27.3	23.1	31.6	36.5	18.1	28.2	16.2	31.8	22.7	25.1	18.8	18.7	30.5	27.1	27.9	20.8	25.1	43.3
2028	1	24.0	25.1	11.6	49.2	25.5	30.2	42.2	20.5	27.2	30.9	17.7	20.3	21.9	35.4	49.2	11.6	11.9	40.3	31.4	25.4	31.6	18.7	13.6	23.3	15.5	20.2	13.9	24.6
2028	2	23.0	21.7	6.3	38.1	38.1	13.0	22.1	31.8	14.6	26.2	13.3	24.1	33.3	29.0	9.1	9.3	18.0	36.5	30.3	16.2	11.3	17.2	24.0	25.2	30.6	15.2	25.9	6.3
2028	3	14.6	17.4	3.9	41.3	21.7	20.1	14.8	10.5	13.3	40.8	9.6	28.4	41.3	9.3	6.7	12.9	7.3	4.3	11.0	14.8	16.4	17.3	30.9	14.4	29.5	3.9	32.4	6.7
2028	4	17.8	20.5	4.2	55.4	37.6	21.3	4.2	14.6	20.0	15.6	24.0	33.0	33.3	14.1	23.4	15.1	30.2	8.1	55.4	9.0	12.6	15.6	23.8	7.8	14.3	20.6	5.6	31.9
2028	5	37.4	40.3	15.1	73.8	38.4	36.4	18.3	30.8	72.9	73.8	41.7	44.9	72.1	48.3	31.1	66.1	35.9	15.1	30.9	15.4	42.2	18.1	26.8	19.4	64.8	54.7	19.0	50.1
2028	6	54.6	56.6	3.8	115.7	61.9	57.1	36.2	32.0	60.3	69.7	90.5	65.9	90.1	45.6	114.9	115.7	55.2	40.3	3.8	54.0	48.0	73.5	23.1	24.7	38.0	72.6	47.6	38.8
2028	7	68.3	74.3	15.9	186.4	60.7	21.4	186.4	33.3	109.4	115.9	91.2	126.1	72.0	99.0	84.4	43.0	54.5	82.2	64.7	15.9	92.2	59.0	51.8	91.5	49.9	63.4	39.5	76.9
2028	8	56.0	63.3	21.2	133.1	99.6	22.0	47.7	44.4	109.7	89.2	60.3	101.3	42.7	133.1	79.8	21.2	24.4	80.2	61.3	100.6	81.2	53.2	58.5	23.1	48.5	33.6	50.3	53.5
2028	9	56.6	59.1	16.8	126.3	49.7	18.8	56.8	69.1	86.8	93.2	55.1	89.6	75.2	29.1	37.7	29.1	23.1	68.0	39.2	97.6	48.3	75.3	26.0	88.7	126.3	62.2	56.4	16.8
2028	10	28.1	31.1	7.4	68.4	27.1	61.6	31.2	20.2	50.9	37.8	7.4	17.5	16.4	29.1	14.9	39.0	31.6	25.5	68.4	36.2	46.2	19.7	26.5	28.0	43.5	25.6	14.2	28.2
2028	11	33.1	32.8	7.1	57.6	29.8	33.5	31.7	51.8	28.3	46.7	38.5	32.5	40.6	39.4	20.4	33.7	35.7	7.1	25.3	57.6	22.7	12.3	33.9	37.0	47.3	31.4	32.7	17.1
2028	12	24.1	24.0	2.6	36.6	19.5	16.9	20.4	35.4	30.0	23.5	23.9	26.0	28.2	14.2	25.3	11.3	24.0	16.9	18.7	30.2	34.2	28.9	24.2	31.4	34.7	19.8	2.6	36.6
2029	1	24.2	26.6	14.5	63.9	20.1	24.5	36.7	32.7	18.5	16.9	16.9	14.5	36.1	30.3	18.7	17.9	24.7	22.9	50.6	63.9	29.2	25.0	23.8	20.8	32.4	16.9	24.6	19.1
2029	2	20.1	19.2	6.0	29.9	24.9	16.8	25.2	12.0	22.6	6.0	20.8	15.4	11.9	8.3	24.6	21.9	29.9	26.6	28.4	19.3	18.7	25.2	18.6	23.4	12.2	11.0	12.5	23.6
2029	3	17.8	20.7	3.0	47.2	18.8	15.3	3.0	42.5	29.0	35.2	22.5	11.8	12.8	7.6	11.3	31.9	23.3	23.7	47.2	6.5	40.1	27.8	13.9	16.9	12.3	6.3	6.0	30.4
2029	4	19.0	21.1	8.3	46.1	17.6	15.0	25.0	15.1	12.1	12.8	20.5	21.8	31.6	23.4	16.2	23.1	12.7	9.5	8.3	17.1	46.1	17.3	13.1	22.5	34.0	34.5	28.2	27.8
2029	5	35.9	35.2	12.0	65.3	17.0	12.0	39.2	40.5	32.8	24.9	20.1	16.6	51.4	45.2	34.0	37.7	15.4	44.8	44.5	31.6	38.0	57.7	58.0	15.5	26.3	55.1	65.3	21.6
2029	6	51.7	58.5	29.1	105.0	40.7	54.2	71.9	54.8	91.0	47.9	47.4	83.6	86.0	52.8	42.0	48.1	55.2	69.8	70.0	29.1	64.8	50.5	47.6	48.9	46.3	105.0	48.2	47.4
2029	7	62.2	72.8	15.1	170.9	138.8	39.3	43.3	170.9	54.3	44.6	42.2	92.2	98.9	40.4	73.0	15.1	55.5	108.2	107.9	45.0	45.9	68.9	76.7	51.6	86.8	85.3	42.6	121.0
2029	8	59.9	68.9	25.2	159.5	59.2	116.5	113.7	44.3	50.2	69.4	150.5	26.1	107.8	69.5	60.6	25.2	122.4	33.2	72.1	60.8	159.5	47.7	40.3	29.2	46.1	42.4	36.6	70.2
2029	9	54.6	57.7	19.3	100.8	23.5	41.8	49.7	22.7	92.8	88.3	21.1	78.8	84.3	24.8	88.8	75.6	53.7	66.3	71.1	19.3	71.2	40.9	50.6	89.6	44.1	100.8	55.6	29.3
2029	10	33.2	32.5	8.0	64.3	20.9	25.1	40.4	60.0	38.9	41.8	17.6	42.6	37.5	22.6	34.3	32.2	28.9	48.7	22.6	21.0	8.0	40.3	64.3	23.1	16.7	18.6	37.5	36.1
2029	11	29.9	30.0	13.2	44.6	32.7	22.2	24.7	21.8	41.5	43.9	26.2	27.6	13.2	30.4	44.6	15.5	40.6	24.2	38.5	42.3	42.4	17.8	31.4	29.5	30.3	26.0	18.7	33.0
2029	12	26.8	28.6	7.0	47.4	40.9	11.1	15.0	35.7	31.6	28.1	19.1	39.9	44.1	41.8	43.8	21.0	47.4	19.4	22.8	22.7	33.0	16.2	20.8	39.1	25.5	43.2	17.2	7.0
2030	1	26.7	25.0	8.7	38.7	9.4	22.2	22.4	16.2	27.8	15.4	8.7	27.7	32.9	25.8	19.9	17.5	9.5	13.6	29.7	34.1	35.7	31.4	38.7	37.5	28.7	34.9	24.4	37.4
2030	2	18.6	19.5	9.1	35.0	23.3	22.3	23.5	22.9	18.4	20.8	18.7	30.8	9.1	17.7	11.3	29.3	26.6	18.6	21.6	25.3	9.7	16.3	15.0	16.9	35.0	11.0	9.6	13.7
2030	3	19.6	20.1	4.0	39.6	13.7	15.2	13.7	19.6	27.6	25.0	7.8	21.6	4.0	28.9	5.7	11.4	31.7	12.6	16.1	10.8	39.6	26.4	22.0	33.0	19.5	18.8	32.6	25.2
2030	4	15.7	19.0	5.5	43.7	25.4	14.6	32.1	13.7	14.5	10.0	17.9	30.3	9.6	5.5	7.4	13.6	19.7	14.7	5.7	24.4	19.1	18.2	14.2	15.1	43.7	35.4	16.4	34.9
2030	5	31.8	38.5	11.2	89.7	30.8	29.9	44.0	37.3	53.5	38.5	63.0	73.0	31.5	24.3	89.7	17.4	15.4	32.0	29.6	20.9	11.2	21.9	18.2	85.3	13.2	57.5	50.4	34.4
2030	6	58.4	66.9	26.9	190.6	49.2	43.8	60.0	190.6	48.0	96.1	47.9	32.5	46.2	54.6	56.7	81.5	37.2	117.8	87.2	81.8	83.2	26.9	28.3	49.7	62.8	70.6	73.0	79.6
2030	7	91.5	99.0	39.8	175.5	43.2	124.3	69.4	149.6	48.9	99.8	66.6	116.2	139.1	83.5	81.8	91.3	68.7	175.5	143.0	78.4	74.8	50.9	151.2	91.7	121.3	171.9	39.8	96.5
2030	8	70.9	70.0	23.6	113.3	77.6	64.0	80.0	96.7	57.7	64.6	31.1	23.6	80.9	113.3	78.2	64.5	79.5	59.6	49.3	25.5	96.4	77.3	42.2	64.6	54.2	109.1	107.2	82.8
2030	9	61.2	64.6	22.3	121.4	42.1	82.0	31.9	93.3	68.8	107.0	67.8	91.0	79.4	36.5	22.3	43.1	54.2	36.9	72.7	48.8	57.3	115.5	60.8	61.5	68.1	30.1	121.4	58.3
2030	10	35.6	34.8	17.3	55.9	55.9	38.2	24.0	35.4	44.8	27.8	30.3	21.9	55.3	42.8	42.4	50.0	49.1	24.7	30.1	36.1	35.8	28.1	17.3	19.2	27.4	41.1	38.1	20.5
2030	11	31.5	33.5	13.4	61.8	34.4	19.2	29.2	48.2	29.5	45.6	33.4	21.6	19.4	45.0	20.2	41.0	61.8	47.3	32.4	17.5	30.4	30.6	44.6	47.5	13.4	29.8	35.7	25.5
2030	12	24.6	26.4	9.8	49.7	32.0	19.1	24.5	9.8	23.2	24.0	27.9	24.6	27.9	43.2	34.2	27.5	28.4	20.3	24.3	49.7	18.4	19.2	16.1	30.5	18.6	32.6	37.5	20.9
2031	1	26.4	26.5	7.3	48.3	43.0	15.9	9.6	48.3	19.2	15.3	33.1	27.0	23.4	32.9	14.9	25.8	30.2	47.5	21.7	28.8	19.4	35.5	13.1	36.5	7.3	13.6	42.6	31.6
2031	2	19.1	20.6	3.3	45.9	21.1	8.3	41.4	16.7	29.6	39.0	6.6	20.3	11.1	6.7	45.8	19.7	14.2	45.9	18.5	3.3	8.1	22.3	7.5	29.8	15.5	33.8	22.9	6.3
2031	3	19.3	21.6	4.7	54.5	22.9	40.3	34.6	4.7	31.1	10.0	12.3	22.9	6.8	7.2	17.3	26.0	23.9	12.4	19.2	19.4	17.9	10.3	40.6	31.6	54.5	9.1	26.9	16.4
2031	4	24.8	22.7	2.5	55.4	26.8	17.2	19.0	34.4	25.6	7.3	8.1	8.2	26.2	2.5	26.0	17.6	5.5	37.4	24.8	55.4	17.8	29.8	9.9	24.9	2.5	46.4	37.8	34.6
2031	5	39.3	45.8	7.2	148.8	26.1	17.1	53.1	49.3	20.3	66.8	25.0	33.7	101.8	22.0	39.5	31.7	27.4	52.0	7.2	53.1	60.8	39.2	28.5	57.7	36.8	61.1	40.8	148.8
2031	6	72.5	66.7	25.7	110.2	104.8	25.7	49.7	79.5	79.2	105.6	47.4	94.3	31.0	25.8	35.6	39.4	75.7	51.9	34.9	97.9	93.4	97.2	88.0	76.3	53.6	69.3	33.6	110.2
2031	7	88.5	85.6	13.5	154.5	88.6	60.2	126.3	106.8	64.1	102.6	68.2	88.4	45.3	61.2	57.1	140.4	26.5	13.5	154.5	92.6	137.5	81.8	35.3	94.2	72.6	106.4	119.9	109.7
2031	8	54.2	64.2	32.3	140.6	95.2	39.4	51.4	49.9	64.1	140.6	44.3	70.5	53.9	40.0	52.2	87.2	45.2	54.5	34.4	64.9	76.8	112.1	32.3	84.2	81.7	47.0	43.4	74.8
2031	9	61.0	65.4	22.4	126.0	86.3	22.4	42.1	126.0	55.5	69.9	74.9	58.6	35.1	87.0	47.2	61.4	81.8	42.4	95.6	75.5	60.0	41.2	82.2	78.3	75.1	55.3	54.3	60.7
2031	10	29.6	32.2	16.0	52.4	35.5	19.6	28.3	24.8	26.2	27.0	51.2	32.9	46.3	38.5	52.4	27.9	27.2	28.8	46.1	29.6	48.7	34.3	31.9	21.3	29.5	16.0	19.3	30.7
2031	11	30.7	31.7	10.1	57.7	33.3	15.1	45.7	34.0	25.3	16.1	57.7	48.2	41.4	28.1	20.7	47.1	24.5	44.5	10.1	31.2	52.1	30.2	19.1	43.6	21.5	17.1	20.0	34.9
2031	12	30.1	33.4	12.7	59.2	21.8	22.6	16.6	46.1	27.8	35.5	51.5	21.8	59.2	36.5	41.3	22.0	38.7	28.5	12.7	23.0	34.1	57.4	27.7	31.6	39.7	48.0	28.0	28.5
2032	1	16.9	21.3	6.7	38.6	16.0	31.1	32.6	14.4	12.6	17.6	38.6	30.0	20.9	12.0	12.5	20.5	12.5	15.3	6.7	31.7	34.9	16.1	11.7	36.3	23.7	15.2	34.6	14.8
2032	2	20.4	21.5	4.8	51.3	22.2	4.8	7.6	28.1	25.7	20.3	18.8	34.3	14.6	29.2	51.1	10.7	19.5	31.7	10.6	11.5	51.3	7.9	23.5	20.4	18.3	8.9	23.7	21.3
2032	3	23.1	22.6	6.1	40.3	17.0	27.6	7.9	40.3	23.2	39.7	39.3	26.1	24.5	18.9	25.8	27.0	6.1	25.3	35.4	6.3	23.0	19.5	19.9	13.4	24.0	20.0	14.4	17.9
2032	4	19.8	21.1	6.2	37.0	20.3	14.7	28.1	35.4	13.5	12.9	25.1	37.0	14.5	10.6	16.9	29.0	16.4	6.2	33.8	22.7	14.0	32.8	20.9	34.0	17.8	22.7	19.2	7.4
2032	5	30.4	33.7	2.8	95.2	47.3	25.7	29.8	40.4	19.7	40.8	41.3	45.7	42.2	16.1	24.2	10.7	32.8	2.8	27.3	7.2	29.1	49.2	69.9	18.3	30.7	30.1	32.8	95.2
2032	6	49.5	51.0	13.8	111.2	53.8	111.2	46.9	57.1	17.7	65.4	72.7	39.3	48.2	60.4	45.3	50.8	56.7	18.2	28.6	85.7	13.8	39.5	79.3	33.6	55.4	84.0	21.0	38.5
2032	7	77.1	86.5	24.5	253.9	177.4	44.7	53.1	100.2	128.1	96.2	57.9	73.1	132.1	112.8	56.5	82.1	47.0	63.2	60.6	68.2	81.2	82.9	48.3	99.4	253.9	84.4	24.5	47.6
2032	8	52.7	55.8	23.5	117.9	64.1	49.0	25.3	73.4	63.2	60.0	71.9	46.5	31.0	72.2	45.3	36.0	42.6	40.6	45.1	66.3	63.0	66.2	30.5	101.7	23.5	56.4	47.2	117.9
2032	9	60.6	62.0	16.0	113.2	68.0	98.3	47.7	73.7	55.4	110.6	17.1	16.0	92.0	36.6	87.6	63.6	76.5	37.7	57.5	76.3	35.3	87.4	113.2	41.2	52.7	19.7	29.5	93.9
2032	10	29.6	33.0	15.4	69.8	26.5	25.7	17.5	32.9	69.8	20.4	41.0	24.1	58.4	21.7	15.4	27.0	29.3	42.7	21.1	40.6	22.4	44.5	35.6	51.3	34.0	30.0	20.0	39.6
2032	11	31.7	33.6	12.2	65.4	31.6	25.0	46.8	34.8	31.4	65.4	51.0	18.1	35.7	34.4	25.9	31.7	25.0	14.9	32.9	28.1	38.8	27.0	37.0	63.3	22.9	28.7	43.8	12.2
2032	12	29.5	31.0	10.9	51.3	37.6	17.7	35.6	35.3	31.8	30.3	13.0	48.0	25.8	16.6	34.5	28.9	25.5	20.4	51.3	50.1	10.9	26.4	30.1	46.7	28.1	20.5	28.7	50.3
2033	1	26.6	27.0	5.5	45.6	10.3	38.9	27.7	19.3	19.8	23.9	32.5	30.7	17.3	38.2	22.6	5.5	28.0	28.6	16.4	38.3	25.3	24.2	33.3	25.5	45.6	22.1	32.5	42.7

2033	2	16.5	17.7	4.6	30.4	11.4	13.0	22.1	21.6	28.0	4.6	18.8	16.6	23.6	30.4	16.2	10.2	12.9	24.0	16.4	19.2	29.1	12.5	14.8	14.3	13.4	11.6	22.3	18.5
2033	3	18.9	18.1	6.6	40.6	19.8	24.6	15.1	25.9	24.7	8.1	8.1	19.6	16.4	8.9	19.8	6.6	19.4	21.7	19.6	9.5	16.6	22.9	15.0	18.5	16.1	40.6	16.4	21.3
2033	4	22.0	21.6	4.4	44.6	33.0	27.5	29.2	24.5	8.3	16.7	13.9	16.6	32.7	29.6	5.2	9.0	4.4	25.3	27.5	6.0	19.0	27.7	13.5	44.6	5.7	19.5	43.5	34.4
2033	5	36.8	37.8	0.9	83.8	64.3	17.2	51.3	40.5	0.9	15.1	39.6	83.8	56.3	48.7	26.3	28.9	24.6	28.8	70.2	24.5	36.3	42.4	67.5	38.4	37.4	17.6	33.8	13.1
2033	6	53.9	54.4	0.0	103.7	61.9	50.6	79.4	35.4	29.5	82.1	40.7	62.6	99.9	56.9	63.0	49.8	39.5	96.6	103.7	0.0	29.5	82.6	59.6	50.8	59.4	25.5	12.1	35.2
2033	7	65.1	69.5	7.9	161.8	73.9	103.4	83.5	161.8	36.6	88.3	67.7	67.6	111.5	73.4	134.0	46.9	44.9	92.2	84.5	7.9	57.1	43.7	62.6	30.2	60.2	47.4	38.3	49.5
2033	8	65.0	67.9	28.5	141.1	42.8	91.9	47.5	62.2	48.7	97.8	141.1	33.2	67.5	59.7	115.1	64.4	28.5	84.0	65.7	48.2	78.4	51.7	39.2	85.6	53.4	65.6	74.2	82.2
2033	9	58.3	59.7	11.6	134.6	11.6	46.7	18.1	116.1	134.6	63.2	59.4	13.8	69.0	77.0	111.9	70.8	49.5	52.3	44.4	60.2	74.5	61.8	57.2	56.0	74.8	23.4	33.9	53.4
2033	10	27.9	29.8	14.0	58.5	18.7	33.5	21.4	37.9	46.0	20.6	14.4	18.7	32.9	27.4	28.3	30.7	47.7	58.5	32.1	25.4	47.6	14.0	16.2	19.9	19.0	30.8	24.6	48.4
2033	11	29.0	30.1	13.2	59.5	14.9	59.5	38.4	25.7	37.2	38.6	13.2	28.5	25.7	28.5	33.4	49.5	34.5	40.0	25.7	21.2	21.5	16.1	30.7	15.7	29.5	28.6	29.5	37.0
2033	12	26.4	25.7	8.4	43.6	33.4	31.1	30.8	23.0	33.5	35.5	16.9	30.3	14.3	38.7	21.1	21.3	43.6	29.6	16.9	38.5	27.0	9.5	8.4	25.9	10.2	21.8	23.6	31.7
2034	1	24.5	24.6	10.4	42.5	25.7	23.9	38.0	42.1	27.3	18.2	11.4	20.1	22.8	29.9	18.3	26.6	17.8	21.4	42.5	36.6	32.1	12.6	13.8	15.4	29.7	25.0	10.4	29.5
2034	2	21.8	23.2	7.7	50.6	14.4	19.8	21.9	23.8	26.6	7.7	50.6	14.7	43.8	10.2	33.3	27.9	21.7	15.8	28.1	24.6	17.6	49.2	15.0	8.3	17.6	23.9	28.3	11.7
2034	3	22.3	21.3	6.6	35.2	15.0	25.5	23.1	19.6	30.7	10.7	23.1	30.9	27.1	6.6	21.5	20.5	27.6	25.7	32.2	13.1	14.2	9.3	35.2	12.4	33.5	10.3	27.4	17.0
2034	4	21.8	21.8	1.5	50.2	26.6	6.1	15.1	25.9	35.8	16.6	27.9	22.1	50.2	26.3	1.5	4.8	29.4	31.8	15.2	38.8	9.6	18.5	24.3	19.5	21.6	22.9	11.9	21.4
2034	5	42.5	43.4	22.4	78.8	44.2	42.3	59.8	25.7	45.6	59.3	43.6	58.8	72.0	33.1	30.0	36.6	53.9	27.7	27.6	45.7	25.2	42.7	31.4	31.2	78.8	22.4	76.0	28.4
2034	6	62.1	67.4	24.5	134.5	79.6	46.1	134.5	104.6	41.5	98.6	56.9	89.7	83.2	40.7	58.8	59.2	65.1	79.1	80.3	83.3	78.1	50.9	24.5	47.0	59.1	96.6	30.4	30.5
2034	7	83.3	83.4	32.2	160.2	89.1	47.5	69.5	99.4	86.4	74.8	89.2	32.2	89.2	60.5	90.3	55.1	121.3	57.7	106.8	61.7	64.1	80.2	96.2	110.1	160.2	74.6	108.8	76.5
2034	8	57.5	63.6	11.4	154.3	57.8	154.3	97.7	56.0	56.0	82.4	28.0	24.6	57.1	91.1	45.4	46.7	87.3	37.5	11.4	64.6	85.5	60.8	76.3	28.9	55.3	66.9	129.9	24.5
2034	9	72.8	68.7	8.8	123.7	8.8	79.7	21.5	122.5	76.3	87.3	64.8	48.2	74.2	71.5	123.7	58.5	47.9	53.9	87.2	53.8	80.7	65.7	109.0	37.1	88.9	30.0	74.5	82.2
2034	10	33.3	34.1	11.4	54.9	18.1	53.7	32.8	12.5	23.2	15.4	40.0	24.0	54.5	54.4	44.3	54.9	35.2	30.2	11.4	51.3	53.6	43.6	42.5	33.7	24.7	24.7	28.0	11.9
2034	11	26.0	29.2	12.3	59.6	23.9	28.2	23.0	23.5	19.8	22.7	25.6	27.0	13.7	47.2	17.6	41.1	38.1	16.7	12.3	41.4	39.2	18.3	59.6	26.5	31.0	44.4	25.5	33.0
2034	12	30.6	27.2	4.5	42.0	13.2	30.0	4.5	35.0	18.1	40.0	36.2	26.3	37.2	7.5	42.0	20.7	26.6	36.7	17.1	22.1	20.5	33.7	38.8	11.5	34.5	32.5	38.0	31.2
2035	1	20.7	24.7	6.1	53.0	13.1	23.5	43.4	39.3	17.0	13.8	20.7	16.6	20.8	19.0	20.4	36.6	18.7	25.2	11.5	25.4	29.9	37.4	53.0	37.7	30.7	17.1	16.2	6.1
2035	2	17.2	21.4	12.0	42.1	34.1	17.0	13.0	17.7	14.6	14.3	20.2	42.1	12.4	40.4	41.0	30.3	22.1	12.0	20.5	13.5	17.3	16.7	27.9	14.4	16.5	13.3	17.2	26.2
2035	3	18.5	19.2	2.4	38.6	21.2	22.1	18.3	18.6	38.6	12.7	18.5	15.6	6.3	18.0	2.4	22.5	15.4	17.0	12.2	19.1	18.4	18.8	26.2	8.9	38.5	22.0	30.9	19.0
2035	4	15.9	20.7	0.9	48.4	10.9	15.7	48.4	24.2	47.1	12.4	16.1	44.2	14.4	14.9	18.1	22.9	34.9	38.8	29.3	1.3	0.9	6.3	13.9	15.5	5.8	27.2	12.7	20.1
2035	5	42.0	40.6	8.1	71.1	45.7	14.6	31.5	38.2	55.6	44.0	71.1	45.2	52.3	29.9	55.0	70.2	53.8	22.3	35.3	28.0	16.9	8.1	39.9	50.8	49.2	23.0	31.3	62.0
2035	6	57.4	62.4	15.2	119.6	56.4	54.0	49.9	89.7	60.7	104.7	15.2	29.7	78.0	53.1	54.8	119.6	50.4	58.5	46.6	58.4	59.3	48.6	92.1	44.1	80.7	81.2	31.9	80.4
2035	7	72.7	75.3	39.2	154.4	78.1	102.0	65.5	44.2	75.4	79.4	39.2	154.4	78.0	58.0	59.4	116.5	66.0	107.6	47.7	59.4	77.8	89.3	51.3	71.7	63.4	85.1	63.2	73.7
2035	8	70.5	72.7	35.7	127.6	68.4	101.6	52.9	79.2	37.8	127.6	39.5	35.7	74.7	58.5	65.0	82.3	63.4	49.5	42.1	54.7	52.7	93.4	79.5	92.2	78.4	127.6	72.7	114.8
2035	9	50.8	56.9	6.5	119.4	83.7	87.3	22.1	48.7	103.4	44.8	52.9	29.2	56.0	64.7	40.7	42.6	56.9	40.6	45.0	33.4	78.7	46.8	6.5	77.2	119.4	82.5	44.8	57.0
2035	10	27.4	31.4	13.7	68.1	68.1	46.7	18.1	21.7	47.2	27.9	14.2	25.3	13.7	25.7	25.3	42.2	33.7	26.9	18.1	44.1	20.3	42.2	33.7	42.7	20.6	34.4	22.3	38.2
2035	11	29.2	32.8	17.0	56.8	28.9	29.5	31.5	25.0	43.0	55.3	56.8	30.1	17.0	40.4	20.3	28.6	23.0	18.8	25.4	34.5	51.0	36.5	26.1	47.8	27.3	26.2	39.5	23.6
2035	12	32.7	32.4	9.3	60.6	37.3	9.3	54.1	47.7	26.6	34.4	14.4	47.9	10.5	52.2	32.7	23.0	41.9	10.8	24.9	39.3	25.6	60.6	39.9	25.5	33.2	32.6	30.5	22.0
2036	1	23.9	23.3	7.0	41.7	23.5	14.7	41.7	28.1	24.3	7.0	26.4	37.5	39.6	14.2	34.8	28.8	7.8	22.1	29.7	38.7	16.2	7.9	26.3	16.0	26.7	13.4	16.5	17.9
2036	2	18.6	20.0	3.5	43.1	17.8	3.5	10.4	28.2	10.2	11.0	18.7	18.4	32.7	25.1	13.9	25.5	25.2	18.5	43.1	7.6	35.0	26.8	10.5	13.6	14.9	23.2	26.6	18.6
2036	3	19.3	20.8	4.6	40.7	21.8	29.0	33.9	18.4	19.7	6.8	31.4	31.8	4.8	37.8	16.2	24.0	13.0	10.9	19.0	12.6	11.9	30.0	7.4	40.7	40.5	4.7	27.4	4.6
2036	4	18.1	21.3	4.4	46.5	40.3	17.8	13.0	17.6	19.9	37.9	46.5	17.2	11.3	12.0	34.5	6.2	27.7	6.6	18.4	29.6	34.9	16.1	6.3	9.7	4.4	18.7	26.0	38.1
2036	5	30.8	34.8	12.8	75.3	48.2	40.3	17.6	38.3	19.2	33.1	37.7	32.4	48.7	20.7	29.2	64.1	75.3	28.2	14.5	23.4	29.1	19.6	63.2	25.5	47.8	12.8	28.4	38.1
2036	6	51.0	57.1	13.1	127.7	44.4	66.1	13.1	80.7	34.1	56.5	110.9	65.9	44.4	50.5	44.7	26.9	37.9	51.4	41.6	53.4	32.4	106.7	29.5	82.9	127.7	31.5	67.1	70.7
2036	7	58.8	62.2	0.6	127.8	58.0	76.6	84.6	87.9	76.0	62.4	64.2	86.0	68.1	77.8	58.6	17.9	41.3	56.3	51.6	58.9	30.3	57.3	48.2	102.1	127.8	0.6	53.8	45.4
2036	8	64.2	73.9	21.9	189.9	85.0	77.5	90.0	114.5	99.0	189.9	59.7	73.0	40.2	107.6	34.7	22.5	47.9	120.8	42.3	155.5	30.7	128.9	68.6	55.3	35.0	43.4	29.7	21.9
2036	9	61.0	59.6	26.7	114.9	63.7	43.8	41.6	72.4	26.7	48.3	75.5	42.3	82.4	73.1	66.4	38.5	49.3	79.3	31.3	61.9	114.9	75.5	45.1	55.9	27.9	86.4	66.8	60.0
2036	10	38.8	38.8	15.7	68.3	21.3	37.3	24.6	68.3	43.6	27.1	38.2	55.9	31.2	52.1	43.0	46.2	37.5	15.7	42.4	39.5	66.7	16.6	39.9	26.7	50.6	48.2	36.2	23.0
2036	11	32.8	32.3	9.2	51.8	29.3	42.8	22.2	42.4	31.3	36.1	37.9	51.8	21.8	27.5	34.0	41.0	44.6	24.9	31.6	36.3	9.2	23.9	24.2	34.7	42.2	20.3	35.1	29.5
2036	12	29.5	30.3	10.8	63.1	36.8	29.3	21.7	48.6	36.0	28.4	11.5	21.8	17.7	63.1	21.8	41.0	39.3	15.0	30.8	29.8	10.8	34.7	12.6	56.9	42.8	17.4	21.4	38.2
2037	1	25.6	24.6	7.1	47.4	17.1	11.9	7.1	27.3	17.3	28.2	28.1	30.8	7.4	32.3	40.4	47.4	9.5	34.8	33.5	25.9	22.3	17.3	39.2	17.4	20.5	25.2	29.0	19.7
2037	2	20.3	22.1	3.1	54.2	54.2	45.0	17.3	8.3	26.8	21.5	33.3	40.0	3.1	20.3	26.6	11.6	29.3	19.0	12.7	17.7	20.3	23.2	14.7	16.9	26.3	6.7	25.0	9.7
2037	3	20.1	21.3	5.3	44.6	10.1	21.5	35.7	16.7	34.8	19.2	17.4	12.9	15.6	30.7	21.8	25.9	26.4	27.7	13.4	16.9	13.7	12.6	20.9	33.7	24.0	9.0	44.6	5.3
2037	4	17.6	21.6	2.1	58.0	24.7	14.0	12.5	36.4	16.7	13.6	22.6	15.0	13.4	35.9	2.1	58.0	3.2	37.0	21.0	31.6	18.5	38.0	30.7	15.9	6.3	5.3	40.5	4.8
2037	5	32.7	39.6	7.1	101.6	26.9	53.7	47.1	36.1	25.9	28.3	44.1	32.3	100.1	7.8	53.4	7.1	25.5	33.2	24.5	33.5	22.5	37.9	28.4	22.0	101.6	28.8	94.4	35.7
2037	6	51.2	52.6	16.5	101.0	45.2	73.2	43.4	85.0	65.7	54.5	27.7	47.6	40.6	53.7	53.4	57.7	52.2	19.5	75.6	38.5	60.4	48.8	101.0	50.2	16.5	37.2	23.2	92.3
2037	7	79.2	83.3	36.0	153.8	80.3	116.3	82.5	90.6	70.1	139.4	36.0	78.1	87.0	153.8	73.8	91.5	110.7	49.5	54.2	95.1	62.2	52.2	68.6	69.4	52.7	143.3	81.1	61.7
2037	8	85.6	87.0	23.2	140.5	60.4	79.0	41.7	79.4	45.0	117.3	23.2	101.3	133.4	136.7	91.7	114.3	39.7	31.9	74.4	78.5	55.7	126.1	76.3	101.2	134.7	107.0	98.1	140.5
2037	9	60.5	62.6	24.9	116.9	101.0	39.7	54.7	78.6	29.0	62.4	63.6	24.9	74.0	67.4	50.0	46.0	63.5	58.5	42.1	85.4	109.8	52.1	69.1	42.7	44.2	54.7	72.4	116.9
2037	10	35.3	38.5	11.9	69.8	11.9	32.2	18.7	32.7	23.5	33.3	49.4	32.0	53.2	69.8	28.9	35.6	65.6	39.5	30.4	61.4	55.8	31.8	38.1	42.3	39.0	24.5	38.3	35.1
2037	11	36.2	37.0	17.5	66.0	37.1	35.9	19.8	55.8	17.5	66.0	36.5	51.8	49.4	31.5	41.5	26.0	49.3	45.0	45.8	19.7	23.7	32.9	32.6	20.2	54.1	37.3	28.0	31.3
2037	12	30.5	32.0	16.1	49.7	34.3	40.2	40.0	43.0	28.0	27.8	19.5	45.1	48.8	30.6	37.8	21.1	24.2	31.1	36.7	49.7	25.9	30.9	30.4	30.2	23.6	29.3	16.1	24.9
2038	1	21.1	24.6	11.2	53.7	53.7	17.9	20.9	22.2	36.4	13.3	18.1	24.8	17.6	18.4	15.0	29.0	24.7	11.2	14.5	14.5	51.1	36.8	16.6	43.0	22.0	28.4	21.3	20.1
2038	2	18.6	21.8	6.9	59.3	18.5	26.0	32.1	15.0	21.7	19.1	22.3	16.2	15.5	20.8	19.8	40.4	35.4	6.9	16.3	8.6	11.6	13.2	40.1	18.8	14.8	13.9	59.3	16.4
2038	3	21.7	23.5	3.3	62.1	18.4	41.4	23.5	32.8	39.5	31.6	15.5	17.0	20.0	22.8	3.3	23.3	7.7	27.6	26.0	20.6	17.1	8.4	9.3	30.1	41.2	62.1	15.1	9.8
2038	4	23.1	22.1	5.4	38.5	23.2	23.1	8.9	17.9	9.0	14.6	29.8	35.1	38.5	19.8	18.4	5.4	17.0	31.0	28.1	26.8	32.0	26.6	11.4	25.9	9.8	8.0	36.2	34.4
2038	5	33.7	36.8	4.9	111.9	111.9	11.1	47.2	37.0	40.0	4.9	28.1	43.2	24.9	25.2	55.9	48.7	30.8	26.5	36.7	50.1	23.7	48.1	27.4	23.9	15.0	54.0	30.3	39.7
2038	6	58.8	66.6	33.0	111.9	52.1	64.9	111.9	53.3	62.5	54.5	51.2	35.9	51.5	92.9	48.2	76.4	55.0	50.9	33.0	40.1	105.4	67.2	90.0	86.5	103.9	34.2	66.8	110.2
2038	7	79.5	83.3	33.4	203.5	33.4	39.8	72.0	110.9	58.7	103.2	78.4	66.9	83.3	50.1	135.4	77.2	76.8	44.3	87.5	106.3	80.6	89.1	60.4	90.7	203.5	91.1	110.4	48.6
2038	8	55.2	59.4	20.3	122.9	115.5	52.0	41.6	46.6	42.8	73.8	32.2	20.3	68.1	43.8	51.8	69.1	34.7	83.5	75.3	63.9	23.5	29.3	76.6	91.9	58.4	30.0	78.5	122.9
2038	9	55.5	66.0	26.2	147.6	127.0	87.2	56.2	41.8	91.2	76.2	26.2	141.3	51.8	55.1	45.6	36.8	69.6	147.6	93.4	45.2	44.6	48.6	92.0	35.1	30.6	26.9	56.0	58.3
2038	10	31.7	34.2	14.8	70.2	20.3	14.8	41.1	23.1	30.9	29.7	48.7	36.2	33.2	70.2	49.4	39.3	56.2	21.6	22.5	25.7	52.2	23.7	53.4	22.9	32.4	18.8	20.3	34.2
2038	11	34.0	35.2	14.2	70.5	21.6	70.5	23.7	49.1	34.5	33.6	20.5	36.6	40.1	46.5	38.9	28.7	24.0	26.2	57.1	50.3	69.1	36.0	37.2	14.2	21.8	21.5	19.8	23.6
2038	12	30.9	32.5	12.7	51.8	30.6	28.5	26.6	20.0	15.2	34.4	51.8	23.6	19.4	51.5	30.0	40.5	40.5	12.7	34.5	40.5	25.3	49.3	28.2	36.2	48.5	33.3	31.3	28.1
2039	1	28.0	27.5	8.7	45.4	33.2	41.2	29.9	24.8	24.0	29.7	18.6	27.3	22.2	40.4	26.5	8.7	29.6	30.5	26.1	35.4	25.4	29.8	45.4	16.2	14.9	10.6	40.0	28.6
2039	2	14.9	18.7	7.5	36.1	32.4	15.8	14.3	36.1	10.4	14.0	21.3	26.6	10.9	7.5	32.7	26.5	13.5	13.0	18.1	14.2	30.1	15.5	33.3	13.6	14.4	9.0	7.5	19.3
2039	3	15.7	20.1	2.6	44.3	39.5	13.5	13.2	21.1	13.3	39.5	15.4	7.4	9.1	18.0	21.6	43.7	2.6	32.8	44.3	4.1	28.9	33.9	4.7	16.1	8.8	14.7	10.4	24.9
2039	4	22.9	20.4	6.1	34.0	25.6	6.1	34.0	8.0	6.3	17.9	6.7	12.7	30.8	26.1	9.8	22.4	25.0	26.5	22.7	31.9	6.7	9.0	27.7	30.5	21.9	31.3	25.7	23.2
2039	5	35.9	41.2	7.6	106.8	52.4	42.1	36.0	33.2	106.8	29.5	32.7	31.5	82.0	7.6	59.9	46.4	45.0	24.0	35.8	36.2	67.1	15.7	30.8	77.6	41.6	9.7	18.0	26.5
2039	6	47.7	52.5	16.5	114.8	74.1	33.5	26.6	43.3	76.7	43.4	50.8	75.2	45.8	114.8	49.6	58.3	62.8	16.5	58.3	65.2	33.3	31.1	45.5	28.2	82.8	28.6	44.4	70.5
2039	7	77.5	81.3	29.3	164.7	58.1	41.0	133.9	48.2	116.5	66.2	79.1	60.7	164.7	52.3	29.3	113.8	102.8	81.5	75.9	103.7	50.9	68.3	45.9	43.0	90.4	92.7	145.9	86.9
2039	8	66.1	70.6	20.7	115.8	68.4	62.2	102.3	20.7	74.2	51.8	66.0	45.7	54.1	106.7	104.5	66.3	62.4	33.5	83.6	63.0	49.5	56.5	66.3	99.2	91.0	43.7	115.8	106.9
2039	9	66.0	63.7	8.7	103.8	80.7	64.3	58.2	77.3	69.8	74.5	79.8	47.8	67.7	17.4	87.1	71.9	44.7	89.7	42.7	53.4	48.7	62.4	52.1	47.5	103.8	8.7	91.2	87.6
2039	10	38.4	37.3	9.8	68.1	31.8	50.9	36.8	35.1	40.6	17.0	38.9	9.8	38.3	42.0	63.7	60.9	59.2	19.3	40.0	10.5	19.3	51.8	47.7	68.1	22.9	22.9	28.2	38.5
2039	11	29.9	30.1	12.0	53.8	27.4	44.1	43.8	13.8	28.8	25.4	13.4	53.8	40.1	27.7	22.1	15.2	12.0	18.4	30.9	19.5	26.0	36.4	39.3	32.4	31.0	46.6	37.6	37.3
2039	12	31.3	32.6	11.6	64.5	38.6	38.3	22.6	32.9	23.6	43.2	17.1	11.6	24.8	64.5	25.6	24.7	59.9	36.4	41.7	44.9	14.5	23.5	29.7	53.7	38.3	20.6	36.8	14.5
2040	1	26.0	25.6	13.2	42.4	29.2	28.2	16.6	13.2	33.8	20.8	19.3	25.5	42.4	28.7	31.2	21.3	21.8	31.4	20.6	26.6	39.2	20.9	32.9	22.2	27.0	16.0	28.6	16.6
2040	2	19.6	20.3	4.7	45.0	25.9	14.0	28.9	27.0	23.1	24.5	15.4	45.0	14.7	7.7	17.5	36.6	9.2	29.6	21.8	22.4	8.1	7.3	13.2	16.5	4.7	11.2	39.0	23.4
2040	3	19.6	23.2	9.4	49.0	9.5	32.8	22.6	27.4	20.9	18.3	9.4	35.4	49.0	15.1	41.3	16.8	15.5	31.2	31.2	15.2	29.8	18.3	12.9	40.6	11.2	12.1	12.6	28.3
2040	4	20.2	23.5	3.6	60.6	53.9	26.0	33.0	15.8	34.0	20.0	3.6	30.5	36.6	25.2	25.7	18.0	15.2	28.3	15.8	18.7	20.4	8.9	5.7	14.8	60.6	15.6	31.8	6.8
2040	5	30.4	30.3	5.1	83.2	52.0	36.9	34.3	5.1	31.9	20.3	32.8	21.1	34.6	23.2	50.0	19.2	83.2	15.3	14.5	10.8	28.9	15.1	26.5	40.5	41.5	5.8	49.4	35.4
2040	6	55.5	60.2	20.8	139.9	65.0	55.3	139.9	70.3	68.2	49.0	41.1	40.5	67.8	89.4	36.5	55.7	53.1	40.5	68.8	20.8	91.0	26.8	70.3	85.1	27.1	128.1	30.9	22.9
2040	7	84.9	85.7	22.2	163.4	66.5	105.8	161.3	115.2	88.5	22.2	45.6	163.4	91.6	62.6	113.3	92.5	63.3	67.6	76.9	107.6	83.6	38.0	78.2	86.3	64.0	88.9	115.8	57.4
2040	8	45.3	53.7	21.2	128.8	56.5	71.1	46.4	55.2	27.5	27.4	27.6	59.1	43.5	33.5	77.1	22.4	74.6	39.7	44.3	43.7	73.1	38.3	57.9	110.6	21.2	31.8	76.7	128.8

2040	9	56.9	61.9	22.0	106.6	40.0	95.9	89.0	50.5	34.3	62.4	48.8	58.9	97.8	72.0	68.4	39.4	22.0	106.6	52.8	98.2	83.5	65.5	70.9	43.1	34.6	43.4	53.7	55.0
2040	10	33.3	34.3	10.8	73.6	17.8	73.6	34.2	61.4	18.2	20.5	32.8	42.1	20.8	41.1	22.4	37.0	29.7	23.1	55.1	57.5	39.1	34.1	38.0	10.8	33.9	19.8	32.2	28.5
2040	11	34.4	34.1	9.9	70.4	30.4	28.5	48.6	32.6	70.4	12.9	45.2	50.6	45.4	54.3	33.0	22.3	35.7	11.6	18.1	44.3	9.9	39.1	36.0	40.4	23.6	13.7	44.1	26.7
2040	12	26.3	26.1	10.6	38.5	32.2	22.1	23.7	15.6	33.1	28.0	31.4	26.8	21.1	35.2	35.1	24.7	28.4	38.5	10.6	30.2	31.8	25.8	23.5	24.7	19.5	23.8	30.3	10.6
2041	1	22.7	23.4	8.5	43.6	23.4	13.5	32.4	17.9	31.9	19.1	31.5	20.0	23.2	8.5	22.2	27.8	26.9	12.3	29.3	25.4	16.1	17.9	20.6	29.3	21.5	27.9	43.6	18.5
2041	2	21.5	22.5	5.9	52.1	40.2	10.2	22.9	6.9	22.2	14.9	25.6	35.0	11.3	32.6	24.3	35.0	16.7	52.1	37.2	26.2	20.2	20.7	5.9	17.5	12.2	13.9	26.8	9.7
2041	3	21.8	24.9	4.7	67.3	22.7	4.8	38.8	21.3	22.5	55.7	38.5	21.8	14.1	33.1	9.0	42.7	11.4	4.7	19.4	35.1	13.5	26.0	31.6	13.9	67.3	8.2	21.9	20.3
2041	4	18.8	20.7	2.1	62.7	26.0	8.5	25.9	17.9	12.5	6.0	18.3	34.8	14.5	24.9	5.5	2.1	13.3	19.3	62.7	35.8	6.6	17.8	11.7	23.9	20.2	19.5	35.5	34.5
2041	5	41.3	40.4	11.6	85.0	14.5	35.7	12.5	42.9	30.5	85.0	27.8	67.6	52.3	41.4	16.7	66.8	11.6	49.8	57.8	41.1	23.0	24.4	15.2	55.9	35.2	77.5	43.4	41.6
2041	6	49.4	57.7	16.4	127.4	27.9	88.1	38.9	35.7	48.5	58.7	72.2	51.6	47.6	48.8	41.7	113.9	35.0	127.4	70.2	49.3	40.6	107.2	16.4	41.5	60.2	56.6	49.4	57.4
2041	7	72.8	73.9	28.3	135.7	68.5	74.8	61.1	83.0	79.8	86.4	62.3	93.4	28.3	93.8	47.3	62.9	100.8	84.2	36.6	64.2	37.9	87.2	59.4	50.6	70.8	118.5	135.7	85.6
2041	8	66.0	68.1	3.7	150.4	43.6	48.0	94.2	59.7	46.8	71.6	62.7	96.7	84.7	79.6	150.4	46.7	42.3	31.7	3.7	52.1	88.9	80.7	82.5	115.3	69.3	86.1	55.1	42.2
2041	9	57.4	60.0	17.1	188.1	90.4	32.6	39.6	40.4	26.0	76.6	67.3	188.1	35.0	64.1	96.4	46.6	48.2	46.8	71.5	55.5	46.3	60.6	67.9	33.4	59.3	17.1	62.2	66.9
2041	10	32.3	32.3	6.9	60.0	6.9	32.5	31.4	44.0	29.9	60.0	44.4	14.2	45.1	33.6	23.3	32.1	34.5	48.0	25.4	15.5	19.3	22.3	28.9	34.9	21.7	42.7	47.6	36.2
2041	11	35.7	37.9	11.8	69.0	28.2	66.1	49.5	29.9	39.5	35.9	38.6	11.8	21.4	31.9	36.8	62.4	33.3	25.5	41.6	33.7	23.5	57.4	69.0	34.4	39.6	24.9	35.4	38.4
2041	12	29.1	28.3	14.1	58.3	18.3	18.6	17.8	40.7	34.3	30.7	22.3	32.4	15.1	29.5	33.5	35.8	28.1	14.1	16.8	31.6	31.7	33.6	15.3	58.3	41.2	25.3	25.2	28.7
2042	1	24.4	25.4	6.3	49.5	48.4	23.4	32.1	19.1	25.1	27.4	34.7	32.1	44.4	33.9	18.9	21.3	23.6	6.3	7.9	27.9	23.5	28.5	13.3	17.6	31.4	13.2	49.5	7.1
2042	2	20.9	20.8	0.7	44.6	20.8	17.7	17.3	17.2	9.6	21.8	26.3	39.2	13.2	20.9	30.0	15.3	23.5	10.9	22.4	21.4	44.6	14.7	33.3	0.7	29.9	10.8	21.5	16.6
2042	3	13.8	15.2	3.7	32.5	14.7	16.3	27.0	18.0	12.6	7.6	11.9	6.8	14.9	11.2	10.9	15.0	32.5	11.0	26.4	7.3	13.1	3.7	27.0	6.7	14.5	22.9	23.7	10.4
2042	4	22.3	23.0	0.6	43.2	17.4	13.7	17.2	33.6	19.8	12.0	19.7	0.6	43.2	11.9	7.4	16.6	25.2	24.8	8.2	16.8	30.9	33.3	31.4	29.9	32.3	35.3	42.0	29.5
2042	5	34.9	36.3	4.3	90.4	26.6	48.2	55.1	20.6	55.1	90.4	17.7	44.1	44.4	4.3	9.7	20.6	56.5	35.8	22.7	54.7	34.0	13.5	58.0	32.2	45.2	5.2	34.0	43.7
2042	6	66.7	69.7	13.0	155.0	79.3	57.4	94.2	27.6	76.1	43.4	51.8	57.4	82.8	101.7	71.2	92.9	55.0	32.5	51.6	117.5	84.0	97.1	106.7	62.2	13.0	155.0	42.5	19.8
2042	7	89.7	86.9	35.4	122.6	64.5	35.4	67.9	80.5	89.1	118.3	110.5	80.6	90.2	98.5	68.5	84.6	63.9	64.4	104.3	115.5	47.3	83.7	112.3	101.4	122.6	97.6	91.1	94.2
2042	8	62.9	71.5	25.5	144.6	55.8	134.6	44.0	30.7	61.7	52.2	72.3	47.2	49.3	97.1	118.6	28.2	37.0	64.1	102.2	144.6	132.7	45.8	120.7	45.5	70.8	70.8	64.3	25.5
2042	9	56.5	68.4	26.1	147.0	49.9	46.1	74.3	124.4	147.0	43.5	52.0	97.6	131.2	123.9	46.4	37.0	61.1	63.6	85.2	47.8	71.0	36.2	26.1	47.7	28.6	61.5	99.9	39.3
2042	10	34.0	35.2	11.9	67.0	29.3	42.2	20.9	36.3	41.3	27.8	28.8	18.2	37.7	36.7	29.4	57.7	50.4	32.4	11.9	35.5	51.4	67.0	56.9	37.8	31.9	19.4	20.1	23.3
2042	11	35.8	35.1	3.1	74.0	44.9	37.9	37.3	31.2	20.4	24.7	57.4	37.6	38.8	34.3	40.2	21.4	33.7	28.4	74.0	17.3	38.3	32.4	46.0	25.0	45.4	3.1	40.3	32.7
2042	12	27.4	29.5	13.8	62.8	21.7	29.3	43.2	25.9	30.9	30.7	16.3	23.8	19.2	19.3	23.2	31.0	35.6	53.6	20.4	23.9	28.4	25.2	45.0	62.8	28.7	13.8	28.7	26.3
2043	1	27.9	29.1	5.8	76.3	31.1	15.2	26.5	21.7	26.5	13.7	31.9	5.8	34.3	50.1	12.4	19.2	33.1	29.3	76.3	34.1	13.5	26.5	22.0	41.5	46.3	27.1	28.7	32.2
2043	2	19.8	23.0	7.2	60.0	26.2	21.2	60.0	7.2	15.9	19.4	25.3	12.1	12.9	12.0	22.1	38.1	16.2	19.8	34.1	23.7	35.5	14.3	18.2	9.0	18.6	44.2	26.9	19.8
2043	3	21.6	23.3	4.6	84.2	34.4	30.6	21.4	28.3	25.6	12.9	26.2	41.7	22.1	21.9	9.3	84.2	16.3	21.1	26.5	14.6	4.6	16.6	8.4	18.7	9.5	15.8	24.0	24.4
2043	4	19.8	22.9	0.9	57.3	20.4	17.0	55.4	18.6	4.8	7.6	19.2	29.1	25.8	28.2	0.9	11.4	24.8	17.9	30.7	44.1	57.3	12.3	7.0	31.5	15.5	29.1	33.5	8.5
2043	5	29.7	32.1	5.5	56.1	27.7	34.7	40.9	17.9	14.8	13.3	56.0	34.1	46.5	30.3	29.2	19.5	26.0	56.1	13.9	55.6	31.7	27.4	15.9	52.1	47.7	56.0	5.5	17.7
2043	6	56.9	53.9	16.3	101.0	83.1	101.0	69.1	64.2	27.8	30.8	44.3	57.3	54.8	28.5	56.5	60.9	58.1	55.1	16.3	70.7	67.1	23.2	53.8	83.0	30.5	67.8	57.8	31.8
2043	7	77.0	92.4	44.8	221.2	58.8	50.5	86.9	66.8	63.6	55.4	62.7	67.3	153.7	113.6	95.0	107.5	96.7	84.4	54.0	135.0	50.7	69.5	88.2	170.4	221.2	158.6	62.6	44.8
2043	8	61.9	67.8	30.2	136.1	36.9	110.9	84.4	46.7	81.6	37.0	44.4	47.9	40.7	95.2	58.4	75.2	40.4	76.1	59.7	82.6	30.2	57.5	105.1	79.2	64.1	136.1	81.1	56.4
2043	9	55.4	56.9	14.6	130.0	52.8	95.6	38.6	116.1	63.6	79.5	50.5	130.0	44.7	16.5	28.1	59.0	57.9	37.7	79.9	65.3	34.5	20.5	87.1	66.7	18.6	42.9	63.7	14.6
2043	10	39.3	38.3	9.9	67.4	10.9	65.7	13.6	9.9	35.5	56.8	36.6	47.7	56.6	43.2	33.8	67.4	47.1	39.8	47.9	25.1	30.0	45.2	24.5	41.0	17.7	46.1	38.7	37.6
2043	11	28.4	31.9	4.8	74.3	17.5	31.1	33.6	22.6	37.8	20.9	37.5	26.0	21.9	74.3	50.2	26.7	27.9	24.7	46.6	32.4	23.4	65.1	41.2	28.9	19.2	4.8	31.7	19.7
2043	12	31.8	30.2	8.2	54.9	32.6	50.6	20.4	48.7	54.9	8.2	36.2	31.8	31.9	35.0	31.6	16.2	31.1	12.4	32.2	14.5	24.4	20.6	19.8	39.2	24.1	38.9	35.0	35.0
2044	1	20.6	21.5	8.3	39.0	39.0	8.3	17.9	27.2	25.5	31.0	26.5	9.2	22.7	11.7	20.3	16.3	15.8	32.1	28.9	17.2	15.2	20.9	16.0	35.3	17.7	21.2	21.2	19.3
2044	2	23.7	23.3	9.9	38.1	23.3	13.0	22.9	17.1	28.5	27.6	13.9	12.0	13.6	21.3	36.2	31.7	15.9	12.2	28.8	9.9	38.1	34.3	24.2	28.4	28.7	29.8	20.9	27.7
2044	3	19.9	20.4	4.0	47.2	22.4	27.5	22.7	15.5	22.0	5.5	4.0	22.8	9.5	16.4	17.7	37.4	9.2	13.1	47.2	12.3	24.1	7.7	24.1	44.2	12.1	28.2	9.2	34.0
2044	4	10.8	14.7	2.5	39.5	34.9	25.0	39.5	22.2	14.2	4.8	12.1	9.7	8.9	7.3	9.2	8.7	10.3	6.4	5.3	36.1	19.6	11.4	6.2	20.2	2.5	17.2	12.6	9.8
2044	5	38.2	42.3	2.1	84.6	58.5	23.4	27.1	21.5	84.6	79.6	46.6	81.6	18.1	76.9	63.3	39.2	2.1	40.0	30.9	19.3	10.3	82.3	57.2	28.6	26.2	37.3	12.1	49.8
2044	6	47.4	51.1	19.1	127.6	19.1	61.5	96.3	27.8	27.9	52.7	43.9	46.3	55.6	56.7	38.1	127.6	32.7	52.0	54.8	36.6	62.7	39.4	48.5	56.0	44.5	34.2	66.2	44.5
2044	7	81.4	87.3	26.0	175.3	53.7	51.9	140.1	64.7	79.9	82.7	120.8	64.6	63.3	175.3	91.6	105.1	77.1	26.0	71.0	98.9	80.1	108.0	112.1	127.5	71.2	105.1	38.5	84.7
2044	8	65.2	74.3	22.9	175.3	79.0	29.8	175.3	22.9	130.4	103.5	27.0	34.9	66.6	164.8	70.0	25.8	55.9	63.8	56.4	44.4	102.8	89.7	58.6	91.4	57.9	99.7	83.5	49.2
2044	9	64.0	63.7	14.6	124.4	60.7	95.5	75.2	90.1	47.4	14.6	47.3	74.5	70.7	77.9	101.9	67.3	42.9	124.4	38.8	92.7	27.4	45.4	57.9	80.0	81.1	36.7	50.1	27.9
2044	10	40.6	39.3	11.8	68.8	41.8	14.0	25.9	25.0	68.8	17.4	30.7	45.5	54.9	65.4	42.2	25.9	48.5	28.7	35.5	40.2	58.1	40.9	27.6	59.7	50.9	37.3	11.8	46.7
2044	11	35.1	34.6	19.0	67.3	39.0	28.1	19.0	34.7	51.2	38.5	30.5	25.2	35.6	20.8	34.9	24.8	35.3	20.8	36.3	67.3	24.9	39.3	19.1	27.5	36.9	36.7	59.4	45.5
2044	12	24.3	26.2	7.0	55.3	29.1	21.4	19.4	47.8	23.1	25.4	29.6	30.1	20.4	55.3	9.0	30.6	30.4	28.8	12.3	7.0	35.1	54.4	19.2	23.3	22.5	29.6	13.9	10.6
2045	1	23.0	26.1	11.5	49.4	33.8	11.5	22.7	42.7	25.5	49.4	27.3	23.0	15.6	42.5	39.1	20.2	17.1	26.8	17.2	21.5	22.6	34.4	11.5	20.6	26.5	21.2	31.7	23.0
2045	2	21.8	22.4	7.0	44.3	14.9	21.5	25.1	22.7	44.3	18.4	20.6	21.1	22.1	17.4	21.3	11.8	27.8	7.0	29.2	25.7	27.4	37.9	10.9	26.7	25.0	7.5	39.5	12.3
2045	3	22.4	23.3	4.7	41.1	4.7	40.1	39.8	13.7	21.5	29.7	10.6	8.3	23.2	17.6	28.2	18.4	32.1	26.6	24.3	37.2	41.1	40.0	16.8	13.2	15.9	8.6	38.1	10.0
2045	4	19.8	21.2	5.3	49.4	49.4	35.6	30.7	33.6	26.4	30.0	10.3	10.5	20.1	26.5	14.7	26.9	18.3	27.8	10.5	23.8	19.5	14.2	22.8	18.6	10.7	5.3	13.5	7.7
2045	5	38.1	39.5	2.7	80.0	39.2	80.0	34.1	44.0	73.4	34.2	22.9	48.7	69.5	38.8	37.5	30.7	14.6	36.6	40.9	2.7	12.6	63.3	56.5	26.6	50.5	21.7	41.4	28.1
2045	6	62.3	63.9	13.5	108.7	99.0	73.7	63.7	83.4	81.9	56.7	60.8	88.6	95.4	108.7	26.7	38.6	56.0	74.7	56.6	24.9	67.5	26.2	52.5	106.2	37.6	87.6	13.5	53.6
2045	7	81.9	86.3	35.4	153.1	111.0	103.3	52.9	153.1	150.8	62.4	67.0	46.3	136.7	94.2	47.2	105.7	104.5	35.4	71.9	55.1	51.9	126.3	90.6	94.0	83.8	71.1	79.9	77.2
2045	8	67.6	70.8	25.9	121.8	47.5	50.0	60.0	82.5	25.9	90.4	84.8	53.7	88.4	73.3	58.9	62.9	69.0	29.4	76.1	112.5	66.1	108.8	121.8	97.2	52.7	104.4	38.2	45.9
2045	9	47.6	53.0	30.2	90.9	62.8	35.7	38.3	72.6	45.5	52.5	36.1	49.2	32.2	59.4	59.8	39.2	90.9	73.3	31.5	84.3	77.2	43.5	30.2	85.1	46.1	54.9	36.5	35.4
2045	10	41.5	39.2	10.2	71.0	35.2	50.7	46.5	48.0	26.0	24.4	23.7	53.5	50.6	23.4	12.1	54.8	64.3	50.9	71.0	14.8	53.2	23.1	52.0	36.5	35.0	10.2	18.6	61.9
2045	11	33.3	34.4	11.2	55.5	47.8	50.5	30.6	26.7	42.5	11.2	22.7	41.1	40.4	55.5	19.4	28.4	30.6	32.5	48.5	31.3	35.7	29.4	36.3	20.3	51.0	43.3	14.5	34.2
2045	12	26.0	26.6	5.9	49.0	32.4	45.6	30.7	21.7	40.6	24.4	20.9	33.3	16.8	46.4	24.1	12.6	49.0	10.9	31.3	31.0	19.4	37.3	15.1	5.9	18.0	27.6	13.2	29.9
2046	1	25.5	29.5	15.7	58.1	22.3	27.9	22.4	22.4	28.3	24.4	30.3	21.3	18.0	30.7	20.6	43.7	25.4	25.6	29.5	58.1	34.9	24.1	20.2	23.1	54.7	15.7	28.4	56.2
2046	2	22.6	23.1	5.1	38.7	26.5	17.1	34.2	22.4	5.1	22.7	29.4	22.6	24.8	11.6	34.2	16.0	12.2	34.1	21.0	5.9	26.0	7.4	15.0	33.6	35.8	38.7	38.6	18.8
2046	3	21.9	22.7	8.1	41.8	22.2	35.1	32.1	21.2	10.6	14.7	9.7	22.3	8.1	20.7	24.8	41.8	18.1	22.3	34.0	33.6	22.0	18.6	28.1	40.6	21.9	12.5	11.4	19.4
2046	4	16.9	19.8	7.7	38.2	17.8	14.7	10.4	9.2	14.9	21.1	13.7	14.8	16.8	17.6	11.3	38.2	21.8	15.6	14.4	24.2	31.3	33.5	27.3	37.2	7.7	34.0	16.9	11.3
2046	5	34.7	39.5	7.3	108.5	42.6	7.3	59.3	26.5	14.6	45.8	26.2	102.4	34.4	40.8	43.4	70.3	52.6	7.3	29.3	16.3	28.9	53.7	35.1	108.5	26.6	22.3	12.6	41.0
2046	6	58.0	61.1	15.1	114.0	52.9	70.8	76.2	49.3	56.9	48.5	68.8	51.4	59.1	44.5	68.9	114.0	68.0	75.9	43.7	40.9	35.0	62.0	81.9	15.1	110.3	89.2	42.5	39.9
2046	7	74.2	71.1	20.2	125.3	83.1	78.9	68.0	105.5	34.4	54.6	58.2	57.7	74.4	74.0	41.5	125.3	76.2	81.1	20.2	79.9	63.3	90.1	95.8	35.7	83.8	48.8	113.8	62.3
2046	8	57.0	61.7	19.7	169.5	55.4	169.5	34.5	53.2	63.9	83.2	40.2	67.4	47.1	58.6	103.0	49.8	19.7	22.6	90.1	84.9	41.7	58.9	73.3	38.5	92.4	26.4	84.1	22.4
2046	9	72.0	71.6	15.8	140.1	111.3	97.2	47.1	51.9	36.6	112.1	23.1	50.5	99.1	43.0	140.1	15.8	85.0	70.4	52.9	81.8	73.6	86.6	32.5	38.9	86.7	60.2	135.2	86.3
2046	10	36.8	36.4	19.5	61.5	23.9	31.7	27.4	34.7	41.6	42.0	61.5	40.8	46.9	43.7	27.1	21.7	19.5	20.7	48.3	38.8	40.1	33.7	44.8	22.9	29.3	27.4	44.5	60.8
2046	11	31.2	32.2	4.2	50.2	38.1	31.4	41.5	30.1	46.7	24.7	32.8	41.4	4.2	14.7	22.4	23.2	31.0	28.0	44.2	43.7	29.2	48.2	50.2	36.9	21.1	18.9	31.1	38.9
2046	12	24.9	27.9	12.4	44.5	25.0	43.0	14.5	38.2	31.9	43.7	40.5	14.5	12.4	30.2	24.4	31.7	24.8	19.1	17.0	37.7	24.7	22.0	36.0	15.9	17.0	21.0	44.5	39.1
2047	1	25.7	23.3	5.9	45.0	32.3	34.3	9.4	29.2	12.9	20.1	28.3	31.5	27.4	45.0	25.5	23.3	12.0	39.3	26.0	28.9	12.2	19.2	9.9	15.6	26.8	35.6	5.9	9.0
2047	2	18.6	20.3	11.7	38.3	14.3	25.8	23.1	38.3	16.6	16.9	11.7	37.5	12.6	16.1	16.2	16.4	18.6	17.0	23.3	17.8	19.4	21.7	18.6	21.2	18.5	26.4	19.1	19.6
2047	3	19.7	20.9	2.6	74.5	30.0	10.2	21.7	14.3	38.1	19.8	21.7	18.0	8.6	11.3	15.7	23.3	19.3	12.1	26.5	28.7	27.1	6.8	4.9	19.5	2.6	74.5	21.4	26.2
2047	4	23.5	23.3	10.9	36.7	32.6	15.7	15.1	35.0	12.5	14.5	22.1	20.3	25.7	25.8	25.2	15.6	23.0	35.7	29.1	36.7	13.0	15.9	10.9	35.7	23.9	28.3	25.0	22.7
2047	5	28.4	29.6	10.8	68.9	17.2	56.0	27.7	49.6	29.2	22.8	10.8	43.9	13.4	12.6	30.8	16.1	49.1	17.0	18.3	23.8	68.9	17.2	34.5	34.9	35.2	20.4	29.9	30.1
2047	6	49.7	55.5	19.8	153.2	44.1	53.0	64.3	37.0	23.4	67.1	45.8	72.9	50.7	31.5	61.0	31.0	64.6	69.9	34.7	84.5	48.7	113.5	44.8	25.1	24.3	67.5	19.8	153.2
2047	7	73.6	77.4	19.4	127.2	71.1	127.2	38.4	90.0	102.5	98.4	80.2	58.8	84.6	66.2	74.3	99.6	72.9	65.6	96.6	71.1	34.4	57.6	65.7	102.6	55.0	19.4	99.9	126.0
2047	8	70.7	75.2	29.6	191.8	45.5	99.7	97.1	88.9	93.1	80.2	54.5	67.7	47.6	191.8	110.5	78.2	71.1	69.9	70.3	33.5	74.3	53.9	74.7	69.3	106.9	61.9	35.2	29.6
2047	9	56.3	65.2	19.1	133.2	43.2	46.6	34.4	38.1	47.1	57.3	98.0	93.7	120.3	88.3	31.4	51.8	81.0	19.1	90.0	55.2	78.3	53.0	68.6	94.9	133.2	35.3	36.3	71.0
2047	10	33.7	38.2	6.8	72.2	33.7	32.0	18.9	44.2	57.3	27.0	12.7	52.3	33.8	64.2	39.1	72.2	6.8	57.4	33.5	19.5	24.7	62.5	32.9	41.5	51.0	40.5	33.5	25.2
2047	11	35.0	35.3	19.7	54.5	39.9	28.3	28.3	21.8	39.9	43.8	52.4	41.2	33.9	44.4	20.9	19.7	35.9	54.5	45.0	31.1	36.1	35.3	34.3	34.7	32.0	22.7	31.7	39.5
2047	12	25.4	26.3	9.1	45.9	23.9	27.1	9.1	34.4	22.7	29.0	40.5	18.2	26.9	27.1	19.2	25.6	35.9	18.4	26.9	25.2	17.8	42.3	45.9	20.6	31.0	22.5	20.5	20.0
2048	1	21.7	24.0	8.1	64.3	21.6	64.3	18.7	26.1	28.0	17.0	33.8	19.8	21.2	37.5	35.8	26.3	8.1	14.3	22.6	11.0	21.8	9.4	22.1	33.4	20.1	12.5	33.4	17.1
2048	2	19.8	21.3	2.6	41.0	17.4	2.6	19.1	22.9	30.4	37.0	32.8	21.2	8.3	32.8	14.7	14.4	38.3	35.4	16.1	10.4	20.4	23.8	12.7	41.0	5.5	15.0	26.4	13.4
2048	3	21.2	19.9	3.1	36.5	22.8	35.4	3.1	20.5	29.8	21.2	23.3	19.8	12.4	22.9	15.5	34.8	36.5	8.8	6.4	15.4	11.0	23.6	17.0	21.3	7.4	23.8	24.0	21.2

2048	4	17.1	20.4	2.8	48.7	10.2	12.6	15.9	7.8	6.3	36.7	29.9	7.3	13.4	27.5	2.8	14.5	23.1	24.0	48.7	36.9	13.5	39.1	21.2	39.2	24.0	9.3	7.1	18.3
2048	5	34.8	33.1	9.5	79.8	51.1	79.8	29.4	61.1	20.0	43.7	34.6	43.4	9.5	14.2	35.8	10.7	37.3	40.0	12.0	19.8	46.3	38.6	29.8	35.0	28.6	42.2	12.1	19.7
2048	6	55.7	56.1	18.1	107.7	28.1	69.7	84.6	51.7	107.7	94.9	35.0	43.2	25.9	44.7	68.0	50.9	63.0	57.5	65.6	61.7	40.3	54.0	47.2	18.1	22.6	75.6	76.9	58.6
2048	7	91.5	94.4	34.9	189.7	54.8	64.1	94.3	137.4	131.3	34.9	70.4	189.7	78.8	81.8	138.1	65.8	77.8	95.0	56.3	56.5	44.8	106.8	102.1	98.5	170.4	124.0	88.8	104.2
2048	8	70.8	67.8	16.7	156.1	23.2	93.8	58.2	49.7	68.1	79.5	16.7	35.1	32.7	105.0	98.0	71.2	39.4	114.4	90.8	22.1	87.6	73.7	82.2	47.2	20.6	91.7	70.5	156.1
2048	9	70.7	64.5	18.5	127.8	35.9	67.7	28.7	45.0	75.7	84.4	78.2	68.5	65.8	127.8	77.2	76.4	59.1	26.3	38.1	76.0	95.1	87.0	18.5	72.9	84.9	55.5	75.5	28.8
2048	10	34.8	39.4	16.2	85.9	39.9	29.2	38.6	21.1	40.4	32.5	40.2	63.4	36.5	31.3	26.4	16.2	19.1	33.6	70.8	63.1	63.1	40.0	26.6	85.9	30.2	36.0	31.6	29.2
2048	11	38.7	38.3	13.5	65.0	37.7	56.1	28.7	53.2	51.0	36.3	61.2	53.3	58.8	45.2	60.9	46.0	39.8	13.5	42.9	14.6	21.3	24.4	27.6	65.0	22.5	26.9	15.1	17.7
2048	12	23.2	26.0	11.0	60.8	28.2	24.1	11.0	29.6	16.7	42.0	18.7	32.0	34.3	12.2	21.2	28.8	60.8	22.2	46.0	20.4	20.7	14.7	32.6	18.8	20.3	26.0	24.3	18.7
2049	1	23.0	25.5	6.9	56.4	52.5	28.2	14.9	7.5	21.8	26.7	28.1	24.3	30.9	11.1	37.6	18.8	18.3	13.8	20.1	56.4	18.6	32.2	6.9	42.6	32.2	34.9	13.2	19.5
2049	2	20.5	22.7	8.0	49.6	11.5	35.2	14.4	16.0	19.5	9.2	21.4	17.8	23.2	22.4	49.6	25.9	24.3	37.0	17.7	8.0	18.9	17.4	18.6	31.5	31.7	36.2	23.2	13.9
2049	3	16.6	18.4	3.7	49.6	20.9	23.4	18.8	15.0	3.7	12.1	16.5	19.6	10.8	20.6	49.6	29.3	11.8	24.5	36.1	12.5	12.9	16.6	21.8	16.6	16.5	4.8	18.4	9.3
2049	4	19.0	20.6	5.5	50.0	20.6	13.0	26.0	7.6	33.8	38.4	18.2	9.3	22.5	15.2	21.0	18.6	41.2	5.5	15.9	10.2	19.4	21.3	20.8	25.1	18.2	16.4	50.0	5.5
2049	5	31.6	33.4	7.1	75.5	7.1	66.6	36.0	43.6	21.0	29.5	33.7	65.8	9.1	24.8	49.2	31.8	31.0	31.5	34.9	41.7	25.6	18.9	34.4	27.3	75.5	10.3	15.9	37.6
2049	6	60.3	64.2	29.7	137.6	86.2	53.3	31.4	32.8	74.4	94.8	56.0	87.9	104.1	95.2	67.4	60.7	74.1	70.1	69.6	31.9	43.1	137.6	51.6	44.1	29.7	59.9	47.7	36.8
2049	7	65.0	75.2	23.9	156.3	75.1	60.5	74.0	156.3	61.4	65.7	23.9	45.2	91.3	56.0	74.7	98.8	64.3	59.1	112.8	44.5	61.7	41.8	115.8	120.8	105.3	117.9	29.6	49.2
2049	8	57.0	62.9	19.2	130.8	48.8	46.6	114.0	91.7	58.3	47.7	53.3	81.3	48.5	64.6	39.0	35.1	20.5	84.7	65.7	40.8	55.8	94.2	80.5	38.8	19.2	130.8	74.1	74.5
2049	9	53.3	56.8	17.7	129.4	41.4	17.7	59.7	77.4	129.4	60.6	75.1	30.1	98.0	28.7	84.6	75.4	84.5	68.1	47.7	58.9	34.4	32.6	39.6	35.5	33.4	79.0	39.9	30.7
2049	10	35.1	39.2	21.1	81.9	35.9	81.9	37.5	21.1	44.0	34.7	32.9	28.4	30.0	21.5	63.1	43.7	39.4	43.0	31.4	35.6	56.2	34.3	34.6	26.2	48.5	62.6	23.4	29.8
2049	11	27.8	35.7	12.4	70.6	26.6	70.6	27.6	24.2	27.2	23.0	20.3	47.4	45.9	21.3	12.4	49.4	46.0	38.2	65.9	33.7	21.9	25.1	58.9	57.1	20.1	28.0	24.0	41.7
2049	12	29.4	31.0	14.4	59.9	29.4	30.5	33.9	42.1	20.9	14.4	26.8	31.2	24.6	42.9	31.9	19.2	37.9	41.9	27.5	59.9	46.3	21.0	29.0	18.2	29.3	34.7	23.3	28.1
2050	1	28.5	27.9	10.7	46.1	44.7	29.2	18.0	37.8	24.6	31.7	46.1	18.3	16.9	25.8	28.6	43.1	28.6	19.2	28.4	16.7	29.6	26.9	38.1	21.6	10.7	17.2	38.7	30.0
2050	2	17.8	18.5	6.1	34.8	21.1	18.7	22.4	16.1	9.8	13.3	10.0	15.9	19.5	14.7	21.1	16.8	12.7	16.3	6.1	22.9	21.3	23.5	24.7	33.3	24.0	12.9	34.8	10.9
2050	3	17.2	20.6	7.0	61.2	16.7	22.7	30.0	9.6	35.7	20.1	10.6	12.6	10.1	36.3	16.4	25.6	10.7	24.1	11.5	9.9	17.6	15.2	7.0	29.2	20.5	29.6	61.2	11.3
2050	4	21.0	21.8	7.9	54.1	25.9	12.6	54.1	31.7	33.7	10.9	17.1	27.2	21.8	11.2	23.5	28.1	8.8	20.3	26.7	8.2	19.8	39.3	11.4	22.0	19.2	7.9	25.7	16.0
2050	5	30.9	34.9	4.0	93.0	4.0	22.1	58.9	12.8	16.6	47.0	33.2	29.6	48.8	31.6	37.4	10.4	83.3	11.1	39.2	7.0	30.2	35.5	24.7	53.0	50.1	93.0	28.6	29.3
2050	6	51.5	58.1	15.3	149.0	28.7	47.6	42.2	28.4	19.3	62.0	100.5	66.2	50.8	95.9	57.6	66.4	149.0	99.8	19.9	24.1	44.1	29.7	70.1	47.9	15.3	73.4	52.3	102.5
2050	7	57.7	65.9	14.2	159.1	159.1	59.7	34.9	70.3	119.9	30.2	39.4	109.1	66.0	96.2	45.2	55.7	74.7	46.0	64.0	67.4	75.2	30.7	50.8	51.2	49.8	131.6	39.3	14.2
2050	8	60.7	63.6	28.3	124.1	54.0	124.1	60.6	54.7	50.5	28.7	76.5	100.8	76.4	70.9	28.3	38.4	96.8	68.7	35.5	60.7	75.7	51.2	48.8	74.4	44.3	78.0	57.6	71.5
2050	9	46.7	54.8	10.4	126.6	58.2	39.2	101.2	44.6	31.5	45.5	47.3	69.0	31.4	126.6	106.1	10.4	63.9	36.0	82.1	40.1	63.0	46.9	31.1	49.8	77.3	46.6	33.5	34.5
2050	10	36.0	37.3	8.1	73.3	60.8	45.3	43.9	73.3	45.7	36.2	17.6	38.1	21.7	44.9	43.4	37.3	33.5	25.8	34.2	33.8	8.1	35.9	56.6	48.8	27.3	18.8	34.9	28.7
2050	11	30.0	31.4	12.5	58.3	22.2	19.3	45.3	30.5	25.7	32.3	58.3	29.4	18.0	23.9	23.0	27.0	39.3	36.1	43.1	37.0	42.5	36.2	28.1	54.5	19.5	18.0	33.0	12.5
2050	12	27.9	28.7	8.9	58.8	27.8	19.1	19.7	58.8	38.3	35.5	19.9	27.0	22.9	8.9	37.4	16.8	31.1	15.0	28.6	32.6	33.7	28.6	21.2	52.4	28.0	21.2	26.7	38.3
2051	1	22.4	23.1	6.3	43.6	23.9	29.4	7.2	20.8	14.2	24.6	43.1	24.5	8.6	13.2	18.9	18.6	43.6	23.3	28.6	24.1	17.2	21.5	43.3	26.9	32.8	6.3	21.3	18.9
2051	2	24.9	23.3	4.0	40.3	30.3	19.6	6.8	29.9	22.7	16.9	20.0	23.9	40.3	4.0	9.2	27.5	32.8	27.6	18.2	16.0	26.6	32.7	30.3	39.0	25.9	9.3	10.4	39.1
2051	3	16.5	20.2	5.0	48.4	18.0	28.8	16.9	36.2	15.8	15.0	12.8	21.8	48.4	17.7	13.3	21.6	17.3	37.3	7.8	5.0	6.1	15.2	16.1	46.6	10.8	12.3	28.4	15.5
2051	4	22.5	22.5	1.4	42.6	26.0	27.3	12.6	37.1	21.6	22.1	17.5	31.2	4.7	19.7	14.7	20.1	20.0	42.6	28.3	22.9	24.5	22.8	30.1	27.6	15.4	1.4	19.4	31.4
2051	5	44.7	43.1	11.6	70.1	55.6	11.6	70.1	45.6	23.2	52.0	55.0	50.1	61.1	54.3	39.0	42.8	58.4	39.4	48.5	21.3	17.4	34.3	46.1	62.5	42.5	43.8	25.3	34.8
2051	6	67.8	63.9	16.2	117.8	117.8	67.6	80.4	72.0	78.8	71.1	39.8	112.2	32.2	93.0	29.9	16.2	17.5	67.9	50.4	71.6	96.3	57.0	54.5	49.5	97.0	32.9	68.0	60.8
2051	7	75.9	72.8	15.1	159.8	85.4	74.9	104.3	112.4	78.5	113.4	159.8	76.9	108.7	53.2	118.4	15.1	41.4	62.8	47.0	81.7	40.7	39.7	89.3	30.8	101.3	28.8	65.7	17.6
2051	8	56.1	61.9	25.9	134.0	80.4	31.1	76.5	55.3	94.0	56.9	31.2	26.4	29.4	134.0	52.5	37.5	25.9	51.5	98.0	69.3	54.7	74.4	82.1	74.6	106.7	34.5	69.6	39.8
2051	9	62.2	60.9	19.0	98.6	57.7	25.3	56.3	46.6	90.1	94.6	62.9	95.0	62.8	30.2	98.4	57.1	37.5	98.6	71.0	34.9	82.6	37.4	61.7	77.1	24.4	64.7	74.7	19.0
2051	10	36.1	33.3	14.2	54.1	14.2	51.9	17.6	30.7	36.2	32.1	39.2	39.2	25.0	41.6	19.3	44.5	52.7	38.9	54.1	15.5	37.0	25.0	53.7	14.8	20.5	37.5	22.6	36.0
2051	11	40.8	39.5	22.5	70.0	24.4	23.4	24.7	26.7	48.4	55.3	42.2	43.8	42.2	22.5	70.0	47.2	48.6	33.0	45.9	36.0	25.8	39.5	56.3	48.7	43.9	25.8	37.2	36.0
2051	12	32.2	30.9	10.5	56.0	46.6	49.5	30.2	56.0	26.0	17.5	32.8	38.0	33.9	24.0	18.4	33.4	31.6	24.1	34.9	14.8	11.5	24.1	34.2	43.7	37.3	50.0	10.5	19.2
2052	1	27.4	26.0	7.4	44.8	30.5	15.2	13.8	34.5	43.2	27.8	44.5	44.8	22.1	9.1	26.2	39.5	29.3	30.9	27.8	27.0	7.4	27.9	36.8	20.3	14.1	19.3	23.1	7.6
2052	2	20.4	22.0	2.0	58.8	37.0	18.5	19.8	5.3	13.4	10.4	58.8	39.2	31.4	16.6	38.1	33.2	2.0	23.6	20.1	22.5	34.2	10.4	25.1	8.0	13.0	5.1	21.4	20.7
2052	3	25.6	25.3	6.0	47.1	41.1	13.9	38.2	21.6	22.6	32.2	25.3	12.0	30.3	31.2	26.4	47.1	25.9	22.3	25.8	30.0	17.2	27.9	46.5	13.4	6.0	12.3	18.7	18.9
2052	4	21.3	24.7	4.4	55.7	39.2	14.0	46.8	13.6	5.8	4.4	19.8	5.2	26.1	13.3	28.3	19.6	27.7	29.4	14.9	17.4	22.8	34.9	52.6	13.6	33.3	19.6	55.7	33.6
2052	5	34.8	38.9	16.7	96.8	63.5	16.7	29.5	23.7	23.3	36.8	46.7	24.1	27.7	65.1	40.2	34.7	19.1	51.0	34.9	53.1	22.5	36.8	57.6	96.8	30.4	30.8	28.5	39.8
2052	6	49.9	53.0	12.1	106.3	26.4	12.1	74.1	35.9	41.7	29.1	43.5	62.6	83.3	83.3	32.0	54.0	36.6	29.5	47.6	56.7	70.8	106.3	85.4	52.3	62.6	86.2	36.9	22.2
2052	7	63.4	71.5	31.8	132.3	74.5	47.6	123.9	61.9	56.9	112.3	57.7	71.1	75.7	132.3	37.4	86.0	55.7	64.9	40.4	56.0	55.6	107.5	76.5	31.8	115.3	54.7	81.2	39.6
2052	8	51.3	69.4	24.6	143.0	115.1	32.0	120.8	118.9	60.0	49.8	40.4	24.6	45.4	92.5	46.8	52.8	34.4	143.0	46.0	36.9	83.6	86.2	29.6	38.4	49.0	138.8	70.4	110.1
2052	9	60.0	64.2	20.0	153.2	62.9	53.2	58.7	26.6	75.4	49.2	111.7	76.4	70.6	34.9	78.1	39.1	34.7	47.9	75.8	83.6	48.1	20.0	85.5	87.3	153.2	61.3	54.7	52.0
2052	10	33.0	35.7	8.8	73.2	27.6	44.5	58.3	45.1	58.0	12.8	26.8	29.7	43.9	12.4	33.9	52.3	11.0	28.8	66.5	32.0	51.1	39.0	38.7	23.0	25.5	73.2	14.6	8.8
2052	11	29.6	37.3	21.0	87.5	42.3	51.2	44.0	46.4	21.0	25.7	25.4	58.6	21.4	22.5	28.4	38.1	29.8	48.8	29.5	35.4	21.1	87.5	74.0	28.8	28.8	28.2	29.3	30.0
2052	12	30.6	30.8	10.5	48.0	30.2	33.3	33.4	44.7	30.3	30.5	18.1	36.1	25.9	48.0	25.3	37.7	23.0	21.2	25.5	37.2	39.2	30.6	10.5	31.0	45.5	28.7	21.0	32.6
2053	1	20.5	24.5	10.8	47.9	36.2	10.8	18.4	47.9	13.3	37.0	23.2	15.4	18.2	32.6	21.1	36.7	15.9	19.4	19.6	25.5	19.3	27.2	30.3	15.9	14.9	30.3	39.0	19.9
2053	2	19.8	22.5	2.0	68.0	14.8	19.7	9.5	19.9	23.7	38.5	19.1	18.8	11.7	21.4	55.8	68.0	11.4	14.9	29.9	2.0	36.8	13.2	20.6	10.4	23.2	23.9	10.5	22.5
2053	3	21.7	23.6	5.4	45.9	28.3	24.9	31.1	21.4	28.5	29.0	5.4	16.2	22.0	19.6	32.4	44.8	13.0	13.3	17.9	26.4	11.7	36.5	14.6	45.9	16.4	19.0	14.7	32.0
2053	4	17.8	21.8	3.4	51.1	15.0	18.2	23.5	10.3	3.4	14.5	15.9	17.3	15.0	21.3	4.0	31.9	28.2	32.5	13.8	44.3	30.7	39.1	15.0	28.5	27.4	9.4	12.1	51.1
2053	5	34.0	37.9	10.3	85.5	37.6	23.9	59.2	34.1	28.3	24.4	17.3	73.4	21.5	28.1	45.3	41.1	18.9	26.5	22.7	34.0	48.8	33.9	63.4	35.4	85.5	67.8	28.1	10.3
2053	6	52.6	59.6	26.4	136.9	78.6	31.7	60.3	27.7	57.8	68.1	51.1	48.2	59.9	45.2	38.8	27.6	136.9	91.9	51.6	101.5	94.4	50.5	47.1	26.4	66.4	53.5	37.9	76.9
2053	7	79.7	78.7	20.7	155.3	72.3	142.7	84.2	37.3	36.7	103.7	45.2	56.4	83.3	92.3	33.4	72.9	76.0	20.7	46.5	50.5	92.8	90.4	93.1	116.9	62.5	155.3	131.7	92.2
2053	8	65.6	68.8	28.0	123.2	62.8	56.3	68.1	72.7	67.0	48.1	61.1	28.0	74.8	123.2	89.1	54.4	79.0	63.6	64.1	47.0	84.8	63.8	95.2	93.9	50.5	56.6	76.9	70.2
2053	9	66.4	67.7	26.7	140.1	90.1	65.0	92.4	140.1	75.7	85.8	46.0	32.2	87.9	90.0	39.7	32.5	57.5	37.4	67.8	98.6	86.1	75.6	45.6	47.4	63.6	102.9	37.0	26.7
2053	10	34.3	36.1	6.1	85.3	56.3	31.1	18.8	85.3	50.7	16.5	16.6	12.1	48.8	39.1	13.5	51.0	34.2	24.6	24.1	41.4	46.1	27.1	37.8	73.9	34.3	28.5	48.8	6.1
2053	11	34.9	36.2	9.2	72.2	72.2	21.5	18.6	21.4	46.5	21.6	60.9	66.4	11.2	47.9	29.0	30.8	45.4	23.2	38.9	22.4	45.1	9.2	49.8	27.1	45.8	21.8	46.5	46.1
2053	12	29.9	31.0	17.1	51.0	36.5	46.2	17.1	40.5	28.8	36.5	31.0	28.3	21.6	51.0	19.1	33.3	39.6	19.9	27.7	19.4	23.8	37.1	34.6	19.7	44.5	28.4	32.6	26.5
2054	1	27.1	28.6	13.0	59.3	59.3	37.1	15.0	32.8	17.3	21.6	28.1	31.0	51.1	24.4	36.4	33.9	16.5	15.0	33.2	26.5	13.0	26.8	32.8	32.1	27.4	24.7	25.9	24.8
2054	2	24.5	24.2	11.2	42.0	42.0	28.2	19.7	28.0	16.7	32.3	20.9	22.3	19.1	17.9	32.7	27.5	18.8	11.2	24.2	24.7	21.8	25.1	29.7	30.3	11.9	15.2	33.8	26.3
2054	3	25.6	25.7	8.3	51.7	14.0	33.6	34.7	30.1	26.0	35.7	25.3	9.3	32.1	15.7	51.7	12.4	21.2	20.9	16.8	8.3	24.3	28.2	12.0	38.2	38.0	45.7	15.0	28.0
2054	4	19.1	22.0	6.1	50.6	19.1	6.1	20.8	16.3	17.3	50.6	27.1	10.1	33.0	21.0	22.0	12.3	10.9	10.2	18.8	34.2	31.2	13.5	37.0	17.7	9.5	19.1	40.5	30.2
2054	5	40.7	41.1	8.3	99.3	9.9	48.9	29.8	41.8	69.4	70.6	99.3	19.8	50.9	30.2	43.5	37.0	39.7	48.1	57.6	36.2	28.3	57.9	47.4	8.3	46.0	32.5	12.0	19.9
2054	6	54.0	56.0	19.9	114.4	70.9	69.5	84.4	51.3	43.1	57.8	19.9	78.0	90.5	33.3	56.7	33.9	64.4	63.7	37.3	67.3	47.7	50.4	46.4	35.4	73.5	114.4	30.7	22.9
2054	7	80.5	88.2	42.5	148.9	148.5	43.0	134.8	75.4	70.4	81.7	55.2	42.5	125.8	96.5	148.9	48.3	72.1	104.6	64.3	90.2	70.5	102.9	73.9	97.4	79.3	100.1	55.0	136.6
2054	8	71.8	72.1	22.3	124.2	87.6	39.2	52.3	49.8	101.4	90.2	29.7	32.0	51.0	124.2	68.9	69.9	22.3	44.5	102.8	69.6	82.7	62.8	87.6	73.7	84.0	87.7	117.0	99.5
2054	9	50.5	55.2	16.9	106.3	51.4	39.3	38.2	77.6	43.3	66.6	50.2	82.6	60.6	16.9	74.6	56.7	40.6	62.8	48.5	48.6	91.6	43.8	34.2	56.4	106.3	44.0	40.0	50.8
2054	10	29.9	34.5	15.1	99.4	30.1	25.5	31.6	19.2	26.3	60.6	49.1	41.8	39.7	17.7	15.1	99.4	26.1	15.4	29.7	18.6	35.1	17.5	22.1	46.9	43.9	29.5	54.5	32.1
2054	11	31.6	36.2	16.1	75.9	23.3	27.8	32.3	21.8	30.9	19.2	44.5	64.0	16.2	43.7	21.7	41.4	21.3	26.6	29.1	16.1	36.5	54.5	62.2	32.5	75.9	54.9	29.2	42.8
2054	12	33.0	34.1	13.9	65.1	16.3	13.9	29.6	40.0	65.1	43.4	37.8	48.3	31.1	24.2	14.9	48.9	30.7	36.6	39.5	24.4	49.8	31.0	40.1	25.0	34.9	16.3	56.7	19.2
2055	1	26.5	27.0	9.5	47.6	26.4	26.6	22.3	31.5	25.4	44.5	13.0	39.2	47.6	16.1	39.7	32.7	17.0	27.9	34.9	31.2	9.5	33.6	17.0	24.7	22.8	19.5	29.4	16.1
2055	2	23.1	22.4	8.3	41.6	23.7	21.5	25.6	24.8	26.8	41.6	28.4	33.1	14.1	20.6	22.4	13.8	29.9	27.2	25.4	22.5	10.7	18.9	17.3	10.4	28.6	32.2	8.3	10.5
2055	3	21.2	21.6	7.6	39.4	14.1	7.6	11.3	26.8	39.4	27.2	23.4	15.1	14.1	10.5	20.7	37.5	27.3	21.7	29.7	13.1	15.7	32.0	12.9	32.2	26.4	10.1	33.6	15.1
2055	4	20.6	22.7	4.2	75.7	23.6	11.4	4.3	18.9	16.7	15.2	38.5	32.3	27.6	8.7	4.2	7.4	10.0	38.1	22.2	13.6	23.0	39.1	34.4	25.0	13.7	75.7	16.9	24.3
2055	5	33.3	37.5	9.4	77.6	40.6	11.4	18.9	29.1	43.9	9.4	31.5	16.9	60.0	20.3	27.3	77.6	67.1	23.2	49.8	25.5	48.7	56.6	43.8	35.0	26.2	42.4	72.9	21.9
2055	6	45.2	50.0	4.2	106.9	77.1	11.5	81.7	42.9	34.7	92.6	47.6	4.2	79.7	57.4	106.9	61.0	90.2	19.8	47.9	20.6	31.4	21.3	27.9	22.9	34.2	66.8	16.0	103.3
2055	7	68.9	80.1	28.8	149.1	73.9	58.0	51.5	149.1	111.1	94.4	72.2	138.6	109.1	67.6	107.2	66.4	132.3	123.9	68.5	28.8	52.0	33.8	57.1	37.4	49.8	107.1	69.2	64.2
2055	8	60.5	59.7	17.3	108.0	74.6	65.0	81.0	48.6	50.4	86.5	62.8	78.4	49.6	17.3	76.7	73.5	58.1	29.1	56.4	70.8	35.9	108.0	53.1	53.6	73.4	31.5	34.6	64.8
2055	9	49.1	57.2	5.6	110.3	61.2	101.8	34.0	84.2	27.7	37.6	43.2	51.5	110.3	49.3	33.7	47.0	48.9	32.8	44.6	82.4	82.8	95.5	59.3	86.3	37.6	72.1	42.6	5.6
2055	10	33.5	35.1	10.4	62.7	40.0	13.8	42.6	10.4	49.8	31.2	16.7	59.1	33.5	53.1	30.6	33.5	23.5	41.8	62.7	29.7	55.4	25.1	22.3	38.5	43.0	42.1	30.7	14.0

2055	11	34.1	36.6	14.1	68.1	66.7	63.0	45.3	51.7	14.3	49.2	41.5	45.4	34.2	24.5	68.1	21.2	16.0	41.6	31.7	14.1	29.7	34.0	47.5	26.1	38.8	29.3	14.5	29.6
2055	12	26.8	27.6	7.3	44.7	37.4	44.7	7.3	38.8	23.5	21.8	19.9	12.5	22.1	28.4	11.5	21.3	23.6	31.2	32.4	9.1	25.1	35.5	36.6	31.6	38.9	42.2	22.6	43.2
2056	1	30.9	32.4	16.8	49.9	16.8	29.1	33.3	28.7	22.6	22.2	23.4	29.9	25.6	27.3	47.6	47.0	34.0	29.4	40.8	37.9	23.5	38.1	34.0	49.9	46.0	32.0	37.9	21.5
2056	2	20.5	23.3	8.3	39.4	15.5	25.2	20.6	17.9	38.3	25.5	36.3	39.4	8.3	20.9	13.1	15.8	31.5	36.2	17.6	20.2	15.2	18.1	24.9	20.5	37.5	18.8	33.3	9.6
2056	3	21.7	23.1	7.3	45.8	27.4	7.3	21.3	13.7	22.1	17.6	16.5	15.6	45.8	33.4	25.1	8.1	38.9	12.1	34.6	28.6	15.8	16.4	14.1	33.0	23.4	27.4	38.0	19.1
2056	4	22.7	23.1	5.4	50.1	36.6	35.8	7.9	26.7	5.4	5.7	23.0	13.1	50.1	8.8	26.0	50.1	8.7	32.1	22.3	23.9	15.9	17.0	35.0	17.6	17.1	33.7	29.6	11.3
2056	5	42.2	42.7	11.8	92.9	14.2	34.4	46.9	25.3	27.3	11.8	41.7	60.0	63.2	27.8	50.1	58.2	92.9	39.8	36.4	17.8	25.5	61.2	46.1	57.3	70.8	27.8	42.6	45.0
2056	6	65.3	68.4	31.1	140.0	140.0	44.1	40.5	44.4	58.2	65.0	31.1	125.7	80.9	65.6	94.5	52.7	72.6	37.2	42.1	80.1	84.8	74.3	75.3	57.7	57.5	91.8	58.3	67.9
2056	7	74.8	86.4	27.1	198.6	173.4	29.3	49.5	76.0	73.6	27.1	42.9	87.3	98.8	108.3	115.1	68.2	42.7	66.2	36.2	70.2	111.6	138.3	110.5	118.9	128.5	67.6	36.0	198.6
2056	8	56.5	66.2	19.5	161.4	161.4	71.5	29.5	57.6	29.0	44.6	19.5	50.3	99.9	81.8	126.8	39.8	55.4	85.6	51.0	34.1	72.4	55.1	57.5	77.0	100.6	90.6	45.1	53.3
2056	9	47.1	54.4	10.1	115.1	97.7	29.6	33.0	98.3	45.3	47.5	68.6	38.3	29.0	46.7	115.1	24.4	74.9	79.0	40.0	62.7	10.1	55.4	75.9	58.6	97.5	22.9	25.2	30.7
2056	10	33.2	32.1	10.6	65.7	24.1	65.7	19.2	44.5	35.0	35.2	19.8	19.2	16.8	24.7	33.4	41.2	37.3	31.5	30.4	42.0	11.5	45.0	49.8	41.3	15.7	42.7	33.1	10.6
2056	11	32.3	35.8	14.3	60.6	49.8	40.4	60.6	48.1	19.2	31.2	33.4	42.7	22.8	45.6	30.1	25.4	24.5	19.0	31.2	57.8	38.2	48.3	14.3	42.2	31.2	27.6	27.8	46.8
2056	12	20.5	23.5	10.1	48.9	27.7	12.1	14.6	19.0	31.8	48.9	10.1	27.6	15.2	30.7	26.4	21.1	39.9	18.5	16.9	34.4	22.4	23.2	10.4	45.5	13.9	18.2	14.8	19.9
2057	1	22.2	25.9	12.8	46.8	18.5	38.4	20.3	46.0	22.6	17.4	20.2	28.1	15.2	21.9	19.6	30.2	13.4	39.2	23.9	24.2	20.1	30.7	29.3	46.8	45.9	21.4	15.9	12.8
2057	2	19.4	21.2	6.7	43.7	20.6	12.0	12.9	24.2	32.3	23.9	16.8	33.9	43.7	12.7	12.7	12.6	6.7	21.1	11.0	14.3	28.0	37.1	9.1	19.2	40.6	19.7	18.1	25.1
2057	3	20.3	23.4	2.4	51.0	27.9	14.7	3.5	40.2	51.0	31.1	20.4	35.0	41.3	18.9	6.0	41.9	24.2	11.9	50.7	7.4	2.4	16.3	20.2	26.3	10.9	18.2	28.8	11.3
2057	4	22.3	22.9	2.7	62.5	48.1	7.9	10.6	62.5	25.5	6.6	13.4	28.3	46.7	27.9	15.3	20.0	8.3	19.0	28.3	2.7	22.0	34.7	24.8	23.9	22.5	13.1	13.4	24.6
2057	5	33.8	38.3	11.5	92.1	41.9	24.6	49.4	47.7	19.4	12.9	65.4	13.0	67.4	11.5	69.3	26.5	43.2	73.2	44.3	35.3	92.1	21.0	31.4	11.7	38.0	32.3	27.6	19.0
2057	6	45.9	56.8	18.6	112.6	55.7	97.9	35.4	23.4	44.9	38.8	35.4	63.9	62.9	91.8	78.3	43.6	18.6	112.6	44.4	109.7	35.2	102.5	40.7	24.7	35.8	52.8	66.4	46.9
2057	7	73.5	72.5	22.9	130.4	130.4	22.9	71.1	88.0	84.7	38.6	66.6	43.6	117.6	50.7	93.1	75.9	39.1	49.3	27.3	116.8	81.0	128.5	84.1	83.6	67.6	31.9	38.4	108.8
2057	8	65.8	64.6	16.6	126.7	126.7	78.0	16.6	81.9	24.8	25.4	62.6	46.7	81.1	38.6	43.1	19.3	72.2	107.9	44.2	49.0	66.7	64.9	67.1	67.8	109.3	114.5	76.8	64.2
2057	9	61.7	65.3	15.6	148.2	103.4	15.6	45.7	99.0	54.2	31.1	44.1	54.8	88.7	43.5	66.8	27.6	68.5	16.4	61.7	76.2	48.3	94.7	148.2	58.8	61.6	80.6	91.6	85.8
2057	10	37.8	38.0	11.2	75.7	12.1	73.8	67.7	12.4	43.9	43.8	38.4	37.3	24.1	11.2	36.1	75.7	24.9	22.2	46.3	26.2	39.7	54.0	28.8	17.8	20.9	52.0	40.9	62.1
2057	11	34.9	36.9	19.8	57.9	48.9	53.0	19.8	39.3	38.4	55.4	24.0	33.6	33.0	36.7	50.2	34.2	57.9	26.3	34.3	56.0	33.7	38.2	22.0	37.4	35.6	22.3	25.3	29.2
2057	12	29.3	28.8	10.3	45.1	31.9	18.5	35.3	27.5	31.1	42.5	21.6	32.2	29.4	30.3	44.3	28.2	39.1	41.6	29.3	34.4	10.3	22.2	11.3	20.2	16.3	45.1	27.6	21.2
2058	1	25.8	26.1	9.2	50.7	20.5	32.8	9.2	32.7	25.3	13.0	39.2	43.5	20.9	28.5	27.6	34.8	40.8	12.9	17.8	11.5	50.7	33.2	16.5	29.7	24.0	16.2	26.3	18.2
2058	2	20.2	23.1	7.3	50.3	21.8	13.0	17.1	39.6	37.7	20.1	35.8	22.3	50.3	24.6	20.4	10.8	19.6	34.6	21.3	25.4	16.5	14.7	18.1	27.5	17.5	19.5	7.3	19.7
2058	3	23.0	24.0	5.1	57.6	5.1	24.7	42.4	31.3	57.6	55.0	24.2	23.4	6.7	26.9	14.7	13.8	22.6	12.1	7.1	28.2	18.3	28.6	54.4	7.4	12.0	13.2	28.2	17.6
2058	4	24.6	22.6	4.1	42.8	24.9	4.1	15.2	6.1	33.6	16.5	7.5	17.8	27.9	21.8	19.8	24.8	15.5	33.6	40.0	29.7	25.0	42.8	27.2	24.3	31.4	15.2	31.8	6.5
2058	5	43.0	46.0	9.6	101.5	31.1	24.9	101.5	53.0	74.0	52.3	21.3	47.6	34.7	54.0	42.5	72.9	40.7	52.2	43.6	75.8	81.3	21.2	9.6	58.8	39.7	21.1	37.2	13.4
2058	6	54.2	55.7	15.2	132.6	53.2	132.6	40.6	90.9	77.2	42.0	95.2	18.1	87.6	56.7	40.3	31.6	68.9	23.0	29.4	67.3	37.8	55.3	59.7	15.2	31.5	71.9	23.8	86.7
2058	7	84.1	81.7	19.6	133.3	30.5	89.4	83.0	45.5	19.6	79.2	124.1	65.2	89.2	101.7	106.5	60.6	31.8	85.1	121.9	65.0	75.4	103.4	50.3	133.3	102.5	111.4	58.1	128.0
2058	8	54.9	62.4	10.2	163.2	57.8	105.1	125.5	79.8	34.2	67.8	37.3	77.3	80.1	94.9	71.8	20.7	53.3	47.8	163.2	10.2	33.1	44.4	31.6	37.0	81.5	56.5	39.1	48.6
2058	9	48.6	54.7	26.8	115.7	62.2	37.8	42.3	115.7	63.8	32.7	63.2	30.7	68.8	38.0	62.6	70.4	51.2	44.8	101.4	77.9	30.4	46.0	69.6	33.5	26.8	65.4	39.4	39.0
2058	10	25.7	29.9	11.6	67.0	11.6	32.7	23.4	32.1	49.5	25.1	13.2	15.4	26.2	20.2	28.1	41.4	49.6	20.5	62.6	20.2	39.4	40.3	67.0	17.5	39.7	12.7	16.7	11.6
2058	11	36.7	37.3	14.5	77.1	14.5	36.9	49.4	42.0	31.2	38.8	45.3	18.4	21.6	18.0	34.8	28.8	77.1	67.6	37.9	26.1	36.4	50.3	45.5	56.3	18.4	36.2	15.5	47.3
2058	12	32.6	32.5	7.3	74.8	29.5	62.3	36.5	55.1	32.9	23.1	32.4	50.3	23.4	34.4	13.8	44.1	7.3	13.6	34.0	14.1	42.5	39.9	23.7	15.1	18.8	39.5	18.9	74.8
2059	1	25.6	24.7	6.5	42.5	31.9	23.5	30.4	29.9	34.7	35.5	42.5	17.1	27.5	18.6	24.0	27.2	14.7	21.7	23.5	29.1	12.3	13.6	30.8	30.8	17.9	6.5	31.9	16.4
2059	2	21.7	21.6	6.6	51.7	21.0	6.6	25.8	19.2	27.3	23.2	23.4	13.4	24.2	14.7	16.8	23.1	18.9	22.4	18.1	27.6	31.0	22.4	51.7	9.5	31.0	14.2	16.6	16.9
2059	3	25.9	26.7	8.5	58.1	13.5	47.0	42.2	39.9	58.1	28.1	9.8	10.7	46.8	19.8	10.4	11.9	13.8	20.9	29.1	43.1	8.5	15.0	29.3	32.2	11.0	41.7	33.4	23.8
2059	4	16.5	21.7	4.5	54.8	38.0	33.0	10.8	39.2	4.5	40.8	6.1	12.6	15.4	17.1	17.8	13.2	14.4	16.8	34.6	54.8	6.4	16.2	33.3	14.3	22.4	27.6	15.3	16.0
2059	5	37.7	45.2	9.0	142.4	21.4	18.5	85.6	32.4	37.6	26.5	62.8	63.3	31.0	92.6	43.7	37.8	25.9	28.7	29.3	22.3	40.4	35.7	40.2	48.0	52.2	142.4	9.0	57.1
2059	6	53.2	65.6	24.7	139.5	79.8	100.5	45.4	50.7	75.0	39.8	76.0	96.9	45.8	112.5	78.8	29.5	37.5	51.3	139.5	55.2	33.3	33.9	58.7	36.3	105.9	132.6	24.7	34.2
2059	7	65.8	70.7	23.4	138.3	119.2	44.0	29.0	130.9	40.4	79.5	90.9	38.8	81.5	31.5	62.0	38.1	44.6	38.3	76.5	76.7	23.4	99.4	129.2	56.5	138.3	65.7	65.9	95.4
2059	8	62.2	72.9	20.3	229.3	48.4	62.8	33.9	113.0	127.5	62.2	35.1	66.4	60.5	229.3	140.0	20.3	36.4	50.1	121.7	88.0	42.8	39.6	64.3	66.7	62.2	82.8	34.2	61.1
2059	9	61.4	65.0	23.7	108.2	45.0	70.5	67.2	48.7	71.0	61.5	90.1	55.0	99.3	38.4	60.1	72.7	73.2	34.0	55.3	108.2	97.0	50.5	23.7	61.3	77.5	55.6	49.8	93.8
2059	10	37.6	40.2	13.8	77.9	55.8	67.9	28.7	47.5	45.9	44.3	77.9	38.2	36.9	29.1	13.8	52.9	24.4	51.4	29.9	21.8	66.7	38.5	16.5	34.5	45.9	34.5	30.9	30.2
2059	11	33.3	35.0	18.8	62.4	37.4	22.4	33.4	35.5	28.3	34.4	29.4	32.3	26.9	49.0	40.9	28.8	18.8	48.2	42.3	33.2	48.6	35.6	31.3	25.7	62.4	39.3	25.2	31.0
2059	12	27.0	31.2	18.0	56.3	45.2	33.2	26.1	21.5	33.2	19.4	26.8	18.0	26.3	50.9	56.3	21.7	37.7	38.6	19.1	38.3	22.4	21.6	48.0	31.2	39.8	18.7	27.2	26.8
2060	1	24.2	25.5	6.1	65.6	17.8	17.1	12.4	27.7	65.6	8.5	18.1	25.5	29.2	49.4	37.8	17.5	18.6	17.9	24.7	26.9	6.1	18.9	36.4	29.9	14.4	25.7	42.0	23.6
2060	2	18.6	20.7	8.0	45.0	12.2	17.1	17.0	12.2	30.0	22.7	29.8	45.0	14.4	18.9	17.7	11.3	27.3	8.3	25.8	8.0	24.6	27.3	10.7	20.6	29.6	32.3	18.3	14.7
2060	3	21.9	22.0	7.6	38.2	15.3	19.9	25.3	14.3	38.2	25.5	17.8	37.9	28.3	10.9	14.3	33.8	24.8	11.0	33.4	23.5	26.5	15.4	21.5	28.5	22.4	14.1	18.9	7.6
2060	4	23.0	23.5	3.6	65.7	21.3	32.6	26.1	40.3	24.9	5.9	24.8	20.7	65.7	11.8	38.3	8.8	13.0	31.7	10.1	27.8	14.9	13.7	3.6	33.0	14.5	24.7	52.0	4.4
2060	5	33.7	34.1	12.8	57.5	27.5	13.8	20.4	12.8	50.1	13.5	55.9	44.3	57.5	18.7	20.4	22.8	55.5	38.5	28.9	44.1	50.4	27.0	41.3	17.2	13.4	48.1	50.0	46.2
2060	6	36.9	52.5	6.0	157.4	61.3	31.7	109.6	157.4	33.7	32.4	29.4	68.9	6.0	31.7	91.7	30.7	80.1	20.3	19.9	31.3	62.7	40.1	65.0	15.3	110.2	15.8	70.6	43.2
2060	7	80.5	77.1	22.9	158.6	100.6	110.1	138.1	67.0	25.6	83.1	22.9	40.4	127.7	86.1	67.6	80.5	80.7	49.4	84.6	55.6	65.5	51.3	81.0	80.4	56.7	158.6	52.6	83.5
2060	8	59.4	68.5	14.8	176.7	82.3	52.5	125.0	101.2	41.1	24.5	14.8	50.8	99.5	32.9	176.7	32.1	96.6	58.9	81.8	93.1	47.6	79.0	31.1	56.3	71.8	59.4	59.4	75.8
2060	9	55.2	60.6	14.9	188.3	188.3	14.9	54.0	35.0	60.3	25.1	46.1	50.3	81.2	49.5	75.6	68.8	49.6	47.9	81.9	62.9	69.5	64.2	33.6	56.5	97.8	60.7	36.3	43.1
2060	10	33.7	34.9	8.4	75.8	75.8	32.7	33.5	33.9	24.4	24.6	16.2	33.2	36.3	34.1	38.3	38.5	36.7	55.3	20.6	42.3	55.9	18.3	8.4	21.9	40.7	52.9	32.5	31.2
2060	11	35.1	34.3	10.3	54.6	50.3	37.4	24.7	37.2	33.0	37.9	37.8	38.5	42.9	33.0	16.3	30.7	54.6	10.3	31.8	20.5	39.0	42.9	28.1	28.5	47.6	24.4	49.8	26.1
2060	12	33.5	31.7	8.8	56.4	36.7	56.3	15.7	33.4	27.7	38.0	24.2	26.0	8.8	43.6	42.2	33.9	56.4	14.8	39.5	25.0	21.9	19.7	28.5	15.3	33.6	37.0	47.6	34.2
2061	1	28.9	30.1	10.3	52.0	44.1	28.8	31.3	24.3	36.4	36.6	24.1	22.0	24.5	33.1	37.7	51.3	23.2	24.2	29.0	10.3	27.0	25.8	13.3	22.1	33.8	52.0	31.4	36.9
2061	2	21.7	25.0	11.7	67.1	67.1	29.7	14.0	21.3	34.6	24.3	15.7	44.6	12.8	11.7	24.7	18.1	21.2	24.7	13.2	27.6	28.0	37.0	18.5	33.0	22.2	20.2	15.8	20.3
2061	3	21.7	22.5	4.1	55.7	13.1	25.6	14.2	19.6	28.1	55.7	7.3	30.6	20.0	5.2	27.7	24.2	32.7	9.3	33.9	24.3	45.2	29.8	4.1	13.5	16.3	17.4	21.7	21.7
2061	4	27.3	28.9	3.0	72.4	25.8	15.8	35.8	14.2	37.9	46.9	14.3	30.5	24.7	3.0	23.4	42.3	72.4	16.2	35.9	19.3	29.1	34.1	35.7	17.2	28.9	23.4	16.2	50.7
2061	5	37.6	40.5	10.2	77.0	51.9	49.1	12.0	29.5	13.0	37.4	10.2	64.6	44.7	37.2	27.2	25.1	10.2	37.9	75.6	68.0	42.4	75.4	77.0	37.4	35.3	45.5	16.8	48.9
2061	6	51.4	55.8	9.2	130.5	52.8	32.6	130.5	31.0	82.6	29.2	65.7	74.4	47.2	51.0	34.9	72.9	78.9	129.4	56.6	82.0	51.7	39.4	43.2	63.6	9.2	35.7	23.7	21.8
2061	7	85.2	86.5	36.2	155.7	155.7	61.5	86.2	89.2	141.4	92.4	36.2	137.6	126.1	65.7	41.4	56.6	88.5	56.4	60.1	119.2	80.8	55.0	87.5	84.3	63.8	99.5	46.9	145.0
2061	8	62.1	76.6	31.7	144.0	144.0	54.6	90.2	103.0	99.0	113.3	43.3	57.2	112.2	107.3	61.6	101.4	34.8	38.6	42.1	132.8	31.7	61.2	133.0	32.1	54.4	77.5	51.2	62.6
2061	9	54.3	60.9	15.4	118.3	42.1	36.1	74.4	50.6	60.1	102.0	48.2	57.9	90.0	34.2	86.4	16.8	66.9	15.4	118.3	67.5	49.6	46.2	75.8	23.4	41.9	117.4	98.8	40.3
2061	10	37.7	38.2	18.3	66.5	29.3	41.8	35.8	26.5	29.3	66.5	46.7	31.1	47.1	53.3	40.0	60.8	43.4	20.3	37.9	54.7	24.7	37.5	22.4	48.5	50.5	26.5	23.9	18.3
2061	11	37.0	38.9	15.7	102.0	54.0	47.2	20.1	37.2	23.4	50.3	102.0	29.7	34.2	39.3	24.1	17.1	45.9	42.0	38.9	24.7	43.4	36.8	55.3	61.3	30.5	31.2	28.1	15.7
2061	12	27.3	29.5	11.6	56.4	24.4	34.5	38.5	40.5	24.0	16.0	18.6	56.0	11.6	50.9	25.2	33.6	29.4	30.6	34.9	23.6	24.1	12.1	23.0	56.4	30.7	31.0	14.8	23.2
2062	1	27.8	27.0	12.0	42.4	32.4	12.4	42.4	33.1	30.6	19.0	29.0	29.3	13.5	34.2	36.0	24.9	23.9	38.2	23.3	17.1	18.9	40.1	41.8	31.1	12.0	18.2	19.0	26.5
2062	2	22.8	23.1	2.8	53.2	23.3	9.5	24.6	26.1	32.6	22.3	29.6	24.3	8.0	21.1	53.2	14.8	21.0	29.5	13.7	38.1	34.5	26.4	27.4	21.7	13.8	19.1	2.8	17.6
2062	3	16.7	20.3	6.8	52.3	52.3	36.2	45.1	14.5	18.3	15.9	16.8	9.3	15.3	8.4	23.2	21.4	11.1	16.6	22.2	18.2	12.4	17.1	33.2	30.3	14.3	6.8	11.9	16.7
2062	4	16.5	19.3	3.3	54.6	18.7	3.3	15.8	54.6	19.1	14.1	17.1	12.2	10.7	22.5	7.0	13.7	24.5	23.9	37.9	41.6	13.2	8.1	13.6	5.6	22.0	5.2	33.7	26.0
2062	5	37.2	45.2	8.1	100.4	56.7	17.7	30.3	78.3	52.0	82.3	42.5	78.9	31.9	18.2	8.1	29.8	100.4	46.5	65.4	83.1	18.4	32.0	10.4	30.0	30.7	48.3	65.4	28.2
2062	6	45.9	49.2	9.2	102.9	62.9	45.8	73.4	102.9	25.4	55.0	51.8	58.2	69.1	89.4	99.0	9.2	20.8	52.1	39.8	30.4	38.3	17.1	44.4	33.5	19.1	46.1	41.8	55.1
2062	7	81.0	79.8	22.3	199.7	102.8	82.2	83.0	102.3	86.3	47.8	49.5	57.2	90.1	114.9	47.8	108.9	22.3	52.9	61.7	79.9	55.1	122.1	199.7	98.1	59.7	52.8	47.1	90.4
2062	8	64.1	68.6	21.5	145.2	93.8	85.9	49.5	55.8	52.8	89.8	89.7	30.5	36.6	51.7	66.5	61.7	23.0	42.2	115.5	60.0	145.2	52.8	75.2	84.1	109.0	21.5	74.1	80.0
2062	9	62.3	67.1	14.6	141.6	72.5	82.7	104.8	61.8	40.6	110.4	58.7	32.5	77.7	59.5	47.5	42.0	14.6	70.8	141.6	55.2	109.6	45.6	96.6	62.9	68.3	51.4	67.9	35.6
2062	10	34.6	36.3	10.8	68.7	16.1	21.3	20.2	34.6	65.4	14.1	17.5	15.4	58.5	10.8	55.9	33.2	22.4	36.6	66.2	52.7	42.8	48.0	33.5	68.7	48.1	35.8	34.7	17.8
2062	11	32.9	34.3	9.7	56.8	37.2	56.2	19.6	22.1	41.2	56.5	49.1	51.0	9.7	56.8	26.6	23.4	35.7	23.7	21.0	36.5	33.9	30.6	43.5	29.0	41.1	31.9	17.7	29.6
2062	12	31.3	30.5	11.9	53.7	23.3	53.7	27.8	25.0	33.1	37.5	32.9	33.9	20.6	35.0	36.3	44.4	21.9	26.5	24.4	29.7	37.9	15.7	11.9	35.9	38.1	26.6	15.3	43.6
2063	1	29.5	31.1	12.8	59.9	41.2	22.2	17.0	38.8	28.9	40.6	39.8	39.6	30.3	12.8	27.4	24.9	28.0	29.4	26.4	34.9	14.7	17.5	35.5	59.9	41.5	28.6	29.6	37.7
2063	2	19.9	22.2	2.7	52.0	16.4	5.8	2.7	18.8	11.9	21.4	44.0	34.7	27.4	6.9	42.3	4.8	34.6	35.4	6.8	27.7	52.0	12.0	16.8	27.2	21.0	14.8	15.3	31.5
2063	3	20.2	23.9	5.8	57.9	20.3	23.8	33.3	56.9	19.0	5.8	9.4	17.7	18.3	11.7	8.4	16.3	24.9	35.6	7.1	20.1	57.9	28.5	33.1	31.8	32.5	29.4	11.8	20.1
2063	4	24.0	23.8	6.0	43.7	43.7	38.1	31.2	24.7	15.2	39.3	29.6	14.7	17.1	14.3	11.9	30.4	30.3	11.7	6.0	36.9	9.6	28.1	23.3	29.9	36.7	11.3	21.9	15.9
2063	5	30.7	35.3	6.3	110.9	48.3	110.9	45.3	28.5	17.0	26.7	15.0	39.8	32.9	47.2	14.7	72.8	51.8	14.4	6.3	34.8	22.2	16.1	47.6	58.3	40.1	23.9	18.8	13.5

2063	6	55.0	52.2	15.6	85.5	39.3	85.5	24.3	83.8	25.0	66.6	55.4	34.2	63.0	54.6	57.3	28.3	56.9	53.5	69.2	81.1	32.5	78.3	59.6	35.7	57.9	15.6	47.4	46.8
2063	7	73.0	73.7	22.5	157.0	55.0	95.8	48.0	157.0	48.3	51.5	46.9	76.7	58.1	70.1	61.1	22.5	108.6	118.5	61.1	100.5	92.0	78.1	78.6	50.3	75.9	83.6	32.8	98.3
2063	8	49.8	62.2	16.2	156.4	93.8	63.5	43.3	95.9	102.4	47.6	42.5	52.0	16.4	46.2	41.2	64.6	41.3	42.4	126.2	16.2	27.9	79.8	25.5	17.8	53.2	77.0	156.4	118.6
2063	9	56.3	58.7	19.9	106.3	52.6	36.5	61.7	56.1	32.1	99.2	19.9	70.6	95.1	32.5	106.3	60.5	33.9	56.7	93.9	56.5	54.0	59.9	38.5	46.6	33.9	103.9	77.0	30.5
2063	10	33.4	36.7	9.3	75.6	42.1	68.0	24.7	35.9	65.4	62.2	9.3	14.1	24.0	30.1	32.9	38.8	36.0	46.0	20.4	23.2	40.4	28.5	23.7	33.9	55.2	23.5	27.5	75.6
2063	11	31.6	35.3	15.9	76.1	24.0	44.9	15.9	28.0	41.2	31.6	31.5	76.1	24.3	19.0	45.8	52.8	34.9	33.0	34.7	74.6	26.5	24.0	47.1	19.5	23.9	44.0	21.8	27.5
2063	12	36.6	35.9	12.8	68.6	29.0	44.6	35.1	52.7	25.0	12.8	15.7	51.9	43.9	38.2	22.9	29.2	43.3	25.7	39.3	15.9	53.0	68.6	31.6	33.3	41.6	39.6	38.7	30.2
2064	1	25.9	29.5	15.5	77.5	25.6	35.7	41.0	41.7	31.6	22.5	29.9	26.2	21.0	21.6	24.1	18.3	16.1	29.5	15.5	77.5	40.6	40.6	23.9	23.8	29.0	19.5	29.0	23.5
2064	2	22.7	23.8	5.7	45.1	21.6	15.1	16.1	14.5	18.8	29.7	24.8	34.9	37.4	22.5	25.9	23.1	37.4	43.9	23.7	5.7	14.6	45.1	17.9	21.4	9.8	23.0	16.6	26.8
2064	3	26.6	28.2	7.2	59.9	35.0	32.6	21.4	17.5	45.0	34.0	7.6	52.1	48.7	25.8	20.9	23.3	20.4	42.0	59.9	7.2	29.3	9.8	30.2	13.5	27.4	16.1	40.5	15.8
2064	4	14.7	18.9	0.0	44.7	13.8	32.5	38.3	3.8	11.3	3.0	9.2	26.8	44.7	27.4	32.7	5.2	16.6	14.6	9.6	7.0	26.1	44.2	0.0	7.7	33.0	14.7	12.2	19.0
2064	5	35.3	37.5	11.9	73.0	37.1	15.9	37.5	15.8	67.9	64.9	55.0	68.8	30.6	13.5	64.5	42.0	25.7	11.9	32.4	15.5	73.0	39.8	47.3	33.7	30.5	20.2	37.0	20.6
2064	6	61.5	67.5	30.9	149.4	33.4	49.7	66.1	92.2	82.5	59.3	30.9	53.0	122.5	55.1	66.3	109.9	41.0	82.3	31.3	52.3	46.2	90.9	63.7	68.7	149.4	69.6	52.3	51.7
2064	7	82.5	87.5	40.3	217.0	79.4	56.7	40.3	79.7	68.9	128.1	134.4	85.2	217.0	51.3	99.4	69.7	86.3	44.4	100.2	48.1	50.1	96.3	61.4	86.5	120.6	118.9	112.3	65.7
2064	8	65.9	61.0	20.1	92.5	68.4	92.5	62.2	78.7	34.9	73.0	79.2	20.1	33.6	46.5	25.3	73.2	21.9	63.5	77.2	90.5	89.5	33.3	79.7	74.6	54.4	48.4	82.2	61.3
2064	9	61.7	60.9	29.4	101.1	79.4	59.8	101.1	62.0	75.3	80.3	48.9	31.0	70.0	34.6	77.1	55.5	92.9	32.6	65.0	53.2	29.6	29.4	36.3	61.4	72.4	72.3	86.7	55.0
2064	10	37.0	41.0	16.0	72.2	31.1	52.1	23.4	61.4	33.3	34.8	41.0	35.8	72.2	47.7	63.8	30.9	28.9	44.9	37.0	16.0	25.8	34.3	30.0	58.8	37.8	37.5	36.9	68.0
2064	11	32.7	33.4	9.9	70.7	31.8	27.1	14.4	46.8	26.4	38.3	29.2	57.7	40.8	20.6	36.5	36.8	26.1	54.2	16.2	11.7	51.0	70.7	33.7	9.9	37.5	36.9	24.5	23.0
2064	12	31.2	32.0	5.8	57.3	51.8	37.5	5.8	25.4	33.0	48.3	29.3	41.1	41.9	37.2	43.0	25.8	25.2	16.1	13.5	57.3	27.8	21.0	18.7	47.8	35.8	24.9	24.9	34.1
2065	1	32.3	32.8	14.9	67.2	29.2	20.4	26.1	45.5	18.9	50.1	17.5	27.4	40.2	30.2	42.9	39.2	35.5	14.9	45.5	24.1	41.1	17.7	38.5	34.5	35.0	22.1	67.2	23.5
2065	2	20.9	22.0	7.1	56.2	19.7	23.7	21.4	11.0	29.7	23.7	32.4	29.3	15.2	16.2	8.9	10.3	7.1	25.4	56.2	20.3	12.8	37.1	32.3	22.7	10.0	19.0	12.5	30.9
2065	3	18.1	19.0	4.2	34.8	34.8	14.8	28.1	16.6	34.6	29.1	4.2	17.2	6.4	24.4	22.1	18.5	5.4	22.8	23.6	13.5	16.3	23.2	20.8	17.7	16.0	13.3	13.3	19.7
2065	4	23.1	25.3	6.8	59.7	47.0	6.8	18.6	33.6	14.7	12.0	10.0	59.7	11.8	13.7	28.5	33.3	22.5	15.5	21.9	31.6	23.7	27.5	42.0	52.6	12.4	24.6	28.9	15.3
2065	5	34.3	36.8	6.0	80.9	15.1	32.6	17.1	25.7	54.2	41.2	22.9	20.0	18.4	38.7	47.5	21.9	30.8	57.1	30.1	54.0	36.0	80.5	43.4	80.9	54.3	40.2	15.2	6.0
2065	6	56.7	60.9	21.9	103.7	51.2	49.8	46.3	100.4	32.6	51.3	66.6	78.3	63.0	28.7	53.7	91.1	103.7	21.9	59.6	59.8	71.2	37.3	49.2	45.3	99.6	66.7	34.2	99.2
2065	7	72.8	77.0	22.4	146.6	55.9	115.1	95.9	97.5	84.7	118.0	43.2	71.4	146.6	62.1	22.4	69.4	56.9	91.3	92.7	30.2	53.1	112.2	74.2	29.9	103.1	48.4	118.7	55.6
2065	8	57.3	64.1	12.7	151.5	12.7	30.2	102.3	58.7	86.5	45.7	74.5	19.7	70.4	55.8	50.3	79.4	69.3	33.7	33.4	90.1	46.0	54.5	98.0	77.5	55.0	32.8	151.5	109.5
2065	9	59.4	63.0	27.3	108.9	27.3	89.6	54.5	45.6	66.5	89.0	71.1	37.5	93.8	41.1	108.9	39.8	53.9	30.2	79.9	70.0	97.9	97.7	82.6	32.9	56.8	30.5	53.1	62.1
2065	10	34.0	37.4	7.2	79.2	47.2	49.2	7.2	57.5	31.1	27.0	63.5	27.0	40.8	15.1	31.0	26.0	27.4	20.2	55.3	35.2	34.1	52.0	79.2	34.0	20.6	21.1	34.1	61.2
2065	11	36.6	35.8	16.5	53.1	43.2	48.5	26.9	24.1	46.1	29.0	44.7	28.6	34.7	39.7	38.6	41.6	32.2	21.3	36.7	40.0	29.7	49.8	53.1	26.7	32.0	38.7	16.5	36.5
2065	12	30.7	32.6	14.5	58.8	21.6	44.4	58.8	31.9	32.8	53.5	26.1	32.9	29.5	27.6	18.7	25.3	33.0	15.9	35.7	25.0	49.1	47.9	43.6	15.0	28.8	46.7	24.5	14.5
2066	1	23.6	26.6	8.3	53.8	15.5	26.1	20.3	26.2	41.0	51.4	24.7	20.1	48.7	18.7	10.1	30.4	13.8	18.6	34.0	17.1	8.3	22.5	21.2	27.5	35.1	20.9	53.8	32.8
2066	2	18.8	21.3	8.0	59.3	24.4	17.7	13.1	14.5	16.7	13.0	59.3	18.0	21.5	8.6	8.0	13.0	40.1	24.6	29.0	8.3	21.4	26.3	11.4	13.9	29.6	20.6	39.6	19.6
2066	3	19.4	22.8	7.7	63.0	22.9	15.8	7.7	21.2	30.7	23.5	28.7	16.9	12.2	9.1	13.6	42.8	31.8	47.7	63.0	12.9	39.0	19.2	12.6	7.7	29.5	7.7	19.6	10.3
2066	4	21.2	23.7	9.9	45.4	13.7	35.3	25.8	43.3	27.7	15.3	14.4	41.2	14.0	14.2	15.6	9.9	28.5	13.7	16.0	36.8	20.6	27.0	20.0	35.2	23.1	21.8	45.4	10.7
2066	5	33.5	38.2	10.0	99.1	24.0	51.3	37.3	53.7	57.5	50.3	38.1	27.9	30.2	19.4	70.9	33.4	33.6	99.1	39.7	38.6	31.9	30.6	15.3	16.1	10.0	22.2	62.1	23.0
2066	6	58.0	62.0	16.8	186.1	49.6	75.5	186.1	66.9	65.8	76.2	69.3	34.8	59.7	31.9	79.2	20.0	72.2	56.4	56.0	16.8	26.0	37.8	43.7	41.1	72.2	74.4	38.8	137.4
2066	7	74.1	77.2	29.7	134.3	70.3	75.2	35.6	125.0	76.9	92.6	37.3	42.3	66.1	102.7	115.5	133.7	109.1	53.9	35.1	83.3	38.7	72.9	134.3	29.7	128.7	78.5	53.8	61.6
2066	8	55.4	61.7	14.9	121.1	14.9	48.8	42.8	74.8	35.0	51.3	113.8	34.8	73.3	39.4	82.0	56.3	77.1	51.3	112.6	54.5	41.1	87.2	71.3	20.2	121.1	67.6	44.0	66.8
2066	9	69.5	66.4	6.0	113.3	69.9	80.2	86.7	48.8	39.7	31.4	55.3	52.5	113.3	6.0	98.6	69.0	88.5	87.6	62.8	35.6	58.8	105.5	76.0	85.3	75.7	38.7	49.5	77.0
2066	10	36.9	38.6	16.3	97.3	37.5	45.6	41.6	23.1	41.9	51.7	27.7	27.0	33.8	16.3	37.5	97.3	26.4	29.8	54.8	37.9	21.4	30.7	36.4	72.4	48.2	23.1	37.5	27.3
2066	11	31.6	33.7	10.0	63.5	43.5	47.4	63.5	37.8	14.7	59.4	29.7	47.4	18.5	27.6	38.5	49.1	22.6	31.6	31.7	29.8	25.8	42.4	23.8	10.0	38.0	25.0	19.0	31.8
2066	12	27.9	32.1	11.2	74.1	52.9	43.6	27.8	41.6	23.2	28.0	31.1	74.1	21.3	24.4	40.0	21.2	30.7	11.2	27.2	22.3	18.8	24.5	52.3	26.7	39.7	29.8	32.9	25.3
2067	1	20.0	24.5	5.8	76.7	19.8	5.8	17.3	30.9	15.0	76.7	15.2	16.9	27.8	15.4	37.0	38.5	20.1	20.0	7.6	32.9	8.9	30.0	38.6	8.7	24.0	6.7	40.1	32.8
2067	2	22.3	20.6	5.6	49.3	27.4	18.3	11.7	11.4	49.3	33.0	26.4	24.5	23.0	12.6	25.2	7.7	31.8	32.1	9.5	5.6	9.3	21.6	28.0	28.0	11.0	6.5	11.0	29.8
2067	3	15.5	18.9	6.0	56.2	21.7	16.0	10.3	14.3	29.7	56.2	20.5	17.5	8.1	11.8	34.5	8.2	9.4	15.0	12.3	22.0	28.9	17.7	43.0	20.7	8.2	14.4	6.0	6.2
2067	4	21.2	22.6	3.7	44.5	13.1	26.7	9.5	19.1	15.7	31.7	20.9	24.8	37.4	3.7	21.4	27.1	37.8	13.3	22.4	20.8	18.4	44.5	18.8	32.7	25.6	28.7	10.0	17.8
2067	5	35.4	35.4	4.6	84.3	37.2	28.1	48.8	41.2	4.6	34.9	21.4	16.8	41.6	84.3	50.9	60.8	26.8	5.6	15.1	42.9	77.7	18.9	35.6	17.5	25.7	35.1	37.0	41.6
2067	6	52.0	59.6	11.0	158.3	50.3	90.3	158.3	49.6	41.2	11.0	75.0	33.3	74.8	66.7	38.6	20.3	91.9	53.3	88.5	76.0	78.5	50.7	22.9	37.9	76.4	18.5	97.3	29.8
2067	7	66.1	72.1	25.3	161.5	50.6	98.3	80.4	57.6	50.5	25.3	39.0	60.3	81.2	71.7	38.6	37.1	75.1	78.5	47.3	77.3	101.6	161.5	60.4	41.1	151.7	50.9	107.9	86.5
2067	8	67.7	66.0	9.0	122.7	69.1	52.5	122.7	63.1	104.4	9.0	42.2	9.8	80.0	86.5	47.2	26.8	32.9	37.5	26.6	71.5	85.5	87.1	114.3	108.8	66.2	75.4	61.6	103.7
2067	9	49.7	58.6	18.1	119.8	47.3	36.6	44.3	84.4	45.2	119.8	26.0	51.6	92.5	30.5	27.4	48.5	103.7	47.9	28.2	25.7	50.9	107.1	62.6	69.0	57.8	98.9	18.1	82.3
2067	10	34.9	38.3	9.7	86.1	50.4	66.9	38.6	21.3	86.1	54.1	43.0	21.1	31.9	9.7	64.6	37.9	28.4	23.0	66.8	27.9	21.0	23.8	28.6	27.7	44.7	16.3	45.0	41.6
2067	11	39.3	41.1	19.9	77.7	31.3	33.3	26.3	19.9	40.6	40.2	77.7	61.7	39.0	44.4	25.7	34.5	21.9	27.0	61.0	66.1	29.3	62.0	51.3	41.9	37.9	44.2	39.6	29.7
2067	12	33.1	35.8	19.7	72.9	42.0	25.8	27.4	37.1	43.6	22.2	27.7	40.8	26.3	29.9	33.4	32.8	72.9	37.6	29.0	72.2	35.6	40.4	33.7	30.0	42.8	27.7	19.7	28.0
2068	1	24.2	26.6	10.2	47.3	23.5	38.0	26.8	20.6	43.3	21.6	11.1	37.5	21.4	20.7	32.1	17.5	44.7	22.3	10.8	31.4	27.7	23.8	47.3	24.7	10.2	38.0	30.6	13.3
2068	2	23.2	22.1	4.0	41.0	41.0	15.2	38.4	17.0	22.5	22.2	13.7	19.3	5.3	25.0	23.9	13.6	15.9	25.2	32.6	7.2	19.6	25.4	29.4	28.6	31.8	26.6	4.0	26.3
2068	3	19.0	21.8	5.9	49.0	7.9	36.1	42.5	27.7	49.0	38.9	24.2	9.9	14.9	19.2	16.2	9.6	21.2	37.1	14.8	13.5	19.7	18.2	24.7	18.8	14.3	14.2	5.9	25.1
2068	4	22.8	26.0	5.8	53.3	17.4	42.2	30.8	49.3	11.1	9.7	18.8	12.1	15.4	35.7	35.6	18.2	9.7	30.3	5.8	33.2	35.2	13.9	42.7	40.8	23.5	17.1	53.3	22.1
2068	5	50.2	49.3	19.8	90.8	48.1	66.4	59.3	54.5	30.6	90.8	33.9	19.8	60.3	47.4	32.8	54.5	76.3	21.4	45.5	46.5	37.9	62.4	20.6	50.0	56.0	57.1	50.4	61.5
2068	6	60.1	61.3	8.8	120.1	81.1	41.5	75.0	69.6	28.8	39.3	37.7	42.1	110.0	120.1	58.4	86.4	62.6	77.4	82.5	61.1	59.0	23.3	65.9	49.3	98.1	8.8	49.5	43.4
2068	7	78.4	85.3	37.3	181.5	53.7	83.2	119.1	111.5	39.6	112.5	37.9	37.3	54.4	48.7	139.8	65.9	66.0	139.4	120.9	90.0	40.4	66.7	101.7	127.2	181.5	73.6	96.1	40.0
2068	8	65.9	73.4	24.2	157.4	87.6	136.3	64.2	73.5	24.2	42.5	46.3	54.5	85.7	146.8	157.4	99.0	37.0	46.9	115.5	37.5	80.5	66.0	28.4	47.0	90.2	34.9	65.8	92.7
2068	9	57.9	64.8	26.3	145.1	33.5	73.9	38.0	88.2	82.6	29.2	69.0	122.3	89.4	41.2	92.7	38.4	36.0	55.9	31.2	59.8	75.5	26.3	111.2	42.8	145.1	83.6	35.6	55.0
2068	10	33.9	40.0	20.2	84.5	25.6	27.3	33.0	24.6	34.7	20.9	42.7	43.1	31.5	60.7	25.3	51.7	36.5	84.5	30.0	38.2	25.7	56.3	50.3	30.0	59.2	32.3	20.2	76.9
2068	11	39.0	39.1	5.1	62.7	30.4	21.5	25.0	51.8	31.6	44.5	62.7	34.4	37.6	38.4	59.0	25.5	22.1	48.3	45.1	52.0	23.4	58.5	32.4	56.1	53.8	5.1	39.6	40.6
2068	12	32.9	31.6	10.3	55.0	33.4	32.9	47.8	24.2	22.1	35.1	17.1	39.7	32.9	34.7	15.6	24.6	55.0	22.0	34.4	43.5	33.3	36.5	24.3	10.3	51.3	32.3	24.9	31.8
2069	1	28.2	28.1	7.7	50.6	13.1	50.6	31.1	33.9	21.9	23.7	10.5	30.9	27.1	43.4	47.6	46.6	16.1	7.7	49.4	38.8	17.9	29.4	19.2	30.5	17.1	16.5	17.6	34.3
2069	2	20.9	23.2	6.8	58.5	13.0	24.4	14.8	18.4	13.1	19.8	44.7	25.3	22.6	13.1	31.9	6.8	16.6	21.2	34.8	14.7	28.2	20.6	14.3	18.0	58.5	34.1	25.1	23.9
2069	3	24.9	25.4	3.9	54.2	20.3	25.9	27.8	54.2	24.4	52.4	25.9	12.7	31.0	9.8	17.2	3.9	39.3	24.0	24.9	24.9	38.8	37.4	16.2	29.6	21.7	13.6	25.9	7.9
2069	4	19.5	25.8	6.5	77.1	35.4	13.5	6.5	10.1	18.7	12.5	28.5	17.4	44.4	13.9	31.3	47.4	13.8	36.3	12.1	19.2	12.6	58.3	22.8	77.1	38.6	20.1	19.7	9.6
2069	5	41.4	43.6	1.2	89.0	60.0	35.0	29.1	75.4	16.2	1.2	78.1	17.1	70.5	42.1	89.0	33.9	45.5	36.1	55.4	49.8	56.1	11.5	39.6	24.9	55.0	29.8	40.7	54.4
2069	6	69.0	67.7	25.1	126.7	77.0	57.2	72.9	32.7	25.1	29.2	69.0	55.7	60.8	126.7	72.9	72.2	72.1	85.9	69.0	75.0	49.7	55.8	67.1	65.4	125.4	76.1	57.3	74.3
2069	7	68.6	82.1	29.6	203.9	102.3	35.3	55.4	185.7	71.3	45.7	74.5	41.6	146.4	59.9	203.9	42.5	65.2	132.6	70.5	70.3	29.6	104.7	61.9	49.9	117.7	74.0	66.9	61.5
2069	8	70.1	72.8	29.1	163.6	76.4	68.1	82.1	34.1	120.0	94.0	99.4	29.1	43.3	83.8	116.9	70.0	51.2	56.8	41.6	65.5	57.1	80.6	163.6	70.2	75.7	43.1	43.8	80.8
2069	9	61.6	66.2	16.3	123.4	47.2	38.2	49.3	87.1	102.8	49.9	123.4	59.7	80.2	63.6	89.1	92.8	84.7	72.2	40.7	45.1	52.1	70.1	45.0	48.1	92.8	81.8	55.6	16.3
2069	10	36.0	41.3	5.9	89.2	72.3	38.5	27.2	37.6	34.9	35.7	22.9	52.2	5.9	35.7	40.6	62.8	89.2	36.3	89.1	22.5	16.3	29.9	35.8	40.2	76.8	14.8	26.8	47.4
2069	11	42.4	42.4	17.3	85.3	85.3	17.3	51.4	29.1	46.0	43.9	40.9	46.7	56.3	28.4	28.6	35.3	55.6	45.3	31.0	52.5	38.6	41.0	32.7	46.4	53.3	28.8	45.6	36.9
2069	12	31.5	33.4	9.8	57.7	29.4	28.8	22.4	35.1	44.7	40.4	16.5	47.5	9.8	36.7	57.7	29.2	31.6	16.4	18.3	55.6	34.9	31.5	52.9	25.5	47.7	29.7	17.6	41.7
2070	1	30.7	29.6	5.3	57.2	47.4	13.7	27.7	37.2	29.4	11.9	37.7	32.0	33.6	36.7	32.7	38.4	20.8	5.3	33.3	26.6	26.6	21.6	55.7	57.2	21.4	13.0	32.0	19.0
2070	2	23.5	23.7	4.1	52.5	11.6	12.2	11.2	4.1	23.4	27.6	26.2	30.7	41.0	29.6	36.8	18.0	22.5	15.5	30.2	25.0	23.5	29.6	32.7	17.6	52.5	12.1	21.8	14.7
2070	3	18.3	22.5	8.1	55.7	26.1	10.5	17.1	17.2	38.0	8.1	55.7	10.4	19.8	13.1	19.5	20.2	12.2	15.4	35.2	43.0	26.5	12.2	33.6	31.3	15.3	15.3	30.9	12.5
2070	4	24.2	26.6	1.0	73.5	13.6	24.3	41.9	32.5	56.7	16.1	73.5	20.6	16.5	7.6	17.8	28.1	31.7	24.2	14.8	8.8	28.7	26.1	48.5	45.3	12.5	29.7	17.0	1.0
2070	5	45.8	43.2	11.4	92.8	49.9	70.0	55.8	29.2	44.9	44.4	59.8	61.5	27.8	21.6	51.0	23.4	23.1	92.8	49.4	29.1	46.8	48.9	61.3	55.3	31.5	13.1	11.4	35.8
2070	6	52.3	56.2	14.0	115.5	89.3	33.5	45.3	104.0	65.1	70.3	26.0	52.7	14.0	55.0	93.4	59.0	78.8	24.4	68.6	47.2	50.9	43.7	25.2	39.5	115.5	23.3	52.0	71.4
2070	7	68.2	82.9	19.3	191.2	191.0	19.3	122.5	128.8	59.7	52.6	52.8	31.7	191.2	80.0	51.7	43.5	74.2	104.7	45.6	51.7	71.3	65.1	116.1	94.8	173.9	88.5	56.8	20.9
2070	8	66.0	77.4	13.3	145.9	49.1	46.1	52.5	110.5	13.3	67.9	64.1	43.6	92.4	63.0	95.3	145.9	107.4	105.0	78.4	53.5	34.5	114.1	106.4	127.7	136.1	46.1	42.5	62.8
2070	9	62.9	60.1	10.8	102.2	56.3	29.1	35.6	71.9	32.6	98.3	102.2	61.3	100.2	64.5	28.9	69.2	27.8	77.1	58.9	43.1	67.3	49.1	70.6	39.7	81.8	72.7	93.9	10.8
2070	10	37.5	39.8	1.9	99.3	34.7	99.3	19.7	29.0	50.2	29.8	40.8	30.6	63.0	30.1	25.4	43.9	1.9	52.3	37.5	37.4	41.8	31.6	49.0	51.3	39.5	47.5	32.0	37.0
2070	11	37.6	42.1	16.9	70.5	31.3	66.9	31.6	47.4	27.0	25.6	62.7	70.5	36.3	39.1	54.4	45.4	34.7	69.2	33.4	67.5	27.5	56.1	18.2	38.9	33.3	34.3	43.2	16.9
2070	12	31.2	33.6	9.7	56.7	51.2	39.2	29.3	27.6	15.5	35.4	32.4	9.7	23.0	53.7	29.5	27.0	56.7	34.2	30.5	43.1	44.5	32.0	22.1	28.6	44.4	22.5	27.5	47.8

2071	1	27.9	25.6	4.7	53.0	41.9	40.3	8.0	28.0	33.2	36.9	28.1	14.2	4.7	34.2	12.8	36.1	16.8	9.5	12.5	44.0	22.1	20.0	27.8	18.6	32.2	53.0	28.8	10.5
2071	2	19.9	21.5	8.8	54.7	39.0	11.3	8.8	20.9	27.8	31.7	15.6	12.3	18.8	24.8	54.7	19.9	13.1	13.4	14.0	10.0	19.8	31.2	13.6	24.5	31.0	15.2	21.5	23.8
2071	3	21.4	26.8	5.9	58.3	21.6	18.8	30.7	10.3	58.3	37.1	19.9	35.8	11.3	13.8	21.3	18.9	22.8	40.9	21.5	50.9	21.0	10.1	37.3	17.8	51.7	5.9	48.7	15.8
2071	4	26.0	24.3	2.2	60.1	25.1	32.1	2.7	14.2	17.6	49.1	7.4	43.4	32.3	2.2	3.4	5.7	37.5	27.0	28.6	9.4	17.2	22.1	60.1	31.2	46.9	28.9	31.1	8.8
2071	5	29.9	39.3	8.7	94.7	56.6	63.2	20.2	72.7	27.9	18.5	26.9	42.8	83.0	39.9	13.3	94.7	31.9	21.7	13.9	38.6	19.7	71.2	52.3	25.4	19.9	27.5	53.0	8.7
2071	6	45.3	50.9	12.8	104.2	43.2	73.9	52.8	46.3	16.2	82.1	86.1	40.7	104.2	39.4	44.3	34.6	23.1	26.4	64.3	12.8	27.5	67.0	96.1	16.5	51.0	49.7	81.5	43.0
2071	7	71.4	70.5	14.9	112.3	34.7	112.3	21.4	97.5	54.1	62.5	102.4	43.7	100.0	53.7	14.9	106.2	71.1	36.9	107.9	42.6	33.8	80.9	73.5	57.6	112.0	110.0	71.7	91.0
2071	8	47.4	61.3	19.7	176.3	129.5	74.2	48.8	62.6	102.0	62.9	39.0	30.8	19.7	46.0	21.1	72.7	176.3	35.3	38.2	25.8	100.0	42.6	70.5	43.8	40.3	56.2	99.4	33.8
2071	9	68.9	71.4	25.3	140.3	106.9	72.8	25.3	73.0	48.8	100.3	66.9	55.7	70.8	59.8	35.9	89.4	89.9	73.3	140.3	51.4	116.5	65.2	98.4	63.1	77.2	34.8	51.5	47.4
2071	10	43.0	44.7	22.2	81.5	40.9	81.5	22.2	34.7	52.9	24.5	71.7	43.7	62.1	29.7	25.7	23.6	27.1	23.6	44.2	42.4	36.8	48.8	60.3	53.7	70.8	70.1	32.8	49.9
2071	11	38.7	40.9	13.6	71.1	20.9	23.2	21.3	71.1	39.2	29.0	50.0	71.1	13.6	49.0	54.1	55.5	62.5	30.2	17.1	36.6	49.5	37.3	29.4	21.1	67.4	38.2	49.8	44.5
2071	12	31.5	34.6	16.0	78.5	60.9	55.6	43.7	31.6	25.0	20.5	32.3	16.9	18.7	45.2	78.5	16.0	30.3	32.4	23.7	16.7	27.9	38.9	24.4	38.3	46.8	48.5	31.5	26.7
2072	1	26.0	27.2	7.1	51.8	28.2	22.7	19.0	29.6	35.9	7.1	45.9	25.9	32.6	27.7	34.3	18.7	31.2	19.9	10.9	51.8	24.3	26.1	26.5	25.0	43.4	20.2	23.0	22.1
2072	2	18.4	18.7	2.9	39.3	14.0	16.7	17.2	18.9	22.1	13.8	11.3	10.9	18.5	10.5	19.2	18.1	21.4	25.8	27.2	23.3	39.3	22.0	31.5	20.2	15.3	11.0	18.4	2.9
2072	3	24.9	24.9	9.7	43.2	27.5	9.7	18.2	24.0	37.9	35.8	35.2	19.5	43.2	28.4	22.6	15.7	17.8	10.4	28.8	24.8	27.1	20.2	32.6	17.4	25.9	23.5	25.0	27.0
2072	4	22.4	23.8	0.0	47.9	43.6	15.3	30.1	32.8	22.1	19.7	30.8	9.1	19.8	15.1	5.2	17.5	7.8	29.9	40.5	0.0	34.9	28.0	17.9	35.6	47.9	31.9	12.9	22.7
2072	5	35.3	38.1	14.0	101.8	101.8	49.1	77.0	40.0	52.0	24.9	84.7	44.1	20.6	23.7	35.3	14.2	20.1	14.8	36.7	36.4	24.1	22.5	15.7	48.3	35.2	42.9	14.0	35.2
2072	6	66.2	67.4	18.6	173.3	39.7	54.0	80.1	64.4	90.6	27.9	92.4	81.7	78.9	56.0	75.4	24.3	39.5	26.4	55.0	67.9	103.0	86.9	173.3	37.7	82.4	107.3	53.4	18.6
2072	7	67.1	75.4	25.8	168.0	109.8	75.4	55.8	168.0	124.3	99.0	54.1	56.6	117.2	46.9	36.4	81.6	79.1	25.8	44.9	137.2	86.3	73.0	45.9	31.0	30.0	133.0	61.1	37.0
2072	8	70.5	66.1	18.4	110.8	50.8	54.9	80.3	69.8	45.7	21.7	87.4	86.8	40.9	18.4	74.6	54.8	83.1	58.8	36.7	110.8	75.0	99.0	110.1	52.8	38.7	71.2	79.4	83.7
2072	9	61.8	61.0	15.2	141.2	141.2	15.8	44.6	18.7	41.4	62.5	118.8	104.1	69.9	65.2	63.2	50.0	85.5	61.2	39.7	85.0	72.6	38.3	65.9	53.9	94.9	26.0	30.9	15.2
2072	10	39.2	40.2	24.2	78.6	36.5	40.1	46.9	24.9	34.1	40.5	31.2	37.6	27.4	26.2	54.3	38.4	45.0	48.0	50.4	26.7	33.1	24.2	78.6	41.2	41.8	56.8	42.6	37.5
2072	11	37.1	38.8	6.0	74.3	32.0	51.1	25.6	6.0	36.1	34.6	38.2	54.3	17.4	34.1	23.9	56.7	45.4	46.8	44.4	43.7	36.0	29.6	54.2	59.8	24.5	17.3	46.1	74.3
2072	12	33.9	35.3	12.7	84.8	59.8	13.8	29.3	37.8	37.8	46.3	20.2	39.6	33.8	33.5	30.1	12.7	48.7	36.4	27.8	25.0	27.1	20.7	46.3	27.4	38.7	33.9	34.8	84.8
2073	1	24.5	28.6	7.7	67.1	15.8	19.7	45.0	29.5	17.8	33.3	17.4	28.0	7.7	51.1	40.0	36.8	40.1	15.8	14.0	29.3	19.3	23.7	67.1	25.2	48.1	22.9	18.3	20.0
2073	2	20.4	21.9	6.2	47.2	16.2	31.4	19.8	25.5	22.7	27.9	22.0	15.6	25.5	15.5	33.6	13.1	17.9	29.8	36.3	16.7	21.0	19.2	16.3	13.3	47.2	6.2	11.0	21.8
2073	3	20.5	23.0	6.7	63.8	11.8	12.5	21.6	12.3	6.7	28.2	13.9	28.7	20.4	11.9	21.9	16.3	20.6	23.9	63.8	26.7	36.5	11.0	29.1	47.9	16.2	14.6	42.2	13.9
2073	4	26.1	23.8	4.6	49.7	26.3	4.6	40.4	6.7	35.6	11.5	12.4	30.7	39.0	18.3	14.5	26.9	21.1	40.7	28.4	28.0	15.3	25.9	28.1	13.4	49.7	16.4	28.5	8.2
2073	5	29.2	37.8	10.0	89.0	24.1	86.7	68.2	39.8	29.5	65.9	51.2	12.3	17.7	32.4	60.6	68.5	89.0	18.5	21.8	28.9	12.6	10.0	19.4	53.0	46.0	13.9	28.0	10.1
2073	6	52.5	50.8	8.9	97.0	54.1	42.4	62.0	20.2	97.0	32.4	75.9	30.6	77.6	52.5	52.5	57.2	34.3	19.8	23.8	65.3	59.1	8.9	50.4	71.9	96.2	70.6	20.9	43.1
2073	7	80.2	78.7	26.2	147.0	119.3	83.1	44.5	47.9	108.0	101.6	51.5	53.9	94.6	26.2	100.8	36.4	60.0	110.2	77.3	60.2	88.5	147.0	121.7	27.6	122.8	90.8	74.7	40.3
2073	8	58.7	65.8	33.7	127.3	46.5	33.8	122.6	40.2	84.2	67.4	36.9	44.8	74.7	83.1	37.7	56.7	33.7	58.3	82.8	127.3	34.9	57.7	87.9	59.0	112.4	73.9	66.9	56.3
2073	9	65.7	69.2	12.1	129.3	47.0	59.7	62.8	95.3	89.7	84.5	129.3	110.0	102.4	53.3	12.1	23.5	69.9	34.4	59.4	47.6	111.6	46.7	124.0	68.7	71.8	70.0	36.3	50.6
2073	10	34.8	37.8	12.6	66.2	55.1	24.9	58.4	47.7	14.3	31.9	46.4	41.5	40.4	66.2	29.5	56.0	33.0	14.1	50.2	33.9	33.1	44.9	12.6	35.8	60.9	16.3	30.1	29.3
2073	11	35.3	35.4	10.5	62.5	37.4	34.0	52.8	21.2	36.6	27.0	42.6	62.5	29.5	38.9	33.4	24.1	10.5	27.1	52.9	47.0	20.9	38.9	44.0	22.8	29.9	49.5	36.6	30.6
2073	12	31.2	31.6	8.4	60.5	60.5	40.2	21.1	20.0	24.7	28.4	34.6	31.5	12.4	57.8	45.9	44.8	31.0	21.1	10.9	41.6	8.4	37.6	43.6	25.6	38.2	34.9	24.6	18.3
2074	1	25.7	27.4	7.6	51.0	27.7	31.4	24.7	25.7	16.7	29.4	31.5	16.3	40.6	25.8	21.7	32.7	21.6	41.3	20.3	28.8	23.3	12.9	7.6	43.0	41.2	51.0	21.9	20.1
2074	2	24.4	24.6	5.4	43.3	27.8	21.1	25.5	25.1	21.4	24.3	34.7	43.3	12.4	10.8	31.0	23.9	12.1	37.6	5.4	13.4	21.2	43.0	35.9	24.5	17.0	27.9	12.2	39.1
2074	3	20.3	22.2	3.7	45.1	21.3	11.2	18.8	20.3	25.1	18.5	34.4	17.9	22.6	12.1	43.0	3.7	12.7	23.7	29.9	45.1	7.9	15.6	22.4	45.0	17.8	23.0	20.4	19.5
2074	4	24.8	28.1	3.0	58.5	10.0	46.2	47.8	46.0	11.9	23.9	3.0	26.3	14.7	6.5	22.0	43.3	58.5	47.1	57.9	22.8	18.0	42.8	11.0	19.1	28.4	25.7	25.8	16.5
2074	5	32.2	36.3	1.1	115.9	25.6	25.1	115.9	31.3	24.1	49.0	33.0	34.2	25.9	41.2	47.6	11.1	39.5	9.9	25.1	47.7	28.8	52.1	27.2	13.2	1.1	44.5	46.4	70.9
2074	6	57.2	59.7	15.4	144.3	68.3	71.6	75.1	25.9	49.8	27.5	30.5	61.3	144.3	67.0	25.7	41.3	56.0	34.7	131.2	58.4	64.1	124.0	76.1	15.4	52.3	44.4	29.3	58.6
2074	7	80.6	82.7	40.5	191.8	100.3	45.8	101.8	40.5	108.2	87.2	85.5	61.8	100.7	89.1	46.1	61.9	76.1	80.9	98.1	78.1	46.3	152.5	43.1	50.6	80.4	102.3	56.6	191.8
2074	8	67.2	68.5	11.9	158.5	69.7	68.3	72.1	17.7	126.7	61.0	32.0	95.2	158.5	78.7	51.3	11.9	43.0	66.1	43.9	43.3	24.0	106.5	118.3	38.1	83.1	36.7	92.8	105.2
2074	9	74.7	74.6	22.3	136.1	61.2	128.7	52.2	136.1	107.4	77.8	56.7	79.0	113.3	69.2	81.8	44.8	29.5	32.8	119.2	102.2	88.9	71.6	54.1	22.3	49.0	86.8	82.8	42.6
2074	10	39.9	39.3	19.6	70.8	23.7	33.2	41.2	39.0	48.6	40.9	42.4	47.1	45.7	21.7	32.3	19.6	51.4	32.5	45.2	70.8	42.8	52.3	35.5	25.1	29.0	59.9	29.7	34.3
2074	11	32.6	35.8	18.4	62.9	35.6	49.0	25.3	29.8	18.9	60.1	61.0	37.0	28.4	62.9	30.0	52.4	35.1	29.9	40.3	23.6	18.4	37.9	47.2	25.9	28.3	19.8	25.1	36.8
2074	12	36.3	33.0	9.0	63.2	36.3	18.1	36.2	63.2	29.9	46.8	47.7	37.3	27.8	43.8	39.1	36.5	42.8	29.6	28.4	13.5	9.0	47.0	20.2	16.3	43.3	27.4	41.0	11.7
2075	1	28.3	31.2	14.7	77.2	18.0	43.3	14.7	23.8	22.9	21.2	23.7	22.7	40.6	15.4	21.2	34.5	44.1	23.1	29.3	38.4	35.1	39.2	77.2	27.3	32.9	33.8	24.7	41.8
2075	2	21.1	23.8	7.2	50.5	7.2	7.2	17.0	15.9	30.3	15.5	28.5	17.9	47.1	20.7	50.5	16.6	25.4	35.9	34.8	26.9	26.1	17.3	32.3	29.1	18.8	21.6	15.0	14.1
2075	3	20.8	23.6	2.9	73.8	9.7	30.9	23.2	21.4	61.9	24.2	27.0	19.6	38.0	9.8	16.8	6.6	2.9	29.2	22.1	14.8	15.0	27.1	19.2	73.8	19.3	20.2	11.8	22.2
2075	4	15.8	19.8	2.4	50.1	27.2	11.2	24.7	7.5	16.2	7.3	6.2	33.7	8.4	9.5	8.9	2.4	8.3	15.4	39.0	27.0	3.9	26.7	13.0	26.2	41.2	34.4	50.1	27.3
2075	5	30.5	37.1	1.4	90.2	33.2	10.4	55.5	27.4	21.1	45.1	27.5	16.5	90.2	22.4	57.4	65.8	73.5	10.8	27.8	44.9	21.7	41.9	71.0	28.1	43.2	33.0	1.4	20.1
2075	6	47.8	52.8	17.4	136.2	57.6	65.9	57.7	55.6	60.0	136.2	20.2	24.8	110.9	17.4	39.5	28.1	70.1	38.9	37.5	49.3	38.4	33.1	89.3	46.3	27.5	67.5	24.1	70.8
2075	7	72.0	81.2	23.4	170.2	115.2	63.4	99.6	55.3	122.0	104.3	60.4	107.4	119.1	36.8	135.0	58.0	83.6	82.9	71.8	170.2	69.8	51.9	67.7	23.4	49.9	89.4	72.3	38.6
2075	8	55.3	60.4	26.1	132.2	76.6	90.8	72.1	84.3	73.7	65.1	45.4	37.0	59.1	47.9	132.2	47.7	29.9	51.4	31.3	69.6	47.4	43.5	80.6	28.4	35.7	99.0	74.5	26.1
2075	9	61.5	69.8	22.9	189.4	189.4	109.0	68.6	63.0	147.3	48.8	105.3	37.2	40.5	58.0	62.4	42.1	33.8	75.0	79.3	105.1	34.4	73.0	50.4	60.6	100.0	22.9	45.6	23.0
2075	10	40.2	37.6	8.2	72.8	20.5	32.7	31.5	27.6	44.7	57.0	22.4	9.8	39.7	41.6	55.8	17.5	19.6	35.3	72.8	56.2	40.8	46.8	48.0	8.2	47.9	46.5	23.5	55.1
2075	11	35.9	37.8	12.5	63.3	28.2	63.3	12.5	28.6	30.1	49.5	51.6	35.6	24.1	22.5	27.3	54.3	47.1	24.8	29.5	37.2	15.1	52.2	51.6	48.8	46.8	36.2	33.8	57.3
2075	12	28.7	30.7	13.0	70.5	29.2	21.1	24.6	47.2	35.1	70.5	27.3	54.4	14.4	29.0	28.4	30.8	35.4	38.0	25.6	27.8	19.1	30.1	14.9	35.2	13.0	26.9	33.7	25.2
2076	1	22.3	27.2	6.8	74.2	46.0	28.2	15.2	6.8	21.7	20.6	16.0	15.9	10.8	21.3	24.8	43.4	12.4	27.6	26.6	74.2	39.0	22.9	65.3	20.0	36.8	8.1	31.3	17.8
2076	2	22.0	22.9	8.7	45.5	16.1	17.8	20.9	30.2	15.7	29.7	18.5	27.9	17.6	11.9	45.5	9.2	34.7	23.7	34.3	8.7	26.0	23.0	27.8	14.9	20.7	28.8	17.5	27.9
2076	3	19.1	22.2	3.3	54.0	18.4	5.2	16.6	12.5	53.3	42.5	32.0	22.2	54.0	19.0	19.2	26.4	26.0	7.6	46.5	13.4	31.5	5.3	12.5	21.7	22.7	15.3	5.2	3.3
2076	4	24.9	28.2	5.7	69.1	23.1	7.5	21.1	9.4	5.7	17.7	53.5	39.8	25.9	40.3	37.0	12.9	10.6	48.3	21.6	69.1	14.3	23.9	53.0	18.7	27.8	37.9	29.9	27.6
2076	5	40.2	41.5	11.5	68.7	11.5	47.9	38.6	61.4	34.9	37.7	51.0	67.9	65.1	41.8	17.3	32.0	61.9	33.3	37.1	68.7	45.6	45.9	52.3	12.9	22.6	58.3	31.4	19.5
2076	6	50.3	59.8	10.8	143.7	72.7	29.9	96.5	127.1	34.4	66.6	28.4	143.7	66.0	35.5	46.9	79.3	86.6	47.0	92.0	40.6	53.6	37.5	68.4	43.4	54.2	44.6	28.8	10.8
2076	7	61.9	67.3	17.9	122.5	80.7	70.6	102.6	57.9	51.7	36.2	34.7	81.2	59.9	17.9	118.5	64.6	56.6	98.1	70.2	47.9	88.8	122.5	81.3	53.7	51.8	64.0	49.2	55.2
2076	8	54.4	67.0	16.4	126.4	126.4	45.3	99.1	52.7	106.6	63.3	33.3	42.2	43.8	105.7	32.4	16.4	61.8	55.3	44.5	53.4	87.8	120.3	46.9	73.2	112.9	35.5	110.0	39.8
2076	9	72.5	76.8	30.2	176.9	55.2	53.7	101.3	77.9	79.8	133.3	45.9	176.9	86.8	85.8	77.7	43.7	67.2	38.9	47.5	93.6	112.3	48.4	51.2	30.2	92.3	52.7	50.5	140.0
2076	10	37.1	40.3	9.4	75.3	75.3	34.1	23.2	55.3	33.7	40.3	44.6	64.3	20.0	43.9	38.2	56.1	14.1	53.3	36.0	33.5	31.3	51.6	9.4	60.7	18.7	30.6	26.8	72.4
2076	11	33.3	37.1	10.5	67.6	51.0	30.9	31.2	32.0	36.4	40.4	34.0	53.9	34.6	27.0	39.5	40.5	29.5	28.0	59.7	24.1	67.6	29.3	27.0	10.5	50.1	32.3	32.6	48.4
2076	12	27.3	27.8	9.3	52.8	37.5	46.3	33.6	52.8	46.8	31.5	20.0	29.1	9.3	24.2	12.1	30.0	47.7	18.7	30.6	19.6	12.9	30.0	16.3	21.4	34.1	18.6	18.3	25.5
2077	1	28.9	30.0	9.4	66.6	45.4	27.7	13.8	27.2	41.7	33.6	30.1	17.9	23.8	41.6	32.8	20.7	34.3	9.4	44.8	66.6	18.2	17.9	50.3	16.9	42.5	31.7	19.2	10.9
2077	2	23.2	21.8	3.0	39.8	29.7	16.9	3.0	39.8	31.3	14.4	23.2	16.5	13.4	16.2	23.2	16.4	29.4	26.5	27.5	29.5	32.3	10.6	26.1	9.8	19.8	15.3	23.4	30.1
2077	3	20.4	22.7	12.5	45.4	15.3	16.4	19.8	21.0	17.0	34.9	14.2	27.4	14.6	13.2	33.4	30.1	13.8	14.8	22.8	16.7	17.6	22.7	24.6	27.2	31.1	12.5	45.4	37.8
2077	4	21.8	22.8	2.5	56.3	6.8	7.9	18.0	30.7	9.4	16.1	2.5	33.4	24.5	32.1	31.5	9.3	10.2	18.8	21.4	25.2	18.6	38.5	27.4	56.3	28.9	22.2	48.9	8.7
2077	5	34.4	36.8	14.3	65.4	43.1	38.3	65.4	16.8	14.3	34.5	29.7	53.7	27.6	19.8	44.6	21.6	34.2	48.5	28.6	56.2	49.7	31.1	34.3	49.7	33.0	19.8	40.4	48.9
2077	6	49.9	51.8	8.4	124.9	35.4	67.4	42.0	35.1	66.1	32.1	54.4	51.5	56.7	65.1	51.0	8.4	48.9	38.4	19.0	124.9	44.4	75.2	75.1	10.5	85.9	86.6	28.4	41.7
2077	7	66.6	69.7	24.0	134.4	89.0	58.7	24.0	134.4	118.4	32.3	36.4	73.1	80.3	97.1	38.4	66.8	68.7	90.2	42.2	45.7	59.6	91.2	65.9	62.9	97.9	65.3	69.2	66.4
2077	8	55.6	61.4	17.3	109.6	78.4	106.1	43.7	106.8	53.5	34.2	31.8	81.8	109.6	48.5	106.6	77.8	20.5	28.6	17.3	43.1	35.6	62.5	56.3	54.8	64.9	94.3	33.9	83.4
2077	9	57.0	60.6	12.3	120.3	120.3	40.8	76.7	55.7	83.7	12.3	97.8	64.7	107.2	36.5	48.4	19.3	58.3	75.3	33.5	92.1	68.2	40.5	49.3	67.1	119.0	29.7	24.0	33.7
2077	10	35.0	36.5	1.6	74.7	52.5	30.3	35.0	32.3	74.7	32.7	44.4	27.6	36.0	47.0	34.6	1.6	59.4	42.0	39.4	28.0	37.5	35.0	30.1	47.5	22.2	21.2	28.1	36.2
2077	11	29.7	33.1	12.3	60.5	30.5	28.8	13.8	12.3	16.6	38.3	31.0	27.0	17.7	45.7	60.5	26.9	49.0	55.6	42.1	38.7	23.1	54.0	52.0	17.9	59.0	14.0	12.3	28.7
2077	12	32.5	35.4	9.8	67.0	67.0	17.7	9.8	52.2	33.2	29.9	36.8	25.4	42.9	45.7	40.0	37.7	31.7	38.7	27.7	22.9	31.1	29.4	28.3	25.2	57.4	14.8	66.4	37.4
2078	1	28.1	27.7	9.5	54.8	27.6	16.2	45.0	29.9	28.7	19.8	21.9	26.8	9.5	31.9	36.1	26.3	17.7	15.9	54.8	20.7	15.7	43.4	29.8	31.0	10.1	34.8	37.6	32.6
2078	2	23.7	22.1	2.9	36.8	16.9	11.6	15.0	26.7	28.2	30.9	33.7	21.2	3.3	26.9	12.4	16.3	28.4	28.6	18.0	2.9	35.1	23.0	31.0	36.8	28.9	11.2	24.5	18.6
2078	3	18.4	22.9	5.4	46.1	18.0	18.5	38.6	7.6	46.1	15.9	17.2	20.9	34.1	12.4	33.0	29.1	17.5	22.5	13.7	32.0	29.0	17.6	15.5	42.4	29.8	5.4	14.6	18.4
2078	4	20.4	24.3	4.6	93.0	22.4	19.0	18.7	30.7	5.8	23.2	14.8	39.9	93.0	10.9	19.5	11.8	20.1	27.4	40.3	28.9	16.8	21.3	30.1	10.4	20.8	4.6	43.6	8.3
2078	5	34.2	41.9	8.6	104.7	60.7	11.9	8.7	31.0	96.7	11.5	49.4	71.9	104.7	32.1	17.3	25.1	62.4	60.6	32.9	64.7	28.3	28.7	35.6	46.5	40.3	8.6	16.7	58.7
2078	6	62.2	63.2	13.8	136.0	14.1	31.7	42.6	31.2	73.2	82.6	13.8	27.3	89.8	81.3	108.1	87.2	95.2	54.8	64.9	91.1	54.1	27.3	132.2	68.4	32.2	136.0	17.4	59.5
2078	7	70.8	81.4	16.1	183.0	41.9	16.1	70.5	59.7	183.0	86.0	48.8	43.5	161.1	93.7	76.8	131.5	59.5	64.3	125.9	85.6	71.2	97.7	82.4	63.3	28.4	51.8	59.9	151.3

2078	8	62.0	68.6	23.6	125.2	64.9	23.6	114.2	40.7	121.5	112.2	27.9	43.4	58.9	36.2	125.2	80.1	49.7	49.2	113.9	59.1	77.6	65.1	27.9	47.5	45.0	115.7	73.6	73.3
2078	9	62.4	68.6	30.8	137.8	137.8	54.2	80.2	62.4	30.8	54.5	114.0	73.0	112.0	82.7	38.9	60.4	32.6	40.9	71.3	108.7	45.8	85.2	85.0	62.4	44.3	74.5	41.0	52.8
2078	10	31.4	38.1	3.5	83.6	28.4	64.6	21.1	34.9	81.4	46.0	18.6	3.5	12.4	32.8	83.6	29.9	40.5	20.3	48.7	72.9	25.4	30.0	49.8	23.7	27.4	54.5	28.4	35.5
2078	11	37.2	37.9	14.8	66.9	29.4	14.8	34.3	46.0	66.9	47.5	57.6	33.1	31.3	33.8	55.1	41.1	59.1	22.0	19.6	49.9	25.0	40.2	43.3	48.1	30.4	25.0	15.0	40.6
2078	12	28.7	31.9	10.5	54.0	28.8	19.3	50.3	49.9	42.4	54.0	39.8	13.9	13.0	53.2	32.7	19.6	45.7	17.1	49.5	10.5	28.6	27.6	21.6	47.0	36.2	18.4	22.6	22.9
2079	1	26.9	28.0	9.5	51.6	24.8	31.7	28.6	27.8	38.8	51.6	46.1	27.6	25.8	9.5	37.6	34.8	27.0	26.7	20.4	22.1	19.2	19.0	45.8	33.3	13.6	23.4	17.7	20.2
2079	2	23.6	26.3	11.7	56.7	25.0	33.9	56.7	22.1	28.8	21.0	22.7	36.4	36.0	11.7	26.1	31.1	21.1	11.8	32.8	19.1	16.4	20.8	35.9	38.3	24.4	19.4	17.3	22.0
2079	3	17.0	19.7	6.6	47.4	45.8	15.4	29.3	13.8	23.3	9.2	14.4	14.1	17.2	11.4	24.4	6.6	14.5	47.4	19.2	16.7	23.8	16.6	18.0	21.9	16.8	20.8	14.8	17.8
2079	4	16.0	18.0	1.8	38.7	38.7	12.1	15.3	11.2	18.2	37.1	33.0	23.0	5.6	12.5	10.2	28.6	21.3	37.5	19.0	18.6	14.4	3.9	10.6	16.7	21.9	6.0	14.7	1.8
2079	5	30.2	33.5	15.0	64.2	19.0	34.1	49.0	19.4	24.0	15.0	28.8	17.2	27.5	31.5	24.3	26.7	36.1	50.7	43.1	49.3	33.6	20.3	26.1	34.5	60.3	64.2	20.6	48.7
2079	6	46.9	55.8	10.4	136.2	47.5	104.0	91.1	34.9	85.8	97.7	11.9	46.3	79.9	34.0	45.7	66.8	20.9	23.3	52.1	55.1	61.3	83.8	39.8	36.3	10.4	33.3	41.2	136.2
2079	7	74.3	81.7	24.4	184.4	96.7	63.8	133.2	46.3	88.5	184.4	24.4	43.1	164.0	66.4	50.2	74.4	93.0	98.1	55.3	107.5	100.2	54.0	75.8	93.0	74.2	57.0	64.0	53.1
2079	8	48.7	59.3	16.4	162.4	55.8	162.4	62.7	102.7	71.3	60.8	28.1	32.7	36.3	65.9	107.3	35.5	30.8	50.4	16.4	90.4	27.2	46.9	103.0	93.7	35.1	31.9	37.0	38.0
2079	9	68.3	71.0	28.1	120.4	47.1	64.1	85.6	68.5	99.8	68.1	57.2	73.3	82.4	28.1	31.9	54.2	62.5	89.1	60.0	64.1	114.5	79.7	70.4	120.4	72.3	64.1	49.6	98.0
2079	10	29.5	32.7	15.7	65.9	52.9	25.7	23.2	19.7	32.5	30.7	28.6	45.1	30.2	41.2	35.1	27.7	45.7	15.7	65.9	19.8	25.4	42.0	36.7	28.3	28.7	27.6	23.7	33.8
2079	11	40.9	41.1	11.4	88.0	50.8	17.7	11.4	22.4	42.2	39.6	88.0	34.5	73.0	55.1	23.8	54.5	25.6	47.4	24.9	19.7	75.3	49.4	42.4	24.0	55.0	44.2	34.5	31.5
2079	12	34.4	32.9	12.1	52.9	39.9	33.0	24.8	44.4	50.5	35.3	36.9	12.1	33.5	17.0	41.4	46.6	40.1	28.6	25.2	52.9	19.3	35.2	25.6	28.0	15.7	41.0	39.8	24.1
2080	1	23.5	25.3	9.5	55.3	32.5	9.5	19.1	55.3	19.6	19.5	24.3	28.8	23.8	21.7	25.3	23.1	23.1	30.2	12.2	34.2	37.0	42.8	36.1	11.5	10.1	18.2	30.9	17.3
2080	2	23.5	27.2	6.6	66.9	66.9	21.8	37.4	14.3	28.6	32.4	29.1	39.1	21.0	6.6	19.3	60.8	16.0	24.7	29.5	16.0	22.4	17.9	20.0	26.0	11.9	19.9	37.2	34.0
2080	3	19.7	23.0	2.1	52.4	12.4	8.7	52.4	21.0	44.5	16.0	28.2	14.0	2.1	20.7	18.7	24.3	32.6	13.3	11.2	9.9	14.8	33.2	47.2	15.0	3.8	37.6	43.2	26.8
2080	4	23.6	25.6	3.3	71.6	28.4	16.4	36.5	19.6	9.7	38.2	3.3	30.8	6.5	39.7	20.6	24.8	16.7	23.2	5.3	24.0	41.9	41.1	19.1	8.8	17.5	45.7	71.6	25.8
2080	5	39.5	45.8	13.5	137.7	63.2	36.2	70.3	37.8	41.1	137.7	25.1	27.3	34.5	17.4	75.9	52.9	42.2	13.5	43.8	57.3	29.1	18.8	83.4	28.2	56.9	20.0	26.8	58.5
2080	6	54.8	50.7	12.5	119.0	61.6	67.2	119.0	65.9	56.8	62.2	23.9	12.5	77.8	26.4	33.5	57.1	53.3	26.0	33.9	57.6	77.9	23.4	30.1	23.2	38.2	55.7	53.9	80.1
2080	7	78.3	78.6	30.7	133.9	77.4	47.2	95.6	65.1	66.3	43.1	64.6	80.8	79.1	81.4	39.9	85.4	68.5	107.4	30.7	57.1	103.2	58.8	77.0	99.2	118.8	133.9	118.5	87.6
2080	8	55.5	64.9	18.9	157.5	103.1	27.0	44.0	79.1	50.9	18.9	79.4	24.5	56.3	157.5	38.7	65.1	39.8	53.3	58.9	102.4	140.7	71.6	79.5	54.7	46.2	38.3	80.8	46.6
2080	9	57.8	61.5	17.3	109.2	109.2	41.8	89.9	95.5	17.3	26.5	51.5	104.3	57.4	80.5	45.0	37.0	19.9	25.6	67.3	98.7	77.9	57.5	98.7	58.1	91.4	59.9	41.5	22.8
2080	10	36.0	38.0	11.9	78.9	23.7	54.5	51.4	32.3	29.5	40.3	24.3	39.6	42.1	78.9	18.8	20.5	50.4	27.3	21.1	54.8	58.9	11.9	71.7	44.4	41.0	32.4	20.3	22.2
2080	11	36.6	38.1	14.9	73.4	19.0	65.0	46.1	22.1	26.0	24.6	50.3	39.8	56.7	30.1	58.5	14.9	46.7	73.4	36.1	44.2	20.4	42.8	25.7	37.2	27.4	34.8	24.4	46.9
2080	12	33.1	31.6	6.4	57.7	39.2	27.7	27.1	33.6	6.4	38.9	39.7	43.9	18.8	57.7	32.9	53.2	20.7	29.6	15.8	6.7	12.7	25.7	51.0	34.4	34.3	33.4	30.2	43.6
2081	1	28.1	30.3	16.0	55.4	26.8	27.7	16.0	23.0	27.3	28.6	38.2	30.8	42.9	25.9	31.1	36.8	28.6	29.0	25.4	55.4	21.2	18.9	51.9	27.7	30.6	16.0	23.3	44.8
2081	2	19.1	22.9	4.3	47.4	45.7	17.5	16.6	15.0	18.5	19.3	25.2	29.6	41.5	16.2	4.3	20.7	15.6	47.4	25.0	17.6	31.2	11.6	23.5	18.8	17.6	18.1	19.7	33.9
2081	3	23.5	22.7	4.7	50.9	11.2	8.5	9.4	26.0	12.7	33.0	15.0	24.0	37.5	15.9	17.1	25.9	21.7	20.9	38.0	23.0	24.5	34.2	4.7	50.9	25.2	14.5	26.0	24.7
2081	4	20.9	23.5	2.4	59.6	22.6	17.5	23.7	17.6	26.3	17.0	17.5	21.6	31.6	17.7	15.9	17.1	16.8	34.4	33.9	7.1	38.2	41.7	24.9	59.6	20.3	2.4	29.2	10.4
2081	5	39.9	40.1	5.1	99.9	45.7	37.4	99.9	61.8	25.6	42.4	43.8	44.1	48.2	70.2	32.0	16.6	44.0	12.7	30.8	44.6	29.7	81.2	5.1	63.0	23.5	28.0	17.7	15.5
2081	6	40.5	49.0	15.9	88.5	51.6	23.9	72.6	52.5	88.5	62.5	35.4	80.4	75.8	38.8	34.5	71.4	31.6	32.8	37.0	40.7	30.6	78.3	40.4	45.2	74.5	22.0	40.3	15.9
2081	7	73.2	75.6	29.6	135.9	81.3	129.3	72.8	76.3	135.9	96.4	29.6	76.4	116.6	65.9	37.1	53.1	100.7	61.3	119.5	73.2	48.1	73.2	74.7	88.0	72.8	29.8	59.0	42.4
2081	8	43.2	50.4	10.3	115.3	62.0	63.1	41.8	30.5	47.1	115.3	37.2	21.6	72.9	29.6	51.7	31.8	74.9	40.4	10.3	50.5	43.7	85.7	92.9	42.0	44.7	42.6	39.8	36.9
2081	9	58.7	73.0	19.4	209.2	209.2	58.9	111.9	106.0	60.2	69.9	129.0	39.3	108.4	19.4	42.0	54.9	44.3	52.3	132.7	38.8	31.1	45.2	111.7	58.4	42.0	62.5	91.9	33.0
2081	10	34.4	37.1	11.8	72.0	39.4	17.2	48.4	22.8	66.1	18.0	32.0	47.3	28.4	35.5	34.9	33.3	43.7	43.2	56.9	36.8	32.4	49.0	11.8	33.9	33.5	29.2	72.0	24.1
2081	11	35.9	37.1	14.3	60.9	49.9	36.4	17.9	29.3	26.7	49.3	27.2	44.7	14.9	51.5	53.5	26.9	44.5	40.4	57.1	14.3	39.4	33.4	60.9	32.7	35.4	32.8	28.8	43.7
2081	12	30.8	34.2	8.1	56.5	52.7	44.9	30.3	21.1	48.9	23.9	33.5	56.5	27.1	22.0	38.2	21.3	43.7	25.8	8.1	31.2	24.0	20.8	47.1	30.4	55.7	34.9	24.9	53.5
2082	1	26.6	29.0	9.8	50.6	21.1	10.0	29.3	47.9	43.9	19.6	21.1	22.0	18.3	21.5	34.8	50.4	32.3	50.6	26.4	23.6	22.7	26.8	42.6	12.9	31.0	36.7	39.7	9.8
2082	2	22.7	25.2	10.3	45.9	25.2	45.9	26.4	15.9	22.5	37.8	40.1	40.2	18.9	26.2	30.3	10.3	12.3	22.2	22.9	20.5	10.5	16.7	26.8	41.6	17.9	22.3	33.3	18.3
2082	3	25.1	24.6	8.4	48.1	30.1	8.5	32.4	34.1	41.4	43.8	12.5	8.4	10.8	19.3	48.1	25.1	23.6	37.3	26.5	26.3	31.4	19.2	32.7	25.2	12.0	10.7	15.0	16.6
2082	4	23.0	27.1	4.1	58.3	19.7	24.4	45.1	54.0	58.3	18.0	14.6	35.2	8.9	22.6	19.4	31.3	14.4	44.5	30.8	22.2	27.0	21.4	4.1	50.6	9.1	23.5	35.4	17.0
2082	5	34.4	37.3	9.7	67.5	26.1	34.9	39.2	23.7	62.0	26.8	53.0	25.6	26.1	67.5	9.7	15.9	45.8	64.1	36.8	56.7	26.5	12.4	65.2	45.1	23.1	25.0	51.0	34.0
2082	6	65.2	63.1	23.0	119.8	74.6	23.0	97.3	72.7	32.6	44.9	44.8	76.3	119.8	56.7	97.2	29.4	74.3	74.6	60.5	82.8	28.0	82.7	69.9	110.2	58.0	47.9	24.9	30.2
2082	7	72.3	84.1	30.2	201.0	193.0	64.1	97.6	152.9	119.0	38.6	70.7	72.7	81.5	115.3	57.7	55.7	45.5	92.2	80.8	40.2	38.9	201.0	76.1	30.2	55.2	71.9	66.8	99.9
2082	8	54.4	63.9	6.8	156.0	27.1	156.0	37.5	131.0	57.0	34.2	26.4	6.8	87.9	27.6	19.0	41.3	23.1	132.6	68.3	40.1	80.2	97.6	49.1	60.1	101.8	90.9	86.6	51.8
2082	9	54.9	55.7	24.5	99.1	99.1	38.0	61.5	55.8	53.9	95.3	59.4	24.5	35.1	26.5	44.1	51.1	47.9	35.5	71.4	78.5	76.2	61.9	62.4	59.2	52.9	70.3	40.3	36.5
2082	10	39.5	44.2	8.2	83.6	63.2	36.4	33.7	57.9	45.7	27.7	48.4	55.2	29.8	63.9	42.5	83.6	31.3	40.0	38.9	55.9	28.4	35.2	73.8	8.2	33.7	53.0	36.1	38.6
2082	11	36.5	39.6	14.4	76.6	74.8	59.5	42.4	57.2	31.9	20.8	66.2	30.2	31.2	42.6	37.2	36.8	14.4	76.6	27.3	25.5	20.9	60.5	42.0	36.2	30.6	20.2	42.2	22.8
2082	12	35.8	36.3	12.9	68.2	50.3	38.4	38.0	28.9	35.7	36.8	35.8	12.9	13.0	29.2	32.5	39.1	53.9	58.2	68.2	20.9	33.1	53.4	16.3	51.1	47.5	27.9	16.7	33.3
2083	1	31.0	35.8	16.8	81.1	18.7	30.5	28.6	22.9	16.8	23.0	28.8	40.7	45.2	31.8	40.2	31.5	27.6	55.7	18.5	21.1	44.0	25.3	48.7	76.0	39.9	18.0	44.1	81.1
2083	2	22.9	22.2	4.7	38.3	13.5	23.2	13.9	33.7	13.3	33.7	38.3	37.2	16.0	17.2	10.0	25.7	25.0	8.9	32.2	26.9	14.4	38.3	15.1	23.3	28.9	16.5	4.7	22.6
2083	3	25.2	25.8	1.8	79.0	23.4	4.4	79.0	10.7	12.8	31.2	17.2	26.7	32.7	8.5	40.0	2.9	20.5	24.2	42.8	11.2	26.2	30.2	29.0	1.8	13.3	46.3	53.5	30.2
2083	4	24.7	25.4	3.3	55.0	31.5	28.1	33.3	25.8	30.7	21.8	21.6	22.3	38.3	7.1	28.7	20.5	33.1	47.2	8.4	42.7	3.3	23.5	35.7	55.0	3.7	21.9	4.6	21.5
2083	5	36.0	40.7	11.4	90.0	75.9	34.0	59.3	38.9	41.2	11.4	50.0	55.5	35.3	53.9	35.5	26.2	32.0	61.0	32.4	36.5	26.2	13.1	25.5	64.6	41.6	14.8	22.0	90.0
2083	6	63.3	65.0	10.3	122.2	77.6	36.7	56.8	105.4	67.7	99.5	47.3	65.8	122.2	46.7	40.0	58.1	41.0	71.6	60.8	26.6	81.5	67.9	39.3	27.7	121.2	121.4	10.3	67.5
2083	7	69.6	70.7	12.3	134.1	134.1	28.9	95.9	81.0	106.1	100.0	12.3	49.5	72.5	93.3	32.3	42.7	41.9	118.5	66.7	77.0	79.1	38.0	64.7	58.8	110.4	80.2	51.7	60.2
2083	8	59.7	65.2	16.3	140.2	65.6	59.4	59.6	59.8	62.8	64.6	27.8	52.7	74.7	140.2	91.9	47.0	16.3	69.5	41.9	55.3	139.8	31.9	131.7	47.6	69.7	81.3	43.1	31.2
2083	9	62.2	67.0	20.1	118.1	98.0	115.5	20.1	92.6	103.9	24.9	73.4	116.5	31.1	63.4	43.0	31.2	61.8	102.9	69.1	35.1	57.1	45.2	52.9	118.1	30.1	105.8	62.7	53.9
2083	10	37.9	44.2	17.2	107.6	36.0	107.6	20.5	63.5	51.0	64.8	17.2	26.6	30.0	19.2	59.4	26.6	80.2	46.7	72.5	37.7	25.2	42.7	37.2	38.1	47.1	34.7	40.1	35.9
2083	11	34.9	37.3	16.5	70.9	34.0	44.5	21.1	48.6	25.7	24.7	58.2	19.3	46.6	44.9	70.9	44.0	28.2	19.4	35.9	43.9	58.7	40.4	25.7	30.6	56.3	16.5	24.4	33.7
2083	12	35.8	34.7	7.4	60.0	60.0	27.0	42.4	30.4	42.8	35.1	33.3	51.1	25.0	32.1	36.5	19.9	19.5	42.8	38.7	41.4	30.0	24.9	43.3	38.8	37.5	29.0	43.3	7.4
2084	1	28.6	28.8	8.1	71.5	21.6	8.5	14.4	28.2	35.4	38.3	23.9	32.2	21.2	22.2	18.4	8.1	31.2	38.3	17.7	43.9	19.6	45.0	44.1	71.5	32.1	29.1	13.8	33.0
2084	2	19.3	21.2	5.2	36.3	18.2	25.5	5.2	26.7	15.6	16.3	11.9	33.1	22.6	16.0	20.7	32.3	36.1	14.3	13.9	25.4	36.3	15.0	19.4	13.3	25.1	19.3	30.9	15.0
2084	3	21.2	23.3	5.9	43.1	20.2	19.0	16.6	25.6	22.3	41.5	13.4	43.1	30.7	15.0	30.9	22.5	37.2	18.7	5.9	27.7	41.5	11.3	14.1	34.8	23.6	19.0	18.7	7.1
2084	4	23.4	25.2	7.2	55.6	52.4	29.0	23.2	21.1	10.9	26.6	39.3	28.1	13.7	11.4	36.1	16.2	43.0	23.6	15.8	26.7	12.1	25.8	55.6	7.2	20.0	11.9	41.3	14.3
2084	5	37.0	41.2	7.3	96.9	62.9	21.0	39.7	13.0	24.9	48.5	37.0	96.9	20.1	37.6	37.1	36.4	72.9	76.5	15.0	46.5	45.2	7.3	83.0	16.4	24.4	69.7	27.6	30.2
2084	6	55.6	61.6	19.9	112.0	88.0	26.2	41.6	104.9	56.3	112.0	19.9	51.6	38.9	61.0	54.9	23.6	54.4	93.9	82.8	57.5	50.3	73.7	75.9	36.0	86.7	108.8	52.2	26.6
2084	7	87.6	92.0	34.4	171.0	45.6	86.5	88.5	107.6	132.9	60.4	64.1	62.5	106.3	171.0	34.4	36.7	54.7	101.6	137.9	90.4	93.8	80.0	158.4	66.8	168.2	86.7	100.5	71.7
2084	8	63.0	67.9	11.6	133.5	37.5	78.7	122.0	95.0	54.5	11.6	104.7	43.8	56.3	75.9	40.7	42.8	48.5	70.5	83.5	72.1	48.5	72.0	51.2	48.8	112.5	133.5	60.6	65.3
2084	9	45.6	50.7	10.2	127.8	16.1	18.5	34.1	98.9	52.1	62.1	31.2	11.5	88.4	78.6	44.5	61.3	80.0	14.8	10.2	57.3	127.8	43.4	73.7	46.7	26.4	78.6	31.8	29.5
2084	10	38.2	37.2	8.4	65.7	40.2	55.4	65.7	23.9	14.9	39.9	38.3	44.0	38.2	59.5	19.5	38.7	32.8	30.4	32.3	26.1	48.6	8.4	47.8	59.9	36.8	57.1	25.4	9.6
2084	11	38.3	40.9	16.7	77.6	33.7	43.9	35.3	16.7	36.2	37.4	46.1	52.1	52.8	21.1	38.8	25.8	23.1	34.2	40.1	36.3	39.3	76.5	77.6	48.0	58.4	43.5	37.8	27.4
2084	12	33.8	35.6	9.5	69.0	52.2	34.1	50.4	37.6	33.6	20.5	40.9	36.1	29.9	41.2	48.4	44.0	69.0	28.5	9.5	26.9	57.5	30.4	19.2	33.3	21.0	32.3	18.8	40.3
2085	1	27.1	29.1	11.9	54.2	27.6	46.3	24.4	26.7	24.0	13.8	25.5	32.8	35.0	25.7	31.7	29.2	23.7	37.8	18.6	31.1	54.2	19.4	11.9	50.1	29.3	23.9	19.7	35.1
2085	2	20.6	22.9	2.6	63.4	24.9	21.2	14.4	12.2	38.5	8.3	63.4	20.0	13.7	18.0	19.2	17.5	36.4	24.2	23.1	35.7	2.6	22.7	15.6	33.1	28.2	25.2	17.4	13.4
2085	3	20.0	22.2	9.2	44.5	12.9	12.3	22.8	18.1	44.5	13.3	16.0	39.7	9.3	11.4	11.8	39.0	28.6	20.0	28.8	22.9	9.4	17.7	35.4	9.2	20.0	20.3	34.6	34.0
2085	4	22.3	25.1	4.6	54.9	12.4	39.3	33.5	34.3	4.7	4.6	18.0	41.2	33.6	10.8	30.0	19.7	7.2	54.9	21.4	23.2	20.4	7.9	49.9	27.5	20.0	42.5	11.0	35.4
2085	5	47.5	48.9	22.2	78.6	70.1	46.2	64.9	41.5	23.4	48.9	47.3	34.2	46.9	78.6	32.3	66.6	22.2	50.4	31.9	73.8	47.7	51.5	36.0	66.6	24.8	76.3	52.6	37.9
2085	6	56.1	61.2	15.8	124.2	73.3	99.0	57.5	53.1	27.3	48.3	15.8	41.1	103.5	124.2	71.9	41.5	64.0	56.8	55.5	119.5	32.3	67.6	81.7	16.1	36.2	51.8	52.7	77.5
2085	7	71.6	73.2	25.2	148.9	72.4	62.9	78.6	82.2	30.5	148.9	80.4	80.3	69.4	77.1	78.2	47.7	25.2	69.8	70.3	30.3	94.6	115.8	70.9	65.0	109.9	95.8	59.5	42.3
2085	8	57.7	57.5	11.7	99.2	64.7	60.1	99.2	61.5	65.8	71.7	22.2	11.7	22.6	55.1	86.4	53.1	49.8	56.8	50.1	43.7	74.4	51.0	98.2	58.6	85.0	82.4	32.3	23.0
2085	9	57.7	55.3	11.0	115.3	57.2	63.1	17.9	58.6	27.6	73.5	11.0	34.6	58.8	74.9	50.0	58.2	71.4	45.5	38.0	64.3	75.9	26.3	115.3	42.7	107.6	42.6	70.5	41.3
2085	10	44.8	45.3	17.1	92.8	47.9	59.2	52.4	34.7	54.2	54.8	54.4	29.9	17.1	71.3	22.0	40.3	76.8	51.5	57.8	27.1	30.9	34.4	28.3	92.8	35.8	54.1	41.7	18.1
2085	11	43.9	40.0	11.5	67.7	49.4	55.3	37.7	43.1	49.8	58.9	30.6	53.7	11.5	45.2	44.6	67.7	12.3	22.7	48.9	23.8	28.1	52.1	48.1	29.5	24.6	28.9	29.3	63.4
2085	12	31.0	31.4	15.9	56.8	21.7	30.8	30.1	42.2	43.3	30.9	32.5	33.4	32.1	26.5	45.9	29.4	29.8	16.1	31.2	21.6	38.8	17.5	34.0	32.0	33.9	56.8	15.9	26.7
2086	1	23.4	24.3	8.8	42.8	28.2	8.8	39.9	42.8	21.8	24.2	21.8	22.0	13.0	33.6	25.2	17.7	18.2	23.4	10.9	23.7	16.0	17.4	30.2	34.9	34.9	17.6	33.0	23.3
2086	2	17.9	19.9	10.0	35.8	12.6	22.8	26.1	34.9	23.0	21.1	12.6	16.6	12.8	17.5	14.6	30.1	26.2	34.0	10.0	12.6	18.2	10.3	19.8	25.0	17.0	12.9	10.4	35.8

2086	3	22.8	22.7	5.0	51.4	32.4	8.2	51.4	33.4	11.6	5.0	8.5	12.4	5.2	29.3	10.3	29.4	22.5	17.8	49.0	18.8	23.1	27.2	36.8	19.9	32.8	12.3	23.6	23.9
2086	4	20.5	22.1	3.6	45.3	41.6	9.4	9.4	34.6	18.3	45.3	25.9	33.5	3.6	25.5	17.6	4.7	17.6	34.8	24.2	19.3	26.8	14.3	22.8	14.3	29.8	15.3	21.7	19.3
2086	5	32.9	34.5	1.8	87.5	20.6	65.1	40.7	1.8	32.9	3.9	44.3	26.3	9.6	32.4	15.4	38.6	33.0	39.6	30.5	17.3	57.4	87.5	28.2	33.2	42.1	53.3	31.7	43.0
2086	6	59.9	61.8	8.4	145.8	78.1	39.3	105.4	51.2	61.3	59.4	59.2	8.4	81.4	60.4	145.8	23.8	86.3	48.0	100.8	65.6	59.2	73.2	96.1	31.0	16.4	47.0	67.7	18.1
2086	7	63.1	73.2	19.1	169.9	98.0	102.6	88.2	31.2	40.3	94.2	37.0	42.0	81.7	169.9	23.8	53.4	130.6	92.2	87.3	69.5	19.1	39.9	121.7	45.3	132.1	54.8	56.8	45.2
2086	8	57.1	61.6	17.0	145.2	63.8	38.7	72.2	60.7	53.5	145.2	21.5	37.3	50.2	32.2	104.9	17.0	69.2	42.3	85.6	46.6	67.7	85.4	75.1	24.9	41.5	96.7	46.1	101.0
2086	9	63.4	67.6	24.4	138.6	88.6	69.1	97.9	85.9	53.5	51.7	42.8	47.9	65.3	51.4	138.6	71.1	90.7	71.2	132.4	59.0	41.2	53.8	77.7	61.5	24.4	41.5	36.8	67.8
2086	10	38.9	41.9	8.6	93.8	26.9	88.3	49.3	40.4	39.4	21.1	8.6	93.8	23.1	14.9	19.8	69.7	30.8	31.0	39.5	49.0	57.4	21.0	31.9	47.2	59.4	38.3	32.5	71.5
2086	11	44.8	43.6	14.5	85.7	48.3	27.4	21.4	55.7	16.3	52.6	30.8	85.7	40.3	41.3	52.6	63.3	59.6	49.5	50.3	14.5	28.5	40.4	55.8	14.9	69.6	37.3	39.9	50.9
2086	12	28.7	30.8	12.2	52.7	49.2	28.6	52.7	23.8	45.8	25.7	33.9	18.8	21.6	34.1	37.5	42.2	41.6	12.2	21.9	16.3	43.4	50.2	16.8	20.6	31.7	17.6	28.7	23.7
2087	1	27.5	31.1	10.8	56.2	45.0	10.8	55.7	18.0	30.7	43.2	42.2	24.3	56.2	33.1	32.9	23.2	16.8	36.8	41.5	22.7	18.6	38.0	19.8	42.7	23.2	22.9	24.3	22.8
2087	2	20.6	26.7	6.3	68.4	51.6	19.5	16.4	32.9	29.2	17.9	39.3	7.9	30.3	8.2	59.2	21.3	14.7	6.3	34.1	10.1	68.4	19.3	25.3	19.9	29.5	52.1	9.5	18.3
2087	3	21.9	22.1	2.9	36.1	28.9	8.1	6.6	36.1	26.8	16.7	7.1	21.2	21.7	23.3	2.9	29.0	17.3	24.2	27.9	20.4	19.5	34.7	21.7	24.6	22.0	35.6	34.5	19.0
2087	4	21.1	22.8	5.9	58.8	58.8	29.3	8.4	8.1	32.8	16.3	22.7	15.8	25.5	6.4	25.0	17.8	22.5	44.3	46.3	5.9	17.2	29.4	19.7	15.4	28.7	8.6	27.5	14.7
2087	5	41.5	51.7	11.5	119.8	44.7	87.4	91.3	11.5	37.6	63.6	31.4	29.4	87.8	98.3	32.2	38.3	17.7	17.4	17.8	53.9	75.8	35.4	45.2	45.5	119.8	26.0	35.3	97.4
2087	6	56.1	56.8	20.6	121.8	60.4	45.4	121.8	32.4	35.2	33.8	60.6	43.0	54.0	58.1	105.9	73.1	60.0	45.7	71.6	20.6	59.0	35.4	59.6	46.4	47.8	58.9	37.7	98.0
2087	7	59.4	67.1	15.4	141.0	66.9	64.6	99.4	110.9	59.6	52.2	42.0	25.9	102.2	27.7	62.9	27.7	141.0	38.5	59.2	15.4	59.2	42.6	92.4	38.0	99.9	101.5	58.9	122.2
2087	8	58.2	62.5	20.1	125.3	60.4	107.2	35.5	92.5	56.6	30.3	106.7	26.7	73.7	57.8	78.8	53.7	41.1	51.9	85.3	42.9	68.4	70.7	125.3	44.4	20.1	43.6	58.5	67.8
2087	9	64.6	69.0	20.8	178.4	71.9	41.6	81.6	83.4	77.2	30.4	122.6	134.0	74.4	87.0	85.5	47.5	51.0	23.5	28.0	33.2	20.8	89.3	86.1	57.4	54.2	178.4	49.2	47.6
2087	10	35.9	39.4	12.0	92.0	57.3	46.8	12.0	14.4	48.6	14.1	72.5	92.0	49.8	23.3	75.3	20.3	27.3	44.5	17.5	50.4	34.5	36.6	43.6	35.2	18.5	71.5	20.2	19.2
2087	11	38.4	42.4	6.4	86.1	25.2	74.5	21.5	30.3	49.5	38.0	42.7	61.1	23.6	37.1	35.7	32.8	52.8	13.3	85.7	52.9	38.9	86.1	43.3	55.3	57.9	28.8	6.4	23.0
2087	12	32.5	33.3	12.8	63.4	38.7	23.7	30.4	49.0	32.3	24.4	15.6	23.0	36.0	32.4	41.4	18.2	63.4	32.6	18.5	35.4	46.8	50.6	51.6	42.2	39.9	19.3	12.8	20.3
2088	1	33.0	30.6	4.6	51.5	51.5	46.9	33.1	20.4	16.8	34.2	38.5	31.5	12.4	19.1	43.0	45.9	42.9	20.6	32.8	38.6	38.0	26.4	25.6	35.4	42.7	15.4	4.6	18.7
2088	2	23.7	23.5	7.9	40.4	26.9	24.8	11.2	16.5	20.8	23.9	40.4	17.2	32.1	14.6	24.2	28.8	25.9	22.5	19.9	21.5	9.6	26.0	30.7	23.5	34.8	38.9	21.4	7.9
2088	3	22.2	23.6	7.9	51.4	17.9	38.5	21.1	13.2	31.4	51.4	12.7	15.7	22.8	22.2	36.3	7.9	22.8	26.5	43.5	28.4	18.4	12.7	11.1	22.1	36.0	26.3	9.1	19.2
2088	4	21.8	26.9	6.2	58.6	53.0	40.2	11.1	19.9	19.2	14.2	41.1	21.8	14.9	34.3	21.8	44.3	6.2	15.4	58.6	11.1	44.9	27.4	12.3	12.1	39.9	7.6	43.0	32.2
2088	5	40.7	40.4	11.1	94.7	32.4	12.0	23.9	23.1	14.0	28.2	11.1	83.5	94.7	41.1	67.2	52.3	41.1	40.9	28.5	57.4	40.5	30.5	51.4	49.5	15.7	43.4	66.6	20.9
2088	6	50.1	59.4	17.1	179.1	93.2	179.1	59.1	43.1	28.0	29.7	41.7	25.3	79.2	38.7	44.1	87.0	61.0	57.8	36.9	83.6	24.2	56.2	95.8	34.6	40.5	94.0	17.1	75.9
2088	7	89.6	83.5	9.2	180.1	180.1	122.7	116.1	105.3	26.7	124.0	39.2	9.2	90.8	105.0	92.3	88.8	149.3	85.4	55.3	79.1	34.8	89.6	89.5	45.2	30.8	97.2	25.8	121.0
2088	8	65.2	72.0	11.4	147.9	142.8	81.9	47.2	147.9	65.5	65.4	20.8	93.6	19.4	130.6	37.5	67.9	126.8	65.0	11.4	36.6	85.6	54.8	120.6	60.9	35.8	37.7	110.5	60.7
2088	9	65.5	62.4	9.0	126.0	68.5	70.4	83.3	50.0	51.1	107.6	74.1	126.0	68.6	100.6	48.2	9.0	12.9	84.1	59.1	52.0	80.3	68.1	48.9	42.1	28.5	81.0	63.0	19.6
2088	10	43.3	42.2	10.3	69.1	69.1	28.6	55.2	10.3	37.3	54.4	39.1	55.5	43.1	25.4	51.0	29.7	43.5	27.5	47.8	40.2	54.7	44.1	48.2	24.7	58.4	25.2	42.4	57.1
2088	11	43.2	44.3	18.7	111.6	63.8	44.3	35.2	54.1	57.6	34.2	62.9	111.6	43.7	22.0	51.4	25.6	21.2	29.3	52.5	18.7	42.7	43.6	56.7	25.1	42.9	38.1	25.5	61.3
2088	12	33.7	32.9	10.7	52.6	32.7	42.4	36.8	52.6	27.0	36.0	22.6	29.3	38.0	23.5	49.0	31.0	42.8	34.5	38.1	33.5	17.7	33.9	10.7	30.6	47.0	24.2	20.1	35.3
2089	1	30.7	31.3	6.5	75.9	25.9	29.7	19.5	75.9	24.5	31.8	27.0	24.9	13.1	34.1	38.7	20.2	18.7	32.4	38.0	35.1	39.7	6.5	27.5	45.9	42.7	16.7	49.0	33.4
2089	2	24.6	24.7	8.7	43.6	36.6	8.7	19.7	22.6	14.7	24.8	38.2	24.3	22.8	17.8	28.2	17.6	28.3	27.1	19.9	32.0	26.2	25.5	28.9	28.6	21.8	15.8	19.0	43.6
2089	3	17.4	23.9	8.0	72.0	11.6	16.8	16.8	40.2	17.5	34.0	28.0	13.6	31.9	11.3	8.9	72.0	9.7	18.8	16.3	8.0	17.3	37.9	16.7	51.8	24.6	22.2	36.5	11.0
2089	4	18.2	22.1	2.4	64.4	8.9	16.4	24.9	41.0	31.3	26.0	14.6	26.9	17.2	3.9	24.8	15.1	19.1	11.6	17.1	5.9	2.4	50.2	64.4	25.0	7.6	33.7	26.0	16.4
2089	5	38.4	39.3	1.8	83.3	42.1	29.8	70.8	27.9	8.6	33.4	39.8	11.1	83.3	1.8	81.2	36.3	37.9	33.8	54.7	40.2	38.9	39.1	45.0	27.0	29.1	50.1	50.4	29.9
2089	6	53.1	55.5	13.2	148.2	21.4	91.3	80.0	148.2	67.2	42.4	29.2	46.5	24.1	81.3	51.7	66.7	57.4	56.6	44.3	15.2	70.6	49.1	36.2	63.2	54.4	13.2	38.6	83.8
2089	7	66.0	67.5	22.4	139.0	22.4	56.8	66.6	65.3	78.0	60.2	22.4	74.8	89.9	42.3	32.0	34.5	68.9	77.0	80.1	49.6	74.6	105.3	48.6	138.4	121.7	139.0	38.4	33.9
2089	8	47.0	55.9	28.4	162.7	44.8	35.8	89.0	46.7	31.2	65.5	44.9	32.8	54.3	57.6	46.7	28.4	74.9	62.5	47.2	162.7	60.5	79.3	42.6	40.7	29.0	71.8	34.2	59.6
2089	9	65.2	67.9	13.8	128.2	65.2	28.1	65.3	100.6	30.1	67.7	13.8	40.5	31.4	83.8	64.5	50.2	59.5	109.1	68.9	90.2	89.6	46.3	128.2	112.0	43.0	84.0	42.4	114.3
2089	10	39.5	41.5	19.9	74.1	40.0	44.4	46.6	41.6	34.6	44.3	27.9	23.8	34.1	41.0	49.7	19.9	58.9	70.8	39.0	31.5	30.6	36.2	27.6	50.1	74.1	21.8	37.4	70.0
2089	11	35.8	40.4	10.6	82.8	29.6	36.6	35.0	56.7	31.1	82.8	58.2	21.8	19.0	61.8	43.4	29.9	47.6	55.7	21.8	10.6	53.4	40.6	25.3	33.1	77.7	20.9	45.9	32.0
2089	12	31.4	34.9	8.9	73.4	73.4	27.4	28.4	25.2	43.5	54.3	32.1	26.8	59.0	46.8	40.1	35.6	47.4	31.2	25.9	30.3	22.7	38.1	38.4	22.6	31.6	19.3	8.9	29.1
2090	1	24.8	27.0	8.4	53.0	19.2	14.3	42.8	9.7	14.3	18.6	25.2	12.0	24.1	16.8	8.4	29.3	39.7	34.8	33.5	24.4	39.6	46.3	17.2	36.2	53.0	38.4	34.3	16.8
2090	2	23.0	25.9	4.2	63.9	30.4	29.5	21.8	38.3	12.3	21.9	16.8	24.1	21.4	37.4	63.9	4.2	39.4	12.1	16.2	43.0	18.8	35.9	26.2	9.5	28.6	38.3	19.8	11.5
2090	3	21.1	20.7	2.7	54.5	22.4	11.1	2.7	43.3	22.0	30.3	11.5	24.5	42.5	24.3	29.7	6.9	20.3	54.5	14.1	8.4	7.4	21.9	22.9	8.4	6.4	12.6	35.2	14.3
2090	4	26.7	24.9	0.4	48.1	45.1	28.5	22.7	37.3	23.6	13.1	32.6	31.7	24.7	4.3	26.2	28.4	14.9	24.9	44.7	36.0	48.1	5.2	2.1	28.0	42.6	0.4	27.2	5.7
2090	5	36.2	42.1	12.7	108.5	62.3	61.3	34.2	16.4	30.3	29.0	28.8	41.7	108.5	40.9	17.6	54.2	97.4	37.8	50.1	44.3	24.5	15.7	42.6	21.0	12.7	88.1	34.6	15.9
2090	6	64.2	63.9	14.8	120.8	56.4	80.7	114.2	75.5	17.3	58.2	14.8	66.6	20.1	54.6	76.6	35.5	73.8	49.6	59.0	97.6	120.8	72.4	69.8	17.1	49.1	89.4	61.8	101.9
2090	7	60.8	61.5	10.3	108.2	60.9	69.5	69.2	33.8	17.7	54.3	60.7	85.0	73.2	50.6	76.2	106.8	88.0	41.1	108.2	30.0	90.4	59.6	31.8	10.3	42.3	73.8	60.3	82.0
2090	8	42.2	53.9	12.3	115.2	12.3	43.2	65.4	22.8	97.3	40.4	26.0	65.4	34.6	106.4	115.2	95.8	32.2	31.7	41.8	73.2	94.9	25.6	94.3	42.6	43.4	21.6	36.8	30.2
2090	9	70.7	69.3	19.7	151.5	151.5	35.1	83.0	69.8	108.0	80.7	41.9	62.2	80.0	43.5	67.5	51.3	19.7	48.4	71.5	72.7	78.3	90.3	33.1	32.1	72.5	96.9	51.6	121.9
2090	10	33.2	40.2	19.2	106.3	32.9	48.2	33.6	34.8	53.5	34.6	27.1	22.2	106.3	27.5	27.5	23.2	65.7	31.7	61.6	28.7	28.3	27.1	59.4	19.2	31.6	40.7	48.8	50.4
2090	11	30.8	36.4	9.6	103.5	17.6	33.5	22.3	18.7	17.2	52.5	24.8	29.8	103.5	27.4	30.4	68.7	52.7	31.3	14.9	20.1	58.9	45.5	34.3	33.5	53.0	9.6	47.0	26.6
2090	12	36.9	36.8	11.3	69.3	36.8	11.3	47.3	29.0	49.6	41.9	33.8	37.0	35.2	14.8	22.4	29.8	63.2	29.9	19.2	13.3	41.0	46.7	57.9	22.5	46.9	46.4	38.3	69.3
2091	1	30.6	32.1	6.9	81.8	32.5	28.5	21.6	49.5	23.7	14.3	81.8	19.8	38.2	19.8	29.9	31.3	6.9	52.6	42.4	17.9	38.0	15.2	35.0	38.0	24.9	18.0	32.8	58.3
2091	2	25.1	23.2	4.6	45.1	24.8	24.2	26.0	27.8	12.2	13.0	13.5	31.9	12.5	16.5	24.4	33.8	42.4	45.1	24.5	7.1	26.2	28.9	4.6	9.0	25.4	25.8	30.5	27.7
2091	3	22.1	24.4	5.3	58.0	42.9	19.6	58.0	22.5	39.7	5.3	8.8	13.3	6.1	21.7	8.5	46.2	12.3	26.3	48.3	10.1	35.0	17.1	23.6	27.9	18.2	25.5	30.2	18.4
2091	4	23.1	25.6	6.7	61.9	16.5	16.0	37.9	61.9	27.4	12.7	21.5	25.4	29.4	30.4	42.2	6.7	20.7	23.7	29.5	22.3	35.2	38.8	22.0	9.9	28.4	17.9	22.4	15.5
2091	5	30.0	38.7	14.0	83.0	77.6	30.4	26.1	38.1	83.0	14.0	62.7	25.1	23.9	37.8	35.5	26.6	29.6	25.4	68.8	17.7	29.0	40.2	63.6	14.1	42.3	62.2	25.7	29.3
2091	6	51.3	53.6	19.0	102.6	47.7	97.8	39.7	41.5	83.5	34.2	19.0	54.7	30.5	44.2	55.9	31.2	54.5	74.5	59.6	68.1	64.2	60.6	48.1	74.0	102.6	40.4	28.0	32.2
2091	7	78.3	75.5	19.8	123.8	81.6	72.4	112.1	108.1	74.4	34.7	36.7	63.2	61.0	110.6	89.3	26.2	91.2	99.9	123.8	75.1	85.5	88.9	92.0	19.8	99.5	69.4	43.6	53.9
2091	8	59.9	58.5	10.3	121.2	75.5	58.5	68.5	56.6	43.0	66.7	19.9	63.0	61.4	121.2	87.1	35.3	38.9	20.5	119.9	75.5	27.9	74.8	74.2	10.3	46.4	55.4	20.2	82.8
2091	9	53.9	59.7	24.2	143.7	143.7	36.8	24.2	113.7	56.8	52.6	24.5	59.6	63.2	49.2	58.6	34.3	40.7	52.1	76.2	38.6	40.5	74.0	51.3	55.5	55.3	87.9	34.5	110.1
2091	10	40.2	41.4	19.1	79.4	31.5	19.7	31.8	71.3	36.9	23.0	59.4	49.1	47.6	50.9	26.3	79.4	70.2	41.6	45.8	27.6	38.3	19.1	21.8	42.9	32.2	38.8	42.0	46.4
2091	11	32.3	34.9	11.3	65.6	11.3	48.6	31.2	65.6	31.3	45.1	34.3	18.9	16.2	43.3	33.2	27.9	45.5	55.7	27.5	49.8	30.8	42.9	44.1	28.4	24.5	16.5	21.8	43.2
2091	12	28.4	29.8	12.6	50.1	18.2	35.4	29.7	31.7	47.4	19.8	12.6	20.0	50.1	36.5	36.7	13.9	40.2	23.4	25.8	16.4	24.1	41.9	27.0	24.2	43.6	30.6	26.0	39.5
2092	1	32.8	32.4	5.4	69.5	52.6	28.7	13.2	35.7	36.1	22.6	33.8	34.1	69.5	5.4	35.2	17.7	36.5	36.2	25.1	34.0	31.8	24.3	29.8	30.1	52.3	30.5	38.8	24.5
2092	2	22.1	20.7	7.2	51.2	10.4	9.2	29.8	24.9	51.2	22.9	26.6	22.4	15.1	18.6	21.9	29.7	30.3	9.7	31.8	17.8	16.9	10.2	27.0	7.2	9.3	8.3	23.1	23.6
2092	3	27.2	27.5	7.9	54.1	24.0	37.1	27.3	31.0	43.3	16.5	27.1	20.1	42.8	26.1	54.1	35.7	37.8	32.8	33.0	16.3	31.6	10.6	23.3	41.2	10.2	20.2	7.9	9.7
2092	4	23.3	24.1	3.6	48.4	44.0	48.4	27.2	17.8	11.5	22.7	13.0	33.8	9.8	8.4	13.0	21.9	33.0	18.7	35.0	31.6	39.1	37.8	23.9	46.3	24.7	4.0	3.6	9.9
2092	5	53.8	54.5	16.0	119.5	67.6	51.3	73.4	69.9	20.0	56.3	39.3	49.3	66.3	47.2	119.5	16.0	42.8	89.6	56.6	64.2	35.5	25.4	38.9	67.3	76.0	43.1	33.6	58.1
2092	6	70.6	69.3	25.0	124.7	87.7	32.4	100.3	71.4	98.7	63.3	25.0	36.2	76.1	92.4	28.5	104.8	36.0	69.7	84.8	38.6	64.9	52.5	90.2	69.9	75.2	124.7	71.8	68.9
2092	7	65.0	83.0	28.5	221.8	221.8	64.0	183.9	56.6	89.0	28.5	59.3	42.1	107.4	94.3	33.1	61.9	88.3	55.4	65.9	80.9	70.6	136.6	51.9	43.9	100.1	38.7	51.5	166.5
2092	8	51.1	55.4	28.7	94.7	46.0	82.6	48.4	28.7	36.6	78.5	63.5	29.7	54.7	47.7	55.0	30.4	35.4	53.7	35.9	59.8	70.5	46.0	69.9	35.5	94.7	91.8	86.1	48.3
2092	9	69.9	70.9	36.8	119.3	46.1	85.8	40.2	66.1	81.4	36.8	85.4	77.2	44.8	86.9	116.1	59.2	38.8	49.1	72.8	59.7	67.1	46.6	91.8	119.3	77.7	65.8	88.3	98.9
2092	10	38.6	42.4	13.7	91.3	29.2	19.6	38.5	38.8	91.3	31.8	60.2	36.2	50.3	37.0	30.7	46.8	22.3	54.1	54.5	61.2	49.3	51.1	46.9	30.3	36.4	57.3	13.7	30.5
2092	11	40.7	41.6	10.5	73.3	20.5	57.6	23.5	36.6	39.8	52.5	34.7	50.6	10.5	28.0	73.3	51.2	63.0	40.7	44.1	29.4	27.1	36.4	58.2	40.7	31.2	65.4	41.5	43.0
2092	12	32.1	33.3	16.7	61.5	35.6	32.7	26.8	35.2	43.6	46.0	17.7	25.6	32.1	61.5	16.7	31.0	26.1	46.0	20.8	58.3	33.5	22.4	29.5	20.0	40.6	32.2	38.5	26.9
2093	1	31.6	32.1	7.3	55.8	55.8	25.5	28.3	24.9	48.6	9.7	35.1	55.3	10.0	21.2	28.9	38.1	29.3	23.4	44.7	29.8	44.8	47.4	7.3	41.1	33.9	19.3	34.0	33.5
2093	2	24.9	23.2	2.6	38.5	37.5	2.6	23.9	20.6	13.1	28.6	17.2	38.5	25.9	11.1	22.5	29.9	28.2	13.5	18.4	11.9	32.2	33.2	7.5	35.8	29.9	33.4	12.9	27.7
2093	3	24.0	25.3	7.7	55.3	25.1	12.5	10.3	22.2	31.5	15.7	17.4	21.3	26.1	28.6	17.9	40.7	55.3	28.4	35.9	46.0	29.3	13.4	7.7	39.6	25.6	11.9	22.9	22.1
2093	4	24.3	26.8	2.6	83.9	83.9	8.9	31.7	23.6	2.6	47.6	20.3	18.9	33.4	36.8	16.3	31.8	32.7	31.8	7.8	25.7	21.5	4.8	11.8	6.2	78.2	24.9	25.2	17.3
2093	5	43.9	44.4	9.6	126.2	65.4	17.9	126.2	37.2	44.4	43.4	86.5	47.4	60.3	13.7	13.7	39.1	18.4	33.4	44.5	31.0	58.9	50.2	28.4	55.6	61.7	64.2	9.6	15.1
2093	6	54.6	63.3	22.1	170.2	142.2	32.1	170.2	31.1	48.8	63.3	41.7	103.7	59.8	43.3	52.4	26.3	54.2	27.3	74.8	87.8	26.4	72.4	110.8	62.0	54.9	48.2	64.3	22.1
2093	7	76.1	77.4	23.4	144.0	106.9	76.7	144.0	82.9	58.5	32.4	23.4	98.7	67.0	38.9	61.0	63.6	118.4	83.5	26.3	57.4	79.2	71.9	111.4	94.4	75.5	134.8	51.0	100.3
2093	8	55.7	57.1	6.8	115.0	51.8	82.9	61.3	67.3	42.4	6.8	61.2	20.9	41.3	22.0	68.0	56.3	55.0	32.3	67.9	31.2	48.3	73.8	115.0	103.2	53.4	101.8	29.0	78.3
2093	9	51.6	50.9	4.4	86.3	61.9	48.0	33.6	78.2	35.2	61.6	85.4	54.1	59.9	59.6	65.0	49.0	4.4	37.0	33.6	40.8	27.5	45.0	61.8	86.3	68.5	79.6	22.7	23.3

2093	10	42.4	38.6	9.0	65.7	48.1	25.7	30.3	46.2	12.0	12.7	27.1	48.2	45.5	21.1	51.0	65.7	9.0	48.6	57.8	41.1	59.1	61.5	28.5	51.8	30.7	28.7	43.7	31.5
2093	11	33.6	35.7	13.6	64.3	32.3	35.1	13.6	50.6	45.1	64.3	50.0	14.8	39.7	19.7	58.5	35.7	32.0	51.4	29.9	25.9	51.5	34.8	20.1	52.0	20.2	25.2	30.5	23.2
2093	12	33.6	35.8	18.2	76.8	23.9	33.4	26.1	27.1	37.3	28.0	18.2	46.1	34.1	76.8	25.3	46.5	56.6	21.6	19.6	33.8	39.6	37.5	30.0	52.6	32.2	52.3	24.5	35.3
2094	1	29.2	29.1	10.4	48.6	34.7	20.5	21.5	48.6	43.4	25.9	34.2	45.4	10.4	25.6	29.7	24.6	31.4	16.1	13.1	28.8	26.3	18.4	30.8	36.2	42.1	32.8	23.1	34.7
2094	2	23.0	25.5	9.6	46.3	21.2	22.4	20.3	22.8	9.6	13.6	46.3	31.6	28.0	10.7	22.7	18.8	43.8	19.2	23.1	19.1	39.5	24.1	21.2	37.2	37.0	28.2	25.5	25.7
2094	3	18.8	20.3	4.2	50.2	22.1	18.7	6.7	27.3	10.6	12.9	11.7	18.9	4.2	11.6	33.5	35.0	10.5	15.8	40.2	9.1	20.2	26.3	17.3	23.5	50.2	23.8	15.8	20.9
2094	4	24.4	27.2	9.2	62.7	24.8	14.3	11.9	16.0	43.5	11.9	18.2	24.5	39.0	13.4	26.5	62.7	18.4	10.5	48.2	9.2	35.0	39.0	37.5	24.3	21.4	52.2	26.5	23.8
2094	5	40.8	43.6	5.3	89.1	65.2	29.9	73.8	30.8	23.6	42.6	41.6	45.1	78.3	23.7	25.7	58.1	89.1	40.0	51.3	5.3	55.6	57.0	33.9	22.3	72.1	35.8	23.4	21.6
2094	6	53.7	57.8	18.5	123.7	31.3	87.9	95.5	46.0	82.6	24.8	68.2	46.8	123.7	46.2	38.0	21.6	35.0	53.5	54.5	86.8	103.5	52.2	69.9	62.6	53.8	61.1	24.2	18.5
2094	7	67.3	70.6	14.4	140.6	66.6	53.3	83.9	39.5	91.2	83.5	41.7	73.7	86.8	119.9	64.1	14.4	62.6	79.8	38.0	51.5	46.9	78.0	140.6	106.1	48.1	68.1	43.9	112.9
2094	8	47.7	53.7	6.8	151.7	69.9	42.9	63.8	16.7	37.3	26.6	36.0	34.6	59.7	56.6	49.6	77.9	6.8	75.4	48.0	94.1	38.0	70.0	151.7	36.1	32.4	89.8	47.3	26.6
2094	9	68.3	70.3	22.2	154.4	84.6	63.4	45.0	75.1	98.1	154.4	46.7	33.7	71.5	65.1	88.7	42.1	90.1	98.2	144.9	31.0	89.4	73.9	22.2	37.4	42.3	102.9	36.0	49.8
2094	10	38.2	43.7	17.3	86.8	32.2	39.0	35.6	66.9	69.4	26.3	30.2	81.1	32.1	46.8	41.2	28.3	44.5	65.0	86.8	54.0	35.9	29.2	17.3	23.2	33.9	46.5	37.4	44.8
2094	11	44.0	41.8	14.2	65.3	46.2	47.6	38.0	43.2	28.8	54.8	43.8	50.4	64.6	47.1	44.2	24.0	27.5	54.1	55.4	38.3	45.3	60.3	65.3	23.6	36.8	14.2	15.6	34.0
2094	12	33.1	35.1	16.2	59.1	53.2	23.3	27.3	38.8	25.7	59.1	21.6	22.1	46.2	30.2	41.4	43.9	23.7	34.0	39.9	36.6	19.6	31.1	52.5	46.3	32.2	30.2	16.2	47.6
2095	1	28.2	29.2	10.3	63.2	33.6	29.1	15.7	28.0	22.6	19.1	29.0	31.1	38.5	25.9	45.0	63.2	39.5	30.7	45.0	28.0	19.4	46.9	26.8	14.1	10.3	18.7	28.4	11.6
2095	2	25.1	25.0	8.3	52.8	22.1	8.3	13.7	13.6	16.8	25.5	40.4	37.5	10.6	24.6	11.2	40.1	27.6	25.7	33.5	22.2	21.7	25.8	24.8	26.5	25.5	12.9	52.8	36.5
2095	3	16.0	19.3	3.8	44.3	20.1	27.0	16.0	20.3	43.9	15.9	8.7	34.1	9.0	15.2	5.4	44.3	23.3	9.0	3.8	10.7	7.3	31.2	8.4	18.8	24.7	10.9	41.5	13.7
2095	4	18.2	22.0	8.0	57.4	57.4	19.6	35.2	10.4	28.3	19.2	29.9	8.4	8.0	25.7	38.7	13.2	12.9	17.2	33.6	14.5	27.8	15.1	30.5	24.9	16.0	16.9	15.3	10.0
2095	5	46.2	48.4	9.2	121.1	44.3	65.4	71.7	31.6	50.0	49.3	46.4	59.0	21.0	24.8	47.7	121.1	93.6	46.0	23.0	9.2	11.7	60.8	35.0	28.5	78.2	40.3	31.0	71.7
2095	6	75.2	71.6	23.1	121.8	55.3	119.9	97.5	23.1	98.7	57.6	68.6	74.0	27.9	93.0	79.5	76.4	121.8	112.3	47.3	88.4	85.2	34.7	85.6	44.9	62.6	36.8	78.3	49.5
2095	7	67.6	73.6	23.1	158.3	66.3	158.3	61.6	54.6	73.0	92.0	23.1	91.1	65.0	59.0	56.2	42.9	93.5	69.2	23.7	82.0	66.5	73.8	64.0	113.4	148.6	92.3	68.8	27.5
2095	8	59.6	61.5	24.6	135.6	79.5	69.5	59.7	37.5	69.7	87.5	26.5	37.7	42.1	98.2	50.2	59.5	24.6	35.8	46.6	60.7	34.2	60.4	135.6	75.5	52.1	69.5	56.7	108.0
2095	9	59.5	66.7	23.1	131.8	61.6	81.8	78.2	26.2	102.9	96.6	29.4	41.2	50.0	55.3	108.7	42.7	73.5	36.1	96.6	77.8	57.5	23.1	116.0	54.9	131.8	40.5	61.8	57.1
2095	10	41.6	40.8	18.8	64.1	47.9	55.0	26.7	33.1	56.0	61.0	64.1	42.2	38.5	30.7	47.9	18.8	23.8	27.4	50.6	28.9	34.3	50.6	51.5	22.2	44.4	59.8	40.9	23.4
2095	11	38.8	38.8	7.5	81.0	27.9	26.4	48.5	27.6	26.0	50.0	45.9	36.7	37.6	17.1	15.5	46.4	51.4	59.2	81.0	31.2	45.6	59.1	40.0	7.5	47.8	49.1	30.5	22.8
2095	12	32.0	29.3	5.7	51.5	37.6	26.5	31.4	39.8	37.2	51.5	5.7	38.2	17.3	22.2	34.3	17.3	39.6	49.7	36.2	10.5	19.0	42.3	12.6	41.5	32.5	24.1	16.6	19.2
2096	1	28.3	30.8	11.9	58.9	33.4	35.5	11.9	46.7	14.9	47.3	36.0	13.6	20.1	40.9	28.4	25.6	28.2	26.3	19.1	49.8	23.6	44.6	43.4	58.9	29.9	12.3	21.1	26.7
2096	2	22.0	22.6	8.1	40.8	29.1	27.8	20.6	17.2	19.6	14.6	22.9	33.4	21.5	25.5	15.1	15.7	20.6	24.6	16.6	23.3	15.3	37.0	40.8	32.5	8.1	25.4	22.5	13.2
2096	3	21.7	23.9	8.0	65.5	27.8	65.5	15.4	10.4	34.0	15.2	33.7	31.4	19.2	16.4	32.2	24.3	9.6	24.4	19.0	24.2	42.0	32.8	40.6	11.0	8.0	10.2	12.5	13.1
2096	4	23.5	24.9	4.0	51.2	15.4	11.5	35.1	26.8	30.8	11.1	25.2	39.8	51.2	4.0	20.0	29.6	17.6	25.4	34.2	19.9	27.0	21.3	29.6	19.7	49.8	9.8	20.5	21.9
2096	5	32.2	37.7	16.1	87.3	38.8	47.5	22.9	22.5	29.1	17.2	52.6	37.8	23.6	21.6	42.9	60.6	75.5	44.1	16.8	16.1	30.1	17.3	38.3	34.1	87.3	22.8	30.4	75.3
2096	6	50.3	61.5	12.8	138.5	96.5	116.8	109.0	94.4	25.4	62.9	46.7	34.7	81.4	24.0	25.1	37.7	69.1	86.7	12.8	53.9	41.4	40.6	42.4	67.4	138.5	129.9	23.4	14.9
2096	7	73.6	76.2	30.6	137.4	44.9	53.7	59.9	104.6	84.4	55.7	45.9	60.5	79.9	137.4	40.9	71.0	78.8	95.3	30.6	95.1	71.9	94.5	117.2	118.9	74.5	103.8	72.7	37.3
2096	8	57.5	67.4	12.1	174.5	25.6	137.2	53.1	95.9	12.1	71.4	28.1	22.3	105.5	90.9	140.9	30.2	40.9	38.3	99.4	18.1	81.8	46.6	86.9	75.7	33.9	45.4	61.9	174.5
2096	9	54.8	57.4	21.3	143.9	143.9	48.5	70.0	60.6	53.8	21.3	86.0	55.7	79.3	22.1	38.9	28.8	29.6	33.5	40.6	56.0	64.1	30.4	75.7	59.4	100.8	35.3	41.7	102.4
2096	10	42.9	43.5	9.9	89.2	43.4	37.4	19.3	77.8	89.2	32.6	73.2	46.7	37.8	56.7	9.9	43.7	35.5	27.6	41.1	45.8	56.1	53.6	33.1	52.1	24.3	13.1	51.9	42.4
2096	11	41.8	41.1	12.1	86.7	40.6	54.2	25.2	86.7	47.2	44.9	34.7	40.4	56.5	20.7	30.9	56.7	45.5	49.9	40.8	20.0	36.9	12.1	43.4	44.2	54.1	23.9	42.7	35.0
2096	12	32.9	35.2	15.6	96.3	17.6	20.1	21.8	36.3	56.8	29.8	96.3	29.1	28.0	36.4	25.0	28.5	24.9	36.6	24.3	15.6	44.7	51.5	39.4	36.0	21.8	44.3	38.5	42.4
2097	1	22.1	24.4	8.3	54.9	23.3	27.6	18.3	8.3	17.6	23.0	21.8	22.2	51.3	9.9	14.7	23.9	39.3	10.2	46.6	54.9	22.0	14.3	22.4	15.6	29.4	33.2	18.9	17.9
2097	2	22.1	24.6	7.9	46.6	24.7	18.4	26.7	26.4	39.4	30.8	39.0	11.8	13.6	13.3	42.7	42.3	11.0	28.6	46.6	18.6	21.4	13.3	22.4	21.9	41.0	7.9	20.1	8.8
2097	3	22.2	24.1	6.9	45.1	39.1	16.1	32.2	23.1	25.3	21.2	23.5	19.9	39.3	18.9	33.2	6.9	7.7	18.2	35.4	45.1	21.3	7.2	23.1	33.9	18.8	19.8	19.0	31.1
2097	4	31.0	29.5	7.0	54.1	19.1	16.0	44.8	16.6	30.2	24.6	29.6	16.6	39.8	14.3	16.7	44.2	13.8	39.2	40.4	31.8	19.6	7.0	54.1	36.8	32.9	33.9	47.9	39.2
2097	5	45.2	40.7	7.2	87.6	24.4	46.0	45.2	27.6	45.4	29.6	46.6	12.1	87.6	29.9	36.4	29.0	66.3	45.8	55.3	45.1	55.0	37.1	7.2	62.1	65.8	12.1	17.9	46.3
2097	6	60.3	68.4	22.6	223.4	58.7	89.5	223.4	55.9	77.9	22.6	33.8	22.7	137.6	27.9	57.2	24.0	111.8	42.6	41.1	61.8	94.7	73.7	86.5	70.9	36.5	42.0	78.9	69.5
2097	7	63.1	65.4	22.3	158.8	158.8	71.9	50.9	137.2	71.4	71.5	26.2	22.3	43.9	41.1	70.1	32.1	62.4	57.8	25.1	86.9	61.2	33.6	70.8	107.5	74.1	73.6	55.2	63.8
2097	8	50.8	59.2	5.7	128.8	31.5	65.6	90.7	73.4	46.9	128.8	11.3	5.7	65.3	48.1	38.9	47.3	53.5	81.1	37.9	108.3	42.4	33.9	27.2	43.5	63.2	90.5	123.0	61.4
2097	9	76.2	68.1	20.0	138.3	51.5	33.0	39.7	85.4	98.0	116.6	82.1	78.9	38.1	31.4	43.8	37.6	55.7	80.6	90.5	20.0	37.2	109.0	138.3	98.3	77.4	22.0	93.4	74.9
2097	10	37.3	42.3	14.9	93.1	14.9	23.2	52.2	22.3	36.4	36.3	42.3	49.5	37.5	33.4	27.6	45.5	32.6	36.7	56.4	36.0	37.1	41.5	60.4	29.3	51.4	93.1	53.3	67.7
2097	11	39.4	37.0	12.3	69.1	45.9	48.0	47.5	17.7	13.7	69.1	26.4	25.5	50.0	49.0	27.1	13.0	42.0	33.0	33.1	12.3	38.3	68.2	44.2	22.1	57.0	19.0	46.0	40.5
2097	12	36.9	39.3	14.4	67.9	26.8	53.9	53.1	49.2	36.6	51.6	33.9	41.2	26.1	49.6	29.4	31.0	52.2	50.5	14.4	23.5	20.9	67.9	37.2	34.9	25.3	43.3	28.0	63.1
2098	1	30.1	28.6	14.6	46.7	29.0	46.7	29.8	34.3	21.1	16.5	30.4	24.6	33.4	33.0	21.5	24.9	21.3	31.1	14.6	28.6	34.5	32.2	31.6	31.4	39.5	17.4	39.6	18.6
2098	2	20.5	25.6	5.3	51.6	44.5	20.8	35.1	11.3	21.1	5.3	34.8	36.4	30.7	17.0	16.4	15.6	49.1	14.1	31.9	17.8	20.1	12.0	31.0	16.9	44.9	20.2	51.6	14.9
2098	3	26.6	26.3	7.2	50.7	31.4	50.7	46.0	22.6	7.2	10.9	26.3	30.6	35.4	14.3	10.7	44.3	43.9	11.8	29.1	29.8	33.2	19.9	36.8	20.3	27.0	8.5	19.6	20.0
2098	4	25.3	28.8	4.7	59.7	23.6	7.7	18.9	23.3	10.1	52.7	33.6	20.7	59.7	22.5	46.2	12.2	26.9	56.6	28.2	6.5	29.2	49.6	52.7	32.8	45.5	4.7	7.5	21.0
2098	5	38.3	43.9	13.5	76.2	26.8	33.9	21.8	38.9	72.3	22.3	13.5	73.5	40.3	32.9	45.8	37.7	46.4	36.3	46.6	67.6	37.2	26.1	72.4	76.2	32.0	73.7	46.7	32.8
2098	6	57.2	64.4	24.5	132.2	56.8	65.8	86.6	53.9	72.6	38.4	43.7	51.1	42.2	111.6	33.5	72.9	100.1	105.4	48.2	82.8	39.5	52.3	132.2	60.0	24.5	57.6	38.9	76.3
2098	7	63.6	71.4	19.5	205.9	64.5	21.8	56.1	205.9	27.0	96.4	59.3	47.6	65.4	33.2	52.2	58.6	68.7	68.1	19.5	89.2	37.1	126.5	91.8	62.7	55.9	136.1	73.7	96.8
2098	8	66.1	67.0	20.0	170.1	120.3	62.7	70.6	82.4	44.8	80.8	23.6	20.0	54.6	77.7	65.0	82.7	21.9	45.4	74.8	67.1	86.1	27.3	170.1	117.3	43.8	68.1	58.7	43.0
2098	9	60.6	65.7	27.3	131.2	38.8	50.0	59.6	127.3	29.7	131.2	27.3	39.7	80.5	64.8	38.2	68.2	46.0	54.1	82.0	62.9	115.4	63.4	119.7	82.8	60.3	61.0	45.6	27.3
2098	10	39.7	40.4	17.8	73.5	21.6	25.8	46.0	23.4	39.7	30.6	44.1	45.5	31.8	27.3	43.1	17.8	72.5	44.2	33.9	46.9	48.4	39.5	42.7	39.7	71.5	73.5	33.2	28.1
2098	11	43.1	47.0	25.1	100.2	29.3	28.3	41.9	34.8	41.4	61.1	32.4	32.1	42.0	29.9	38.7	25.1	52.8	49.8	100.2	56.6	57.6	54.5	58.0	41.9	44.3	47.0	83.7	45.7
2098	12	32.8	34.9	11.5	64.7	64.7	22.1	28.3	43.9	23.3	30.0	44.6	53.4	42.3	20.9	47.5	21.5	52.6	34.3	12.1	41.2	25.4	62.6	11.5	49.2	33.2	14.0	32.4	26.6
2099	1	23.7	26.2	6.0	73.6	14.3	19.2	18.1	39.8	19.5	19.7	36.2	23.0	8.6	23.8	32.8	35.7	22.2	23.6	27.7	46.2	6.0	30.3	10.3	26.5	26.3	20.5	73.6	25.5
2099	2	22.1	25.8	8.3	52.8	52.8	34.4	30.6	19.4	20.5	29.8	14.4	48.3	22.2	12.8	36.8	10.8	36.3	31.5	16.7	22.0	20.4	32.3	19.6	33.5	22.0	27.9	15.6	8.3
2099	3	18.0	20.9	2.5	43.2	26.8	18.8	18.7	30.1	16.9	24.8	32.5	20.2	15.5	10.8	5.6	14.9	17.1	10.3	43.0	14.0	7.5	23.0	41.7	38.9	43.2	17.3	7.4	2.5
2099	4	22.8	26.4	4.5	68.5	29.4	29.7	35.2	9.5	12.6	14.5	31.3	14.6	14.5	21.2	12.1	48.8	23.3	22.3	43.2	19.5	13.3	62.2	28.6	68.5	12.0	31.0	31.4	4.5
2099	5	34.5	39.3	9.3	91.1	20.9	31.1	55.0	32.0	41.7	88.6	20.6	44.2	31.9	45.2	11.9	19.5	46.1	37.0	37.6	76.0	9.3	23.0	19.8	83.8	91.1	24.1	38.7	14.8
2099	6	64.5	62.5	4.4	131.8	29.7	5.3	128.1	131.8	83.8	77.4	32.5	72.9	58.1	4.4	55.4	95.1	76.2	15.4	48.2	39.7	111.0	33.5	78.5	71.0	88.1	71.8	55.6	35.9
2099	7	74.5	75.0	22.0	137.9	41.4	28.9	128.2	80.5	137.9	68.5	25.7	54.5	90.4	104.5	69.0	72.9	51.9	100.0	22.0	61.4	102.7	77.0	77.9	76.0	114.9	70.4	35.0	107.3
2099	8	64.8	66.4	9.3	120.6	120.6	64.4	72.6	104.2	42.2	106.5	87.8	41.2	48.9	60.0	84.5	26.1	9.3	31.2	97.9	65.2	84.9	60.2	94.5	61.1	85.7	66.9	60.3	17.7
2099	9	59.9	66.2	21.1	123.8	68.7	98.0	31.3	99.3	80.7	90.2	71.9	48.2	38.0	50.0	47.4	38.8	51.1	37.1	32.4	94.8	123.8	86.8	111.6	45.2	102.1	81.3	21.1	38.8
2099	10	33.5	40.7	17.5	67.7	24.3	64.6	17.5	32.2	56.3	23.1	52.0	59.1	30.5	30.2	30.8	58.0	31.2	34.1	22.5	28.3	32.8	46.2	50.0	50.1	62.6	67.7	26.4	45.7
2099	11	43.3	44.4	12.5	76.5	17.9	54.0	50.4	23.0	44.9	72.6	36.4	33.7	35.4	35.0	76.5	47.1	37.2	12.5	63.2	13.0	49.5	68.1	50.0	39.3	41.7	57.6	66.7	38.7
2099	12	26.0	29.3	13.3	50.6	41.2	13.3	26.3	34.0	32.1	26.4	49.8	41.6	22.4	23.8	30.4	50.6	21.9	19.3	25.8	23.8	48.1	19.7	17.9	21.0	43.2	31.4	16.6	21.5
2100	1	26.1	25.8	0.0	49.3	41.5	32.8	22.4	35.3	28.0	33.6		0.0	30.0	20.3	19.0	38.2	8.9	26.1	7.6	11.2	14.4	24.7	47.7	42.1	22.9	27.0	11.2	49.3
2100	2	19.5	21.7	0.0	57.9	8.6	14.3	33.1	30.1	34.7	51.0		0.0	24.3	8.0	24.2	19.5	27.2	57.9	19.3	23.2	12.5	18.6	21.1	7.5	17.7	11.0	21.0	13.7
2100	3	27.9	27.1	0.0	68.4	13.3	20.8	31.8	28.5	17.0	22.4		0.0	17.3	23.2	33.1	28.3	68.4	27.9	44.2	39.4	12.4	37.5	40.8	34.6	20.0	18.0	8.4	35.2
2100	4	23.8	23.5	0.0	53.1	17.5	23.8	53.1	31.2	7.9	12.8		0.0	13.0	22.2	10.6	27.5	25.0	27.9	41.8	21.5	24.5	31.4	49.5	32.7	44.2	11.2	3.3	8.9
2100	5	43.1	39.5	0.0	74.8	35.8	58.9	74.8	50.0	13.5	65.3		0.0	44.2	43.1	26.4	48.7	45.1	44.7	30.4	27.3	27.4	32.8	55.7	15.3	53.3	37.5	26.7	51.1
2100	6	53.3	58.4	0.0	148.8	33.1	58.2	45.4	148.8	61.0	78.3		0.0	74.1	77.5	21.4	68.3	41.6	33.8	53.3	37.1	143.8	67.8	31.4	49.8	37.1	52.1	61.4	67.2
2100	7	83.5	82.2	0.0	134.7	132.9	37.8	129.1	49.5	134.7	89.3		0.0	83.5	112.6	108.6	53.8	65.6	54.6	30.6	118.2	62.3	91.1	72.9	58.1	108.0	100.9	81.2	115.0
2100	8	65.3	65.2	0.0	127.2	81.5	65.3	36.8	71.4	107.8	127.2		0.0	74.3	90.6	34.5	55.5	31.8	65.7	50.1	81.7	39.7	71.7	108.4	60.3	51.7	44.9	54.9	93.5
2100	9	52.8	61.3	0.0	132.8	132.8	57.6	96.0	113.7	48.2	78.2		0.0	71.0	49.7	36.2	51.2	25.4	83.8	13.9	48.4	29.7	50.2	101.0	46.7	52.8	92.3	67.2	63.7
2100	10	36.5	36.9	0.0	65.5	42.3	36.8	25.7	30.7	65.4	43.9		0.0	39.7	40.6	25.1	36.4	50.0	36.9	31.9	36.5	41.2	43.9	65.5	35.9	22.8	33.2	33.7	31.4
2100	11	35.9	35.9	0.0	68.3	51.1	21.1	38.4	42.7	68.3	47.2		0.0	11.5	35.9	39.7	33.7	31.8	60.9	42.4	38.0	24.4	8.9	64.3	32.2	52.2	32.5	29.3	18.8
2100	12	35.6	36.7	0.0	70.9	49.0	27.4	36.4	28.5	35.6	40.5		0.0	22.1	70.9	40.4	42.1	66.3	28.5	33.9	24.8	59.6	37.1	34.0	25.4	33.3	37.5	29.3	40.6

RCP8.5
Max Daily Precip (mm)

						std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d
Year	**Month**	**Median**	**Mean**	**Min**	**Max**	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
2011	1	4.0	4.3	1.9	11.1	4.2	1.9	4.0	2.6	11.1	2.6	6.1	6.6	6.1	2.5	6.6	4.7	6.3	3.3	3.1	2.7	2.3	4.0	4.0	2.5	2.9	4.1	4.6	4.1
2011	2	4.0	5.4	1.5	17.6	3.0	7.6	9.4	1.5	2.0	2.9	1.8	3.4	4.9	6.5	6.4	3.8	1.7	9.1	3.5	5.7	4.2	17.6	5.6	3.8	2.5	7.9	11.8	3.5
2011	3	5.7	6.5	1.3	13.4	4.2	11.5	9.5	5.7	4.3	3.6	1.3	4.2	5.7	3.9	5.6	6.9	11.6	4.8	6.5	8.4	9.1	4.8	6.5	4.6	10.9	5.7	13.4	3.6
2011	4	4.1	4.3	1.0	10.5	1.4	4.3	5.1	3.1	4.6	2.9	1.2	1.0	5.5	7.5	3.4	10.5	5.0	4.7	9.5	6.7	4.7	2.3	3.6	3.9	2.2	1.5	6.9	2.7
2011	5	7.9	8.7	2.5	22.3	8.7	11.7	3.4	8.4	5.1	8.4	5.3	12.0	5.9	9.7	4.2	22.3	18.9	3.5	8.7	14.1	6.9	5.7	11.1	2.5	13.6	7.3	3.5	7.5
2011	6	10.6	12.1	5.5	23.1	10.5	22.8	14.8	7.4	11.8	13.6	5.7	6.6	10.7	18.0	9.8	7.3	15.3	20.3	16.6	6.5	13.1	23.1	5.5	10.4	8.8	9.6	13.2	9.7
2011	7	13.8	15.1	5.2	39.8	14.6	16.0	11.6	5.2	17.0	8.3	24.2	6.1	39.8	14.3	8.6	9.9	12.5	16.8	19.2	13.3	12.0	12.9	16.0	15.1	24.1	26.6	8.9	9.8
2011	8	10.3	12.0	4.0	32.2	18.9	16.2	10.5	10.1	17.7	8.9	7.4	6.9	8.0	10.9	13.0	8.3	4.0	7.1	19.9	7.3	12.9	13.7	32.2	7.3	10.5	20.1	9.0	7.6
2011	9	15.9	16.7	3.7	45.9	26.0	3.7	17.8	25.2	11.1	6.5	15.9	45.9	16.7	15.8	17.3	9.8	11.2	16.8	10.4	18.9	12.8	7.1	17.8	13.7	15.3	9.1	38.1	18.6
2011	10	5.5	6.4	1.8	15.7	3.6	5.3	5.0	1.8	5.7	2.2	5.0	3.0	5.7	8.3	2.9	8.8	5.1	8.7	15.7	9.3	11.2	2.9	7.6	3.3	13.5	9.2	3.7	7.1
2011	11	6.0	6.0	1.2	9.9	6.5	9.2	8.6	3.1	5.1	3.7	9.9	6.1	3.0	5.2	3.9	8.5	2.5	7.2	4.7	8.4	7.9	5.9	1.2	5.8	7.2	7.6	5.7	6.7
2011	12	5.0	5.4	3.0	9.9	3.4	7.6	4.4	3.0	7.0	7.6	8.9	4.5	3.9	7.7	5.8	3.0	4.4	9.9	6.6	6.0	5.3	3.2	4.9	3.3	6.3	4.4	3.8	5.1
2012	1	4.2	5.8	1.9	27.0	2.4	6.2	3.2	1.9	4.8	3.5	11.8	7.8	5.4	4.6	4.1	27.0	4.3	9.3	5.3	3.1	3.7	3.6	2.7	7.6	3.7	3.8	7.5	2.6
2012	2	4.3	4.7	0.9	16.0	4.5	2.0	2.5	5.9	3.4	2.6	9.1	4.6	0.9	4.3	16.0	3.0	3.3	3.4	4.9	2.4	4.0	4.3	4.5	7.2	3.6	4.5	6.8	4.6
2012	3	5.0	5.8	1.0	11.9	1.0	8.8	4.7	6.5	3.3	4.9	8.1	1.8	4.4	5.4	11.3	4.0	8.6	5.1	2.6	9.3	4.6	3.0	2.1	11.2	7.0	3.7	11.9	5.3
2012	4	5.3	6.4	1.2	20.1	8.0	2.6	9.1	8.8	5.8	7.0	5.3	4.7	5.3	3.9	3.3	17.4	3.6	9.6	6.3	5.4	7.1	6.3	4.7	1.2	2.7	20.1	4.3	1.9
2012	5	9.2	9.2	3.5	17.3	7.3	12.4	9.0	6.5	10.1	9.5	8.6	4.9	10.9	14.7	11.6	5.9	9.3	10.4	13.3	3.5	5.4	5.0	4.3	14.7	6.9	13.8	17.3	6.5
2012	6	12.3	12.1	5.5	23.0	5.5	7.7	15.1	10.6	9.8	12.1	10.3	9.1	14.0	6.8	17.0	14.3	13.2	18.9	12.7	13.5	23.0	11.6	12.5	15.5	6.0	7.9	13.9	9.6
2012	7	12.3	14.5	4.5	31.7	4.5	10.1	13.1	8.2	5.1	9.3	21.0	29.1	7.8	13.1	31.5	13.1	13.9	30.6	8.6	8.7	9.7	6.1	11.5	13.8	20.6	31.7	18.1	8.4
2012	8	14.0	15.1	5.5	33.2	17.4	16.8	10.9	9.8	33.2	14.4	22.4	14.1	9.9	26.4	27.5	9.1	15.1	9.1	12.7	8.9	7.5	16.3	11.5	14.0	9.7	23.7	5.5	16.4
2012	9	13.4	15.1	3.1	38.6	6.7	6.4	17.6	14.0	25.8	31.8	30.7	15.2	10.9	11.0	19.8	3.1	4.5	19.1	15.0	10.9	6.0	6.5	7.0	12.8	19.4	38.6	18.1	11.0
2012	10	7.4	7.8	2.5	19.5	6.5	2.5	7.0	3.9	9.4	5.5	9.6	8.5	13.1	7.1	4.3	7.6	8.2	6.7	5.0	6.8	3.5	10.4	6.1	10.7	8.0	19.5	7.9	8.3
2012	11	7.1	7.5	3.6	12.5	8.6	6.5	12.5	6.8	7.1	3.6	12.1	5.0	12.5	5.2	5.6	7.1	6.5	7.5	4.8	8.9	9.4	11.7	7.4	7.8	5.9	3.6	6.8	7.4
2012	12	4.2	5.1	2.1	10.9	10.0	8.9	7.6	7.0	2.8	4.3	5.4	3.2	3.6	8.1	4.0	5.0	10.9	6.4	2.6	6.1	2.3	2.1	5.3	3.4	3.4	2.6	4.0	4.2
2013	1	4.9	5.7	1.6	11.8	4.1	4.3	9.0	3.3	4.6	3.5	8.2	11.8	6.7	2.0	8.0	10.8	4.9	1.6	9.1	8.1	5.0	5.3	4.6	5.4	4.1	5.6	4.0	3.1
2013	2	4.6	4.6	0.9	10.4	5.7	2.2	5.6	5.4	4.2	3.6	5.0	4.6	5.1	5.5	2.4	3.5	6.1	7.0	8.8	4.5	10.4	4.7	2.5	0.9	3.7	1.2	4.0	3.5
2013	3	4.5	4.6	1.3	9.3	2.6	5.5	5.3	6.0	4.6	4.1	4.3	8.1	4.5	3.0	3.6	5.4	5.4	4.7	1.3	7.0	9.3	2.0	1.7	2.7	4.3	4.8	3.5	6.9
2013	4	4.5	5.2	1.8	13.7	10.8	4.6	8.7	5.8	11.0	2.3	1.8	6.5	2.7	4.2	3.7	4.9	2.3	3.5	4.1	13.7	4.7	4.5	4.2	5.3	3.3	4.4	2.9	5.9
2013	5	6.9	7.9	3.3	16.8	3.3	4.4	4.0	6.3	7.7	7.5	9.1	10.6	12.7	10.2	13.0	6.3	12.1	13.5	10.1	6.1	5.4	4.2	3.3	9.0	6.4	4.6	3.5	16.8
2013	6	11.1	13.9	4.5	52.6	7.3	11.6	9.3	14.9	14.9	18.4	9.7	6.9	32.2	11.6	7.4	11.0	14.8	9.7	4.5	22.4	4.8	9.8	52.6	14.7	7.5	8.7	11.2	17.3
2013	7	14.2	17.9	7.8	47.4	29.3	14.7	20.2	8.7	13.7	9.8	26.7	9.3	8.0	26.6	28.3	8.1	20.3	11.4	12.0	16.8	35.1	9.2	14.7	29.8	7.8	11.2	47.4	10.3
2013	8	13.4	15.5	6.5	36.5	10.0	23.4	23.9	15.2	36.5	17.2	11.9	6.6	13.8	11.4	12.3	13.0	6.5	11.9	14.2	23.3	15.5	7.8	8.2	15.4	29.1	7.1	25.2	11.9
2013	9	13.0	14.5	2.6	62.0	16.5	7.2	8.0	7.9	2.6	14.0	5.8	20.3	16.5	12.1	4.5	12.5	14.9	17.5	10.3	5.5	20.7	13.5	9.5	6.8	22.4	62.0	18.2	17.6
2013	10	7.2	8.0	3.6	21.5	21.5	9.8	6.8	9.6	12.1	5.6	4.7	5.1	8.1	6.0	7.3	8.9	4.8	7.2	5.2	5.6	3.6	9.3	10.7	8.5	8.0	12.5	5.5	6.7
2013	11	6.2	6.5	2.1	14.2	6.5	7.6	3.1	2.9	7.8	6.3	14.2	13.2	3.6	10.2	5.1	3.9	6.0	4.6	2.9	8.5	3.9	9.0	4.1	2.1	10.0	6.8	8.2	6.0
2013	12	4.8	6.2	2.0	24.2	5.4	10.2	4.2	4.5	4.4	3.6	10.3	6.5	2.1	4.3	4.0	7.9	6.3	2.0	4.7	4.3	24.2	5.7	7.9	4.7	3.6	4.8	5.8	7.5
2014	1	4.3	5.9	1.5	18.1	2.3	11.1	8.5	6.4	18.1	2.3	7.5	3.9	4.3	4.8	8.4	8.9	4.3	3.3	4.9	13.8	3.5	2.3	1.5	3.9	3.6	3.3	4.2	6.7
2014	2	3.9	4.5	1.4	10.8	3.1	4.0	4.8	7.3	5.4	1.9	3.3	3.2	5.3	2.9	6.5	3.4	3.4	4.7	3.9	2.9	4.6	10.8	1.9	1.4	4.1	9.3	4.8	3.9
2014	3	4.3	5.6	2.1	15.8	2.1	14.4	4.1	7.2	15.8	2.3	4.3	3.4	4.2	4.6	3.9	4.7	2.9	3.4	10.4	9.9	4.6	3.6	5.2	3.7	4.8	2.2	9.4	2.4
2014	4	4.8	5.4	2.0	16.0	3.7	3.5	4.1	4.9	7.7	4.7	7.5	5.3	3.9	2.0	4.1	7.1	3.9	6.8	16.0	3.7	9.1	6.2	3.0	3.6	3.0	5.7	4.9	5.3
2014	5	10.9	11.6	2.1	31.3	11.9	2.1	5.2	18.3	10.2	16.1	15.9	3.8	14.1	7.4	5.5	17.7	19.5	20.6	10.0	12.9	16.6	8.9	4.9	31.3	11.5	7.8	2.5	4.3
2014	6	13.9	17.0	4.4	56.1	10.6	4.4	16.0	16.9	20.2	15.3	13.5	11.0	41.5	14.2	5.8	25.6	20.7	10.8	28.5	15.3	13.3	18.6	10.5	7.5	13.6	6.0	11.4	56.1
2014	7	13.4	18.0	8.9	51.0	11.9	14.1	13.9	15.6	19.3	18.8	9.2	40.7	10.9	11.4	11.1	13.9	51.0	31.8	8.9	12.4	15.1	37.7	26.3	9.8	9.7	12.1	12.9	12.8
2014	8	10.4	12.0	3.6	35.8	8.3	8.6	7.9	14.7	8.3	17.6	12.7	5.6	10.9	18.0	12.2	11.4	9.9	9.0	3.6	11.1	15.7	9.6	9.9	14.0	3.6	20.4	8.4	35.8
2014	9	15.8	16.8	3.4	40.6	12.5	14.9	31.0	20.3	17.4	18.0	24.0	18.9	13.5	22.9	13.3	12.2	16.6	9.4	7.3	19.1	40.6	5.5	14.9	20.2	13.5	14.9	18.2	3.4
2014	10	6.9	6.6	1.5	13.3	9.7	10.6	3.9	7.8	11.4	1.5	7.0	5.6	3.4	8.4	3.3	10.4	2.5	10.2	13.3	5.7	8.9	7.1	2.1	4.3	3.8	2.9	8.6	6.8
2014	11	6.8	7.3	0.9	18.9	5.7	6.7	6.1	5.1	5.5	10.3	2.9	9.0	10.0	8.3	6.7	4.9	6.9	4.1	8.1	18.9	0.9	11.8	3.9	8.2	10.6	9.1	4.6	8.1
2014	12	5.9	6.5	0.9	16.4	16.4	6.3	12.2	7.0	8.5	10.1	2.6	4.4	7.2	3.1	4.1	4.6	7.2	0.9	2.5	5.2	6.1	5.1	5.6	7.7	7.0	5.6	10.5	5.4
2015	1	3.9	4.8	0.8	11.0	8.7	7.5	3.1	4.5	6.0	2.4	3.1	2.7	8.2	1.7	3.5	4.1	0.8	5.4	2.8	3.7	11.0	6.7	4.9	7.8	3.0	8.9	3.1	1.6
2015	2	4.0	4.8	1.4	10.1	5.6	2.2	4.7	5.4	2.8	3.6	3.7	7.5	5.4	4.0	3.6	2.3	3.1	8.8	4.9	3.5	3.5	4.0	1.4	7.9	10.1	3.9	6.6	5.6
2015	3	5.0	5.0	1.3	11.5	4.8	3.7	6.2	4.9	10.0	3.0	1.7	3.0	8.4	5.1	2.8	2.9	5.7	5.4	7.3	5.6	11.5	1.3	5.4	6.4	6.9	2.0	4.0	3.0
2015	4	5.9	6.1	3.1	8.8	8.3	3.8	3.6	3.7	3.7	3.1	8.7	4.5	3.7	8.2	8.5	4.6	6.7	4.8	5.1	7.6	8.7	6.0	8.4	8.4	8.8	4.6	6.9	5.9
2015	5	6.5	8.7	2.8	21.4	6.1	5.5	11.7	12.8	5.1	4.2	3.7	13.0	17.0	13.5	7.9	3.6	2.8	3.1	4.7	14.7	4.5	5.0	10.7	21.4	3.6	6.9	16.7	11.1
2015	6	12.0	14.5	2.2	35.5	27.2	10.6	35.5	2.2	12.9	5.0	16.5	8.7	23.3	17.2	11.0	8.9	22.9	6.0	7.3	8.8	33.1	15.5	6.8	26.6	9.1	5.8	13.3	13.7
2015	7	16.6	17.9	4.7	59.5	59.5	8.0	10.5	20.9	8.6	6.9	30.3	22.3	21.6	8.2	19.4	13.9	9.7	24.8	10.5	23.5	12.6	21.1	8.0	7.0	33.5	22.9	20.3	4.7
2015	8	14.1	15.2	4.7	47.2	13.0	9.6	14.7	23.9	15.7	14.9	14.0	9.1	17.2	13.6	14.0	6.4	18.7	47.2	13.8	5.8	25.7	21.6	16.0	16.0	4.7	6.4	7.8	14.1
2015	9	12.8	13.4	5.0	23.4	22.3	11.4	7.1	14.1	5.0	19.1	18.8	16.9	23.4	23.3	17.0	19.5	6.0	5.2	19.7	5.2	12.6	5.3	6.7	5.7	13.0	21.9	10.7	12.5
2015	10	7.8	7.4	2.2	15.0	14.9	12.9	2.5	7.0	9.7	7.7	8.3	4.0	8.1	3.2	3.3	8.0	3.9	8.5	7.3	4.6	4.4	10.1	2.2	5.7	15.0	8.0	9.5	8.2
2015	11	7.7	7.6	2.8	13.1	8.9	6.9	10.2	8.4	9.4	6.3	4.8	6.6	2.8	5.2	3.9	9.6	9.1	11.0	7.2	3.9	8.1	7.1	8.2	6.5	13.1	6.8	8.6	8.9
2015	12	4.1	4.9	1.4	13.0	4.3	6.2	3.5	3.8	3.5	13.0	2.6	3.2	6.1	6.6	4.2	2.6	9.4	1.4	1.8	4.5	6.5	4.1	4.9	3.7	6.0	9.2	3.2	3.0
2016	1	5.0	5.0	2.1	10.7	10.7	5.3	6.1	6.1	6.0	2.6	5.8	2.1	5.1	4.2	4.4	3.2	5.0	2.3	7.1	6.6	2.5	4.0	6.4	6.0	6.5	3.8	3.8	3.1
2016	2	3.8	4.8	1.4	18.8	3.3	3.7	4.6	2.6	3.4	6.7	18.8	6.3	2.0	1.8	4.1	5.5	11.4	2.8	3.8	2.3	3.8	5.6	1.4	7.6	1.4	1.6	4.7	6.1
2016	3	4.1	5.0	1.7	11.3	7.5	5.5	3.2	2.7	5.1	8.6	2.8	2.9	4.2	1.8	3.8	8.7	5.4	5.5	6.5	4.0	3.0	11.3	3.3	7.5	2.8	1.7	8.1	3.4
2016	4	4.6	5.9	1.3	11.7	2.6	2.5	3.9	9.7	7.7	3.3	3.2	11.1	7.7	1.3	3.0	6.0	9.4	3.7	10.1	2.7	10.3	9.5	8.1	5.1	2.8	4.0	11.7	2.9
2016	5	8.8	10.0	3.0	24.9	12.7	7.2	12.4	14.1	5.9	8.4	5.0	11.1	4.6	6.7	3.5	10.2	23.8	4.9	3.0	16.5	4.6	9.2	7.8	17.0	9.9	24.9	4.7	12.0
2016	6	11.3	13.6	3.0	42.6	14.4	3.7	24.2	8.7	4.3	6.4	14.6	42.6	11.0	8.1	12.6	21.0	11.5	8.2	14.5	19.5	9.9	8.0	10.5	13.8	30.7	20.4	4.2	3.0
2016	7	12.1	15.5	6.1	37.6	30.4	8.2	10.9	10.4	18.1	10.0	10.2	9.7	7.5	8.1	23.0	15.4	8.0	30.3	23.8	6.1	12.2	37.6	18.2	12.0	13.6	13.2	10.3	23.8
2016	8	12.3	16.0	5.4	39.3	9.7	9.1	14.5	5.9	9.5	14.9	33.4	8.5	7.8	19.8	35.5	39.3	22.1	39.0	12.2	5.7	12.4	13.5	9.9	10.7	18.8	5.4	8.6	18.5
2016	9	13.6	15.3	2.5	55.7	11.9	25.4	16.3	16.2	19.6	12.4	55.7	14.7	13.9	10.3	23.4	3.4	2.5	12.0	10.9	13.2	16.7	12.7	8.2	16.1	11.0	8.4	18.2	14.2
2016	10	8.4	8.5	1.2	18.3	9.5	2.4	3.2	1.2	10.1	9.0	16.3	6.9	15.6	9.9	5.2	7.2	11.0	16.0	9.5	18.3	6.8	9.4	5.3	7.8	4.3	6.1	10.2	3.1
2016	11	5.3	6.5	2.8	16.6	4.1	4.8	4.0	4.8	4.5	16.6	10.6	6.5	5.4	6.8	7.9	5.5	4.8	6.4	3.1	4.7	12.6	5.3	8.5	3.6	9.7	2.8	5.3	6.9
2016	12	4.9	5.3	1.0	10.1	2.8	5.1	4.6	8.2	5.1	5.7	5.8	8.6	4.7	4.4	3.8	3.9	4.0	9.3	4.0	5.9	2.6	1.0	2.8	5.2	3.3	5.7	9.7	10.1
2017	1	4.4	4.9	1.5	10.0	6.4	1.5	4.2	7.0	4.7	4.5	3.8	4.8	3.1	5.9	6.5	7.5	3.6	1.9	2.5	8.5	5.4	1.9	10.0	4.4	3.9	3.1	8.8	3.4
2017	2	3.9	5.2	1.9	26.5	2.2	4.5	6.1	3.1	6.0	3.3	3.1	2.1	3.1	2.9	3.7	5.7	1.9	4.1	26.5	5.0	9.5	3.2	3.5	5.2	4.3	8.2	1.9	6.3
2017	3	4.6	5.3	1.2	15.3	3.0	1.2	4.2	13.0	15.3	3.6	4.6	3.0	3.0	5.9	4.5	8.4	4.6	2.6	4.9	5.8	2.9	4.9	7.0	5.4	8.9	3.9	5.5	1.9
2017	4	5.7	6.4	1.4	15.2	6.3	5.7	2.8	6.7	3.5	4.6	4.6	3.2	10.9	5.4	5.9	10.3	6.0	5.4	15.2	9.4	13.5	6.8	2.0	7.9	5.1	1.4	5.7	5.4
2017	5	10.2	10.2	2.7	18.7	8.9	7.3	14.4	15.1	2.7	4.7	5.4	15.9	9.1	14.1	18.7	6.9	10.5	4.7	12.5	6.3	13.0	4.8	10.1	12.6	9.7	16.1	10.4	11.6
2017	6	9.1	12.5	2.9	32.7	6.5	3.2	11.3	9.4	9.0	8.5	10.9	7.1	10.2	2.9	26.5	6.8	6.8	8.6	26.0	32.7	25.0	8.7	29.5	9.9	9.2	6.4	19.5	6.2
2017	7	15.2	16.6	5.6	47.9	20.4	27.3	18.3	11.0	17.6	12.3	9.8	9.9	12.0	15.7	47.9	5.6	14.5	10.2	8.0	15.2	11.4	19.8	16.0	25.8	24.1	22.0	7.6	15.2
2017	8	12.6	17.7	4.4	67.0	31.5	12.5	12.7	11.2	28.9	10.3	21.9	21.6	32.6	12.2	18.1	10.1	13.6	6.3	67.0	12.4	5.7	5.9	16.7	9.3	21.4	29.7	4.4	8.3
2017	9	11.2	13.5	3.1	32.0	32.0	11.1	7.8	9.3	22.8	24.4	8.6	17.9	21.6	9.2	10.7	10.3	3.1	4.1	13.8	18.3	23.1	15.6	11.3	11.9	9.2	11.9	8.0	9.3
2017	10	7.8	9.1	3.5	18.9	13.9	13.4	14.4	5.5	7.6	3.5	3.5	5.2	9.8	13.0	5.8	13.3	8.1	11.2	18.9	7.0	5.4	6.7	9.7	4.0	6.5	16.7	8.6	6.8
2017	11	7.0	6.8	2.4	13.3	5.4	2.7	2.9	4.5	13.3	5.5	4.4	10.1	3.0	2.8	8.5	8.7	2.4	10.3	7.7	4.8	8.3	10.5	9.3	8.3	7.3	6.0	9.0	6.8
2017	12	4.7	5.1	1.3	11.8	6.2	11.8	3.9	4.9	7.7	6.9	2.6	6.1	4.5	1.3	2.5	6.1	4.1	1.9	4.2	5.9	4.6	3.8	2.3	4.4	8.3	7.1	5.7	6.9
2018	1	5.1	6.4	1.7	24.9	4.6	4.1	1.8	4.3	17.0	6.1	5.1	7.1	5.1	6.6	3.1	11.9	7.8	4.5	4.3	4.7	5.7	3.6	1.7	5.1	6.2	24.9	6.6	2.1

2018	2	3.9	4.5	1.8	10.6	2.7	3.6	4.2	4.6	3.7	3.4	3.7	8.6	4.0	5.7	5.1	3.9	4.2	10.6	2.7	3.5	3.9	3.3	3.7	6.8	4.8	1.8	4.1	6.5
2018	3	5.0	6.4	0.9	14.7	3.2	5.2	4.8	1.5	5.9	14.7	9.1	9.4	4.0	0.9	4.2	3.7	3.3	12.0	8.9	8.5	12.4	2.0	14.4	4.5	8.1	2.4	4.1	5.8
2018	4	5.3	6.7	2.2	16.0	2.7	11.6	12.9	5.8	3.6	2.2	4.7	6.4	5.5	2.9	12.5	5.9	8.2	4.1	16.0	13.3	5.1	4.2	4.4	7.7	3.3	5.2	8.4	3.6
2018	5	6.8	8.0	2.4	22.3	3.9	8.6	12.9	3.6	6.9	4.4	2.5	7.7	4.2	9.4	7.3	22.3	13.5	6.0	2.4	5.1	11.9	7.0	6.7	13.3	13.3	5.9	6.6	5.6
2018	6	10.2	12.3	4.4	23.9	9.7	8.6	4.4	8.8	13.4	14.9	8.1	9.7	9.3	9.0	23.9	13.4	9.7	12.1	6.9	18.8	7.6	20.5	22.7	10.6	8.9	20.4	12.3	11.7
2018	7	14.2	15.8	7.4	34.9	17.8	7.6	14.1	12.4	8.2	16.6	14.4	8.3	8.5	12.5	34.9	10.5	15.1	16.5	17.3	9.6	32.9	16.8	13.3	27.1	7.4	13.3	29.4	15.7
2018	8	12.4	14.7	5.8	37.9	19.2	8.8	8.8	9.8	25.2	16.6	10.2	10.3	15.9	25.0	5.8	14.4	8.9	25.6	17.3	6.6	7.7	17.8	20.6	7.5	9.5	9.2	37.9	15.1
2018	9	15.1	14.9	4.9	25.7	6.7	17.2	22.7	15.1	13.5	8.8	16.0	16.6	12.2	21.0	18.2	17.5	4.9	10.4	16.7	18.8	13.2	11.0	15.1	25.7	9.9	14.4	18.1	14.1
2018	10	7.5	7.3	1.0	18.3	7.4	1.0	8.9	3.1	2.3	6.0	7.6	18.3	8.6	8.1	4.7	5.2	11.3	5.5	14.3	5.9	8.5	2.8	3.2	10.2	7.9	8.9	9.2	6.4
2018	11	6.5	7.3	1.7	14.8	1.7	10.3	7.8	8.7	5.7	9.3	10.6	5.1	6.3	4.6	7.5	6.8	5.6	3.1	8.4	12.3	14.8	9.4	5.1	13.0	6.3	4.0	4.7	5.4
2018	12	5.2	5.7	2.8	11.9	7.5	2.8	4.1	3.1	5.7	6.1	5.0	6.1	3.7	8.2	3.2	5.3	11.0	5.0	9.3	6.0	4.9	3.6	5.9	3.7	6.0	4.8	4.0	11.9
2019	1	4.3	4.7	1.5	7.6	3.6	6.3	7.6	2.6	7.2	3.4	6.1	4.1	6.4	3.1	6.5	1.5	3.9	1.9	6.5	3.5	3.8	3.7	5.8	5.2	4.4	3.9	4.5	6.2
2019	2	4.3	4.3	1.5	8.6	1.5	6.0	8.6	5.4	4.0	4.6	2.2	3.0	2.5	4.5	5.2	2.4	5.3	4.1	4.1	3.9	6.0	4.7	2.7	7.6	5.5	4.7	2.4	2.7
2019	3	5.3	5.5	1.8	11.3	5.4	5.1	4.2	7.3	11.3	3.0	6.4	6.3	5.3	3.6	1.8	4.7	2.1	2.3	7.6	5.7	9.1	10.0	2.6	4.5	11.0	5.5	5.9	2.2
2019	4	5.1	8.0	1.2	22.0	4.2	2.6	9.7	14.1	3.3	4.8	20.1	3.9	5.4	9.5	3.2	17.6	3.4	11.8	1.2	9.2	13.0	5.8	3.5	2.1	15.6	2.8	22.0	3.2
2019	5	9.2	9.7	3.2	21.1	13.3	4.3	7.1	6.5	13.6	4.2	12.4	21.1	3.3	9.7	3.2	15.4	9.1	4.6	10.4	4.2	9.1	7.8	15.4	14.0	13.6	9.3	5.7	14.7
2019	6	11.8	11.3	2.1	22.1	10.3	6.2	11.3	12.8	15.3	13.8	11.9	15.7	14.4	22.1	10.0	2.3	14.2	14.7	19.1	8.7	5.9	10.2	11.6	2.1	6.2	7.2	13.7	12.1
2019	7	14.7	16.2	9.2	38.3	19.8	9.2	18.9	11.3	11.5	16.7	38.3	13.3	11.7	23.8	13.3	10.1	11.9	9.8	11.5	19.9	10.1	16.1	23.0	21.9	9.4	23.2	16.4	18.3
2019	8	11.0	14.5	3.4	34.5	8.3	16.2	5.2	10.4	15.9	20.5	10.8	31.3	18.0	8.2	34.5	3.4	6.6	26.6	16.3	7.0	14.6	9.6	11.2	6.3	9.4	6.0	32.3	17.9
2019	9	12.4	12.4	4.0	24.8	18.6	7.0	16.7	9.7	4.0	4.4	24.8	17.3	21.7	8.9	5.1	11.3	13.0	9.4	13.9	13.5	8.9	13.7	14.9	18.2	10.2	11.8	7.9	13.5
2019	10	7.1	7.5	4.0	17.1	6.5	4.5	5.3	4.7	5.5	6.6	6.6	4.6	9.0	8.2	7.9	7.5	13.9	4.6	17.1	8.1	5.9	10.1	4.5	7.9	4.0	9.4	8.2	8.8
2019	11	5.9	6.9	2.5	16.1	8.6	6.0	7.7	5.9	8.3	14.3	3.0	10.0	6.9	8.7	5.9	5.8	11.2	5.4	5.6	7.3	3.9	3.6	2.6	2.5	16.1	5.5	8.8	2.5
2019	12	4.8	5.4	1.7	11.5	5.3	6.1	4.1	7.0	10.5	5.7	8.5	6.8	7.5	11.5	3.4	5.2	4.0	4.1	2.1	3.7	4.2	3.5	8.6	6.1	3.3	1.7	4.4	3.2
2020	1	4.7	5.2	2.4	11.2	5.7	6.1	2.4	4.4	4.8	4.7	5.0	4.5	6.0	11.2	4.5	4.6	4.9	6.6	4.4	3.6	6.5	3.7	3.0	2.6	4.6	5.7	5.8	8.3
2020	2	4.0	5.3	1.4	20.4	4.0	20.3	5.7	4.1	2.6	3.4	4.9	6.1	2.8	7.2	3.4	3.9	20.4	3.8	4.1	2.7	3.0	3.0	2.2	4.6	1.4	4.9	5.0	3.4
2020	3	4.7	6.1	1.6	16.4	4.6	4.4	4.6	4.8	5.9	9.1	4.6	8.5	4.2	4.1	4.6	10.1	4.0	5.8	6.5	1.6	2.9	7.3	7.7	5.1	16.4	12.8	3.4	4.1
2020	4	5.6	6.7	1.2	17.3	11.1	3.5	3.0	4.7	5.8	4.2	3.9	2.7	8.0	7.8	2.3	17.3	6.3	7.2	5.4	1.2	4.8	13.0	16.9	4.9	6.1	9.8	4.8	6.6
2020	5	12.7	12.2	3.7	24.5	3.7	7.8	14.4	6.4	12.0	13.6	18.7	10.0	18.8	20.4	24.5	7.4	22.7	4.9	9.9	14.2	4.4	9.7	14.3	4.6	13.8	4.1	13.3	19.3
2020	6	9.0	11.3	2.4	30.8	10.6	19.1	6.1	9.6	8.9	11.3	4.7	22.7	25.1	2.4	8.0	5.6	30.8	6.4	12.0	15.3	7.4	6.3	4.0	8.0	6.0	9.1	21.4	9.3
2020	7	12.9	15.7	4.4	39.0	11.8	10.9	6.2	14.1	16.0	8.4	7.8	8.6	7.8	39.0	5.7	14.7	4.4	30.9	9.5	18.8	27.0	16.6	30.7	9.6	14.0	26.7	28.2	9.5
2020	8	11.9	15.8	6.0	47.6	7.9	6.0	14.0	27.4	27.4	19.4	31.9	12.0	7.7	11.2	15.8	9.2	8.9	17.6	13.3	11.8	7.0	19.9	28.1	6.7	8.6	9.1	47.6	10.3
2020	9	15.3	14.8	5.6	32.8	6.4	16.2	9.6	19.9	7.8	10.0	6.6	16.2	15.1	15.4	16.5	20.7	16.1	6.6	10.1	18.9	8.1	5.6	15.1	32.8	12.5	30.6	20.3	17.8
2020	10	7.5	8.0	3.4	18.2	5.7	6.2	8.3	12.4	5.2	18.0	9.4	3.9	6.5	9.1	18.2	6.9	5.1	9.9	5.3	7.8	7.1	7.9	7.9	3.5	3.4	7.9	5.9	9.3
2020	11	6.4	7.0	2.1	12.4	9.0	6.3	4.4	5.4	6.6	9.3	7.3	3.7	6.3	6.3	4.5	9.6	6.5	5.0	11.9	8.1	3.4	5.2	5.5	12.4	7.2	10.9	2.1	10.6
2020	12	5.3	6.0	2.6	13.0	2.9	4.3	10.2	7.0	6.3	5.1	12.0	4.1	9.7	13.0	2.6	3.4	5.5	4.7	3.6	3.9	5.7	3.3	9.0	3.3	6.8	2.9	5.7	8.4
2021	1	4.4	5.1	2.2	15.5	6.7	4.3	2.4	5.3	5.2	4.2	7.2	5.1	8.1	6.9	3.2	3.8	6.0	4.6	5.3	4.0	3.5	4.3	4.0	2.6	4.5	3.7	15.5	2.2
2021	2	3.8	3.8	1.4	7.3	5.3	2.1	2.0	3.5	2.0	2.7	4.7	6.4	2.8	2.9	4.6	1.4	3.7	4.1	5.5	2.7	7.3	2.8	4.5	4.7	5.9	4.1	3.8	1.9
2021	3	5.0	5.6	1.6	14.6	4.4	5.7	2.1	1.6	11.2	5.3	2.8	2.4	3.2	4.8	4.9	5.2	8.8	6.1	10.6	5.5	4.7	7.4	8.6	14.6	6.8	2.2	2.1	4.4
2021	4	4.8	6.3	0.9	14.8	1.9	3.7	14.8	13.0	8.2	3.8	7.6	3.2	7.3	5.2	1.8	14.2	0.9	4.3	14.1	9.3	4.3	5.3	4.2	2.2	3.9	2.6	9.2	6.9
2021	5	6.9	7.8	3.6	15.5	5.9	5.8	9.9	6.9	11.5	5.5	11.9	4.4	6.9	12.9	4.5	9.4	8.1	4.2	5.5	13.4	3.6	8.1	3.8	10.0	6.8	6.8	6.8	15.5
2021	6	12.5	13.0	2.4	25.9	22.6	22.4	12.2	10.4	6.1	4.9	12.5	15.8	5.4	13.6	13.6	13.7	6.0	2.4	17.7	3.8	8.8	25.9	25.8	12.5	12.2	19.0	15.1	9.6
2021	7	15.0	15.9	7.3	28.5	9.8	11.5	7.4	14.2	11.4	13.9	15.8	8.5	28.1	8.7	20.3	25.7	14.4	17.1	7.3	19.8	28.5	15.7	16.4	26.9	22.3	9.4	18.5	10.9
2021	8	11.7	15.1	6.4	39.5	10.9	19.7	9.2	6.7	29.1	30.6	22.3	13.5	11.2	39.5	17.8	18.4	9.5	7.1	9.8	19.9	6.4	12.7	7.2	8.4	12.2	11.2	18.0	10.8
2021	9	10.4	11.9	2.1	34.1	8.8	11.1	6.2	9.5	2.1	34.1	8.6	15.2	11.6	18.0	7.1	8.8	11.3	6.6	11.8	12.8	9.5	8.3	15.7	4.6	10.2	30.9	12.5	10.5
2021	10	6.3	6.6	2.3	14.5	5.1	4.8	14.5	11.5	2.3	3.6	5.5	7.6	4.7	5.3	8.5	6.0	6.0	7.8	7.4	5.1	4.3	7.2	7.4	7.8	7.3	2.8	8.3	6.6
2021	11	5.6	6.5	1.8	14.4	4.8	2.8	2.9	5.7	3.6	5.3	7.4	5.9	13.5	12.7	1.8	7.1	2.8	14.4	5.5	1.8	5.3	11.5	6.8	2.7	4.7	8.8	11.5	5.9
2021	12	4.2	6.0	2.0	18.2	2.0	3.7	2.3	9.5	2.7	7.8	4.6	8.5	5.5	6.7	3.7	3.8	8.3	3.3	18.2	2.9	5.0	3.4	3.1	11.8	3.4	3.3	9.9	10.6
2022	1	5.0	5.5	1.9	13.0	5.2	3.7	6.9	2.2	6.3	8.7	6.8	3.7	4.7	3.0	4.8	5.7	6.7	8.2	4.8	13.0	3.7	4.0	1.9	3.5	7.6	4.8	5.5	5.8
2022	2	3.7	5.1	2.0	17.3	3.6	3.7	2.1	2.0	2.7	2.8	5.1	17.3	4.4	5.1	6.7	4.1	6.5	13.1	10.5	2.4	4.7	3.2	2.2	2.7	3.0	2.2	3.8	8.8
2022	3	4.2	5.7	2.0	16.8	3.4	7.0	2.4	5.0	4.3	4.1	6.0	5.5	6.2	3.4	4.7	3.5	10.4	2.1	16.8	3.7	4.2	6.5	2.0	11.2	2.8	3.5	14.2	2.7
2022	4	4.9	6.5	1.4	20.8	1.4	3.3	6.5	12.6	6.8	8.2	4.6	6.5	2.8	4.6	3.4	3.8	1.9	7.8	5.3	3.4	7.9	3.7	7.0	20.8	4.0	14.7	10.1	4.6
2022	5	12.7	11.6	3.3	20.5	12.9	3.3	14.7	13.0	8.9	6.6	6.0	12.6	15.2	20.5	16.2	18.3	13.0	10.4	7.6	13.4	6.8	4.2	8.6	18.9	18.4	16.6	5.2	8.1
2022	6	10.2	12.0	3.6	28.7	9.1	3.6	14.2	6.9	7.0	8.3	6.5	20.4	12.2	18.1	5.1	15.1	28.7	12.8	6.9	12.9	11.9	8.2	18.9	10.2	5.3	27.5	10.1	8.8
2022	7	11.2	13.0	3.9	29.7	11.2	9.7	3.9	11.3	9.8	15.4	19.0	12.0	8.1	8.1	6.5	16.2	9.0	7.7	23.0	12.6	8.2	9.1	29.7	10.2	17.2	16.6	19.7	18.3
2022	8	14.8	17.4	5.8	41.5	11.6	18.9	13.3	5.8	10.0	6.9	13.1	25.3	19.8	31.9	18.1	11.5	14.5	22.2	13.2	12.4	20.0	10.6	15.2	13.3	17.3	24.8	25.2	41.5
2022	9	12.8	15.2	1.5	40.4	13.0	4.4	5.1	28.7	31.0	14.7	8.5	40.4	13.1	5.9	7.4	19.8	17.8	19.1	23.2	9.0	12.6	1.5	12.3	14.8	11.6	5.5	33.0	12.2
2022	10	7.0	7.4	3.5	13.4	3.5	6.9	4.7	5.7	6.0	4.5	7.9	6.6	13.4	7.1	4.4	7.9	8.7	13.0	8.4	5.2	7.8	7.4	8.9	10.7	5.5	6.6	4.6	13.4
2022	11	5.1	5.3	2.3	11.1	11.1	7.8	4.3	3.0	5.5	3.0	4.7	9.3	3.7	8.3	2.7	7.9	7.5	3.3	5.8	4.1	5.8	5.7	2.3	5.5	3.9	5.6	2.9	3.3
2022	12	5.4	5.6	3.3	10.0	5.2	3.3	3.5	6.5	5.5	7.3	4.9	4.3	7.4	6.2	4.6	3.3	3.6	6.0	5.3	5.7	10.0	5.0	5.3	7.7	5.6	8.8	3.7	5.4
2023	1	4.1	5.4	1.0	24.3	3.8	5.3	5.6	1.9	3.5	24.3	10.4	5.5	1.2	8.4	6.6	3.8	3.6	3.5	5.3	3.9	4.3	6.7	2.4	2.3	7.4	1.0	6.4	2.4
2023	2	4.7	4.8	2.1	9.5	2.9	4.8	4.4	4.2	6.3	5.7	6.0	2.8	3.5	6.6	9.5	5.9	6.6	4.8	4.5	4.6	2.2	5.4	2.8	5.7	5.8	4.5	4.1	2.1
2023	3	4.5	5.0	0.7	10.9	5.7	7.2	2.1	4.4	5.9	3.1	7.2	3.9	10.9	0.7	3.9	8.2	4.9	0.9	3.9	8.3	9.1	1.4	8.8	4.6	6.9	2.1	2.7	2.1
2023	4	6.4	6.7	1.1	12.2	11.2	8.2	9.7	3.2	6.0	6.6	7.3	7.8	10.9	2.5	3.0	8.9	3.7	3.0	8.9	12.0	6.2	5.0	2.8	6.2	4.1	12.2	9.9	1.1
2023	5	8.7	10.2	3.0	22.1	4.2	3.0	20.3	10.9	6.7	14.6	3.9	22.1	19.2	9.7	12.8	4.5	6.1	6.7	5.6	16.2	7.4	12.1	15.2	4.7	7.6	5.8	10.4	15.5
2023	6	8.5	11.3	5.0	27.9	11.4	7.6	5.2	7.8	8.2	6.2	17.6	6.5	21.3	15.2	13.0	16.5	8.6	27.9	7.7	8.3	12.6	10.3	11.5	21.2	6.3	5.0	7.5	7.9
2023	7	16.9	19.3	8.3	45.0	41.0	8.9	27.7	11.2	9.3	11.7	24.3	27.0	27.2	8.3	18.3	21.8	19.2	9.5	17.4	15.4	8.9	16.4	36.7	12.1	45.0	12.6	18.1	15.6
2023	8	15.6	16.2	6.5	31.1	16.6	28.5	9.5	19.4	10.9	21.0	10.2	7.7	15.1	27.2	17.0	10.1	14.8	14.9	25.4	10.4	7.4	11.5	20.2	31.1	16.0	20.4	18.0	6.5
2023	9	9.9	13.4	2.9	34.8	9.7	13.0	6.4	10.2	21.7	9.1	2.9	21.6	14.0	34.8	7.6	8.7	6.2	19.8	3.6	17.9	18.8	6.0	6.4	9.0	32.5	16.2	8.1	17.5
2023	10	7.1	7.5	2.2	19.3	3.3	12.1	6.6	2.2	2.7	5.9	12.2	8.9	10.4	7.6	4.6	19.3	9.5	4.4	13.6	2.8	3.4	9.3	5.7	4.2	4.2	7.8	7.7	11.6
2023	11	6.0	6.6	2.5	14.3	4.3	8.0	8.2	6.0	5.5	9.3	14.3	5.2	4.3	2.5	7.1	5.1	5.9	8.4	6.0	6.6	2.9	5.4	7.6	5.5	6.4	11.9	4.9	7.8
2023	12	5.5	8.0	2.2	32.7	32.7	4.9	6.5	7.0	6.3	7.0	11.8	30.7	3.3	4.3	4.0	4.7	9.7	7.3	13.8	2.7	7.7	2.2	5.3	4.9	3.2	3.0	2.4	5.6
2024	1	4.7	5.1	2.9	12.0	4.4	2.9	5.6	4.4	4.8	4.1	7.4	4.8	12.0	6.1	5.5	3.3	6.5	4.7	6.1	4.2	3.0	3.2	3.4	3.9	4.6	5.8	5.7	6.8
2024	2	4.6	4.9	1.9	9.5	3.2	4.7	6.9	7.3	4.7	4.5	4.3	5.9	1.9	5.5	5.2	3.5	2.8	5.2	7.2	3.8	8.4	4.6	2.8	4.8	4.4	2.0	4.4	9.5
2024	3	4.7	5.0	1.4	13.9	5.2	9.9	5.8	3.0	6.9	1.4	4.2	5.9	4.8	2.7	1.4	6.4	3.8	4.7	13.9	6.8	4.7	4.5	1.9	4.0	6.1	4.1	5.4	1.8
2024	4	5.4	6.5	1.1	16.8	6.3	11.3	4.6	7.2	3.4	7.6	3.7	4.8	12.2	1.6	8.5	16.8	3.5	10.0	5.5	4.7	3.0	12.2	5.9	1.1	2.9	1.4	13.5	5.4
2024	5	10.7	12.1	3.7	21.4	16.1	6.9	9.6	7.6	10.9	6.4	7.3	17.3	9.9	18.2	7.2	18.0	14.1	7.2	10.4	4.9	18.5	3.7	18.6	21.4	9.9	21.1	14.3	11.2
2024	6	14.5	15.1	5.2	39.6	17.9	11.6	15.1	16.8	13.8	7.7	6.3	39.6	11.5	17.7	8.9	16.3	18.6	34.8	15.7	22.2	10.2	12.4	10.1	5.2	10.3	15.1	8.8	15.6
2024	7	11.8	14.5	6.5	38.1	16.3	20.9	20.8	9.8	38.1	6.5	7.4	9.1	12.0	8.5	19.2	10.1	23.4	11.6	13.1	12.4	15.3	8.9	7.3	30.7	11.4	7.7	16.5	10.9
2024	8	10.9	12.5	3.6	27.0	10.0	8.4	4.7	15.7	27.0	12.1	11.2	25.0	8.7	17.1	21.2	7.7	7.6	5.6	13.8	8.6	10.6	26.1	10.1	11.1	11.3	12.6	3.6	9.8
2024	9	13.4	14.5	4.9	29.1	4.9	12.7	21.2	19.1	17.7	7.7	10.1	19.4	11.8	11.7	8.1	13.4	13.5	18.4	15.9	8.2	18.1	29.1	24.6	16.1	10.8	8.2	13.2	14.0
2024	10	6.7	8.1	2.6	17.6	7.5	3.3	7.3	6.8	17.6	9.6	5.1	9.0	9.3	5.3	3.1	9.9	15.0	6.0	14.1	13.3	16.8	5.4	6.5	6.3	5.5	4.9	2.6	5.5
2024	11	6.3	6.7	2.3	14.9	2.4	3.1	9.2	5.3	10.4	6.4	14.9	6.1	10.6	8.0	5.5	7.4	4.7	6.3	7.3	5.2	2.3	8.6	9.3	6.7	6.3	5.4	5.5	5.1
2024	12	6.3	5.9	1.9	15.9	6.9	8.9	7.7	4.5	4.4	2.9	7.0	2.3	3.7	6.3	5.2	6.4	1.9	6.5	6.4	2.7	5.9	5.5	6.3	8.0	6.5	6.4	15.9	4.2
2025	1	5.3	5.3	1.6	10.8	5.2	8.0	8.5	3.0	3.0	2.3	5.0	3.1	5.7	5.7	5.3	3.5	1.6	6.3	6.5	7.4	3.8	3.4	8.7	10.8	5.6	8.0	4.0	2.5
2025	2	3.7	4.2	1.9	8.2	6.3	4.5	5.5	2.1	4.7	6.2	4.7	2.8	5.1	3.8	8.2	3.8	2.6	3.6	2.9	6.0	7.3	1.9	3.7	3.0	3.6	3.6	2.7	2.1
2025	3	5.2	4.9	0.9	7.8	5.8	6.3	6.3	7.7	5.9	6.1	0.9	6.5	4.9	3.4	2.9	5.5	4.7	6.2	7.8	2.3	7.4	2.5	2.2	2.8	4.6	4.5	4.5	6.4
2025	4	5.5	7.2	1.9	17.9	6.8	6.8	2.8	3.3	3.3	11.3	17.9	1.9	16.9	3.7	4.2	3.6	2.6	9.8	6.5	4.5	6.2	5.1	17.9	5.6	5.5	14.4	7.5	4.7
2025	5	10.3	9.7	2.1	18.3	14.2	10.1	4.1	2.1	4.2	12.2	8.9	16.1	10.8	10.4	3.9	2.7	4.9	14.5	15.4	9.8	14.8	8.8	4.9	11.9	12.1	14.4	2.4	18.3
2025	6	9.1	11.2	3.3	31.5	14.9	5.9	21.7	6.9	18.1	14.4	7.5	9.7	8.6	5.2	6.2	8.2	26.3	9.9	7.3	10.6	11.8	3.6	31.5	6.3	11.5	3.3	5.6	14.4
2025	7	14.7	17.0	5.5	55.9	20.8	8.2	27.7	29.5	18.6	10.6	14.9	5.5	55.9	25.7	7.4	15.7	18.0	12.1	10.2	14.5	11.8	15.5	11.7	16.3	10.0	8.5	26.7	12.3
2025	8	13.8	15.0	6.5	32.4	20.4	16.3	7.1	10.2	20.6	23.8	32.4	13.9	6.6	15.0	11.5	8.9	24.7	7.1	15.6	10.6	6.5	12.2	9.5	13.8	28.2	19.7	16.9	9.3

2025	9	12.4	14.5	6.4	31.4	23.8	8.4	12.2	9.6	15.4	9.4	14.2	11.0	12.6	14.8	20.1	13.3	6.4	8.2	9.7	8.3	22.8	11.7	24.9	18.9	31.4	21.9	11.3	6.7
2025	10	7.5	8.5	1.8	24.8	6.8	19.3	19.3	1.8	8.0	9.3	5.3	24.8	4.8	7.1	6.9	7.9	2.1	8.7	9.5	8.2	6.6	10.9	8.4	6.7	9.0	3.7	4.9	4.6
2025	11	5.8	6.7	2.5	15.0	7.2	4.5	5.0	5.2	4.0	12.0	9.5	15.0	2.5	6.1	6.6	5.5	7.6	5.0	4.5	5.2	6.2	7.9	7.8	7.8	13.7	3.5	4.0	4.1
2025	12	4.7	6.1	1.7	22.4	4.9	3.3	2.2	9.2	10.9	2.5	3.6	8.4	4.4	3.9	2.9	6.1	8.6	2.6	6.0	4.4	6.0	1.7	3.6	12.8	5.8	7.3	3.6	22.4
2026	1	4.6	4.8	1.1	13.5	3.9	6.3	4.4	3.1	5.9	3.3	3.4	5.1	13.5	5.5	2.2	5.2	6.0	5.5	4.9	6.9	1.1	4.0	3.8	8.6	3.0	5.4	1.5	4.1
2026	2	3.4	4.2	1.4	19.0	2.8	4.5	6.5	19.0	5.0	3.7	5.0	4.0	1.6	4.7	2.8	3.2	1.7	3.3	4.3	3.3	3.3	6.4	3.4	2.9	2.2	1.4	3.6	2.5
2026	3	4.6	6.2	0.8	16.2	3.5	1.9	4.9	16.2	10.4	1.8	5.4	5.0	3.8	1.8	0.8	14.4	4.2	15.4	10.4	7.2	3.0	4.4	9.1	4.7	4.5	2.5	8.4	4.0
2026	4	5.1	6.0	2.9	15.2	10.7	10.4	4.5	4.9	5.1	7.9	4.1	6.2	6.3	3.8	4.7	2.9	4.7	5.2	8.3	7.4	3.5	2.9	5.4	6.6	2.9	4.0	15.2	5.1
2026	5	10.1	11.0	3.1	26.5	10.5	7.3	7.1	9.1	20.3	13.8	4.6	5.7	3.1	12.7	7.3	12.0	26.5	10.0	10.2	9.2	6.9	10.6	17.1	10.3	14.0	8.6	6.4	19.5
2026	6	10.2	10.7	3.5	19.9	9.4	13.4	15.1	12.4	10.6	10.1	15.9	7.8	10.2	6.6	6.6	4.6	5.2	9.5	10.6	18.0	8.5	3.5	17.2	19.9	5.4	13.7	9.0	12.4
2026	7	12.4	16.4	4.9	63.3	6.9	12.7	23.1	5.7	6.7	11.3	14.6	13.2	17.1	12.6	56.6	4.9	9.9	5.6	21.0	17.3	63.3	11.0	26.5	13.8	6.0	10.7	11.7	12.2
2026	8	14.2	16.0	4.2	36.9	13.4	16.2	12.3	23.9	17.6	10.1	16.4	18.0	13.2	18.1	13.8	8.2	10.1	8.4	13.3	24.5	7.6	13.8	36.9	27.3	14.6	22.3	18.6	4.2
2026	9	14.2	15.9	3.6	30.8	11.2	24.1	27.2	9.4	25.4	21.9	18.8	30.8	12.2	14.7	21.4	17.5	13.0	10.4	23.8	13.7	3.6	23.8	10.8	6.6	8.5	16.7	4.2	11.9
2026	10	7.8	8.0	3.4	17.6	17.6	12.3	7.3	9.1	4.8	6.6	11.3	4.1	10.1	4.4	9.7	6.9	9.3	3.7	9.5	6.5	8.5	8.1	7.3	5.3	7.8	10.0	3.4	7.8
2026	11	5.8	6.5	1.9	12.4	5.7	10.0	9.0	5.6	3.6	12.4	10.1	5.9	2.1	5.1	7.3	5.3	3.1	5.5	5.6	6.0	7.1	4.2	9.2	9.8	9.1	1.9	5.6	6.7
2026	12	5.7	6.1	2.0	17.6	8.3	3.6	3.5	8.2	11.8	2.4	5.6	2.0	8.9	6.3	7.9	5.9	3.6	4.3	3.8	7.0	2.4	4.7	4.9	3.4	6.0	17.6	5.9	8.2
2027	1	4.7	5.4	3.0	13.1	5.6	7.9	13.1	4.1	4.4	3.2	5.0	8.4	4.9	3.0	3.9	3.0	5.2	3.6	9.0	3.4	3.6	8.4	3.2	4.2	6.0	7.1	5.0	3.9
2027	2	4.0	4.4	1.6	11.4	3.6	3.3	7.6	5.5	2.5	4.5	4.5	3.5	2.0	4.9	4.4	3.8	8.6	6.1	4.1	3.0	5.2	3.0	2.2	2.0	3.3	5.3	11.4	1.6
2027	3	4.7	5.3	2.6	12.9	6.1	3.1	5.2	6.3	6.0	5.0	3.5	11.4	7.4	5.4	3.6	12.9	5.1	2.8	3.8	3.5	4.1	2.6	3.4	8.3	3.3	4.4	6.7	4.2
2027	4	4.0	4.8	1.2	14.5	1.9	6.6	7.9	2.9	6.4	3.8	3.5	6.0	1.9	1.2	11.7	3.4	4.8	1.9	3.1	7.0	4.6	3.8	4.1	5.5	14.5	2.5	5.4	1.3
2027	5	9.6	10.0	0.7	27.5	6.1	5.4	5.1	4.5	3.1	11.0	11.5	11.1	9.9	9.8	24.7	27.5	9.7	9.4	13.4	2.8	22.2	7.2	10.6	6.6	6.8	10.6	9.6	0.7
2027	6	13.7	16.5	2.0	64.7	24.7	22.5	37.9	6.1	13.7	10.8	10.3	16.9	2.0	5.4	35.2	5.7	8.7	16.0	7.8	3.2	13.7	8.6	19.0	22.0	6.8	14.2	20.6	64.7
2027	7	14.9	14.8	4.7	29.6	17.9	8.8	20.9	15.9	22.1	15.5	11.3	11.2	22.4	7.1	16.8	10.5	14.1	14.8	8.5	15.3	13.4	10.7	29.6	14.9	24.0	10.3	15.2	4.7
2027	8	10.9	13.8	4.8	34.1	10.9	22.2	12.4	10.5	14.8	34.1	11.0	8.1	10.8	33.0	12.5	11.5	7.0	8.5	7.0	8.0	26.3	12.1	10.1	4.8	10.1	25.8	8.8	10.3
2027	9	14.2	16.1	7.6	62.5	7.9	23.3	17.6	7.8	10.3	13.7	62.5	14.3	17.6	21.0	15.0	7.6	17.8	14.2	14.9	13.9	9.2	14.1	9.9	10.4	30.3	8.6	10.5	14.9
2027	10	6.7	7.7	2.6	18.2	2.6	5.1	7.1	6.4	4.2	4.2	5.0	9.5	10.6	3.6	12.0	5.5	10.5	11.9	8.2	18.2	4.3	10.4	4.1	4.4	9.7	9.1	5.4	11.9
2027	11	5.8	6.7	1.8	14.1	6.2	8.8	9.4	4.6	4.8	11.4	10.6	4.6	1.8	8.2	4.5	10.8	5.3	3.2	3.4	6.9	9.8	4.6	4.0	3.2	9.4	2.8	14.1	7.1
2027	12	4.3	5.0	2.4	11.1	10.4	3.3	7.3	7.8	11.1	5.8	3.6	4.5	4.5	5.5	2.5	3.9	2.4	5.0	3.4	4.1	3.2	3.8	5.0	7.3	2.8	3.5	3.5	6.2
2028	1	5.0	5.4	2.0	12.9	5.4	5.5	7.3	2.9	4.8	4.5	4.5	4.2	5.6	5.5	12.9	2.0	2.5	9.1	5.6	7.9	5.2	4.7	4.5	6.4	3.3	3.1	4.2	9.3
2028	2	4.6	4.8	1.6	9.0	5.5	3.6	8.1	7.1	4.5	4.2	1.6	5.3	6.7	5.5	2.4	2.0	3.5	7.3	9.0	3.3	3.3	3.9	6.4	6.1	4.7	3.7	6.6	2.0
2028	3	4.5	4.8	1.0	11.2	3.5	5.4	5.7	3.2	3.3	10.1	3.3	5.1	6.9	2.3	3.2	7.3	2.1	1.4	3.0	4.4	4.6	4.9	11.2	5.5	9.4	1.0	6.3	1.6
2028	4	4.5	5.7	2.0	15.3	6.4	7.1	2.0	3.6	10.1	4.1	6.2	7.0	7.9	2.7	6.8	7.0	12.6	2.1	15.3	3.6	3.0	4.2	3.1	2.0	4.9	3.8	2.2	8.8
2028	5	10.5	11.1	2.9	23.5	11.0	5.6	5.9	6.0	23.5	14.3	9.3	14.2	16.6	15.2	14.3	22.2	11.9	7.1	6.9	5.2	9.2	11.1	2.9	7.6	11.4	10.1	4.0	19.9
2028	6	10.6	12.3	2.8	24.2	8.0	20.6	10.0	8.1	11.1	15.5	24.2	9.8	15.1	8.7	19.7	15.3	11.9	6.3	2.8	21.1	8.6	15.1	7.6	3.9	6.6	24.1	12.5	9.0
2028	7	13.2	14.3	6.0	35.8	13.6	6.8	35.8	11.2	24.2	16.2	16.5	18.1	9.6	14.3	14.1	7.9	12.5	28.0	10.6	6.0	18.1	9.9	7.2	17.1	6.3	12.7	7.5	17.8
2028	8	12.5	14.3	3.8	31.8	23.3	9.1	10.0	14.5	26.9	13.3	8.5	25.3	12.2	31.8	18.0	3.8	4.5	23.8	25.9	15.8	11.0	7.4	12.9	7.0	7.2	7.5	15.9	8.6
2028	9	13.3	13.2	2.5	31.9	8.7	3.7	31.9	18.8	19.9	12.5	9.6	15.4	13.2	14.7	7.8	3.9	4.6	14.7	12.9	15.6	9.0	13.4	10.1	17.9	17.2	21.2	18.2	2.5
2028	10	7.7	8.2	2.1	17.6	7.1	9.1	6.6	7.2	8.9	15.2	2.1	5.8	3.8	5.3	8.3	11.3	14.5	8.2	10.7	8.2	17.6	6.7	5.4	10.7	9.5	3.9	2.8	6.8
2028	11	6.3	6.5	1.1	15.7	7.4	6.8	5.9	5.9	3.1	15.7	12.8	5.3	6.8	7.1	3.1	7.0	9.1	1.1	7.5	9.0	3.8	5.4	4.7	8.7	6.4	4.9	6.2	3.4
2028	12	4.9	5.0	0.9	10.2	4.3	5.5	4.4	7.2	5.9	2.8	4.0	3.9	4.3	4.7	5.9	2.5	4.8	5.0	3.7	4.4	10.2	6.2	7.7	6.1	6.0	5.2	0.9	5.2
2029	1	5.7	5.7	2.8	10.7	3.1	3.4	4.7	9.5	2.8	6.1	3.1	6.5	5.7	7.0	5.1	6.3	6.6	4.7	10.0	10.7	3.5	4.3	3.3	3.5	8.1	5.7	6.0	6.3
2029	2	4.0	4.9	1.7	11.8	4.0	2.4	6.1	2.5	6.8	1.9	6.6	3.9	3.7	1.7	3.7	4.2	5.6	11.8	8.4	5.0	3.5	4.0	7.0	9.5	2.6	2.8	3.6	5.8
2029	3	4.7	5.9	1.0	14.4	5.7	5.1	1.0	10.2	4.8	11.2	4.0	3.5	5.0	2.2	3.0	12.5	11.4	6.5	14.4	2.9	13.1	5.0	3.9	2.7	4.0	2.9	2.1	4.5
2029	4	5.5	7.7	1.6	19.0	5.2	11.8	5.0	5.5	3.7	2.1	5.1	6.2	14.4	5.7	2.4	17.2	4.0	4.1	1.6	3.8	19.0	11.4	5.4	9.8	7.9	15.0	13.7	4.8
2029	5	8.8	9.4	2.6	21.9	6.1	2.6	11.6	12.3	9.2	6.5	6.7	4.9	9.0	15.5	6.3	8.6	4.4	11.1	14.1	6.4	6.9	9.3	16.8	3.4	5.7	15.6	21.9	10.2
2029	6	12.0	13.8	4.6	29.8	14.7	12.0	9.3	16.0	27.5	12.5	10.5	26.7	11.9	11.9	11.3	15.0	9.0	12.5	9.8	4.6	14.1	10.1	15.8	5.9	10.7	29.8	17.9	10.4
2029	7	13.8	16.0	4.8	43.9	43.9	21.7	15.5	31.0	10.2	12.0	8.7	24.6	15.8	6.3	23.1	4.8	10.4	16.9	12.6	9.4	13.0	8.7	21.4	11.1	14.5	22.0	7.1	20.2
2029	8	11.7	20.3	6.3	57.2	10.0	49.7	30.0	11.7	14.9	9.4	40.1	6.3	17.9	26.7	8.5	9.2	52.5	7.6	11.7	19.0	57.2	21.9	8.4	6.3	9.7	9.4	9.4	38.8
2029	9	12.8	12.8	5.2	29.4	5.2	6.5	10.3	5.6	15.9	29.4	7.3	20.6	18.4	5.2	14.7	16.2	14.5	13.2	15.9	7.6	16.5	5.9	11.8	18.3	9.6	17.4	12.4	9.2
2029	10	6.2	6.7	2.5	20.7	5.9	3.4	4.7	20.7	9.4	6.4	7.5	8.6	6.7	4.0	6.7	6.3	6.8	8.3	4.1	3.1	2.5	6.0	10.0	3.7	3.1	3.6	14.2	5.9
2029	11	6.0	6.7	2.4	18.9	5.1	6.0	7.7	2.8	7.4	13.1	5.2	5.7	2.4	4.8	5.9	6.2	5.4	5.0	5.9	18.9	7.9	3.3	8.9	7.9	6.7	6.6	6.1	5.9
2029	12	4.9	5.8	2.2	13.4	8.0	3.8	3.4	7.1	4.8	5.1	3.3	10.3	13.4	11.2	9.9	4.5	6.7	4.3	4.3	3.5	5.9	4.0	3.7	5.3	3.7	5.9	5.1	2.2
2030	1	4.9	5.9	2.6	13.6	2.8	4.4	2.8	4.5	3.5	8.6	2.6	6.6	7.1	6.7	5.0	8.3	2.6	4.7	6.7	4.6	6.4	13.0	13.6	6.7	4.7	6.2	4.7	3.5
2030	2	5.0	5.3	2.3	15.1	15.1	4.8	4.9	3.9	4.2	5.7	5.1	6.5	2.3	5.0	2.5	7.0	8.3	5.5	5.0	6.5	2.5	4.4	5.3	2.8	7.7	2.6	5.6	3.2
2030	3	5.0	5.8	2.1	13.0	3.2	7.4	3.5	5.3	4.7	9.2	3.2	8.0	2.1	4.9	2.1	5.3	10.5	2.2	3.1	4.0	13.0	4.2	8.6	4.7	6.7	8.9	9.5	5.1
2030	4	4.4	5.7	2.5	11.3	8.4	5.5	7.8	3.5	3.8	2.8	3.3	9.9	3.9	3.5	3.0	7.6	3.5	5.8	2.5	10.0	3.7	4.2	3.4	4.7	8.8	9.1	7.2	11.3
2030	5	8.5	11.2	3.6	24.9	9.9	6.2	18.2	7.7	19.7	13.5	15.2	21.8	5.3	7.5	24.3	6.4	6.3	8.7	7.1	3.9	6.1	5.7	8.3	18.7	3.6	24.9	10.1	10.5
2030	6	12.1	14.3	6.2	35.8	11.2	14.4	9.7	35.8	8.2	17.5	11.3	6.2	11.5	15.7	10.5	27.4	6.4	22.9	22.9	15.6	15.9	9.7	7.3	6.4	24.1	6.3	12.6	12.8
2030	7	16.3	19.5	8.0	49.8	8.0	12.6	10.2	37.0	15.6	11.4	10.0	30.2	21.9	15.1	16.2	10.5	16.6	30.6	12.0	19.9	16.4	9.4	30.6	16.1	28.7	49.8	17.8	21.7
2030	8	16.2	17.7	4.4	38.9	16.8	16.1	11.7	12.1	25.9	11.3	4.4	6.3	38.9	20.7	11.3	27.2	26.7	16.2	11.7	9.7	31.2	19.2	7.5	8.3	8.2	25.0	33.8	25.4
2030	9	12.4	15.6	4.4	32.5	7.1	14.8	12.6	22.6	10.7	28.1	17.6	27.1	10.2	10.2	7.3	12.1	17.8	4.4	17.2	17.9	8.7	30.9	10.0	26.6	10.7	8.4	32.5	9.7
2030	10	6.9	7.6	3.6	17.5	14.8	8.0	6.5	5.7	9.9	6.4	9.7	4.2	9.5	8.9	7.6	8.7	17.5	5.4	5.5	9.8	7.4	3.6	3.6	6.3	5.2	5.7	9.7	3.8
2030	11	6.5	6.9	3.4	14.4	6.6	3.8	5.2	6.0	8.0	8.0	8.1	4.6	4.7	8.2	4.3	6.4	14.4	9.3	10.4	4.2	5.9	9.4	8.5	10.5	4.7	6.9	5.2	3.4
2030	12	4.5	4.8	1.9	8.3	4.9	3.6	4.4	2.9	4.1	8.3	5.9	5.9	4.6	6.6	6.3	5.7	3.6	2.3	3.8	6.3	3.8	6.0	1.9	7.3	2.7	3.9	6.9	4.2
2031	1	4.9	5.5	2.6	11.9	9.5	3.0	2.6	5.2	5.1	3.5	11.9	6.5	4.1	5.0	3.1	4.9	4.7	9.9	3.9	5.8	3.4	8.3	3.2	6.7	3.0	3.3	9.3	5.1
2031	2	3.6	5.2	1.6	13.5	7.0	1.7	13.5	2.5	10.0	9.0	1.8	3.1	3.6	1.6	11.4	3.5	2.9	8.0	5.2	2.1	1.8	4.4	2.4	8.5	2.9	8.3	6.1	2.5
2031	3	6.5	7.3	1.8	28.2	6.4	10.5	9.8	1.9	15.1	2.7	3.8	7.9	1.8	2.0	6.7	7.8	12.7	3.4	6.7	5.9	4.6	2.0	9.6	10.6	28.2	1.9	7.8	5.0
2031	4	6.7	7.4	1.2	23.3	8.7	5.5	6.9	6.8	8.3	2.8	3.4	6.4	10.8	1.8	6.6	6.7	1.2	23.3	14.5	13.6	4.7	7.8	2.6	6.6	1.8	9.4	10.4	7.9
2031	5	9.2	10.3	3.2	23.4	7.5	5.2	9.6	9.0	3.8	16.0	9.7	10.4	16.6	7.5	8.4	5.4	5.7	13.7	3.2	9.3	18.2	12.9	6.0	14.8	6.1	8.1	17.0	23.4
2031	6	14.0	16.4	4.9	65.6	26.3	8.1	9.2	29.9	13.4	19.5	14.6	23.4	6.5	7.6	4.9	6.0	24.8	12.7	6.1	14.8	18.6	16.8	19.9	10.5	8.4	17.5	9.3	65.6
2031	7	15.4	19.9	3.2	50.7	23.2	10.1	21.3	27.6	11.1	12.6	29.6	13.2	8.9	18.0	11.0	30.2	6.9	3.2	45.0	19.8	50.7	11.8	5.6	15.1	11.2	29.0	46.7	15.7
2031	8	11.6	13.6	5.5	36.5	13.4	6.1	12.7	10.2	17.0	29.9	11.0	11.2	8.3	6.9	13.0	25.5	9.2	14.3	10.8	8.3	12.9	36.5	9.2	15.5	17.2	5.5	12.0	10.4
2031	9	14.4	14.8	3.8	31.1	31.1	3.8	7.4	26.1	12.5	13.9	19.2	14.6	9.4	17.9	12.5	17.4	15.5	6.1	16.1	19.0	13.3	10.7	18.6	21.6	17.0	8.1	8.8	14.2
2031	10	6.9	8.6	3.5	19.8	7.0	5.8	4.9	3.9	6.9	4.2	18.9	9.7	10.3	5.9	13.3	6.8	8.7	8.3	19.8	6.4	9.8	4.7	12.0	3.5	4.7	6.1	5.7	18.0
2031	11	5.7	7.0	2.6	22.1	9.1	2.6	5.8	9.6	5.1	2.6	15.4	10.4	5.9	4.5	4.8	5.5	3.8	11.3	5.0	6.4	22.1	6.1	3.3	5.7	6.5	4.7	4.2	6.7
2031	12	6.4	6.8	1.8	20.8	7.9	4.0	6.5	11.3	4.9	6.9	5.6	3.5	8.4	5.2	6.8	2.3	8.2	6.1	1.8	3.5	8.2	20.8	6.3	6.1	6.1	6.9	6.8	8.1
2032	1	4.2	5.7	1.9	20.4	3.1	20.4	3.8	5.9	1.9	4.0	5.7	5.0	7.8	2.0	3.2	3.3	3.6	2.1	3.0	6.3	17.7	4.6	3.6	8.5	5.0	4.4	7.4	3.5
2032	2	4.2	4.9	1.8	13.2	6.9	2.0	6.2	4.7	3.8	4.0	3.7	5.1	3.3	6.9	7.2	4.6	3.7	4.2	2.6	3.6	13.2	3.2	4.8	9.3	4.2	1.8	3.8	5.5
2032	3	4.8	5.4	1.5	13.2	3.1	13.2	3.2	7.3	4.5	6.6	7.3	4.4	9.7	2.6	8.5	5.6	1.5	3.3	8.4	2.6	3.5	3.6	5.2	3.6	5.2	8.2	2.4	5.4
2032	4	6.6	7.0	2.3	13.4	5.7	3.1	10.5	9.9	4.7	2.5	12.9	12.5	5.5	2.7	2.8	9.9	3.7	2.7	8.0	7.0	6.1	12.2	6.1	13.4	8.3	7.1	7.3	2.3
2032	5	8.3	8.1	0.9	14.4	8.4	4.9	6.8	11.1	5.7	10.7	13.9	10.9	6.4	11.1	5.4	5.3	8.9	0.9	7.1	2.0	9.9	12.5	14.4	4.0	8.1	9.4	4.3	11.3
2032	6	11.8	12.1	5.1	25.0	16.1	16.2	13.2	16.5	8.4	13.5	13.8	7.3	12.0	17.9	10.0	11.5	10.2	6.0	7.7	11.3	7.3	5.1	25.0	14.1	13.1	19.5	6.7	6.7
2032	7	11.9	16.1	5.2	41.0	41.0	8.6	10.0	17.7	21.2	11.4	11.8	26.0	34.1	20.4	11.7	20.7	9.5	8.2	6.5	12.0	14.1	18.5	9.6	10.4	25.7	21.1	5.2	10.0
2032	8	13.2	15.7	6.0	42.5	11.3	27.7	6.0	23.7	22.3	22.5	18.1	9.1	6.1	18.9	16.0	9.9	8.9	9.5	10.2	15.2	25.1	18.6	6.3	20.9	7.0	9.9	10.8	42.5
2032	9	14.9	14.6	2.9	28.9	11.2	16.3	17.6	28.9	16.5	21.0	3.8	11.5	16.0	15.9	19.7	14.0	28.7	6.7	13.9	8.5	5.7	21.2	16.6	13.0	12.2	2.9	11.9	17.6
2032	10	5.8	7.4	2.5	20.2	7.9	9.1	4.0	4.7	18.3	4.2	5.8	4.8	20.2	5.3	3.0	7.9	4.4	6.2	4.1	9.6	2.5	8.5	4.4	13.4	5.3	6.9	5.9	10.4
2032	11	6.5	6.4	2.4	10.2	8.8	4.4	9.3	6.0	3.4	7.2	10.2	4.0	7.1	7.3	7.9	8.7	7.5	4.3	3.8	3.4	5.9	4.5	6.8	10.2	4.9	6.2	9.6	2.4
2032	12	5.3	5.9	2.2	20.3	3.9	3.1	9.0	7.3	5.3	3.0	2.7	6.0	3.1	5.4	4.7	3.9	8.2	3.9	6.1	20.3	2.2	6.1	4.5	9.6	5.3	4.8	5.6	6.6
2033	1	4.7	5.4	2.3	11.8	2.3	6.3	4.6	3.4	3.6	4.7	11.8	4.2	3.9	10.2	5.7	2.4	4.3	8.2	3.7	4.7	4.0	6.3	4.5	5.2	5.8	6.3	5.2	7.3
2033	2	3.8	4.5	1.9	10.2	5.2	2.2	5.4	4.9	8.8	1.9	3.6	3.5	5.6	5.7	2.8	2.6	2.4	6.6	3.9	6.1	10.2	3.6	3.4	4.4	3.4	3.4	6.2	2.6
2033	3	4.5	5.1	1.6	10.3	3.8	5.1	4.0	5.7	7.4	2.5	1.6	5.8	8.9	2.3	4.0	1.7	5.6	9.0	10.3	3.6	4.9	7.8	3.9	3.7	4.5	7.8	4.6	3.2

2033	4	6.4	7.7	0.8	19.1	14.8	8.2	7.8	4.9	4.0	6.6	4.7	7.4	15.3	6.3	0.8	5.3	1.5	15.2	6.4	2.7	6.4	9.8	3.8	17.0	1.9	4.6	19.1	9.6
2033	5	8.9	9.1	0.9	18.6	10.4	4.3	15.0	7.2	0.9	3.9	10.1	14.4	7.7	11.9	9.1	10.0	4.1	9.7	8.7	4.1	8.7	12.9	17.0	10.7	18.6	6.6	8.2	5.2
2033	6	13.2	16.3	0.0	51.4	20.7	16.1	14.1	9.1	6.2	29.4	10.7	16.8	28.4	13.4	17.5	13.0	7.9	51.4	37.4	0.0	5.7	25.5	20.9	12.4	10.3	10.9	3.4	10.6
2033	7	13.6	15.0	2.1	33.6	12.5	12.0	16.3	25.1	11.2	29.1	8.9	15.8	14.7	11.0	33.6	13.4	6.7	23.5	15.4	2.1	14.2	16.2	12.3	9.3	23.9	11.1	7.9	13.8
2033	8	15.6	15.9	6.6	29.1	17.1	29.1	9.2	19.8	12.9	16.6	24.7	11.1	16.2	12.8	24.6	9.9	6.6	18.3	14.9	13.6	12.6	20.1	8.5	18.4	10.6	23.0	12.4	17.3
2033	9	14.9	15.4	3.0	36.6	3.0	13.2	4.7	20.6	36.6	17.9	14.2	6.8	21.7	19.2	21.4	17.9	9.4	8.4	7.0	17.7	20.3	15.6	9.8	27.6	31.6	5.6	12.5	7.9
2033	10	6.3	7.0	3.1	15.3	3.7	7.1	3.9	7.3	8.8	5.8	4.5	6.3	4.5	4.7	5.1	8.9	6.9	14.2	9.1	6.1	9.1	3.1	3.2	6.3	4.0	15.3	8.8	11.0
2033	11	5.9	6.1	2.0	11.7	7.7	11.7	11.1	6.2	8.4	7.5	3.8	6.5	4.4	3.4	5.8	8.8	8.5	5.0	4.6	6.9	2.8	2.7	5.6	2.0	5.6	7.2	3.6	5.9
2033	12	4.9	5.2	1.6	8.5	7.3	4.0	6.9	6.9	6.3	8.0	3.1	4.1	3.0	8.4	4.9	4.9	8.5	6.7	2.1	5.8	3.8	5.0	1.6	4.7	2.5	4.7	4.7	6.3
2034	1	4.6	6.1	1.6	14.8	3.9	3.4	7.5	8.9	6.3	3.6	2.2	4.2	5.2	6.6	4.3	10.0	4.3	4.1	9.2	7.3	9.9	3.0	4.9	3.5	14.8	13.5	1.6	3.5
2034	2	5.4	5.3	1.4	12.1	4.7	4.9	6.3	5.4	3.0	1.8	7.2	5.9	5.5	2.9	6.7	5.7	5.2	5.6	6.1	4.3	3.1	7.0	3.8	1.4	7.1	7.8	12.1	3.3
2034	3	5.2	5.2	1.2	10.0	2.8	4.4	5.2	4.4	10.0	3.4	7.2	6.0	5.3	1.2	5.4	3.7	6.8	8.9	8.5	4.2	7.7	2.7	5.4	2.3	7.0	3.5	5.4	3.1
2034	4	6.3	6.7	0.8	16.7	12.7	1.8	3.7	7.6	9.9	4.7	9.7	9.0	16.7	5.5	0.8	1.9	5.4	7.5	4.0	11.8	3.6	5.6	3.5	7.8	8.9	7.0	3.3	7.2
2034	5	10.2	11.1	3.6	22.6	11.9	9.0	11.6	9.4	14.1	22.6	9.5	21.6	14.4	9.7	9.9	8.4	11.2	6.7	8.5	10.2	5.0	13.7	3.6	10.3	17.7	4.7	11.1	10.7
2034	6	15.1	17.1	4.7	49.5	15.2	9.4	26.0	24.3	13.1	23.1	9.6	19.6	17.2	16.8	8.5	11.8	10.4	30.0	25.9	15.0	24.1	17.6	4.7	9.2	10.7	49.5	5.6	13.9
2034	7	15.3	16.1	5.8	29.2	18.0	8.3	10.1	27.4	29.2	9.8	16.9	5.8	19.1	10.3	27.0	9.6	28.9	7.7	20.1	19.9	8.1	13.6	11.5	27.1	15.0	9.8	16.9	15.6
2034	8	12.3	15.5	2.7	63.7	8.0	63.7	24.3	13.1	17.0	15.8	5.8	6.5	17.2	8.7	9.7	8.3	22.7	9.7	2.7	12.0	19.4	18.6	10.8	12.7	9.1	20.7	29.8	4.4
2034	9	14.0	15.7	4.0	34.1	4.0	14.2	5.2	27.0	14.0	18.8	14.1	11.5	17.2	11.5	24.9	10.4	12.1	9.3	23.7	11.7	13.4	15.6	34.1	8.3	21.4	11.7	18.1	25.5
2034	10	6.7	7.8	2.4	14.4	4.0	14.4	6.4	2.9	3.4	3.8	6.6	4.7	11.1	13.9	11.0	12.3	13.1	6.7	3.0	12.8	13.5	8.4	8.1	6.7	3.7	3.5	11.0	2.4
2034	11	5.4	5.8	2.5	11.9	3.9	7.9	7.3	5.0	6.8	7.8	4.6	3.7	2.9	5.8	2.5	8.8	8.3	3.7	3.3	6.3	8.5	3.0	7.4	3.9	4.9	11.9	6.2	5.0
2034	12	5.4	6.1	1.4	15.4	2.1	5.4	1.4	5.1	4.3	7.9	15.0	7.4	6.2	2.4	15.4	6.2	2.7	5.4	4.7	4.1	4.3	7.4	8.6	2.7	7.3	4.9	8.4	6.6
2035	1	5.2	5.7	2.1	20.7	3.1	6.1	20.7	5.6	4.5	2.4	5.0	2.1	3.7	5.3	6.5	6.6	6.6	5.2	2.1	6.0	6.6	7.5	10.1	8.5	4.2	3.3	2.4	2.2
2035	2	4.0	4.3	2.3	7.5	6.2	3.6	4.3	3.3	3.1	4.0	2.6	7.5	3.6	6.9	6.5	5.3	4.0	2.4	6.8	2.3	3.0	4.9	4.6	3.6	4.7	2.7	3.7	4.1
2035	3	5.4	5.9	1.3	13.0	5.7	8.3	4.5	4.3	11.7	5.0	5.1	5.2	1.3	5.4	1.3	7.9	5.4	5.6	5.9	3.7	4.6	7.7	8.7	4.1	13.0	5.9	5.9	5.1
2035	4	6.3	6.3	0.6	22.3	7.0	3.5	10.3	7.1	10.2	6.6	7.5	22.3	6.1	3.9	7.0	5.8	6.9	9.6	6.6	0.8	0.6	2.1	6.5	4.5	1.4	4.8	3.9	5.4
2035	5	10.0	9.9	2.2	17.2	12.7	2.7	8.8	4.8	15.6	10.6	16.6	10.6	13.8	8.5	9.2	17.2	9.4	6.0	12.8	7.0	7.0	2.2	13.1	12.4	12.4	7.0	5.8	11.7
2035	6	13.7	15.0	3.1	29.7	17.2	7.7	20.3	21.5	11.5	22.9	3.1	11.8	12.0	9.4	15.0	21.2	11.2	24.0	8.0	8.8	12.3	17.3	29.7	7.0	24.0	20.5	8.1	15.6
2035	7	13.2	15.7	8.6	39.7	13.6	21.0	16.0	11.2	11.7	31.2	10.6	25.4	11.5	15.7	21.9	39.7	11.6	13.2	8.6	12.3	14.5	13.1	10.1	10.7	15.9	13.8	9.2	13.3
2035	8	13.7	17.4	7.7	47.2	7.8	45.5	10.6	16.2	16.7	47.2	8.6	7.7	11.1	18.1	11.7	25.9	11.3	12.3	10.5	18.8	8.3	11.7	11.6	18.6	21.8	25.7	15.1	23.8
2035	9	14.1	15.5	1.6	39.5	16.6	28.9	8.0	10.0	24.2	15.3	16.7	12.1	8.7	39.5	7.0	13.9	11.6	14.3	9.2	6.0	30.7	17.2	1.6	24.3	19.7	14.9	12.5	8.8
2035	10	7.1	7.1	2.7	15.1	7.8	9.8	3.3	9.2	9.1	6.2	6.1	10.3	2.7	6.5	6.6	4.2	5.3	7.5	4.5	8.7	4.1	10.2	4.3	15.1	3.6	7.8	8.6	8.1
2035	11	6.3	7.0	3.3	12.6	6.1	10.1	9.4	5.7	8.3	12.4	10.7	6.6	3.7	8.4	3.8	3.3	3.5	5.7	4.7	11.0	12.6	4.3	3.7	10.4	6.7	5.4	7.9	4.6
2035	12	6.9	8.6	2.1	24.2	8.0	2.1	11.3	20.8	5.2	14.6	2.8	10.7	2.9	9.9	10.3	2.9	6.1	3.8	4.9	9.0	4.5	24.2	21.6	7.6	5.3	4.1	10.3	4.4
2036	1	4.9	5.1	1.5	9.3	4.4	4.0	7.3	6.0	3.6	1.5	6.7	7.9	9.3	3.3	6.3	7.2	2.1	5.0	6.0	9.1	5.5	1.7	6.4	3.4	4.7	3.8	3.5	4.3
2036	2	4.2	4.7	1.3	11.3	2.5	1.3	2.4	8.8	3.5	4.3	4.7	6.5	5.1	9.4	2.8	3.4	4.4	3.0	6.5	1.8	6.1	4.1	1.6	6.5	3.9	3.9	11.3	5.0
2036	3	4.9	5.2	0.8	13.7	4.3	5.7	13.7	6.4	5.1	3.0	5.6	6.0	2.5	5.0	3.4	5.9	1.9	2.4	5.2	3.5	3.7	13.4	4.7	9.2	7.3	0.8	4.4	1.2
2036	4	6.6	7.6	1.5	20.8	14.1	7.2	9.2	2.9	6.6	13.6	19.5	7.7	4.4	5.1	20.8	2.1	9.2	2.5	3.7	4.0	14.1	6.9	3.3	4.5	1.5	4.6	6.6	8.0
2036	5	9.6	10.5	3.7	31.2	12.7	5.1	10.8	9.0	6.0	10.4	16.6	9.6	9.1	7.5	4.7	11.5	31.2	10.9	5.2	9.1	6.2	9.4	11.0	11.0	19.1	3.7	9.6	11.6
2036	6	9.9	13.0	5.7	38.0	10.2	9.2	5.7	15.5	7.7	6.8	31.8	24.0	8.7	5.7	9.5	6.0	11.4	11.4	6.9	14.2	7.0	38.0	6.0	12.6	17.5	5.9	27.5	12.8
2036	7	13.2	14.2	0.6	41.2	14.2	41.2	11.4	19.5	17.5	17.6	16.1	17.9	9.3	19.0	9.2	3.8	8.3	9.0	12.3	9.2	4.4	14.4	11.6	25.6	28.2	0.6	16.0	4.9
2036	8	13.7	18.4	5.9	63.1	15.0	16.2	15.0	15.9	26.5	63.1	9.5	17.9	7.9	33.0	8.4	8.4	14.5	17.4	5.9	55.9	11.7	38.2	12.9	8.3	7.2	12.4	9.2	11.2
2036	9	13.2	14.3	5.3	38.6	6.9	13.3	5.3	16.3	6.7	16.8	13.4	8.4	23.4	11.4	19.5	9.1	12.2	11.0	9.5	13.6	38.6	15.6	6.8	13.0	8.2	22.4	24.5	17.8
2036	10	8.0	9.0	2.8	24.9	5.7	6.7	6.3	8.1	9.7	4.5	7.4	17.0	8.7	7.5	10.2	7.9	8.6	7.0	8.3	8.5	24.9	2.8	7.4	4.9	12.7	19.0	8.9	4.4
2036	11	6.2	7.3	2.3	17.9	5.2	8.7	4.3	7.8	4.4	6.5	17.9	16.8	3.1	4.3	5.0	6.8	14.8	4.5	8.0	8.6	2.3	5.8	4.7	8.2	9.3	5.8	5.5	7.9
2036	12	5.2	5.4	2.1	13.1	4.2	4.4	2.1	8.1	6.2	4.0	4.9	5.7	2.8	13.1	5.4	6.4	6.9	5.6	4.9	6.3	3.0	8.6	3.1	6.2	6.0	3.4	3.6	4.1
2037	1	4.9	5.0	1.5	9.5	2.7	2.7	1.5	4.4	3.5	4.2	5.1	7.8	3.2	6.0	9.5	7.8	1.7	5.5	7.4	5.0	3.0	4.1	8.6	3.0	5.1	5.6	6.9	4.7
2037	2	5.2	4.8	1.4	7.4	6.2	7.0	5.3	2.3	3.0	4.1	5.5	6.6	1.4	5.1	7.1	4.7	7.4	5.9	2.7	6.0	5.8	7.0	3.7	3.2	5.8	1.6	5.2	2.3
2037	3	5.7	6.1	1.9	18.1	1.9	7.4	5.8	5.7	15.0	3.7	4.0	5.9	10.2	3.1	4.9	6.6	6.0	6.2	4.5	3.6	6.2	2.8	7.9	5.5	5.6	1.9	18.1	2.9
2037	4	5.9	6.4	1.1	14.2	5.8	8.2	2.6	11.0	4.3	4.7	10.9	6.5	2.5	6.6	1.1	12.3	1.8	14.2	9.2	6.0	7.5	11.3	5.0	4.2	2.8	2.3	10.8	2.5
2037	5	8.8	9.9	1.7	22.2	5.7	11.2	15.2	12.9	8.7	11.2	11.0	5.3	22.2	3.1	11.5	1.7	5.8	7.2	10.0	7.0	5.3	7.3	7.4	5.9	22.2	8.8	18.6	11.7
2037	6	12.8	12.5	3.5	24.3	8.3	16.0	14.8	13.4	15.1	9.4	11.8	15.3	8.1	24.3	7.8	12.1	8.4	5.0	16.7	15.2	10.1	10.3	15.5	15.0	3.5	17.5	7.3	19.5
2037	7	15.7	17.4	8.3	29.0	27.3	26.6	15.1	13.8	17.7	29.0	8.3	25.1	10.9	16.2	18.7	15.3	24.7	9.8	13.5	17.7	17.7	12.1	25.8	10.3	13.7	27.7	9.6	11.5
2037	8	17.6	21.2	6.6	56.9	24.6	19.5	7.2	16.3	17.6	39.5	6.6	20.5	36.2	48.7	17.5	11.8	7.5	9.7	14.1	17.9	15.8	27.6	12.8	12.5	56.9	29.2	21.5	16.2
2037	9	13.5	14.7	3.4	36.5	30.7	7.6	13.6	16.6	12.6	8.7	16.0	3.4	21.7	13.4	14.3	7.1	11.7	15.7	8.5	16.8	36.5	8.9	17.5	10.0	7.4	9.9	22.4	22.9
2037	10	8.4	9.6	2.3	19.8	2.3	14.6	3.3	8.3	5.2	5.2	18.7	11.5	13.3	16.2	12.1	19.8	7.4	14.2	5.6	13.5	8.5	9.9	7.5	9.3	4.7	4.9	6.4	7.4
2037	11	6.3	8.5	3.1	17.9	6.7	14.9	4.4	12.8	4.9	17.9	9.4	9.8	13.9	3.6	9.7	5.1	14.1	9.1	16.2	6.0	5.9	4.1	3.9	3.1	13.0	5.2	5.5	3.8
2037	12	5.9	6.2	3.8	10.4	4.2	8.6	6.2	7.0	9.2	4.4	4.1	8.9	7.5	4.9	8.5	3.9	5.7	6.9	5.0	10.4	4.4	4.7	4.8	6.1	4.2	9.3	3.8	6.2
2038	1	4.5	4.6	1.7	11.0	8.3	5.4	5.9	3.9	4.4	1.7	5.0	4.5	4.3	2.7	5.4	5.9	3.2	3.0	3.7	5.8	11.0	4.6	4.6	5.4	2.5	4.4	2.8	2.8
2038	2	4.2	4.8	2.2	12.1	4.6	4.3	5.3	3.1	3.7	3.6	4.5	4.6	5.5	7.1	4.9	12.1	4.9	2.2	3.9	3.6	2.3	4.0	8.6	3.2	3.0	3.9	9.6	3.5
2038	3	4.9	5.9	1.1	19.0	4.3	11.4	5.5	6.3	7.7	6.9	3.4	3.6	3.5	6.1	1.1	5.9	2.4	9.3	3.8	9.2	4.4	1.8	2.6	8.5	8.3	19.0	3.8	2.1
2038	4	5.6	6.9	1.7	18.2	6.7	5.1	4.1	8.2	2.2	5.3	10.6	12.4	8.5	4.6	9.4	1.9	4.7	7.6	11.5	4.7	10.6	5.5	3.0	5.7	3.6	1.7	18.2	10.2
2038	5	9.4	10.9	1.8	35.4	35.4	4.9	14.8	10.8	18.2	1.8	5.4	8.8	11.5	7.5	15.7	15.9	5.2	10.0	6.6	12.1	5.5	6.8	4.9	7.9	4.7	10.4	13.8	23.6
2038	6	17.7	19.2	8.0	52.2	10.9	18.3	34.2	11.8	17.9	32.8	15.2	16.0	8.0	52.2	22.2	21.2	11.6	13.8	11.8	19.8	13.8	13.0	22.6	25.0	22.8	11.7	17.4	18.2
2038	7	13.0	14.4	5.0	37.4	6.0	5.1	10.0	13.0	20.2	29.7	24.1	13.6	10.5	17.6	37.4	13.3	13.0	5.0	10.9	14.0	22.5	7.3	9.7	11.2	20.9	10.7	15.1	5.3
2038	8	11.3	11.9	5.3	27.3	27.3	11.1	5.3	7.4	15.9	17.6	5.7	6.9	17.6	13.8	10.2	19.1	6.3	17.6	11.1	14.2	7.0	5.8	12.0	16.9	6.6	6.4	12.4	11.5
2038	9	15.0	16.8	6.1	40.2	32.4	14.8	12.8	9.8	17.6	14.2	15.8	40.2	6.1	18.1	12.8	16.9	23.7	31.2	15.2	14.8	9.3	11.2	23.0	8.9	7.9	9.0	18.2	18.5
2038	10	5.6	8.0	3.4	27.4	5.3	4.4	10.7	5.9	3.6	9.0	8.9	4.8	10.0	18.7	4.9	8.8	7.3	5.7	3.8	5.4	27.4	3.6	20.0	6.8	5.3	3.4	4.4	4.6
2038	11	6.4	8.3	2.9	29.2	5.2	14.7	7.8	9.9	6.0	4.8	4.4	8.5	5.4	4.5	7.2	6.4	4.7	8.9	17.7	18.4	29.2	6.9	7.0	2.9	4.6	4.8	3.1	6.4
2038	12	6.2	7.2	1.3	25.3	5.4	7.8	9.0	4.4	3.4	6.5	11.2	8.4	6.7	10.9	4.6	5.7	5.3	1.3	3.2	6.6	6.7	10.6	5.4	4.7	25.3	6.0	8.3	4.5
2039	1	6.1	6.7	2.2	24.0	7.5	7.1	7.6	3.4	3.9	8.5	6.3	6.5	4.9	5.8	5.0	3.9	4.8	12.4	10.2	7.1	4.8	6.4	6.7	2.2	5.2	2.2	24.0	5.6
2039	2	4.1	4.4	1.4	8.3	6.8	3.2	3.2	7.3	2.2	5.6	3.6	5.0	2.8	1.6	8.3	5.7	3.8	5.0	4.7	4.1	7.8	3.3	6.6	3.1	4.1	2.1	1.4	4.2
2039	3	5.2	5.6	0.9	10.0	6.7	6.3	4.2	4.1	8.6	9.1	3.0	3.4	3.3	2.8	8.3	9.8	0.9	8.9	10.0	1.1	7.1	7.4	1.9	7.4	3.2	9.4	3.3	3.4
2039	4	5.5	6.1	1.5	12.8	5.7	1.5	9.4	2.7	2.4	6.3	3.8	3.5	11.8	3.6	2.9	12.1	8.9	6.9	4.5	6.2	2.3	2.7	6.7	10.6	4.5	12.8	8.5	5.4
2039	5	10.9	11.5	3.1	28.7	11.2	7.3	12.1	10.9	23.2	13.5	6.3	9.9	28.7	3.1	12.3	12.2	7.2	4.8	12.4	10.8	22.9	3.7	5.2	24.4	10.9	5.0	3.8	14.3
2039	6	10.5	13.9	4.2	42.9	12.5	5.0	4.9	8.2	27.8	10.7	14.6	16.4	12.2	42.9	8.9	11.8	8.5	8.2	10.3	15.2	7.8	5.8	7.3	4.2	28.9	13.9	6.8	40.3
2039	7	13.8	15.1	7.3	34.6	13.3	8.0	31.4	7.3	17.0	17.6	9.4	14.4	34.6	10.3	7.5	20.9	25.7	8.2	12.0	16.8	11.8	12.2	8.8	9.7	16.5	18.3	14.3	16.1
2039	8	16.2	15.8	7.0	30.6	8.4	16.0	11.9	7.4	10.3	25.2	17.3	20.1	17.6	16.3	14.6	23.9	9.3	7.0	14.5	16.6	15.8	9.2	18.0	24.0	16.3	9.2	19.3	30.6
2039	9	15.2	15.1	2.4	22.1	22.1	18.2	17.7	19.6	12.0	22.0	15.8	11.5	14.6	5.9	21.5	17.0	14.6	14.0	20.7	9.6	9.5	16.1	13.5	13.0	18.3	2.4	17.6	14.3
2039	10	7.4	8.8	2.9	19.1	6.0	12.0	4.6	19.1	6.6	7.3	7.4	2.9	7.4	10.4	17.5	13.3	17.8	4.7	5.6	3.3	5.2	9.9	7.4	15.8	6.6	4.2	8.2	7.4
2039	11	5.7	6.1	2.0	13.6	6.4	7.5	6.5	3.0	3.7	4.8	3.8	13.6	9.5	9.9	3.4	6.0	2.0	3.0	3.9	4.1	3.9	8.1	7.2	7.4	3.8	13.4	5.5	5.8
2039	12	5.8	7.5	1.8	20.3	9.9	12.3	6.5	5.7	5.4	4.1	2.5	1.8	6.3	20.3	3.6	5.8	18.7	5.8	9.6	8.3	2.6	6.3	3.7	20.2	8.8	3.2	5.3	2.6
2040	1	5.7	5.7	3.0	11.1	11.1	6.2	3.0	3.4	7.7	4.4	8.1	6.3	5.5	6.4	7.2	3.0	3.5	6.1	4.1	6.4	5.8	7.3	4.8	4.1	4.5	3.9	5.5	9.4
2040	2	3.9	4.9	1.6	12.0	9.4	2.5	6.0	7.4	2.5	12.0	5.0	8.7	2.1	3.1	3.6	4.4	1.8	6.6	11.5	3.7	1.6	2.1	2.9	3.9	1.6	3.8	5.8	4.6
2040	3	5.6	7.2	2.0	19.9	5.8	10.5	5.0	5.2	6.3	4.9	6.6	19.9	13.6	2.0	5.6	4.7	5.7	8.0	16.1	5.0	6.4	5.1	3.4	11.2	7.9	2.6	5.3	5.0
2040	4	7.1	7.5	1.4	21.2	12.4	8.8	21.2	3.8	8.8	4.1	2.2	7.2	10.4	8.4	5.9	7.9	8.8	8.7	6.0	5.5	7.1	2.2	1.4	9.2	14.6	7.0	6.6	1.8
2040	5	6.5	8.9	2.3	23.1	7.1	9.2	5.6	2.3	11.5	4.2	16.6	4.4	23.1	5.4	12.4	4.5	18.4	5.1	4.4	3.5	4.9	10.3	10.5	5.8	9.0	3.5	14.9	15.7
2040	6	11.0	13.7	5.0	30.0	12.1	7.0	24.4	22.9	29.6	12.0	6.9	10.0	23.0	18.5	9.0	14.9	8.2	7.0	6.9	10.0	12.5	6.7	18.5	19.4	7.8	30.0	5.9	5.0
2040	7	16.6	20.2	5.0	93.7	13.0	16.7	42.1	18.9	19.0	13.6	11.4	93.7	9.3	26.8	22.8	21.4	7.9	12.4	33.4	14.7	18.7	5.0	16.4	13.1	17.1	8.8	17.8	10.0
2040	8	11.1	11.8	3.9	33.0	8.6	12.1	10.7	8.7	13.1	11.4	8.8	11.7	5.9	9.8	18.3	3.9	15.9	8.6	11.4	6.6	11.5	8.0	11.6	33.0	6.9	7.1	18.9	19.7
2040	9	15.1	17.0	4.7	38.2	8.9	27.7	28.6	10.2	11.1	25.8	10.8	27.1	23.8	38.2	16.8	9.2	4.7	23.1	17.8	20.0	10.8	10.3	24.9	18.1	10.0	9.3	8.4	13.4
2040	10	6.3	7.3	3.2	19.9	4.8	8.4	7.0	9.6	3.2	3.3	4.1	11.6	4.4	6.1	10.9	9.8	4.5	6.1	7.2	19.9	18.4	6.6	5.4	3.2	3.6	3.3	7.6	6.9

2040	11	6.3	7.7	3.6	15.1	5.7	6.1	15.1	4.1	12.8	5.2	5.9	14.2	7.0	11.9	8.9	5.4	5.8	5.1	3.6	8.3	3.9	10.9	12.0	10.2	6.5	7.2	5.4	4.5
2040	12	4.6	5.5	2.4	10.8	4.6	9.5	4.1	3.4	6.7	8.6	9.8	8.2	4.1	6.5	5.2	6.4	5.2	10.8	2.4	4.6	4.6	4.5	3.5	2.9	5.5	3.8	4.4	3.4
2041	1	4.1	4.5	1.7	9.1	3.5	4.2	6.6	4.9	4.8	5.7	8.5	5.0	3.7	1.7	4.1	4.0	4.0	3.0	4.5	4.9	2.9	3.4	3.8	3.8	4.5	3.0	9.1	3.8
2041	2	4.7	5.6	1.4	14.1	7.0	2.0	3.4	1.7	8.5	2.9	3.5	14.1	3.8	7.8	9.2	12.0	3.4	8.1	7.5	5.0	3.2	4.3	1.4	4.4	5.0	6.1	7.1	4.0
2041	3	6.5	7.0	1.5	14.1	11.1	4.8	7.3	4.2	6.8	7.5	8.7	4.9	6.6	6.4	3.0	13.6	3.1	1.5	9.9	12.7	3.1	6.2	11.9	3.7	14.1	3.4	8.8	4.3
2041	4	4.9	6.0	1.0	16.3	9.7	2.1	6.1	4.8	3.2	1.7	5.0	12.3	3.9	6.4	1.5	1.0	3.0	6.1	16.3	8.8	3.7	2.5	4.6	8.9	10.5	4.8	9.8	6.2
2041	5	8.5	10.6	2.7	22.8	2.7	11.3	3.3	6.8	5.5	16.7	3.8	13.5	21.8	13.1	5.9	18.3	4.2	18.8	15.6	8.0	6.3	8.5	5.1	12.6	8.5	22.8	8.5	13.0
2041	6	11.5	15.0	5.7	65.8	10.7	15.0	5.7	14.4	12.4	8.5	26.8	11.2	22.8	14.1	6.2	12.9	7.0	65.8	22.5	11.5	9.4	22.4	6.1	6.8	9.3	6.4	11.5	19.4
2041	7	14.7	16.3	5.5	42.6	21.4	15.7	12.4	24.1	22.4	15.1	16.6	18.8	5.5	14.3	9.8	14.6	30.1	14.9	7.7	12.7	7.9	14.3	6.6	6.4	15.8	28.0	42.6	13.2
2041	8	15.3	18.4	2.2	39.6	9.0	14.5	35.9	23.5	10.2	9.4	19.2	24.7	15.0	31.3	39.6	6.9	7.4	8.5	2.2	9.9	25.1	36.5	10.4	31.9	13.0	22.0	15.5	19.7
2041	9	9.5	12.9	4.9	34.0	26.2	4.9	8.6	10.4	6.2	15.6	18.2	34.0	8.5	9.4	26.0	9.5	9.4	9.6	9.0	8.5	8.3	19.0	13.4	8.1	14.6	6.8	16.0	9.8
2041	10	6.3	7.6	2.5	24.2	2.8	7.3	8.2	11.1	4.4	24.2	12.6	3.6	8.1	3.7	4.1	7.5	6.6	7.9	5.2	2.5	8.5	4.5	4.2	5.9	4.1	19.4	9.9	5.1
2041	11	7.3	7.7	2.3	18.7	3.9	8.4	7.5	3.3	10.8	7.3	5.6	2.3	6.0	10.5	18.7	10.8	5.4	7.0	10.9	9.3	7.2	9.9	11.0	3.0	11.7	3.3	5.5	5.3
2041	12	5.5	5.9	2.8	13.1	3.3	3.9	2.8	13.1	5.9	5.5	3.9	4.7	4.5	4.7	5.7	7.2	5.5	2.8	5.7	5.3	5.9	9.4	3.5	13.1	8.4	3.9	6.2	6.6
2042	1	4.3	4.9	1.4	11.6	6.2	2.6	8.4	2.9	5.9	5.5	9.4	4.2	7.8	6.0	4.3	3.3	2.5	1.9	1.4	6.4	3.6	6.0	3.4	3.5	5.6	3.7	11.6	2.4
2042	2	4.9	5.1	0.7	15.5	5.6	2.7	3.7	4.7	1.5	3.3	5.3	5.9	3.2	5.5	8.2	5.6	5.9	2.8	3.7	5.0	10.5	2.7	15.5	0.7	6.9	2.6	6.2	3.8
2042	3	3.9	4.8	2.0	9.3	3.6	6.4	5.5	4.5	8.2	3.6	2.5	2.6	6.2	2.0	5.3	4.9	8.8	2.6	8.5	3.1	4.2	2.2	9.3	2.9	3.4	3.4	7.2	3.6
2042	4	6.3	7.5	0.6	20.7	8.0	5.1	11.0	13.5	8.7	6.1	3.7	0.6	20.7	3.4	3.0	6.3	6.2	5.0	4.0	3.0	10.1	8.4	9.8	6.5	4.5	10.9	15.3	6.3
2042	5	10.1	10.4	1.5	26.1	9.3	17.1	11.8	7.7	17.8	23.9	4.2	13.0	11.0	1.5	2.4	4.8	12.1	8.2	3.5	15.0	5.5	3.9	12.6	26.1	11.4	4.9	5.9	16.8
2042	6	14.4	16.9	3.4	63.5	18.3	9.0	19.0	5.1	16.5	19.7	17.4	11.3	42.6	23.5	16.3	20.4	7.0	7.2	9.3	63.5	12.4	16.8	11.1	11.9	3.4	31.2	9.7	3.4
2042	7	15.4	17.1	8.3	33.2	14.7	18.1	10.7	13.2	13.3	12.9	33.2	18.7	8.3	15.9	24.3	11.6	9.9	18.5	19.2	24.4	12.4	17.5	17.3	28.2	26.7	14.8	14.3	11.5
2042	8	12.7	16.4	4.5	56.7	9.4	31.6	12.9	8.5	23.8	13.2	11.3	7.5	9.6	18.8	41.4	4.5	7.8	9.9	17.1	56.7	20.1	11.9	12.5	13.1	12.3	19.5	13.5	5.7
2042	9	15.6	16.1	4.6	34.3	6.2	8.7	17.2	34.3	32.4	8.1	16.8	25.3	24.0	30.9	8.9	15.2	15.6	18.0	24.7	5.4	15.6	11.3	4.6	12.8	5.0	18.8	17.5	9.7
2042	10	7.1	8.1	3.0	20.5	10.0	6.8	5.0	7.0	9.1	5.2	5.4	3.6	7.1	5.3	20.5	8.7	13.6	7.3	3.8	8.6	10.5	13.8	12.4	14.0	5.4	5.5	3.0	3.5
2042	11	7.1	7.8	1.0	21.6	5.1	7.9	8.3	6.6	4.5	5.0	12.1	11.4	14.7	5.2	7.1	4.0	5.0	5.0	9.5	4.6	7.1	13.3	7.9	8.1	21.6	1.0	8.8	4.1
2042	12	4.9	5.8	2.8	13.1	3.9	3.3	11.6	5.3	5.8	4.0	2.8	4.3	3.4	3.1	5.0	3.5	10.5	6.9	5.6	4.7	8.0	4.7	7.7	13.1	4.2	4.4	6.0	7.0
2043	1	5.7	7.1	1.7	25.4	7.5	4.3	6.2	4.0	6.4	2.3	10.7	1.7	3.9	25.4	2.5	6.1	5.9	4.3	24.5	6.5	5.4	4.7	5.6	7.9	9.2	3.8	5.5	7.3
2043	2	4.2	6.0	1.7	24.0	4.3	3.8	24.0	2.9	4.4	3.9	7.6	3.7	2.2	3.3	3.3	14.9	3.1	5.2	6.0	4.5	4.9	3.4	4.3	1.7	3.8	18.7	6.3	4.1
2043	3	5.8	6.7	1.8	21.6	10.6	7.4	3.2	6.1	7.2	4.0	10.9	21.6	4.0	4.9	3.3	15.3	5.5	5.1	6.9	4.4	1.8	8.3	2.1	7.5	2.3	6.8	7.5	5.1
2043	4	6.2	6.8	0.5	15.7	6.3	4.9	11.0	5.5	3.6	2.7	5.8	6.4	11.0	7.3	0.5	5.8	7.2	4.9	8.4	15.7	12.3	5.5	2.7	12.7	6.6	6.1	7.9	3.3
2043	5	7.7	9.2	2.2	19.3	6.9	9.7	10.5	4.1	8.1	5.1	15.8	5.9	15.6	10.3	5.0	5.5	9.9	17.3	3.5	18.4	19.3	5.7	6.5	13.5	7.3	11.2	2.2	3.6
2043	6	10.8	12.8	5.8	24.0	11.0	14.5	15.0	23.5	7.1	5.8	14.1	11.0	10.6	7.7	21.3	8.6	22.8	24.0	5.9	14.4	21.8	8.7	9.1	12.5	6.8	10.6	10.3	9.1
2043	7	16.2	19.5	7.8	49.1	16.8	7.8	17.3	11.3	25.8	12.9	15.7	12.3	31.0	29.2	18.4	15.7	20.2	9.3	8.4	32.6	15.2	14.7	27.6	29.8	49.1	22.7	15.5	8.6
2043	8	15.9	17.8	8.3	33.3	8.3	32.0	26.1	8.7	32.4	9.1	16.1	10.9	15.7	24.0	10.7	22.0	9.5	11.7	23.1	18.8	9.0	13.3	32.1	19.3	17.1	33.3	14.6	8.5
2043	9	11.4	13.9	4.2	42.8	6.5	25.5	11.7	20.5	20.1	10.3	10.3	42.8	15.3	7.5	9.4	18.1	9.3	11.5	20.2	11.3	6.2	5.6	27.5	17.7	4.6	4.2	11.8	6.3
2043	10	6.6	8.0	2.2	18.9	2.2	18.9	4.9	3.0	5.7	6.3	15.0	9.0	15.1	9.2	7.3	18.8	5.9	5.7	8.9	4.6	10.9	7.2	3.2	8.0	4.4	6.2	5.5	6.9
2043	11	5.4	6.3	1.1	15.3	4.5	4.8	3.7	4.4	4.9	6.2	5.4	3.9	8.5	10.8	8.9	5.4	3.9	3.7	15.3	7.1	4.1	13.2	6.5	8.3	3.1	1.1	6.6	8.0
2043	12	6.3	7.2	2.1	26.1	6.7	14.0	4.3	7.8	26.1	2.2	10.1	4.5	8.5	6.5	5.7	2.1	10.9	3.3	4.6	5.3	6.2	4.4	2.5	5.7	8.8	6.7	7.2	9.9
2044	1	4.1	4.2	1.7	8.8	4.5	2.5	3.6	3.6	5.8	7.6	4.9	3.1	4.0	1.7	3.4	3.1	1.9	5.5	5.1	3.8	5.0	4.2	1.9	8.8	4.7	4.2	4.9	3.2
2044	2	5.5	5.6	2.2	13.1	5.8	2.2	5.6	6.3	4.9	5.4	5.3	3.5	6.2	4.3	7.5	13.1	2.4	5.5	7.6	4.2	5.7	6.5	3.5	7.8	3.8	6.2	7.5	4.2
2044	3	4.7	5.6	1.0	15.7	4.4	7.5	4.5	3.3	5.8	2.4	1.0	4.1	3.1	2.5	6.1	7.9	4.3	3.9	15.7	9.0	7.1	2.8	6.2	9.8	5.1	4.8	3.6	10.1
2044	4	4.2	5.8	1.1	17.2	9.6	17.2	11.9	10.6	12.3	2.1	2.8	2.3	5.0	5.0	1.8	3.1	4.2	3.6	3.2	8.1	10.7	2.3	3.3	7.1	1.1	4.2	4.2	2.6
2044	5	10.8	11.4	1.0	31.0	11.5	5.5	6.0	5.5	17.5	16.3	11.4	31.0	9.5	13.3	23.3	8.8	1.0	11.4	9.4	5.0	2.8	20.6	15.8	13.0	4.7	10.3	3.2	16.2
2044	6	12.2	12.9	4.6	31.9	5.1	19.2	31.9	7.3	6.0	9.0	9.4	4.6	12.9	11.5	6.3	20.8	15.9	19.7	10.5	5.0	14.6	17.6	7.2	18.2	13.0	19.4	15.5	10.4
2044	7	14.1	16.5	3.7	49.1	12.7	6.8	17.2	14.2	17.3	26.5	49.1	13.5	12.8	39.2	16.6	11.9	11.4	3.7	8.4	16.0	15.3	12.1	25.5	16.2	10.0	14.0	7.3	19.1
2044	8	15.7	17.8	5.3	46.3	19.2	7.5	46.3	5.3	30.7	18.9	10.6	8.3	13.3	34.4	21.3	6.9	17.3	14.6	12.8	8.1	21.0	23.8	12.8	14.3	13.3	32.4	16.8	17.2
2044	9	15.1	15.1	4.9	26.7	23.4	26.5	26.7	16.0	11.2	5.5	11.6	12.4	8.9	15.7	22.7	18.9	14.5	17.4	17.9	20.1	8.5	10.7	5.7	22.8	25.4	4.9	5.9	8.5
2044	10	8.7	9.2	3.0	20.4	6.2	7.7	3.9	9.1	10.6	3.2	6.2	9.7	10.6	19.4	5.5	9.0	13.1	6.3	15.0	10.2	20.4	8.5	6.3	14.0	8.8	7.6	3.0	7.4
2044	11	7.6	8.7	3.9	20.2	4.5	5.1	5.6	4.7	9.8	9.4	6.8	3.9	15.0	3.9	10.3	4.3	12.7	4.4	7.0	20.2	14.6	8.2	5.5	6.2	11.3	12.0	14.2	9.0
2044	12	4.9	5.0	1.7	9.1	6.0	2.9	4.0	7.0	7.5	6.1	5.5	4.8	4.4	7.3	1.7	6.1	9.1	5.1	2.0	2.1	6.3	7.8	3.4	3.8	2.9	9.1	2.2	3.6
2045	1	4.8	5.5	2.3	20.5	4.1	2.7	2.8	6.4	5.4	5.4	10.2	5.5	3.5	20.5	4.2	3.9	2.8	5.0	4.1	2.3	4.0	6.3	3.2	4.7	5.7	4.9	8.4	6.8
2045	2	5.2	5.3	1.3	13.0	5.5	6.9	7.2	5.8	12.1	5.2	3.9	5.6	5.9	3.7	3.5	2.6	5.1	1.3	3.9	5.2	4.4	7.1	3.1	5.2	6.1	2.6	13.0	1.5
2045	3	5.4	6.4	1.5	15.8	1.7	15.8	10.7	2.5	5.4	4.2	1.7	1.5	5.5	3.0	6.3	7.5	10.3	10.3	3.4	10.4	14.0	9.9	3.7	3.0	7.4	3.4	9.2	2.6
2045	4	5.4	5.9	2.2	18.1	11.1	18.1	5.1	7.7	5.7	6.3	3.7	4.4	7.2	6.6	3.0	6.1	6.1	5.3	2.7	6.1	4.4	3.3	11.4	5.6	4.5	2.2	2.2	2.7
2045	5	9.9	10.4	1.5	25.7	8.8	11.9	8.2	9.4	25.7	9.9	4.6	11.5	20.0	10.3	12.4	9.4	4.9	6.6	10.0	1.5	3.6	10.9	13.0	13.6	8.6	8.1	15.9	10.6
2045	6	13.4	14.3	3.5	33.2	13.1	14.7	8.4	13.4	13.4	9.8	15.3	28.8	12.6	19.4	8.8	6.9	15.9	11.1	11.1	6.3	16.0	5.2	20.7	19.0	14.9	33.2	3.5	20.9
2045	7	13.7	17.0	6.4	46.9	20.8	27.0	8.3	19.9	29.4	9.1	12.8	6.8	46.9	11.6	10.3	14.9	32.9	6.4	10.0	9.1	8.6	20.5	16.1	30.7	13.6	19.0	9.9	13.8
2045	8	17.0	17.9	7.4	32.9	9.7	7.8	18.9	12.6	7.4	27.6	25.6	10.3	18.3	20.4	29.3	24.5	13.4	7.6	15.8	12.8	23.5	32.9	21.9	29.3	7.7	26.2	11.3	15.2
2045	9	14.1	13.7	3.7	24.3	11.7	13.9	3.7	16.2	11.0	14.3	14.0	10.2	7.2	14.7	24.3	7.7	15.8	16.5	5.8	20.0	20.8	18.4	8.9	19.7	15.6	7.7	17.6	12.8
2045	10	8.6	8.4	2.0	18.0	4.5	9.2	14.4	6.2	6.2	8.3	4.6	12.2	9.0	3.3	2.1	5.5	18.0	9.6	15.7	2.2	13.6	5.3	10.1	13.3	8.9	2.0	3.7	14.1
2045	11	6.4	6.8	1.9	11.6	7.1	8.7	4.1	6.2	11.1	3.8	3.6	6.5	9.0	8.6	4.9	6.5	3.8	5.8	9.1	6.0	8.7	5.8	11.3	4.2	7.8	11.6	1.9	6.4
2045	12	4.5	5.2	1.1	9.2	6.6	8.8	3.7	4.2	4.1	4.1	5.1	8.6	3.9	8.7	4.2	1.1	7.4	5.1	6.1	3.6	3.6	4.6	2.2	2.1	6.0	9.2	4.3	7.2
2046	1	5.1	6.4	2.9	23.6	4.8	11.1	3.7	5.2	3.7	5.0	5.4	3.0	4.8	4.7	5.2	5.0	4.8	9.6	6.3	10.6	4.9	5.8	7.1	2.9	7.0	3.3	7.0	23.6
2046	2	4.8	4.8	1.0	9.0	5.2	6.0	6.6	4.6	1.0	4.9	3.6	5.3	5.2	2.7	7.3	3.0	4.6	4.9	3.2	3.0	3.9	2.6	4.8	9.0	5.2	6.0	8.0	3.8
2046	3	5.7	5.8	2.8	14.5	6.6	6.4	8.2	5.7	3.2	3.9	3.7	5.9	3.8	4.5	8.3	7.4	3.6	6.1	7.8	6.7	4.3	2.9	5.7	14.5	9.2	2.8	3.7	4.8
2046	4	5.2	5.3	2.1	9.8	5.3	3.3	4.2	2.6	3.9	6.3	2.1	4.1	5.0	4.6	5.1	9.8	6.0	5.4	4.6	2.8	6.4	7.2	7.4	6.1	2.2	9.0	7.8	5.7
2046	5	8.5	10.9	1.8	28.4	9.6	1.8	19.9	12.4	3.6	16.8	9.3	28.4	6.3	12.5	6.6	23.9	20.0	2.4	8.1	7.3	8.1	15.8	5.5	17.3	8.9	5.8	4.3	7.9
2046	6	11.8	15.3	4.7	32.9	10.3	27.7	20.9	11.3	14.7	11.0	13.4	10.3	7.3	8.2	8.7	23.2	12.4	22.5	10.8	19.0	6.2	11.0	32.9	4.7	16.6	31.7	10.4	22.0
2046	7	14.8	13.8	5.1	26.1	22.8	16.2	9.8	14.9	7.0	16.1	9.7	26.1	18.2	7.2	6.0	12.3	16.2	14.6	9.2	18.9	11.3	16.7	15.9	5.1	20.2	8.0	21.8	7.7
2046	8	11.7	13.7	4.0	29.9	11.7	19.0	7.8	13.3	29.9	9.5	12.6	23.7	10.1	11.7	17.7	11.0	4.0	5.4	20.4	16.5	11.9	25.0	9.6	8.8	11.8	6.5	21.6	8.4
2046	9	14.6	16.1	3.6	35.5	29.8	11.2	14.0	9.4	13.3	19.0	6.3	13.8	26.3	7.1	25.4	3.6	35.5	18.6	11.9	14.1	23.7	15.1	5.6	13.5	15.2	19.7	16.9	17.6
2046	10	7.1	7.9	3.5	16.6	6.9	6.8	6.3	10.0	8.5	7.4	10.2	7.9	15.3	9.4	4.3	6.6	4.8	3.5	12.9	16.6	4.7	6.4	8.4	6.2	6.2	4.9	7.2	7.4
2046	11	5.7	6.1	1.0	14.5	7.7	7.5	7.9	5.0	8.3	4.9	3.7	7.5	1.0	2.7	3.6	3.6	7.3	3.3	6.3	8.0	5.2	14.5	10.6	7.4	6.2	5.0	5.0	4.5
2046	12	5.1	6.9	1.9	27.8	5.0	8.0	4.8	7.6	5.0	10.9	9.7	3.2	2.5	5.3	3.9	6.8	5.8	4.8	4.5	15.3	3.5	4.2	6.7	1.9	4.0	7.8	27.8	7.0
2047	1	5.3	5.4	1.4	10.0	10.0	5.3	2.6	7.8	4.2	3.3	7.8	8.0	5.3	6.5	8.9	8.3	2.4	4.5	4.3	4.4	6.9	5.5	2.2	5.9	4.1	6.1	1.4	3.3
2047	2	5.2	5.4	2.5	10.3	7.3	5.5	9.4	7.3	4.0	2.5	5.8	10.3	2.6	5.2	4.0	4.7	9.7	4.8	3.4	6.7	4.8	3.6	6.5	6.0	5.2	5.3	2.8	2.9
2047	3	5.7	5.7	1.4	13.7	7.0	6.8	7.8	4.8	8.4	5.8	5.7	6.4	2.8	3.2	3.6	5.7	10.7	3.6	6.4	6.8	5.4	1.4	2.6	4.2	1.6	13.7	5.6	6.2
2047	4	7.2	7.2	2.0	15.2	9.0	7.7	4.2	15.2	4.9	3.1	4.4	6.0	11.2	9.4	7.0	7.4	6.9	6.8	10.6	10.4	2.0	5.5	3.1	8.7	9.4	8.6	7.4	4.9
2047	5	6.4	8.1	3.0	21.1	6.3	21.1	13.0	13.8	7.4	7.9	5.0	7.9	3.7	5.8	6.6	3.0	10.9	6.0	6.1	6.1	9.6	5.6	8.1	7.6	5.4	6.1	15.1	5.4
2047	6	9.6	14.9	4.9	85.5	11.1	5.9	18.3	6.5	6.7	9.8	9.2	10.4	12.9	9.5	9.5	6.7	17.1	30.7	9.1	25.6	7.6	15.4	15.7	8.0	5.9	15.6	4.9	85.5
2047	7	13.5	15.0	5.0	27.6	11.6	16.1	12.0	16.4	21.7	25.2	19.8	8.5	27.6	14.0	25.1	24.7	11.0	13.1	17.3	14.0	5.0	7.2	18.3	12.0	6.4	7.8	12.2	12.2
2047	8	18.1	20.5	5.5	56.1	9.6	15.0	12.9	39.4	18.8	11.0	14.7	29.8	5.5	56.1	28.7	17.4	20.5	30.8	13.5	9.3	31.5	18.7	30.4	15.9	23.9	20.2	8.7	10.0
2047	9	14.9	14.5	3.1	27.5	6.8	8.2	6.2	5.4	13.9	20.2	21.3	21.2	26.0	14.6	5.2	11.2	17.6	3.1	18.7	15.2	20.9	18.2	13.4	24.0	17.3	4.1	8.1	27.5
2047	10	8.0	8.5	2.5	19.1	8.4	3.8	3.8	19.1	11.9	3.1	5.4	7.5	7.3	8.3	16.1	14.7	2.5	9.3	6.2	3.6	5.0	8.2	10.9	6.0	10.3	7.7	11.6	13.0
2047	11	7.3	8.0	3.5	17.8	7.3	7.8	6.5	4.6	4.5	5.8	16.0	9.4	7.0	8.4	5.8	7.3	6.1	14.4	12.8	17.8	7.3	7.6	8.5	8.6	5.9	5.2	4.8	3.5
2047	12	4.8	5.5	2.2	11.4	3.4	5.3	2.2	6.5	6.2	3.8	5.8	4.4	5.2	4.2	4.1	3.4	11.4	3.5	5.4	8.6	2.6	9.6	8.1	4.0	9.8	6.4	3.9	4.1
2048	1	5.0	5.4	1.6	12.5	5.0	12.5	3.7	6.6	3.8	1.9	5.0	3.5	8.5	11.9	7.4	6.6	2.2	2.5	6.4	3.6	5.4	1.6	3.7	6.9	6.9	3.7	5.7	4.1
2048	2	5.0	5.0	1.5	10.5	5.2	1.5	3.7	5.0	5.6	6.0	10.5	5.1	3.1	4.7	2.9	7.2	6.4	7.4	5.2	2.9	3.1	4.6	4.3	7.0	2.1	5.2	6.1	4.7
2048	3	5.0	5.9	1.3	17.7	5.4	7.3	1.3	7.3	17.7	7.4	12.2	5.1	3.6	4.7	5.2	7.4	12.8	2.8	1.9	4.0	2.2	4.4	4.8	5.2	1.6	9.1	4.4	4.5
2048	4	5.4	6.4	1.3	13.0	4.4	5.5	5.0	4.2	2.4	7.2	10.1	2.7	6.3	3.8	1.6	9.5	10.4	8.0	10.7	8.5	5.4	13.0	4.3	13.0	10.0	1.9	1.3	5.2
2048	5	9.9	10.9	3.1	29.2	12.9	22.3	6.8	29.2	6.6	17.4	8.2	6.6	4.2	6.8	12.8	7.6	9.1	12.6	3.1	5.2	15.7	13.1	5.4	10.6	10.6	18.6	4.3	10.8

2048	6	12.9	14.5	5.0	35.6	10.3	35.6	14.0	13.3	29.9	25.5	5.9	10.1	8.5	8.2	11.6	14.0	15.6	10.8	23.1	21.9	13.5	12.5	10.9	5.0	5.6	13.8	17.7	9.7
2048	7	16.9	21.0	6.6	49.4	8.6	9.9	49.4	26.8	22.3	7.2	26.0	28.6	9.1	13.7	23.1	9.1	42.6	18.3	12.7	9.2	6.6	20.7	45.3	34.0	39.1	15.4	11.6	14.5
2048	8	14.7	16.7	4.5	41.5	5.8	17.4	10.5	15.2	10.6	35.6	4.5	5.2	7.5	26.9	17.7	13.1	10.6	41.5	16.2	6.8	23.4	15.8	28.1	14.1	7.5	11.5	20.5	35.8
2048	9	16.0	16.7	4.3	41.0	8.4	15.5	6.9	14.3	18.7	20.3	18.2	23.6	16.4	41.0	21.0	32.0	16.1	5.8	15.3	15.3	17.9	11.4	4.3	17.4	22.4	15.0	16.0	8.0
2048	10	7.9	9.2	3.0	19.0	7.7	8.1	16.9	3.0	5.0	6.4	9.7	17.5	10.7	7.8	6.7	3.1	4.3	7.2	19.0	16.7	10.5	10.1	4.3	17.2	6.3	10.0	9.6	3.4
2048	11	8.2	8.4	2.4	21.7	8.3	11.3	4.5	9.7	6.6	5.4	13.9	9.0	14.4	8.3	21.7	12.7	7.6	2.4	8.9	4.0	10.2	4.7	8.2	11.2	7.0	5.3	3.5	4.1
2048	12	5.9	6.8	2.5	23.8	5.9	4.4	5.3	5.4	2.5	8.1	6.1	5.9	11.1	5.8	7.3	7.5	23.8	4.3	7.6	6.3	5.4	2.8	4.9	9.3	5.6	7.5	5.8	3.6
2049	1	5.8	5.7	1.4	10.6	8.1	6.2	5.5	2.2	6.1	8.0	8.7	6.4	7.1	2.6	7.5	4.7	3.8	3.2	4.5	10.3	3.8	10.6	1.4	8.3	4.4	6.8	3.7	3.8
2049	2	4.4	5.1	2.2	15.6	2.8	7.7	4.7	2.2	5.5	2.9	3.8	3.7	3.9	5.1	15.6	6.4	3.0	8.6	7.4	2.3	5.0	5.2	3.3	4.2	6.2	4.6	4.1	3.9
2049	3	4.6	5.3	1.2	12.1	5.5	6.3	5.4	4.2	1.2	4.6	5.3	4.1	4.5	2.9	9.5	12.1	3.1	4.4	10.6	4.1	4.5	6.7	5.9	4.2	4.7	1.9	9.8	2.6
2049	4	5.6	6.0	2.1	15.4	5.7	2.1	10.7	2.8	10.1	7.7	7.4	3.1	5.0	7.4	5.8	5.7	10.1	2.1	3.7	4.8	5.6	3.9	7.7	3.9	5.2	6.3	15.4	2.6
2049	5	9.1	10.1	2.7	32.8	2.7	15.5	8.4	11.9	8.1	7.3	7.6	32.8	2.8	10.8	17.5	10.5	7.9	6.2	10.7	17.8	8.0	3.4	9.8	11.9	12.1	4.4	5.4	10.1
2049	6	12.4	15.2	4.4	39.4	19.4	7.8	7.0	6.5	11.8	32.4	8.7	16.4	18.1	26.7	18.7	13.0	9.7	18.0	7.5	10.5	27.0	39.4	14.4	16.9	4.4	11.6	11.5	8.4
2049	7	12.9	14.2	6.3	29.8	18.5	10.4	14.5	17.4	9.7	11.1	8.3	10.6	18.8	20.6	17.1	14.0	8.2	13.5	11.2	12.3	8.5	6.3	29.8	15.1	28.7	18.2	7.2	11.3
2049	8	13.9	15.4	4.5	34.2	8.5	11.1	34.2	18.1	10.4	15.6	21.3	27.2	11.7	16.7	7.8	5.5	4.6	28.9	9.6	9.7	12.1	16.3	22.5	6.1	4.5	24.6	25.2	16.6
2049	9	12.8	14.0	3.8	40.3	11.8	3.8	14.3	17.8	40.3	12.1	18.6	7.5	18.3	8.4	18.7	27.6	14.3	13.0	9.2	13.0	8.1	8.2	12.7	9.4	5.4	19.7	16.3	6.9
2049	10	8.3	9.3	3.5	28.4	5.1	11.6	9.4	3.9	8.5	8.0	8.9	7.9	6.8	5.2	28.4	9.8	9.9	6.5	4.7	11.2	17.9	8.1	4.4	10.0	8.9	18.9	3.5	5.4
2049	11	6.5	7.1	3.2	15.1	5.4	12.9	6.7	7.8	5.3	5.9	3.2	7.5	9.4	3.5	3.6	5.7	8.6	8.4	11.1	4.9	4.1	6.2	15.1	10.9	4.4	8.3	5.5	6.7
2049	12	5.8	7.9	2.8	29.0	4.8	5.5	4.5	7.2	5.0	4.0	7.4	5.6	4.6	12.2	7.4	5.1	6.3	8.0	5.0	20.3	29.0	5.9	7.3	2.8	6.6	14.8	5.7	5.5
2050	1	5.7	5.8	2.4	10.2	7.0	5.1	4.8	9.0	3.1	6.6	10.2	4.6	7.0	6.4	5.9	8.9	5.5	4.0	2.4	3.0	10.1	6.2	5.9	4.5	3.5	3.7	6.2	4.6
2050	2	4.2	4.3	1.7	7.9	5.2	2.6	4.7	7.0	2.0	4.1	4.3	3.4	2.8	3.7	3.9	7.2	1.7	6.1	1.9	4.2	4.6	4.0	4.4	6.4	7.9	2.3	6.1	3.5
2050	3	5.7	5.5	1.9	16.1	2.8	6.4	5.6	3.1	8.4	4.5	1.9	7.3	4.7	6.9	4.1	5.8	2.8	6.0	4.1	3.7	7.1	5.7	2.9	6.1	8.0	6.3	16.1	2.5
2050	4	4.8	6.2	1.6	19.6	6.5	4.8	19.6	7.3	11.1	4.0	9.2	4.1	5.2	2.8	4.7	5.7	3.1	4.2	15.3	3.3	4.8	8.3	4.6	5.7	3.9	1.6	6.0	3.5
2050	5	9.5	8.9	1.3	17.6	1.3	4.0	14.3	3.7	6.5	12.8	6.3	11.5	11.7	12.6	10.1	3.1	13.6	3.7	11.5	2.2	7.4	6.4	6.8	16.5	9.2	17.6	9.8	9.8
2050	6	11.1	14.1	3.1	39.1	13.6	6.3	8.1	7.7	4.0	10.6	14.4	14.6	11.5	23.7	22.3	22.0	30.1	39.1	7.3	6.5	9.7	5.1	9.9	12.6	3.1	21.2	8.1	27.6
2050	7	9.3	14.1	3.7	39.0	39.0	11.8	8.1	24.7	25.1	5.7	8.6	13.0	7.8	36.5	8.0	6.7	16.9	9.3	9.9	20.7	9.3	7.7	12.3	7.5	8.6	28.8	9.0	3.7
2050	8	10.8	14.9	6.2	33.4	8.1	24.9	11.1	11.0	10.5	6.8	15.5	25.8	19.9	31.5	7.3	6.2	23.2	29.6	12.8	10.9	10.7	9.4	10.1	9.8	9.0	33.4	9.7	10.4
2050	9	10.5	13.7	4.1	41.9	14.8	6.4	29.2	10.2	6.8	17.0	7.8	24.5	5.5	41.9	25.5	4.1	14.9	10.6	18.2	6.0	10.5	13.3	7.6	12.7	16.2	7.8	10.0	7.6
2050	10	10.4	10.5	1.7	21.7	21.7	8.4	10.9	21.6	12.0	4.4	3.2	11.2	9.2	10.0	19.5	8.2	9.1	3.8	12.5	11.6	1.7	13.2	15.2	10.3	3.8	7.3	12.3	10.4
2050	11	6.1	7.1	2.6	14.5	7.8	3.0	11.7	5.4	3.1	6.0	12.2	6.1	4.0	4.5	10.5	4.9	5.2	5.3	14.0	14.5	6.6	6.6	8.4	10.8	5.6	2.7	7.5	2.6
2050	12	5.1	5.7	2.4	17.7	5.9	4.1	4.0	17.7	5.1	8.4	3.4	6.4	7.9	3.2	5.2	2.6	9.1	2.4	3.7	5.0	5.0	6.3	4.7	6.4	5.2	2.9	6.2	6.7
2051	1	5.7	5.6	1.7	12.1	3.3	6.4	2.5	6.1	3.5	9.4	6.4	5.1	1.7	2.9	3.2	3.9	9.6	5.3	9.0	6.4	3.7	2.6	7.1	6.7	12.1	2.5	7.0	8.5
2051	2	4.6	5.5	1.1	16.2	7.2	4.7	2.5	6.8	4.7	2.5	3.4	4.5	12.6	1.1	3.8	7.2	5.6	13.7	3.3	3.9	3.8	3.9	5.9	7.0	16.2	1.3	2.1	5.6
2051	3	4.9	6.3	1.7	20.9	5.8	7.7	3.9	13.7	4.4	3.8	4.5	6.4	10.2	4.3	2.7	8.3	6.6	10.2	3.0	1.7	3.4	5.2	7.3	20.9	3.6	3.0	7.0	4.1
2051	4	7.2	6.9	0.9	11.5	6.8	11.5	8.2	9.4	3.8	6.3	8.5	9.1	1.4	9.9	3.9	7.6	6.9	8.5	8.0	11.2	4.9	7.8	6.5	7.5	3.9	0.9	6.7	5.7
2051	5	12.1	12.7	4.1	25.6	12.7	4.1	15.3	8.5	8.3	14.2	11.7	14.1	22.2	12.5	8.4	24.0	9.9	19.2	10.1	15.1	7.5	8.3	10.3	25.6	5.7	17.8	4.1	14.9
2051	6	11.7	14.9	4.0	37.4	25.5	10.8	10.7	17.7	16.3	10.1	8.3	37.4	12.5	12.2	6.7	16.2	4.0	9.5	8.6	30.0	11.2	24.8	12.3	8.9	26.8	7.0	11.2	18.8
2051	7	12.5	15.8	3.7	63.2	18.1	17.5	12.7	14.4	10.6	21.8	33.8	20.0	10.5	16.5	63.2	7.8	9.6	9.7	7.6	14.5	4.2	4.9	28.6	5.5	12.4	9.9	21.0	3.7
2051	8	15.3	16.4	4.8	48.7	20.8	7.6	23.9	21.3	41.9	15.7	7.1	4.8	6.0	48.7	7.4	9.7	13.2	11.4	17.5	23.0	14.8	16.0	20.8	16.3	17.0	6.9	13.2	8.7
2051	9	12.3	13.9	4.1	30.7	12.1	11.8	13.3	11.8	30.7	18.3	9.5	24.7	10.4	4.1	15.3	12.5	8.3	21.4	8.9	5.0	16.9	9.1	8.6	22.3	5.7	21.7	17.6	13.6
2051	10	7.1	8.3	2.0	18.5	4.9	17.2	4.1	6.0	7.2	18.5	8.6	6.5	4.7	9.1	6.9	7.7	8.3	6.9	10.5	2.0	12.4	6.7	13.0	4.7	6.0	15.0	3.3	8.0
2051	11	7.6	7.6	4.1	12.0	4.2	8.0	5.3	4.1	9.2	9.4	9.5	6.0	7.9	7.3	12.0	6.6	11.9	6.9	8.5	7.1	4.6	9.4	8.4	9.7	9.7	5.8	6.2	5.5
2051	12	5.5	6.3	2.0	19.5	8.4	5.5	4.7	10.8	3.2	9.3	4.1	7.9	4.4	7.5	5.7	7.3	6.9	5.0	6.4	2.6	2.2	4.6	8.5	5.2	5.5	19.5	2.0	4.9
2052	1	4.6	5.5	1.3	13.0	4.2	3.1	4.1	4.6	11.3	5.0	9.0	11.3	3.9	2.7	6.0	7.1	3.9	4.0	6.0	4.7	1.7	6.4	13.0	4.4	4.9	4.9	4.3	1.3
2052	2	4.5	5.3	0.7	18.6	5.7	4.5	4.7	2.2	4.4	3.1	18.6	4.9	5.2	2.6	9.0	12.2	0.7	5.7	4.9	4.7	12.6	1.6	3.5	2.8	3.4	1.3	4.1	3.9
2052	3	6.8	7.0	2.4	15.0	10.1	5.4	10.7	8.4	5.0	6.3	7.8	2.9	8.6	5.6	9.3	12.7	7.3	4.4	5.0	8.0	8.5	4.6	15.0	2.4	3.2	3.7	8.2	4.6
2052	4	5.6	6.8	1.6	20.9	11.5	4.6	20.9	3.1	1.7	1.9	5.6	1.6	5.6	4.2	6.6	6.4	7.5	5.7	4.0	3.4	5.4	9.7	10.3	5.2	12.0	6.1	13.6	5.5
2052	5	9.0	10.1	3.1	24.1	8.9	3.1	4.0	7.0	11.3	6.6	16.0	13.4	8.9	10.1	8.1	14.2	6.5	11.4	13.7	15.1	6.5	9.0	9.5	24.1	6.5	7.3	7.2	13.5
2052	6	11.5	14.5	2.7	48.8	9.5	2.7	18.3	12.9	9.9	3.5	12.4	15.3	31.0	48.8	5.8	7.3	12.3	5.5	9.4	10.6	24.9	25.6	26.1	17.1	9.0	16.5	5.0	9.2
2052	7	15.4	17.0	9.4	44.5	18.1	19.1	23.2	15.6	10.8	23.0	15.3	20.2	11.5	44.5	10.3	24.2	13.7	17.3	9.9	10.7	20.1	14.8	15.8	10.2	26.9	10.8	11.5	9.4
2052	8	14.7	15.4	4.5	33.6	33.6	5.1	18.8	27.0	16.8	14.7	8.2	10.0	8.3	14.7	12.7	23.1	10.6	21.4	9.1	4.5	28.3	20.5	10.6	6.3	9.1	25.1	15.7	15.5
2052	9	13.4	14.3	4.5	31.9	9.3	19.3	8.2	8.7	31.9	13.0	15.2	15.3	16.3	9.7	15.8	5.4	14.9	7.4	13.7	26.0	20.8	4.5	12.4	22.0	25.4	10.4	6.6	11.7
2052	10	6.8	8.5	2.5	21.7	3.4	9.8	13.7	5.8	10.3	5.7	3.7	6.8	16.3	3.9	6.7	7.9	3.6	5.8	21.7	6.5	18.0	10.6	8.9	8.3	6.8	14.5	2.5	3.8
2052	11	6.5	7.9	2.9	16.7	6.2	13.2	8.3	9.5	5.8	6.2	6.1	16.7	2.9	6.9	5.3	6.8	5.5	11.7	8.5	6.0	6.7	11.3	13.3	5.6	5.6	10.7	4.4	6.0
2052	12	6.2	6.1	3.0	12.0	6.4	6.8	7.6	7.6	4.6	7.4	3.4	8.1	4.8	6.0	4.1	5.7	3.7	3.7	6.5	5.5	5.2	7.3	6.3	7.6	12.0	5.7	3.0	6.6
2053	1	4.9	6.2	2.3	24.9	4.6	2.5	5.0	20.1	6.5	6.1	4.3	3.7	4.8	5.5	7.8	6.9	2.8	5.1	4.7	3.3	2.3	4.4	5.1	2.9	2.4	8.4	24.9	5.1
2053	2	4.4	5.5	1.2	29.1	5.6	2.6	2.1	2.8	3.7	6.4	2.9	4.8	2.2	4.7	8.5	29.1	2.7	4.3	8.9	1.2	7.6	4.4	4.4	3.1	4.7	4.5	3.6	6.0
2053	3	5.1	5.8	1.9	11.0	7.9	7.1	5.0	7.0	11.0	7.7	1.9	3.8	4.1	4.5	6.5	8.3	3.9	3.3	8.3	3.4	3.1	9.0	4.3	9.4	5.2	5.8	3.7	4.3
2053	4	5.8	7.0	1.0	16.1	6.1	7.3	5.9	5.0	1.0	9.6	4.9	5.6	3.5	7.0	1.6	16.1	8.6	14.1	3.4	14.8	10.4	14.4	5.1	5.3	5.7	1.9	2.2	9.2
2053	5	8.7	11.3	5.0	33.2	9.2	8.6	16.7	6.3	8.4	7.7	5.0	26.6	8.8	6.5	7.5	11.1	5.2	16.4	8.3	7.0	14.4	9.1	12.9	10.7	33.2	20.1	5.8	6.5
2053	6	10.4	15.0	5.5	32.8	26.4	8.1	24.9	7.5	10.4	15.2	9.7	9.4	9.4	10.0	9.2	6.9	32.8	29.6	18.9	18.8	29.3	7.6	10.5	8.9	14.3	10.5	5.5	27.3
2053	7	14.2	16.7	6.1	60.9	12.7	27.0	11.5	13.6	9.0	16.0	8.4	15.8	22.5	18.6	7.8	9.8	24.4	6.1	18.3	14.2	14.2	16.9	11.1	25.6	6.2	60.9	16.9	14.0
2053	8	16.3	16.3	6.0	38.1	8.9	10.0	17.1	14.8	18.0	12.7	17.9	6.0	14.9	27.2	21.3	9.5	38.1	20.9	16.7	11.8	15.9	20.9	19.8	20.5	9.8	10.1	18.5	9.9
2053	9	13.6	16.7	4.5	45.8	23.4	20.3	27.1	23.5	18.7	23.4	9.3	10.3	16.4	45.8	8.2	6.0	10.8	8.1	9.3	20.2	25.0	18.5	6.0	9.3	9.7	38.0	8.4	4.5
2053	10	7.9	8.3	2.5	17.8	12.2	4.8	3.5	17.8	11.4	2.5	4.4	2.5	14.2	9.1	4.6	11.4	5.3	7.3	5.7	7.7	10.8	8.8	8.1	14.7	4.3	11.3	14.5	3.0
2053	11	6.8	7.3	2.0	14.3	14.2	6.5	2.2	4.2	10.4	4.3	8.0	11.2	3.7	8.4	4.4	7.9	14.1	3.4	11.0	4.0	14.3	2.0	6.3	4.5	7.4	4.0	12.7	7.1
2053	12	6.9	7.1	3.0	14.5	9.5	11.7	4.1	11.8	6.8	7.2	6.9	4.3	4.1	14.5	3.0	9.1	6.8	3.5	6.5	3.1	3.7	12.0	7.1	4.0	6.9	10.3	5.4	9.1
2054	1	4.5	6.0	2.1	33.6	33.6	8.0	2.1	5.7	2.9	5.0	7.8	4.6	7.9	4.5	4.5	3.8	3.3	3.8	4.3	3.6	3.8	3.5	4.9	4.4	6.8	5.7	3.9	5.9
2054	2	5.0	5.7	2.4	12.2	8.2	6.6	4.0	5.2	3.5	9.2	4.1	4.3	3.3	9.3	4.8	12.2	6.4	2.4	4.3	4.5	4.2	6.4	4.9	5.2	6.6	5.2	6.4	4.8
2054	3	6.3	7.6	3.0	18.6	3.1	18.6	5.7	5.8	9.1	8.1	6.2	3.0	9.2	5.8	13.8	3.6	5.3	4.2	12.0	3.9	6.7	6.1	6.4	13.8	6.9	12.5	3.0	8.5
2054	4	5.4	6.4	2.7	14.7	3.4	2.7	6.8	5.4	7.7	11.3	6.3	3.0	13.4	6.1	5.5	4.7	3.0	4.8	3.5	8.6	10.9	3.3	14.7	4.7	8.4	3.6	7.0	5.4
2054	5	10.1	10.6	3.2	23.0	3.4	11.4	9.7	13.1	15.6	15.3	23.0	4.2	13.0	11.8	7.4	18.3	14.6	12.3	10.6	6.3	9.1	19.7	9.5	3.2	6.7	5.3	4.8	5.0
2054	6	12.1	12.9	4.9	34.0	16.0	26.1	19.8	12.5	6.6	8.3	6.5	34.0	18.4	6.4	11.8	8.4	9.0	12.5	6.5	14.5	16.7	16.6	6.9	5.2	14.7	21.9	4.9	6.2
2054	7	19.1	20.3	8.7	34.6	22.1	8.7	26.7	18.8	13.1	27.1	13.4	12.3	28.9	17.3	32.5	19.7	15.2	29.5	10.1	16.2	17.2	26.4	21.7	34.6	11.1	19.4	18.0	27.8
2054	8	16.6	23.3	5.6	74.9	26.8	30.9	10.8	21.5	14.8	12.2	5.6	8.8	16.2	31.4	12.0	16.7	7.1	13.4	24.2	16.5	34.6	8.3	36.9	12.9	26.7	40.0	55.7	74.9
2054	9	12.3	14.3	5.8	34.5	12.7	8.8	16.2	20.6	8.5	18.5	13.1	34.5	15.3	5.8	11.4	10.2	11.9	24.1	9.2	7.5	21.5	7.9	8.4	20.9	25.9	13.4	8.5	9.0
2054	10	6.9	7.7	2.5	15.9	7.2	6.8	6.5	5.2	6.1	10.3	15.9	14.1	7.2	5.5	3.6	11.3	4.3	7.1	4.3	3.1	6.4	2.5	4.2	12.3	11.3	7.1	15.1	8.5
2054	11	8.0	8.4	2.6	21.2	7.0	3.9	8.3	7.8	3.7	2.6	13.8	12.5	2.7	8.3	8.4	10.1	6.5	5.4	5.1	5.8	8.7	16.4	8.6	4.9	11.3	21.2	6.4	11.7
2054	12	6.8	7.7	2.8	17.4	4.1	3.1	4.8	8.1	11.5	17.4	7.2	11.4	8.1	5.4	2.8	11.1	5.7	10.2	5.4	6.3	10.7	6.1	8.8	4.3	7.6	4.7	16.7	4.2
2055	1	4.9	5.7	2.5	12.5	4.9	4.0	4.5	3.0	7.4	8.7	4.9	8.0	7.6	3.3	12.5	7.2	4.6	4.7	5.9	3.6	2.5	4.7	3.1	3.7	6.9	6.4	6.2	9.5
2055	2	4.9	5.4	1.3	10.6	4.1	6.1	9.2	4.8	7.7	10.6	3.9	6.7	3.7	3.7	4.4	3.9	5.0	6.1	6.7	5.1	2.5	3.9	8.5	3.0	10.4	5.9	1.3	1.9
2055	3	5.7	5.7	2.1	12.0	3.3	2.5	3.4	7.8	12.0	5.5	6.3	3.5	3.6	3.9	6.6	11.3	6.2	7.3	7.2	4.0	5.9	6.7	2.1	7.8	3.8	4.4	6.9	5.2
2055	4	6.2	6.4	1.3	15.3	6.0	6.4	2.4	4.4	3.0	6.8	12.6	10.6	7.4	2.9	1.3	2.1	4.8	4.2	6.4	7.6	5.2	10.5	11.9	6.6	3.7	15.3	5.1	6.9
2055	5	9.5	11.1	3.2	29.2	13.1	4.0	8.6	9.4	21.0	3.2	12.7	4.9	18.9	7.6	7.2	18.8	29.2	10.4	9.1	5.4	13.7	18.5	9.5	11.4	6.5	7.3	11.9	4.6
2055	6	10.1	11.3	2.1	32.8	10.8	3.2	18.6	9.8	10.0	17.4	10.2	2.1	11.5	18.0	32.8	10.5	18.2	7.3	13.7	8.2	9.4	4.8	4.7	5.5	6.9	11.1	2.9	24.2
2055	7	12.7	17.0	4.7	55.9	12.0	8.4	8.8	33.0	23.4	12.2	25.7	32.7	18.0	12.7	26.7	12.6	55.9	20.2	23.0	10.1	8.5	4.7	9.3	4.9	8.8	12.7	12.7	11.5
2055	8	13.7	14.4	6.4	32.9	10.2	13.5	18.9	19.7	17.8	14.3	10.8	24.4	7.3	7.4	23.3	13.9	13.7	11.4	9.8	13.7	12.8	32.9	13.7	14.7	13.8	7.9	6.4	14.4
2055	9	14.6	14.2	2.2	22.5	13.7	22.3	17.3	18.6	8.7	14.5	20.8	13.3	22.1	10.6	18.0	14.9	17.1	12.1	9.4	15.2	14.6	13.3	9.5	22.5	5.7	17.4	7.2	2.2
2055	10	7.0	8.2	2.5	17.5	7.2	4.1	8.3	5.0	8.0	6.0	2.5	9.3	4.6	14.6	4.4	5.9	5.2	16.5	17.5	5.1	14.6	10.5	3.8	6.8	13.2	10.2	8.9	5.7
2055	11	5.9	7.8	2.7	21.0	18.9	16.2	5.6	10.3	3.3	6.3	7.5	8.6	4.8	2.7	21.0	5.4	3.3	8.2	6.8	4.4	4.9	6.7	13.6	4.3	12.2	5.5	3.2	4.1
2055	12	5.4	6.1	2.3	17.4	4.9	6.7	2.7	7.7	4.9	3.1	4.6	3.2	5.1	6.2	4.2	4.5	5.6	9.0	8.0	2.3	6.0	7.8	7.7	6.8	7.7	4.7	4.7	17.4

2056	1	5.3	6.4	2.6	23.0	5.4	6.6	3.4	2.6	3.6	3.6	3.3	10.6	3.4	5.7	9.4	6.9	8.0	4.3	8.4	5.2	5.1	4.7	8.1	7.7	23.0	5.2	6.8	3.1
2056	2	5.2	5.1	1.7	11.4	2.9	4.4	3.3	7.3	6.8	5.5	11.4	8.7	2.8	5.4	4.0	3.6	6.2	8.0	3.0	2.1	2.9	5.2	5.3	3.1	6.8	6.1	5.7	1.7
2056	3	6.6	7.1	2.4	14.5	7.2	4.4	3.6	4.2	11.3	4.0	5.3	7.6	10.8	9.2	11.8	2.4	12.5	5.7	6.0	7.7	4.9	2.7	3.0	14.5	7.3	10.2	9.4	4.3
2056	4	6.7	7.5	2.2	18.2	6.4	9.7	2.3	4.5	2.2	2.6	9.4	3.5	13.4	5.6	7.8	18.2	2.5	9.0	9.8	10.0	6.4	7.0	8.6	5.4	6.3	10.3	13.1	5.6
2056	5	11.0	12.0	5.0	26.2	6.8	6.4	5.0	5.3	7.2	5.5	12.3	12.5	21.1	5.4	11.3	18.3	26.2	9.0	10.6	9.3	5.6	18.2	14.2	24.6	14.5	8.1	14.3	16.3
2056	6	14.1	16.0	5.2	41.9	34.2	10.2	12.1	8.8	14.1	20.0	5.2	41.9	11.9	8.6	18.3	8.5	16.8	9.0	16.2	15.4	11.2	16.2	10.6	13.1	16.8	22.7	14.2	29.2
2056	7	16.1	17.5	6.0	45.3	37.7	8.3	6.8	20.8	19.1	6.6	7.6	19.3	13.7	45.3	28.8	10.7	7.1	12.8	7.7	21.9	24.7	31.4	15.5	25.6	16.7	7.6	6.0	18.5
2056	8	15.1	17.1	4.7	35.5	25.5	26.5	4.7	13.0	10.9	9.4	4.8	18.9	12.7	20.7	28.1	6.7	12.3	15.6	15.0	15.2	15.5	10.5	26.7	34.5	12.9	23.2	10.6	35.5
2056	9	12.6	13.4	2.0	26.3	18.0	7.5	4.9	17.0	16.0	12.6	11.8	15.4	8.4	11.1	26.3	8.8	17.4	10.7	13.5	20.0	2.0	17.8	26.2	10.4	22.9	4.9	4.5	12.6
2056	10	6.5	7.4	2.0	16.1	5.3	15.8	10.3	12.1	4.3	8.0	4.6	9.2	11.0	6.5	11.5	16.1	8.4	4.9	4.6	5.4	2.0	6.9	6.4	7.8	2.6	5.8	6.3	2.1
2056	11	7.2	8.1	3.9	23.9	23.9	7.5	14.4	10.3	3.9	4.3	9.3	7.5	11.5	7.8	13.2	8.6	5.4	4.3	4.5	7.4	7.1	6.6	4.5	7.0	6.0	4.3	7.3	6.9
2056	12	4.5	4.9	1.6	12.5	5.5	2.5	4.5	6.0	12.5	8.0	1.8	6.8	2.5	4.5	2.9	4.4	5.2	3.7	2.0	5.5	7.3	5.9	1.6	10.0	3.3	3.3	2.8	5.5
2057	1	5.9	5.9	2.3	9.8	6.7	5.5	4.4	7.6	7.7	3.8	2.4	6.9	5.6	5.4	6.6	6.2	3.9	4.3	7.8	5.0	9.3	8.7	6.8	8.2	9.8	4.7	2.7	2.3
2057	2	3.8	5.0	1.4	14.8	5.8	2.7	3.2	2.7	9.5	6.2	3.8	8.1	14.8	2.8	2.5	3.0	1.4	4.9	1.8	2.8	7.2	5.0	2.1	3.7	10.4	3.4	4.0	8.6
2057	3	5.4	7.1	0.8	17.1	14.5	6.4	1.2	11.6	15.6	5.2	2.9	6.0	7.6	5.4	2.0	17.1	4.6	5.1	9.2	4.8	0.8	4.0	11.8	5.4	5.1	6.0	12.9	4.9
2057	4	6.6	7.6	0.6	15.1	13.6	3.9	4.6	15.1	12.8	2.8	8.2	13.1	11.1	6.7	5.8	11.1	3.1	5.9	5.3	0.6	6.5	11.3	12.4	3.5	9.4	3.2	8.1	4.1
2057	5	10.7	11.3	3.0	20.3	10.4	3.9	19.5	7.9	11.3	4.8	20.3	6.2	13.5	6.8	17.6	6.2	17.6	16.8	15.3	11.0	19.1	12.5	6.5	3.0	13.6	10.1	6.3	10.2
2057	6	11.7	14.4	3.7	49.5	11.9	18.8	9.0	4.9	8.2	8.1	8.4	12.7	21.6	23.1	13.7	10.0	3.7	49.5	16.1	34.0	11.0	15.9	5.8	8.6	6.3	18.3	11.6	14.4
2057	7	13.5	15.0	5.7	34.4	17.1	5.7	14.6	14.0	8.3	9.5	25.7	6.9	17.1	8.1	34.4	15.6	12.6	8.4	9.7	20.0	31.1	22.6	13.8	20.3	11.6	7.9	13.3	12.0
2057	8	15.0	17.5	5.0	30.4	28.4	14.5	8.8	15.1	5.8	13.7	20.5	16.8	11.5	10.6	11.4	5.0	21.4	29.4	30.4	11.2	24.3	10.4	24.0	10.6	26.1	27.6	14.9	27.7
2057	9	14.8	16.0	2.7	40.5	24.9	2.7	17.7	32.1	9.0	16.3	7.6	17.1	19.1	24.7	12.7	5.2	9.1	6.5	11.1	8.6	20.8	17.9	40.5	25.9	16.0	10.4	13.6	13.5
2057	10	6.6	8.4	2.4	20.4	2.4	11.7	13.8	3.8	20.4	11.8	15.1	6.5	4.5	7.1	6.7	16.4	4.8	5.3	8.1	3.0	5.4	6.1	4.5	8.9	5.7	11.0	6.4	12.8
2057	11	7.0	7.7	3.2	14.3	13.3	8.3	5.9	5.8	8.5	10.1	3.2	6.6	9.2	5.8	9.5	6.3	14.3	9.2	7.3	9.5	9.0	6.8	3.7	6.1	6.2	8.6	5.8	4.9
2057	12	5.9	6.1	2.6	10.6	6.1	3.7	7.9	4.3	5.3	7.6	5.5	6.5	5.9	5.8	10.6	4.9	6.7	6.0	7.6	7.2	3.0	8.9	2.6	5.3	4.9	6.8	7.5	5.3
2058	1	5.1	5.9	2.1	13.9	3.8	4.7	2.7	7.6	10.2	2.1	7.1	8.8	7.5	10.5	6.8	5.5	6.4	2.3	3.2	2.6	11.4	13.9	3.6	9.2	3.9	2.6	3.0	2.6
2058	2	4.8	5.3	1.4	15.0	3.9	3.0	6.4	8.2	7.9	2.9	6.5	4.9	8.6	4.6	2.9	3.7	4.2	15.0	5.2	6.1	2.6	4.6	4.5	5.3	4.9	5.5	1.4	4.3
2058	3	5.1	5.9	1.9	15.2	2.9	5.6	5.7	9.4	10.7	10.8	4.7	7.5	1.9	3.5	4.3	4.1	6.9	3.0	2.9	10.4	3.9	6.6	15.2	2.0	2.2	4.0	5.9	6.0
2058	4	5.9	6.5	2.0	15.7	8.8	2.0	3.3	3.4	5.0	6.9	2.5	4.2	8.0	6.0	4.0	7.3	3.2	7.3	15.7	6.3	4.9	12.5	5.8	10.3	11.4	4.8	8.8	2.5
2058	5	11.5	12.2	2.6	24.9	8.5	8.8	20.1	11.5	18.9	20.8	5.5	15.8	4.8	14.0	16.2	22.0	14.2	10.6	7.9	24.9	14.4	4.9	2.6	18.3	11.6	4.8	7.9	4.5
2058	6	11.3	14.2	4.5	42.3	10.2	42.3	8.3	30.0	18.8	11.3	21.2	5.6	26.5	7.3	7.8	12.6	26.1	9.8	12.1	11.2	9.4	15.6	17.5	4.5	5.3	9.8	6.9	11.5
2058	7	12.6	16.1	7.3	40.2	7.3	11.9	13.9	8.9	8.1	14.3	40.2	12.9	15.3	14.9	12.2	8.9	8.6	11.9	26.6	10.2	12.3	18.8	8.5	26.7	15.6	39.8	10.4	27.4
2058	8	14.2	16.1	2.3	56.3	19.7	16.3	34.0	11.5	10.1	13.8	18.0	22.4	26.0	19.1	11.4	6.8	15.8	8.9	56.3	2.3	7.8	14.7	6.9	17.2	24.2	8.0	6.2	10.1
2058	9	14.6	13.5	5.4	29.7	14.8	8.0	6.8	16.2	29.7	5.9	16.6	6.6	10.8	15.4	20.3	14.3	15.8	8.6	15.3	25.8	5.4	18.8	16.9	7.7	9.6	15.9	6.1	13.8
2058	10	6.2	7.3	2.3	15.1	4.5	13.3	5.9	8.4	10.1	5.9	2.6	6.2	4.9	6.1	4.5	6.5	15.1	9.1	6.8	3.4	13.3	12.3	12.5	4.1	7.9	2.5	6.0	2.3
2058	11	8.1	7.9	2.2	18.2	3.0	8.7	9.2	6.6	8.5	7.6	7.3	3.3	3.5	3.0	8.6	5.2	18.2	14.5	11.6	11.5	5.7	9.4	10.5	7.6	3.3	9.8	2.2	10.6
2058	12	6.2	7.0	1.9	21.5	5.9	21.5	7.6	7.2	7.1	8.5	7.8	8.0	4.1	11.0	4.5	5.5	2.4	4.3	5.8	4.2	11.4	7.1	5.6	4.0	1.9	6.5	3.7	12.0
2059	1	5.4	6.1	2.9	11.1	8.6	4.6	4.1	6.8	8.1	9.5	11.1	6.4	7.8	4.1	5.8	5.2	3.2	8.2	8.7	5.6	3.2	2.9	4.8	10.1	4.9	4.4	5.3	4.1
2059	2	3.9	4.9	2.5	13.4	2.5	3.2	3.9	4.6	5.5	3.0	3.8	4.5	12.2	3.9	3.0	3.9	3.9	6.5	3.0	3.9	8.4	4.0	13.4	3.3	6.9	3.4	3.4	4.1
2059	3	5.9	8.2	1.7	21.3	4.3	13.9	21.3	17.2	20.2	9.9	3.1	1.7	12.6	6.4	2.1	5.5	3.2	4.8	4.1	10.9	3.2	3.8	14.6	7.6	3.1	11.1	10.4	2.9
2059	4	5.4	5.9	1.7	12.5	9.7	12.5	4.0	6.8	1.7	8.2	2.6	4.4	5.0	3.3	7.2	8.1	4.1	3.0	11.2	8.0	2.4	3.2	9.0	3.6	5.7	7.2	6.3	4.2
2059	5	9.5	11.7	4.2	30.8	7.8	4.4	19.8	12.0	9.6	7.6	15.6	17.5	15.1	15.1	7.7	12.5	7.6	9.4	9.0	5.6	8.5	9.4	6.2	14.5	14.5	30.8	4.2	17.3
2059	6	12.8	16.8	5.6	39.0	30.3	29.5	10.6	12.7	13.3	5.6	12.8	23.6	8.3	31.2	39.0	8.4	7.5	12.4	37.4	14.8	7.2	12.5	20.2	7.1	17.5	27.5	7.0	6.4
2059	7	13.5	16.9	4.2	48.6	29.4	11.9	5.4	48.6	17.8	26.5	32.8	12.7	13.7	8.2	11.2	6.7	10.9	10.9	10.4	13.3	4.2	18.3	22.8	14.5	23.9	14.3	13.4	23.3
2059	8	12.6	16.8	3.9	88.4	10.0	8.1	4.8	15.1	28.4	12.7	6.7	15.0	17.6	88.4	32.0	3.9	18.8	11.3	24.1	15.0	8.5	5.5	10.2	14.3	9.8	12.5	8.3	22.8
2059	9	16.3	16.1	4.8	26.7	6.2	13.6	17.3	12.9	16.3	13.1	24.6	26.0	21.9	16.2	11.1	18.1	17.5	4.8	11.1	22.7	26.7	9.1	11.5	22.3	24.3	8.3	9.6	21.6
2059	10	7.3	9.7	3.7	24.1	17.2	12.2	4.0	15.1	7.2	17.6	17.7	7.1	7.4	3.9	5.7	14.6	3.7	9.9	6.2	8.0	24.1	7.2	4.0	9.3	6.5	12.2	7.1	5.4
2059	11	7.2	7.7	3.0	15.6	7.2	3.8	5.0	6.6	4.1	6.3	6.3	10.2	9.2	8.6	8.6	7.8	3.4	8.7	15.6	9.5	14.7	8.7	7.3	3.0	11.4	4.8	5.9	7.1
2059	12	5.4	5.5	3.1	9.9	9.9	7.1	3.5	6.1	6.3	4.7	6.3	3.6	5.1	6.6	5.8	3.6	6.4	7.3	3.9	5.1	4.8	3.1	5.6	7.1	7.0	5.3	4.0	4.6
2060	1	4.0	5.1	1.4	16.0	2.8	3.5	1.4	3.9	16.0	2.0	5.8	3.7	3.5	7.9	9.0	4.5	5.6	2.8	7.5	3.7	1.5	4.2	6.8	4.9	3.4	4.7	8.5	3.8
2060	2	4.0	4.5	1.8	9.3	2.6	4.1	3.3	2.1	5.8	4.9	8.6	6.4	2.5	3.5	3.2	1.8	7.7	3.1	9.3	2.1	4.8	3.5	2.2	4.6	7.9	6.1	3.9	5.1
2060	3	4.8	5.2	2.3	12.8	2.8	7.1	3.7	4.6	8.7	5.5	2.7	10.2	4.0	2.3	3.6	12.8	5.5	4.8	7.4	5.2	5.0	2.3	3.5	6.1	4.1	5.8	4.8	3.2
2060	4	6.2	6.6	1.3	14.4	14.1	8.9	7.7	9.4	7.3	2.7	7.8	4.6	13.7	3.6	9.4	2.2	4.2	5.7	2.8	6.8	3.8	3.1	3.1	8.8	4.0	8.0	14.4	1.3
2060	5	8.3	8.9	2.7	18.7	6.3	4.3	8.5	4.5	14.0	5.1	18.7	6.7	9.6	5.4	5.3	3.6	11.8	12.3	8.2	10.4	15.1	12.9	4.6	7.5	2.7	10.5	15.0	10.9
2060	6	12.3	13.1	3.8	32.0	11.7	3.8	30.6	32.0	15.8	12.2	7.2	12.7	3.8	6.7	18.3	4.9	17.1	7.2	5.9	8.2	13.6	16.0	23.7	3.8	26.6	6.4	13.9	12.5
2060	7	14.4	17.0	8.2	41.0	11.3	14.5	41.0	22.4	10.9	29.5	8.2	10.3	18.3	15.9	11.1	10.4	12.3	16.3	20.4	11.7	20.6	14.2	22.0	22.6	14.4	23.7	13.7	11.4
2060	8	12.8	15.6	4.5	39.9	10.5	8.1	36.7	18.8	10.8	6.0	4.5	13.5	22.9	4.6	39.9	13.0	27.7	11.2	14.7	21.8	12.3	21.8	12.4	12.5	9.8	8.6	13.3	18.2
2060	9	12.4	13.9	4.1	48.1	48.1	4.1	8.3	12.6	10.3	4.2	10.0	12.6	16.1	9.1	22.7	13.9	10.3	8.9	18.9	13.8	19.7	17.7	5.3	14.5	23.1	12.3	8.0	9.5
2060	10	6.1	7.9	2.3	20.7	18.1	5.3	6.8	5.5	4.3	4.2	4.7	6.1	10.6	8.3	14.8	7.6	5.3	20.7	3.1	6.1	11.5	2.9	2.3	4.6	8.3	15.4	5.6	7.3
2060	11	7.2	7.5	2.0	19.1	12.9	4.7	7.1	9.4	3.8	10.8	9.9	9.4	19.1	6.7	3.8	4.9	9.5	2.0	9.5	3.4	8.4	8.5	5.3	5.0	10.4	4.9	7.2	3.0
2060	12	6.1	6.9	2.2	29.0	6.7	29.0	3.7	5.6	4.6	7.4	3.6	3.4	2.2	7.5	6.1	6.4	9.7	2.9	9.3	6.0	4.0	4.8	8.7	4.4	4.1	7.0	12.5	6.8
2061	1	6.0	6.0	2.5	11.6	6.3	4.7	4.0	4.7	9.9	6.2	6.2	3.7	6.8	6.4	7.5	6.0	5.8	5.1	8.1	2.5	4.7	5.4	2.5	3.4	5.9	11.6	6.2	11.0
2061	2	5.3	5.9	2.6	14.1	14.1	4.0	4.0	5.7	8.7	3.6	3.3	10.9	2.6	2.7	5.2	4.7	6.2	6.4	5.4	6.8	7.4	7.5	3.6	8.0	7.8	4.2	4.8	3.1
2061	3	5.4	5.5	1.6	11.4	5.8	4.6	4.7	3.4	10.6	11.4	2.3	7.7	5.1	1.6	6.6	6.1	5.5	3.2	6.3	7.0	7.6	6.5	1.8	5.3	4.0	5.9	4.9	4.2
2061	4	7.8	8.8	2.6	19.5	7.6	7.6	12.2	4.9	10.6	15.4	3.5	19.5	8.4	2.6	4.9	17.0	16.9	9.0	9.2	4.0	5.8	7.0	13.0	8.1	5.5	8.1	4.4	6.3
2061	5	11.8	12.4	1.7	25.6	10.3	20.3	4.0	8.4	4.3	8.6	1.7	19.4	11.3	10.3	13.6	8.3	5.5	10.6	15.4	24.8	14.6	19.8	13.3	25.6	14.3	17.0	4.0	12.2
2061	6	11.9	13.0	3.5	35.1	13.5	7.5	35.1	11.1	14.3	4.9	20.7	10.9	24.2	9.2	5.8	17.9	17.1	20.5	12.7	13.2	11.5	12.4	14.3	11.4	3.5	8.8	3.8	7.0
2061	7	14.7	19.3	6.1	67.1	53.0	17.5	14.2	12.8	29.8	12.1	7.3	67.1	25.9	8.4	14.0	9.5	32.8	8.5	15.2	16.4	21.7	15.1	14.2	13.5	9.0	19.9	6.1	19.6
2061	8	14.6	18.4	6.2	56.7	19.5	7.6	17.3	16.2	27.6	24.5	9.0	9.4	56.7	41.3	14.2	20.6	6.2	9.1	10.4	30.6	6.4	15.0	38.4	6.8	10.0	27.3	9.1	8.0
2061	9	14.1	14.7	3.6	31.5	8.2	7.4	17.7	9.5	9.0	24.0	13.3	14.8	24.6	22.2	13.0	3.6	15.8	5.7	23.2	16.9	19.4	9.2	17.0	5.4	10.4	31.5	16.7	13.2
2061	10	9.2	9.5	3.1	20.2	4.6	13.9	6.8	3.9	10.6	12.9	17.0	4.7	10.9	12.9	8.6	9.0	13.0	3.8	6.3	20.2	5.3	13.2	4.3	15.1	11.2	9.4	7.7	3.1
2061	11	7.5	7.8	2.3	14.9	7.6	9.2	3.0	6.4	4.9	9.6	14.9	7.0	7.3	7.3	3.8	2.3	7.6	8.4	7.1	3.6	12.9	11.9	11.3	12.4	6.2	9.9	8.4	4.4
2061	12	4.9	5.6	2.3	12.1	5.0	6.6	6.3	7.3	3.6	2.3	4.0	11.4	3.6	12.1	4.7	5.6	7.0	4.3	8.2	6.3	3.8	2.8	5.4	9.9	4.6	4.4	3.2	2.6
2062	1	5.9	6.7	2.5	19.3	5.0	5.5	19.3	5.3	6.5	3.7	12.1	11.0	3.2	5.3	7.2	6.9	4.8	10.4	6.0	4.4	6.0	6.4	5.9	8.0	2.5	2.5	4.0	8.7
2062	2	5.2	5.5	1.1	10.1	2.6	3.0	5.7	10.0	4.9	8.0	7.4	5.5	3.7	5.8	10.1	4.6	3.5	9.4	4.8	6.3	4.5	6.2	5.8	4.7	5.3	5.1	1.1	4.1
2062	3	5.1	6.9	3.4	14.4	11.9	6.4	13.9	4.3	5.1	4.6	11.0	3.9	4.8	3.4	10.0	9.3	4.2	4.8	4.8	5.9	3.8	9.3	10.7	14.4	4.1	4.6	5.9	5.0
2062	4	4.6	5.3	1.0	13.7	4.4	1.9	4.1	13.7	4.8	4.5	6.3	3.0	7.0	5.0	3.0	6.2	5.0	10.7	6.6	7.3	4.2	2.9	4.2	1.0	4.2	3.7	7.0	6.6
2062	5	10.0	13.7	4.0	47.3	19.7	7.9	9.4	24.1	8.4	16.5	8.4	18.7	22.4	7.3	4.0	5.2	47.3	7.2	12.1	27.8	7.0	9.8	4.0	10.2	8.9	10.1	15.3	17.3
2062	6	11.1	13.5	4.0	33.8	9.7	15.4	17.3	21.9	6.7	9.7	11.5	21.7	18.2	33.8	26.4	4.0	7.4	7.0	9.2	6.8	10.7	6.2	13.2	8.1	5.7	16.4	23.6	13.3
2062	7	14.5	16.5	5.8	43.3	18.8	16.3	15.7	12.7	11.3	12.9	6.1	11.6	25.8	43.3	10.3	21.1	5.8	13.2	9.2	17.2	16.6	26.6	36.8	17.8	7.7	12.1	8.6	17.6
2062	8	13.6	18.7	4.5	70.3	14.1	13.2	7.2	18.7	13.2	33.8	35.0	8.6	11.5	34.2	17.0	9.7	4.5	6.2	25.9	14.4	70.3	8.8	13.2	20.3	32.0	4.6	21.2	10.8
2062	9	15.5	16.0	3.6	39.3	18.2	15.9	18.6	20.5	12.8	23.3	12.1	5.4	14.0	20.8	16.9	7.8	3.6	19.6	39.3	15.2	29.9	7.7	10.6	6.3	20.0	19.7	13.6	13.3
2062	10	6.8	8.3	1.8	20.2	5.1	5.1	4.1	4.6	19.7	3.1	4.4	3.3	13.0	1.8	14.3	8.4	6.1	6.1	15.3	20.2	7.9	8.8	8.2	15.3	7.5	7.4	4.1	5.5
2062	11	6.4	7.0	2.2	13.3	10.3	6.9	3.6	6.2	6.4	11.7	9.3	13.3	2.2	9.5	6.9	5.0	9.7	3.0	3.8	6.1	6.5	4.8	9.1	5.7	12.5	6.4	4.9	3.2
2062	12	6.1	6.5	1.7	12.0	6.4	11.3	4.5	9.4	6.0	12.0	7.1	5.9	4.9	4.6	6.6	8.6	4.0	5.1	9.3	4.2	8.4	5.7	1.7	11.8	6.5	3.6	2.5	6.2
2063	1	6.1	6.8	2.6	17.0	8.5	4.6	5.0	7.2	12.1	10.0	8.1	6.7	5.5	3.0	3.7	7.5	6.4	8.9	10.5	5.5	2.6	3.2	4.3	17.0	5.8	3.6	10.2	4.0
2063	2	4.4	5.3	1.6	15.4	3.0	1.6	2.0	6.7	2.9	3.1	8.0	14.2	4.3	3.9	10.4	3.3	6.8	4.9	2.2	4.9	15.4	1.6	2.4	5.6	4.6	2.9	7.5	5.7
2063	3	5.2	6.3	2.1	17.6	3.9	6.9	5.0	13.4	3.6	2.6	2.6	3.9	6.2	2.1	2.5	4.2	9.0	17.6	2.7	5.3	9.9	10.1	5.1	6.8	8.5	9.8	3.3	5.4
2063	4	6.7	8.0	2.3	20.9	13.3	13.2	8.6	5.6	7.7	16.4	11.0	4.8	5.1	4.2	2.8	7.2	6.3	2.3	5.1	20.9	3.7	5.2	9.0	7.3	14.3	3.7	9.8	4.5
2063	5	7.3	10.2	2.6	43.9	12.9	43.9	19.6	5.8	5.3	7.1	2.6	12.3	7.5	8.9	2.6	24.8	13.8	4.0	2.6	6.3	8.5	5.2	9.5	14.2	9.2	6.1	5.7	5.5
2063	6	12.0	13.5	3.6	28.6	8.5	10.5	9.2	14.3	7.2	18.4	10.7	11.7	13.1	18.0	17.0	7.1	16.3	24.7	23.8	15.8	7.0	21.4	9.2	6.8	12.3	3.6	9.5	28.6
2063	7	15.7	17.3	6.1	33.5	16.7	18.7	6.4	18.9	6.2	6.5	14.4	14.2	24.1	24.7	14.2	6.1	33.5	32.7	22.1	12.3	29.3	24.6	20.8	9.6	13.7	14.7	8.9	22.7

2063	8	15.0	16.6	3.4	45.7	24.5	18.8	6.5	18.1	44.6	25.2	11.2	15.5	9.3	6.7	7.8	20.6	16.7	8.4	45.7	3.7	7.1	26.1	6.0	3.4	16.7	13.2	14.5	27.6
2063	9	13.5	14.2	6.8	24.4	13.3	6.8	11.5	7.8	15.8	17.8	9.8	15.3	13.6	14.5	21.5	8.3	10.9	21.6	22.3	9.5	24.4	18.3	10.2	10.2	12.1	19.2	17.2	8.5
2063	10	8.1	8.9	2.2	18.1	12.0	7.9	6.2	8.3	14.7	9.4	2.2	6.7	4.4	6.6	5.6	15.1	10.2	8.8	3.5	5.7	8.9	12.6	6.9	13.9	18.1	6.3	5.8	14.1
2063	11	6.5	7.5	2.9	22.0	7.6	5.9	4.1	6.0	6.5	3.7	5.5	11.5	2.9	3.2	7.5	8.5	7.8	9.0	8.9	18.3	6.2	8.1	8.4	3.8	5.4	22.0	6.4	3.1
2063	12	5.6	7.3	3.1	19.7	3.9	5.5	5.2	12.3	5.6	3.1	5.3	10.3	13.4	5.6	6.6	3.9	6.7	3.9	7.8	5.2	9.6	19.7	5.1	9.2	7.8	9.3	4.8	5.0
2064	1	5.5	5.7	3.0	11.4	3.0	6.5	6.5	5.7	6.9	5.5	5.5	8.3	5.4	3.6	3.6	5.5	3.2	6.2	3.1	11.4	8.0	7.1	5.4	8.7	4.2	3.6	5.7	4.3
2064	2	5.0	5.6	1.7	11.6	5.5	5.1	3.7	2.5	5.4	8.0	4.4	11.6	4.8	8.0	6.1	4.9	11.0	7.2	9.0	1.7	2.5	9.2	3.9	6.0	5.0	2.3	3.5	4.3
2064	3	7.8	8.2	2.3	17.4	7.8	17.4	8.6	8.8	10.9	7.6	2.3	15.2	14.4	8.8	4.4	5.7	3.9	10.5	14.4	5.5	3.8	2.3	14.2	3.5	6.3	7.9	10.0	3.9
2064	4	4.8	5.6	0.0	20.2	5.4	14.4	6.9	2.4	6.1	1.2	2.8	6.4	9.2	4.8	6.9	1.2	4.0	4.9	2.6	2.6	5.2	20.2	0.0	4.7	8.6	4.2	4.7	4.2
2064	5	9.6	10.4	2.8	28.7	9.6	3.6	6.9	6.8	10.7	16.2	15.0	28.7	6.1	7.3	14.6	13.0	8.6	2.8	14.6	5.1	15.3	9.5	14.5	5.5	11.7	4.8	10.2	8.0
2064	6	12.2	15.4	7.0	34.7	9.6	11.8	11.2	14.3	19.2	12.1	7.0	8.0	34.7	11.0	14.5	20.2	10.2	12.8	9.7	12.4	24.7	19.1	24.1	11.1	29.3	22.1	10.0	11.4
2064	7	14.6	18.2	6.7	50.8	11.1	8.7	7.8	15.0	22.5	30.3	39.0	9.8	50.8	6.7	21.9	8.5	21.1	9.9	33.1	10.6	7.6	14.2	13.2	30.0	15.0	21.7	15.5	12.4
2064	8	18.2	17.5	3.8	41.5	19.2	41.5	8.3	24.7	7.3	20.2	18.0	6.1	6.7	34.4	6.8	13.1	3.8	8.6	26.6	20.4	35.9	15.0	23.8	25.7	11.1	5.9	19.4	18.4
2064	9	15.0	17.0	4.4	40.9	29.4	16.5	21.7	13.0	40.9	17.9	36.2	9.4	8.3	10.5	22.7	19.4	12.6	12.4	19.1	11.1	10.5	4.4	19.0	10.0	11.6	19.4	17.5	13.4
2064	10	8.5	9.7	2.4	22.9	10.4	8.1	3.3	22.9	7.7	6.9	17.9	6.9	16.3	14.7	9.5	11.3	2.8	8.4	7.2	2.4	7.9	8.4	4.2	10.8	11.3	14.1	8.5	11.5
2064	11	7.1	8.0	2.7	20.5	4.5	10.6	3.4	7.7	3.9	6.6	13.7	20.5	17.7	8.3	8.1	4.9	2.9	13.7	4.1	2.7	8.1	13.3	9.6	3.3	6.3	9.9	4.0	4.9
2064	12	5.1	5.7	1.6	14.9	5.5	10.6	1.6	3.4	4.2	8.7	5.6	14.9	6.2	6.8	5.5	3.9	4.0	4.0	3.6	8.7	4.4	4.7	3.0	8.1	5.4	4.4	5.7	4.8
2065	1	6.1	8.4	3.9	24.3	13.0	5.0	10.4	6.1	4.8	24.3	3.9	5.1	7.9	5.8	10.1	16.1	6.2	4.4	16.8	4.8	8.9	4.6	6.3	13.7	3.9	4.3	10.7	4.3
2065	2	4.8	5.5	1.6	23.2	4.7	4.5	4.8	2.5	6.9	9.5	5.1	5.6	5.2	3.9	2.3	2.9	2.7	4.8	23.2	6.4	2.1	8.3	7.5	5.7	1.6	4.2	2.9	5.8
2065	3	5.5	5.8	1.0	12.1	12.1	5.6	5.6	5.1	11.1	6.0	1.9	5.0	2.8	9.2	3.6	4.1	1.0	6.9	6.1	5.0	5.0	6.0	11.2	5.6	4.4	6.0	4.2	5.4
2065	4	6.2	7.5	2.1	18.5	13.1	2.6	5.2	7.7	4.5	3.7	4.1	13.1	3.2	3.8	9.0	12.1	4.6	6.1	6.7	12.5	6.4	7.3	14.5	18.5	2.1	4.8	9.2	6.0
2065	5	7.8	8.9	2.4	20.3	4.0	8.0	3.1	5.4	18.1	6.3	4.5	5.9	3.3	13.6	9.2	3.4	8.7	12.7	6.8	10.4	17.4	20.3	12.7	17.0	10.8	7.5	2.6	2.4
2065	6	15.0	17.1	4.9	57.1	28.7	18.0	9.1	17.3	4.9	8.4	14.4	14.0	15.4	17.2	14.7	57.1	28.7	5.1	16.2	32.4	22.4	11.8	16.0	6.8	13.6	14.7	7.0	17.6
2065	7	16.2	16.4	4.1	35.9	12.1	26.1	16.7	10.2	31.5	16.4	9.7	16.6	31.0	23.1	4.1	20.2	10.0	13.0	9.4	6.1	7.4	16.3	24.3	5.4	35.9	7.6	23.3	16.1
2065	8	15.0	17.5	3.7	66.8	5.3	14.5	36.9	18.7	16.6	6.2	11.7	3.7	15.6	11.9	21.2	11.9	30.0	9.3	7.3	26.6	5.4	17.0	19.8	22.4	10.4	7.6	66.8	22.0
2065	9	15.4	15.5	4.6	27.0	4.6	27.0	12.0	18.2	22.0	17.5	17.7	6.8	25.6	11.2	21.3	8.9	26.4	6.6	10.4	25.9	20.7	19.8	10.6	9.1	12.2	6.8	16.9	13.8
2065	10	8.0	8.6	1.9	18.9	7.7	6.2	1.9	15.6	5.2	6.3	18.9	9.8	10.4	3.4	6.6	6.5	5.2	3.3	9.1	6.2	8.3	10.2	13.8	11.7	11.3	5.4	9.6	14.0
2065	11	7.5	8.1	2.8	28.9	9.3	8.8	6.4	7.4	9.0	5.9	10.4	3.3	7.3	7.6	12.0	9.3	5.5	4.6	9.4	5.3	8.9	8.0	28.9	2.8	5.8	8.3	5.7	5.5
2065	12	5.8	6.1	2.6	13.6	5.3	7.0	8.9	5.7	6.8	9.1	4.2	6.3	3.9	7.2	4.6	5.3	5.2	2.6	6.6	5.3	7.8	13.6	6.6	3.6	5.5	6.0	3.1	5.9
2066	1	4.3	4.8	1.7	10.3	3.7	4.4	3.8	4.9	10.3	5.4	4.2	4.0	7.7	3.7	1.8	4.9	3.2	5.7	7.9	2.8	1.7	4.9	3.9	4.5	7.2	3.6	7.5	4.0
2066	2	4.7	5.5	1.7	13.1	6.4	4.6	2.7	4.6	3.0	6.7	11.2	9.1	6.6	3.8	1.7	3.7	4.9	4.8	10.5	3.5	2.8	7.1	3.1	2.8	5.7	6.0	13.1	3.8
2066	3	5.6	6.4	2.3	15.4	4.9	7.4	2.3	7.7	6.8	7.1	6.2	5.0	4.7	2.7	3.6	11.2	9.3	9.0	15.4	3.5	13.2	9.7	3.8	2.7	6.6	4.3	3.0	2.7
2066	4	6.2	7.5	3.1	17.8	3.1	10.0	5.0	12.9	5.1	3.6	6.2	17.8	3.7	3.9	6.9	4.8	9.3	4.9	8.2	13.9	6.1	9.3	6.5	5.4	5.5	7.8	15.1	4.5
2066	5	11.1	11.7	4.1	38.9	5.5	8.2	10.9	14.0	10.6	18.1	13.2	4.4	5.1	6.5	22.5	15.7	13.6	38.9	12.2	11.2	11.6	5.9	6.1	8.7	4.1	11.7	15.7	5.4
2066	6	13.3	15.8	4.4	68.4	10.1	14.5	68.4	12.8	24.9	21.5	13.8	18.7	9.5	6.3	21.8	6.7	14.5	18.1	14.1	5.2	4.4	10.8	11.0	6.1	19.4	10.1	8.9	28.5
2066	7	15.1	17.1	7.0	49.8	15.6	9.9	8.1	30.6	19.2	10.3	10.2	9.5	10.2	25.0	21.3	40.8	49.8	7.1	7.0	11.8	21.0	14.6	18.9	8.3	17.7	16.0	9.9	17.2
2066	8	12.4	14.9	4.2	52.0	4.2	14.6	5.6	18.9	10.0	11.3	52.0	4.6	16.8	11.5	18.2	7.2	28.9	9.3	29.3	16.3	7.1	21.4	11.8	6.0	13.7	16.4	8.9	13.0
2066	9	15.6	16.1	2.9	29.7	13.3	22.3	16.3	7.2	11.2	9.4	29.3	19.5	25.0	2.9	25.5	11.5	19.6	18.5	14.6	15.5	8.3	29.7	10.6	15.8	23.1	9.6	9.4	18.8
2066	10	7.8	9.7	3.6	22.3	12.1	16.1	8.1	5.2	8.3	18.7	7.4	6.9	8.1	4.6	7.7	22.0	5.5	5.2	18.2	6.9	3.6	7.7	6.8	22.3	10.8	8.1	7.9	5.6
2066	11	6.1	6.7	2.4	13.5	7.7	5.8	8.7	6.7	2.4	13.5	5.2	10.3	2.8	6.9	5.5	10.7	3.6	8.9	6.2	9.6	4.9	11.7	6.2	4.4	5.7	6.0	3.7	4.8
2066	12	5.0	6.6	2.1	31.6	6.4	14.1	4.7	4.5	5.4	4.4	7.2	31.6	5.2	3.6	4.5	5.6	6.4	2.1	7.8	4.8	2.7	5.4	8.6	4.1	6.9	3.7	4.5	4.2
2067	1	4.4	6.6	1.7	29.2	3.2	1.7	6.4	8.3	3.0	9.4	3.7	5.8	5.8	3.3	13.7	29.2	6.9	4.4	2.2	8.2	3.0	3.7	9.2	2.3	2.9	4.4	14.6	4.1
2067	2	4.2	5.0	1.4	13.4	4.9	3.1	3.4	3.1	13.4	7.6	6.1	4.5	6.5	3.9	4.2	2.0	4.1	11.9	1.9	2.4	2.5	5.6	8.5	3.9	3.8	1.4	4.4	6.2
2067	3	5.5	5.9	1.4	14.1	4.9	6.6	4.6	3.1	6.1	12.1	5.6	4.5	2.2	4.0	9.0	2.8	2.8	6.7	6.6	5.4	14.1	6.5	5.9	12.1	2.9	8.0	1.4	3.7
2067	4	5.2	6.8	2.2	20.6	3.3	18.5	4.1	2.7	3.2	5.4	10.2	5.0	5.9	2.2	4.2	6.7	7.2	5.0	8.1	10.4	4.5	20.6	6.5	6.4	4.2	9.9	4.8	3.8
2067	5	8.4	10.3	1.9	20.4	18.7	8.7	7.4	15.8	1.9	5.7	5.2	5.2	18.4	15.1	17.5	8.7	17.8	3.1	3.4	8.2	20.4	7.2	6.7	3.5	4.8	18.9	11.2	13.1
2067	6	12.1	14.9	4.9	49.3	8.6	16.3	20.9	7.8	6.2	5.0	19.6	10.2	12.0	10.0	11.5	4.9	16.9	12.7	26.2	13.1	49.3	12.2	7.0	8.8	17.5	6.4	42.6	12.6
2067	7	13.4	16.2	6.1	48.6	8.3	10.7	36.4	8.7	8.0	6.1	7.8	15.5	14.9	8.3	8.0	8.8	16.2	16.4	12.0	20.3	16.1	25.1	10.6	10.2	48.6	19.8	36.7	15.8
2067	8	14.9	18.1	3.4	44.5	13.2	13.7	34.9	16.1	21.7	4.1	17.0	3.4	12.8	34.4	10.8	6.3	16.7	7.0	8.0	25.7	12.9	44.5	28.1	25.4	9.0	18.5	11.7	37.5
2067	9	12.3	16.4	3.4	38.1	8.1	6.3	8.8	34.4	11.3	22.3	9.9	25.1	9.5	8.7	5.5	18.3	26.6	19.5	7.6	4.7	15.3	24.7	13.4	31.8	9.7	29.6	3.4	38.1
2067	10	8.1	8.8	2.1	24.8	5.4	22.9	8.8	2.1	24.8	10.9	9.3	6.6	6.4	2.5	10.6	12.3	5.8	4.0	11.5	8.1	3.1	8.7	8.1	4.6	9.6	3.6	7.6	14.0
2067	11	7.1	8.8	3.3	22.3	9.9	4.6	4.5	4.1	6.1	15.6	22.3	17.2	7.4	7.5	3.3	6.6	6.1	5.1	6.5	14.1	5.9	7.0	12.3	8.3	5.7	14.5	7.2	8.6
2067	12	7.2	8.3	3.7	28.7	5.4	7.7	6.5	9.5	7.6	3.7	6.3	11.8	7.9	7.7	9.8	5.3	15.1	6.5	5.0	28.7	6.6	6.0	4.5	8.1	7.4	10.2	7.0	4.6
2068	1	5.1	5.9	1.7	13.5	4.7	7.3	4.4	4.5	8.1	7.9	2.9	10.2	6.0	6.3	4.3	2.6	8.3	3.8	1.7	4.4	8.8	3.1	8.6	5.5	4.0	8.3	13.5	2.4
2068	2	5.0	5.4	1.9	10.0	9.4	6.5	8.6	3.4	6.5	4.8	3.6	5.1	1.9	6.1	7.3	3.6	4.9	6.2	10.0	2.5	4.8	3.9	5.8	4.2	7.2	4.5	2.2	6.7
2068	3	4.9	6.5	2.4	17.3	3.5	17.3	10.8	7.0	15.6	6.7	5.4	2.9	8.2	5.0	4.8	3.8	7.3	13.6	3.9	3.3	4.3	6.5	4.4	3.8	3.9	4.8	2.4	7.2
2068	4	6.1	7.4	2.1	18.6	5.7	18.6	14.6	9.2	5.4	5.5	3.3	3.1	4.6	6.5	6.6	11.4	2.1	9.4	3.0	8.4	16.1	4.5	6.5	11.9	5.3	4.0	9.3	3.8
2068	5	13.4	13.1	4.9	22.8	17.3	18.5	12.0	14.9	6.8	21.6	13.1	8.5	22.8	14.3	6.1	8.9	11.5	8.6	13.6	15.2	10.1	16.9	4.9	14.4	11.0	12.6	15.3	16.3
2068	6	13.0	14.3	4.1	55.7	15.3	8.2	12.6	18.0	8.2	8.8	9.2	10.8	13.4	55.7	14.1	12.6	12.1	18.1	24.1	16.6	10.4	5.7	14.1	15.3	15.9	4.1	13.3	6.6
2068	7	16.3	19.0	6.9	45.5	11.9	13.3	17.3	16.2	30.8	30.2	14.4	12.5	6.9	16.8	31.4	10.4	17.1	45.5	36.3	16.3	8.1	9.5	13.4	24.4	22.8	22.0	11.7	16.4
2068	8	14.6	16.7	6.1	55.1	27.2	21.3	13.7	16.8	6.1	6.6	14.3	15.6	14.9	55.1	27.8	32.1	9.8	15.8	13.3	11.3	16.7	10.6	8.2	8.9	15.2	7.8	11.1	20.9
2068	9	15.1	16.5	5.4	39.7	5.4	25.9	8.5	19.7	24.7	9.7	17.9	39.7	14.6	10.3	20.6	6.6	15.5	10.7	5.7	20.0	10.6	7.8	19.2	14.1	25.1	32.8	8.4	22.5
2068	10	7.9	9.0	2.8	19.4	13.6	5.9	6.0	5.1	8.7	3.8	13.0	10.2	8.0	16.8	5.4	15.0	7.0	19.4	5.7	7.8	5.7	11.5	8.1	5.6	16.6	4.1	2.8	11.0
2068	11	8.9	8.8	3.4	15.2	6.0	5.3	9.7	12.1	10.5	8.8	8.9	11.6	7.0	6.6	14.1	4.4	8.4	10.7	10.7	10.0	3.6	10.2	8.9	9.8	15.2	3.4	8.3	7.4
2068	12	5.3	6.2	1.6	19.4	4.9	4.5	12.8	3.5	4.2	5.5	2.9	8.2	5.2	5.6	4.1	5.4	19.4	3.0	9.2	7.0	9.9	6.0	4.8	1.6	7.0	6.1	4.4	5.0
2069	1	6.1	6.5	1.8	15.3	3.4	15.3	6.2	6.1	7.0	4.8	3.8	6.2	7.8	13.9	11.2	10.7	4.3	2.1	8.9	4.7	2.2	10.6	3.7	6.7	3.5	4.7	1.8	6.1
2069	2	5.1	6.0	1.5	16.7	3.6	9.7	5.4	3.4	5.6	2.9	16.7	5.7	5.3	4.9	6.3	1.5	3.0	4.5	5.4	4.3	7.9	4.9	4.7	7.7	13.4	9.1	4.5	4.3
2069	3	6.3	7.2	0.7	16.6	6.9	7.7	5.6	9.3	15.5	16.6	14.6	3.3	5.2	2.0	8.6	0.7	8.2	8.0	3.4	7.4	13.6	5.7	3.6	5.2	4.4	4.1	9.9	2.1
2069	4	6.2	7.9	2.1	20.4	9.6	3.3	5.0	3.3	3.6	4.8	10.4	4.2	16.3	5.5	11.2	17.9	5.9	10.2	6.9	6.6	2.1	20.4	7.8	15.7	6.4	4.4	5.1	3.5
2069	5	9.7	10.6	1.2	20.6	11.3	8.1	4.6	13.7	4.6	1.2	18.4	4.9	16.3	9.8	16.6	20.6	14.3	5.7	11.5	14.6	16.2	5.5	7.0	6.2	9.2	9.1	9.6	16.3
2069	6	13.7	14.7	4.3	34.2	13.3	8.0	14.1	4.6	8.1	4.3	21.6	16.0	11.6	34.2	9.1	12.8	12.8	21.0	15.9	11.4	7.1	16.9	15.4	18.3	26.6	10.7	20.7	18.8
2069	7	15.3	19.9	5.2	58.0	28.7	10.0	14.8	33.7	12.6	10.2	48.2	10.0	19.2	9.5	58.0	8.4	25.5	35.0	15.8	17.7	5.2	10.7	11.1	10.9	31.5	17.5	14.8	19.7
2069	8	15.5	19.7	7.1	52.8	24.2	12.8	15.4	12.9	31.9	42.5	36.7	15.6	7.1	14.5	21.4	12.6	22.3	22.3	7.2	9.8	12.4	14.3	52.8	16.8	8.2	16.0	8.3	35.2
2069	9	12.9	15.8	7.6	32.2	11.0	8.9	7.7	31.1	25.6	17.7	32.2	20.5	16.0	10.6	13.3	25.8	14.2	11.7	10.5	11.5	10.5	17.6	12.5	10.9	25.9	11.0	14.7	7.6
2069	10	7.6	8.9	1.5	20.9	14.8	8.3	10.9	7.0	8.1	7.6	4.4	10.2	1.5	5.4	5.5	14.9	20.9	18.2	17.9	6.2	2.6	4.6	7.7	9.0	14.1	4.0	4.9	6.4
2069	11	8.4	8.4	3.4	15.8	8.7	3.8	12.0	5.2	8.7	15.4	5.4	5.8	11.2	4.6	5.2	5.9	15.8	8.9	7.0	9.6	9.4	5.9	8.0	8.1	13.0	10.9	10.4	3.4
2069	12	5.9	6.1	2.3	11.9	4.3	7.3	5.2	7.1	6.6	6.7	5.8	8.0	2.3	7.1	11.9	4.5	5.4	2.6	3.1	7.9	4.4	9.8	8.4	4.7	6.4	5.2	4.7	6.0
2070	1	5.4	6.7	1.6	19.3	10.2	2.5	4.7	5.9	10.1	1.9	7.8	4.5	5.5	7.4	8.5	16.4	4.4	1.6	9.8	5.0	4.5	3.3	8.5	19.3	5.2	2.4	9.4	3.2
2070	2	5.1	5.9	1.9	25.0	2.6	3.2	3.4	2.2	7.2	4.9	5.3	8.7	9.0	5.0	6.5	5.1	7.6	2.9	7.4	3.4	5.8	5.7	8.7	3.4	25.0	1.9	4.6	2.2
2070	3	6.4	7.1	2.7	20.2	7.5	6.3	4.0	4.5	11.4	2.7	20.2	3.6	4.4	3.6	5.5	10.3	6.6	4.2	6.8	12.8	6.4	2.9	6.9	7.0	5.3	10.5	11.1	5.0
2070	4	6.9	7.5	1.0	18.7	2.9	7.8	12.2	12.5	11.6	4.3	18.7	4.8	4.7	2.1	6.6	6.3	8.0	6.5	4.2	3.6	10.0	11.0	9.8	14.2	3.1	7.3	7.5	1.0
2070	5	10.8	13.2	2.4	33.8	15.5	15.4	8.2	6.5	10.5	10.2	21.4	23.4	15.9	10.9	15.2	5.7	5.3	31.8	6.3	10.0	12.9	14.8	33.8	21.8	4.6	2.4	2.8	10.8
2070	6	11.1	12.3	3.1	25.3	23.0	7.9	10.6	18.6	21.9	22.6	6.7	12.2	3.1	11.0	13.3	11.2	14.4	6.0	17.5	6.9	13.7	6.9	6.6	7.7	25.3	6.6	10.3	12.3
2070	7	15.3	16.4	3.8	36.5	34.1	5.8	19.5	36.5	18.9	15.1	7.1	12.1	19.8	14.9	15.6	7.5	16.8	19.1	9.9	13.3	22.0	13.9	21.4	14.4	17.4	20.0	13.4	3.8
2070	8	13.1	16.8	5.7	38.2	13.7	11.8	8.2	14.1	5.7	38.2	19.3	8.7	12.5	9.9	23.6	34.5	24.3	22.8	9.3	9.7	7.5	29.5	19.9	25.6	25.0	9.5	10.2	10.5
2070	9	12.6	14.5	4.5	28.9	11.5	4.9	5.9	11.4	6.5	28.9	13.7	21.8	15.9	12.0	4.5	13.1	7.7	17.5	20.4	10.2	11.5	9.9	25.2	18.2	22.5	25.3	25.6	4.5
2070	10	7.9	8.4	0.5	19.6	11.9	19.6	2.8	5.4	11.8	6.8	11.8	4.9	12.2	5.4	5.6	10.0	0.5	13.3	5.8	8.0	9.8	7.3	7.4	10.1	4.7	9.0	7.8	9.6
2070	11	8.1	9.0	2.8	19.3	4.9	9.4	7.9	9.7	6.0	6.2	13.2	13.1	6.6	9.7	15.3	7.4	8.8	13.4	6.5	19.3	6.7	8.4	7.8	5.4	9.2	6.0	12.4	2.8
2070	12	6.6	6.7	2.1	13.5	9.3	8.1	7.3	4.3	3.7	6.9	7.6	2.1	6.2	13.5	3.7	4.8	8.7	7.2	5.3	7.0	11.8	5.4	4.0	7.0	5.4	5.9	3.8	11.1
2071	1	5.0	5.7	1.2	21.9	7.1	6.4	4.0	5.3	4.2	5.8	8.0	1.9	1.2	5.0	2.2	7.2	2.4	1.6	2.8	9.1	4.3	7.1	4.7	6.5	10.1	21.9	4.0	5.1
2071	2	5.4	5.8	2.7	11.7	6.6	4.7	3.4	6.8	9.7	10.3	2.8	2.9	4.0	4.0	11.7	5.6	5.3	5.6	4.3	2.7	8.9	5.5	4.2	4.1	4.1	7.6	6.2	7.7

2071	3	5.3	6.4	2.1	18.7	4.7	3.5	7.0	2.1	18.7	16.8	2.8	6.2	3.2	2.4	6.5	5.3	5.2	8.1	4.5	10.2	5.9	4.8	8.7	3.3	8.2	2.3	11.3	2.8
2071	4	7.2	8.0	1.1	18.7	10.0	13.0	2.2	3.0	5.8	14.1	4.0	13.9	12.5	1.1	2.8	3.7	9.6	5.2	6.7	2.5	4.0	11.5	8.1	7.7	18.7	9.4	17.3	4.8
2071	5	9.4	11.0	3.1	31.9	16.2	13.3	4.8	21.3	15.6	3.4	5.3	7.7	22.8	11.0	4.7	31.9	17.5	5.2	6.8	11.5	6.8	11.6	11.6	7.8	4.9	7.1	12.6	3.1
2071	6	9.9	11.4	3.9	31.3	7.2	16.7	15.2	8.8	3.9	9.9	21.8	10.2	31.3	6.1	5.9	7.8	5.5	8.2	11.6	3.9	9.1	9.9	15.3	4.1	22.8	12.1	16.9	10.6
2071	7	14.4	14.9	2.9	33.4	9.7	15.5	3.8	27.9	15.1	12.7	18.6	17.7	21.4	10.8	2.9	17.3	15.0	6.9	8.9	11.7	7.2	12.9	21.4	14.7	14.0	33.4	12.2	25.5
2071	8	9.4	14.7	4.7	72.0	26.3	13.4	7.4	9.5	34.3	11.5	8.6	7.7	4.7	7.8	5.9	15.9	72.0	9.3	8.8	6.5	20.3	10.7	13.2	7.5	5.8	14.5	21.3	9.1
2071	9	19.5	18.0	6.4	31.6	20.3	14.7	6.4	22.3	17.9	27.7	19.4	20.9	21.0	9.4	6.4	19.0	30.4	24.9	22.9	10.8	23.9	13.2	19.9	31.6	12.1	8.8	8.0	19.5
2071	10	10.0	11.2	3.3	21.7	21.7	14.6	3.4	8.9	19.8	11.7	15.6	4.7	15.0	6.8	5.3	5.5	5.6	3.3	8.3	16.2	9.6	15.2	19.8	8.0	15.4	15.0	10.3	9.4
2071	11	7.1	8.1	3.1	21.7	3.7	3.6	3.9	21.7	7.1	4.6	11.2	11.2	3.1	14.9	14.1	8.5	9.5	6.7	3.3	12.5	7.8	5.9	7.0	3.3	9.4	7.4	6.9	6.5
2071	12	6.0	9.1	2.6	30.1	21.3	30.1	6.5	7.3	5.9	2.6	12.0	2.8	3.4	9.5	26.8	4.9	5.3	4.8	4.2	3.4	4.4	11.4	4.8	5.9	13.0	11.0	6.1	11.5
2072	1	4.9	6.2	1.6	19.9	4.9	4.9	4.7	6.0	7.0	1.6	12.9	6.1	3.6	6.3	11.2	5.0	6.9	4.2	2.4	19.9	3.8	4.9	3.8	7.5	8.2	3.6	4.2	4.2
2072	2	4.2	4.6	1.2	11.0	2.8	5.1	4.7	4.9	5.9	2.9	1.7	3.2	3.6	3.1	2.8	4.5	6.2	8.1	11.0	3.1	7.8	4.8	8.5	4.0	4.4	2.8	3.2	1.2
2072	3	5.9	6.8	2.6	11.7	11.7	4.8	10.9	10.5	7.7	6.8	11.3	5.7	6.5	6.2	3.6	5.1	3.9	2.6	4.8	4.2	10.5	5.1	6.9	2.6	11.0	9.9	5.2	5.4
2072	4	6.2	7.4	0.0	19.0	8.3	5.7	7.2	7.3	6.1	4.2	6.3	2.7	4.8	3.8	3.2	4.6	5.3	12.0	9.4	0.0	10.1	19.0	4.4	7.3	14.3	18.5	5.2	7.2
2072	5	9.9	11.2	2.7	25.8	14.9	8.6	19.2	12.0	14.4	9.6	16.2	21.2	9.2	12.2	7.0	2.7	6.7	4.5	16.0	25.8	5.9	9.9	3.5	11.8	9.8	9.2	4.6	13.5
2072	6	15.1	16.9	3.9	44.0	7.3	17.6	16.6	19.1	35.3	10.2	14.2	22.1	10.4	16.9	20.4	3.9	19.9	9.0	21.7	11.8	34.9	14.1	44.0	8.2	14.0	16.0	10.9	6.1
2072	7	15.6	17.9	5.5	61.4	17.7	17.7	8.2	61.4	19.9	25.0	21.8	13.4	18.2	7.5	14.3	9.2	27.9	5.5	7.5	41.8	22.0	14.4	9.5	11.2	7.1	16.7	21.2	9.5
2072	8	15.6	18.0	5.0	39.0	12.6	25.6	14.3	20.6	10.7	10.1	29.1	12.6	9.5	5.0	13.6	20.3	22.7	34.3	8.7	39.0	24.5	24.5	16.7	11.5	5.4	16.9	14.5	29.4
2072	9	15.8	17.3	3.7	55.3	32.6	4.4	8.7	3.7	11.3	17.3	55.3	27.8	16.0	32.3	19.1	19.5	23.6	10.7	10.7	19.4	25.8	11.4	11.1	20.7	15.6	5.2	7.7	6.0
2072	10	10.3	10.4	5.1	20.6	19.1	10.3	10.0	7.3	13.4	11.0	5.1	10.6	5.1	7.0	12.8	10.5	20.6	13.2	12.7	7.5	6.8	8.9	17.6	10.5	8.3	10.4	6.0	5.4
2072	11	7.3	8.0	2.0	17.3	10.1	10.6	7.1	2.0	10.9	9.9	12.0	10.4	2.3	3.8	5.3	17.3	7.6	7.7	6.6	9.0	5.5	4.3	5.9	14.4	5.5	3.6	6.3	14.2
2072	12	6.2	8.2	1.7	38.4	38.4	5.0	3.2	10.0	8.9	6.4	3.6	6.1	9.9	9.0	6.3	1.7	7.6	6.6	4.0	4.0	5.6	6.6	6.6	3.6	5.8	5.9	5.3	27.3
2073	1	6.4	7.3	1.6	24.8	3.1	3.2	11.2	6.4	3.9	5.2	3.3	6.4	1.6	24.8	7.2	6.9	8.1	7.7	7.8	11.5	4.9	4.5	15.9	3.8	9.7	9.2	2.9	6.3
2073	2	4.8	5.2	1.4	11.0	2.4	7.2	5.3	5.1	6.7	4.1	6.2	2.6	5.6	5.1	10.0	5.0	4.4	4.7	9.8	4.0	3.5	4.2	3.5	3.9	11.0	1.4	2.8	6.9
2073	3	5.8	6.1	1.2	12.7	2.8	4.0	4.7	2.2	1.2	5.8	3.8	12.7	6.9	3.1	6.6	3.4	5.8	8.2	8.9	9.0	7.8	4.1	9.8	11.0	3.8	6.0	11.1	3.6
2073	4	7.8	7.8	1.6	18.6	8.9	1.6	8.2	5.6	7.2	4.1	4.7	9.1	7.5	8.2	2.6	11.9	6.9	10.6	8.8	11.0	3.1	9.6	18.6	4.3	15.2	4.6	12.8	3.1
2073	5	9.7	12.5	3.5	45.1	4.8	42.5	15.6	12.3	8.7	13.4	12.3	6.4	4.4	9.4	18.0	21.3	45.1	5.4	12.6	9.9	3.5	5.2	5.0	14.9	11.9	3.7	7.6	5.7
2073	6	12.3	12.1	3.2	24.8	14.4	3.9	16.0	5.4	22.6	7.4	16.6	7.0	15.2	15.0	12.1	6.9	8.5	4.2	5.5	12.5	24.8	3.2	10.5	17.0	23.6	13.0	7.8	17.9
2073	7	14.3	17.1	5.4	58.6	16.4	32.9	8.1	14.0	22.3	30.9	8.3	9.0	12.5	9.8	19.7	6.0	14.6	19.9	7.8	17.4	20.3	58.6	22.5	5.4	20.3	10.4	11.7	12.0
2073	8	13.5	16.3	5.7	52.5	11.3	9.6	19.1	7.8	24.5	8.5	10.1	7.0	17.0	16.3	5.7	10.2	17.4	10.0	29.8	52.5	7.5	21.7	30.5	14.5	23.5	10.3	14.6	12.5
2073	9	17.5	17.4	4.8	33.4	9.9	19.0	13.2	17.9	17.2	23.0	19.5	26.0	16.0	12.6	4.8	6.2	25.0	15.1	19.0	15.6	16.5	10.9	33.4	22.6	19.8	23.9	10.8	18.9
2073	10	10.2	10.0	2.4	21.1	12.3	5.9	12.6	21.1	3.8	11.3	16.8	8.9	17.4	13.0	11.8	14.4	5.6	4.1	11.0	4.8	6.1	12.2	2.4	9.4	18.1	4.4	5.7	6.2
2073	11	6.9	8.0	3.8	19.1	4.6	7.8	6.8	6.5	5.3	6.7	11.5	13.6	7.3	9.4	6.4	7.0	4.5	4.9	7.2	12.1	4.8	9.9	19.1	3.8	5.4	10.2	10.4	6.0
2073	12	5.7	5.7	2.0	11.1	11.1	5.6	5.1	2.6	6.0	8.2	6.5	4.0	3.7	8.6	5.9	8.4	5.8	4.3	2.0	4.6	2.5	6.0	8.9	4.9	5.7	7.3	6.2	2.0
2074	1	6.5	6.9	2.1	14.7	6.7	14.6	5.1	5.3	2.2	4.9	7.2	3.9	14.7	6.9	6.1	6.6	6.4	10.8	3.6	7.1	6.0	2.4	2.1	9.9	8.3	12.5	3.5	8.2
2074	2	5.5	7.1	2.1	21.4	7.4	5.7	6.3	4.4	5.8	5.5	5.1	21.4	2.1	4.3	7.8	10.3	3.4	14.0	4.7	2.7	4.3	14.1	5.5	2.9	8.2	5.4	4.5	14.2
2074	3	5.5	6.0	1.8	12.3	7.5	4.3	3.8	4.5	4.4	5.2	12.3	7.0	7.5	3.9	10.6	1.8	2.0	5.4	4.8	8.3	2.8	2.9	8.4	8.8	5.6	6.5	10.6	5.9
2074	4	7.4	8.1	1.6	17.0	3.3	12.2	13.6	8.4	2.4	9.7	1.6	9.7	4.4	2.1	4.6	17.0	14.9	15.7	10.8	6.0	3.7	9.8	4.8	7.8	14.3	6.9	5.7	4.0
2074	5	9.6	11.0	1.1	27.0	5.5	5.0	27.0	12.3	6.6	10.9	15.4	13.2	8.3	7.7	16.9	2.8	15.7	3.3	5.9	7.4	6.4	14.1	13.1	2.1	1.1	25.7	15.8	22.7
2074	6	11.3	14.4	7.1	39.4	21.1	18.1	19.1	8.1	11.2	8.2	8.8	14.5	28.1	8.3	7.1	7.2	11.2	10.8	27.0	11.4	14.8	24.0	39.4	8.3	8.5	11.9	7.4	12.2
2074	7	13.0	16.4	7.9	72.7	13.7	8.0	17.0	9.7	21.0	18.7	11.3	17.5	11.6	15.1	12.6	9.0	13.7	19.2	11.1	11.4	8.9	30.3	9.2	7.9	10.5	19.4	13.5	72.7
2074	8	12.9	14.8	4.1	38.5	13.8	12.2	10.1	6.6	38.5	13.6	15.2	20.0	25.1	12.2	8.4	4.5	8.7	26.4	7.7	4.6	4.1	16.4	15.5	7.7	24.2	7.7	21.2	30.1
2074	9	16.1	18.4	5.5	32.1	12.4	22.9	8.8	30.7	26.1	29.7	15.4	27.4	18.8	16.5	24.3	12.5	5.5	6.2	32.1	19.5	31.7	15.8	8.6	9.2	11.7	31.9	14.3	10.9
2074	10	7.3	8.5	3.7	21.5	4.2	3.7	7.2	11.7	11.9	8.9	13.9	12.6	6.8	6.7	9.1	4.2	7.3	8.9	7.1	17.4	5.4	7.9	5.4	3.8	6.2	21.5	5.7	7.3
2074	11	6.4	6.8	3.0	17.3	5.8	7.5	3.7	6.7	6.3	17.3	11.3	5.2	3.8	11.1	5.3	8.0	6.8	9.0	6.1	6.7	3.0	6.6	10.2	4.0	3.2	4.4	5.0	6.9
2074	12	6.4	6.7	1.5	12.2	6.7	3.9	4.6	9.1	12.2	11.4	11.1	4.5	5.8	9.8	8.9	6.1	7.8	4.8	7.4	2.6	1.5	10.0	4.0	3.1	8.0	5.9	7.4	4.7
2075	1	5.7	6.7	3.1	22.4	3.6	7.3	3.1	5.6	5.9	4.2	3.8	5.3	6.9	3.1	3.5	5.2	6.6	4.7	3.7	6.2	14.5	22.4	9.5	8.6	7.9	8.8	4.2	6.0
2075	2	5.0	5.8	2.4	13.8	3.5	2.8	3.2	3.6	5.1	4.2	13.8	3.3	13.3	8.1	7.4	3.2	6.4	8.3	7.7	5.4	4.7	7.8	5.9	6.9	4.8	3.0	3.1	2.4
2075	3	5.9	6.8	1.0	19.9	5.5	15.2	13.1	6.0	11.7	5.7	8.6	5.9	8.4	2.5	3.8	1.9	1.0	6.9	5.2	6.0	3.6	6.3	4.3	19.9	6.0	6.2	4.8	5.5
2075	4	4.9	5.8	1.2	15.5	11.6	3.6	5.3	2.5	4.9	2.5	2.8	9.4	3.0	6.1	3.3	1.2	3.0	4.8	8.5	4.8	1.8	5.9	6.0	7.8	11.1	15.5	8.8	4.8
2075	5	9.1	10.7	0.8	22.1	8.9	1.9	13.3	9.5	9.7	17.3	7.3	13.0	22.0	7.9	17.2	21.3	14.9	4.5	6.4	8.7	7.6	7.6	22.1	8.7	9.6	9.3	0.8	6.8
2075	6	10.8	14.2	3.3	36.0	10.7	18.3	12.2	15.6	10.4	32.5	6.4	3.8	27.6	3.3	7.0	8.2	36.0	10.8	10.9	13.3	10.7	21.8	18.5	8.8	8.0	10.8	5.1	30.2
2075	7	14.0	16.3	6.0	35.1	23.4	10.7	15.9	9.6	18.4	15.8	16.4	28.2	12.1	10.5	29.3	10.6	13.9	14.1	21.4	33.9	35.1	10.5	11.8	6.0	7.0	15.0	14.0	8.3
2075	8	11.2	15.9	6.1	33.6	11.6	29.8	13.9	15.9	25.0	26.8	9.2	8.8	12.5	7.0	32.5	8.4	13.5	10.8	9.4	9.5	9.1	8.5	30.2	6.1	9.6	33.6	33.4	6.5
2075	9	16.5	18.5	6.2	48.6	48.6	29.6	16.8	16.6	40.9	22.4	19.0	16.1	6.2	9.5	20.8	24.9	6.9	14.4	14.6	26.5	6.8	16.3	10.1	19.3	24.5	8.8	15.3	8.0
2075	10	8.7	8.3	2.6	14.9	6.2	8.4	9.8	9.5	8.9	11.5	6.4	4.8	4.4	5.5	13.1	9.8	2.6	9.9	14.9	8.8	12.1	8.5	8.6	3.2	5.0	12.1	5.2	10.7
2075	11	7.0	7.7	3.2	17.0	6.5	13.6	3.2	7.2	6.3	7.1	6.8	8.2	4.0	4.0	4.6	17.0	8.2	4.9	3.8	7.2	3.3	8.9	15.9	6.7	11.8	6.3	9.7	9.6
2075	12	6.1	7.8	3.1	37.3	6.8	5.4	5.4	9.7	7.8	37.3	8.0	13.3	6.5	6.7	4.6	7.2	12.8	5.8	3.1	5.1	3.9	5.1	4.1	6.0	3.7	6.1	5.1	6.4
2076	1	4.9	6.1	1.7	15.8	7.9	4.5	3.7	2.1	5.9	3.0	4.5	4.3	1.7	4.1	5.3	7.5	3.1	11.8	4.4	14.7	5.2	6.8	11.5	3.7	15.8	2.5	5.6	5.6
2076	2	4.4	5.5	1.8	13.0	3.0	3.3	11.2	7.9	3.0	4.4	3.1	4.8	4.1	4.9	10.1	2.1	6.7	2.9	9.2	1.8	13.0	3.3	8.1	4.4	4.4	6.1	3.8	6.0
2076	3	4.3	6.0	1.1	16.3	5.3	1.1	4.4	3.3	14.6	8.5	7.7	5.3	16.3	3.6	3.8	5.7	9.3	3.5	11.9	3.8	12.7	2.2	2.9	4.1	5.8	4.1	2.5	1.6
2076	4	6.7	7.4	1.6	15.8	4.5	3.4	5.1	4.1	1.6	3.8	15.2	9.0	5.4	8.2	8.4	3.7	2.5	15.8	8.5	14.9	3.7	6.8	11.7	9.4	11.9	8.4	5.7	6.5
2076	5	9.5	12.0	5.0	27.2	5.0	17.0	10.8	9.0	8.9	16.8	12.1	20.7	27.2	8.8	5.1	17.6	18.3	6.9	6.8	22.4	11.2	8.3	10.0	7.6	7.2	7.2	16.0	8.0
2076	6	11.3	14.5	5.5	57.6	16.8	8.4	16.5	28.3	11.7	10.7	5.5	57.6	11.7	8.8	6.5	18.4	22.2	7.8	21.5	6.0	9.2	9.9	13.7	13.0	18.7	8.3	10.8	6.4
2076	7	11.3	12.0	4.2	23.7	11.1	18.2	13.9	12.5	14.9	7.5	4.7	17.2	9.0	4.2	23.7	9.4	17.5	9.5	17.9	7.0	11.5	14.3	21.6	11.5	7.1	7.8	7.4	8.5
2076	8	13.6	16.2	3.7	51.7	51.7	14.6	14.4	10.9	35.9	10.7	6.8	8.6	13.7	23.1	7.2	3.7	10.4	12.6	8.7	19.6	17.1	20.4	8.1	24.8	23.7	13.5	22.2	6.7
2076	9	15.7	19.6	7.5	56.0	16.0	11.1	41.0	30.3	26.9	27.8	13.6	56.0	25.5	10.4	24.7	9.0	19.7	9.8	9.5	32.4	15.5	8.1	7.5	9.0	18.0	12.2	8.4	29.0
2076	10	7.5	9.3	2.7	25.8	19.7	8.2	4.9	19.8	6.9	6.4	17.5	25.8	3.3	9.0	5.0	8.0	2.7	5.9	8.2	5.9	6.4	10.9	4.1	12.8	3.5	8.5	5.0	13.9
2076	11	7.4	8.9	2.6	18.5	12.2	7.0	6.8	7.6	12.1	8.8	6.9	10.4	9.4	3.9	18.5	8.8	5.3	6.0	14.4	6.3	13.5	16.9	7.2	2.6	5.2	6.0	4.6	13.4
2076	12	4.7	5.1	2.1	9.6	7.0	8.0	4.8	4.9	7.8	5.5	4.7	4.7	2.1	4.4	3.4	7.9	9.6	5.0	3.5	2.6	3.7	7.0	2.5	5.1	5.2	4.5	3.1	4.6
2077	1	5.3	6.6	1.9	13.1	10.6	8.0	4.7	5.2	8.4	13.1	8.1	7.5	3.8	10.2	5.3	4.6	5.2	3.1	7.7	12.9	3.3	3.6	9.8	5.2	4.8	5.2	5.7	1.9
2077	2	4.7	4.9	0.9	8.8	5.3	5.1	0.9	7.5	4.7	2.8	4.7	2.8	4.3	3.2	4.0	2.2	6.5	8.6	6.1	5.2	8.8	3.8	5.8	3.1	3.4	5.9	8.5	4.7
2077	3	6.0	7.1	3.0	18.3	3.3	4.8	5.7	5.7	8.7	10.9	5.7	10.0	5.0	3.0	7.6	5.3	3.9	3.5	15.0	4.6	6.8	7.0	6.2	5.6	7.4	8.0	18.3	8.7
2077	4	5.1	7.2	2.4	24.9	2.7	3.6	4.8	3.5	3.7	5.1	2.4	7.4	7.2	5.2	10.1	4.4	4.8	6.9	4.8	6.4	3.5	15.3	11.6	24.9	5.3	13.6	11.4	4.5
2077	5	8.3	9.4	3.9	21.2	11.0	4.6	9.6	4.2	3.9	13.5	6.5	17.1	4.6	6.2	13.1	10.7	5.5	21.2	7.9	10.3	17.4	7.4	7.8	10.1	8.2	5.0	8.5	12.3
2077	6	10.2	15.2	3.7	43.7	6.8	22.8	8.1	11.1	13.4	7.7	25.8	24.7	8.5	27.6	8.2	3.8	9.2	6.5	3.7	34.1	11.8	43.7	32.5	3.9	21.1	17.2	5.4	7.6
2077	7	12.2	15.0	5.7	50.7	12.7	8.1	6.9	33.4	50.7	5.7	12.4	16.7	15.5	25.5	10.7	16.3	15.8	10.6	7.9	5.9	14.5	12.1	17.0	11.5	10.3	11.6	18.9	9.4
2077	8	12.3	14.0	5.4	31.0	11.3	24.7	14.2	27.7	8.2	12.7	5.6	22.2	12.7	12.4	17.8	11.1	5.4	5.4	6.1	8.9	12.1	13.4	9.6	13.0	11.0	31.0	9.1	30.5
2077	9	12.9	15.8	6.1	42.9	42.9	8.9	18.8	10.3	18.5	6.1	24.9	12.9	15.8	19.7	11.9	12.9	13.2	22.8	9.7	19.3	26.4	10.1	10.2	9.9	26.0	11.7	7.0	9.7
2077	10	6.5	8.1	0.5	31.9	10.5	8.9	6.1	4.8	31.9	4.5	12.4	12.2	6.9	6.6	4.9	0.5	10.6	10.4	7.9	4.4	5.6	6.3	9.4	6.5	5.4	5.7	5.3	7.3
2077	11	7.5	7.5	2.5	16.8	10.4	5.9	3.9	3.1	4.7	7.3	6.8	6.8	8.3	8.6	8.9	8.9	13.8	8.4	7.6	8.3	4.5	11.4	10.5	4.3	16.8	4.4	2.5	3.5
2077	12	6.7	7.3	2.1	13.2	8.7	4.5	2.1	13.2	6.5	6.9	8.8	5.1	5.7	11.2	9.9	4.3	7.6	6.4	8.7	9.6	4.1	6.0	5.9	8.6	6.2	6.1	10.3	8.8
2078	1	5.5	6.3	1.7	18.1	3.5	3.3	18.1	6.8	5.1	4.7	4.6	5.3	1.7	7.4	9.6	5.6	4.5	3.8	7.8	6.9	2.7	6.5	5.1	9.6	5.6	5.4	9.1	9.3
2078	2	4.7	4.9	0.9	8.7	2.4	3.9	3.7	4.7	8.4	4.9	6.2	3.9	0.9	7.5	2.9	4.3	5.6	8.7	4.6	1.2	5.9	5.5	7.4	4.8	8.2	4.1	3.8	4.3
2078	3	5.4	6.7	2.3	27.7	7.4	4.2	6.9	2.8	7.7	3.6	3.6	8.5	7.7	3.1	9.7	5.7	4.5	3.7	4.9	5.7	8.1	5.2	5.8	27.7	13.5	2.3	4.8	2.5
2078	4	5.7	7.1	1.7	24.7	4.9	4.1	4.3	8.3	2.4	6.7	6.2	8.0	24.7	3.8	7.0	4.0	9.3	5.6	12.8	10.5	4.7	4.4	7.7	5.8	4.8	1.7	15.0	3.3
2078	5	11.0	12.4	2.2	25.1	11.9	5.5	3.3	10.2	16.9	4.6	10.7	23.7	19.6	8.2	4.4	9.5	15.8	24.3	11.9	25.1	11.4	10.0	8.4	22.7	12.0	2.2	10.5	15.2
2078	6	12.4	14.9	2.3	47.7	3.6	5.8	10.0	7.4	8.2	17.5	2.3	5.1	12.5	20.8	16.6	23.6	15.1	21.5	24.2	12.4	10.2	6.6	47.7	22.5	10.4	33.1	7.3	12.5
2078	7	12.8	15.5	5.1	34.2	10.2	5.1	13.2	23.1	34.2	16.9	10.9	7.9	23.0	15.6	24.2	23.3	12.4	8.4	26.0	21.4	12.2	10.6	18.5	8.3	7.2	18.8	8.6	11.1
2078	8	12.3	15.6	6.4	42.8	20.4	6.9	42.8	13.1	28.7	32.6	6.4	7.9	8.7	9.6	19.3	9.3	16.2	11.0	15.7	18.1	13.7	15.8	8.3	8.2	6.4	33.7	11.6	11.1
2078	9	15.6	17.0	6.4	34.5	17.9	7.6	34.0	10.0	6.7	9.9	34.5	33.7	15.8	24.1	6.4	17.3	15.5	13.0	17.3	27.6	12.1	20.8	19.8	11.4	6.8	15.0	12.1	17.5

2078	10	7.5	8.9	2.1	22.0	11.0	22.0	6.3	6.8	12.4	9.6	3.3	2.1	2.1	7.1	20.0	4.7	8.9	5.9	6.6	14.3	4.6	8.3	7.8	4.4	6.9	15.9	9.9	12.3
2078	11	7.3	8.8	3.2	19.2	7.3	5.2	4.3	14.0	15.5	5.8	19.2	6.9	9.6	6.6	12.1	7.3	13.3	5.8	5.2	14.9	3.2	8.9	12.2	8.0	5.0	7.4	5.1	9.2
2078	12	5.3	5.5	2.1	9.8	6.0	3.6	7.6	9.1	7.3	7.5	5.6	2.2	4.5	5.8	3.8	5.8	8.0	3.4	9.8	3.4	4.1	3.7	4.7	7.6	4.9	2.1	5.1	6.8
2079	1	5.3	7.2	1.9	25.4	6.6	5.6	5.8	3.7	7.8	24.6	11.6	7.3	3.7	1.9	12.8	7.8	4.0	5.4	3.6	3.8	3.0	1.9	25.4	8.4	5.2	4.7	4.1	5.0
2079	2	5.7	7.1	2.0	17.6	4.6	10.5	17.6	5.3	6.5	8.7	13.9	8.3	6.3	2.0	7.8	3.6	5.3	2.5	6.1	4.0	3.7	3.3	5.2	13.8	3.7	5.2	7.9	14.1
2079	3	4.9	5.3	1.9	16.3	16.3	5.9	7.0	3.3	5.7	3.0	5.0	3.5	4.8	2.4	4.6	1.9	2.5	10.9	7.1	3.8	5.1	2.4	5.0	5.4	4.6	5.8	7.8	4.6
2079	4	5.1	6.8	0.8	23.1	11.8	2.7	3.9	4.3	4.7	13.7	12.2	6.4	2.8	5.5	2.6	23.1	7.9	10.4	7.5	9.4	4.0	3.4	4.2	7.4	3.7	1.1	10.4	0.8
2079	5	7.9	8.7	4.2	17.1	8.2	11.3	6.3	9.1	6.0	7.0	7.6	5.9	4.4	10.6	6.5	7.1	6.1	11.1	17.1	10.4	7.6	6.1	10.5	11.2	8.9	9.5	4.2	15.2
2079	6	10.6	13.6	3.3	39.2	10.5	39.2	10.7	5.0	21.8	29.0	3.3	7.2	21.9	7.1	11.1	20.3	4.9	6.7	17.7	11.6	11.9	9.9	10.5	16.7	4.5	5.6	8.9	30.0
2079	7	16.9	20.1	7.3	56.2	12.0	15.5	36.7	9.2	17.5	44.0	7.6	7.3	25.6	11.8	13.3	16.2	19.5	20.6	8.3	56.2	32.0	8.3	30.5	32.8	20.0	9.5	19.6	8.9
2079	8	10.9	16.6	6.1	59.4	8.8	59.4	14.1	25.2	13.9	11.2	6.7	6.1	8.8	11.1	46.3	10.3	10.5	18.5	6.3	38.6	6.8	8.5	28.1	14.9	10.6	16.9	8.8	8.4
2079	9	16.7	18.0	6.1	31.4	10.5	18.4	28.1	12.4	23.6	21.5	12.1	30.6	21.9	6.1	10.6	12.4	17.5	24.0	10.9	21.6	31.4	14.8	15.9	19.4	13.6	12.2	14.7	27.3
2079	10	7.0	7.4	3.0	16.2	7.4	4.5	4.3	7.2	9.7	6.5	7.4	12.8	4.9	13.5	6.9	7.1	9.0	7.6	7.9	3.0	5.0	16.2	5.1	9.1	5.6	6.5	5.4	5.5
2079	11	7.8	8.6	2.6	19.2	11.8	4.1	2.6	3.3	7.6	7.3	19.2	12.2	11.0	11.9	7.9	7.0	6.6	10.2	7.7	5.4	9.2	11.5	6.0	3.2	16.2	10.5	7.8	6.1
2079	12	6.2	6.7	2.5	11.0	4.7	6.6	6.5	8.5	6.3	10.6	5.6	2.5	10.3	4.4	9.9	7.2	8.3	4.7	4.8	8.3	6.0	7.6	5.5	5.7	3.1	11.0	6.1	6.1
2080	1	5.5	5.8	1.6	12.2	7.0	1.6	6.4	11.4	5.7	3.0	5.5	6.5	7.9	12.2	3.6	5.3	4.5	5.5	3.6	6.4	6.6	5.0	8.2	2.6	4.3	5.4	5.6	5.3
2080	2	5.6	7.1	1.9	16.2	16.2	5.1	10.1	6.4	6.5	5.4	5.2	10.5	5.7	3.4	4.1	14.3	3.1	4.3	16.2	6.3	8.2	4.0	4.1	5.2	1.9	5.4	7.9	10.1
2080	3	5.7	6.9	1.2	17.7	4.2	3.9	12.2	6.8	8.9	4.3	12.0	3.2	1.6	6.0	4.2	6.0	12.2	2.8	3.6	2.9	7.7	5.4	17.7	4.7	1.2	10.9	13.9	9.3
2080	4	6.7	6.9	1.3	15.9	7.9	5.5	7.8	7.0	3.4	9.6	1.3	9.1	2.5	6.5	10.3	7.0	7.3	6.2	2.7	5.8	10.2	9.7	4.4	2.6	3.6	14.4	15.9	4.2
2080	5	11.8	13.3	5.8	33.5	14.8	10.6	12.1	12.8	11.7	27.6	10.0	11.1	5.9	5.8	18.3	23.4	12.3	5.8	10.8	11.9	12.0	11.3	33.5	7.8	16.3	6.5	8.9	17.8
2080	6	10.3	12.4	3.3	43.7	14.5	19.4	43.7	30.0	11.6	8.9	7.1	3.3	12.6	10.2	10.8	10.4	7.9	8.8	10.3	12.0	12.7	5.4	8.3	5.6	6.4	15.9	9.5	11.8
2080	7	13.7	15.4	5.2	36.3	13.4	12.6	8.2	14.2	16.4	7.6	9.7	26.2	10.4	17.4	5.2	18.7	12.9	13.7	7.5	16.0	21.9	7.3	14.5	13.8	13.7	28.8	24.2	36.3
2080	8	16.2	20.6	6.0	93.6	26.3	6.9	18.9	17.2	12.2	6.2	24.8	7.9	9.5	93.6	17.3	10.4	6.0	8.8	13.1	38.9	57.5	20.5	20.2	23.2	8.7	9.2	21.2	15.1
2080	9	12.9	14.6	4.2	33.2	33.2	6.8	22.6	21.9	4.4	6.8	14.7	31.3	10.0	21.6	8.1	8.1	4.2	5.6	13.8	17.7	12.0	15.7	28.3	10.2	15.3	19.4	9.7	9.3
2080	10	7.6	8.8	2.5	20.1	4.7	7.1	7.6	7.6	6.3	3.8	8.3	9.3	5.9	17.1	2.5	5.6	19.8	10.1	5.2	14.8	15.2	2.8	10.5	8.1	9.5	20.1	4.2	4.5
2080	11	7.5	9.1	3.0	20.2	3.2	10.6	7.8	7.4	12.4	3.8	13.2	7.3	10.5	6.1	20.2	3.6	18.9	16.1	5.5	15.6	6.1	7.0	6.6	4.1	7.7	11.3	3.0	10.5
2080	12	5.8	6.3	1.3	14.6	5.1	5.6	7.4	5.5	1.3	5.7	6.8	10.6	2.9	13.0	8.0	7.9	4.6	4.0	4.7	2.6	1.9	5.9	14.6	6.0	8.3	4.3	7.4	7.8
2081	1	5.3	6.6	2.4	25.2	7.5	4.5	2.4	4.9	6.5	4.6	12.0	4.1	7.6	5.6	8.5	5.8	4.9	4.1	4.0	25.2	3.6	4.3	5.8	4.6	7.2	3.3	10.1	7.4
2081	2	5.0	5.3	2.2	10.5	7.0	4.9	5.5	3.0	4.7	3.2	3.5	10.5	6.2	3.9	2.2	3.8	4.1	9.4	7.9	6.3	5.2	3.6	6.6	3.9	5.6	5.2	6.3	4.3
2081	3	5.8	6.5	2.4	14.1	5.2	2.6	3.0	4.3	5.4	10.8	4.0	7.7	7.6	3.3	2.7	6.1	7.5	9.9	7.9	4.8	4.8	9.8	2.4	14.1	12.7	3.6	8.2	7.7
2081	4	7.1	7.8	1.5	20.9	10.3	8.9	5.1	3.1	5.4	7.8	6.9	4.8	8.6	6.8	3.2	7.5	4.7	7.4	10.8	5.2	13.9	9.4	20.9	17.7	5.6	1.5	7.3	5.4
2081	5	12.7	12.4	3.7	29.4	13.0	13.6	29.4	15.6	11.5	12.3	18.4	23.6	17.5	14.9	13.1	6.0	11.8	5.6	5.6	7.9	13.2	19.0	3.7	14.9	5.3	9.3	5.7	5.6
2081	6	10.9	11.5	3.7	25.2	11.9	3.7	11.2	12.6	19.9	10.2	10.6	13.5	17.6	5.7	7.6	10.6	10.5	6.2	6.5	11.7	7.0	13.4	12.1	25.2	24.0	11.6	5.7	7.7
2081	7	13.5	15.5	5.0	34.8	21.5	34.8	8.2	13.8	33.2	11.6	6.8	23.8	17.7	18.4	14.3	8.8	26.8	7.6	22.0	13.2	9.6	9.9	14.6	11.8	7.8	5.0	21.1	10.5
2081	8	10.3	12.6	3.8	50.8	10.7	8.0	8.3	15.1	9.9	18.8	6.4	3.8	10.0	9.1	13.7	3.8	50.8	6.5	3.8	12.4	12.4	25.0	11.9	10.9	7.4	15.5	20.7	6.8
2081	9	14.4	17.1	3.7	51.6	51.6	11.0	34.9	20.4	21.8	14.4	25.7	7.0	25.6	9.8	12.9	12.7	8.3	14.5	20.5	9.1	3.7	15.7	25.7	18.5	8.0	13.3	15.0	9.6
2081	10	7.2	8.5	2.7	16.8	8.8	6.8	16.8	6.5	9.1	7.1	5.1	5.3	6.3	12.7	8.8	8.6	6.7	5.9	16.3	9.0	9.2	10.0	2.7	6.4	5.7	7.0	14.7	7.4
2081	11	8.6	8.7	2.8	19.6	8.7	7.8	2.8	10.0	4.7	8.5	13.3	4.5	6.6	11.0	8.9	5.9	7.9	7.2	11.8	4.6	9.4	5.9	12.6	9.5	5.5	19.6	9.5	13.4
2081	12	6.8	7.1	2.0	13.6	13.6	7.3	7.5	5.1	6.2	3.7	9.7	8.3	3.6	10.0	5.4	3.6	9.9	3.9	2.0	4.1	3.6	4.7	11.5	4.4	12.3	9.9	10.7	8.8
2082	1	6.3	6.7	2.0	21.6	6.3	2.0	5.2	7.7	11.0	4.1	5.0	4.7	6.3	4.1	9.3	21.6	7.0	10.0	4.7	6.5	4.4	6.9	6.8	2.0	8.5	4.9	10.8	2.4
2082	2	6.3	5.7	1.8	11.4	5.4	9.0	7.0	3.1	3.0	11.4	6.6	6.3	3.9	6.3	8.2	6.9	2.9	5.0	4.3	6.2	1.8	8.0	6.9	7.3	2.7	5.9	6.7	2.8
2082	3	5.8	7.1	2.8	18.4	10.7	3.9	6.2	11.7	18.4	6.3	4.3	3.5	3.4	3.0	10.6	16.0	6.1	5.7	5.5	10.3	12.5	3.4	5.3	6.0	6.8	2.8	5.6	3.2
2082	4	7.8	9.0	1.1	18.6	6.1	5.9	5.6	18.6	11.9	3.6	8.6	12.6	5.2	8.4	7.3	16.9	5.9	17.7	13.7	3.4	4.9	9.5	1.1	17.9	2.6	13.8	10.0	4.8
2082	5	9.0	10.6	2.7	24.9	8.6	5.6	9.9	10.5	12.9	6.5	9.3	8.3	6.4	18.3	2.7	3.6	17.1	17.7	8.7	24.9	7.7	6.2	18.6	8.1	7.2	11.5	15.9	9.2
2082	6	13.3	14.4	6.2	34.5	7.9	7.6	14.5	15.9	7.8	20.3	21.7	29.9	18.3	7.2	18.0	7.0	13.3	12.3	16.5	16.6	8.1	19.6	12.2	34.5	10.0	13.4	6.2	7.4
2082	7	14.7	20.4	6.0	59.5	32.8	7.8	53.7	36.3	35.6	9.3	15.0	15.2	8.8	27.8	20.6	10.8	9.1	10.8	31.2	14.1	12.5	59.5	16.1	16.4	6.0	14.3	10.7	14.1
2082	8	12.3	16.2	4.1	61.1	7.8	61.1	6.5	27.9	19.1	15.1	9.8	4.1	18.5	8.9	8.5	8.2	8.0	21.5	12.3	7.5	10.8	23.9	12.4	8.8	25.1	22.3	25.5	14.8
2082	9	11.5	13.9	6.0	27.2	14.0	12.3	14.5	10.6	21.8	21.6	12.4	10.4	6.0	7.3	10.3	10.4	9.2	7.8	20.1	22.7	20.0	16.5	10.2	27.2	9.7	19.1	9.0	10.5
2082	10	9.2	9.3	1.9	15.7	13.4	6.5	9.8	11.6	10.4	12.4	15.7	11.8	5.4	7.7	8.3	12.8	7.8	8.7	10.6	15.5	3.3	4.3	13.7	1.9	4.8	11.9	8.3	5.8
2082	11	8.0	9.1	3.2	19.0	11.5	6.0	11.3	17.7	4.7	5.2	17.4	16.0	7.6	9.3	6.4	6.5	3.2	19.0	5.1	5.5	10.1	10.1	9.9	6.2	8.4	6.4	8.7	5.5
2082	12	7.1	8.9	1.9	27.9	8.7	5.8	13.1	7.9	12.6	6.6	6.1	1.9	2.8	5.0	5.3	6.5	17.8	12.9	27.9	3.3	6.5	17.9	4.8	7.7	8.6	7.8	9.4	5.9
2083	1	7.2	7.6	2.5	23.3	2.9	4.5	7.5	4.2	3.0	5.7	7.2	7.3	8.4	10.0	11.4	6.1	6.3	13.3	3.2	6.0	7.2	4.9	7.6	13.6	8.3	2.5	8.5	23.3
2083	2	5.8	5.7	1.3	12.2	2.7	6.8	5.7	12.2	1.8	6.0	5.7	6.1	4.1	6.7	3.0	5.9	7.2	2.4	7.4	8.8	2.9	7.8	4.6	8.5	9.7	4.7	1.3	4.7
2083	3	6.9	7.6	1.0	22.4	7.3	2.7	22.4	3.3	7.0	6.2	5.6	14.7	12.6	2.2	5.2	1.1	5.2	6.9	13.5	3.4	14.2	9.0	6.9	1.0	5.2	10.0	8.4	8.1
2083	4	7.3	8.1	1.2	20.3	20.3	7.0	10.1	6.6	5.1	4.1	11.5	7.4	9.7	5.3	9.7	7.2	8.1	11.5	6.8	14.1	2.2	6.3	11.9	13.4	1.6	3.7	1.2	10.2
2083	5	9.8	11.4	3.4	34.5	23.4	5.9	11.8	7.4	16.2	5.6	21.4	10.0	7.0	13.9	9.5	5.4	5.9	13.3	10.0	15.3	5.0	3.4	6.0	9.2	11.9	6.5	14.1	34.5
2083	6	17.0	17.7	3.0	45.7	18.7	12.8	24.2	20.6	18.1	27.5	8.3	17.0	27.7	13.1	10.9	11.2	10.0	15.6	18.9	19.6	21.4	17.1	14.1	13.4	45.7	22.9	3.0	12.2
2083	7	12.9	13.9	3.9	25.1	18.1	7.2	16.1	19.3	25.1	21.3	3.9	12.3	12.8	20.7	12.6	7.0	6.9	18.9	19.8	11.3	18.5	7.4	16.4	13.0	23.9	9.1	7.1	6.0
2083	8	12.8	16.1	3.9	48.6	16.0	10.1	16.5	13.0	11.6	17.4	5.6	14.7	12.4	44.0	48.6	8.3	3.9	15.4	8.8	9.2	23.4	7.2	27.8	7.9	17.1	22.9	12.7	10.7
2083	9	18.4	18.3	5.0	48.4	20.3	23.0	5.0	22.6	26.5	13.3	25.8	48.4	8.5	15.5	9.2	7.8	24.5	27.2	18.0	5.0	20.1	16.3	8.8	18.8	16.7	24.3	14.0	20.7
2083	10	8.3	9.8	2.5	21.6	6.9	21.6	6.8	16.0	6.8	9.8	4.0	6.4	6.5	2.5	13.6	7.9	17.0	13.4	19.6	5.9	6.0	6.6	6.3	9.0	9.5	8.6	11.9	11.8
2083	11	7.5	7.7	2.3	15.9	7.8	9.7	3.9	11.7	3.7	7.2	10.8	2.6	15.7	6.2	15.9	8.0	3.3	3.7	11.1	10.2	9.6	5.8	7.0	8.1	8.5	2.3	4.8	6.8
2083	12	7.2	8.1	1.5	21.0	21.0	8.9	10.2	6.8	7.6	9.9	5.5	12.2	6.3	5.5	5.5	4.7	4.6	11.6	7.8	7.7	6.6	5.5	6.2	7.6	11.9	5.7	13.0	1.5
2084	1	5.2	6.7	2.3	21.1	4.8	2.5	3.1	5.5	7.8	6.9	3.5	10.2	2.8	3.1	3.5	2.3	10.5	6.5	4.5	10.9	5.8	7.4	21.1	20.8	3.2	5.0	2.4	6.0
2084	2	5.0	5.3	1.0	9.3	5.7	4.9	1.0	9.3	3.3	4.9	3.8	7.8	4.3	5.0	9.3	7.0	7.6	2.5	4.6	4.0	8.7	4.0	6.1	5.2	4.4	3.1	5.0	5.4
2084	3	6.2	6.7	2.0	16.6	6.2	4.4	3.8	6.3	5.7	15.5	3.9	7.3	7.5	2.4	8.5	6.8	7.5	6.2	4.1	7.4	16.6	4.0	5.0	11.6	10.4	4.8	3.4	2.0
2084	4	7.0	8.0	2.6	21.3	8.4	11.0	7.3	5.9	4.2	4.6	15.0	7.2	5.9	2.6	19.5	6.5	13.3	7.9	3.8	7.4	7.8	6.8	21.3	2.6	4.4	4.9	9.8	4.2
2084	5	12.1	10.9	3.1	21.3	14.5	4.5	10.9	5.2	12.6	8.0	12.1	21.3	4.4	16.2	14.6	17.7	15.3	12.0	4.9	13.4	8.4	3.1	14.9	7.7	14.0	8.4	4.4	12.3
2084	6	13.6	16.5	4.4	36.6	36.6	7.1	10.3	28.1	7.4	31.6	8.6	18.1	13.5	11.3	9.4	4.4	10.7	21.0	13.7	27.9	7.9	13.5	22.5	16.4	22.4	20.6	12.3	19.9
2084	7	18.1	20.9	6.7	56.3	7.0	19.9	34.0	20.6	30.6	11.5	19.1	13.0	8.7	54.9	7.0	6.7	11.9	25.5	13.2	36.5	56.3	12.6	17.1	14.4	27.9	20.6	23.5	9.0
2084	8	14.9	15.1	2.8	30.8	8.6	15.2	29.6	20.5	18.9	2.8	21.6	7.7	17.2	14.6	8.0	6.1	16.5	7.3	24.0	14.0	16.9	16.1	8.1	13.0	12.5	30.8	11.9	20.4
2084	9	11.3	12.5	2.9	34.2	3.7	5.3	5.1	16.9	14.7	12.8	14.5	3.0	34.2	16.4	18.4	11.6	19.1	5.9	2.9	10.3	24.1	10.1	16.2	10.6	10.3	14.8	8.1	10.9
2084	10	9.6	10.6	1.6	22.7	13.7	9.0	22.7	6.0	2.6	21.6	6.5	21.8	7.1	15.8	3.7	19.9	7.4	8.4	10.3	6.6	14.4	1.6	11.8	13.6	11.5	12.2	4.2	1.9
2084	11	9.4	9.3	3.7	19.1	9.5	11.9	7.5	3.7	12.5	9.8	14.5	13.1	9.4	3.8	10.1	5.2	11.9	5.6	5.4	8.6	12.5	15.7	19.1	6.5	7.6	10.8	4.2	4.6
2084	12	6.0	6.6	1.6	12.4	7.0	5.7	8.5	4.5	5.5	4.0	11.4	6.4	7.4	6.8	10.4	9.4	10.5	5.8	1.6	4.8	12.4	6.0	4.5	6.0	3.4	5.6	6.7	4.8
2085	1	5.9	7.3	2.9	26.6	6.4	7.6	7.6	5.7	3.5	3.0	3.6	7.5	9.2	3.0	6.8	9.7	10.9	5.9	5.8	4.5	26.6	2.9	4.2	18.2	5.2	4.7	3.8	9.2
2085	2	4.4	4.9	1.4	14.1	3.8	2.6	3.4	4.4	6.0	2.8	14.1	2.9	5.7	2.7	9.3	7.0	6.4	5.7	5.2	6.0	1.4	3.5	4.4	4.9	6.2	2.6	4.4	2.4
2085	3	5.8	7.2	2.1	23.3	2.5	9.7	4.9	4.1	11.6	4.5	2.9	14.8	3.4	2.4	5.6	23.3	12.5	5.8	7.2	5.8	3.3	11.1	10.5	2.1	5.9	4.9	6.9	7.9
2085	4	8.6	8.3	2.2	19.0	3.7	8.8	10.1	8.7	2.2	3.3	8.5	18.2	13.3	4.3	11.7	4.7	3.4	19.0	4.7	5.3	6.5	4.2	11.1	11.4	10.3	9.8	5.7	9.2
2085	5	11.6	11.8	3.9	23.4	13.3	4.3	11.8	8.5	3.9	5.9	21.7	14.6	8.1	18.1	5.0	23.4	6.7	14.9	6.2	11.6	14.9	19.1	11.7	13.9	5.7	19.7	10.2	10.0
2085	6	13.5	15.8	6.4	43.4	17.2	18.0	14.4	11.1	8.7	7.3	6.4	6.9	23.8	43.4	17.0	8.2	16.4	12.6	8.7	40.6	7.2	19.0	10.8	10.7	12.8	24.6	14.2	18.8
2085	7	15.2	17.4	5.7	52.9	31.1	9.6	11.1	17.3	10.4	52.9	25.8	22.9	25.9	25.0	15.7	9.6	5.7	10.4	10.2	7.3	29.0	11.6	21.4	8.2	15.0	15.3	18.1	8.2
2085	8	12.2	14.9	5.2	55.2	11.6	8.1	55.2	15.1	15.1	18.9	8.3	5.2	6.4	23.7	11.7	11.1	18.3	16.7	10.1	12.6	13.5	8.0	25.4	14.8	19.4	11.9	10.8	5.2
2085	9	13.2	14.7	7.1	28.0	20.9	10.9	7.1	11.6	7.7	28.0	11.0	7.8	15.8	15.7	25.4	10.6	19.7	9.1	15.4	19.5	21.5	8.9	17.4	12.6	23.2	9.3	13.8	10.5
2085	10	11.9	10.9	3.4	18.3	13.4	13.5	17.0	9.0	11.0	9.0	15.1	7.5	4.8	17.5	3.4	6.5	18.3	12.9	12.9	8.2	11.8	12.0	6.3	14.4	14.2	12.5	5.5	4.5
2085	11	7.2	8.6	2.6	21.8	6.7	8.4	7.5	9.6	11.5	21.8	6.2	8.6	2.6	6.4	15.6	20.7	6.3	4.1	10.1	4.7	4.1	7.9	8.8	5.4	6.1	6.8	5.2	10.5
2085	12	6.4	7.6	2.7	23.5	6.2	9.3	10.4	8.2	10.5	8.4	8.8	5.3	9.3	5.8	8.1	4.5	5.6	6.3	7.7	3.7	6.4	2.7	10.5	4.6	5.8	23.5	3.9	6.1
2086	1	4.8	4.9	2.3	7.7	4.8	3.1	6.6	7.7	5.0	5.1	6.9	3.9	3.4	5.3	7.4	3.0	6.5	4.8	3.3	4.7	2.3	4.3	5.6	6.2	6.1	4.7	3.8	2.8
2086	2	4.4	5.1	2.4	11.7	2.5	5.0	4.9	9.4	4.4	3.3	5.1	5.1	4.9	3.8	5.3	8.8	8.5	11.7	2.6	4.2	4.4	2.4	4.3	4.0	3.6	3.7	2.5	9.1
2086	3	4.9	5.3	1.2	10.8	6.6	4.0	8.0	10.8	2.4	1.2	1.6	2.6	1.4	5.6	4.4	3.8	4.5	3.9	10.7	5.4	4.8	8.2	6.6	4.5	9.6	5.1	5.8	5.6
2086	4	6.3	6.9	1.8	15.0	7.5	4.0	2.4	9.4	6.7	15.0	6.2	12.6	1.8	5.1	4.2	2.7	5.7	11.8	4.1	3.8	11.1	6.8	6.4	5.7	11.5	5.0	7.3	10.0

2086	5	8.8	9.4	0.7	18.9	5.2	16.6	7.6	0.7	9.0	2.1	14.1	11.5	2.6	8.6	3.2	13.7	12.7	9.9	6.8	5.7	17.8	17.9	4.4	5.7	9.6	13.8	7.5	18.9
2086	6	13.0	16.8	4.7	58.9	29.2	18.3	16.7	7.5	13.7	7.7	12.0	4.7	34.9	12.2	58.9	5.2	16.5	11.5	22.5	12.4	10.5	14.0	31.2	9.4	6.8	14.5	26.6	5.4
2086	7	12.3	17.1	6.1	49.5	19.1	18.3	19.1	6.7	9.6	20.5	9.8	11.6	19.1	49.5	12.6	7.5	43.3	10.8	11.5	16.3	6.1	6.5	29.4	7.9	40.5	11.9	12.7	10.3
2086	8	12.4	14.0	5.3	37.1	8.3	8.6	12.2	15.0	11.3	37.1	5.3	7.8	12.6	6.9	24.1	5.9	22.2	20.0	23.7	9.5	13.0	12.6	13.9	8.5	7.5	25.1	11.8	14.2
2086	9	17.8	18.8	5.5	42.1	29.6	14.3	42.1	21.9	7.5	11.8	11.0	14.6	19.1	12.1	25.5	21.0	24.9	40.3	26.3	11.2	16.5	7.5	19.1	20.0	5.5	6.0	14.6	28.2
2086	10	9.2	9.6	2.5	21.5	6.0	20.6	11.4	5.6	17.4	3.1	2.5	12.7	9.5	5.9	3.5	17.6	5.3	7.7	9.5	12.9	21.5	4.2	9.0	10.2	9.7	8.7	3.9	12.3
2086	11	10.1	9.6	2.4	20.6	10.6	5.0	5.1	10.4	2.4	16.4	11.6	20.6	11.8	9.7	7.3	13.0	8.8	5.9	7.3	5.4	5.0	9.0	10.5	2.7	13.5	15.0	10.9	12.7
2086	12	5.5	6.3	2.5	18.6	9.7	4.1	6.9	5.1	7.6	5.5	18.6	7.4	4.3	7.1	8.5	7.1	5.3	3.4	4.6	3.8	8.0	7.7	2.5	4.2	5.6	3.7	6.0	5.1
2087	1	6.0	6.9	3.0	18.9	6.7	3.7	6.8	3.2	4.7	8.2	5.5	5.8	18.9	7.2	5.8	3.3	8.9	14.3	9.4	6.2	9.1	7.1	5.8	8.9	3.9	3.6	5.7	3.0
2087	2	5.5	6.2	1.3	18.7	7.0	3.9	4.4	7.3	7.0	5.3	9.0	1.3	5.2	2.6	7.9	5.7	4.6	2.2	8.4	1.3	18.7	4.0	7.9	3.8	5.6	17.2	3.0	5.6
2087	3	5.3	6.3	0.8	11.7	4.5	5.4	1.7	11.6	4.7	5.2	2.6	7.3	5.4	4.1	0.8	11.7	3.6	4.5	8.4	8.0	5.7	9.6	8.5	11.6	5.0	5.1	10.4	5.1
2087	4	6.3	7.0	1.7	16.7	16.7	6.1	3.0	1.7	5.4	6.6	10.1	10.8	5.6	2.9	5.7	3.9	7.2	8.7	8.6	2.4	4.7	8.2	10.8	5.9	11.6	6.8	10.3	3.3
2087	5	12.9	13.5	4.2	23.9	12.9	23.4	19.5	4.2	11.3	15.2	16.2	6.3	19.0	21.5	7.0	23.9	5.8	4.9	7.5	14.4	12.5	7.8	18.7	11.7	17.3	12.8	10.6	19.6
2087	6	12.0	14.6	5.3	31.4	27.5	20.5	31.4	5.6	7.0	10.4	25.5	9.2	14.4	15.4	16.7	9.5	20.2	16.1	15.4	5.3	11.1	6.1	11.1	12.0	9.8	12.0	10.6	26.6
2087	7	12.2	13.7	5.0	29.3	19.7	15.5	14.0	28.3	11.7	9.3	19.7	8.1	11.5	6.6	10.3	5.8	29.3	8.3	10.2	5.0	22.3	6.2	22.6	9.1	12.7	15.2	14.1	13.4
2087	8	12.8	14.5	4.1	33.5	12.4	33.5	15.7	19.7	16.7	9.3	25.6	8.6	12.5	14.4	16.0	9.0	8.7	10.2	11.5	15.0	11.9	13.1	30.3	16.0	4.1	9.5	15.6	9.9
2087	9	18.9	18.3	4.4	34.3	20.3	11.5	21.4	18.4	21.7	7.3	26.9	32.6	15.1	26.9	19.4	8.7	21.5	9.1	15.1	8.2	4.4	14.9	19.8	29.2	9.6	34.3	14.6	29.4
2087	10	7.5	9.2	2.0	24.4	13.9	14.6	2.0	3.6	8.1	4.6	11.3	24.4	8.2	6.2	14.4	7.7	4.4	5.9	7.1	19.3	6.8	7.9	7.2	7.8	5.7	21.7	3.1	4.7
2087	11	8.4	8.1	2.4	15.5	6.6	15.5	2.6	5.5	10.0	6.5	11.1	13.0	9.5	5.7	5.1	4.1	8.2	2.4	11.3	10.8	10.6	13.4	10.2	10.7	8.6	6.8	2.5	2.9
2087	12	5.7	6.2	3.0	13.5	6.1	5.3	5.0	8.6	7.2	3.0	4.7	4.1	5.3	5.5	6.3	5.3	8.1	8.3	3.0	6.0	4.9	13.5	8.5	10.1	7.0	4.2	3.6	6.3
2088	1	5.7	6.6	0.9	17.7	11.4	17.7	5.7	2.7	7.9	6.5	5.7	3.9	3.1	5.7	9.3	8.9	6.4	3.9	5.5	12.5	11.6	3.2	5.1	3.3	6.7	5.9	0.9	5.4
2088	2	4.8	4.8	1.0	10.8	4.0	5.0	2.4	2.7	5.3	3.8	8.1	4.3	6.4	2.6	4.1	4.7	5.6	5.7	5.5	5.5	2.4	4.6	5.7	3.6	5.7	10.8	5.0	1.0
2088	3	6.0	6.7	2.2	17.8	6.4	14.8	7.2	3.4	7.9	9.6	3.7	5.8	4.6	6.4	7.9	2.5	5.7	6.8	17.8	12.4	5.4	2.2	5.0	7.0	4.4	6.3	3.0	4.8
2088	4	7.5	7.7	2.3	16.4	9.3	10.2	4.2	8.4	5.4	4.2	11.7	10.9	8.1	6.8	6.0	13.1	2.3	4.2	9.0	2.9	15.2	3.7	3.9	3.4	10.9	3.8	16.4	10.2
2088	5	13.3	12.2	3.0	23.0	7.4	4.7	6.7	6.8	6.1	6.1	3.0	21.3	23.0	18.5	14.5	13.1	13.6	15.7	14.9	15.8	10.1	9.3	20.8	16.4	4.8	15.7	15.9	7.7
2088	6	14.3	14.8	4.9	27.8	13.4	25.5	16.6	8.3	9.3	5.1	10.2	17.0	27.8	10.3	8.1	18.0	27.4	21.5	6.5	13.5	7.9	15.2	21.5	9.2	17.3	15.1	4.9	25.5
2088	7	17.2	18.5	4.1	49.6	39.0	33.9	21.8	12.4	4.8	18.2	9.0	4.7	11.5	21.5	18.1	23.4	34.4	17.3	12.1	19.5	6.0	10.2	34.2	7.7	14.4	49.6	4.1	17.1
2088	8	14.4	21.6	3.2	72.5	72.5	14.0	9.5	22.7	35.3	37.8	8.2	31.9	6.0	69.2	10.5	8.9	33.5	15.4	3.2	12.3	22.1	8.2	14.9	13.6	7.3	8.6	32.4	21.2
2088	9	15.6	15.8	2.1	30.7	22.9	7.5	17.1	15.2	17.0	21.9	17.3	28.5	16.0	30.7	8.3	2.1	3.2	24.7	26.7	9.7	29.1	12.6	9.0	10.7	6.9	22.4	15.1	3.9
2088	10	8.5	10.4	3.9	23.4	23.4	13.3	8.2	3.9	10.3	7.3	17.1	10.4	7.9	11.4	6.4	8.9	7.4	6.0	22.5	12.8	14.7	8.9	7.5	8.1	14.1	5.1	6.8	7.1
2088	11	8.9	9.9	3.0	21.7	11.7	7.4	13.7	13.3	12.3	7.2	7.7	21.7	9.1	3.0	8.8	4.0	3.8	8.4	19.3	5.7	12.4	11.9	15.0	4.1	7.7	13.5	5.5	10.7
2088	12	7.1	7.4	2.5	14.9	7.0	14.9	10.2	11.7	5.4	4.0	4.6	9.0	7.2	8.2	13.4	8.1	13.4	7.3	6.7	7.0	2.7	8.0	2.5	5.2	5.7	4.5	2.6	7.6
2089	1	5.9	7.5	2.2	24.8	6.9	5.1	4.3	19.6	6.8	6.3	5.4	4.1	3.1	6.2	5.6	4.8	6.6	7.1	7.1	5.5	24.8	2.2	4.9	14.0	10.2	4.1	10.2	4.6
2089	2	5.8	6.1	2.2	18.0	8.6	2.2	3.3	5.9	4.2	7.6	6.6	8.9	6.7	4.1	4.7	3.4	5.0	4.6	7.7	4.4	6.4	6.9	6.7	6.4	3.9	4.7	5.6	18.0
2089	3	6.0	7.7	2.3	31.0	3.8	9.3	5.4	10.0	5.6	6.8	4.6	5.9	8.3	4.6	3.3	31.0	2.3	6.6	5.4	3.8	5.4	7.1	6.1	13.6	9.1	6.2	18.3	3.4
2089	4	6.2	6.5	1.0	15.0	3.9	2.9	5.5	12.4	8.1	6.8	6.3	8.0	5.2	3.3	4.9	4.3	3.9	6.3	7.5	2.8	1.0	13.4	15.0	7.3	2.7	8.8	8.4	6.1
2089	5	10.3	11.0	1.1	21.2	16.2	5.6	21.2	9.8	3.8	9.2	12.3	5.9	20.3	1.1	18.1	14.0	8.2	8.4	16.1	10.8	6.4	10.9	9.6	9.4	12.0	13.0	14.7	7.8
2089	6	9.8	13.2	2.9	33.6	6.2	8.4	8.4	21.0	25.1	7.2	5.6	19.2	12.1	33.6	14.8	23.0	16.4	8.4	9.8	2.9	22.1	12.8	8.1	7.8	9.0	9.9	8.3	16.2
2089	7	15.4	16.6	3.9	41.7	4.7	14.0	13.5	25.0	22.1	15.8	3.9	20.4	27.4	15.3	11.4	6.1	9.1	21.9	17.4	15.4	27.0	10.6	8.8	30.9	16.5	41.7	6.2	12.1
2089	8	12.5	17.0	5.3	78.8	8.5	8.5	22.6	24.5	8.7	17.1	10.1	11.4	19.8	13.7	12.1	5.3	25.5	8.0	16.4	78.8	12.8	23.9	10.7	7.3	5.9	22.4	12.1	21.1
2089	9	14.9	18.0	3.7	36.2	11.5	3.7	9.2	14.1	12.1	14.6	7.3	16.9	10.3	19.5	15.3	21.8	26.7	35.5	36.2	11.6	31.4	12.8	20.3	24.9	12.8	24.5	14.6	23.5
2089	10	8.0	9.5	3.4	22.1	6.6	7.9	8.2	13.8	7.5	7.8	7.2	3.9	6.7	8.8	12.1	4.1	15.0	19.5	10.3	10.1	4.1	7.0	3.8	12.7	22.1	3.4	9.9	14.7
2089	11	7.4	7.9	3.1	16.4	4.6	6.0	10.5	9.4	6.3	14.1	8.6	4.2	3.1	9.4	11.4	7.4	9.1	11.9	4.7	3.3	16.4	7.4	3.6	8.9	12.5	3.4	6.5	6.1
2089	12	7.3	7.3	2.0	12.0	11.4	7.6	5.7	4.8	7.2	8.3	11.2	5.1	6.9	11.0	6.9	8.1	12.0	4.5	8.6	6.2	3.8	11.9	7.4	6.0	8.4	3.7	2.0	7.3
2090	1	4.6	6.0	1.9	21.1	2.9	3.9	21.1	2.1	4.5	3.9	6.9	3.3	3.6	2.8	1.9	8.1	4.7	11.1	4.3	4.4	6.9	9.6	3.3	5.4	9.3	7.8	5.9	5.4
2090	2	5.5	6.5	1.8	18.5	5.7	7.1	6.9	9.8	5.2	5.5	5.5	4.6	4.0	15.0	18.5	1.8	6.9	5.1	2.9	10.6	5.1	6.8	8.6	1.9	6.2	5.4	5.6	2.2
2090	3	6.0	6.1	1.7	16.2	7.3	3.5	1.8	9.6	9.4	9.8	6.5	10.8	7.7	8.3	5.5	2.7	7.2	16.2	4.3	1.7	3.4	6.5	3.7	4.4	2.5	3.2	6.8	3.9
2090	4	6.9	7.4	0.4	19.8	10.5	11.6	4.1	12.1	7.0	2.6	11.1	11.9	5.7	2.0	4.6	7.1	4.0	6.8	19.8	14.7	13.5	3.1	1.3	4.3	7.6	0.4	10.6	2.1
2090	5	11.3	12.5	3.0	37.1	17.3	24.9	10.2	3.5	11.5	5.8	11.1	13.3	27.2	10.3	4.2	15.9	37.1	5.9	8.5	12.7	6.3	4.4	18.0	15.0	3.0	15.8	6.8	11.6
2090	6	12.8	13.5	4.3	36.2	13.6	13.6	36.2	10.2	5.0	14.2	4.3	13.8	9.0	14.1	10.2	5.4	9.1	15.1	9.6	22.4	15.4	15.9	11.1	4.8	23.6	12.1	22.8	12.0
2090	7	11.9	12.9	2.8	26.0	11.4	9.8	11.1	10.0	6.1	8.9	14.1	25.2	15.8	7.4	15.0	23.0	26.0	13.2	12.4	5.0	17.8	12.4	8.6	2.8	5.8	20.0	8.3	20.1
2090	8	11.0	14.4	3.1	46.4	3.1	10.4	15.4	8.2	46.4	19.4	8.7	13.9	12.7	18.8	24.2	14.8	11.7	8.0	10.2	25.9	33.6	4.7	21.5	5.3	7.2	5.8	7.0	8.6
2090	9	17.2	18.0	3.5	34.2	27.6	6.3	19.1	17.3	27.1	27.4	14.5	13.3	17.1	15.2	18.8	19.3	3.5	16.3	20.5	14.3	17.2	17.2	5.8	14.1	24.5	26.6	15.1	34.2
2090	10	9.3	9.7	3.8	18.1	12.0	9.2	17.2	18.1	10.7	10.1	9.3	7.3	15.8	7.5	5.0	5.7	14.0	7.0	12.3	8.6	6.8	3.8	10.2	4.9	8.6	4.5	13.7	10.5
2090	11	6.1	7.8	2.1	18.8	4.5	7.1	2.8	2.4	3.8	10.0	4.0	4.7	15.4	3.3	6.9	14.4	18.8	5.3	2.4	3.8	12.5	10.2	15.1	9.1	15.9	2.1	6.8	4.9
2090	12	6.5	6.9	2.7	16.4	4.7	2.7	5.7	3.3	6.6	7.7	8.3	6.1	6.0	4.2	3.9	6.0	16.4	4.2	7.0	4.5	8.3	8.4	10.6	7.2	6.5	7.4	8.2	12.3
2091	1	5.9	6.6	1.6	23.8	3.7	5.9	3.8	23.8	5.9	2.6	13.1	6.4	7.2	5.0	6.2	4.8	1.6	9.5	11.5	3.3	7.8	3.3	6.6	4.6	4.3	4.2	7.1	6.4
2091	2	4.7	5.3	1.4	15.4	4.7	4.8	5.4	9.5	4.4	3.9	3.0	10.1	3.1	3.2	3.5	15.4	5.1	5.5	4.7	1.4	5.8	4.0	1.9	1.9	5.9	6.9	9.9	4.2
2091	3	6.4	6.8	1.9	18.6	11.4	8.3	13.1	5.2	7.7	1.9	2.6	4.7	2.8	3.3	4.4	14.1	3.5	6.5	18.6	1.9	6.4	2.8	8.1	6.8	6.5	7.1	9.8	5.7
2091	4	7.1	7.9	2.1	16.6	6.9	6.6	9.8	16.6	11.5	3.7	9.5	7.0	6.8	11.4	10.6	2.1	4.3	7.8	11.1	5.1	14.0	11.1	7.1	3.7	9.6	4.8	4.7	4.6
2091	5	9.6	10.2	4.8	18.3	14.6	5.5	9.1	11.9	14.6	9.8	14.8	6.0	7.2	12.2	7.0	7.3	6.7	8.6	18.3	5.1	9.4	13.5	13.7	4.9	11.5	17.8	4.8	10.2
2091	6	10.9	12.3	4.5	40.2	9.1	22.5	13.2	11.8	19.3	12.2	4.5	12.3	8.1	6.9	11.5	6.1	8.1	40.2	10.2	13.9	12.8	7.8	7.1	13.5	23.5	9.4	5.5	5.1
2091	7	16.9	16.2	4.0	28.5	10.5	10.5	19.7	28.5	11.3	6.9	25.0	12.1	13.4	27.0	21.1	4.0	19.0	23.5	21.6	19.3	16.2	20.2	14.7	5.2	21.9	17.7	7.4	12.9
2091	8	13.1	14.7	3.2	37.2	13.6	12.2	11.5	11.0	12.2	10.4	8.9	20.3	14.6	24.8	24.2	9.9	16.4	14.3	18.1	37.2	17.8	18.9	12.5	3.2	8.9	9.5	6.6	14.9
2091	9	13.2	15.5	4.4	49.0	49.0	12.2	4.4	14.1	11.7	23.7	9.0	23.0	15.7	11.7	15.3	7.3	19.7	6.9	17.6	6.0	11.7	17.5	7.9	19.5	8.5	20.0	9.5	29.3
2091	10	9.6	10.3	4.1	20.2	18.2	7.0	5.8	13.8	10.1	8.8	19.7	14.3	11.5	6.2	4.1	20.2	19.2	5.9	9.3	4.2	11.1	5.2	5.0	9.9	10.7	6.0	14.4	7.1
2091	11	6.6	7.6	2.3	16.4	2.3	10.3	5.7	9.2	14.0	6.9	6.8	5.6	4.1	9.8	6.0	4.9	11.6	11.6	4.8	16.4	4.3	12.0	7.5	6.3	4.5	4.7	3.6	8.8
2091	12	6.1	6.2	2.4	12.7	7.4	7.3	7.0	6.3	7.6	3.8	2.4	5.9	9.1	5.8	6.6	2.9	5.3	3.1	5.3	5.2	6.9	12.7	5.8	8.3	7.3	5.0	2.7	9.9
2092	1	6.4	6.6	1.9	11.5	11.5	6.8	2.7	7.4	5.7	10.4	5.1	9.6	9.2	1.9	4.2	3.5	4.3	7.7	4.0	5.9	5.3	3.6	10.5	5.7	8.7	7.5	10.9	6.8
2092	2	5.0	6.2	1.8	24.3	2.5	1.8	5.8	8.4	24.3	7.0	9.1	7.3	3.2	4.3	5.5	5.7	4.7	2.0	5.3	8.3	3.7	4.3	13.5	2.0	2.6	3.8	3.5	10.2
2092	3	6.6	7.1	2.5	15.6	3.9	9.4	4.9	6.1	9.8	5.3	10.4	4.9	7.3	5.0	10.8	15.6	6.1	11.0	8.1	8.6	8.6	3.1	5.8	7.2	2.5	8.2	5.2	2.6
2092	4	7.1	7.5	1.1	16.3	12.7	14.3	5.5	6.6	4.2	8.4	3.2	9.2	3.7	3.3	3.8	8.4	6.4	5.4	14.1	16.3	14.1	9.9	7.6	8.0	8.0	1.1	2.7	4.0
2092	5	12.6	13.8	2.8	27.1	9.1	6.2	27.1	15.4	10.5	10.3	18.6	13.6	7.9	17.1	26.2	2.8	12.1	11.8	19.6	15.4	10.4	8.9	10.6	21.8	18.4	13.1	9.0	16.0
2092	6	14.4	17.9	6.3	51.4	31.8	6.3	44.9	12.6	31.5	11.2	7.8	7.8	11.1	20.5	7.1	51.4	6.9	15.8	21.9	19.6	8.2	9.9	16.6	20.7	15.1	22.8	13.8	13.5
2092	7	13.7	19.2	5.2	100.0	63.0	14.0	100.0	14.0	11.7	7.6	20.9	13.4	14.6	14.6	13.4	10.3	11.3	9.8	9.8	17.6	18.8	16.2	12.2	5.2	16.4	7.8	12.8	25.5
2092	8	11.6	14.1	6.2	33.2	8.6	10.9	8.6	8.5	9.1	15.8	25.7	6.2	16.9	11.5	10.9	6.6	11.3	15.6	13.0	14.5	11.7	8.9	33.2	7.7	26.1	20.0	18.9	18.6
2092	9	18.3	16.3	5.6	24.2	10.4	21.8	5.6	10.2	21.8	9.5	19.3	19.8	11.8	22.0	24.2	17.3	9.6	20.5	13.8	10.7	9.6	10.6	19.6	23.3	21.5	23.3	15.1	20.9
2092	10	9.5	10.1	4.0	18.4	4.0	7.4	8.1	8.1	16.0	7.5	9.7	8.6	13.8	9.0	8.6	10.4	5.1	9.7	11.0	16.1	13.3	18.4	13.0	5.6	11.6	11.8	5.2	9.2
2092	11	8.6	9.5	2.2	21.3	4.2	16.0	7.8	5.7	10.7	7.8	5.7	7.2	2.2	4.6	9.8	17.6	17.1	10.9	10.4	6.1	12.1	3.7	12.8	9.3	5.8	21.3	12.6	6.6
2092	12	7.1	8.2	2.1	20.2	5.7	7.1	2.1	17.7	8.3	10.6	4.2	4.7	8.6	13.0	2.5	6.9	10.2	20.2	9.8	13.3	4.5	6.9	6.1	7.2	8.6	5.7	7.8	6.0
2093	1	6.1	7.8	1.5	23.4	6.7	4.6	5.4	4.9	23.4	2.3	7.9	16.3	1.5	3.9	6.1	8.1	8.3	5.7	14.7	5.8	11.1	10.3	3.1	4.8	7.8	4.9	14.0	6.1
2093	2	6.0	5.8	0.7	11.2	6.7	0.7	5.2	6.5	8.2	6.8	7.4	6.3	4.7	2.3	3.1	8.3	5.7	3.3	5.6	3.1	5.5	9.5	1.9	11.2	7.2	7.4	5.7	7.0
2093	3	6.8	7.4	2.5	23.3	7.3	5.0	4.6	9.3	14.7	4.2	6.9	7.0	6.7	8.2	4.9	23.3	12.0	5.1	9.4	8.4	4.8	3.9	2.5	7.0	4.4	2.7	9.4	5.6
2093	4	7.4	8.6	1.1	22.2	22.2	1.5	14.7	6.8	1.1	9.1	13.0	7.0	13.4	15.0	5.1	15.9	12.5	8.4	3.6	5.7	7.8	2.3	3.9	5.1	14.5	8.7	6.3	3.6
2093	5	10.8	11.7	3.3	24.4	11.1	3.3	18.5	8.9	17.1	15.1	20.0	13.4	20.3	5.4	6.7	10.0	6.9	11.9	8.4	7.4	10.5	14.7	6.7	15.2	24.4	18.3	3.5	4.1
2093	6	11.8	14.8	3.8	33.4	25.7	13.9	33.4	6.0	10.9	9.8	8.7	23.9	33.2	9.8	10.2	3.8	12.2	6.9	10.9	28.9	5.8	17.2	17.6	14.8	16.7	11.4	14.0	8.8
2093	7	14.7	16.2	5.2	36.8	22.8	11.3	35.5	14.7	14.6	8.9	8.7	36.8	8.6	6.5	8.2	6.9	19.5	19.9	5.2	15.4	17.2	9.6	25.5	18.8	12.6	30.4	6.8	23.4
2093	8	14.2	14.5	3.8	36.7	14.9	17.9	12.6	15.1	23.0	4.3	20.7	3.8	10.7	4.7	14.3	11.2	26.2	6.5	8.7	12.0	6.1	14.0	22.2	19.5	14.9	36.7	17.8	10.5
2093	9	11.1	13.3	2.1	26.6	16.2	8.9	8.7	16.7	11.1	21.6	26.6	25.8	10.2	17.3	17.9	20.0	2.1	11.1	4.8	9.0	4.5	7.0	9.5	24.5	12.1	23.9	5.0	5.6
2093	10	8.3	9.2	2.9	24.8	17.0	9.8	5.4	10.6	3.5	7.6	4.0	12.2	13.7	7.3	12.7	7.8	2.9	14.4	7.1	9.0	24.8	12.0	3.7	8.8	7.2	5.8	9.3	5.5
2093	11	8.1	8.2	2.2	13.9	5.8	7.3	2.8	11.6	7.6	12.9	7.7	2.2	9.7	3.8	8.4	11.2	8.8	12.4	6.2	4.7	10.5	13.2	6.5	13.9	9.6	4.2	8.9	5.7

2093	12	7.7	9.4	2.8	27.5	10.6	7.4	7.6	14.6	9.2	3.2	3.7	17.6	5.4	27.5	11.4	21.0	6.4	3.7	2.8	5.8	8.7	6.5	5.8	12.2	4.8	11.2	10.1	7.7
2094	1	5.2	5.7	2.0	10.9	8.6	3.1	5.5	7.1	10.9	4.7	4.8	6.4	4.3	7.5	8.2	4.9	4.6	6.1	2.0	4.5	7.9	3.0	4.2	6.2	7.4	5.0	3.6	7.5
2094	2	5.5	5.8	1.7	15.4	5.9	4.3	4.0	3.1	1.7	2.4	15.4	7.1	6.3	3.0	6.4	5.3	5.5	4.0	5.4	6.2	7.1	4.3	4.9	9.7	7.7	8.9	5.6	4.3
2094	3	4.9	6.8	1.3	20.3	11.1	2.9	3.5	12.0	4.7	3.8	2.9	3.3	1.3	4.1	6.7	14.1	3.9	5.2	14.9	3.2	9.2	7.1	6.9	3.9	20.3	7.3	7.1	4.0
2094	4	7.2	8.7	3.4	23.6	9.9	5.4	3.4	5.1	13.9	9.0	7.8	9.3	6.0	6.5	6.7	23.6	4.9	5.9	9.5	4.1	12.4	9.6	18.5	7.8	5.7	13.0	6.4	4.7
2094	5	10.5	12.8	1.4	30.3	30.3	5.0	9.7	9.3	6.2	10.9	8.0	10.7	15.8	9.8	7.7	23.3	27.6	8.4	13.4	1.4	18.5	16.2	17.7	3.7	11.5	24.9	10.2	7.2
2094	6	11.0	13.3	4.4	39.4	10.1	19.5	27.3	13.0	15.8	5.1	10.3	12.4	15.9	31.5	10.0	4.4	7.3	9.4	11.6	39.4	15.5	7.7	13.3	14.9	7.2	8.4	4.8	4.9
2094	7	13.3	14.2	2.8	28.6	12.8	12.0	14.7	12.8	20.9	13.8	9.5	15.9	12.5	24.1	11.5	2.8	15.0	13.5	8.7	9.3	13.0	15.7	19.8	28.6	14.7	11.6	7.8	18.9
2094	8	11.2	13.1	4.3	36.3	14.4	10.4	9.7	5.0	18.9	4.3	9.6	11.1	19.9	20.9	13.2	11.2	4.6	36.3	9.0	12.3	13.2	14.1	29.3	7.4	7.1	18.0	7.5	7.9
2094	9	17.2	16.8	3.5	36.6	12.6	6.0	21.3	21.1	19.8	36.6	13.6	8.3	26.6	24.1	17.9	9.6	24.4	16.8	28.5	8.1	25.0	11.8	3.5	8.6	8.7	24.5	7.1	17.7
2094	10	9.1	9.7	3.0	18.1	7.3	10.8	4.9	6.4	14.1	6.0	6.6	18.1	5.1	9.8	10.0	5.8	8.4	13.1	17.6	16.2	10.8	7.1	3.0	8.5	7.2	14.9	9.9	11.1
2094	11	8.4	9.0	3.1	21.2	10.1	10.2	6.4	7.2	6.3	6.4	6.8	7.0	15.3	13.5	6.2	3.1	9.0	7.8	21.2	11.6	8.9	11.7	12.1	3.9	10.1	4.9	3.3	13.7
2094	12	5.5	6.4	2.7	12.5	9.9	5.8	4.2	6.6	3.6	11.0	4.7	5.1	9.8	4.1	4.4	8.1	4.7	5.7	5.9	8.4	5.3	5.2	12.5	8.3	4.4	5.3	2.7	8.5
2095	1	7.5	8.3	1.8	24.3	4.5	10.6	2.8	4.5	9.6	5.4	5.6	6.1	9.9	12.4	8.6	12.0	6.5	6.5	10.8	8.7	6.3	24.3	9.6	3.5	1.8	11.4	11.0	6.1
2095	2	4.8	7.4	1.7	31.0	4.0	2.7	4.3	4.9	10.6	5.0	9.7	10.1	2.5	3.9	1.7	26.6	5.9	4.8	7.7	3.1	6.6	4.6	4.4	6.6	3.8	3.1	31.0	10.5
2095	3	4.8	6.4	1.5	23.1	6.3	6.5	3.4	6.7	13.4	9.0	5.3	23.1	2.4	3.6	1.5	9.9	7.0	3.5	2.0	3.2	2.9	5.9	3.6	6.6	4.4	4.2	16.6	2.1
2095	4	5.5	7.1	2.3	23.9	23.9	4.9	7.8	3.4	8.0	2.3	8.8	2.3	3.1	5.2	10.5	6.0	3.9	6.0	11.9	4.4	17.3	3.7	8.8	11.6	5.7	3.1	3.3	4.2
2095	5	11.4	12.9	4.3	31.5	12.0	6.7	15.3	8.7	14.3	15.2	9.8	21.9	5.5	8.7	14.6	31.5	18.3	10.3	9.5	4.3	4.6	18.8	10.9	5.8	20.3	10.8	12.6	20.1
2095	6	19.1	19.9	6.8	53.6	9.1	14.3	23.1	7.2	25.0	19.1	19.1	17.4	10.6	12.3	22.7	11.2	26.3	38.7	9.1	35.4	20.2	6.8	53.6	11.4	23.6	19.8	28.8	13.5
2095	7	12.8	16.7	6.3	41.5	11.1	25.3	24.1	8.8	27.8	41.5	7.1	30.9	12.1	20.8	12.2	6.8	17.2	8.4	6.3	16.6	22.1	10.4	9.9	20.4	13.3	32.1	9.1	7.0
2095	8	13.2	16.1	5.2	46.5	38.1	17.6	10.9	6.3	15.9	16.3	5.2	8.7	17.2	35.0	9.2	17.3	8.7	8.8	9.6	19.5	7.2	10.5	46.5	15.5	11.0	18.2	9.1	23.3
2095	9	18.2	19.4	7.0	55.8	20.7	22.6	22.0	9.7	26.6	21.7	10.3	19.2	29.0	9.4	25.0	17.9	16.8	16.8	12.8	18.4	12.1	7.0	55.8	17.3	26.1	8.9	15.0	23.8
2095	10	8.7	9.3	3.2	19.5	11.5	11.3	3.2	7.3	10.9	12.2	19.5	13.6	5.4	5.7	15.9	5.1	5.8	8.9	9.9	5.5	9.9	13.8	4.9	3.8	8.4	14.5	7.8	7.7
2095	11	8.5	8.4	1.9	19.5	5.1	6.9	9.2	10.1	6.3	19.5	8.0	4.3	8.6	6.5	4.1	8.4	10.5	12.1	11.7	9.4	10.4	9.4	6.9	1.9	11.4	6.7	10.0	3.6
2095	12	5.4	6.3	2.3	15.1	11.7	4.9	5.7	7.8	5.4	8.9	2.3	11.9	3.8	5.8	3.5	4.8	6.6	8.2	5.5	3.2	3.9	9.0	3.1	15.1	4.8	7.5	4.6	3.0
2096	1	6.3	6.6	2.6	12.4	5.2	7.8	4.3	9.5	3.4	6.2	7.6	4.3	5.6	8.8	8.3	8.1	6.4	4.1	4.6	12.4	2.6	8.3	8.0	11.1	8.5	3.2	3.2	6.0
2096	2	4.6	5.1	1.9	11.7	4.7	6.8	7.4	3.6	4.3	3.3	3.3	5.1	3.3	4.2	3.7	5.2	4.7	6.1	3.4	5.3	3.7	7.0	9.2	5.4	1.9	11.7	4.6	4.3
2096	3	6.0	6.5	1.8	20.4	7.4	20.4	4.6	2.8	6.7	2.7	6.9	8.8	4.5	7.1	13.9	5.6	2.9	7.9	5.0	7.7	6.4	7.3	11.8	4.4	1.8	3.0	4.3	3.1
2096	4	6.5	7.4	2.3	14.6	2.3	4.0	9.4	5.4	6.7	4.4	4.8	14.6	13.8	3.0	12.7	14.2	8.2	8.2	11.1	5.0	5.8	5.1	5.4	6.7	9.3	2.5	6.2	7.9
2096	5	10.7	12.4	2.6	28.6	7.2	24.0	7.6	12.1	4.2	4.3	19.6	20.6	17.1	12.0	11.2	23.3	28.6	7.9	2.6	7.8	6.3	4.1	9.3	17.6	18.9	10.3	12.8	7.7
2096	6	11.4	13.8	4.8	33.5	24.5	15.8	26.0	19.7	14.2	10.4	9.2	7.1	12.3	5.1	9.8	6.6	21.0	15.4	6.0	15.2	9.6	14.7	8.1	8.6	26.9	33.5	6.4	4.8
2096	7	14.2	16.5	5.8	50.0	8.3	9.1	7.7	12.2	18.6	9.7	6.3	16.2	10.7	50.0	9.7	24.1	20.9	24.1	5.8	35.3	16.9	12.2	18.8	27.5	9.1	14.7	14.0	14.4
2096	8	11.0	15.9	3.9	59.1	4.8	21.8	10.4	29.5	3.9	13.9	7.1	10.8	12.0	59.1	31.4	6.1	7.3	11.1	23.9	8.0	12.1	7.7	27.3	22.4	8.9	7.5	9.9	25.5
2096	9	12.4	14.3	5.1	36.5	36.5	6.7	11.8	12.7	15.1	7.0	15.1	20.6	31.8	10.0	5.1	5.3	5.6	10.2	12.2	15.1	22.3	8.9	13.7	9.3	25.4	5.8	13.7	23.8
2096	10	8.4	10.1	2.2	21.5	6.7	17.8	4.5	21.5	12.4	11.0	19.5	8.0	8.8	14.1	4.1	7.7	10.5	6.5	4.9	9.0	17.7	7.8	6.3	14.6	7.5	2.2	11.2	8.0
2096	11	7.8	9.6	3.6	21.5	7.9	21.5	5.9	21.0	13.8	11.0	7.8	7.8	7.2	4.0	5.0	19.3	7.8	15.0	7.6	3.6	6.6	6.0	12.7	6.0	10.0	6.8	11.5	5.5
2096	12	6.4	8.2	3.8	22.0	4.0	4.2	9.3	6.3	19.6	5.1	22.0	4.8	9.0	9.2	3.8	4.5	6.5	6.3	6.5	6.0	18.4	4.5	8.5	8.1	4.9	9.2	4.6	11.4
2097	1	4.9	6.1	1.9	23.4	6.7	7.2	7.0	4.8	5.9	5.7	4.7	6.4	11.8	3.2	4.1	2.4	4.9	1.9	11.2	23.4	4.1	2.7	3.1	2.5	9.4	5.9	3.4	4.9
2097	2	5.4	6.5	1.6	27.8	4.3	6.5	4.5	7.0	6.5	7.3	9.4	1.6	4.1	3.0	8.0	8.7	3.6	5.4	27.8	4.8	6.2	4.6	3.8	5.3	9.3	2.1	9.0	2.9
2097	3	5.7	6.5	2.2	14.2	7.4	4.9	7.3	5.9	5.7	6.2	5.0	5.5	10.8	5.0	14.2	2.9	2.2	5.7	8.6	12.6	4.7	2.7	4.0	6.9	6.7	4.5	5.0	10.6
2097	4	8.5	9.1	3.7	19.3	11.5	7.0	10.1	5.2	12.9	5.6	19.3	5.7	5.9	4.7	4.5	17.4	5.0	6.6	8.4	10.9	7.6	3.7	9.1	8.5	14.1	9.0	13.9	10.7
2097	5	9.0	11.8	2.6	26.5	8.2	9.7	8.5	6.7	17.3	9.1	9.0	7.6	25.0	8.8	6.5	9.4	11.7	8.4	17.0	9.0	17.2	8.6	2.6	26.5	15.1	4.9	10.4	26.4
2097	6	15.0	18.5	6.2	62.9	18.7	22.4	62.9	12.2	37.4	7.5	6.9	10.5	27.6	11.0	16.9	6.2	24.6	11.8	15.0	12.6	14.8	17.0	30.3	13.8	14.9	17.4	15.0	16.9
2097	7	11.9	13.7	4.9	35.2	31.4	11.6	9.6	35.2	16.1	17.6	5.0	8.6	12.1	16.4	12.1	5.2	17.4	8.7	4.9	14.1	10.2	6.6	13.4	33.5	8.0	14.0	6.8	10.7
2097	8	11.9	15.9	2.9	53.2	7.0	18.1	19.1	25.0	10.9	36.8	6.0	2.9	53.2	12.0	6.7	8.2	17.5	11.8	5.2	26.6	13.7	5.3	9.9	11.3	24.3	13.6	10.9	25.8
2097	9	14.6	16.1	4.7	31.6	14.1	6.9	6.0	27.9	26.9	31.6	11.4	30.4	11.6	11.2	8.0	5.7	13.7	18.9	16.9	4.7	10.6	16.3	20.7	23.3	23.5	6.8	15.2	23.8
2097	10	9.0	9.4	4.0	16.7	4.0	5.4	10.3	14.3	13.7	12.7	7.7	12.6	4.5	9.7	5.6	16.4	9.4	7.3	12.6	6.4	7.5	6.8	11.6	5.8	10.2	16.7	6.3	8.7
2097	11	8.0	8.2	1.6	16.7	7.5	9.0	12.7	2.5	1.6	11.1	6.1	4.2	16.0	8.8	6.9	3.3	12.0	4.8	7.3	3.0	16.7	13.3	7.6	11.3	8.3	5.3	8.7	9.7
2097	12	7.6	7.9	3.2	14.3	3.3	12.2	9.4	7.3	6.0	10.0	7.7	5.8	5.6	8.2	4.2	12.3	11.4	14.3	3.3	8.1	3.2	12.1	5.9	7.1	6.0	7.8	7.5	11.0
2098	1	5.7	6.1	3.6	12.0	12.0	6.4	5.7	6.6	4.8	4.7	8.4	8.1	5.5	6.7	6.6	5.7	5.3	4.7	4.4	5.7	4.5	4.0	6.7	8.1	7.2	3.6	6.1	4.7
2098	2	6.0	6.2	1.4	19.3	7.9	3.6	5.7	3.7	7.3	1.4	6.5	9.5	6.7	3.3	5.8	4.9	8.2	3.4	8.2	6.5	6.6	3.4	6.2	3.4	10.1	4.1	19.3	4.3
2098	3	5.6	7.5	2.5	14.7	9.5	14.7	11.9	3.7	2.7	3.2	8.9	4.5	12.3	4.9	3.9	12.2	11.3	4.6	8.5	14.6	5.6	5.2	8.7	4.6	10.5	2.5	5.0	5.5
2098	4	5.9	8.3	1.7	17.5	11.7	3.5	5.9	5.8	3.0	17.2	14.1	5.5	16.3	6.2	8.0	4.2	11.1	17.5	5.8	2.3	4.4	14.7	14.5	5.7	13.0	1.7	3.3	4.5
2098	5	12.1	12.1	5.2	22.0	5.2	12.4	6.2	8.9	13.4	7.8	6.8	19.9	13.6	9.8	11.5	16.0	19.4	11.9	13.6	18.4	5.7	5.8	14.2	14.4	13.9	22.0	8.8	10.6
2098	6	16.7	17.3	6.1	34.2	16.3	18.2	17.1	10.2	34.2	22.1	22.3	17.6	6.6	28.2	6.9	15.4	31.8	21.6	9.6	27.2	10.8	17.1	19.1	11.5	6.1	14.5	14.9	16.3
2098	7	10.7	14.3	5.1	44.0	15.3	5.1	9.5	44.0	6.7	21.5	11.5	7.6	12.3	7.9	7.9	8.1	20.4	10.0	5.8	19.9	8.1	21.5	14.3	11.4	8.5	33.6	8.1	23.8
2098	8	12.8	16.9	5.1	77.5	22.2	11.8	11.1	10.7	10.4	18.8	7.6	5.1	15.0	20.8	23.8	19.8	5.5	7.5	14.5	26.4	12.8	7.3	77.5	33.2	6.5	7.3	12.7	17.9
2098	9	15.5	17.2	6.4	47.0	12.3	9.4	15.3	24.9	11.9	47.0	7.0	10.9	19.3	18.6	10.1	18.9	17.8	15.7	19.3	18.6	32.3	12.8	30.5	23.0	11.6	11.1	7.0	6.4
2098	10	8.2	9.2	2.4	17.6	6.5	5.1	9.2	4.4	6.7	6.2	13.5	17.6	6.2	7.5	7.8	2.4	17.1	9.7	4.4	10.0	9.0	9.0	6.9	8.5	15.1	17.2	5.1	15.3
2098	11	10.0	10.1	4.1	19.9	7.2	8.0	12.9	5.7	5.3	18.2	5.7	11.0	10.3	12.2	9.9	4.1	7.2	8.4	19.9	12.3	11.1	10.1	14.2	11.5	8.0	5.6	14.8	8.8
2098	12	7.1	7.3	1.7	16.8	16.8	4.2	7.3	7.4	13.5	4.4	14.3	8.8	4.8	4.1	7.2	4.4	8.6	5.9	3.9	5.8	7.0	8.8	3.1	5.7	8.9	1.7	7.2	12.4
2099	1	4.8	5.5	1.5	18.7	5.5	5.0	6.2	5.1	3.6	3.4	9.5	4.5	1.5	3.4	4.5	9.9	4.3	6.3	5.6	10.0	1.8	4.5	1.9	5.5	6.2	3.1	18.7	3.2
2099	2	5.1	5.9	2.4	12.8	8.6	8.3	7.6	5.5	3.8	5.7	2.4	10.6	7.3	5.2	10.1	2.7	4.8	12.8	3.2	4.8	5.1	7.1	4.4	5.0	6.6	3.9	3.3	3.7
2099	3	5.7	7.0	2.0	20.5	11.0	5.7	4.6	9.1	7.6	9.9	6.8	7.1	5.8	2.6	2.1	4.6	3.4	5.7	19.7	4.7	3.4	5.4	7.8	20.5	11.4	3.6	3.4	2.0
2099	4	5.7	7.3	2.4	17.3	10.0	5.6	15.8	5.3	7.8	4.4	6.3	2.4	3.5	4.9	2.8	12.9	4.7	6.4	9.7	4.7	3.9	17.3	8.7	17.1	2.7	9.1	5.8	4.0
2099	5	10.6	11.4	2.6	45.9	5.1	5.9	12.2	6.2	17.4	17.4	4.5	12.5	10.2	12.9	4.8	6.8	13.8	11.0	11.5	19.6	2.6	4.3	5.9	45.9	16.4	3.9	16.0	6.4
2099	6	12.9	14.6	1.0	49.3	6.5	1.8	15.8	24.6	25.2	13.2	6.4	13.7	11.5	1.0	13.8	24.0	15.8	4.7	12.5	10.0	49.3	8.1	19.5	13.4	26.0	11.0	12.5	9.4
2099	7	16.3	16.4	5.6	32.4	7.8	11.5	23.8	16.8	32.4	13.1	5.6	23.8	17.3	23.2	18.2	9.2	14.3	15.7	12.0	14.1	23.4	19.0	13.2	22.5	18.0	10.9	8.8	19.6
2099	8	13.6	15.8	4.6	38.5	28.7	31.6	7.8	22.4	12.8	12.6	23.7	6.0	9.0	14.9	12.7	9.2	5.3	4.7	38.5	14.1	17.8	19.0	21.5	19.1	13.1	17.5	13.1	4.6
2099	9	15.8	15.7	3.5	35.9	16.0	21.5	9.6	26.8	9.7	19.7	15.5	18.5	7.2	15.8	11.1	7.0	15.7	5.6	5.8	20.7	24.6	35.9	27.6	10.3	22.1	16.9	3.5	10.4
2099	10	8.1	8.2	2.6	17.7	6.0	11.1	2.6	9.9	12.5	4.8	13.5	13.7	7.4	5.6	6.4	8.4	7.9	4.9	3.5	3.9	8.5	8.3	5.6	9.0	10.1	9.3	5.5	17.7
2099	11	9.4	9.8	2.5	22.0	3.2	9.0	6.0	6.3	10.8	10.0	6.9	7.4	5.1	6.8	22.0	6.3	9.2	2.9	15.8	2.5	12.9	14.9	10.3	10.4	11.2	20.0	15.9	9.6
2099	12	5.5	6.0	2.0	10.9	6.6	2.0	5.9	7.9	5.1	5.1	10.9	9.1	3.0	4.2	6.1	10.0	6.0	5.6	5.3	5.4	7.5	4.7	8.8	3.8	8.3	4.7	2.5	4.9
2100	1	5.4	5.4	0.0	11.2	6.7	7.2	7.4	7.4	4.2	9.6		0.0	5.4	4.6	2.9	6.3	3.2	11.2	1.8	1.9	5.2	4.4	6.2	5.9	4.0	4.1	7.0	6.6
2100	2	4.6	4.8	0.0	10.5	2.2	7.4	3.7	6.8	8.1	10.5		0.0	6.2	2.8	5.8	3.4	5.5	9.0	5.1	3.7	2.7	2.7	5.2	1.9	3.8	6.8	4.6	2.4
2100	3	6.4	6.2	0.0	14.9	2.1	4.7	8.9	9.3	3.9	7.8		0.0	4.2	5.8	5.5	6.9	14.9	4.5	10.0	8.6	3.9	7.9	6.4	6.5	7.4	5.2	1.9	6.8
2100	4	5.8	6.5	0.0	19.5	2.5	9.4	19.5	4.3	2.3	6.1		0.0	3.6	4.8	3.6	6.9	5.8	7.0	5.7	9.7	7.6	5.5	10.3	10.8	10.8	8.3	1.2	2.8
2100	5	10.9	10.7	0.0	21.5	9.3	20.7	19.5	13.2	4.0	16.0		0.0	7.5	14.9	7.1	10.9	9.9	11.9	6.6	12.2	12.1	5.5	21.5	4.3	13.6	8.6	4.0	12.6
2100	6	10.3	14.3	0.0	40.0	6.4	8.0	15.2	36.5	9.8	24.2		0.0	19.8	26.2	8.2	10.9	13.6	6.0	9.0	9.4	40.0	23.2	10.5	9.3	8.9	6.6	10.3	15.8
2100	7	12.9	15.9	0.0	34.1	29.4	8.8	19.1	10.5	34.1	18.7		0.0	12.9	17.5	16.7	11.2	9.4	7.9	9.0	23.8	12.0	33.0	11.3	7.3	15.6	26.6	12.4	19.0
2100	8	14.7	15.7	0.0	32.9	19.4	21.4	5.7	23.2	26.9	32.9		0.0	8.8	20.3	7.0	12.9	10.1	9.1	12.0	15.0	14.5	20.6	20.5	9.0	14.7	10.1	16.8	30.4
2100	9	15.9	15.4	0.0	36.9	29.3	8.4	36.9	19.5	12.2	15.9		0.0	24.7	18.7	11.2	22.7	7.1	26.3	3.4	6.8	8.2	17.1	23.5	4.6	10.0	20.8	10.6	17.4
2100	10	7.6	9.5	0.0	19.9	19.9	6.9	5.7	7.6	11.9	12.7		0.0	15.9	9.7	5.9	5.6	13.1	5.5	6.7	6.3	17.4	16.5	15.3	11.2	6.0	6.7	5.4	7.6
2100	11	6.5	7.4	0.0	16.1	16.1	3.5	5.7	7.5	9.9	6.5		0.0	2.3	6.8	9.6	5.2	5.6	9.8	9.8	6.3	4.8	1.9	11.2	6.5	15.1	13.7	7.8	4.5
2100	12	7.6	8.7	0.0	24.7	16.8	7.6	6.5	6.8	6.1	6.3		0.0	5.3	9.4	15.8	7.9	24.7	4.3	7.7	5.0	13.2	5.1	6.0	8.6	8.3	6.2	8.8	12.9

RCP8.5

Day with Daily Precip (mm) … **>1**

						std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d

Year	Month	Median	Mean	Min	Max	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
2011	1	7	7.7	2	18	7	6	2	8	18	4	11	11	6	4	12	5	14	8	4	5	9	7	10	6	4	5	12	6
2011	2	7	7.2	3	13	3	7	12	5	4	6	4	9	9	6	8	6	3	8	6	7	12	13	7	10	4	7	9	8
2011	3	6	6.3	2	14	4	7	8	2	4	3	2	6	8	5	7	7	6	5	5	9	14	6	6	7	6	4	5	14
2011	4	5	5.2	1	14	2	5	5	7	7	3	1	1	4	14	6	11	6	10	8	5	7	1	3	5	2	2	4	5
2011	5	9	8.0	3	13	12	13	4	4	9	9	6	9	3	7	7	10	11	3	8	11	10	3	5	7	12	8	9	13
2011	6	12	11.8	7	18	12	14	11	9	15	12	13	9	10	11	14	12	13	11	8	13	18	11	10	13	15	7	14	7
2011	7	15	15.3	8	22	11	19	18	8	22	10	17	10	20	14	14	19	16	14	11	13	19	13	14	14	20	16	19	16
2011	8	13	12.8	6	21	18	12	14	15	13	6	13	9	16	10	12	11	6	11	10	14	14	16	16	9	21	16	16	10
2011	9	13	11.9	5	20	13	6	15	13	10	8	12	18	9	20	12	8	5	15	13	6	13	10	13	13	15	17	15	6
2011	10	8	8.2	3	13	8	7	6	4	6	13	5	4	13	12	12	8	9	8	9	7	11	6	5	11	9	10	3	10
2011	11	11	10.8	3	19	9	15	11	3	11	13	13	10	9	10	11	19	4	12	15	11	17	8	4	10	9	8	11	15
2011	12	10	9.5	3	14	6	11	13	12	12	10	10	8	11	14	9	3	9	7	11	8	11	6	3	11	11	10	10	12
2012	1	8	7.6	3	13	7	7	8	4	7	6	9	12	8	7	8	9	5	10	4	6	9	13	7	9	8	7	10	3
2012	2	5	6.1	0	14	4	4	7	3	5	8	5	6	0	9	14	5	3	4	10	4	4	8	9	8	6	5	12	3
2012	3	6	5.8	1	12	1	6	12	7	7	8	3	1	4	6	4	9	6	6	3	9	7	3	2	11	7	5	8	5
2012	4	6	5.8	1	9	6	5	8	6	9	3	7	6	7	6	4	7	5	8	7	3	8	8	6	1	3	8	5	4
2012	5	9	9.3	4	18	11	9	5	6	7	10	6	8	18	8	11	10	9	6	10	9	4	12	8	7	12	17	12	9
2012	6	12	12.8	6	19	8	9	18	11	16	10	19	15	12	10	18	13	6	18	13	11	12	16	16	10	9	12	12	13
2012	7	12	12.0	7	21	7	8	15	11	12	15	12	13	11	9	11	12	14	21	8	15	13	8	12	15	8	13	12	14
2012	8	13	12.5	7	16	14	10	14	14	11	12	15	12	15	15	11	14	16	13	13	11	10	13	9	15	15	7	7	13
2012	9	11	11.1	4	18	10	10	16	18	6	11	13	8	12	12	9	5	10	9	9	9	15	11	14	11	16	16	12	4
2012	10	11	10.1	3	17	11	4	11	5	11	17	12	7	8	8	11	3	14	9	14	15	7	12	12	9	10	10	12	11
2012	11	11	11.0	6	18	9	16	13	13	18	14	11	13	15	11	8	7	9	16	6	8	11	9	12	7	7	7	10	13
2012	12	9	9.3	3	18	13	15	13	9	3	11	11	6	5	9	18	12	7	12	5	16	7	4	8	9	4	5	11	10
2013	1	8	8.3	4	13	7	8	6	13	10	7	8	10	10	4	11	8	7	6	8	11	11	5	12	8	7	10	8	5
2013	2	6	6.2	0	13	9	6	5	5	9	4	6	13	7	5	6	3	9	6	7	8	6	7	3	0	8	3	6	8
2013	3	6	6.2	1	13	8	7	13	6	6	9	7	8	3	5	4	9	5	6	1	9	11	2	2	3	10	2	8	5
2013	4	6	5.7	1	11	7	7	9	8	4	4	2	7	2	6	6	5	1	3	7	6	3	11	8	9	5	4	6	6
2013	5	8	7.9	3	12	9	6	9	9	12	7	11	10	8	7	5	9	8	7	9	4	6	7	3	8	10	11	6	8
2013	6	13	12.0	5	21	11	14	13	11	21	16	8	7	14	10	17	16	16	7	6	14	12	14	13	6	5	10	13	14
2013	7	15	14.9	9	22	21	20	19	11	16	9	11	15	12	22	17	15	9	16	21	18	17	11	14	11	10	14	18	10
2013	8	14	13.2	7	19	7	14	11	15	16	16	13	10	13	17	16	13	12	19	14	10	16	10	8	8	17	14	12	15
2013	9	11	11.9	6	20	15	7	7	11	6	8	15	15	17	11	11	15	10	10	13	11	17	11	8	11	20	9	15	13
2013	10	9	9.2	4	21	4	12	16	21	10	6	4	7	11	8	6	9	5	6	12	10	4	9	17	8	12	5	11	7
2013	11	11	10.4	4	17	5	12	17	4	8	8	17	11	8	16	17	8	10	16	13	12	4	9	8	4	11	11	10	11
2013	12	9	9.3	5	15	7	11	10	9	11	6	13	6	5	7	15	10	9	5	6	13	9	10	14	10	12	8	8	8
2014	1	7	7.4	3	14	5	12	5	9	14	7	9	8	6	11	12	5	4	8	5	6	5	5	5	3	10	6	8	9
2014	2	7	7.1	3	13	7	11	8	5	11	3	6	9	7	8	13	8	7	9	5	7	5	7	4	4	6	8	6	6
2014	3	6	6.2	2	12	4	10	7	7	7	7	9	7	12	7	10	4	5	4	5	9	4	5	4	6	5	2	4	4
2014	4	6	5.8	2	10	2	5	9	5	7	3	7	4	5	6	6	5	4	7	10	5	8	9	6	3	6	5	5	7
2014	5	8	8.3	2	17	14	3	5	13	8	2	13	9	13	5	7	7	9	17	4	6	4	7	10	17	9	8	3	6
2014	6	12	11.5	7	16	11	7	11	12	11	7	7	12	14	13	8	13	14	13	15	14	12	14	16	10	13	11	7	10
2014	7	15	15.0	10	22	22	11	14	10	18	15	15	19	11	11	11	15	15	18	15	16	13	21	17	15	14	11	15	17
2014	8	13	12.4	5	19	19	13	14	19	9	10	13	7	11	8	14	15	11	14	5	14	12	14	9	16	9	17	11	14
2014	9	13	13.2	4	20	13	13	9	15	14	4	12	13	16	12	13	13	17	13	13	12	18	6	13	20	17	18	18	5
2014	10	10	10.0	2	21	12	13	9	13	21	2	10	7	9	12	8	10	9	16	13	8	13	8	4	13	8	2	9	12
2014	11	11	10.3	0	18	13	7	10	11	8	10	6	14	8	12	8	7	12	12	18	5	0	16	14	11	16	12	10	8
2014	12	10	9.3	0	16	9	9	10	11	16	12	4	13	8	4	7	13	9	0	7	10	10	8	11	6	9	13	10	15
2015	1	7	7.5	0	19	10	7	6	5	10	6	8	5	9	8	4	10	0	19	9	6	12	10	5	12	7	6	6	1
2015	2	7	7.0	2	13	6	4	3	9	6	5	7	9	11	8	2	6	8	8	13	3	7	8	3	8	9	7	12	6
2015	3	6	5.9	2	10	3	3	6	3	9	3	5	3	10	8	3	3	5	6	9	7	10	2	5	4	9	9	7	9
2015	4	7	6.8	1	11	10	7	7	7	4	8	7	3	6	9	11	8	6	6	6	5	10	9	9	4	6	6	1	7
2015	5	8	8.2	4	15	10	7	4	7	6	4	7	11	12	7	11	11	8	5	4	15	7	8	12	9	5	8	10	8
2015	6	12	11.3	3	22	14	11	22	3	13	6	10	13	19	10	14	8	13	7	6	14	11	13	5	18	12	7	16	7
2015	7	15	14.8	8	24	15	9	11	12	17	10	14	18	17	17	17	18	12	16	15	13	14	24	17	8	15	17	19	9
2015	8	12	11.8	4	22	10	14	16	6	6	11	12	11	14	12	14	12	7	15	12	13	16	8	14	14	4	9	12	22
2015	9	12	12.0	6	19	13	13	9	18	14	6	10	15	19	12	14	16	11	9	13	7	14	11	12	8	11	12	14	6
2015	10	8	8.6	4	16	6	11	4	7	8	5	8	6	5	7	7	13	6	11	10	6	5	14	5	12	16	10	10	14
2015	11	10	10.2	5	16	7	12	16	10	12	12	12	12	9	7	10	10	14	9	5	9	8	16	8	9	12	6	12	8
2015	12	8	7.9	2	14	10	5	8	5	10	7	10	5	9	14	8	8	7	2	2	13	6	10	10	12	5	11	3	10
2016	1	9	8.8	4	15	10	11	8	9	11	9	5	5	10	15	7	4	10	5	7	14	9	8	12	10	9	12	6	6
2016	2	7	7.1	2	16	9	4	15	7	6	16	10	6	3	2	6	6	14	7	7	3	11	7	3	7	2	4	11	5
2016	3	6	6.3	2	13	4	3	5	6	6	10	6	3	4	3	10	10	10	3	10	7	4	9	6	13	6	2	6	6
2016	4	6	5.2	1	9	3	6	7	6	8	7	1	9	4	3	1	3	7	4	9	3	6	7	4	7	7	5	3	4
2016	5	9	7.8	3	16	9	9	10	9	5	4	4	5	8	5	3	10	12	3	4	5	4	12	11	14	10	16	5	10
2016	6	13	12.5	5	19	17	5	14	16	9	6	16	14	12	10	17	17	19	11	13	8	14	11	14	12	11	18	7	10
2016	7	15	14.4	6	21	16	12	17	16	13	6	16	11	14	11	18	19	14	17	18	10	11	17	9	18	21	15	13	14
2016	8	14	13.0	3	20	16	10	15	10	20	15	14	10	8	12	16	14	9	18	8	3	15	11	14	19	13	16	13	13
2016	9	14	13.6	3	26	18	13	11	13	10	23	12	19	19	18	16	5	3	16	16	10	11	15	8	8	16	14	26	7
2016	10	10	9.6	2	19	10	2	6	5	12	19	8	7	10	11	10	7	15	10	16	12	9	12	7	11	5	15	8	4
2016	11	8	9.0	5	17	5	7	7	8	10	9	11	10	7	7	17	8	8	11	10	7	15	8	11	5	11	8	8	8
2016	12	8	8.5	0	15	6	6	9	11	15	4	9	12	7	14	13	5	12	10	6	11	7	0	11	8	8	6	8	7
2017	1	7	7.5	2	14	14	3	8	8	8	10	11	3	6	4	8	7	7	7	2	14	5	3	14	4	9	12	7	7
2017	2	7	6.8	3	10	5	6	7	10	5	7	10	5	6	8	9	6	6	8	10	6	5	7	7	3	9	9	6	4
2017	3	6	6.1	1	14	6	1	5	7	4	4	5	3	6	9	6	11	7	2	8	13	6	6	6	6	14	3	5	4
2017	4	5	6.2	2	15	8	4	5	4	5	6	3	4	11	5	5	7	3	3	12	9	4	7	3	15	9	2	7	7
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2100	9	13	12.4	0	24	22	15	17	17	16	13		0	16	8	10	7	7	14	6	13	7	8	24	16	13	17	13	7
2100	10	10	9.8	0	13	10	10	6	10	12	11		0	10	10	8	13	9	12	9	12	8	9	13	7	9	13	12	12
2100	11	11	10.1	0	17	12	9	17	12	14	15		0	4	8	14	11	11	12	9	9	9	5	15	10	14	5	11	7
2100	12	11	10.5	0	17	11	8	9	9	13	13		0	7	17	9	15	9	12	12	8	16	13	11	5	13	11	10	11

RCP8.5

Day with Daily Precip (mm) ... **>10**

			std	std	std	std	greg	greg	360d	360d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d	365d

Year	Month	Median	Mean	Min	Max	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
2011	1	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	2	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0
2011	3	0	0.2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0
2011	4	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2011	5	0	0.4	0	3	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	3	0	0	1	0	1	0	0	0
2011	6	1	0.8	0	3	1	1	3	0	1	1	0	0	1	2	0	0	1	2	2	0	2	1	0	1	0	0	1	0
2011	7	1	1.5	0	4	2	1	3	0	1	0	3	0	2	2	0	0	1	2	1	1	1	1	4	3	3	4	0	0
2011	8	1	1.0	0	4	1	1	2	1	4	0	0	0	0	2	1	0	0	0	2	0	1	3	3	0	2	1	0	0
2011	9	1	1.4	0	4	2	0	2	3	3	0	2	3	2	1	1	0	1	4	1	1	1	0	1	1	1	0	2	1
2011	10	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0
2011	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2012	2	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0
2012	4	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
2012	5	0	0.5	0	2	0	2	0	0	2	0	0	0	1	1	1	0	0	1	1	0	0	0	0	1	0	2	1	0
2012	6	1	1.0	0	4	0	0	3	1	0	1	1	0	2	0	4	2	1	1	1	1	1	1	3	1	0	0	1	0
2012	7	1	1.3	0	4	0	1	1	0	0	0	3	3	0	1	4	1	4	3	0	0	0	0	2	1	1	4	2	0
2012	8	1	1.0	0	3	1	2	1	0	1	1	3	1	0	2	1	0	1	0	2	0	0	2	1	2	0	1	0	1
2012	9	1	1.3	0	4	0	0	1	2	1	2	3	1	1	1	2	0	0	2	2	1	0	0	0	2	2	4	2	1
2012	10	0	0.2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0
2012	11	0	0.2	0	2	0	0	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2012	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2013	1	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2013	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2013	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	4	0	0.1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2013	5	0	0.4	0	3	0	0	0	0	0	0	0	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	3
2013	6	1	0.9	0	4	0	1	0	1	2	3	0	0	2	1	0	1	1	0	0	3	0	0	1	1	0	0	1	4
2013	7	1	1.5	0	6	4	2	1	0	4	0	2	0	0	3	6	0	1	1	1	1	1	0	3	1	0	1	4	1
2013	8	1	1.3	0	4	0	2	2	1	1	1	2	0	1	4	1	2	0	2	2	2	2	0	0	2	1	0	1	2
2013	9	1	1.1	0	3	2	0	0	0	0	2	0	2	2	1	0	1	1	1	1	0	2	2	0	0	3	3	1	3
2013	10	0	0.2	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2013	11	0	0.3	0	2	0	0	0	0	0	0	2	2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2013	12	0	0.1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2014	1	0	0.2	0	2	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2014	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2014	3	0	0.1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2014	4	0	0.1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
2014	5	1	0.9	0	5	1	0	0	1	1	1	1	0	2	0	0	1	1	3	1	1	1	0	0	5	1	0	0	0
2014	6	1	1.3	0	3	1	0	1	1	1	1	2	1	2	1	0	2	2	2	3	1	1	2	1	0	3	0	1	3
2014	7	2	1.8	0	5	1	1	1	3	2	2	0	3	2	1	1	2	3	5	0	3	2	5	2	0	0	1	1	1
2014	8	1	1.0	0	5	0	0	0	5	0	3	1	0	2	1	2	1	0	0	0	1	1	0	0	3	0	3	0	2
2014	9	1	1.5	0	4	1	1	2	1	3	1	1	1	1	2	1	1	1	0	0	3	4	0	2	2	4	1	2	0
2014	10	0	0.2	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
2014	11	0	0.2	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2	0	0	1	0	0	0
2014	12	0	0.2	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2015	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2015	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2015	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2015	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	5	0	0.6	0	4	0	0	1	1	0	0	0	1	1	2	0	0	0	0	0	1	0	0	1	1	0	0	4	2
2015	6	1	1.2	0	5	3	1	5	0	1	0	3	0	1	1	1	0	1	0	0	0	2	2	0	4	0	0	1	2
2015	7	1	1.5	0	6	6	0	2	1	0	0	1	4	2	0	4	1	0	1	1	1	1	2	0	0	1	3	4	0
2015	8	1	1.2	0	4	1	0	2	1	1	3	2	0	2	1	1	0	1	4	2	0	2	1	1	1	0	0	0	2
2015	9	1	1.3	0	4	2	1	0	2	0	2	2	1	1	2	3	2	0	0	4	0	1	0	0	0	2	3	1	1
2015	10	0	0.2	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
2015	11	0	0.2	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0
2015	12	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	1	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	2	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2016	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2016	4	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0
2016	5	0	0.7	0	4	1	0	1	1	0	0	0	1	0	0	0	1	1	0	0	2	0	0	0	4	0	3	0	1
2016	6	1	1.0	0	4	1	0	1	0	0	0	3	4	2	0	2	1	1	0	2	1	0	0	1	2	2	1	0	0
2016	7	1	1.5	0	4	2	0	1	1	3	1	1	0	0	0	1	1	0	2	2	0	2	4	4	1	3	2	1	3
2016	8	1	1.1	0	4	0	0	1	0	0	3	2	0	0	1	3	2	2	3	1	0	1	1	0	1	4	0	0	2
2016	9	1	1.5	0	6	2	1	1	2	2	3	3	1	2	1	6	0	0	1	1	2	3	1	0	1	1	0	1	1
2016	10	0	0.4	0	3	0	0	0	0	1	0	1	0	1	0	0	0	1	2	0	3	0	0	0	0	0	0	1	0
2016	11	0	0.2	0	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2016	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2017	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2017	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2017	3	0	0.1	0	2	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	4	0	0.3	0	3	0	0	0	0	0	0	0	0	1	0	0	1	0	0	3	0	1	0	0	0	0	0	0	0
2017	5	1	0.7	0	2	0	0	2	1	0	0	0	2	0	1	2	0	1	0	1	0	1	0	1	1	0	1	1	1
2017	6	0	1.1	0	6	0	0	1	0	0	0	2	0	1	0	2	0	0	0	4	6	4	0	5	0	0	0	1	0
2017	7	1	1.9	0	5	1	1	2	1	3	4	0	0	3	1	2	0	1	1	0	1	1	5	2	3	4	5	0	4
2017	8	1	1.5	0	5	4	2	1	1	5	1	1	1	2	2	2	1	1	0	3	1	0	0	2	0	1	4	0	0
2017	9	1	1.0	0	4	2	1	0	0	4	2	0	1	1	0	1	1	0	0	1	2	2	2	1	1	0	1	0	0
2017	10	0	0.5	0	2	2	2	2	0	0	0	0	0	0	2	0	1	0	1	1	0	0	0	0	0	0	1	0	0
2017	11	0	0.2	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
2017	12	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	1	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
2018	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

2018	3	0	0.2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0
2018	4	0	0.2	0	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
2018	5	0	0.3	0	2	0	0	1	0	0	0	0	0	0	0	0	1	2	0	0	0	1	0	0	1	1	0	0	0	0
2018	6	1	0.6	0	3	0	0	0	0	1	2	0	0	0	0	1	1	0	1	0	1	0	3	1	1	0	1	1	1	1
2018	7	1	1.7	0	6	1	0	1	1	0	4	1	0	0	4	2	1	1	1	2	0	4	4	1	6	0	3	2	2	2
2018	8	1	1.3	0	5	1	0	0	0	5	4	1	1	2	3	0	2	0	2	2	0	0	1	2	0	0	0	3	2	2
2018	9	1	1.3	0	3	0	2	1	2	2	0	1	2	1	2	1	2	0	1	1	1	1	1	2	3	0	2	1	1	1
2018	10	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0
2018	11	0	0.2	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0
2018	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
2019	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	3	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2019	4	0	0.4	0	2	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	2	0	2	0	0
2019	5	0	0.7	0	3	2	0	0	0	1	0	1	3	0	0	0	1	0	0	2	0	0	0	2	1	2	0	0	1	0
2019	6	1	1.0	0	2	1	0	1	2	2	2	1	1	2	2	1	0	2	2	1	0	0	1	2	0	0	0	1	1	1
2019	7	1	1.7	0	5	1	0	2	1	2	4	2	1	1	4	1	1	1	0	1	4	1	3	1	1	0	2	5	1	1
2019	8	1	1.3	0	4	0	2	0	1	3	3	1	2	3	0	4	0	0	1	2	0	1	0	1	0	0	0	3	3	3
2019	9	1	1.0	0	5	2	0	3	0	0	0	5	1	3	0	0	1	1	0	1	1	0	1	1	1	1	1	0	1	1
2019	10	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
2019	11	0	0.2	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
2019	12	0	0.1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	2	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2020	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
2020	4	0	0.2	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0
2020	5	1	1.1	0	4	0	0	1	0	1	2	1	1	2	4	2	0	3	0	0	1	0	0	2	0	3	0	1	2	2
2020	6	0	0.7	0	3	1	2	0	0	0	1	0	2	2	0	0	0	3	0	2	3	0	0	0	0	0	0	1	0	0
2020	7	1	1.2	0	4	2	2	0	4	2	0	0	0	0	1	0	1	0	2	0	1	4	3	2	0	1	1	3	0	0
2020	8	1	1.3	0	4	0	0	1	3	1	1	4	1	0	1	2	0	0	1	4	1	0	3	4	0	0	0	2	1	1
2020	9	1	1.4	0	4	0	1	0	1	0	0	0	3	2	2	2	2	2	0	1	2	0	0	4	3	2	1	1	4	4
2020	10	0	0.2	0	2	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	11	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1
2020	12	0	0.1	0	1	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2021	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	3	0	0.2	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0
2021	4	0	0.2	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
2021	5	0	0.3	0	3	0	0	0	0	1	0	2	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
2021	6	1	1.0	0	2	1	2	2	1	0	0	1	1	0	1	2	2	0	0	2	0	0	1	2	1	1	2	1	0	0
2021	7	1	1.6	0	4	0	1	0	4	1	3	3	0	1	0	4	4	1	2	0	1	4	2	1	2	1	0	2	2	2
2021	8	1	1.5	0	4	1	4	0	0	3	1	3	4	3	3	1	4	0	0	0	1	0	2	0	0	1	1	3	1	1
2021	9	1	0.9	0	2	0	1	0	0	0	2	0	2	2	1	0	0	1	0	2	1	0	0	2	0	2	2	2	1	1
2021	10	0	0.1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	11	0	0.3	0	2	0	0	0	0	0	0	0	0	2	1	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0
2021	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
2022	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2022	2	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
2022	3	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	1	0	0	1	0	0
2022	4	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0
2022	5	1	0.9	0	4	1	0	1	1	0	0	0	1	1	1	1	4	2	2	0	1	0	0	0	1	2	2	0	0	0
2022	6	1	1.1	0	4	0	0	3	0	0	0	0	2	3	3	0	4	1	1	0	2	1	0	1	2	0	2	1	0	0
2022	7	1	1.1	0	4	2	0	0	1	0	2	1	1	0	0	0	1	0	0	2	2	0	0	4	1	2	2	2	3	3
2022	8	1	1.8	0	6	1	1	2	0	1	0	1	3	2	6	1	1	2	2	2	4	1	1	2	1	1	2	1	5	5
2022	9	1	1.1	0	5	1	0	0	1	5	1	0	2	2	0	0	2	2	1	2	0	1	0	2	1	1	0	2	1	1
2022	10	0	0.2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1
2022	11	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2023	1	0	0.1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	3	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	4	0	0.2	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
2023	5	0	0.8	0	5	0	0	5	1	0	1	0	3	3	0	1	0	0	0	0	1	0	1	1	0	0	0	1	1	1
2023	6	0	0.6	0	2	1	0	0	0	0	0	1	0	2	1	1	2	0	2	0	0	2	1	1	1	0	0	0	0	0
2023	7	1	1.9	0	6	4	0	1	1	0	3	1	3	5	0	1	1	2	0	2	1	0	2	6	1	6	2	1	2	2
2023	8	1	1.4	0	4	1	3	0	1	2	4	1	0	1	2	2	1	1	1	2	1	0	1	2	3	2	1	1	0	0
2023	9	1	1.2	0	5	0	2	0	1	3	0	0	2	1	2	0	0	0	5	0	3	3	0	0	0	2	2	0	3	3
2023	10	0	0.4	0	3	0	1	0	0	0	0	1	0	1	0	0	3	0	0	2	0	0	0	0	0	0	0	0	1	1
2023	11	0	0.1	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2023	12	0	0.2	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2024	1	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2024	4	0	0.2	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0
2024	5	1	0.9	0	5	2	0	0	0	1	0	0	1	0	5	0	1	1	0	1	0	3	0	2	1	0	2	1	1	1
2024	6	1	1.3	0	5	2	1	1	2	1	0	0	3	2	2	0	1	1	5	1	1	1	1	1	0	1	1	0	2	2
2024	7	1	1.2	0	4	1	4	2	0	2	0	0	0	1	0	3	1	2	2	2	1	3	0	0	1	1	0	2	1	1
2024	8	1	1.1	0	3	1	0	0	2	3	1	2	2	0	2	2	0	0	0	3	0	1	3	1	2	1	1	0	0	0
2024	9	1	1.3	0	3	0	1	3	1	1	0	1	3	1	2	0	1	2	1	1	0	3	1	2	3	1	0	1	2	2
2024	10	0	0.4	0	4	0	0	0	0	4	0	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	0	0	0
2024	11	0	0.1	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2025	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2025	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	4	0	0.3	0	2	0	0	0	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
2025	5	1	0.8	0	3	1	1	0	0	0	1	0	1	1	1	0	0	0	1	1	0	2	0	0	3	2	3	0	1	1
2025	6	0	0.8	0	5	2	0	5	0	2	1	0	0	0	0	0	0	2	0	0	1	2	0	2	0	2	0	0	1	1
2025	7	2	1.9	0	5	1	0	3	4	3	2	3	0	5	5	0	2	3	1	1	2	2	3	1	1	0	0	3	1	1
2025	8	2	1.6	0	4	2	3	0	2	4	3	2	1	0	1	2	0	4	0	2	1	0	4	0	1	2	2	2	2	0
2025	9	1	1.5	0	6	4	0	2	0	2	0	1	1	1	2	5	1	0	0	0	0	3	1	1	6	3	1	1	0	0

2025	10	0	0.2	0	2	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2025	11	0	0.2	0	2	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2025	12	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
2026	1	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	2	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	3	0	0.3	0	3	0	0	0	3	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
2026	4	0	0.1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2026	5	1	0.6	0	2	1	0	0	0	1	2	0	0	0	1	0	2	1	1	1	0	0	0	1	1	1	1	0	0	1
2026	6	1	0.9	0	4	0	1	3	2	2	1	1	0	1	0	0	0	0	0	1	4	0	0	2	2	0	1	0	1	1
2026	7	1	1.3	0	5	0	1	1	0	0	1	1	1	2	1	5	0	0	0	3	1	3	1	3	2	0	2	2	2	2
2026	8	1	1.4	0	3	3	1	2	3	2	1	1	2	1	1	2	0	1	0	2	2	0	1	1	2	1	3	2	0	0
2026	9	1	1.4	0	4	2	4	1	0	1	3	1	2	1	2	2	2	1	1	1	3	0	2	2	0	0	0	1	0	2
2026	10	0	0.2	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	11	0	0.1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	12	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2027	1	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2027	3	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	4	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2027	5	0	0.5	0	2	0	0	0	0	0	2	1	1	0	0	1	1	0	0	1	0	2	0	1	0	0	1	0	0	0
2027	6	1	1.2	0	5	1	4	1	0	1	1	1	2	0	0	3	0	0	1	0	0	2	0	1	3	0	1	2	5	5
2027	7	2	1.7	0	4	2	0	4	4	2	1	1	1	4	0	2	1	2	3	0	2	1	1	2	2	3	1	1	0	0
2027	8	1	1.2	0	5	1	2	1	1	2	2	2	0	1	5	1	1	0	0	0	0	1	1	1	0	1	4	0	1	1
2027	9	1	1.5	0	6	0	2	1	0	1	4	6	3	2	3	1	0	2	2	1	1	0	1	0	1	3	0	1	1	1
2027	10	0	0.3	0	2	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	2	0	1	0	0	0	0	0	0	1
2027	11	0	0.2	0	2	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0
2027	12	0	0.1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	3	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2028	4	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
2028	5	1	0.8	0	3	1	0	0	0	2	2	0	1	1	1	1	3	1	0	0	0	0	1	0	0	1	2	0	1	1
2028	6	1	1.0	0	5	0	1	0	0	1	1	3	0	4	0	5	3	1	0	0	2	0	1	0	0	0	1	1	1	0
2028	7	1	1.5	0	7	1	0	7	1	2	2	3	6	0	4	1	0	1	2	2	0	1	0	0	2	0	1	0	1	1
2028	8	1	1.3	0	5	1	0	0	1	4	2	0	3	1	5	3	0	0	2	1	4	2	0	1	0	0	0	2	0	0
2028	9	1	1.5	0	6	0	0	1	2	3	3	0	3	1	1	0	0	0	2	2	4	0	1	1	4	6	2	1	0	0
2028	10	0	0.3	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	1	0	0	1	0	0	0	0	0
2028	11	0	0.1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2029	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2029	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2029	3	0	0.3	0	2	0	0	0	1	0	1	0	0	0	0	0	1	1	0	2	0	1	0	0	0	0	0	0	0	0
2029	4	0	0.3	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0
2029	5	0	0.5	0	2	0	0	1	1	0	0	0	0	0	2	0	0	0	1	1	0	0	0	1	0	0	1	2	1	1
2029	6	1	1.3	0	4	1	1	0	1	2	1	1	4	4	1	1	1	0	2	0	0	2	1	1	0	1	2	1	2	2
2029	7	1	1.5	0	6	3	2	1	6	1	1	0	2	2	0	2	0	2	3	2	0	1	0	2	1	1	2	0	1	1
2029	8	1	1.3	0	5	0	2	3	1	1	0	5	0	5	1	0	0	3	0	3	1	3	1	0	0	0	0	0	0	1
2029	9	2	1.5	0	4	0	0	1	0	4	3	0	2	2	0	2	2	2	2	4	0	2	0	2	3	0	4	1	0	0
2029	10	0	0.2	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
2029	11	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2029	12	0	0.1	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
2030	2	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
2030	4	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
2030	5	0	0.7	0	4	0	0	1	0	2	1	1	3	0	0	2	0	0	0	0	0	0	0	0	4	0	1	1	1	1
2030	6	1	1.3	0	8	1	1	0	8	0	4	1	0	1	2	1	1	0	2	1	2	2	0	0	0	1	0	2	1	1
2030	7	2	2.4	0	8	0	3	1	5	1	1	1	3	2	2	2	1	2	7	4	3	2	0	8	2	2	3	1	2	2
2030	8	1	1.7	0	5	3	1	3	1	1	2	0	0	1	4	3	1	2	1	1	0	3	4	0	0	0	5	2	3	3
2030	9	1	1.5	0	4	0	3	1	3	1	3	1	4	1	1	0	1	1	0	2	1	0	3	1	1	3	0	4	0	0
2030	10	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2030	11	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	1	0	0	0	0	0
2030	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	1	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	2	0	0.1	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	3	0	0.2	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0
2031	4	0	0.3	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	3	0	0	0	0	0	0	1	0	0
2031	5	0	0.8	0	6	0	0	0	0	0	2	0	1	3	0	0	0	0	2	0	0	1	1	0	2	0	0	1	6	6
2031	6	1	1.3	0	5	2	0	0	2	1	5	1	2	0	0	0	0	1	2	0	3	2	3	3	1	0	2	0	1	1
2031	7	2	2.0	0	5	2	1	4	4	1	2	1	1	0	1	1	5	0	0	4	3	3	2	0	3	1	4	3	3	3
2031	8	1	1.2	0	3	3	0	1	1	2	3	2	1	0	0	1	3	0	2	1	0	1	3	0	2	1	0	1	1	1
2031	9	1	1.4	0	4	2	0	0	4	2	1	2	1	0	3	1	1	1	0	3	2	2	2	2	1	1	0	0	2	2
2031	10	0	0.4	0	2	0	0	0	0	0	0	2	0	2	0	2	0	0	0	1	0	0	0	1	0	0	0	0	0	1
2031	11	0	0.2	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2031	12	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2032	1	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2032	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2032	3	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	4	0	0.2	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
2032	5	0	0.5	0	4	0	0	0	1	0	1	1	2	0	1	0	0	0	0	0	0	0	1	4	0	0	0	0	0	2
2032	6	1	1.2	0	5	1	5	2	1	0	1	3	0	2	2	0	3	1	0	0	1	0	0	1	1	2	2	0	0	0
2032	7	2	2.0	0	11	7	0	0	2	4	1	2	2	3	2	1	2	0	0	0	1	3	3	0	1	11	3	0	0	0
2032	8	1	1.0	0	3	2	1	0	2	2	1	2	0	0	2	1	0	0	0	1	1	1	1	0	3	0	0	2	3	3
2032	9	1	1.6	0	4	1	3	2	2	1	3	0	1	4	1	2	2	1	0	1	0	0	3	4	2	1	0	1	3	3
2032	10	0	0.2	0	2	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
2032	11	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2032	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2033	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2033	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2033	4	0	0.3	0	2	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2	0	0	1	0	0

2033	5	0	0.5	0	3	1	0	1	0	0	0	1	3	0	1	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0
2033	6	1	1.2	0	4	2	1	4	0	0	1	1	1	3	1	2	1	0	3	2	0	0	1	1	1	1	1	1	0	1
2033	7	1	1.7	0	8	2	1	2	8	1	2	0	3	2	4	4	1	0	2	2	0	1	1	1	0	1	1	0	0	2
2033	8	2	1.8	0	4	1	2	0	1	1	4	4	1	2	1	4	0	0	1	2	2	2	2	0	3	1	2	3	3	3
2033	9	1	1.3	0	5	0	1	0	5	3	2	2	0	1	2	5	3	0	0	0	1	1	1	0	2	1	0	1	0	0
2033	10	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
2033	11	0	0.1	0	2	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0
2034	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2034	3	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	4	0	0.1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2034	5	1	0.8	0	3	1	0	1	0	1	2	0	1	3	0	0	0	1	0	0	1	0	2	0	1	2	0	3	1	1
2034	6	1	1.5	0	5	2	0	5	3	1	2	0	3	2	1	0	1	1	2	2	3	2	1	0	0	1	2	0	1	1
2034	7	2	1.7	0	6	3	0	1	2	1	0	4	0	2	1	3	0	4	0	2	1	0	2	2	3	6	0	3	1	1
2034	8	1	1.3	0	5	0	2	4	1	2	3	0	0	1	0	0	0	4	0	0	1	2	1	1	2	0	1	5	0	0
2034	9	2	1.8	0	5	0	2	0	5	3	2	2	1	2	1	4	1	1	0	3	2	1	1	3	0	2	1	2	4	4
2034	10	0	0.4	0	2	0	1	0	0	0	0	0	0	1	1	1	1	1	0	0	2	1	0	0	0	0	0	1	0	0
2034	11	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2034	12	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	1	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2035	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	3	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2035	4	0	0.2	0	2	0	0	2	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	5	1	0.8	0	3	1	0	0	0	3	1	3	1	2	0	0	2	0	0	1	0	0	0	1	1	1	1	0	0	1
2035	6	1	1.5	0	5	2	0	1	4	1	4	0	1	4	0	1	4	1	1	0	0	1	1	3	0	1	2	0	5	5
2035	7	1	1.5	0	5	2	2	2	1	1	1	1	5	1	1	1	1	1	1	0	2	2	2	1	1	2	3	0	1	1
2035	8	2	1.5	0	3	0	2	1	2	1	2	0	0	2	2	2	2	1	1	1	1	0	2	2	3	2	3	2	1	1
2035	9	1	1.3	0	5	3	2	0	0	4	1	2	1	0	1	0	1	1	1	0	0	2	1	0	1	5	4	1	0	0
2035	10	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
2035	11	0	0.3	0	2	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	2	0	0	1	0	0	0	0	0
2035	12	0	0.3	0	1	0	0	1	1	0	1	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0	0
2036	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2036	3	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2036	4	0	0.3	0	2	1	0	0	0	0	2	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2036	5	0	0.5	0	2	2	0	1	0	0	1	1	0	0	0	0	1	2	1	0	0	0	0	1	1	1	1	0	0	1
2036	6	1	1.0	0	5	1	0	0	4	0	0	2	1	0	0	0	0	1	1	0	1	0	2	0	1	5	0	3	1	1
2036	7	1	1.0	0	3	2	1	2	2	2	1	1	3	0	1	0	0	0	0	1	0	0	1	1	1	3	0	1	0	0
2036	8	2	1.7	0	5	3	2	3	2	3	3	0	2	0	4	0	0	2	2	0	4	1	5	1	0	0	2	0	1	1
2036	9	1	1.1	0	3	0	1	0	1	0	2	1	0	3	1	2	0	1	2	0	1	3	2	0	1	0	3	1	1	1
2036	10	0	0.3	0	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	2	0	0	0
2036	11	0	0.1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2036	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	3	0	0.1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2037	4	0	0.3	0	2	0	0	0	1	0	0	1	0	0	0	0	2	0	1	0	0	0	1	0	0	0	0	1	0	0
2037	5	0	0.8	0	5	0	1	2	2	0	1	1	0	2	0	1	0	0	0	1	0	0	0	0	0	2	0	5	2	2
2037	6	1	1.1	0	4	0	1	1	3	2	0	1	1	0	2	0	1	0	0	2	1	1	1	4	1	0	1	0	3	3
2037	7	2	1.9	0	5	2	4	1	2	1	5	0	2	1	5	2	2	3	0	1	2	2	1	1	1	1	5	0	1	1
2037	8	2	2.3	0	6	1	2	0	3	1	5	0	4	5	3	2	3	0	0	1	2	2	4	3	3	2	2	2	6	6
2037	9	1	1.1	0	4	2	0	2	4	1	0	2	0	1	2	1	0	1	1	0	2	3	0	1	0	0	0	1	3	3
2037	10	0	0.5	0	3	0	1	0	0	0	0	1	1	2	3	1	1	0	1	0	2	0	0	0	0	0	0	0	0	0
2037	11	0	0.4	0	2	0	1	0	1	0	2	0	0	1	0	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0
2037	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2038	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2038	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	3	0	0.1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2038	4	0	0.3	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1
2038	5	0	0.6	0	3	3	0	1	1	1	0	0	0	1	0	2	1	0	0	0	1	0	0	0	0	0	1	1	1	1
2038	6	2	1.7	0	4	1	2	3	2	2	1	2	1	0	2	1	2	1	1	1	1	3	1	3	1	2	2	1	4	4
2038	7	2	1.9	0	8	0	0	0	5	2	4	1	1	1	1	4	2	2	0	2	5	3	0	0	2	8	1	2	0	0
2038	8	1	1.1	0	3	2	2	0	0	1	3	0	0	1	2	1	2	0	2	1	1	0	0	2	3	0	0	2	2	2
2038	9	1	1.5	0	6	3	2	2	0	4	2	1	3	0	1	2	1	1	6	1	1	0	1	2	0	0	0	2	1	1
2038	10	0	0.3	0	2	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0
2038	11	0	0.2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
2038	12	0	0.2	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
2039	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0
2039	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	4	0	0.2	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0
2039	5	1	0.8	0	3	1	0	1	1	3	1	0	0	3	0	1	1	0	0	1	1	2	0	0	1	1	0	0	1	1
2039	6	1	1.0	0	3	2	0	0	0	2	1	2	2	1	3	0	1	0	0	2	2	0	0	0	0	3	1	0	1	1
2039	7	2	1.8	0	6	2	0	3	0	6	2	0	2	4	1	0	2	2	0	1	4	1	1	0	0	1	2	6	3	3
2039	8	2	1.6	0	6	0	1	2	0	1	1	2	1	2	6	2	2	0	0	2	2	1	0	2	3	4	0	3	2	2
2039	9	2	1.6	0	3	2	1	1	1	2	3	3	2	1	0	2	2	1	3	2	0	0	1	2	1	3	0	3	3	3
2039	10	0	0.4	0	2	0	1	0	1	0	0	0	0	0	1	2	1	1	0	0	0	0	0	0	2	0	0	0	0	0
2039	11	0	0.1	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2039	12	0	0.2	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
2040	1	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	2	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2040	3	0	0.3	0	2	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0
2040	4	0	0.3	0	2	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
2040	5	0	0.5	0	2	0	0	0	0	1	0	1	0	1	0	1	0	2	0	0	0	0	1	1	0	0	0	2	1	1
2040	6	1	1.4	0	5	3	0	4	1	1	1	0	1	2	2	0	2	0	0	0	0	5	0	3	3	0	5	0	0	0
2040	7	2	2.1	0	5	2	3	5	4	3	1	2	2	0	1	4	3	0	1	2	5	3	0	3	2	1	0	3	0	0
2040	8	1	0.9	0	5	0	2	2	0	1	1	0	2	0	0	1	0	2	0	1	0	1	0	1	2	0	0	1	5	5
2040	9	1	1.4	0	4	0	2	4	1	1	1	1	2	2	1	2	0	0	4	1	3	1	1	3	1	1	0	0	1	1
2040	10	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2040	11	0	0.3	0	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0

2040	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2041	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	2	0	0.1	0	2	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
2041	3	0	0.3	0	3	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	3	0	0	0
2041	4	0	0.2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0
2041	5	0	0.8	0	3	0	1	0	0	0	3	0	2	1	1	0	2	0	1	2	0	0	0	0	2	0	2	0	2
2041	6	1	1.1	0	4	1	4	0	1	1	0	2	1	2	2	0	1	0	2	1	2	0	4	0	0	0	0	1	2
2041	7	2	1.7	0	4	1	2	1	2	2	2	1	3	0	2	0	1	4	3	0	1	0	3	0	0	3	3	3	3
2041	8	1	1.4	0	5	0	1	1	2	1	0	1	4	3	3	5	0	0	0	0	0	2	2	1	3	1	1	1	1
2041	9	0	1.1	0	7	3	0	0	1	0	3	3	7	0	0	2	0	0	0	0	0	0	2	2	0	1	0	2	0
2041	10	0	0.2	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2041	11	0	0.3	0	2	0	0	0	0	1	0	0	0	0	1	1	1	0	0	1	0	0	0	2	0	1	0	0	0
2041	12	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2042	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2042	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
2042	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	4	0	0.3	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0
2042	5	1	0.6	0	3	0	1	1	0	1	3	0	1	1	0	0	0	1	0	0	2	0	0	1	1	1	0	0	1
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2042	8	1	1.5	0	5	0	3	1	0	1	1	1	0	0	1	2	0	0	0	4	4	5	1	5	1	1	1	3	0
2042	9	2	1.9	0	6	0	0	2	5	6	0	2	3	5	3	0	1	1	2	3	0	3	1	0	2	0	2	4	0
2042	10	0	0.3	0	2	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	2	1	1	0	0	0	0
2042	11	0	0.2	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
2042	12	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
2043	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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2043	3	0	0.3	0	3	1	0	0	0	0	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
2043	4	0	0.3	0	2	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2	1	0	0	1	0	0	0	0
2043	5	0	0.5	0	2	0	0	1	0	0	0	2	0	1	1	0	0	0	2	0	1	1	0	0	1	0	1	0	0
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2043	7	2	2.3	0	6	1	0	2	2	2	1	1	1	6	3	3	3	3	0	0	3	1	1	2	6	6	6	2	0
2043	8	2	1.5	0	4	0	3	2	0	2	0	1	1	1	2	1	3	0	2	2	2	0	1	4	2	2	3	2	0
2043	9	1	1.1	0	4	0	2	1	3	2	1	1	4	1	0	0	2	0	1	2	2	0	0	1	2	0	0	1	0
2043	10	0	0.3	0	2	0	2	0	0	0	0	1	0	1	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0
2043	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0
2043	12	0	0.2	0	2	0	1	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2044	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2044	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2044	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
2044	4	0	0.2	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2044	5	1	0.9	0	4	1	0	0	0	4	2	2	1	0	1	2	0	0	1	0	0	0	3	1	1	0	1	0	2
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2044	7	2	1.9	0	6	1	0	3	1	2	2	3	1	2	6	1	2	1	0	0	2	2	1	4	5	1	4	0	2
2044	8	1	1.6	0	6	2	0	3	0	4	3	1	0	1	6	3	0	2	2	1	0	1	2	1	2	1	1	2	1
2044	9	2	1.5	0	4	3	2	2	3	2	0	2	2	0	1	3	2	1	4	1	2	0	1	0	1	3	0	0	0
2044	10	0	0.3	0	1	0	0	0	0	1	0	0	0	1	1	0	0	1	0	1	1	1	0	0	1	0	0	0	0
2044	11	0	0.3	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	0	0	0	1	1	1	0
2044	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045	2	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2045	3	0	0.3	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0
2045	4	0	0.1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2045	5	0	0.7	0	2	0	2	0	0	2	0	0	2	2	1	1	0	0	0	0	0	0	2	1	1	0	0	1	1
2045	6	1	1.1	0	3	3	1	0	2	2	0	2	2	1	2	0	0	1	1	1	0	1	0	1	2	1	2	0	1
2045	7	2	1.7	0	6	3	3	0	6	3	0	1	0	2	2	1	2	2	0	0	0	0	3	3	4	2	1	0	3
2045	8	1	1.7	0	4	0	0	1	1	0	4	3	1	4	1	1	1	1	0	2	3	1	4	4	3	0	4	1	1
2045	9	1	1.2	0	4	2	1	0	1	1	1	1	1	0	1	1	0	2	3	0	3	3	1	0	4	1	0	1	1
2045	10	0	0.3	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	1
2045	11	0	0.2	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0
2045	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	1	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
2046	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2046	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2046	5	0	0.8	0	4	0	0	2	1	0	2	0	3	0	2	0	2	2	0	0	0	0	2	0	4	0	0	0	0
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2046	9	2	1.8	0	5	4	1	2	0	2	4	0	1	2	0	4	0	2	3	1	2	1	3	0	1	2	1	5	3
2046	10	0	0.2	0	1	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2046	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2046	12	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
2047	1	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2047	2	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2047	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
2047	4	0	0.2	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2047	5	0	0.3	0	2	0	1	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2047	6	0	0.8	0	3	1	0	3	0	0	0	0	1	1	0	0	0	1	1	0	3	0	3	1	0	0	2	0	3
2047	7	2	1.5	0	5	2	5	1	2	4	2	1	0	3	1	2	1	1	1	2	2	0	0	1	2	0	0	2	2
2047	8	2	1.6	0	5	0	2	3	1	3	2	2	1	0	5	1	4	1	2	2	0	2	1	2	1	2	1	0	1
2047	9	1	1.5	0	5	0	0	0	0	2	1	4	2	4	2	0	1	2	0	4	1	2	1	1	3	5	0	0	2
2047	10	0	0.4	0	2	0	0	0	1	2	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1
2047	11	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
2047	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2048	1	0	0.1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	2	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2048	3	0	0.1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2048	4	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0
2048	5	1	0.6	0	2	2	1	0	1	0	2	0	0	0	0	1	0	0	1	0	0	1	1	0	1	1	1	0	1
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2048	7	2	2.2	0	8	0	0	2	5	4	0	2	8	0	3	4	0	1	2	2	0	0	2	2	2	6	3	1	3
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2048	9	2	1.5	0	5	0	1	0	2	2	2	2	2	1	3	1	1	2	0	1	3	5	3	0	2	2	1	1	0
2048	10	0	0.5	0	2	0	0	1	0	0	0	0	1	1	0	0	0	0	0	2	2	1	1	0	2	0	0	0	0
2048	11	0	0.4	0	2	0	1	0	0	0	0	2	0	1	0	1	1	0	0	0	0	1	0	0	2	0	0	0	0
2048	12	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2049	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
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2049	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
2049	4	0	0.2	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
2049	5	0	0.6	0	3	0	2	0	1	0	0	0	2	0	1	1	1	0	0	1	1	0	0	0	1	3	0	0	1
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2049	7	1	1.7	0	6	3	2	1	5	0	1	0	1	1	1	2	4	0	1	1	1	0	0	4	6	2	3	0	1
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2049	9	1	1.2	0	3	1	0	1	1	3	1	2	0	3	0	2	2	3	3	0	2	0	0	1	0	0	2	1	0
2049	10	0	0.3	0	3	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	3	0	0	0	0	2	0	0
2049	11	0	0.2	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0
2049	12	0	0.2	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0
2050	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2050	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2050	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2050	4	0	0.2	0	2	0	0	2	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2050	5	0	0.8	0	4	0	0	1	0	0	2	0	1	1	1	1	0	4	0	2	0	0	0	0	2	0	3	0	0
2050	6	1	1.1	0	5	1	0	0	0	0	1	2	2	1	3	1	2	5	3	0	0	0	0	0	2	0	2	0	1
2050	7	0	1.1	0	5	5	1	0	3	4	0	0	3	0	2	0	0	2	0	0	2	0	0	1	0	0	4	0	0
2050	8	1	1.2	0	4	0	3	1	2	1	0	3	4	3	1	0	0	2	2	1	1	2	0	1	0	0	1	0	1
2050	9	1	1.1	0	3	1	0	3	2	0	1	0	2	0	3	3	0	1	1	3	0	1	1	0	2	1	0	1	0
2050	10	1	0.7	0	2	1	0	1	2	2	0	0	1	0	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1
2050	11	0	0.3	0	2	0	0	2	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0
2050	12	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2051	3	0	0.2	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
2051	4	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2051	5	1	0.9	0	3	1	0	3	0	0	1	1	1	2	2	0	1	0	1	2	1	0	0	1	2	0	1	0	1
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2051	7	1	1.3	0	6	2	1	1	2	1	2	6	2	3	2	2	0	0	0	0	2	0	0	2	0	3	0	1	0
2051	8	1	1.2	0	3	3	0	1	1	3	2	0	0	0	3	0	0	1	1	3	1	2	1	2	1	2	0	2	0
2051	9	1	1.3	0	3	2	1	1	1	2	3	0	3	1	0	3	2	0	3	0	0	2	0	0	3	0	1	2	1
2051	10	0	0.3	0	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	2	0	0
2051	11	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
2051	12	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
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2052	3	0	0.2	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
2052	4	0	0.3	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0
2052	5	0	0.6	0	3	0	0	0	0	1	0	2	1	0	1	0	1	0	1	1	2	0	0	0	3	0	0	0	1
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2052	7	1	1.7	0	5	1	1	5	2	1	3	1	1	2	4	1	2	1	1	0	1	1	4	2	1	3	1	1	0
2052	8	2	1.8	0	8	3	0	3	2	2	2	0	1	0	1	2	2	1	8	0	0	3	2	1	0	0	5	2	2
2052	9	1	1.4	0	4	0	2	0	0	3	2	3	3	2	0	3	0	1	0	3	2	1	0	1	2	4	1	0	1
2052	10	0	0.4	0	4	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	4	0	0
2052	11	0	0.3	0	2	0	1	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0
2052	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
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2053	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
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2053	4	0	0.3	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	1	1	0	0	0	0	0	0
2053	5	0	0.7	0	3	0	0	3	0	0	0	0	2	0	0	0	1	0	1	0	0	2	0	2	1	2	3	0	0
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2053	7	2	1.8	0	4	2	4	1	1	0	4	0	1	3	2	0	0	2	0	2	1	3	2	2	3	0	3	4	3
2053	8	1	1.3	0	4	0	1	1	1	2	1	1	0	3	3	2	0	1	1	1	1	2	1	3	4	0	2	1	0
2053	9	1	1.3	0	6	2	1	2	6	1	2	0	1	3	2	0	0	2	0	0	2	2	2	0	0	0	3	0	0
2053	10	0	0.5	0	3	1	0	0	3	2	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	1	2	0
2053	11	0	0.3	0	2	2	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	0	1	0	0
2053	12	0	0.2	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0
2054	1	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2054	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2054	3	0	0.3	0	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	2	0	0
2054	4	0	0.2	0	2	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
2054	5	1	0.8	0	4	0	1	0	1	4	2	3	0	1	1	0	1	1	1	1	0	0	2	0	0	0	0	0	0
2054	6	1	1.1	0	4	3	2	4	1	0	0	0	1	4	0	1	0	0	1	0	2	1	2	0	0	2	3	0	0
2054	7	2	2.3	0	6	6	0	3	1	2	2	1	2	3	4	4	1	2	2	1	1	2	3	3	2	2	2	1	6
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2054	9	1	1.1	0	3	1	0	1	3	0	2	1	2	1	0	1	1	1	2	0	0	3	0	0	2	3	2	0	0
2054	10	0	0.3	0	2	0	0	0	0	0	2	1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0
2054	11	0	0.4	0	3	0	0	0	0	0	0	1	3	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	1
2054	12	0	0.3	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	1	0
2055	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2055	2	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2055	3	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2055	4	0	0.3	0	3	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	3	0	0
2055	5	0	0.7	0	3	1	0	0	0	1	0	1	0	2	0	0	3	2	1	0	0	2	1	0	1	0	0	2	0
2055	6	1	1.1	0	4	1	0	3	0	0	4	1	0	2	3	4	1	2	0	1	0	0	0	0	0	0	1	0	3
2055	7	2	1.7	0	5	1	0	0	5	2	3	2	3	5	1	2	1	4	3	2	1	0	0	0	0	0	2	1	2
2055	8	2	1.4	0	5	1	2	2	1	2	5	1	2	0	0	2	2	2	1	0	2	1	2	1	1	2	0	0	2
2055	9	1	1.3	0	4	1	2	1	2	0	1	1	1	2	2	1	1	2	1	0	3	2	4	0	3	0	2	0	0
2055	10	0	0.3	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	1	1	0	0	1	1	0	0
2055	11	0	0.3	0	2	2	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0
2055	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2056	1	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

2056	2	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2056	3	0	0.3	0	2	0	0	0	0	1	0	0	0	1	0	1	0	2	0	0	0	0	0	0	1	0	1	0	0	0
2056	4	0	0.3	0	2	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0
2056	5	1	1.0	0	3	0	0	0	0	0	0	2	2	2	0	1	2	3	0	1	0	0	0	2	1	1	3	0	1	2
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2056	7	2	2.4	0	10	6	0	0	2	2	0	0	2	4	4	2	1	0	1	0	1	5	3	4	5	5	0	0	0	10
2056	8	1	1.5	0	5	5	2	0	2	1	0	0	1	1	3	3	0	3	1	1	1	3	1	1	1	2	2	2	0	1
2056	9	1	1.3	0	3	2	0	0	3	2	1	2	1	0	1	3	0	2	1	1	3	0	1	2	2	2	0	0	0	1
2056	10	0	0.3	0	2	0	2	1	1	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2056	11	0	0.2	0	1	1	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2056	12	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
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2057	3	0	0.3	0	2	1	0	0	1	2	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0
2057	4	0	0.4	0	2	2	0	0	2	1	0	0	1	1	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0
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2057	6	1	1.1	0	5	1	3	0	0	0	0	0	2	2	3	2	0	0	2	1	2	1	5	0	0	0	1	1	1	1
2057	7	1	1.6	0	6	6	0	3	3	0	0	2	0	3	0	1	3	1	0	0	5	2	2	1	2	1	0	1	2	2
2057	8	2	1.9	0	5	4	2	0	3	0	1	2	1	3	1	1	0	2	3	1	2	1	2	3	1	4	5	2	1	1
2057	9	2	1.5	0	5	3	0	1	3	0	1	0	2	2	2	2	0	0	0	2	0	1	3	5	1	1	3	2	2	2
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2057	11	0	0.2	0	2	2	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2057	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2058	1	0	0.2	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
2058	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2058	3	0	0.2	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0
2058	4	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	1	1	0	0	0	0
2058	5	1	1.1	0	4	0	0	4	2	2	1	0	2	0	1	1	3	2	2	0	2	3	0	0	1	1	0	0	0	0
2058	6	1	1.1	0	4	1	4	0	3	2	1	3	0	2	0	0	1	1	0	1	1	0	1	2	0	0	0	0	0	4
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2058	9	1	1.3	0	5	2	0	0	5	2	0	2	0	1	1	2	2	1	0	3	1	0	2	2	0	0	3	0	0	1
2058	10	0	0.3	0	2	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	2	0	0	0	0	0	0
2058	11	0	0.3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	0	0	1	0	0	0	0	0	1
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2059	6	1	1.5	0	6	2	2	1	2	2	0	1	4	0	3	2	0	0	1	5	1	0	1	2	0	2	6	0	0	0
2059	7	1	1.6	0	4	2	1	0	4	1	3	2	1	2	0	1	0	1	1	1	1	0	2	4	3	3	2	1	2	2
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2059	10	0	0.4	0	2	1	1	0	1	0	1	2	0	0	0	0	2	0	0	0	0	1	0	0	0	0	1	0	0	0
2059	11	0	0.2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2	0	0	0	1	0	0	0	0
2059	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2060	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2060	3	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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2060	8	1	1.5	0	5	2	0	3	4	1	0	0	1	1	0	5	1	3	1	1	4	1	2	2	1	0	0	1	3	3
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2060	10	0	0.3	0	2	2	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0
2060	11	0	0.2	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2060	12	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2061	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
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2061	4	0	0.4	0	3	0	0	1	0	2	1	0	1	0	0	0	1	3	0	0	0	0	0	1	0	0	0	0	0	0
2061	5	1	1.0	0	3	1	1	0	0	0	0	0	2	1	1	1	0	0	1	3	1	1	3	2	1	1	2	0	1	1
2061	6	1	1.4	0	6	2	0	4	1	2	0	2	2	1	0	0	3	1	6	1	4	1	1	1	1	0	0	0	0	0
2061	7	2	1.8	0	5	3	2	1	2	5	2	0	2	3	0	1	0	2	0	1	4	2	2	2	2	0	1	0	5	5
2061	8	2	1.6	0	6	6	0	2	2	2	3	0	0	3	2	3	2	0	0	1	4	0	2	5	0	0	2	0	0	0
2061	9	1	1.3	0	4	0	0	2	0	0	4	1	2	3	1	1	0	1	0	4	1	1	0	2	0	1	3	3	3	2
2061	10	0	0.5	0	2	0	1	0	0	1	1	1	0	1	1	0	0	1	0	0	1	0	1	0	1	2	0	0	0	0
2061	11	0	0.3	0	3	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	1	1	2	0	0	0	0	0
2061	12	0	0.1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2062	1	0	0.2	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2062	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2062	3	0	0.3	0	1	1	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2062	4	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2062	5	1	0.9	0	4	1	0	0	2	0	1	0	4	1	0	0	0	3	0	2	2	0	0	0	1	0	1	2	1	1
2062	6	1	1.0	0	4	0	2	4	2	0	0	2	1	1	3	3	0	0	0	0	0	1	0	1	0	0	1	1	2	2
2062	7	1	1.7	0	7	2	1	3	2	4	1	0	1	2	1	1	2	0	1	0	2	1	4	7	3	0	1	0	2	2
2062	8	1	1.5	0	6	3	3	0	2	1	2	3	0	1	1	1	0	0	0	6	1	2	0	2	3	2	0	1	2	2
2062	9	1	1.5	0	4	2	1	3	1	2	3	1	0	2	2	1	0	0	2	3	1	4	0	2	0	2	1	1	1	1
2062	10	0	0.4	0	2	0	0	0	0	2	0	0	0	1	0	1	0	0	0	2	1	0	0	0	2	0	0	0	0	0
2062	11	0	0.2	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2062	12	0	0.1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2063	1	0	0.2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0
2063	2	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2063	3	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
2063	4	0	0.3	0	2	1	2	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
2063	5	0	0.5	0	3	1	3	1	0	0	0	0	1	0	0	0	2	2	0	0	0	0	0	0	1	0	0	0	0	0
2063	6	1	1.0	0	3	0	1	0	2	0	3	1	1	1	2	1	0	2	1	2	3	0	2	0	0	1	0	0	1	1
2063	7	1	1.5	0	6	1	1	0	6	0	0	1	1	1	2	2	0	1	2	1	1	3	1	3	0	2	5	0	0	3
2063	8	1	1.4	0	7	2	3	0	4	3	1	1	1	0	0	0	1	1	0	3	0	0	2	0	0	1	1	7	2	2

2063	9	1	1.4	0	5	1	0	1	0	1	5	0	1	2	1	4	0	1	2	3	0	2	1	1	1	1	3	2	0
2063	10	0	0.4	0	2	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	1	0	0	2
2063	11	0	0.3	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0
2063	12	0	0.2	0	2	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
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2064	3	0	0.5	0	2	0	1	0	0	1	0	0	2	2	0	0	0	0	1	2	0	0	0	1	0	0	0	1	0
2064	4	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2064	5	0	0.6	0	2	0	0	0	0	2	1	2	1	0	0	1	1	0	0	1	0	1	0	2	0	1	0	1	0
2064	6	1	1.8	0	6	0	1	1	4	3	2	0	0	3	1	1	5	1	2	0	1	1	2	2	1	6	3	1	1
2064	7	2	1.9	0	7	1	0	0	2	2	4	4	0	7	0	1	0	4	0	3	1	0	2	2	2	2	2	5	2
2064	8	1	1.4	0	4	2	3	0	1	0	3	3	0	0	1	0	2	0	0	1	4	1	1	3	2	2	0	3	2
2064	9	1	1.5	0	4	2	1	4	3	2	4	1	0	0	1	2	1	3	1	2	1	1	0	1	0	1	2	2	1
2064	10	0	0.5	0	2	1	0	0	1	0	0	1	0	2	1	0	1	0	0	0	0	0	0	0	2	1	1	0	1
2064	11	0	0.3	0	2	0	1	0	0	0	0	1	1	1	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0
2064	12	0	0.1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	1	0	0.3	0	1	1	0	1	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	1	0
2065	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2065	3	0	0.1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2065	4	0	0.3	0	2	2	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0
2065	5	0	0.6	0	3	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	2	1	2	1	3	1	0	0	0
2065	6	1	1.3	0	4	1	1	0	3	0	0	2	2	1	1	1	1	4	0	2	1	1	1	2	0	2	2	0	4
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2065	8	1	1.3	0	4	0	1	2	1	2	0	2	0	1	2	1	2	2	0	0	2	0	1	3	2	1	0	4	3
2065	9	1	1.4	0	3	0	2	3	1	2	3	1	0	3	1	3	0	1	0	1	2	2	1	1	0	1	0	2	3
2065	10	0	0.4	0	2	0	0	0	1	0	0	2	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	2
2065	11	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
2065	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
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2066	2	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2066	3	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	1	0	0	0	0	0	0	0
2066	4	0	0.3	0	2	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0
2066	5	1	0.9	0	2	0	0	1	2	2	1	2	0	0	0	2	1	2	2	1	1	1	0	0	0	0	1	2	0
2066	6	1	1.4	0	7	1	2	7	2	1	2	2	1	0	0	2	0	3	1	1	0	0	1	1	0	2	1	0	4
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2066	9	2	1.5	0	4	2	2	1	0	1	0	2	1	3	0	2	1	4	2	3	1	0	2	2	2	3	0	0	2
2066	10	0	0.4	0	2	1	1	0	0	0	1	0	0	0	0	0	2	0	0	1	0	0	0	0	2	1	0	0	0
2066	11	0	0.2	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
2066	12	0	0.1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2067	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0
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2067	3	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
2067	4	0	0.2	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
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2067	8	1	1.4	0	3	1	1	3	1	3	0	2	0	3	3	1	0	1	0	0	2	1	1	3	3	0	1	1	2
2067	9	1	1.0	0	4	0	0	0	3	1	4	0	1	0	0	0	2	3	1	0	0	2	2	1	1	0	2	0	1
2067	10	0	0.4	0	3	0	1	0	0	3	1	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	1
2067	11	0	0.3	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0
2067	12	0	0.2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	0	0	0	1	0	0
2068	1	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2068	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	3	0	0.2	0	2	0	1	1	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2068	4	0	0.3	0	2	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	1	0	0	0	0
2068	5	1	1.3	0	4	1	3	2	2	0	4	1	0	2	3	0	0	2	0	1	2	1	1	0	1	1	1	1	3
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2068	8	1	1.7	0	6	3	6	1	1	0	0	1	1	1	3	6	3	0	2	2	1	2	2	0	0	1	0	1	4
2068	9	1	1.6	0	4	0	1	0	2	2	0	3	4	2	1	1	0	1	3	0	1	4	0	4	2	4	2	0	1
2068	10	0	0.5	0	2	1	0	0	0	0	0	1	1	0	1	0	2	0	1	0	0	0	1	0	0	2	0	0	1
2068	11	0	0.4	0	2	0	0	0	1	1	0	0	1	0	0	2	0	0	1	1	1	0	1	0	0	1	0	0	0
2068	12	0	0.1	0	2	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
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2069	2	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2069	3	0	0.2	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2069	4	0	0.5	0	4	0	0	0	0	0	0	1	0	1	0	1	1	0	1	0	0	0	2	0	4	0	0	0	0
2069	5	0	0.8	0	3	1	0	0	1	0	0	3	0	2	0	2	2	2	0	2	1	3	0	0	0	0	0	0	1
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2069	9	1	1.5	0	5	1	0	0	1	3	1	5	2	1	1	2	3	2	1	1	1	1	1	1	1	3	1	2	0
2069	10	0	0.5	0	3	2	0	1	0	0	0	0	1	0	0	0	1	1	1	3	0	0	0	0	0	1	0	0	0
2069	11	0	0.3	0	2	0	0	1	0	0	1	0	0	2	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0
2069	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	1	0	0.2	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
2070	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2070	3	0	0.3	0	2	0	0	0	0	1	0	2	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0
2070	4	0	0.4	0	2	0	0	1	1	2	0	2	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0
2070	5	1	1.0	0	3	1	3	0	0	2	1	2	2	1	1	1	0	0	3	0	0	1	1	2	1	0	0	0	1
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2070	10	0	0.5	0	3	1	2	0	0	1	0	1	0	3	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
2070	11	0	0.3	0	2	0	0	0	0	0	0	1	2	0	0	1	0	0	2	0	1	0	0	0	0	0	0	1	0
2070	12	0	0.2	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	1
2071	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
2071	2	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	3	0	0.3	0	3	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0

2071	4	0	0.3	0	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0
2071	5	1	0.8	0	2	1	1	0	2	1	0	0	0	2	1	0	2	1	0	0	2	0	2	1	0	0	0	2	0
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2071	8	0	1.3	0	6	6	3	0	0	2	1	0	0	0	0	0	1	5	0	0	0	3	1	4	0	0	1	3	0
2071	9	2	1.8	0	5	3	1	0	1	2	4	2	1	3	0	0	4	1	2	5	1	3	2	3	2	1	0	0	1
2071	10	1	0.8	0	2	1	2	0	0	2	1	2	0	1	0	0	0	0	0	0	2	0	2	2	0	2	2	1	0
2071	11	0	0.3	0	2	0	0	0	1	0	0	1	2	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0
2071	12	0	0.4	0	2	1	1	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	1	0	0	1	1	0	1
2072	1	0	0.2	0	2	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0
2072	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2072	3	0	0.3	0	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
2072	4	0	0.3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	2	1	0	0
2072	5	0	0.8	0	3	3	0	3	1	1	0	3	1	0	1	0	0	0	0	1	1	0	0	0	2	0	0	0	1
2072	6	1	1.5	0	4	0	1	3	1	2	1	3	2	1	2	1	0	1	0	1	1	2	2	4	0	1	4	2	0
2072	7	1	1.5	0	5	3	2	0	5	3	5	1	1	3	0	1	0	1	0	0	3	2	2	0	1	0	2	1	0
2072	8	2	1.7	0	5	1	1	2	1	2	1	2	2	0	0	1	2	2	1	0	3	1	3	5	2	0	2	3	3
2072	9	1	1.3	0	5	4	0	0	0	1	1	3	5	1	1	1	1	2	1	1	2	2	1	1	2	2	0	0	0
2072	10	1	0.6	0	2	1	1	0	0	1	1	0	1	0	0	1	2	1	1	1	0	0	0	1	1	0	2	0	0
2072	11	0	0.4	0	2	1	1	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	1
2072	12	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2073	1	0	0.2	0	2	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2	0	0	0	0	0
2073	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2073	3	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
2073	4	0	0.3	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	0	1	0	1	0
2073	5	0	0.8	0	3	0	2	3	1	0	2	1	0	0	0	3	2	1	0	1	0	0	0	0	3	1	0	0	0
2073	6	1	0.9	0	2	2	0	1	0	1	0	1	0	1	1	2	0	0	0	0	1	2	0	1	2	2	2	0	2
2073	7	1	1.8	0	5	5	2	0	1	3	2	0	0	1	0	4	0	1	3	0	1	2	3	5	0	5	1	2	1
2073	8	1	1.3	0	5	1	0	5	0	3	0	1	0	1	4	0	1	1	1	1	3	0	1	2	1	3	1	1	1
2073	9	2	2.0	0	6	0	1	1	2	3	3	5	4	6	2	0	0	2	1	2	1	2	1	3	1	3	2	1	2
2073	10	1	0.6	0	2	1	0	1	1	0	1	2	0	1	1	1	2	0	0	1	0	0	1	0	0	1	0	0	0
2073	11	0	0.3	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0
2073	12	0	0.1	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	1	0	0.3	0	2	0	1	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0
2074	2	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1
2074	3	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
2074	4	0	0.5	0	3	0	1	1	0	0	0	0	0	0	0	0	2	2	3	1	0	0	0	0	0	1	0	0	0
2074	5	1	0.8	0	4	0	0	4	2	0	1	1	1	0	0	1	0	1	0	0	0	0	3	1	0	0	1	2	1
2074	6	1	1.1	0	5	1	1	2	0	1	0	0	1	5	0	0	0	1	1	3	1	2	5	1	0	0	1	0	1
2074	7	2	1.7	0	5	3	0	2	0	2	1	1	1	2	3	3	0	2	2	1	2	0	5	0	0	3	3	1	3
2074	8	1	1.3	0	4	2	2	1	0	3	1	1	2	1	2	0	0	0	2	0	0	0	3	4	0	3	0	3	1
2074	9	2	1.9	0	5	1	4	0	4	1	3	1	1	5	2	2	1	0	0	3	5	3	2	0	0	1	3	2	1
2074	10	0	0.4	0	2	0	0	0	1	1	0	2	1	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0
2074	11	0	0.2	0	2	0	0	0	0	0	2	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2074	12	0	0.2	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2075	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
2075	2	0	0.1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	3	0	0.2	0	2	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
2075	4	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
2075	5	0	0.7	0	4	0	0	3	0	0	2	0	1	4	0	1	2	3	0	0	0	0	0	1	0	0	0	0	0
2075	6	1	1.1	0	4	1	1	1	1	1	3	0	0	4	0	0	0	1	1	1	1	2	1	3	0	0	1	0	3
2075	7	1	1.7	0	5	2	2	3	0	5	1	2	3	2	1	4	1	2	1	1	4	1	1	1	0	0	2	1	0
2075	8	1	1.2	0	4	2	4	2	2	2	2	0	0	2	0	4	0	1	1	0	0	0	0	2	0	0	2	2	0
2075	9	1	1.6	0	5	5	2	1	2	4	1	5	1	0	0	2	1	0	1	1	3	0	4	1	1	3	0	1	0
2075	10	0	0.3	0	2	0	0	0	0	0	2	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	0	2
2075	11	0	0.2	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0
2075	12	0	0.1	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2076	1	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	1	0	1	0	0	0
2076	2	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2076	3	0	0.3	0	2	0	0	0	0	2	0	0	0	2	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
2076	4	0	0.4	0	3	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0	3	0	0	1	0	1	0	0	0
2076	5	1	0.6	0	2	0	1	1	0	0	1	1	1	2	0	0	1	1	0	0	2	2	0	1	0	0	0	1	0
2076	6	1	1.2	0	4	2	0	3	4	1	1	0	3	2	0	0	2	3	0	2	0	0	0	1	2	1	0	1	0
2076	7	1	1.2	0	5	2	2	5	1	1	0	0	2	0	0	2	0	1	0	2	0	2	4	2	2	0	0	0	0
2076	8	1	1.3	0	4	3	2	3	1	2	1	0	0	1	2	0	0	1	1	0	2	1	4	0	1	2	1	4	0
2076	9	2	1.8	0	6	2	1	3	2	3	6	2	3	2	1	2	0	1	0	0	3	4	0	0	0	3	1	0	4
2076	10	0	0.5	0	3	3	0	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
2076	11	0	0.4	0	2	1	0	0	0	1	0	0	1	0	0	1	0	0	0	2	0	1	1	0	0	0	0	0	1
2076	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	1	0	0.2	0	2	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0
2077	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	3	0	0.2	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
2077	4	0	0.3	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	2	0	1	1	0
2077	5	0	0.5	0	3	1	0	0	0	0	1	0	2	0	0	1	1	0	1	0	1	1	0	0	1	0	0	0	3
2077	6	1	0.9	0	3	0	2	0	1	3	0	1	1	0	2	0	0	0	0	0	3	1	1	1	0	2	3	0	0
2077	7	1	1.3	0	4	3	0	0	4	3	0	1	1	2	3	1	1	1	1	0	0	1	1	2	1	2	2	2	0
2077	8	1	1.3	0	3	3	3	1	2	0	1	0	2	3	1	3	2	0	0	0	0	1	1	0	1	1	3	0	2
2077	9	1	1.5	0	4	3	0	2	1	3	0	3	1	4	1	2	1	2	2	0	3	2	1	1	0	3	1	0	0
2077	10	0	0.3	0	2	1	0	0	0	2	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
2077	11	0	0.3	0	2	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	0	2	0	0	0
2077	12	0	0.1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2078	1	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	3	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
2078	4	0	0.3	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	1	0	0	0	0	0	0	2	0
2078	5	1	1.2	0	4	1	0	0	1	4	0	2	1	4	0	0	0	1	2	1	2	1	1	0	2	1	0	1	3
2078	6	1	1.6	0	5	0	0	1	0	0	2	0	0	2	2	5	3	3	1	1	4	1	0	4	2	1	5	0	2
2078	7	2	1.7	0	5	1	0	2	2	5	4	1	0	3	3	2	2	1	0	2	2	1	2	3	0	0	2	0	3
2078	8	1	1.3	0	6	1	0	2	1	3	3	0	0	0	0	6	0	2	1	1	2	2	2	0	0	0	3	2	1
2078	9	2	1.8	0	6	6	0	3	2	0	0	2	1	3	2	0	2	1	1	1	4	2	2	2	2	0	3	1	2
2078	10	0	0.5	0	2	1	2	0	0	2	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	1	0	1

2078	11	0	0.5	0	2	0	0	0	2	2	0	1	0	0	0	2	0	1	0	0	2	0	0	1	0	0	0	0	0	0
2078	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	1	0	0.2	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2079	2	0	0.2	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2079	3	0	0.1	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2079	4	0	0.3	0	1	1	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0
2079	5	0	0.4	0	2	0	1	0	0	0	0	0	0	0	1	0	0	0	2	1	1	0	0	1	1	0	0	0	0	2
2079	6	1	1.0	0	5	1	3	1	0	2	2	0	0	3	0	1	1	0	0	1	1	1	0	1	1	0	0	0	0	5
2079	7	2	1.9	0	5	3	2	5	0	4	5	0	0	5	1	2	2	3	3	0	2	2	0	2	2	1	0	2	0	0
2079	8	1	1.2	0	4	0	3	2	3	1	1	0	0	0	1	4	1	1	2	0	2	0	0	3	2	1	1	0	0	0
2079	9	2	2.2	0	5	1	3	2	3	4	2	1	2	1	0	1	1	3	3	1	1	4	2	2	5	3	1	1	1	5
2079	10	0	0.2	0	2	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2079	11	0	0.4	0	1	1	0	0	0	0	0	1	1	1	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0
2079	12	0	0.1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2080	1	0	0.1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	2	0	0.3	0	1	1	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1
2080	3	0	0.3	0	2	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2	0	0	1	1	0	0
2080	4	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	2	0	0
2080	5	1	1.3	0	4	2	1	1	1	1	3	1	1	0	0	4	2	2	0	1	1	1	1	2	0	3	0	0	3	0
2080	6	1	0.9	0	4	2	2	4	2	1	0	0	0	2	1	1	1	0	0	1	1	1	0	0	0	0	2	0	1	0
2080	7	1	1.3	0	3	1	1	0	1	2	0	0	2	2	2	0	2	1	1	0	2	3	0	2	1	2	2	2	1	0
2080	8	1	1.4	0	4	3	0	1	2	1	0	3	0	0	4	1	1	0	0	1	3	2	3	3	2	0	0	2	1	0
2080	9	1	1.4	0	4	3	0	3	3	0	0	1	3	0	4	0	0	0	0	2	3	3	2	3	1	2	1	0	0	0
2080	10	0	0.4	0	2	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	1	2	0	1	0	0	1	0	0	0
2080	11	0	0.5	0	2	0	1	0	0	1	0	1	0	1	0	2	0	1	2	0	1	0	0	0	0	0	1	0	1	1
2080	12	0	0.1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2081	1	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
2081	2	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	3	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
2081	4	0	0.2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0
2081	5	1	1.0	0	5	1	1	3	2	1	1	1	1	1	5	1	0	1	0	0	0	1	2	0	2	0	0	0	0	0
2081	6	1	1.0	0	3	1	0	2	1	3	1	1	2	3	0	0	1	1	0	0	2	0	2	1	1	2	1	0	0	0
2081	7	2	1.6	0	4	3	4	0	2	3	2	0	2	3	2	1	0	4	0	3	2	0	0	3	2	0	0	2	1	1
2081	8	1	0.9	0	4	2	0	0	1	0	3	0	0	0	0	3	0	1	0	0	1	1	2	4	1	0	1	1	0	0
2081	9	1	1.8	0	5	4	2	3	4	2	1	5	0	3	0	1	1	0	1	5	0	0	1	4	2	0	1	2	0	0
2081	10	0	0.3	0	2	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	2	0	0
2081	11	0	0.3	0	2	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	2	0	0	1	0	1	1
2081	12	0	0.2	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0
2082	1	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
2082	2	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	3	0	0.3	0	1	1	0	0	1	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0
2082	4	0	0.4	0	2	0	0	0	1	2	0	0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	0	0
2082	5	0	0.6	0	3	0	0	0	1	2	0	0	0	0	3	0	0	1	2	0	1	0	0	1	0	0	1	2	0	0
2082	6	1	1.3	0	5	0	0	3	1	0	1	2	1	5	0	2	0	1	2	1	2	0	2	2	3	1	1	0	0	0
2082	7	2	2.1	0	8	8	0	2	6	4	0	2	2	0	3	1	1	0	1	1	1	1	4	3	1	0	3	3	4	0
2082	8	1	1.4	0	5	0	3	0	4	2	1	0	0	3	0	0	0	0	5	3	0	1	3	2	0	3	2	1	1	0
2082	9	1	1.3	0	3	2	1	1	1	2	3	2	1	0	0	1	1	0	0	1	3	2	2	1	2	0	3	0	2	0
2082	10	0	0.6	0	2	2	0	0	1	1	1	1	1	0	0	0	2	0	0	1	1	0	0	2	0	0	1	0	0	0
2082	11	0	0.5	0	3	3	0	2	2	0	0	1	1	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
2082	12	0	0.3	0	2	0	0	1	0	1	0	0	0	0	0	0	0	2	1	1	0	0	1	0	0	0	0	0	0	0
2083	1	0	0.3	0	2	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	2	0	0	0	2	0
2083	2	0	0.0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	3	0	0.3	0	2	0	0	2	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0
2083	4	0	0.3	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	1	1
2083	5	0	0.7	0	2	2	0	1	0	2	0	2	0	0	2	0	0	0	1	1	1	0	0	0	0	1	0	1	2	2
2083	6	1	1.8	0	5	1	1	1	5	1	3	0	2	5	2	1	1	0	2	1	1	3	1	1	1	3	3	0	3	3
2083	7	1	1.3	0	5	5	0	2	2	3	1	0	1	1	2	1	0	0	5	1	1	1	0	2	1	2	0	0	0	0
2083	8	1	1.3	0	6	1	1	1	2	2	1	0	1	1	3	1	0	0	2	0	0	3	0	6	0	2	1	1	1	1
2083	9	1	1.7	0	5	3	3	0	2	5	1	1	3	0	2	0	0	1	3	3	0	1	1	0	4	1	4	1	1	1
2083	10	0	0.5	0	3	0	3	0	2	0	0	0	0	0	0	1	0	1	1	3	0	0	0	0	0	0	0	1	1	1
2083	11	0	0.3	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
2083	12	0	0.3	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0
2084	1	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0
2084	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	3	0	0.2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
2084	4	0	0.3	0	2	0	1	0	0	0	0	1	0	0	0	1	0	2	0	0	0	0	0	2	0	0	0	0	0	0
2084	5	1	1.0	0	3	3	0	1	0	1	0	1	3	0	2	1	1	3	1	0	1	0	0	3	0	1	0	0	1	1
2084	6	1	1.3	0	3	3	0	1	3	0	3	0	1	1	1	0	0	1	3	1	2	0	2	2	1	2	3	1	1	1
2084	7	2	1.8	0	6	0	1	2	1	3	1	2	2	0	2	0	0	2	2	4	2	1	1	6	2	4	1	4	0	0
2084	8	1	1.6	0	5	0	2	4	5	2	0	4	0	1	3	0	0	1	0	1	2	1	2	0	1	3	4	1	2	2
2084	9	1	1.3	0	5	0	0	0	3	2	1	1	0	2	3	1	1	3	0	0	1	5	1	2	1	1	2	0	1	1
2084	10	1	0.7	0	3	1	0	1	0	0	1	0	2	0	3	0	1	0	0	1	0	1	0	1	1	1	2	0	0	0
2084	11	0	0.6	0	3	0	1	0	0	1	0	2	1	0	0	1	0	1	0	0	0	2	3	1	0	0	1	0	0	0
2084	12	0	0.3	0	2	0	0	0	0	0	0	2	0	0	0	1	0	1	0	0	0	2	0	0	0	0	0	0	0	0
2085	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0
2085	2	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	3	0	0.3	0	2	0	0	0	0	1	0	0	2	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0
2085	4	0	0.4	0	2	0	0	1	0	0	0	0	1	1	0	2	0	0	1	0	0	0	0	1	1	1	0	0	0	0
2085	5	1	1.0	0	3	2	0	1	0	0	0	1	1	0	3	0	2	0	2	0	2	1	1	1	3	0	3	1	0	0
2085	6	1	1.2	0	4	3	1	1	1	0	0	0	0	3	4	2	0	1	1	0	2	0	1	1	1	1	2	2	2	2
2085	7	1	1.4	0	3	1	0	2	3	1	1	2	3	2	1	3	0	0	2	1	0	3	2	1	0	1	3	1	0	0
2085	8	1	1.3	0	4	1	0	2	3	2	1	0	0	0	1	1	1	2	1	1	1	2	0	4	1	2	4	1	0	0
2085	9	1	1.4	0	5	1	1	0	1	0	3	1	0	2	2	2	1	3	0	1	1	3	0	5	1	3	0	2	1	1
2085	10	1	0.8	0	3	1	1	2	0	1	0	3	0	0	1	0	0	3	1	1	0	1	1	0	2	1	1	0	0	0
2085	11	0	0.3	0	2	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	2
2085	12	0	0.2	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
2086	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2086	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2086	3	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2086	4	0	0.3	0	2	0	0	0	0	0	2	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	1
2086	5	0	0.4	0	2	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	1	2	0	0	0	1	0	1	1

2086	6	1	1.1	0	4	1	1	1	0	2	0	1	0	2	3	2	0	4	1	2	1	1	1	2	0	0	1	1	0
2086	7	1	1.5	0	6	4	3	3	0	0	1	0	1	2	6	1	0	2	2	2	1	0	0	4	0	2	1	1	1
2086	8	1	1.2	0	5	0	0	1	3	1	5	0	0	2	0	1	0	2	1	2	0	1	1	2	0	0	2	1	3
2086	9	1	1.5	0	5	2	2	2	1	0	1	1	1	3	1	5	1	2	1	3	2	1	0	1	2	0	0	1	2
2086	10	0	0.5	0	4	0	1	1	0	1	0	0	4	0	0	0	2	0	0	0	1	1	0	0	1	0	0	0	1
2086	11	1	0.6	0	3	1	0	0	1	0	1	1	3	1	0	0	1	0	0	0	0	0	0	1	0	1	1	1	1
2086	12	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2087	1	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2087	2	0	0.2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	0
2087	3	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0
2087	4	0	0.3	0	2	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0
2087	5	1	1.4	0	5	1	2	3	0	1	2	1	0	2	5	0	1	0	0	0	1	2	0	1	1	5	1	1	4
2087	6	1	1.1	0	3	1	1	3	0	0	1	1	0	1	2	3	0	1	2	2	0	1	0	1	1	0	2	1	2
2087	7	1	1.5	0	5	2	2	3	3	3	0	1	0	2	0	1	0	5	0	1	0	1	0	1	0	4	2	2	4
2087	8	1	1.3	0	4	1	3	1	2	2	0	4	0	2	2	2	0	0	1	1	2	2	1	3	1	0	0	1	0
2087	9	2	1.8	0	6	2	1	3	3	2	0	2	6	2	2	3	0	1	0	1	0	0	3	1	1	0	6	2	1
2087	10	0	0.3	0	1	1	1	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0
2087	11	0	0.6	0	3	0	1	0	0	1	0	1	2	0	0	0	0	0	0	3	1	1	2	1	1	0	0	0	0
2087	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
2088	1	0	0.2	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
2088	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2088	3	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2088	4	0	0.4	0	2	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	2	1
2088	5	1	0.9	0	3	0	0	0	0	0	0	0	2	3	1	2	2	1	1	1	2	1	0	2	1	0	1	2	0
2088	6	1	1.1	0	7	1	7	1	0	0	0	1	1	1	1	0	2	1	1	0	2	0	1	2	0	1	2	0	2
2088	7	2	2.0	0	5	5	3	3	4	0	3	0	0	2	4	3	1	5	1	2	2	0	1	2	0	1	2	0	3
2088	8	1	1.4	0	5	4	3	0	5	1	1	0	2	0	3	1	0	2	2	0	2	2	0	2	1	0	0	1	1
2088	9	2	1.6	0	4	1	0	4	2	2	4	3	4	3	4	0	0	0	2	1	0	2	1	0	1	0	3	2	0
2088	10	0	0.5	0	2	1	1	0	0	1	0	1	1	0	1	0	0	0	0	1	1	2	0	0	0	2	0	0	0
2088	11	0	0.6	0	3	1	0	1	2	1	0	0	3	0	0	0	0	0	0	1	0	1	1	1	0	0	1	0	1
2088	12	0	0.2	0	1	0	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
2089	1	0	0.2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0
2089	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2089	3	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	2	0
2089	4	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2089	5	1	0.8	0	4	1	0	1	0	0	0	1	0	3	0	4	1	0	0	2	1	0	1	0	0	1	1	1	0
2089	6	0	0.9	0	6	0	0	0	6	2	0	0	1	1	2	2	1	1	0	0	0	2	2	0	0	0	0	0	2
2089	7	1	1.2	0	5	0	1	1	1	1	1	0	2	3	1	1	0	0	2	1	1	1	1	0	5	2	2	0	1
2089	8	1	1.1	0	4	0	0	3	1	0	2	1	1	1	2	1	0	1	0	1	4	2	2	1	0	0	1	1	1
2089	9	1	1.8	0	5	2	0	0	3	1	2	0	1	1	2	1	1	2	4	1	1	1	1	4	5	1	2	1	5
2089	10	0	0.5	0	2	0	0	0	1	0	0	0	0	0	0	2	0	1	1	1	1	0	0	0	1	1	0	0	2
2089	11	0	0.3	0	2	0	0	1	0	0	2	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0
2089	12	0	0.2	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0
2090	1	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2090	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2090	3	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2090	4	0	0.4	0	2	2	1	0	1	0	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0
2090	5	1	1.1	0	4	1	2	1	0	2	0	1	2	4	1	0	2	3	0	0	2	0	0	1	1	0	2	0	1
2090	6	1	1.4	0	4	2	2	3	1	0	2	0	2	0	2	1	0	0	1	0	3	4	2	1	0	1	1	2	3
2090	7	1	0.9	0	2	2	0	2	1	0	0	1	1	1	0	1	2	1	1	2	0	1	2	0	0	0	2	0	1
2090	8	1	1.3	0	5	0	1	1	0	3	1	0	2	2	5	3	1	1	0	1	3	2	0	4	0	0	0	0	0
2090	9	2	1.9	0	6	6	0	3	2	2	1	1	3	2	1	1	1	0	3	2	2	3	3	0	1	1	3	1	4
2090	10	0	0.6	0	3	1	0	1	1	1	1	0	0	3	0	0	0	1	0	2	0	0	0	1	0	0	0	1	1
2090	11	0	0.5	0	2	0	0	0	0	0	1	0	0	2	0	0	1	2	0	0	0	2	1	1	0	1	0	0	0
2090	12	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1
2091	1	0	0.2	0	2	0	0	0	1	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2091	2	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2091	3	0	0.3	0	3	1	0	3	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0
2091	4	0	0.3	0	1	0	0	0	1	1	0	0	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0
2091	5	0	0.6	0	3	1	0	0	1	3	0	1	0	0	2	0	0	0	0	2	0	0	1	1	0	1	1	0	1
2091	6	1	1.0	0	5	0	4	1	2	2	2	0	1	0	0	1	0	0	1	1	2	1	0	0	2	5	0	0	0
2091	7	1	1.5	0	5	1	1	2	2	1	0	1	1	1	5	2	0	2	2	1	1	3	1	4	0	2	1	0	1
2091	8	1	1.4	0	5	2	1	1	1	1	1	0	2	1	5	3	0	2	1	3	3	1	3	1	0	0	0	0	2
2091	9	1	1.3	0	4	4	1	0	2	2	2	0	1	2	1	2	0	1	0	1	0	1	3	0	1	0	3	0	4
2091	10	0	0.7	0	3	1	0	0	1	1	0	3	1	1	0	0	2	2	0	0	0	2	0	0	0	1	0	1	0
2091	11	0	0.3	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0
2091	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2092	1	0	0.2	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
2092	2	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2092	3	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
2092	4	0	0.3	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0
2092	5	1	1.2	0	4	0	0	2	2	1	1	1	1	0	2	4	0	1	2	3	1	1	0	1	1	3	1	0	1
2092	6	1	1.5	0	5	3	0	2	1	2	1	0	0	3	4	0	1	0	1	2	2	0	0	4	1	2	5	1	1
2092	7	2	1.9	0	5	5	2	2	2	3	0	2	2	4	3	1	1	2	0	0	1	3	3	1	0	2	0	1	5
2092	8	1	1.2	0	4	0	1	0	0	0	3	2	0	2	2	1	0	1	1	1	1	2	0	2	0	2	4	2	1
2092	9	2	1.9	0	5	1	3	0	1	3	0	3	2	1	3	2	1	0	1	4	1	0	1	3	5	2	2	2	4
2092	10	0	0.5	0	2	0	0	0	0	2	0	0	0	1	0	0	1	0	0	1	2	1	1	2	0	1	1	0	0
2092	11	0	0.5	0	2	0	2	0	0	1	0	0	0	0	0	0	2	1	1	1	0	1	0	1	0	0	2	1	0
2092	12	0	0.3	0	2	0	0	0	1	0	1	0	0	0	2	0	0	1	1	0	1	0	0	0	0	0	0	0	0
2093	1	0	0.3	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0
2093	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2093	3	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
2093	4	0	0.6	0	4	3	0	1	0	0	0	1	0	2	1	0	1	2	0	0	0	0	0	0	0	4	0	0	0
2093	5	1	1.0	0	4	1	0	3	0	2	1	3	2	3	0	0	0	0	1	0	0	4	1	0	1	1	2	0	0
2093	6	1	1.4	0	5	5	1	5	0	1	0	0	3	1	0	1	0	1	0	3	2	0	2	3	1	2	1	1	0
2093	7	2	1.6	0	4	3	2	4	4	1	0	0	1	0	0	0	0	4	3	0	1	2	0	2	2	2	4	0	3
2093	8	1	1.2	0	4	1	2	1	3	1	0	2	0	1	0	2	1	2	0	0	1	0	1	4	2	1	1	1	1
2093	9	1	1.2	0	4	1	0	0	1	1	2	3	2	1	3	2	1	0	1	0	0	0	0	0	3	3	4	0	0
2093	10	0	0.4	0	2	2	0	0	1	0	0	0	1	1	0	1	0	0	1	0	0	2	1	0	0	0	0	0	0
2093	11	0	0.4	0	3	0	0	0	1	0	3	0	0	0	0	0	1	0	1	0	0	1	1	0	1	0	0	0	0
2093	12	0	0.4	0	2	1	0	0	1	0	0	0	1	0	2	1	1	0	0	0	0	0	0	0	1	0	1	1	0

2094	1	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	2	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2094	3	0	0.2	0	1	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0
2094	4	0	0.3	0	2	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	1	0	1	0	0	1	0	0
2094	5	1	0.8	0	3	2	0	0	0	0	1	0	2	1	0	0	1	3	0	2	0	2	1	1	0	1	1	1	0
2094	6	1	1.3	0	4	1	4	3	1	3	0	1	1	4	1	0	0	0	0	1	2	3	0	4	1	0	0	0	0
2094	7	1	1.7	0	6	1	1	3	1	3	2	0	1	1	3	2	0	1	2	0	0	1	1	5	4	1	1	0	6
2094	8	1	1.1	0	5	1	1	0	0	1	0	0	1	1	2	2	3	0	1	0	2	2	2	5	0	0	3	0	0
2094	9	2	1.8	0	6	1	0	1	3	3	6	2	0	3	3	3	0	2	3	3	0	2	2	0	0	0	3	0	2
2094	10	0	0.5	0	3	0	1	0	0	2	0	0	3	0	0	0	0	0	2	1	1	1	0	0	0	0	1	0	1
2094	11	0	0.4	0	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	1	0	1	0	0	1
2094	12	0	0.1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
2095	1	0	0.3	0	2	0	1	0	0	0	0	0	0	0	1	0	2	0	0	1	0	0	1	0	0	0	1	1	0
2095	2	0	0.2	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
2095	3	0	0.2	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
2095	4	0	0.3	0	2	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	1	0	0	0	0
2095	5	1	1.1	0	4	1	0	2	0	1	2	0	2	0	0	1	3	4	1	0	0	0	2	1	0	2	1	1	2
2095	6	2	1.9	0	4	0	4	3	0	3	3	2	4	1	2	1	2	4	3	0	3	3	0	1	1	1	1	2	1
2095	7	1	1.5	0	7	1	7	1	0	1	1	0	2	1	3	1	0	2	0	0	3	1	1	0	3	4	3	0	0
2095	8	1	1.3	0	4	1	3	2	0	2	4	0	0	1	2	0	1	0	0	0	2	0	1	4	2	1	3	0	3
2095	9	1	1.7	0	4	1	1	3	0	4	2	1	1	1	0	4	1	3	1	4	2	1	0	2	1	3	0	2	2
2095	10	0	0.5	0	3	2	1	0	0	1	2	3	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0
2095	11	0	0.3	0	2	0	0	0	1	0	1	0	0	0	0	0	0	1	1	2	0	1	0	0	0	1	0	0	0
2095	12	0	0.1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2096	1	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
2096	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2096	3	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
2096	4	0	0.3	0	2	0	0	0	0	0	0	0	1	2	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0
2096	5	1	0.7	0	3	0	1	0	1	0	0	2	1	1	1	1	1	1	0	0	0	0	0	0	1	3	1	1	0
2096	6	1	1.3	0	4	3	4	3	4	1	1	0	0	4	0	0	0	1	2	0	1	0	1	0	0	3	4	0	0
2096	7	2	1.4	0	4	0	0	0	3	2	0	0	1	2	3	0	2	2	2	0	3	1	2	4	3	0	1	2	1
2096	8	1	1.6	0	7	0	6	1	2	0	1	0	1	3	1	5	0	0	1	3	0	3	0	2	2	0	0	0	7
2096	9	1	1.4	0	5	4	0	1	2	1	0	5	2	3	1	0	0	0	1	1	1	1	0	2	0	4	0	1	3
2096	10	0	0.8	0	3	0	1	0	3	3	1	3	0	0	1	0	0	1	0	0	0	2	0	0	2	0	0	1	0
2096	11	0	0.3	0	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0
2096	12	0	0.3	0	3	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
2097	1	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
2097	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2097	3	0	0.2	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
2097	4	0	0.4	0	1	1	0	1	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1
2097	5	0	0.6	0	3	0	0	0	0	1	0	0	0	3	0	0	0	1	0	2	0	2	0	0	1	2	0	1	2
2097	6	1	1.6	0	8	2	3	8	1	1	0	0	1	3	1	1	0	1	1	1	2	1	2	2	2	1	1	2	1
2097	7	1	1.2	0	6	6	1	0	4	1	3	0	0	1	1	1	0	1	0	0	2	1	0	1	3	0	1	0	1
2097	8	1	1.2	0	4	0	2	4	1	2	4	0	0	1	2	0	0	1	1	0	2	1	0	0	1	1	3	1	1
2097	9	2	1.6	0	5	1	0	0	2	2	3	2	2	1	2	0	0	1	3	3	0	1	4	5	3	1	0	2	1
2097	10	0	0.4	0	1	0	0	1	1	1	1	0	1	0	0	0	1	0	0	1	0	0	0	1	0	1	1	0	0
2097	11	0	0.4	0	2	0	0	1	0	0	1	0	0	2	0	0	0	1	0	0	0	1	2	0	1	0	0	0	0
2097	12	0	0.4	0	2	0	2	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	2	0	0	0	0	0	1
2098	1	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	2	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2098	3	0	0.3	0	1	0	1	1	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0
2098	4	0	0.5	0	2	1	0	0	0	0	2	2	0	2	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0
2098	5	1	1.1	0	4	0	1	0	0	2	0	0	3	1	0	1	1	2	1	1	4	0	0	2	2	1	3	0	2
2098	6	1	1.6	0	4	2	1	3	2	1	1	1	1	0	4	0	1	4	2	0	2	1	2	4	1	0	1	1	3
2098	7	1	1.3	0	5	2	0	0	5	0	2	1	0	2	0	0	0	2	0	0	2	0	4	2	1	0	5	0	3
2098	8	2	1.5	0	4	3	1	1	2	1	3	0	0	2	3	2	2	0	0	4	2	1	0	3	3	0	0	2	1
2098	9	2	1.7	0	4	1	0	1	4	1	3	0	2	2	2	1	1	3	2	3	1	3	1	4	3	2	1	0	0
2098	10	0	0.4	0	3	0	0	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	1	3	0	1
2098	11	1	0.8	0	3	0	0	1	0	0	1	0	1	1	2	0	0	0	0	3	2	2	1	1	1	0	0	2	0
2098	12	0	0.2	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2099	1	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
2099	2	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
2099	3	0	0.2	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	0	0	0
2099	4	0	0.4	0	4	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	4	0	0	0	0
2099	5	1	0.9	0	3	0	0	2	0	1	3	0	2	1	2	0	0	1	1	1	3	0	0	0	2	1	0	1	0
2099	6	1	1.5	0	5	0	0	5	4	2	1	0	2	2	0	2	2	1	0	1	0	4	0	3	2	2	1	1	0
2099	7	2	1.8	0	5	0	1	5	2	3	1	0	1	3	3	1	0	1	2	1	1	2	4	3	2	4	1	0	3
2099	8	1	1.4	0	5	4	1	0	5	1	2	3	0	0	1	2	0	0	0	2	1	3	2	3	1	1	1	1	0
2099	9	2	1.7	0	4	2	3	0	3	0	3	3	2	0	2	1	0	1	0	0	3	4	3	4	1	2	3	0	1
2099	10	0	0.4	0	2	0	1	0	0	2	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
2099	11	0	0.5	0	2	0	0	0	0	1	1	0	0	0	0	1	0	0	0	2	0	1	1	1	1	1	1	1	0
2099	12	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2100	1	0	0.0	0	1	0	0	0	0	0	0		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2100	2	0	0.0	0	1	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	3	0	0.1	0	2	0	0	0	0	0	0		0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0
2100	4	0	0.2	0	1	0	0	1	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
2100	5	1	0.8	0	3	0	2	1	1	0	2		0	0	2	0	1	0	2	0	1	1	0	1	0	3	0	0	1
2100	6	1	0.9	0	4	0	0	1	3	0	1		0	2	3	0	1	1	0	0	0	4	1	1	0	0	0	1	2
2100	7	2	2.3	0	6	5	0	5	1	5	3		0	3	6	5	1	0	0	0	2	2	2	2	0	2	5	2	3
2100	8	1	1.6	0	5	3	2	0	3	3	5		0	0	4	0	1	1	0	1	3	1	1	2	0	1	1	2	3
2100	9	1	1.2	0	3	3	0	2	3	1	3		0	2	1	1	1	0	2	0	0	0	1	2	0	0	1	1	3
2100	10	0	0.4	0	2	1	0	0	0	2	1		0	1	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0
2100	11	0	0.2	0	1	1	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0
2100	12	0	0.3	0	2	1	0	0	0	0	0		0	0	0	1	0	2	0	0	0	1	0	0	0	0	0	0	1

RCP8.5

Day with Daily Precip (mm) … **>25**

std std std std greg greg 360d 360d 365d 365d 365d 365d 365d 365d 365d 365d 365d 365d 365d 365d 365d 365d 365d 365d

Year	Month	Median	Mean	Min	Max	pr MIROC-ESM historical rcp85 (kg m-2 d-1)	pr MIROC-ESM-CHEM historical rcp85 (kg m-2 d-1)	pr CNRM-CM5 historical rcp85 (kg m-2 d-1)	pr MRI-CGCM3 historical rcp85 (kg m-2 d-1)	pr MPI-ESM-MR historical rcp85 (kg m-2 d-1)	pr MPI-ESM-LR historical rcp85 (kg m-2 d-1)	pr HadGEM2-ES historical rcp85 (kg m-2 d-1)	pr HadGEM2-AO historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1-m historical rcp85 (kg m-2 d-1)	pr FGOALS-g2 historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-MR historical rcp85 (kg m-2 d-1)	pr GFDL-CM3 historical rcp85 (kg m-2 d-1)	pr CESM1-CAM5 historical rcp85 (kg m-2 d-1)	pr CanESM2 historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2G historical rcp85 (kg m-2 d-1)	pr IPSL-CM5A-LR historical rcp85 (kg m-2 d-1)	pr MIROC5 historical rcp85 (kg m-2 d-1)	pr bcc-csm1-1 historical rcp85 (kg m-2 d-1)	pr NorESM1-M historical rcp85 (kg m-2 d-1)	pr BNU-ESM historical rcp85 (kg m-2 d-1)	pr NorESM1-ME historical rcp85 (kg m-2 d-1)	pr GFDL-ESM2M historical rcp85 (kg m-2 d-1)	pr CCSM4 historical rcp85 (kg m-2 d-1)	pr CSIRO-Mk3-6-0 historical rcp85 (kg m-2 d-1)
2011	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	7	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2011	8	0	0.1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
2011	9	0	0.2	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2011	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2012	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	7	0	0.2	0	2	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	2	0	0
2012	8	0	0.2	0	2	0	0	0	0	1	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
2012	9	0	0.2	0	2	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
2012	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2013	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	6	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2013	7	0	0.3	0	2	2	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0
2013	8	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
2013	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2013	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2014	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2014	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2014	6	0	0.2	0	2	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0	1
2014	7	0	0.3	0	3	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	3	1	0	0	0	0	0
2014	8	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2014	9	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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2014	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	6	0	0.2	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
2015	7	0	0.2	0	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2015	8	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0
2015	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2015	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2016	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	6	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2016	7	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
2016	8	0	0.2	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0
2016	9	0	0.1	0	2	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2017	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2017	7	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
2017	8	0	0.3	0	3	1	0	0	0	1	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0
2017	9	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2018	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2018	7	0	0.2	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	0
2018	8	0	0.2	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0
2018	9	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2018	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	7	0	0.0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	8	0	0.2	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0
2019	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	6	0	0.1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2020	7	0	0.3	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	0	1	2	0
2020	8	0	0.2	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
2020	9	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
2020	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
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2021	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
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2022	9	0	0.3	0	2	0	0	0	1	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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2022	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2023	7	0	0.4	0	3	2	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0
2023	8	0	0.2	0	2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0
2023	9	0	0.1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2023	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023	12	0	0.1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2024	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2024	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2024	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2025	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2025	7	0	0.3	0	2	0	0	1	2	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2025	8	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2025	9	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0

2025	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2026	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2027	7	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
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2027	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2027	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2028	8	0	0.2	0	2	0	0	0	0	2	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2028	9	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2028	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2029	6	0	0.1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2029	7	0	0.1	0	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2029	8	0	0.4	0	2	0	2	2	0	0	0	1	0	0	1	0	0	2	0	0	0	1	0	0	0	0	0	0	1
2029	9	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2029	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2029	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2029	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2031	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2031	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2032	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2032	7	0	0.2	0	2	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
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2032	9	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2032	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2032	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2033	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2033	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	6	0	0.2	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0
2033	7	0	0.1	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	8	0	0.0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	9	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
2033	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2033	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	6	0	0.2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0
2034	7	0	0.2	0	1	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0
2034	8	0	0.1	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2034	9	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2034	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2034	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2035	7	0	0.1	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	8	0	0.2	0	1	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
2035	9	0	0.1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2035	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2035	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2036	6	0	0.2	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0
2036	7	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
2036	8	0	0.3	0	3	0	0	0	0	1	3	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
2036	9	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
2036	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2036	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	7	0	0.3	0	2	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0
2037	8	0	0.3	0	2	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0
2037	9	0	0.1	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
2037	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2037	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	5	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	6	0	0.2	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2038	7	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	8	0	0.0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2038	9	0	0.2	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
2038	10	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2038	11	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2038	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2039	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	5	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	6	0	0.2	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
2039	7	0	0.2	0	2	0	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2039	8	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2039	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2039	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	6	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2040	7	0	0.2	0	2	0	0	2	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2040	8	0	0.1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
2040	9	0	0.3	0	2	0	2	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2040	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2040	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	6	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2041	7	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
2041	8	0	0.3	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	1	0	0	0	0
2041	9	0	0.2	0	3	1	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2041	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2042	6	0	0.2	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0
2042	7	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
2042	8	0	0.2	0	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0
2042	9	0	0.2	0	2	0	0	0	1	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2042	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	7	0	0.6	0	3	0	0	0	0	1	0	0	0	3	1	0	0	0	0	0	2	0	0	1	3	3	0	0	0
2043	8	0	0.2	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2043	9	0	0.2	0	2	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2043	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2043	12	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2044	8	0	0.2	0	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2044	9	0	0.1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2044	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2048	8	0	0.3	0	2	0	0	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	0	1	0	0	0	0	2
2048	9	0	0.1	0	2	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
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2049	10	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2049	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2050	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2050	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2051	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2063	7	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
2063	8	0	0.3	0	2	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1

2063	9	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2064	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2064	7	0	0.3	0	2	0	0	0	0	0	1	2	0	2	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
2064	8	0	0.2	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0
2064	9	0	0.1	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2064	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2064	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2064	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	6	0	0.2	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
2065	7	0	0.2	0	1	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2065	8	0	0.2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0
2065	9	0	0.2	0	1	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2065	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2065	11	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2065	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2066	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2066	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2066	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2066	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2066	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
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2066	7	0	0.2	0	1	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
2066	8	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
2066	9	0	0.2	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
2066	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2066	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2066	12	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2067	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
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2067	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2067	8	0	0.3	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	1	1	0	0	0	1
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2067	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2067	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2067	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
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2068	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	6	0	0.1	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	7	0	0.3	0	2	0	0	0	0	1	1	0	0	0	0	2	0	0	2	1	0	0	0	0	0	0	0	0	0
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2068	9	0	0.2	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
2068	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2068	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2069	9	0	0.2	0	1	0	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
2069	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2069	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	5	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
2070	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
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2070	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2070	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2071	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2071	6	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	7	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
2071	8	0	0.2	0	2	1	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2071	9	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
2071	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2071	12	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2072	6	0	0.2	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0
2072	7	0	0.2	0	2	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2072	8	0	0.2	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
2072	9	0	0.2	0	1	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2072	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2072	12	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2073	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	5	0	0.1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2073	6	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	7	0	0.2	0	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
2073	8	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0
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2073	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2073	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2074	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	5	0	0.1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2074	6	0	0.2	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0
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2074	8	0	0.2	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
2074	9	0	0.3	0	2	0	0	0	2	1	1	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
2074	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2074	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	6	0	0.2	0	2	0	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
2075	7	0	0.3	0	2	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	2	1	0	0	0	0	0	0	0
2075	8	0	0.3	0	2	0	1	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	1	1	0
2075	9	0	0.3	0	3	3	1	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2075	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2075	12	0	0.0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	5	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	6	0	0.1	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	7	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	8	0	0.1	0	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	9	0	0.5	0	3	0	0	1	1	1	1	0	3	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
2076	10	0	0.0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2076	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2077	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	6	0	0.2	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0
2077	7	0	0.1	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	8	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
2077	9	0	0.1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
2077	10	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2077	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	3	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2078	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2078	6	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
2078	7	0	0.2	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2078	8	0	0.2	0	2	0	0	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2078	9	0	0.2	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
2078	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2078	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2078	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2079	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2079	7	0	0.3	0	2	0	0	1	0	0	1	0	0	2	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0
2079	8	0	0.3	0	2	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0
2079	9	0	0.2	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
2079	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2079	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	5	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2080	6	0	0.1	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	7	0	0.1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
2080	8	0	0.2	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0
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2080	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2080	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2081	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	5	0	0.0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	6	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2081	7	0	0.1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2081	8	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
2081	9	0	0.3	0	3	3	0	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2081	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2081	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	6	0	0.1	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
2082	7	0	0.4	0	3	2	0	1	1	1	0	0	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	0	0
2082	8	0	0.3	0	3	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
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2082	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2082	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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2083	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2083	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2083	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2084	7	0	0.3	0	2	0	0	1	0	1	0	0	0	0	2	0	0	0	1	0	1	1	0	0	0	1	0	0	0
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2084	9	0	0.0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2084	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	1	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2085	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2085	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2085	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2085	7	0	0.3	0	2	1	0	0	0	0	1	2	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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2085	9	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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2086	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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2090	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2091	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2091	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2092	8	0	0.1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
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2092	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2092	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2093	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2093	12	0	0.0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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2094	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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2095	9	0	0.2	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
2095	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2095	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2096	6	0	0.2	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0
2096	7	0	0.2	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	2	0	0	0	0
2096	8	0	0.3	0	2	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	1	0	0	0	0	1
2096	9	0	0.2	0	2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2096	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2096	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	2	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2097	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	5	0	0.1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
2097	6	0	0.2	0	2	0	0	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2097	7	0	0.1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2097	8	0	0.3	0	2	0	0	0	1	0	2	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
2097	9	0	0.2	0	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2097	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2097	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	5	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	6	0	0.2	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2098	7	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
2098	8	0	0.2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0
2098	9	0	0.1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
2098	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2098	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	1	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	2	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	3	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	4	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	5	0	0.0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2099	6	0	0.1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
2099	7	0	0.1	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	8	0	0.1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2099	9	0	0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
2099	10	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	11	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2099	12	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	1	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	2	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	3	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	4	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	5	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	6	0	0.1	0	1	0	0	0	1	0	0		0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2100	7	0	0.2	0	1	1	0	0	0	1	0		0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
2100	8	0	0.1	0	1	0	0	0	0	1	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2100	9	0	0.1	0	1	1	0	1	0	0	0		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2100	10	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	11	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100	12	0	0.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	456.63	350.88	529.13									
01/01/1951 0:00	1951	453.21	363.29	544.16									
01/01/1952 0:00	1952	469.66	371.13	542.38									
01/01/1953 0:00	1953	478.35	366.13	555.68									
01/01/1954 0:00	1954	447.61	356.03	558.78									
01/01/1955 0:00	1955	463.19	398.76	539.22									
01/01/1956 0:00	1956	442.14	376.96	513.03									
01/01/1957 0:00	1957	460.35	394.28	515.95									
01/01/1958 0:00	1958	467.84	379.81	544.97									
01/01/1959 0:00	1959	443.52	389.29	592.81									
01/01/1960 0:00	1960	457.44	369.09	524.69									
01/01/1961 0:00	1961	470	394.92	546.37									
01/01/1962 0:00	1962	461.88	390.14	543.81									
01/01/1963 0:00	1963	491.89	337.52	566.47									
01/01/1964 0:00	1964	448.16	382.84	586.2									
01/01/1965 0:00	1965	437.66	355.5	534.85									
01/01/1966 0:00	1966	414.02	368.76	536.97									
01/01/1967 0:00	1967	441.26	377.94	523.53									
01/01/1968 0:00	1968	455.84	386.86	538.82									
01/01/1969 0:00	1969	438.98	366.21	517.22									
01/01/1970 0:00	1970	423.98	384.85	532.14									
01/01/1971 0:00	1971	456.3	398.87	543.39									
01/01/1972 0:00	1972	462.53	374.43	520.99									
01/01/1973 0:00	1973	433.34	378.33	559.13									
01/01/1974 0:00	1974	443.03	391.29	522.66									
01/01/1975 0:00	1975	437.69	357.44	494.08									
01/01/1976 0:00	1976	448.03	389.13	511.31									
01/01/1977 0:00	1977	447.09	359.41	531.65									
01/01/1978 0:00	1978	437.55	347.05	540.7									
01/01/1979 0:00	1979	456.27	345.94	523.45									
01/01/1980 0:00	1980	457.82	384.08	555.46									
01/01/1981 0:00	1981	452.71	380.42	502.52									
01/01/1982 0:00	1982	460.08	372.76	537.83									
01/01/1983 0:00	1983	455.55	389.06	526.56									
01/01/1984 0:00	1984	438.11	346.56	540.82									
01/01/1985 0:00	1985	431.28	376.5	497.96									

01/01/1986 0:00	1986	463.04	406.31	534.05									
01/01/1987 0:00	1987	446.91	329.72	558.1									
01/01/1988 0:00	1988	434.65	364.3	513.34									
01/01/1989 0:00	1989	456.69	385.04	551.37									
01/01/1990 0:00	1990	468.53	396.63	560.28									
01/01/1991 0:00	1991	454.76	391.39	513.87									
01/01/1992 0:00	1992	445.37	369.61	529.26									
01/01/1993 0:00	1993	440.59	360.87	569.81									
01/01/1994 0:00	1994	467.05	383.77	551.24									
01/01/1995 0:00	1995	456.19	403.09	573.42									
01/01/1996 0:00	1996	446.06	388.58	521.38									
01/01/1997 0:00	1997	447.9	384.59	519.44									
01/01/1998 0:00	1998	439.47	371.83	499.62									
01/01/1999 0:00	1999	447.78	381.42	504.9									
01/01/2000 0:00	2000	470.61	373.43	530									
01/01/2001 0:00	2001	460.51	409.79	567.33									
01/01/2002 0:00	2002	466.48	367.23	538.81									
01/01/2003 0:00	2003	475.8	403.58	553.67									
01/01/2004 0:00	2004	455.66	400.55	576.63									
01/01/2005 0:00	2005	475.85	380.86	549.48	475.85	380.86	549.48	475.53	380.4	548.53	476.85	380.24	547.57
01/01/2006 0:00	2006				457.05	357.88	569.14	478.17	351.72	548.89	487.05	410.58	575.06
01/01/2007 0:00	2007				451.03	387.07	567.84	470.79	380.74	525.13	469.32	387.97	565.31
01/01/2008 0:00	2008				471.26	404.9	586.1	499.28	383.06	590.38	460.86	382.31	556.26
01/01/2009 0:00	2009				482.41	400.27	576.06	465.46	395.16	590.61	478.94	342.32	589.96
01/01/2010 0:00	2010				468.82	409.88	531.99	454.51	350.2	567.76	473.31	402.15	559.09
01/01/2011 0:00	2011				469.65	400.87	555.86	468.25	394.41	557.5	448.86	395.96	531.74
01/01/2012 0:00	2012				471.01	368.06	568.69	474.05	375.87	582.54	429.7	385.25	607.07
01/01/2013 0:00	2013				471.95	387.99	561.12	488.8	384.03	530.36	470.23	396.9	518.57
01/01/2014 0:00	2014				490.31	404.02	574.33	472.09	414.56	527.01	493.73	412.35	586.48
01/01/2015 0:00	2015				459.65	399.25	543.66	462.63	384.47	552.72	455.74	376.84	519.95
01/01/2016 0:00	2016				451.23	376.45	586.08	480.12	386.4	554.32	498.21	398.22	541.54
01/01/2017 0:00	2017				470.87	382.29	603.72	457.6	382.62	575.61	485.62	349.58	600.36
01/01/2018 0:00	2018				484.05	396.01	571.85	450.77	373.06	543.9	445.5	385.07	560.82
01/01/2019 0:00	2019				436.06	373.33	582.33	436.81	372.59	484.15	456.32	373.34	556.22
01/01/2020 0:00	2020				524.98	403.6	570.15	469.38	397.4	581.15	468.52	411.65	559.18
01/01/2021 0:00	2021				453.9	377.19	553.89	464.48	369.9	532.47	477.75	395.81	513.97
01/01/2022 0:00	2022				458.11	380.25	520.73	472.11	373.95	541.62	478.2	356.96	559.58
01/01/2023 0:00	2023				467.89	374.88	584.86	475.77	393.12	570.72	458.99	397.74	561.44
01/01/2024 0:00	2024				467.01	383.62	522.65	471.52	406.11	565.65	463.2	412.6	555.29

01/01/2025 0:00	2025	434.09	366.94	586.83	467.22	380.79	542.57	476.21	412.66	589.44
01/01/2026 0:00	2026	477.98	353	549.92	446.88	375.37	502.42	467.09	372.74	542.9
01/01/2027 0:00	2027	514.53	427.42	605.23	490.07	410.06	567.1	449.55	381.25	540.07
01/01/2028 0:00	2028	473.5	411.13	572.03	466.61	380.77	562.82	456.49	355.47	596.75
01/01/2029 0:00	2029	474.86	365.79	560.65	477.82	374.55	571.63	463.01	393.29	574.75
01/01/2030 0:00	2030	489.41	419.41	596.72	470.53	415.39	567.17	508.78	453.7	582.56
01/01/2031 0:00	2031	509.9	399.09	610.96	482.93	380.7	606.75	504.05	417.47	624.82
01/01/2032 0:00	2032	466.72	393.98	609.29	498.47	414.54	605.11	481.64	382.25	575.58
01/01/2033 0:00	2033	470.1	350.5	557.81	497.31	367.43	576.77	454.83	379.68	577.08
01/01/2034 0:00	2034	488.6	402.95	529.95	484.52	406.66	584.03	508.96	417.12	590.14
01/01/2035 0:00	2035	492.88	386.92	628.81	488.14	405.69	612.57	492	411.69	570.1
01/01/2036 0:00	2036	469.22	395	572.08	485.11	394.56	602.63	448.31	386.55	560.74
01/01/2037 0:00	2037	508.46	388.49	594.24	468.19	394.41	562.72	516.52	422.37	605.32
01/01/2038 0:00	2038	478.76	427.77	576.61	526.6	397.99	628.55	501.45	465.61	546.01
01/01/2039 0:00	2039	468.39	422.11	601.5	492.27	382.29	567.57	519.87	403.46	582.75
01/01/2040 0:00	2040	448.54	403.78	530.48	483.29	378.18	577.44	481.46	357.62	582.65
01/01/2041 0:00	2041	477.46	384.44	573.15	477.55	387.25	604.61	493.45	404.54	579.76
01/01/2042 0:00	2042	480.44	413.14	585.66	500.37	391.45	693.27	499.57	448.53	606.2
01/01/2043 0:00	2043	488.21	394.21	624.13	470.41	393.22	536.08	490.31	400.03	616.22
01/01/2044 0:00	2044	492.31	408.76	598.6	475.12	424.02	565.96	476.28	404.53	616.38
01/01/2045 0:00	2045	491.37	374.17	576.56	492.28	420.63	602.56	488.96	411.25	604.09
01/01/2046 0:00	2046	507.8	399.06	560.48	469.66	384.98	596.6	481.93	424.92	589.99
01/01/2047 0:00	2047	495.36	360.13	605.58	448.51	398.39	575.18	487.91	433.19	555.9
01/01/2048 0:00	2048	509.98	408.95	600.36	463.23	401.33	590.78	502.49	414.71	596.05
01/01/2049 0:00	2049	483	386.32	555.01	501.6	414.85	607.08	490.65	408.77	543.4
01/01/2050 0:00	2050	466.96	390.8	545.91	497.5	388.34	602.26	460.18	388.3	546.73
01/01/2051 0:00	2051	479.67	415.31	592.09	518.02	435.25	592.31	505.4	390.97	577.81
01/01/2052 0:00	2052	483.28	384	599.18	484.82	408.73	587.39	486.15	417.35	607.66
01/01/2053 0:00	2053	488.94	397.73	581.07	470.48	414.56	597.16	514.46	415.32	599.63
01/01/2054 0:00	2054	488.91	415.83	568.14	531.95	434.63	638.35	517.89	460.96	596.93
01/01/2055 0:00	2055	458.38	386.14	623.88	485.05	414.57	562.63	460.93	397.75	558.58
01/01/2056 0:00	2056	519.67	473.6	599.27	483.51	395.22	595.35	505.32	387.44	633.67
01/01/2057 0:00	2057	492.85	426.88	583.33	499.2	395.62	580.27	475.96	401.85	628.87
01/01/2058 0:00	2058	489.66	431.87	590.45	478.76	407.11	566.96	480.79	434.21	593.27
01/01/2059 0:00	2059	531.88	443.12	597.57	469.33	418.13	537.12	526.01	390.63	648.78
01/01/2060 0:00	2060	472.96	402.22	547.04	500.44	414.73	598.39	471.29	371.75	600.55
01/01/2061 0:00	2061	455.26	363.94	572.01	509.65	432.42	589.87	512.84	436.07	648.7
01/01/2062 0:00	2062	483.65	415.61	587.92	509.42	434.2	625.08	501.98	428.59	605.26
01/01/2063 0:00	2063	516	431	623.18	497.86	423.35	673.69	498.3	397.83	539.63

01/01/2064 0:00	2064	527.77	427.43	606.69	495.68	418.56	614.83	508.12	442.21	605.14
01/01/2065 0:00	2065	465.43	412.29	553.15	497.89	412.74	570.15	507.05	404.25	570.56
01/01/2066 0:00	2066	492.6	416.8	557.45	473.11	413.55	582.14	524.47	388.19	584.83
01/01/2067 0:00	2067	471.84	420.25	560.83	487.64	383.45	566.24	495.99	397.91	569.59
01/01/2068 0:00	2068	494.62	387.37	575.29	487.89	417.91	562.84	519.76	438.1	631.26
01/01/2069 0:00	2069	483.29	397.19	554.83	479.36	375.56	586.68	541.27	437.93	634.03
01/01/2070 0:00	2070	503.28	408.37	579.22	494.35	399.89	596.08	504.88	455.58	647.93
01/01/2071 0:00	2071	482.9	388.39	571.22	512.43	405.98	681.39	536.65	380.32	636.83
01/01/2072 0:00	2072	479.64	412.64	585.84	505.25	420.25	613.64	519.57	408.65	644.85
01/01/2073 0:00	2073	474.66	416.67	537.38	467.22	418.17	625.27	486.33	414.94	603.37
01/01/2074 0:00	2074	481.19	400.23	559.8	511.39	437.26	647.33	518.19	414.69	646.45
01/01/2075 0:00	2075	498.82	418.82	588.42	517.6	451.99	582.48	479.4	406.11	641.98
01/01/2076 0:00	2076	494.47	390.61	599.29	502.4	360.47	618.04	510.31	420.19	607.37
01/01/2077 0:00	2077	503.26	376.73	601.13	512.73	419.84	612.34	475.28	365.24	582.02
01/01/2078 0:00	2078	483.67	400.24	574.68	471.62	380.99	604.24	528.03	401.94	648.9
01/01/2079 0:00	2079	473	390.65	614.4	480.15	408.79	627.08	506.28	409.83	608.72
01/01/2080 0:00	2080	484.35	374.28	564.35	517.68	392.09	624.71	497.8	424.18	636.83
01/01/2081 0:00	2081	488.57	385.33	578.37	522.28	436.17	565.78	482.05	392.8	581.46
01/01/2082 0:00	2082	485.17	413.96	535.62	539.11	442.03	605.04	496.68	420.26	699.75
01/01/2083 0:00	2083	497.79	392.32	614.04	480.69	394.53	577.7	544.24	422.66	609.09
01/01/2084 0:00	2084	465.65	375.19	565.81	467.32	367.89	592.69	517.11	430.98	630.73
01/01/2085 0:00	2085	499.14	419.01	567.84	493.77	415.56	628.73	509.5	440.35	599.16
01/01/2086 0:00	2086	505.51	371.43	589.92	485.73	412.5	606.37	502.2	409	622.28
01/01/2087 0:00	2087	480.35	405.05	564.41	502.4	408.35	587.05	530.25	379.43	634.68
01/01/2088 0:00	2088	466.87	402.67	548.11	464.66	349.98	539.71	529.4	445.81	615.1
01/01/2089 0:00	2089	476.76	395.86	607.5	502.93	366.1	606.99	510.56	415.15	580.78
01/01/2090 0:00	2090	496.19	394.69	579.85	530.83	455.98	601.55	493.95	428.26	593.31
01/01/2091 0:00	2091	483.59	396.42	553.32	492.97	425.7	624.11	499.93	368.18	597.26
01/01/2092 0:00	2092	474.89	381.48	544.32	499.24	442.05	591.46	552.56	486.97	631.19
01/01/2093 0:00	2093	483.63	414.69	547.03	497.62	402.23	589.49	498.16	405.12	663.79
01/01/2094 0:00	2094	472.9	409.59	526.67	525.68	406.16	640.39	506.51	454.2	625.99
01/01/2095 0:00	2095	485.34	375.53	565.95	458.05	389.92	605.12	523.12	421.39	629.16
01/01/2096 0:00	2096	503.42	424.47	588.05	450.85	383.61	549.19	496.92	438.39	630.84
01/01/2097 0:00	2097	483.2	403.62	591.5	515.98	395.15	613.74	531.55	388.64	618.39
01/01/2098 0:00	2098	496.21	385.71	603.9	506.81	419.81	589.74	545.84	440.76	622.52
01/01/2099 0:00	2099	485.68	444.83	595.23	492.06	437.42	595.14	502.77	418.01	629.51

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	22.14	14.03	28.45									
01/01/1951 0:00	1951	21.63	14.16	36.96									
01/01/1952 0:00	1952	20.43	16.01	33.88									
01/01/1953 0:00	1953	22.43	14.42	33.48									
01/01/1954 0:00	1954	24.21	17.16	47.77									
01/01/1955 0:00	1955	24.57	16.31	39.88									
01/01/1956 0:00	1956	22.52	14.77	31.37									
01/01/1957 0:00	1957	21.66	14.89	31.41									
01/01/1958 0:00	1958	21.53	14.77	33.35									
01/01/1959 0:00	1959	23.65	13.56	40.4									
01/01/1960 0:00	1960	25.02	13.29	29.11									
01/01/1961 0:00	1961	23.01	13.3	39.85									
01/01/1962 0:00	1962	22.16	14.5	30.78									
01/01/1963 0:00	1963	21.89	12.24	35.87									
01/01/1964 0:00	1964	25.7	15.7	36.4									
01/01/1965 0:00	1965	26.04	13.49	35.69									
01/01/1966 0:00	1966	19.46	15.14	28.52									
01/01/1967 0:00	1967	20.92	12.04	28.81									
01/01/1968 0:00	1968	22.62	16.42	30.59									
01/01/1969 0:00	1969	23.51	15.31	34.45									
01/01/1970 0:00	1970	23.46	14.21	34.71									
01/01/1971 0:00	1971	22.43	15.92	31.05									
01/01/1972 0:00	1972	19.73	15.07	30.51									
01/01/1973 0:00	1973	23.82	17.66	41.87									
01/01/1974 0:00	1974	21.39	14.29	34.27									
01/01/1975 0:00	1975	18.02	13.76	26.04									
01/01/1976 0:00	1976	22.06	16.6	31.57									
01/01/1977 0:00	1977	20.67	15.89	35.12									
01/01/1978 0:00	1978	20.54	15.82	34.9									
01/01/1979 0:00	1979	23.97	16.09	33.54									
01/01/1980 0:00	1980	26.64	16.36	33.31									
01/01/1981 0:00	1981	22.66	14.96	29.4									
01/01/1982 0:00	1982	21.47	15.66	31.31									
01/01/1983 0:00	1983	23.98	16.22	34.23									
01/01/1984 0:00	1984	27.38	16.76	36.6									

01/01/1985 0:00	1985	21.99	15.43	29.51									
01/01/1986 0:00	1986	20.73	13.96	41.15									
01/01/1987 0:00	1987	21.1	14.21	32.12									
01/01/1988 0:00	1988	24.79	16.05	49.94									
01/01/1989 0:00	1989	19.76	17.16	33.18									
01/01/1990 0:00	1990	19.74	15.16	31.19									
01/01/1991 0:00	1991	23.58	14.65	34.06									
01/01/1992 0:00	1992	24.05	15.64	35.75									
01/01/1993 0:00	1993	22.3	17.33	28.65									
01/01/1994 0:00	1994	22.14	16.08	32.93									
01/01/1995 0:00	1995	25.06	15.53	37.6									
01/01/1996 0:00	1996	22.61	14.42	28.72									
01/01/1997 0:00	1997	23.68	16.08	28									
01/01/1998 0:00	1998	21.69	12.82	36.15									
01/01/1999 0:00	1999	22.46	15.61	32.84									
01/01/2000 0:00	2000	22.02	15.54	30.51									
01/01/2001 0:00	2001	20.54	15.56	28.81									
01/01/2002 0:00	2002	22.99	16.48	29.92									
01/01/2003 0:00	2003	24.32	16.79	32.79									
01/01/2004 0:00	2004	23.11	16.15	30.08									
01/01/2005 0:00	2005	23.8	14.86	32.11	23.8	14.86	32.11	24.26	14.8	31.51	23.49	14.73	31.41
01/01/2006 0:00	2006				20.47	12.77	29.55	20.86	14.63	31.02	23.47	16.35	31.17
01/01/2007 0:00	2007				24.43	16.69	43.97	22.8	14.62	38.89	23.52	15.61	35.18
01/01/2008 0:00	2008				21.71	16.58	29.39	25.82	16.44	53.81	24.35	14.5	36.92
01/01/2009 0:00	2009				25.31	14.54	37.02	19.87	14.81	29.27	24.24	15.31	35.92
01/01/2010 0:00	2010				24.07	13.91	35.32	22.45	14.75	30.25	27.16	20.04	39.77
01/01/2011 0:00	2011				23.13	16.07	35.08	20.62	15.27	31.48	21.31	15.75	36.34
01/01/2012 0:00	2012				22.51	14.87	46	25.51	16.57	31.74	17.86	13.99	31.74
01/01/2013 0:00	2013				24.11	15.39	36.39	22.16	14.35	35.72	25.28	14.49	44.14
01/01/2014 0:00	2014				23.05	17.92	41.23	22.27	16.28	35.21	24.8	15.32	41.24
01/01/2015 0:00	2015				19.52	16.37	25.6	25.76	16.77	36.56	22.91	15.82	34.93
01/01/2016 0:00	2016				21.79	14.4	33.32	23.84	15.77	49.83	23.8	16.61	39.23
01/01/2017 0:00	2017				21.66	16.02	36.52	23.77	16.28	48.04	24.21	14.7	32.7
01/01/2018 0:00	2018				21.17	16.85	31.33	20.67	15.37	31.57	19.83	15.27	31.17
01/01/2019 0:00	2019				21.97	16.55	47.12	22.05	12.94	29.3	19.89	14.98	32.05
01/01/2020 0:00	2020				21.23	16.35	35.41	22.94	15.65	45.83	24.79	14.99	32.56
01/01/2021 0:00	2021				22.41	16.72	30.72	24.55	14.43	33.76	22.37	15.01	30.36
01/01/2022 0:00	2022				18.15	14.85	34.9	24.19	14.98	40.86	20.41	13.75	32.68

01/01/2023 0:00	2023	24.46	15.82	36.65	26.7	16.64	31.2	24.27	17.97	36.15
01/01/2024 0:00	2024	19.67	16.34	34.61	22.64	16.05	28.77	20.01	13	33.55
01/01/2025 0:00	2025	21.52	13.85	36.95	20.6	15.88	37.6	23.27	15.51	31.46
01/01/2026 0:00	2026	25.79	15.18	35.39	23.79	14.81	32.04	23.8	17.22	35.05
01/01/2027 0:00	2027	29.79	19.95	41.7	21.57	16.39	38.35	24.01	15.96	37.08
01/01/2028 0:00	2028	21.86	17.12	30.92	19.92	15.55	34.72	20.25	15.46	27.62
01/01/2029 0:00	2029	22.21	15.61	42.94	21.63	14.55	37.46	26.66	17.01	47.98
01/01/2030 0:00	2030	24.54	15.94	44.29	21.32	17.6	28.13	27.06	17.76	36.06
01/01/2031 0:00	2031	22.03	17.23	39.14	27.03	16.4	39.93	26.5	16.74	46.22
01/01/2032 0:00	2032	25.03	16.11	35.82	26.58	16.23	36.19	21.77	15.01	32.56
01/01/2033 0:00	2033	20.73	15.47	32.44	22.59	16.14	28.98	23.89	16.93	35.66
01/01/2034 0:00	2034	24.02	18.08	42.71	28.78	15.85	33.99	25.7	17.2	32.89
01/01/2035 0:00	2035	23.02	17.01	32.19	25.52	13.76	49.99	23.99	14.17	39.61
01/01/2036 0:00	2036	25.43	15.97	39.9	23.41	14.66	37.24	24.8	13.57	40.4
01/01/2037 0:00	2037	24.04	12.61	42.16	23.5	17.18	34.3	23.79	15.97	38.61
01/01/2038 0:00	2038	23.36	15.1	33.73	29.21	16.63	44.63	23.68	17.64	36.77
01/01/2039 0:00	2039	25.76	16.86	41.42	23.91	14.51	34.77	22.47	16.94	33.62
01/01/2040 0:00	2040	24.6	15.66	36.98	23.9	17.62	30.06	23	16.76	36.78
01/01/2041 0:00	2041	21.78	15.01	34.57	21.5	17.41	40.27	25.68	15.76	38.68
01/01/2042 0:00	2042	22.97	15.21	35.56	27.29	16.12	39.52	24.98	17.38	39.24
01/01/2043 0:00	2043	20.01	14.08	33.26	22.96	14.46	36.02	24.26	14.95	33.1
01/01/2044 0:00	2044	21.44	13.66	50.53	22.67	14.68	40.91	23.32	16.96	37.15
01/01/2045 0:00	2045	23.88	15.46	31.21	23.61	18.16	34.8	24.02	16.8	32.91
01/01/2046 0:00	2046	23.84	16.22	33.26	22.61	16.71	45.79	23.79	15.62	31.18
01/01/2047 0:00	2047	23.36	13.96	32.92	19.48	15.94	30.39	24.35	18.42	37.01
01/01/2048 0:00	2048	19.72	14.03	34.47	25.7	14.95	36.25	29.52	19.19	42.26
01/01/2049 0:00	2049	21.05	14.96	42.58	24.33	17.55	34.2	25.98	15.79	33.73
01/01/2050 0:00	2050	22.16	14.74	28.92	24.43	14.94	43.78	23.32	15.26	37.36
01/01/2051 0:00	2051	24.21	16.73	43.76	25.15	18.62	41.01	23.91	17.48	40.57
01/01/2052 0:00	2052	25.11	16.15	37.47	26.42	17.61	35.16	24.16	15.72	31.61
01/01/2053 0:00	2053	25.21	15.35	43.4	21.97	13.17	35.13	26.04	19.14	36.65
01/01/2054 0:00	2054	24.73	18.75	34.34	22.77	16.1	44.34	29.19	17.46	39.06
01/01/2055 0:00	2055	21.3	15.69	36.26	20.47	15.33	36.58	21.14	14.04	32.85
01/01/2056 0:00	2056	27.22	18.68	44.26	21.93	15.37	39.22	23.12	14.76	37.03
01/01/2057 0:00	2057	24.99	14.7	33.57	22.31	16.75	41.73	25.8	17.11	34.26
01/01/2058 0:00	2058	24.72	16.78	33.39	22.39	15.98	36.51	25.02	15.74	40.08
01/01/2059 0:00	2059	24.16	17.46	43.78	24.55	16.07	33.92	25.13	18.15	38.51
01/01/2060 0:00	2060	20.15	15.65	31.88	23.43	17.01	40.56	22.23	15.26	37.57

01/01/2061 0:00	2061	21.03	15.15	35.9	22.76	16.07	34	23.8	16.32	49.48
01/01/2062 0:00	2062	23.4	18.56	42.32	24.91	16.49	30.87	24.92	19.36	42.12
01/01/2063 0:00	2063	23.08	17	35.19	24.98	16.78	37.25	24.26	17.08	40.82
01/01/2064 0:00	2064	27.11	18.42	39.35	23.77	13.77	32.55	26.68	19.66	40.34
01/01/2065 0:00	2065	21.63	16.42	33.12	22.82	17.33	38.51	23.72	17.23	36.62
01/01/2066 0:00	2066	20.13	15.96	31.87	22.77	16.9	37.65	25	16.35	47.13
01/01/2067 0:00	2067	23.51	15.52	44.51	22.56	14.62	42.87	28.41	18.97	43.92
01/01/2068 0:00	2068	24.54	14.63	36.43	27.28	19.15	37.71	24.76	17	38.7
01/01/2069 0:00	2069	21.16	15.67	36.85	24.87	16.02	35.39	25.67	16.57	46.47
01/01/2070 0:00	2070	23.32	17.23	34.42	24.9	17.73	38.15	23.96	19.41	34.4
01/01/2071 0:00	2071	24.37	17.18	30.74	25.17	16.22	37.83	25.21	15.51	32.99
01/01/2072 0:00	2072	25.13	16.57	40.73	25.98	17.29	38.06	26.7	18.68	43.37
01/01/2073 0:00	2073	22.25	15.91	32.85	25.82	17.73	33.13	23.75	17.85	44.3
01/01/2074 0:00	2074	24.66	17.39	35.48	25.76	17.57	44.27	26.7	15.93	36.55
01/01/2075 0:00	2075	24.52	17	33.16	29.6	18.89	37.31	29	16.7	36.92
01/01/2076 0:00	2076	24.5	15.77	34.56	24.27	15.53	31.88	23.41	17.19	39.47
01/01/2077 0:00	2077	22.04	16.64	30.64	25.14	16.62	44.26	25.37	15.79	40.29
01/01/2078 0:00	2078	20.33	16.67	34.53	23.12	15.17	41	24.27	15.37	34.4
01/01/2079 0:00	2079	23.62	15.92	57.7	25.96	19.22	41.01	24.6	16.5	45.61
01/01/2080 0:00	2080	22.64	15.74	36.92	27.04	17.09	44.82	24.49	16.2	42.23
01/01/2081 0:00	2081	21.47	17.57	29.98	23.58	16.66	37.13	23.9	14.02	34.84
01/01/2082 0:00	2082	23	18.23	40.52	24.38	17.11	31.85	25.02	18.51	48.52
01/01/2083 0:00	2083	24.05	19.45	40.04	22.29	17.06	36.08	24.37	17.59	45.16
01/01/2084 0:00	2084	25.29	14.95	34.07	22.39	15.49	35.99	24.74	19.63	36.57
01/01/2085 0:00	2085	25.46	16.83	34.94	23.35	15.57	30.87	23.33	17.53	42.59
01/01/2086 0:00	2086	23.94	17	33.84	24.71	14.11	52.29	26.44	18.14	42.92
01/01/2087 0:00	2087	24.65	14.5	38.45	22.33	16.74	35.1	25.38	15.49	32.25
01/01/2088 0:00	2088	24.74	18.34	35.13	19.87	13.97	33.95	27.27	17.31	46.08
01/01/2089 0:00	2089	22.67	17.03	38.2	25.94	17.88	54.02	24.44	16.42	35.98
01/01/2090 0:00	2090	27.61	17.45	42.55	28.88	17.05	40.17	24.71	16.54	35.6
01/01/2091 0:00	2091	23.25	13.95	38.09	23.82	15.84	37.36	22.06	16.31	34.81
01/01/2092 0:00	2092	23.34	16.16	33.58	23.09	15.29	31.86	21.93	17.25	45.94
01/01/2093 0:00	2093	20.82	13.9	32.78	22.08	15.45	36.73	24.43	17.39	34.8
01/01/2094 0:00	2094	22.67	14.25	26.27	26.16	17.81	44.23	24.96	16.69	34.86
01/01/2095 0:00	2095	21.79	14.86	35.32	19.03	14.58	39.04	27.09	19.74	38.53
01/01/2096 0:00	2096	25.63	17.97	45.87	20.22	17.12	31.13	25.73	16.2	34.76
01/01/2097 0:00	2097	21.61	17.94	32.04	25.23	16.83	38.51	25.53	16.95	37.22
01/01/2098 0:00	2098	27.69	18.87	57.59	25.02	19.7	34.19	23.05	18.51	41.03

01/01/2099 0:00	2099	24.39	16.73	37.59	22.58	15.79	31.13	23.79	17.75	37.72

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	115	96	122.7									
01/01/1951 0:00	1951	111.5	101	131									
01/01/1952 0:00	1952	116.5	95.5	130									
01/01/1953 0:00	1953	114	104	131.4									
01/01/1954 0:00	1954	112.5	95.3	133.1									
01/01/1955 0:00	1955	117.5	103	132.9									
01/01/1956 0:00	1956	114	98.9	128									
01/01/1957 0:00	1957	115.5	103.3	124									
01/01/1958 0:00	1958	118.5	97.6	131									
01/01/1959 0:00	1959	116	101.6	134.9									
01/01/1960 0:00	1960	113.5	96	125.7									
01/01/1961 0:00	1961	111	104	125									
01/01/1962 0:00	1962	121.5	103.3	135.5									
01/01/1963 0:00	1963	116.5	94.9	139.1									
01/01/1964 0:00	1964	111.5	95.9	126.4									
01/01/1965 0:00	1965	113.5	92.3	121.7									
01/01/1966 0:00	1966	107	97.3	120.7									
01/01/1967 0:00	1967	113	99.5	131.1									
01/01/1968 0:00	1968	113.5	98.3	131.7									
01/01/1969 0:00	1969	115	100.6	120.4									
01/01/1970 0:00	1970	115.5	100.3	126.7									
01/01/1971 0:00	1971	114.5	100	129.7									
01/01/1972 0:00	1972	117.5	97.9	124.7									
01/01/1973 0:00	1973	110.5	98.2	132.6									
01/01/1974 0:00	1974	113	99.1	126.7									
01/01/1975 0:00	1975	113	90	124.4									
01/01/1976 0:00	1976	111	95	123.7									
01/01/1977 0:00	1977	116	99.6	128.4									
01/01/1978 0:00	1978	111	97.3	128.7									
01/01/1979 0:00	1979	111.5	98.3	123.4									
01/01/1980 0:00	1980	109	98	131.4									
01/01/1981 0:00	1981	110	92.2	123.7									
01/01/1982 0:00	1982	114.5	98.3	126.7									
01/01/1983 0:00	1983	108.5	97.3	123.4									
01/01/1984 0:00	1984	107	96.6	118.7									

01/01/1985 0:00	1985	110.5	97.3	124.7									
01/01/1986 0:00	1986	114.5	102.6	131									
01/01/1987 0:00	1987	116	95	126.8									
01/01/1988 0:00	1988	107	96.3	120.1									
01/01/1989 0:00	1989	115.5	98	131.2									
01/01/1990 0:00	1990	121	103.5	133									
01/01/1991 0:00	1991	115.5	101.6	126.1									
01/01/1992 0:00	1992	110.5	98	125.4									
01/01/1993 0:00	1993	110.5	95.9	129.5									
01/01/1994 0:00	1994	119.5	100.1	134.8									
01/01/1995 0:00	1995	113.5	103.6	131									
01/01/1996 0:00	1996	112	101.9	123.4									
01/01/1997 0:00	1997	108.5	99.3	127.9									
01/01/1998 0:00	1998	108	100	124.5									
01/01/1999 0:00	1999	114	100.6	127.7									
01/01/2000 0:00	2000	113.5	103.6	128									
01/01/2001 0:00	2001	113	104	125.7									
01/01/2002 0:00	2002	117	95.9	127.5									
01/01/2003 0:00	2003	124	106.8	132.1									
01/01/2004 0:00	2004	113	99.3	129.7									
01/01/2005 0:00	2005	117	103	132.2	117	103	132.2	117	102.4	129.8	116.5	103.3	128.7
01/01/2006 0:00	2006				115.5	93.5	129	113	95.8	126.1	120	99.6	129.4
01/01/2007 0:00	2007				111	100.6	130	111.5	100.3	133.1	119.5	102.6	139.6
01/01/2008 0:00	2008				115	98.6	136.4	120	96.8	129	114	98.6	125.8
01/01/2009 0:00	2009				122	102.3	131.7	121.5	104.6	136.5	116.5	94.2	129.5
01/01/2010 0:00	2010				117	104.2	127.7	114.5	94.7	133.7	115	94	128
01/01/2011 0:00	2011				118	98	129	116.5	102.8	130.1	114	97.9	127.7
01/01/2012 0:00	2012				113	100.2	125.7	116.5	97.3	137	112	102.3	126.4
01/01/2013 0:00	2013				117	100.6	128.4	118	96.3	131.8	116.5	101	128.4
01/01/2014 0:00	2014				118	106.6	129.1	111.5	106	127.1	115	106.9	130.7
01/01/2015 0:00	2015				120.5	103.5	133.4	116	97.3	124.4	111.5	98.8	122.7
01/01/2016 0:00	2016				113.5	100.6	132.4	117.5	105	127.7	116	97.6	131.7
01/01/2017 0:00	2017				117.5	103.3	129.2	112.5	100.6	126.7	117	97	139.8
01/01/2018 0:00	2018				119	99.1	130.8	113.5	97.3	127	114	102.2	129.7
01/01/2019 0:00	2019				114.5	98.4	136.1	109	102.3	118.4	113	96.6	133.8
01/01/2020 0:00	2020				122	96.2	138	120	98.6	134.7	112	100	136.7
01/01/2021 0:00	2021				113.5	99.5	127.7	117	97.9	132.8	119	100.1	129.5
01/01/2022 0:00	2022				113	100.2	124.7	114	104.9	129.1	109	93	133.9

01/01/2023 0:00	2023	117.5	104.2	128.7	118	106.3	133.7	113.5	101	125.7
01/01/2024 0:00	2024	111.5	98.3	126.7	113.5	101.3	129.7	115	105	138.8
01/01/2025 0:00	2025	114.5	98.3	128.4	115.5	102.1	129	115	97.2	130
01/01/2026 0:00	2026	114	89.8	128.1	110	101.1	118.7	115	98.2	134.5
01/01/2027 0:00	2027	118.5	102.5	133.1	114.5	101.3	128.4	115	99.9	132
01/01/2028 0:00	2028	117	99.3	135.4	117	97.7	134.7	108.5	97.3	140
01/01/2029 0:00	2029	116.5	97.6	125.7	119	101.9	134.5	113.5	95.5	134
01/01/2030 0:00	2030	117	104.3	136.4	118.5	98.6	134.1	119	110	130
01/01/2031 0:00	2031	119.5	108.6	134.8	115.5	95.3	133	123	100.5	137
01/01/2032 0:00	2032	114.5	97.3	135.1	112	103	130.7	117.5	102.3	131.7
01/01/2033 0:00	2033	113.5	101.6	128.1	118.5	99.8	132.4	112	90	130
01/01/2034 0:00	2034	117	104.3	129.4	116.5	106	133.4	118	105.3	133.4
01/01/2035 0:00	2035	120	98.3	132.7	115.5	100.8	127.7	117.5	101.9	128.4
01/01/2036 0:00	2036	117	100.8	127.7	122.5	105.6	136.7	113.5	103.3	137.4
01/01/2037 0:00	2037	120.5	108.2	138.7	114	100.9	131	123	106.8	135
01/01/2038 0:00	2038	118	110.9	128.5	118.5	97.9	138.7	123	110	135
01/01/2039 0:00	2039	116	105	132.1	119.5	102.6	130.7	121.5	108	128
01/01/2040 0:00	2040	111	104.3	133.4	112	100.3	135	115.5	99	133
01/01/2041 0:00	2041	114	103	127.5	118.5	104.6	133.5	114.5	103.9	133.7
01/01/2042 0:00	2042	115	103.6	131.9	120	105.6	141.1	120	103.3	137.7
01/01/2043 0:00	2043	119.5	105.4	136.5	113	103.3	126.1	116.5	104	131.3
01/01/2044 0:00	2044	120.5	102.3	135.4	118	107.3	127.4	115	99.2	135
01/01/2045 0:00	2045	121.5	102.3	137.6	117	103.3	135	122	99.2	141.6
01/01/2046 0:00	2046	114	96.6	131.1	120	106	140.7	120.5	105	135.7
01/01/2047 0:00	2047	118	98.5	138	116	99.5	140.7	116.5	108	130.1
01/01/2048 0:00	2048	119	101.3	136	111.5	100.3	130.4	112.5	98.3	131.7
01/01/2049 0:00	2049	119	94.9	133.4	113.5	101.5	139.5	118.5	101	131.8
01/01/2050 0:00	2050	113.5	103	130	116.5	104.6	130.8	112	104	130.4
01/01/2051 0:00	2051	117	100.1	144.7	120	100.3	134.7	118.5	97.7	134.4
01/01/2052 0:00	2052	115.5	100.3	134	115	102	128.4	116	98.2	135.7
01/01/2053 0:00	2053	114.5	103.3	126	117.5	107.3	131.7	119	106	131.7
01/01/2054 0:00	2054	121	104.9	132.7	121.5	106.9	140.8	122.5	106.1	141.7
01/01/2055 0:00	2055	116	106.3	131.7	117	104.6	129.8	114.5	99	138.1
01/01/2056 0:00	2056	123	106.9	136.2	121	98.3	137.3	120.5	103.3	136
01/01/2057 0:00	2057	120.5	108.1	132.7	121.5	112.3	133.7	115	104.3	129.8
01/01/2058 0:00	2058	117	101.1	128	118	101.3	149.1	118	102.2	132
01/01/2059 0:00	2059	123.5	108.6	136.7	113.5	104.6	126.1	121.5	102	134
01/01/2060 0:00	2060	113.5	102.3	130.5	117.5	101.6	136.7	116.5	99.6	134

01/01/2061 0:00	2061	115	97.6	135.9	125	107.5	134.4	122	112.9	136.9
01/01/2062 0:00	2062	117.5	95.6	131.7	117.5	107	134.4	117.5	100.3	135.4
01/01/2063 0:00	2063	119.5	101.2	140.7	119	104.3	139.4	114.5	98	132.1
01/01/2064 0:00	2064	123.5	98.4	144	120.5	105.9	130.8	120.5	102.6	136.2
01/01/2065 0:00	2065	116	107.3	130.7	119	108.3	130.7	117.5	101.5	135.4
01/01/2066 0:00	2066	119	108.3	132	110.5	99.5	134.4	116.5	99	135.6
01/01/2067 0:00	2067	118	102.6	131.5	112	102	128.7	115.5	99.9	134.5
01/01/2068 0:00	2068	114.5	99.3	132.8	116.5	101.6	133.6	124.5	107.6	138.7
01/01/2069 0:00	2069	115	100.8	127.1	117.5	90.7	129.4	119.5	110	145.1
01/01/2070 0:00	2070	117	107.3	136.4	116.5	102.3	132.5	124.5	107.3	137
01/01/2071 0:00	2071	114.5	104	137.1	124	103.6	141.6	118.5	95.3	134.7
01/01/2072 0:00	2072	118	101.2	128	121.5	103.3	134.4	118	101.9	133
01/01/2073 0:00	2073	117	104	131.9	117	98.2	135.1	115.5	107.3	130.8
01/01/2074 0:00	2074	121	101.2	128	118	110.6	135.4	121.5	110.9	142.2
01/01/2075 0:00	2075	120.5	106.6	139.2	120.5	106.8	131	117.5	103.9	139.7
01/01/2076 0:00	2076	114.5	103	133.3	118.5	93.4	130.4	120.5	107	134.4
01/01/2077 0:00	2077	120.5	98.9	133.1	121.5	109.3	134	116	98.3	138.8
01/01/2078 0:00	2078	117.5	107.2	132.8	117	100.6	133.2	118.5	104.9	137.7
01/01/2079 0:00	2079	116.5	94.9	136.6	121	100	131.8	115.5	99.6	130.4
01/01/2080 0:00	2080	115.5	98.3	137.1	121	102.9	143.7	119.5	108.6	136
01/01/2081 0:00	2081	115	106.3	130	120.5	107.2	132.1	116	104.6	137.7
01/01/2082 0:00	2082	113.5	101.5	127.1	120.5	106.6	138	117.5	103.3	134.1
01/01/2083 0:00	2083	114.5	100.6	135.4	114.5	100.9	136.8	124	106	133.7
01/01/2084 0:00	2084	119	94.7	133.2	116	95.1	132	120	107.6	139.1
01/01/2085 0:00	2085	118	101.3	134.5	120	102.8	133.7	121	101.3	130.7
01/01/2086 0:00	2086	122	99.6	132	114	96.3	131.1	119.5	100	137.7
01/01/2087 0:00	2087	118	101.9	135.7	119	106.3	132.7	120.5	99.6	140.8
01/01/2088 0:00	2088	114.5	103.9	124.4	112.5	98.2	128.7	119.5	105.2	141.4
01/01/2089 0:00	2089	120.5	99.6	137.1	110	100.3	134.1	117	104	136.4
01/01/2090 0:00	2090	117.5	99	134.1	119	101.2	133.7	119.5	96.6	135.4
01/01/2091 0:00	2091	119.5	107.9	132	116.5	98.9	130.7	122	96.3	134.7
01/01/2092 0:00	2092	112.5	99.3	133.7	119.5	108	132	125	117	134
01/01/2093 0:00	2093	116.5	107.6	127.8	115.5	101.1	134	121.5	99.5	136.1
01/01/2094 0:00	2094	115	98	127.7	117.5	102.3	139.9	123	107.3	132.7
01/01/2095 0:00	2095	119.5	95	128.7	114.5	100.3	141.9	120	99.3	133.1
01/01/2096 0:00	2096	120	103.5	132.7	113	100.9	129	120.5	109.3	139.1
01/01/2097 0:00	2097	116	101	132.3	123	108.5	139.1	122	103.1	134.7
01/01/2098 0:00	2098	119.5	101.3	130.4	114	97.9	137.4	127	100	139.8

01/01/2099 0:00	2099	121.5	113	131.4	117	107.3	134.9	116	102.6	144.8

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	6	3	10.7									
01/01/1951 0:00	1951	6	1.3	9.7									
01/01/1952 0:00	1952	6.5	4	9									
01/01/1953 0:00	1953	6	3	11									
01/01/1954 0:00	1954	6	3	9									
01/01/1955 0:00	1955	6	3.3	9.7									
01/01/1956 0:00	1956	5	4	7.7									
01/01/1957 0:00	1957	6.5	4.3	10									
01/01/1958 0:00	1958	5.5	3	8.7									
01/01/1959 0:00	1959	6.5	2.3	9.4									
01/01/1960 0:00	1960	5	3	8									
01/01/1961 0:00	1961	6.5	3	11.7									
01/01/1962 0:00	1962	6	2.3	8.7									
01/01/1963 0:00	1963	6	3	8.7									
01/01/1964 0:00	1964	7	3	12									
01/01/1965 0:00	1965	5.5	3	10									
01/01/1966 0:00	1966	5	3	10									
01/01/1967 0:00	1967	6	2	10									
01/01/1968 0:00	1968	6.5	4	9									
01/01/1969 0:00	1969	5	2.3	8.7									
01/01/1970 0:00	1970	5	2	8									
01/01/1971 0:00	1971	7	4	8.7									
01/01/1972 0:00	1972	6	3.6	9									
01/01/1973 0:00	1973	6	4	8.7									
01/01/1974 0:00	1974	5	2.3	9.4									
01/01/1975 0:00	1975	5	3	8									
01/01/1976 0:00	1976	7	3	9									
01/01/1977 0:00	1977	6	2	8									
01/01/1978 0:00	1978	5	1.3	10.7									
01/01/1979 0:00	1979	7	4	10.7									
01/01/1980 0:00	1980	7	4	9									
01/01/1981 0:00	1981	6	3	9									
01/01/1982 0:00	1982	6.5	3	9.7									
01/01/1983 0:00	1983	7	4.3	9									
01/01/1984 0:00	1984	5.5	3	9									

01/01/1985 0:00	1985	5	2.6	10									
01/01/1986 0:00	1986	6	4	8.7									
01/01/1987 0:00	1987	6	3.3	9.7									
01/01/1988 0:00	1988	6	3	8.7									
01/01/1989 0:00	1989	6	4	8.7									
01/01/1990 0:00	1990	6	3.3	10									
01/01/1991 0:00	1991	6.5	3.3	10									
01/01/1992 0:00	1992	6	3	10.7									
01/01/1993 0:00	1993	6	2.3	11.7									
01/01/1994 0:00	1994	7	3.3	9.7									
01/01/1995 0:00	1995	6	3.3	9.7									
01/01/1996 0:00	1996	6	2.3	9									
01/01/1997 0:00	1997	6.5	4	9.7									
01/01/1998 0:00	1998	5.5	3.3	9									
01/01/1999 0:00	1999	6	3	11									
01/01/2000 0:00	2000	5.5	3.3	9.7									
01/01/2001 0:00	2001	6	4	9.7									
01/01/2002 0:00	2002	5.5	3	9									
01/01/2003 0:00	2003	6	4	11.7									
01/01/2004 0:00	2004	6	2.6	10									
01/01/2005 0:00	2005	7	4	9	7	4	9	6.5	3.3	9	7	4	9
01/01/2006 0:00	2006				6	3	9	7	2	9.7	7	5	11.7
01/01/2007 0:00	2007				5.5	2	10.4	7	3	10	7.5	3.3	10
01/01/2008 0:00	2008				7	4.3	11.7	7	3.3	11.7	5	2	10
01/01/2009 0:00	2009				6.5	4	10.7	6	3.3	10.7	7	3	13.8
01/01/2010 0:00	2010				6.5	4	8.7	6	2.3	11.7	7	5	10.7
01/01/2011 0:00	2011				7	4.3	10.7	7	4.3	10.7	5	2.3	9
01/01/2012 0:00	2012				7	3.3	13	7	4	10	5	2	11.8
01/01/2013 0:00	2013				7	2.3	9.7	7	4	9	6	3.3	8.7
01/01/2014 0:00	2014				6	4	10.7	6.5	3.3	9.4	7.5	5	11
01/01/2015 0:00	2015				6.5	4	10.7	6	3.3	9.7	6	2	9.7
01/01/2016 0:00	2016				6.5	4	11	7	3.3	11	7	4	9.7
01/01/2017 0:00	2017				6.5	2.3	9.7	8	3.3	11.7	7	3	12
01/01/2018 0:00	2018				8	4	10.7	7	4	9.7	7	3	9
01/01/2019 0:00	2019				5.5	3	9	5.5	4	8	6	3	10
01/01/2020 0:00	2020				8	5	11.4	6.5	5	9.7	6.5	4	9
01/01/2021 0:00	2021				6	4	8	6	4.3	9	6	3.3	9
01/01/2022 0:00	2022				6	3.3	9.7	7	4	10.4	8	2	10

01/01/2023 0:00	2023	8	2.3	12.4	6	3	10	7	4.3	9.7
01/01/2024 0:00	2024	6	3	12	6	4	11	6	4	10.7
01/01/2025 0:00	2025	5.5	2.3	11.7	7	3	10	7	4	11.4
01/01/2026 0:00	2026	6.5	4	9.7	5.5	4	10	7	3	9
01/01/2027 0:00	2027	7.5	4	11	8	4	10.7	7	5	9.4
01/01/2028 0:00	2028	6	4	10	7	4.3	11.4	7	3	12.4
01/01/2029 0:00	2029	6	3	9	6	3.3	11.4	6	3.3	11.4
01/01/2030 0:00	2030	7	3.3	11	7	4	10	8	5	10
01/01/2031 0:00	2031	6.5	3	11	7	3	12.4	8	4	12
01/01/2032 0:00	2032	7	3	10.7	9	5	12.7	7.5	2.3	11
01/01/2033 0:00	2033	6	3	9	7	3	10.7	7	3.6	9.7
01/01/2034 0:00	2034	7	3.3	10.4	7	5	10.7	7	4.3	12
01/01/2035 0:00	2035	7	3	12	7.5	4	12	8	4	12
01/01/2036 0:00	2036	6	3.3	11.7	6	3.3	11	6	3	9
01/01/2037 0:00	2037	7	2	11.4	6	4.3	9.7	8	5.3	14.4
01/01/2038 0:00	2038	6.5	5	10.7	9	4.3	13.7	8.5	4.6	10
01/01/2039 0:00	2039	7.5	4	12.1	6	3	11.7	7.5	4	12
01/01/2040 0:00	2040	6	3.3	11	7.5	4	11.7	6.5	4	11
01/01/2041 0:00	2041	7.5	3	10	6	3.3	11.7	7	4	9.7
01/01/2042 0:00	2042	7	4.3	10	7	3	15	9	4	13
01/01/2043 0:00	2043	8	3.3	12.8	6	3	9	7.5	3.6	13
01/01/2044 0:00	2044	7	2.3	10.7	7	5	11.7	7.5	4.3	12.4
01/01/2045 0:00	2045	7	3.3	8.7	7.5	4.3	11.7	8	4	10
01/01/2046 0:00	2046	7	4	11.7	6.5	3.3	11	7	3.3	9.7
01/01/2047 0:00	2047	7.5	2.3	10	7	3	9	7	4	9
01/01/2048 0:00	2048	8	4.3	10.7	6	2	11	9	5	11
01/01/2049 0:00	2049	7	3.3	11	8.5	4	13	7	4	10
01/01/2050 0:00	2050	7	3.3	9.7	7.5	4	11.7	6.5	2.3	10.7
01/01/2051 0:00	2051	6	3.3	11.1	8.5	4.3	11.7	7	4	10
01/01/2052 0:00	2052	6.5	3.3	11.4	7.5	4.3	12.1	7.5	4.3	11
01/01/2053 0:00	2053	7	2.6	10.7	7	3	11	8.5	4	12.1
01/01/2054 0:00	2054	7	4.3	10	7.5	5	14.4	8	5.3	11.7
01/01/2055 0:00	2055	6	3.3	12.8	6.5	4.3	10.7	7	5	11
01/01/2056 0:00	2056	8	6	11.7	6	4	11.4	8.5	4.3	14.7
01/01/2057 0:00	2057	6.5	4.3	11	8	2.3	10.7	8	5	13.4
01/01/2058 0:00	2058	7	5	11.7	7	5	10	8	4.3	11.7
01/01/2059 0:00	2059	7.5	5.3	11.7	6.5	3.3	10	9.5	3.6	15
01/01/2060 0:00	2060	6.5	4	10	7	4	12	6.5	3.3	10.7

01/01/2061 0:00	2061	6.5	2.3	11	8	3	10	8.5	4.3	13.7
01/01/2062 0:00	2062	7.5	4	11	9	5	12.7	8	4	11.7
01/01/2063 0:00	2063	8.5	5	11.7	7.5	3.3	11.7	7.5	4	10
01/01/2064 0:00	2064	8	5	11	7	3.6	12	9	5	13
01/01/2065 0:00	2065	7	3.3	9.7	8	4	11	8	4.3	11.4
01/01/2066 0:00	2066	7	4	9	7	4	10.7	8	4.3	12
01/01/2067 0:00	2067	7	4.3	9	7	3	11	7	5	10
01/01/2068 0:00	2068	7.5	3	11	7	3	13.1	9	6	13
01/01/2069 0:00	2069	6	3.3	11.7	7.5	3.6	12.7	9	5	13
01/01/2070 0:00	2070	7.5	4.3	12	8	5	11	8	4	15.7
01/01/2071 0:00	2071	7	4.3	11.7	8	5.3	14	9	3	12.7
01/01/2072 0:00	2072	7	4.3	11.4	8.5	4.3	11.7	9	5	12.7
01/01/2073 0:00	2073	6.5	4	11	8	4	15	7.5	5	11.7
01/01/2074 0:00	2074	6	3.3	9.7	9	4	12.7	8	5.3	11.4
01/01/2075 0:00	2075	7.5	4.3	12	7	5.3	11	7	4	12
01/01/2076 0:00	2076	8	4	11.7	7	4	12	7	3	12
01/01/2077 0:00	2077	6.5	3.3	13.7	8	4	12.4	6	4.3	10
01/01/2078 0:00	2078	6	4	11	7	4	13.5	7.5	3.6	15.7
01/01/2079 0:00	2079	6.5	4	10.7	7.5	5	13.4	7	4	13
01/01/2080 0:00	2080	6.5	2.3	10.7	7.5	3.3	14.4	7	4.3	12.7
01/01/2081 0:00	2081	7	4	11.7	8	4.3	11.7	8.5	2.3	11
01/01/2082 0:00	2082	7	4.3	10	8.5	5	12.7	7.5	4.3	15.1
01/01/2083 0:00	2083	8	4	11.7	8	3	12	9	2.9	13.7
01/01/2084 0:00	2084	6.5	4	9.7	7	4.3	13.1	9	5	13.7
01/01/2085 0:00	2085	8	5	10	7.5	5	12.7	8	5.3	11.7
01/01/2086 0:00	2086	6.5	3	10.7	8	5	11.7	7.5	4	10
01/01/2087 0:00	2087	7	3.3	10	8	4.3	11	9.5	4.3	11.7
01/01/2088 0:00	2088	7	4	9.7	6	4	10.7	8.5	5	14
01/01/2089 0:00	2089	7	4.6	11.4	7.5	3.3	12	6.5	4	12
01/01/2090 0:00	2090	6	3.6	10.7	9	4.6	13.4	8	4.3	12.7
01/01/2091 0:00	2091	6	4	9.7	9	3.9	10.7	7.5	4.3	11.7
01/01/2092 0:00	2092	7	3	9	8.5	6	11	9	6	14.4
01/01/2093 0:00	2093	7	4	10	8	6	11	8.5	4	13
01/01/2094 0:00	2094	6.5	3.3	10	8	4.3	11.4	8	4.3	11.7
01/01/2095 0:00	2095	6.5	2.3	11.7	6	4	10.7	9	6	14
01/01/2096 0:00	2096	7	5	11	6	4	10	7	5	13.7
01/01/2097 0:00	2097	7.5	5	11	8	4.3	13.4	8.5	3.3	12.4
01/01/2098 0:00	2098	7.5	5	12.7	7	6	10.7	10	6	13.7

01/01/2099 0:00	2099	7	5	10.7	7.5	4.3	10.7	8.5	4.6	14

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	0	0	0									
01/01/1951 0:00	1951	0	0	0									
01/01/1952 0:00	1952	0	0	0									
01/01/1953 0:00	1953	0	0	0									
01/01/1954 0:00	1954	0	0	0									
01/01/1955 0:00	1955	0	0	0									
01/01/1956 0:00	1956	0	0	0									
01/01/1957 0:00	1957	0	0	0									
01/01/1958 0:00	1958	0	0	0									
01/01/1959 0:00	1959	0	0	0									
01/01/1960 0:00	1960	0	0	0									
01/01/1961 0:00	1961	0	0	0									
01/01/1962 0:00	1962	0	0	0									
01/01/1963 0:00	1963	0	0	0									
01/01/1964 0:00	1964	0	0	0									
01/01/1965 0:00	1965	0	0	0									
01/01/1966 0:00	1966	0	0	0									
01/01/1967 0:00	1967	0	0	0									
01/01/1968 0:00	1968	0	0	0									
01/01/1969 0:00	1969	0	0	0									
01/01/1970 0:00	1970	0	0	0									
01/01/1971 0:00	1971	0	0	0									
01/01/1972 0:00	1972	0	0	0									
01/01/1973 0:00	1973	0	0	0									
01/01/1974 0:00	1974	0	0	0									
01/01/1975 0:00	1975	0	0	0									
01/01/1976 0:00	1976	0	0	0									
01/01/1977 0:00	1977	0	0	0									
01/01/1978 0:00	1978	0	0	0									
01/01/1979 0:00	1979	0	0	0									
01/01/1980 0:00	1980	0	0	0									
01/01/1981 0:00	1981	0	0	0									
01/01/1982 0:00	1982	0	0	0									
01/01/1983 0:00	1983	0	0	0									
01/01/1984 0:00	1984	0	0	0									

01/01/1985 0:00	1985	0	0	0									
01/01/1986 0:00	1986	0	0	0									
01/01/1987 0:00	1987	0	0	0									
01/01/1988 0:00	1988	0	0	0									
01/01/1989 0:00	1989	0	0	0									
01/01/1990 0:00	1990	0	0	0									
01/01/1991 0:00	1991	0	0	0									
01/01/1992 0:00	1992	0	0	0									
01/01/1993 0:00	1993	0	0	0									
01/01/1994 0:00	1994	0	0	0									
01/01/1995 0:00	1995	0	0	0									
01/01/1996 0:00	1996	0	0	0									
01/01/1997 0:00	1997	0	0	0									
01/01/1998 0:00	1998	0	0	0									
01/01/1999 0:00	1999	0	0	0									
01/01/2000 0:00	2000	0	0	0									
01/01/2001 0:00	2001	0	0	0									
01/01/2002 0:00	2002	0	0	0									
01/01/2003 0:00	2003	0	0	0									
01/01/2004 0:00	2004	0	0	0									
01/01/2005 0:00	2005	0	0	0	0	0	0	1	0	2	1	0	2.7
01/01/2006 0:00	2006				0	0	0	1	0	3	1	0	2.7
01/01/2007 0:00	2007				0	0	0	1	0	2.7	1	0	2
01/01/2008 0:00	2008				0	0	0	1.5	0	3.7	1	0	2
01/01/2009 0:00	2009				0	0	0	0.5	0	2	1	0	3
01/01/2010 0:00	2010				0	0	0	1	0	2	1	0.3	2.7
01/01/2011 0:00	2011				0	0	0	1	0	2.7	1	0	1
01/01/2012 0:00	2012				0	0	0	1	0	2	0	0	2
01/01/2013 0:00	2013				0	0	0	1	0	2	1	0	2
01/01/2014 0:00	2014				0	0	0	1	0	2	1	0	3
01/01/2015 0:00	2015				0	0	0	1	0	3	1	0	2.7
01/01/2016 0:00	2016				0	0	0	1	0	2.7	1	0	3
01/01/2017 0:00	2017				0	0	0	1	0	3	1	0	2.7
01/01/2018 0:00	2018				0	0	0	1	0	2	0.5	0	2
01/01/2019 0:00	2019				0	0	0	1	0	1.7	0	0	2
01/01/2020 0:00	2020				0	0	0	1	0	2	1	0	3
01/01/2021 0:00	2021				0	0	0	1	0	2	1	0	2
01/01/2022 0:00	2022				0	0	0	1	0	2.7	1	0	2

01/01/2023 0:00	2023	0	0	0	1	0	3.7	1	0	2.7
01/01/2024 0:00	2024	0	0	0	1	0	2	0.5	0	2
01/01/2025 0:00	2025	0	0	0	1	0	2	1	0	2.7
01/01/2026 0:00	2026	0	0	0	1	0	2	1	0	2
01/01/2027 0:00	2027	0	0	0	1	0	2.4	1	0	2
01/01/2028 0:00	2028	0	0	0	0.5	0	3	0.5	0	2
01/01/2029 0:00	2029	0	0	0	1	0	2	1	0	2.7
01/01/2030 0:00	2030	0	0	0	1	0	2.7	1	0	4.4
01/01/2031 0:00	2031	0	0	0	1	0	3	1	0	3
01/01/2032 0:00	2032	0	0	0	1	0	2.7	1	0	2
01/01/2033 0:00	2033	0	0	0	1	0	2.7	1	0	2
01/01/2034 0:00	2034	0	0	0	1	0	2	1	0	3
01/01/2035 0:00	2035	0	0	0	1.5	0	4.4	1	0	3
01/01/2036 0:00	2036	0	0	0	1	0	3	1	0	2.7
01/01/2037 0:00	2037	0	0	0	1	0	2	1	0	3
01/01/2038 0:00	2038	0	0	0	2	0	3	1	0	3
01/01/2039 0:00	2039	0	0	0	1	0	2.7	1	0	2
01/01/2040 0:00	2040	0	0	0	1	0	3	1	0	2
01/01/2041 0:00	2041	0	0	0	1	0	3	1	0	3
01/01/2042 0:00	2042	0	0	0	1	0	3.7	1	0	3.7
01/01/2043 0:00	2043	0	0	0	1	0	2.7	2	0	3
01/01/2044 0:00	2044	0	0	0	1	0	2	1	0	3.7
01/01/2045 0:00	2045	0	0	0	1	0	3	1	0	2
01/01/2046 0:00	2046	0	0	0	1	0	2	1	0	2.7
01/01/2047 0:00	2047	0	0	0	0	0	1	1	0	2
01/01/2048 0:00	2048	0	0	0	1	0	2	1.5	0.3	3.7
01/01/2049 0:00	2049	0	0	0	1	0	3	1	0	2
01/01/2050 0:00	2050	0	0	0	1	0	2.7	1	0	3.7
01/01/2051 0:00	2051	0	0	0	1	0	3	1	0	2.7
01/01/2052 0:00	2052	0	0	0	1	0	3.7	1	0	3
01/01/2053 0:00	2053	0	0	0	1	0	2.7	1	0	3
01/01/2054 0:00	2054	0	0	0	1	0	3	2	0	2.7
01/01/2055 0:00	2055	0	0	0	1	0	2	1	0	2
01/01/2056 0:00	2056	0	0	0	1	0	3	1.5	0	3
01/01/2057 0:00	2057	0	0	0	1	0	3	1	0	3
01/01/2058 0:00	2058	0	0	0	1	0	2	1	0	2
01/01/2059 0:00	2059	0	0	0	1	0	2	2	0	3
01/01/2060 0:00	2060	0	0	0	1	0	3	1	0	4

01/01/2061 0:00	2061	0	0	0	1	0	3	1	0	2.7
01/01/2062 0:00	2062	0	0	0	1	0	2	1	0	3
01/01/2063 0:00	2063	0	0	0	1	0	3	1	0	3
01/01/2064 0:00	2064	0	0	0	1	0	3	2	0.3	3
01/01/2065 0:00	2065	0	0	0	1	0	2.7	1	0	3
01/01/2066 0:00	2066	0	0	0	1	0	2.7	1	0	2
01/01/2067 0:00	2067	0	0	0	1	0	2	1	0	2.7
01/01/2068 0:00	2068	0	0	0	1	0	3	1.5	0	3.7
01/01/2069 0:00	2069	0	0	0	1	0	2.7	1	0	4
01/01/2070 0:00	2070	0	0	0	2	0	3	1	0	3
01/01/2071 0:00	2071	0	0	0	1.5	0	4	1	0	3.7
01/01/2072 0:00	2072	0	0	0	1.5	0	3	1	0	4
01/01/2073 0:00	2073	0	0	0	1	0	2.7	1	0	3
01/01/2074 0:00	2074	0	0	0	1	0	4	1	0	3
01/01/2075 0:00	2075	0	0	0	1	0	2.7	1	0	4
01/01/2076 0:00	2076	0	0	0	1	0	2.7	1.5	0	2.7
01/01/2077 0:00	2077	0	0	0	1	0	3	1	0	2.7
01/01/2078 0:00	2078	0	0	0	1.5	0	2.7	2	0	3
01/01/2079 0:00	2079	0	0	0	2	0.3	3.7	1.5	0	3.7
01/01/2080 0:00	2080	0	0	0	1	0	2.7	1	0	3
01/01/2081 0:00	2081	0	0	0	1	0	3.7	1	0	2.7
01/01/2082 0:00	2082	0	0	0	1	0	3	1	0	3
01/01/2083 0:00	2083	0	0	0	1	0	2.7	2	0	4
01/01/2084 0:00	2084	0	0	0	1	0	2	1.5	0	3
01/01/2085 0:00	2085	0	0	0	1	0	2.7	1	0	3.7
01/01/2086 0:00	2086	0	0	0	1	0	2	1	0	3.7
01/01/2087 0:00	2087	0	0	0	1	0	2.7	1	0	3.7
01/01/2088 0:00	2088	0	0	0	0.5	0	2	2	0	4
01/01/2089 0:00	2089	0	0	0	1	0	2.7	1.5	0	3.7
01/01/2090 0:00	2090	0	0	0	2	0	3.7	1	0	2
01/01/2091 0:00	2091	0	0	0	1	0	2	1	0	2
01/01/2092 0:00	2092	0	0	0	1	0	3	1	0	4.4
01/01/2093 0:00	2093	0	0	0	1	0	3	1	0	3
01/01/2094 0:00	2094	0	0	0	1	0	4	1	0	3
01/01/2095 0:00	2095	0	0	0	0	0	2.7	2	0.3	4
01/01/2096 0:00	2096	0	0	0	1	0	2	1.5	0	3
01/01/2097 0:00	2097	0	0	0	1	0	3	1	0	3
01/01/2098 0:00	2098	0	0	0	1	0	2	1	0	3

01/01/2099 0:00	2099	0	0	0	1	0	2	1	0	3

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	456.63	350.88	529.13									
01/01/1951 0:00	1951	453.21	363.29	544.16									
01/01/1952 0:00	1952	469.66	371.13	542.38									
01/01/1953 0:00	1953	478.35	366.13	555.68									
01/01/1954 0:00	1954	447.61	356.03	558.78									
01/01/1955 0:00	1955	463.19	398.76	539.22									
01/01/1956 0:00	1956	442.14	376.96	513.03									
01/01/1957 0:00	1957	460.35	394.28	515.95									
01/01/1958 0:00	1958	467.84	379.81	544.97									
01/01/1959 0:00	1959	443.52	389.29	592.81									
01/01/1960 0:00	1960	457.44	369.09	524.69									
01/01/1961 0:00	1961	470	394.92	546.37									
01/01/1962 0:00	1962	461.88	390.14	543.81									
01/01/1963 0:00	1963	491.89	337.52	566.47									
01/01/1964 0:00	1964	448.16	382.84	586.2									
01/01/1965 0:00	1965	437.66	355.5	534.85									
01/01/1966 0:00	1966	414.02	368.76	536.97									
01/01/1967 0:00	1967	441.26	377.94	523.53									
01/01/1968 0:00	1968	455.84	386.86	538.82									
01/01/1969 0:00	1969	438.98	366.21	517.22									
01/01/1970 0:00	1970	423.98	384.85	532.14									
01/01/1971 0:00	1971	456.3	398.87	543.39									
01/01/1972 0:00	1972	462.53	374.43	520.99									
01/01/1973 0:00	1973	433.34	378.33	559.13									
01/01/1974 0:00	1974	443.03	391.29	522.66									
01/01/1975 0:00	1975	437.69	357.44	494.08									
01/01/1976 0:00	1976	448.03	389.13	511.31									
01/01/1977 0:00	1977	447.09	359.41	531.65									
01/01/1978 0:00	1978	437.55	347.05	540.7									
01/01/1979 0:00	1979	456.27	345.94	523.45									
01/01/1980 0:00	1980	457.82	384.08	555.46									
01/01/1981 0:00	1981	452.71	380.42	502.52									
01/01/1982 0:00	1982	460.08	372.76	537.83									
01/01/1983 0:00	1983	455.55	389.06	526.56									
01/01/1984 0:00	1984	438.11	346.56	540.82									
01/01/1985 0:00	1985	431.28	376.5	497.96									

01/01/1986 0:00	1986	463.04	406.31	534.05									
01/01/1987 0:00	1987	446.91	329.72	558.1									
01/01/1988 0:00	1988	434.65	364.3	513.34									
01/01/1989 0:00	1989	456.69	385.04	551.37									
01/01/1990 0:00	1990	468.53	396.63	560.28									
01/01/1991 0:00	1991	454.76	391.39	513.87									
01/01/1992 0:00	1992	445.37	369.61	529.26									
01/01/1993 0:00	1993	440.59	360.87	569.81									
01/01/1994 0:00	1994	467.05	383.77	551.24									
01/01/1995 0:00	1995	456.19	403.09	573.42									
01/01/1996 0:00	1996	446.06	388.58	521.38									
01/01/1997 0:00	1997	447.9	384.59	519.44									
01/01/1998 0:00	1998	439.47	371.83	499.62									
01/01/1999 0:00	1999	447.78	381.42	504.9									
01/01/2000 0:00	2000	470.61	373.43	530									
01/01/2001 0:00	2001	460.51	409.79	567.33									
01/01/2002 0:00	2002	466.48	367.23	538.81									
01/01/2003 0:00	2003	475.8	403.58	553.67									
01/01/2004 0:00	2004	455.66	400.55	576.63									
01/01/2005 0:00	2005	475.85	380.86	549.48	475.85	380.86	549.48	475.53	380.4	548.53	476.85	380.24	547.57
01/01/2006 0:00	2006				457.05	357.88	569.14	478.17	351.72	548.89	487.05	410.58	575.06
01/01/2007 0:00	2007				451.03	387.07	567.84	470.79	380.74	525.13	469.32	387.97	565.31
01/01/2008 0:00	2008				471.26	404.9	586.1	499.28	383.06	590.38	460.86	382.31	556.26
01/01/2009 0:00	2009				482.41	400.27	576.06	465.46	395.16	590.61	478.94	342.32	589.96
01/01/2010 0:00	2010				468.82	409.88	531.99	454.51	350.2	567.76	473.31	402.15	559.09
01/01/2011 0:00	2011				469.65	400.87	555.86	468.25	394.41	557.5	448.86	395.96	531.74
01/01/2012 0:00	2012				471.01	368.06	568.69	474.05	375.87	582.54	429.7	385.25	607.07
01/01/2013 0:00	2013				471.95	387.99	561.12	488.8	384.03	530.36	470.23	396.9	518.57
01/01/2014 0:00	2014				490.31	404.02	574.33	472.09	414.56	527.01	493.73	412.35	586.48
01/01/2015 0:00	2015				459.65	399.25	543.66	462.63	384.47	552.72	455.74	376.84	519.95
01/01/2016 0:00	2016				451.23	376.45	586.08	480.12	386.4	554.32	498.21	398.22	541.54
01/01/2017 0:00	2017				470.87	382.29	603.72	457.6	382.62	575.61	485.62	349.58	600.36
01/01/2018 0:00	2018				484.05	396.01	571.85	450.77	373.06	543.9	445.5	385.07	560.82
01/01/2019 0:00	2019				436.06	373.33	582.33	436.81	372.59	484.15	456.32	373.34	556.22
01/01/2020 0:00	2020				524.98	403.6	570.15	469.38	397.4	581.15	468.52	411.65	559.18
01/01/2021 0:00	2021				453.9	377.19	553.89	464.48	369.9	532.47	477.75	395.81	513.97
01/01/2022 0:00	2022				458.11	380.25	520.73	472.11	373.95	541.62	478.2	356.96	559.58
01/01/2023 0:00	2023				467.89	374.88	584.86	475.77	393.12	570.72	458.99	397.74	561.44
01/01/2024 0:00	2024				467.01	383.62	522.65	471.52	406.11	565.65	463.2	412.6	555.29

01/01/2025 0:00	2025	434.09	366.94	586.83	467.22	380.79	542.57	476.21	412.66	589.44
01/01/2026 0:00	2026	477.98	353	549.92	446.88	375.37	502.42	467.09	372.74	542.9
01/01/2027 0:00	2027	514.53	427.42	605.23	490.07	410.06	567.1	449.55	381.25	540.07
01/01/2028 0:00	2028	473.5	411.13	572.03	466.61	380.77	562.82	456.49	355.47	596.75
01/01/2029 0:00	2029	474.86	365.79	560.65	477.82	374.55	571.63	463.01	393.29	574.75
01/01/2030 0:00	2030	489.41	419.41	596.72	470.53	415.39	567.17	508.78	453.7	582.56
01/01/2031 0:00	2031	509.9	399.09	610.96	482.93	380.7	606.75	504.05	417.47	624.82
01/01/2032 0:00	2032	466.72	393.98	609.29	498.47	414.54	605.11	481.64	382.25	575.58
01/01/2033 0:00	2033	470.1	350.5	557.81	497.31	367.43	576.77	454.83	379.68	577.08
01/01/2034 0:00	2034	488.6	402.95	529.95	484.52	406.66	584.03	508.96	417.12	590.14
01/01/2035 0:00	2035	492.88	386.92	628.81	488.14	405.69	612.57	492	411.69	570.1
01/01/2036 0:00	2036	469.22	395	572.08	485.11	394.56	602.63	448.31	386.55	560.74
01/01/2037 0:00	2037	508.46	388.49	594.24	468.19	394.41	562.72	516.52	422.37	605.32
01/01/2038 0:00	2038	478.76	427.77	576.61	526.6	397.99	628.55	501.45	465.61	546.01
01/01/2039 0:00	2039	468.39	422.11	601.5	492.27	382.29	567.57	519.87	403.46	582.75
01/01/2040 0:00	2040	448.54	403.78	530.48	483.29	378.18	577.44	481.46	357.62	582.65
01/01/2041 0:00	2041	477.46	384.44	573.15	477.55	387.25	604.61	493.45	404.54	579.76
01/01/2042 0:00	2042	480.44	413.14	585.66	500.37	391.45	693.27	499.57	448.53	606.2
01/01/2043 0:00	2043	488.21	394.21	624.13	470.41	393.22	536.08	490.31	400.03	616.22
01/01/2044 0:00	2044	492.31	408.76	598.6	475.12	424.02	565.96	476.28	404.53	616.38
01/01/2045 0:00	2045	491.37	374.17	576.56	492.28	420.63	602.56	488.96	411.25	604.09
01/01/2046 0:00	2046	507.8	399.06	560.48	469.66	384.98	596.6	481.93	424.92	589.99
01/01/2047 0:00	2047	495.36	360.13	605.58	448.51	398.39	575.18	487.91	433.19	555.9
01/01/2048 0:00	2048	509.98	408.95	600.36	463.23	401.33	590.78	502.49	414.71	596.05
01/01/2049 0:00	2049	483	386.32	555.01	501.6	414.85	607.08	490.65	408.77	543.4
01/01/2050 0:00	2050	466.96	390.8	545.91	497.5	388.34	602.26	460.18	388.3	546.73
01/01/2051 0:00	2051	479.67	415.31	592.09	518.02	435.25	592.31	505.4	390.97	577.81
01/01/2052 0:00	2052	483.28	384	599.18	484.82	408.73	587.39	486.15	417.35	607.66
01/01/2053 0:00	2053	488.94	397.73	581.07	470.48	414.56	597.16	514.46	415.32	599.63
01/01/2054 0:00	2054	488.91	415.83	568.14	531.95	434.63	638.35	517.89	460.96	596.93
01/01/2055 0:00	2055	458.38	386.14	623.88	485.05	414.57	562.63	460.93	397.75	558.58
01/01/2056 0:00	2056	519.67	473.6	599.27	483.51	395.22	595.35	505.32	387.44	633.67
01/01/2057 0:00	2057	492.85	426.88	583.33	499.2	395.62	580.27	475.96	401.85	628.87
01/01/2058 0:00	2058	489.66	431.87	590.45	478.76	407.11	566.96	480.79	434.21	593.27
01/01/2059 0:00	2059	531.88	443.12	597.57	469.33	418.13	537.12	526.01	390.63	648.78
01/01/2060 0:00	2060	472.96	402.22	547.04	500.44	414.73	598.39	471.29	371.75	600.55
01/01/2061 0:00	2061	455.26	363.94	572.01	509.65	432.42	589.87	512.84	436.07	648.7
01/01/2062 0:00	2062	483.65	415.61	587.92	509.42	434.2	625.08	501.98	428.59	605.26
01/01/2063 0:00	2063	516	431	623.18	497.86	423.35	673.69	498.3	397.83	539.63

01/01/2064 0:00	2064	527.77	427.43	606.69	495.68	418.56	614.83	508.12	442.21	605.14
01/01/2065 0:00	2065	465.43	412.29	553.15	497.89	412.74	570.15	507.05	404.25	570.56
01/01/2066 0:00	2066	492.6	416.8	557.45	473.11	413.55	582.14	524.47	388.19	584.83
01/01/2067 0:00	2067	471.84	420.25	560.83	487.64	383.45	566.24	495.99	397.91	569.59
01/01/2068 0:00	2068	494.62	387.37	575.29	487.89	417.91	562.84	519.76	438.1	631.26
01/01/2069 0:00	2069	483.29	397.19	554.83	479.36	375.56	586.68	541.27	437.93	634.03
01/01/2070 0:00	2070	503.28	408.37	579.22	494.35	399.89	596.08	504.88	455.58	647.93
01/01/2071 0:00	2071	482.9	388.39	571.22	512.43	405.98	681.39	536.65	380.32	636.83
01/01/2072 0:00	2072	479.64	412.64	585.84	505.25	420.25	613.64	519.57	408.65	644.85
01/01/2073 0:00	2073	474.66	416.67	537.38	467.22	418.17	625.27	486.33	414.94	603.37
01/01/2074 0:00	2074	481.19	400.23	559.8	511.39	437.26	647.33	518.19	414.69	646.45
01/01/2075 0:00	2075	498.82	418.82	588.42	517.6	451.99	582.48	479.4	406.11	641.98
01/01/2076 0:00	2076	494.47	390.61	599.29	502.4	360.47	618.04	510.31	420.19	607.37
01/01/2077 0:00	2077	503.26	376.73	601.13	512.73	419.84	612.34	475.28	365.24	582.02
01/01/2078 0:00	2078	483.67	400.24	574.68	471.62	380.99	604.24	528.03	401.94	648.9
01/01/2079 0:00	2079	473	390.65	614.4	480.15	408.79	627.08	506.28	409.83	608.72
01/01/2080 0:00	2080	484.35	374.28	564.35	517.68	392.09	624.71	497.8	424.18	636.83
01/01/2081 0:00	2081	488.57	385.33	578.37	522.28	436.17	565.78	482.05	392.8	581.46
01/01/2082 0:00	2082	485.17	413.96	535.62	539.11	442.03	605.04	496.68	420.26	699.75
01/01/2083 0:00	2083	497.79	392.32	614.04	480.69	394.53	577.7	544.24	422.66	609.09
01/01/2084 0:00	2084	465.65	375.19	565.81	467.32	367.89	592.69	517.11	430.98	630.73
01/01/2085 0:00	2085	499.14	419.01	567.84	493.77	415.56	628.73	509.5	440.35	599.16
01/01/2086 0:00	2086	505.51	371.43	589.92	485.73	412.5	606.37	502.2	409	622.28
01/01/2087 0:00	2087	480.35	405.05	564.41	502.4	408.35	587.05	530.25	379.43	634.68
01/01/2088 0:00	2088	466.87	402.67	548.11	464.66	349.98	539.71	529.4	445.81	615.1
01/01/2089 0:00	2089	476.76	395.86	607.5	502.93	366.1	606.99	510.56	415.15	580.78
01/01/2090 0:00	2090	496.19	394.69	579.85	530.83	455.98	601.55	493.95	428.26	593.31
01/01/2091 0:00	2091	483.59	396.42	553.32	492.97	425.7	624.11	499.93	368.18	597.26
01/01/2092 0:00	2092	474.89	381.48	544.32	499.24	442.05	591.46	552.56	486.97	631.19
01/01/2093 0:00	2093	483.63	414.69	547.03	497.62	402.23	589.49	498.16	405.12	663.79
01/01/2094 0:00	2094	472.9	409.59	526.67	525.68	406.16	640.39	506.51	454.2	625.99
01/01/2095 0:00	2095	485.34	375.53	565.95	458.05	389.92	605.12	523.12	421.39	629.16
01/01/2096 0:00	2096	503.42	424.47	588.05	450.85	383.61	549.19	496.92	438.39	630.84
01/01/2097 0:00	2097	483.2	403.62	591.5	515.98	395.15	613.74	531.55	388.64	618.39
01/01/2098 0:00	2098	496.21	385.71	603.9	506.81	419.81	589.74	545.84	440.76	622.52
01/01/2099 0:00	2099	485.68	444.83	595.23	492.06	437.42	595.14	502.77	418.01	629.51

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	22.14	14.03	28.45									
01/01/1951 0:00	1951	21.63	14.16	36.96									
01/01/1952 0:00	1952	20.43	16.01	33.88									
01/01/1953 0:00	1953	22.43	14.42	33.48									
01/01/1954 0:00	1954	24.21	17.16	47.77									
01/01/1955 0:00	1955	24.57	16.31	39.88									
01/01/1956 0:00	1956	22.52	14.77	31.37									
01/01/1957 0:00	1957	21.66	14.89	31.41									
01/01/1958 0:00	1958	21.53	14.77	33.35									
01/01/1959 0:00	1959	23.65	13.56	40.4									
01/01/1960 0:00	1960	25.02	13.29	29.11									
01/01/1961 0:00	1961	23.01	13.3	39.85									
01/01/1962 0:00	1962	22.16	14.5	30.78									
01/01/1963 0:00	1963	21.89	12.24	35.87									
01/01/1964 0:00	1964	25.7	15.7	36.4									
01/01/1965 0:00	1965	26.04	13.49	35.69									
01/01/1966 0:00	1966	19.46	15.14	28.52									
01/01/1967 0:00	1967	20.92	12.04	28.81									
01/01/1968 0:00	1968	22.62	16.42	30.59									
01/01/1969 0:00	1969	23.51	15.31	34.45									
01/01/1970 0:00	1970	23.46	14.21	34.71									
01/01/1971 0:00	1971	22.43	15.92	31.05									
01/01/1972 0:00	1972	19.73	15.07	30.51									
01/01/1973 0:00	1973	23.82	17.66	41.87									
01/01/1974 0:00	1974	21.39	14.29	34.27									
01/01/1975 0:00	1975	18.02	13.76	26.04									
01/01/1976 0:00	1976	22.06	16.6	31.57									
01/01/1977 0:00	1977	20.67	15.89	35.12									
01/01/1978 0:00	1978	20.54	15.82	34.9									
01/01/1979 0:00	1979	23.97	16.09	33.54									
01/01/1980 0:00	1980	26.64	16.36	33.31									
01/01/1981 0:00	1981	22.66	14.96	29.4									
01/01/1982 0:00	1982	21.47	15.66	31.31									
01/01/1983 0:00	1983	23.98	16.22	34.23									
01/01/1984 0:00	1984	27.38	16.76	36.6									

01/01/1985 0:00	1985	21.99	15.43	29.51									
01/01/1986 0:00	1986	20.73	13.96	41.15									
01/01/1987 0:00	1987	21.1	14.21	32.12									
01/01/1988 0:00	1988	24.79	16.05	49.94									
01/01/1989 0:00	1989	19.76	17.16	33.18									
01/01/1990 0:00	1990	19.74	15.16	31.19									
01/01/1991 0:00	1991	23.58	14.65	34.06									
01/01/1992 0:00	1992	24.05	15.64	35.75									
01/01/1993 0:00	1993	22.3	17.33	28.65									
01/01/1994 0:00	1994	22.14	16.08	32.93									
01/01/1995 0:00	1995	25.06	15.53	37.6									
01/01/1996 0:00	1996	22.61	14.42	28.72									
01/01/1997 0:00	1997	23.68	16.08	28									
01/01/1998 0:00	1998	21.69	12.82	36.15									
01/01/1999 0:00	1999	22.46	15.61	32.84									
01/01/2000 0:00	2000	22.02	15.54	30.51									
01/01/2001 0:00	2001	20.54	15.56	28.81									
01/01/2002 0:00	2002	22.99	16.48	29.92									
01/01/2003 0:00	2003	24.32	16.79	32.79									
01/01/2004 0:00	2004	23.11	16.15	30.08									
01/01/2005 0:00	2005	23.8	14.86	32.11	23.8	14.86	32.11	24.26	14.8	31.51	23.49	14.73	31.41
01/01/2006 0:00	2006				20.47	12.77	29.55	20.86	14.63	31.02	23.47	16.35	31.17
01/01/2007 0:00	2007				24.43	16.69	43.97	22.8	14.62	38.89	23.52	15.61	35.18
01/01/2008 0:00	2008				21.71	16.58	29.39	25.82	16.44	53.81	24.35	14.5	36.92
01/01/2009 0:00	2009				25.31	14.54	37.02	19.87	14.81	29.27	24.24	15.31	35.92
01/01/2010 0:00	2010				24.07	13.91	35.32	22.45	14.75	30.25	27.16	20.04	39.77
01/01/2011 0:00	2011				23.13	16.07	35.08	20.62	15.27	31.48	21.31	15.75	36.34
01/01/2012 0:00	2012				22.51	14.87	46	25.51	16.57	31.74	17.86	13.99	31.74
01/01/2013 0:00	2013				24.11	15.39	36.39	22.16	14.35	35.72	25.28	14.49	44.14
01/01/2014 0:00	2014				23.05	17.92	41.23	22.27	16.28	35.21	24.8	15.32	41.24
01/01/2015 0:00	2015				19.52	16.37	25.6	25.76	16.77	36.56	22.91	15.82	34.93
01/01/2016 0:00	2016				21.79	14.4	33.32	23.84	15.77	49.83	23.8	16.61	39.23
01/01/2017 0:00	2017				21.66	16.02	36.52	23.77	16.28	48.04	24.21	14.7	32.7
01/01/2018 0:00	2018				21.17	16.85	31.33	20.67	15.37	31.57	19.83	15.27	31.17
01/01/2019 0:00	2019				21.97	16.55	47.12	22.05	12.94	29.3	19.89	14.98	32.05
01/01/2020 0:00	2020				21.23	16.35	35.41	22.94	15.65	45.83	24.79	14.99	32.56
01/01/2021 0:00	2021				22.41	16.72	30.72	24.55	14.43	33.76	22.37	15.01	30.36
01/01/2022 0:00	2022				18.15	14.85	34.9	24.19	14.98	40.86	20.41	13.75	32.68

01/01/2023 0:00	2023	24.46	15.82	36.65	26.7	16.64	31.2	24.27	17.97	36.15
01/01/2024 0:00	2024	19.67	16.34	34.61	22.64	16.05	28.77	20.01	13	33.55
01/01/2025 0:00	2025	21.52	13.85	36.95	20.6	15.88	37.6	23.27	15.51	31.46
01/01/2026 0:00	2026	25.79	15.18	35.39	23.79	14.81	32.04	23.8	17.22	35.05
01/01/2027 0:00	2027	29.79	19.95	41.7	21.57	16.39	38.35	24.01	15.96	37.08
01/01/2028 0:00	2028	21.86	17.12	30.92	19.92	15.55	34.72	20.25	15.46	27.62
01/01/2029 0:00	2029	22.21	15.61	42.94	21.63	14.55	37.46	26.66	17.01	47.98
01/01/2030 0:00	2030	24.54	15.94	44.29	21.32	17.6	28.13	27.06	17.76	36.06
01/01/2031 0:00	2031	22.03	17.23	39.14	27.03	16.4	39.93	26.5	16.74	46.22
01/01/2032 0:00	2032	25.03	16.11	35.82	26.58	16.23	36.19	21.77	15.01	32.56
01/01/2033 0:00	2033	20.73	15.47	32.44	22.59	16.14	28.98	23.89	16.93	35.66
01/01/2034 0:00	2034	24.02	18.08	42.71	28.78	15.85	33.99	25.7	17.2	32.89
01/01/2035 0:00	2035	23.02	17.01	32.19	25.52	13.76	49.99	23.99	14.17	39.61
01/01/2036 0:00	2036	25.43	15.97	39.9	23.41	14.66	37.24	24.8	13.57	40.4
01/01/2037 0:00	2037	24.04	12.61	42.16	23.5	17.18	34.3	23.79	15.97	38.61
01/01/2038 0:00	2038	23.36	15.1	33.73	29.21	16.63	44.63	23.68	17.64	36.77
01/01/2039 0:00	2039	25.76	16.86	41.42	23.91	14.51	34.77	22.47	16.94	33.62
01/01/2040 0:00	2040	24.6	15.66	36.98	23.9	17.62	30.06	23	16.76	36.78
01/01/2041 0:00	2041	21.78	15.01	34.57	21.5	17.41	40.27	25.68	15.76	38.68
01/01/2042 0:00	2042	22.97	15.21	35.56	27.29	16.12	39.52	24.98	17.38	39.24
01/01/2043 0:00	2043	20.01	14.08	33.26	22.96	14.46	36.02	24.26	14.95	33.1
01/01/2044 0:00	2044	21.44	13.66	50.53	22.67	14.68	40.91	23.32	16.96	37.15
01/01/2045 0:00	2045	23.88	15.46	31.21	23.61	18.16	34.8	24.02	16.8	32.91
01/01/2046 0:00	2046	23.84	16.22	33.26	22.61	16.71	45.79	23.79	15.62	31.18
01/01/2047 0:00	2047	23.36	13.96	32.92	19.48	15.94	30.39	24.35	18.42	37.01
01/01/2048 0:00	2048	19.72	14.03	34.47	25.7	14.95	36.25	29.52	19.19	42.26
01/01/2049 0:00	2049	21.05	14.96	42.58	24.33	17.55	34.2	25.98	15.79	33.73
01/01/2050 0:00	2050	22.16	14.74	28.92	24.43	14.94	43.78	23.32	15.26	37.36
01/01/2051 0:00	2051	24.21	16.73	43.76	25.15	18.62	41.01	23.91	17.48	40.57
01/01/2052 0:00	2052	25.11	16.15	37.47	26.42	17.61	35.16	24.16	15.72	31.61
01/01/2053 0:00	2053	25.21	15.35	43.4	21.97	13.17	35.13	26.04	19.14	36.65
01/01/2054 0:00	2054	24.73	18.75	34.34	22.77	16.1	44.34	29.19	17.46	39.06
01/01/2055 0:00	2055	21.3	15.69	36.26	20.47	15.33	36.58	21.14	14.04	32.85
01/01/2056 0:00	2056	27.22	18.68	44.26	21.93	15.37	39.22	23.12	14.76	37.03
01/01/2057 0:00	2057	24.99	14.7	33.57	22.31	16.75	41.73	25.8	17.11	34.26
01/01/2058 0:00	2058	24.72	16.78	33.39	22.39	15.98	36.51	25.02	15.74	40.08
01/01/2059 0:00	2059	24.16	17.46	43.78	24.55	16.07	33.92	25.13	18.15	38.51
01/01/2060 0:00	2060	20.15	15.65	31.88	23.43	17.01	40.56	22.23	15.26	37.57

01/01/2061 0:00	2061	21.03	15.15	35.9	22.76	16.07	34	23.8	16.32	49.48
01/01/2062 0:00	2062	23.4	18.56	42.32	24.91	16.49	30.87	24.92	19.36	42.12
01/01/2063 0:00	2063	23.08	17	35.19	24.98	16.78	37.25	24.26	17.08	40.82
01/01/2064 0:00	2064	27.11	18.42	39.35	23.77	13.77	32.55	26.68	19.66	40.34
01/01/2065 0:00	2065	21.63	16.42	33.12	22.82	17.33	38.51	23.72	17.23	36.62
01/01/2066 0:00	2066	20.13	15.96	31.87	22.77	16.9	37.65	25	16.35	47.13
01/01/2067 0:00	2067	23.51	15.52	44.51	22.56	14.62	42.87	28.41	18.97	43.92
01/01/2068 0:00	2068	24.54	14.63	36.43	27.28	19.15	37.71	24.76	17	38.7
01/01/2069 0:00	2069	21.16	15.67	36.85	24.87	16.02	35.39	25.67	16.57	46.47
01/01/2070 0:00	2070	23.32	17.23	34.42	24.9	17.73	38.15	23.96	19.41	34.4
01/01/2071 0:00	2071	24.37	17.18	30.74	25.17	16.22	37.83	25.21	15.51	32.99
01/01/2072 0:00	2072	25.13	16.57	40.73	25.98	17.29	38.06	26.7	18.68	43.37
01/01/2073 0:00	2073	22.25	15.91	32.85	25.82	17.73	33.13	23.75	17.85	44.3
01/01/2074 0:00	2074	24.66	17.39	35.48	25.76	17.57	44.27	26.7	15.93	36.55
01/01/2075 0:00	2075	24.52	17	33.16	29.6	18.89	37.31	29	16.7	36.92
01/01/2076 0:00	2076	24.5	15.77	34.56	24.27	15.53	31.88	23.41	17.19	39.47
01/01/2077 0:00	2077	22.04	16.64	30.64	25.14	16.62	44.26	25.37	15.79	40.29
01/01/2078 0:00	2078	20.33	16.67	34.53	23.12	15.17	41	24.27	15.37	34.4
01/01/2079 0:00	2079	23.62	15.92	57.7	25.96	19.22	41.01	24.6	16.5	45.61
01/01/2080 0:00	2080	22.64	15.74	36.92	27.04	17.09	44.82	24.49	16.2	42.23
01/01/2081 0:00	2081	21.47	17.57	29.98	23.58	16.66	37.13	23.9	14.02	34.84
01/01/2082 0:00	2082	23	18.23	40.52	24.38	17.11	31.85	25.02	18.51	48.52
01/01/2083 0:00	2083	24.05	19.45	40.04	22.29	17.06	36.08	24.37	17.59	45.16
01/01/2084 0:00	2084	25.29	14.95	34.07	22.39	15.49	35.99	24.74	19.63	36.57
01/01/2085 0:00	2085	25.46	16.83	34.94	23.35	15.57	30.87	23.33	17.53	42.59
01/01/2086 0:00	2086	23.94	17	33.84	24.71	14.11	52.29	26.44	18.14	42.92
01/01/2087 0:00	2087	24.65	14.5	38.45	22.33	16.74	35.1	25.38	15.49	32.25
01/01/2088 0:00	2088	24.74	18.34	35.13	19.87	13.97	33.95	27.27	17.31	46.08
01/01/2089 0:00	2089	22.67	17.03	38.2	25.94	17.88	54.02	24.44	16.42	35.98
01/01/2090 0:00	2090	27.61	17.45	42.55	28.88	17.05	40.17	24.71	16.54	35.6
01/01/2091 0:00	2091	23.25	13.95	38.09	23.82	15.84	37.36	22.06	16.31	34.81
01/01/2092 0:00	2092	23.34	16.16	33.58	23.09	15.29	31.86	21.93	17.25	45.94
01/01/2093 0:00	2093	20.82	13.9	32.78	22.08	15.45	36.73	24.43	17.39	34.8
01/01/2094 0:00	2094	22.67	14.25	26.27	26.16	17.81	44.23	24.96	16.69	34.86
01/01/2095 0:00	2095	21.79	14.86	35.32	19.03	14.58	39.04	27.09	19.74	38.53
01/01/2096 0:00	2096	25.63	17.97	45.87	20.22	17.12	31.13	25.73	16.2	34.76
01/01/2097 0:00	2097	21.61	17.94	32.04	25.23	16.83	38.51	25.53	16.95	37.22
01/01/2098 0:00	2098	27.69	18.87	57.59	25.02	19.7	34.19	23.05	18.51	41.03

01/01/2099 0:00	2099	24.39	16.73	37.59	22.58	15.79	31.13	23.79	17.75	37.72

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	115	96	122.7									
01/01/1951 0:00	1951	111.5	101	131									
01/01/1952 0:00	1952	116.5	95.5	130									
01/01/1953 0:00	1953	114	104	131.4									
01/01/1954 0:00	1954	112.5	95.3	133.1									
01/01/1955 0:00	1955	117.5	103	132.9									
01/01/1956 0:00	1956	114	98.9	128									
01/01/1957 0:00	1957	115.5	103.3	124									
01/01/1958 0:00	1958	118.5	97.6	131									
01/01/1959 0:00	1959	116	101.6	134.9									
01/01/1960 0:00	1960	113.5	96	125.7									
01/01/1961 0:00	1961	111	104	125									
01/01/1962 0:00	1962	121.5	103.3	135.5									
01/01/1963 0:00	1963	116.5	94.9	139.1									
01/01/1964 0:00	1964	111.5	95.9	126.4									
01/01/1965 0:00	1965	113.5	92.3	121.7									
01/01/1966 0:00	1966	107	97.3	120.7									
01/01/1967 0:00	1967	113	99.5	131.1									
01/01/1968 0:00	1968	113.5	98.3	131.7									
01/01/1969 0:00	1969	115	100.6	120.4									
01/01/1970 0:00	1970	115.5	100.3	126.7									
01/01/1971 0:00	1971	114.5	100	129.7									
01/01/1972 0:00	1972	117.5	97.9	124.7									
01/01/1973 0:00	1973	110.5	98.2	132.6									
01/01/1974 0:00	1974	113	99.1	126.7									
01/01/1975 0:00	1975	113	90	124.4									
01/01/1976 0:00	1976	111	95	123.7									
01/01/1977 0:00	1977	116	99.6	128.4									
01/01/1978 0:00	1978	111	97.3	128.7									
01/01/1979 0:00	1979	111.5	98.3	123.4									
01/01/1980 0:00	1980	109	98	131.4									
01/01/1981 0:00	1981	110	92.2	123.7									
01/01/1982 0:00	1982	114.5	98.3	126.7									
01/01/1983 0:00	1983	108.5	97.3	123.4									
01/01/1984 0:00	1984	107	96.6	118.7									

01/01/1985 0:00	1985	110.5	97.3	124.7									
01/01/1986 0:00	1986	114.5	102.6	131									
01/01/1987 0:00	1987	116	95	126.8									
01/01/1988 0:00	1988	107	96.3	120.1									
01/01/1989 0:00	1989	115.5	98	131.2									
01/01/1990 0:00	1990	121	103.5	133									
01/01/1991 0:00	1991	115.5	101.6	126.1									
01/01/1992 0:00	1992	110.5	98	125.4									
01/01/1993 0:00	1993	110.5	95.9	129.5									
01/01/1994 0:00	1994	119.5	100.1	134.8									
01/01/1995 0:00	1995	113.5	103.6	131									
01/01/1996 0:00	1996	112	101.9	123.4									
01/01/1997 0:00	1997	108.5	99.3	127.9									
01/01/1998 0:00	1998	108	100	124.5									
01/01/1999 0:00	1999	114	100.6	127.7									
01/01/2000 0:00	2000	113.5	103.6	128									
01/01/2001 0:00	2001	113	104	125.7									
01/01/2002 0:00	2002	117	95.9	127.5									
01/01/2003 0:00	2003	124	106.8	132.1									
01/01/2004 0:00	2004	113	99.3	129.7									
01/01/2005 0:00	2005	117	103	132.2	117	103	132.2	117	102.4	129.8	116.5	103.3	128.7
01/01/2006 0:00	2006				115.5	93.5	129	113	95.8	126.1	120	99.6	129.4
01/01/2007 0:00	2007				111	100.6	130	111.5	100.3	133.1	119.5	102.6	139.6
01/01/2008 0:00	2008				115	98.6	136.4	120	96.8	129	114	98.6	125.8
01/01/2009 0:00	2009				122	102.3	131.7	121.5	104.6	136.5	116.5	94.2	129.5
01/01/2010 0:00	2010				117	104.2	127.7	114.5	94.7	133.7	115	94	128
01/01/2011 0:00	2011				118	98	129	116.5	102.8	130.1	114	97.9	127.7
01/01/2012 0:00	2012				113	100.2	125.7	116.5	97.3	137	112	102.3	126.4
01/01/2013 0:00	2013				117	100.6	128.4	118	96.3	131.8	116.5	101	128.4
01/01/2014 0:00	2014				118	106.6	129.1	111.5	106	127.1	115	106.9	130.7
01/01/2015 0:00	2015				120.5	103.5	133.4	116	97.3	124.4	111.5	98.8	122.7
01/01/2016 0:00	2016				113.5	100.6	132.4	117.5	105	127.7	116	97.6	131.7
01/01/2017 0:00	2017				117.5	103.3	129.2	112.5	100.6	126.7	117	97	139.8
01/01/2018 0:00	2018				119	99.1	130.8	113.5	97.3	127	114	102.2	129.7
01/01/2019 0:00	2019				114.5	98.4	136.1	109	102.3	118.4	113	96.6	133.8
01/01/2020 0:00	2020				122	96.2	138	120	98.6	134.7	112	100	136.7
01/01/2021 0:00	2021				113.5	99.5	127.7	117	97.9	132.8	119	100.1	129.5
01/01/2022 0:00	2022				113	100.2	124.7	114	104.9	129.1	109	93	133.9

01/01/2023 0:00	2023	117.5	104.2	128.7	118	106.3	133.7	113.5	101	125.7
01/01/2024 0:00	2024	111.5	98.3	126.7	113.5	101.3	129.7	115	105	138.8
01/01/2025 0:00	2025	114.5	98.3	128.4	115.5	102.1	129	115	97.2	130
01/01/2026 0:00	2026	114	89.8	128.1	110	101.1	118.7	115	98.2	134.5
01/01/2027 0:00	2027	118.5	102.5	133.1	114.5	101.3	128.4	115	99.9	132
01/01/2028 0:00	2028	117	99.3	135.4	117	97.7	134.7	108.5	97.3	140
01/01/2029 0:00	2029	116.5	97.6	125.7	119	101.9	134.5	113.5	95.5	134
01/01/2030 0:00	2030	117	104.3	136.4	118.5	98.6	134.1	119	110	130
01/01/2031 0:00	2031	119.5	108.6	134.8	115.5	95.3	133	123	100.5	137
01/01/2032 0:00	2032	114.5	97.3	135.1	112	103	130.7	117.5	102.3	131.7
01/01/2033 0:00	2033	113.5	101.6	128.1	118.5	99.8	132.4	112	90	130
01/01/2034 0:00	2034	117	104.3	129.4	116.5	106	133.4	118	105.3	133.4
01/01/2035 0:00	2035	120	98.3	132.7	115.5	100.8	127.7	117.5	101.9	128.4
01/01/2036 0:00	2036	117	100.8	127.7	122.5	105.6	136.7	113.5	103.3	137.4
01/01/2037 0:00	2037	120.5	108.2	138.7	114	100.9	131	123	106.8	135
01/01/2038 0:00	2038	118	110.9	128.5	118.5	97.9	138.7	123	110	135
01/01/2039 0:00	2039	116	105	132.1	119.5	102.6	130.7	121.5	108	128
01/01/2040 0:00	2040	111	104.3	133.4	112	100.3	135	115.5	99	133
01/01/2041 0:00	2041	114	103	127.5	118.5	104.6	133.5	114.5	103.9	133.7
01/01/2042 0:00	2042	115	103.6	131.9	120	105.6	141.1	120	103.3	137.7
01/01/2043 0:00	2043	119.5	105.4	136.5	113	103.3	126.1	116.5	104	131.3
01/01/2044 0:00	2044	120.5	102.3	135.4	118	107.3	127.4	115	99.2	135
01/01/2045 0:00	2045	121.5	102.3	137.6	117	103.3	135	122	99.2	141.6
01/01/2046 0:00	2046	114	96.6	131.1	120	106	140.7	120.5	105	135.7
01/01/2047 0:00	2047	118	98.5	138	116	99.5	140.7	116.5	108	130.1
01/01/2048 0:00	2048	119	101.3	136	111.5	100.3	130.4	112.5	98.3	131.7
01/01/2049 0:00	2049	119	94.9	133.4	113.5	101.5	139.5	118.5	101	131.8
01/01/2050 0:00	2050	113.5	103	130	116.5	104.6	130.8	112	104	130.4
01/01/2051 0:00	2051	117	100.1	144.7	120	100.3	134.7	118.5	97.7	134.4
01/01/2052 0:00	2052	115.5	100.3	134	115	102	128.4	116	98.2	135.7
01/01/2053 0:00	2053	114.5	103.3	126	117.5	107.3	131.7	119	106	131.7
01/01/2054 0:00	2054	121	104.9	132.7	121.5	106.9	140.8	122.5	106.1	141.7
01/01/2055 0:00	2055	116	106.3	131.7	117	104.6	129.8	114.5	99	138.1
01/01/2056 0:00	2056	123	106.9	136.2	121	98.3	137.3	120.5	103.3	136
01/01/2057 0:00	2057	120.5	108.1	132.7	121.5	112.3	133.7	115	104.3	129.8
01/01/2058 0:00	2058	117	101.1	128	118	101.3	149.1	118	102.2	132
01/01/2059 0:00	2059	123.5	108.6	136.7	113.5	104.6	126.1	121.5	102	134
01/01/2060 0:00	2060	113.5	102.3	130.5	117.5	101.6	136.7	116.5	99.6	134

01/01/2061 0:00	2061	115	97.6	135.9	125	107.5	134.4	122	112.9	136.9
01/01/2062 0:00	2062	117.5	95.6	131.7	117.5	107	134.4	117.5	100.3	135.4
01/01/2063 0:00	2063	119.5	101.2	140.7	119	104.3	139.4	114.5	98	132.1
01/01/2064 0:00	2064	123.5	98.4	144	120.5	105.9	130.8	120.5	102.6	136.2
01/01/2065 0:00	2065	116	107.3	130.7	119	108.3	130.7	117.5	101.5	135.4
01/01/2066 0:00	2066	119	108.3	132	110.5	99.5	134.4	116.5	99	135.6
01/01/2067 0:00	2067	118	102.6	131.5	112	102	128.7	115.5	99.9	134.5
01/01/2068 0:00	2068	114.5	99.3	132.8	116.5	101.6	133.6	124.5	107.6	138.7
01/01/2069 0:00	2069	115	100.8	127.1	117.5	90.7	129.4	119.5	110	145.1
01/01/2070 0:00	2070	117	107.3	136.4	116.5	102.3	132.5	124.5	107.3	137
01/01/2071 0:00	2071	114.5	104	137.1	124	103.6	141.6	118.5	95.3	134.7
01/01/2072 0:00	2072	118	101.2	128	121.5	103.3	134.4	118	101.9	133
01/01/2073 0:00	2073	117	104	131.9	117	98.2	135.1	115.5	107.3	130.8
01/01/2074 0:00	2074	121	101.2	128	118	110.6	135.4	121.5	110.9	142.2
01/01/2075 0:00	2075	120.5	106.6	139.2	120.5	106.8	131	117.5	103.9	139.7
01/01/2076 0:00	2076	114.5	103	133.3	118.5	93.4	130.4	120.5	107	134.4
01/01/2077 0:00	2077	120.5	98.9	133.1	121.5	109.3	134	116	98.3	138.8
01/01/2078 0:00	2078	117.5	107.2	132.8	117	100.6	133.2	118.5	104.9	137.7
01/01/2079 0:00	2079	116.5	94.9	136.6	121	100	131.8	115.5	99.6	130.4
01/01/2080 0:00	2080	115.5	98.3	137.1	121	102.9	143.7	119.5	108.6	136
01/01/2081 0:00	2081	115	106.3	130	120.5	107.2	132.1	116	104.6	137.7
01/01/2082 0:00	2082	113.5	101.5	127.1	120.5	106.6	138	117.5	103.3	134.1
01/01/2083 0:00	2083	114.5	100.6	135.4	114.5	100.9	136.8	124	106	133.7
01/01/2084 0:00	2084	119	94.7	133.2	116	95.1	132	120	107.6	139.1
01/01/2085 0:00	2085	118	101.3	134.5	120	102.8	133.7	121	101.3	130.7
01/01/2086 0:00	2086	122	99.6	132	114	96.3	131.1	119.5	100	137.7
01/01/2087 0:00	2087	118	101.9	135.7	119	106.3	132.7	120.5	99.6	140.8
01/01/2088 0:00	2088	114.5	103.9	124.4	112.5	98.2	128.7	119.5	105.2	141.4
01/01/2089 0:00	2089	120.5	99.6	137.1	110	100.3	134.1	117	104	136.4
01/01/2090 0:00	2090	117.5	99	134.1	119	101.2	133.7	119.5	96.6	135.4
01/01/2091 0:00	2091	119.5	107.9	132	116.5	98.9	130.7	122	96.3	134.7
01/01/2092 0:00	2092	112.5	99.3	133.7	119.5	108	132	125	117	134
01/01/2093 0:00	2093	116.5	107.6	127.8	115.5	101.1	134	121.5	99.5	136.1
01/01/2094 0:00	2094	115	98	127.7	117.5	102.3	139.9	123	107.3	132.7
01/01/2095 0:00	2095	119.5	95	128.7	114.5	100.3	141.9	120	99.3	133.1
01/01/2096 0:00	2096	120	103.5	132.7	113	100.9	129	120.5	109.3	139.1
01/01/2097 0:00	2097	116	101	132.3	123	108.5	139.1	122	103.1	134.7
01/01/2098 0:00	2098	119.5	101.3	130.4	114	97.9	137.4	127	100	139.8

01/01/2099 0:00	2099	121.5	113	131.4	117	107.3	134.9	116	102.6	144.8

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	6	3	10.7									
01/01/1951 0:00	1951	6	1.3	9.7									
01/01/1952 0:00	1952	6.5	4	9									
01/01/1953 0:00	1953	6	3	11									
01/01/1954 0:00	1954	6	3	9									
01/01/1955 0:00	1955	6	3.3	9.7									
01/01/1956 0:00	1956	5	4	7.7									
01/01/1957 0:00	1957	6.5	4.3	10									
01/01/1958 0:00	1958	5.5	3	8.7									
01/01/1959 0:00	1959	6.5	2.3	9.4									
01/01/1960 0:00	1960	5	3	8									
01/01/1961 0:00	1961	6.5	3	11.7									
01/01/1962 0:00	1962	6	2.3	8.7									
01/01/1963 0:00	1963	6	3	8.7									
01/01/1964 0:00	1964	7	3	12									
01/01/1965 0:00	1965	5.5	3	10									
01/01/1966 0:00	1966	5	3	10									
01/01/1967 0:00	1967	6	2	10									
01/01/1968 0:00	1968	6.5	4	9									
01/01/1969 0:00	1969	5	2.3	8.7									
01/01/1970 0:00	1970	5	2	8									
01/01/1971 0:00	1971	7	4	8.7									
01/01/1972 0:00	1972	6	3.6	9									
01/01/1973 0:00	1973	6	4	8.7									
01/01/1974 0:00	1974	5	2.3	9.4									
01/01/1975 0:00	1975	5	3	8									
01/01/1976 0:00	1976	7	3	9									
01/01/1977 0:00	1977	6	2	8									
01/01/1978 0:00	1978	5	1.3	10.7									
01/01/1979 0:00	1979	7	4	10.7									
01/01/1980 0:00	1980	7	4	9									
01/01/1981 0:00	1981	6	3	9									
01/01/1982 0:00	1982	6.5	3	9.7									
01/01/1983 0:00	1983	7	4.3	9									
01/01/1984 0:00	1984	5.5	3	9									

01/01/1985 0:00	1985	5	2.6	10									
01/01/1986 0:00	1986	6	4	8.7									
01/01/1987 0:00	1987	6	3.3	9.7									
01/01/1988 0:00	1988	6	3	8.7									
01/01/1989 0:00	1989	6	4	8.7									
01/01/1990 0:00	1990	6	3.3	10									
01/01/1991 0:00	1991	6.5	3.3	10									
01/01/1992 0:00	1992	6	3	10.7									
01/01/1993 0:00	1993	6	2.3	11.7									
01/01/1994 0:00	1994	7	3.3	9.7									
01/01/1995 0:00	1995	6	3.3	9.7									
01/01/1996 0:00	1996	6	2.3	9									
01/01/1997 0:00	1997	6.5	4	9.7									
01/01/1998 0:00	1998	5.5	3.3	9									
01/01/1999 0:00	1999	6	3	11									
01/01/2000 0:00	2000	5.5	3.3	9.7									
01/01/2001 0:00	2001	6	4	9.7									
01/01/2002 0:00	2002	5.5	3	9									
01/01/2003 0:00	2003	6	4	11.7									
01/01/2004 0:00	2004	6	2.6	10									
01/01/2005 0:00	2005	7	4	9	7	4	9	6.5	3.3	9	7	4	9
01/01/2006 0:00	2006				6	3	9	7	2	9.7	7	5	11.7
01/01/2007 0:00	2007				5.5	2	10.4	7	3	10	7.5	3.3	10
01/01/2008 0:00	2008				7	4.3	11.7	7	3.3	11.7	5	2	10
01/01/2009 0:00	2009				6.5	4	10.7	6	3.3	10.7	7	3	13.8
01/01/2010 0:00	2010				6.5	4	8.7	6	2.3	11.7	7	5	10.7
01/01/2011 0:00	2011				7	4.3	10.7	7	4.3	10.7	5	2.3	9
01/01/2012 0:00	2012				7	3.3	13	7	4	10	5	2	11.8
01/01/2013 0:00	2013				7	2.3	9.7	7	4	9	6	3.3	8.7
01/01/2014 0:00	2014				6	4	10.7	6.5	3.3	9.4	7.5	5	11
01/01/2015 0:00	2015				6.5	4	10.7	6	3.3	9.7	6	2	9.7
01/01/2016 0:00	2016				6.5	4	11	7	3.3	11	7	4	9.7
01/01/2017 0:00	2017				6.5	2.3	9.7	8	3.3	11.7	7	3	12
01/01/2018 0:00	2018				8	4	10.7	7	4	9.7	7	3	9
01/01/2019 0:00	2019				5.5	3	9	5.5	4	8	6	3	10
01/01/2020 0:00	2020				8	5	11.4	6.5	5	9.7	6.5	4	9
01/01/2021 0:00	2021				6	4	8	6	4.3	9	6	3.3	9
01/01/2022 0:00	2022				6	3.3	9.7	7	4	10.4	8	2	10

01/01/2023 0:00	2023	8	2.3	12.4	6	3	10	7	4.3	9.7
01/01/2024 0:00	2024	6	3	12	6	4	11	6	4	10.7
01/01/2025 0:00	2025	5.5	2.3	11.7	7	3	10	7	4	11.4
01/01/2026 0:00	2026	6.5	4	9.7	5.5	4	10	7	3	9
01/01/2027 0:00	2027	7.5	4	11	8	4	10.7	7	5	9.4
01/01/2028 0:00	2028	6	4	10	7	4.3	11.4	7	3	12.4
01/01/2029 0:00	2029	6	3	9	6	3.3	11.4	6	3.3	11.4
01/01/2030 0:00	2030	7	3.3	11	7	4	10	8	5	10
01/01/2031 0:00	2031	6.5	3	11	7	3	12.4	8	4	12
01/01/2032 0:00	2032	7	3	10.7	9	5	12.7	7.5	2.3	11
01/01/2033 0:00	2033	6	3	9	7	3	10.7	7	3.6	9.7
01/01/2034 0:00	2034	7	3.3	10.4	7	5	10.7	7	4.3	12
01/01/2035 0:00	2035	7	3	12	7.5	4	12	8	4	12
01/01/2036 0:00	2036	6	3.3	11.7	6	3.3	11	6	3	9
01/01/2037 0:00	2037	7	2	11.4	6	4.3	9.7	8	5.3	14.4
01/01/2038 0:00	2038	6.5	5	10.7	9	4.3	13.7	8.5	4.6	10
01/01/2039 0:00	2039	7.5	4	12.1	6	3	11.7	7.5	4	12
01/01/2040 0:00	2040	6	3.3	11	7.5	4	11.7	6.5	4	11
01/01/2041 0:00	2041	7.5	3	10	6	3.3	11.7	7	4	9.7
01/01/2042 0:00	2042	7	4.3	10	7	3	15	9	4	13
01/01/2043 0:00	2043	8	3.3	12.8	6	3	9	7.5	3.6	13
01/01/2044 0:00	2044	7	2.3	10.7	7	5	11.7	7.5	4.3	12.4
01/01/2045 0:00	2045	7	3.3	8.7	7.5	4.3	11.7	8	4	10
01/01/2046 0:00	2046	7	4	11.7	6.5	3.3	11	7	3.3	9.7
01/01/2047 0:00	2047	7.5	2.3	10	7	3	9	7	4	9
01/01/2048 0:00	2048	8	4.3	10.7	6	2	11	9	5	11
01/01/2049 0:00	2049	7	3.3	11	8.5	4	13	7	4	10
01/01/2050 0:00	2050	7	3.3	9.7	7.5	4	11.7	6.5	2.3	10.7
01/01/2051 0:00	2051	6	3.3	11.1	8.5	4.3	11.7	7	4	10
01/01/2052 0:00	2052	6.5	3.3	11.4	7.5	4.3	12.1	7.5	4.3	11
01/01/2053 0:00	2053	7	2.6	10.7	7	3	11	8.5	4	12.1
01/01/2054 0:00	2054	7	4.3	10	7.5	5	14.4	8	5.3	11.7
01/01/2055 0:00	2055	6	3.3	12.8	6.5	4.3	10.7	7	5	11
01/01/2056 0:00	2056	8	6	11.7	6	4	11.4	8.5	4.3	14.7
01/01/2057 0:00	2057	6.5	4.3	11	8	2.3	10.7	8	5	13.4
01/01/2058 0:00	2058	7	5	11.7	7	5	10	8	4.3	11.7
01/01/2059 0:00	2059	7.5	5.3	11.7	6.5	3.3	10	9.5	3.6	15
01/01/2060 0:00	2060	6.5	4	10	7	4	12	6.5	3.3	10.7

01/01/2061 0:00	2061	6.5	2.3	11	8	3	10	8.5	4.3	13.7
01/01/2062 0:00	2062	7.5	4	11	9	5	12.7	8	4	11.7
01/01/2063 0:00	2063	8.5	5	11.7	7.5	3.3	11.7	7.5	4	10
01/01/2064 0:00	2064	8	5	11	7	3.6	12	9	5	13
01/01/2065 0:00	2065	7	3.3	9.7	8	4	11	8	4.3	11.4
01/01/2066 0:00	2066	7	4	9	7	4	10.7	8	4.3	12
01/01/2067 0:00	2067	7	4.3	9	7	3	11	7	5	10
01/01/2068 0:00	2068	7.5	3	11	7	3	13.1	9	6	13
01/01/2069 0:00	2069	6	3.3	11.7	7.5	3.6	12.7	9	5	13
01/01/2070 0:00	2070	7.5	4.3	12	8	5	11	8	4	15.7
01/01/2071 0:00	2071	7	4.3	11.7	8	5.3	14	9	3	12.7
01/01/2072 0:00	2072	7	4.3	11.4	8.5	4.3	11.7	9	5	12.7
01/01/2073 0:00	2073	6.5	4	11	8	4	15	7.5	5	11.7
01/01/2074 0:00	2074	6	3.3	9.7	9	4	12.7	8	5.3	11.4
01/01/2075 0:00	2075	7.5	4.3	12	7	5.3	11	7	4	12
01/01/2076 0:00	2076	8	4	11.7	7	4	12	7	3	12
01/01/2077 0:00	2077	6.5	3.3	13.7	8	4	12.4	6	4.3	10
01/01/2078 0:00	2078	6	4	11	7	4	13.5	7.5	3.6	15.7
01/01/2079 0:00	2079	6.5	4	10.7	7.5	5	13.4	7	4	13
01/01/2080 0:00	2080	6.5	2.3	10.7	7.5	3.3	14.4	7	4.3	12.7
01/01/2081 0:00	2081	7	4	11.7	8	4.3	11.7	8.5	2.3	11
01/01/2082 0:00	2082	7	4.3	10	8.5	5	12.7	7.5	4.3	15.1
01/01/2083 0:00	2083	8	4	11.7	8	3	12	9	2.9	13.7
01/01/2084 0:00	2084	6.5	4	9.7	7	4.3	13.1	9	5	13.7
01/01/2085 0:00	2085	8	5	10	7.5	5	12.7	8	5.3	11.7
01/01/2086 0:00	2086	6.5	3	10.7	8	5	11.7	7.5	4	10
01/01/2087 0:00	2087	7	3.3	10	8	4.3	11	9.5	4.3	11.7
01/01/2088 0:00	2088	7	4	9.7	6	4	10.7	8.5	5	14
01/01/2089 0:00	2089	7	4.6	11.4	7.5	3.3	12	6.5	4	12
01/01/2090 0:00	2090	6	3.6	10.7	9	4.6	13.4	8	4.3	12.7
01/01/2091 0:00	2091	6	4	9.7	9	3.9	10.7	7.5	4.3	11.7
01/01/2092 0:00	2092	7	3	9	8.5	6	11	9	6	14.4
01/01/2093 0:00	2093	7	4	10	8	6	11	8.5	4	13
01/01/2094 0:00	2094	6.5	3.3	10	8	4.3	11.4	8	4.3	11.7
01/01/2095 0:00	2095	6.5	2.3	11.7	6	4	10.7	9	6	14
01/01/2096 0:00	2096	7	5	11	6	4	10	7	5	13.7
01/01/2097 0:00	2097	7.5	5	11	8	4.3	13.4	8.5	3.3	12.4
01/01/2098 0:00	2098	7.5	5	12.7	7	6	10.7	10	6	13.7

01/01/2099 0:00	2099	7	5	10.7	7.5	4.3	10.7	8.5	4.6	14

DateTime	Year	Historical	Historical Range (low)	Historical Range (high)	RCP 2.6 Median	RCP 2.6 Range (low)	RCP 2.6 Range (high)	RCP 4.5 Median	RCP 4.5 Range (low)	RCP 4.5 Range (high)	RCP 8.5 Median	RCP 8.5 Range (low)	RCP 8.5 Range (high)
01/01/1950 0:00	1950	0	0	0									
01/01/1951 0:00	1951	0	0	0									
01/01/1952 0:00	1952	0	0	0									
01/01/1953 0:00	1953	0	0	0									
01/01/1954 0:00	1954	0	0	0									
01/01/1955 0:00	1955	0	0	0									
01/01/1956 0:00	1956	0	0	0									
01/01/1957 0:00	1957	0	0	0									
01/01/1958 0:00	1958	0	0	0									
01/01/1959 0:00	1959	0	0	0									
01/01/1960 0:00	1960	0	0	0									
01/01/1961 0:00	1961	0	0	0									
01/01/1962 0:00	1962	0	0	0									
01/01/1963 0:00	1963	0	0	0									
01/01/1964 0:00	1964	0	0	0									
01/01/1965 0:00	1965	0	0	0									
01/01/1966 0:00	1966	0	0	0									
01/01/1967 0:00	1967	0	0	0									
01/01/1968 0:00	1968	0	0	0									
01/01/1969 0:00	1969	0	0	0									
01/01/1970 0:00	1970	0	0	0									
01/01/1971 0:00	1971	0	0	0									
01/01/1972 0:00	1972	0	0	0									
01/01/1973 0:00	1973	0	0	0									
01/01/1974 0:00	1974	0	0	0									
01/01/1975 0:00	1975	0	0	0									
01/01/1976 0:00	1976	0	0	0									
01/01/1977 0:00	1977	0	0	0									
01/01/1978 0:00	1978	0	0	0									
01/01/1979 0:00	1979	0	0	0									
01/01/1980 0:00	1980	0	0	0									
01/01/1981 0:00	1981	0	0	0									
01/01/1982 0:00	1982	0	0	0									
01/01/1983 0:00	1983	0	0	0									
01/01/1984 0:00	1984	0	0	0									

01/01/1985 0:00	1985	0	0	0									
01/01/1986 0:00	1986	0	0	0									
01/01/1987 0:00	1987	0	0	0									
01/01/1988 0:00	1988	0	0	0									
01/01/1989 0:00	1989	0	0	0									
01/01/1990 0:00	1990	0	0	0									
01/01/1991 0:00	1991	0	0	0									
01/01/1992 0:00	1992	0	0	0									
01/01/1993 0:00	1993	0	0	0									
01/01/1994 0:00	1994	0	0	0									
01/01/1995 0:00	1995	0	0	0									
01/01/1996 0:00	1996	0	0	0									
01/01/1997 0:00	1997	0	0	0									
01/01/1998 0:00	1998	0	0	0									
01/01/1999 0:00	1999	0	0	0									
01/01/2000 0:00	2000	0	0	0									
01/01/2001 0:00	2001	0	0	0									
01/01/2002 0:00	2002	0	0	0									
01/01/2003 0:00	2003	0	0	0									
01/01/2004 0:00	2004	0	0	0									
01/01/2005 0:00	2005	0	0	0	0	0	0	1	0	2	1	0	2.7
01/01/2006 0:00	2006				0	0	0	1	0	3	1	0	2.7
01/01/2007 0:00	2007				0	0	0	1	0	2.7	1	0	2
01/01/2008 0:00	2008				0	0	0	1.5	0	3.7	1	0	2
01/01/2009 0:00	2009				0	0	0	0.5	0	2	1	0	3
01/01/2010 0:00	2010				0	0	0	1	0	2	1	0.3	2.7
01/01/2011 0:00	2011				0	0	0	1	0	2.7	1	0	1
01/01/2012 0:00	2012				0	0	0	1	0	2	0	0	2
01/01/2013 0:00	2013				0	0	0	1	0	2	1	0	2
01/01/2014 0:00	2014				0	0	0	1	0	2	1	0	3
01/01/2015 0:00	2015				0	0	0	1	0	3	1	0	2.7
01/01/2016 0:00	2016				0	0	0	1	0	2.7	1	0	3
01/01/2017 0:00	2017				0	0	0	1	0	3	1	0	2.7
01/01/2018 0:00	2018				0	0	0	1	0	2	0.5	0	2
01/01/2019 0:00	2019				0	0	0	1	0	1.7	0	0	2
01/01/2020 0:00	2020				0	0	0	1	0	2	1	0	3
01/01/2021 0:00	2021				0	0	0	1	0	2	1	0	2
01/01/2022 0:00	2022				0	0	0	1	0	2.7	1	0	2

01/01/2023 0:00	2023	0	0	0	1	0	3.7	1	0	2.7
01/01/2024 0:00	2024	0	0	0	1	0	2	0.5	0	2
01/01/2025 0:00	2025	0	0	0	1	0	2	1	0	2.7
01/01/2026 0:00	2026	0	0	0	1	0	2	1	0	2
01/01/2027 0:00	2027	0	0	0	1	0	2.4	1	0	2
01/01/2028 0:00	2028	0	0	0	0.5	0	3	0.5	0	2
01/01/2029 0:00	2029	0	0	0	1	0	2	1	0	2.7
01/01/2030 0:00	2030	0	0	0	1	0	2.7	1	0	4.4
01/01/2031 0:00	2031	0	0	0	1	0	3	1	0	3
01/01/2032 0:00	2032	0	0	0	1	0	2.7	1	0	2
01/01/2033 0:00	2033	0	0	0	1	0	2.7	1	0	2
01/01/2034 0:00	2034	0	0	0	1	0	2	1	0	3
01/01/2035 0:00	2035	0	0	0	1.5	0	4.4	1	0	3
01/01/2036 0:00	2036	0	0	0	1	0	3	1	0	2.7
01/01/2037 0:00	2037	0	0	0	1	0	2	1	0	3
01/01/2038 0:00	2038	0	0	0	2	0	3	1	0	3
01/01/2039 0:00	2039	0	0	0	1	0	2.7	1	0	2
01/01/2040 0:00	2040	0	0	0	1	0	3	1	0	2
01/01/2041 0:00	2041	0	0	0	1	0	3	1	0	3
01/01/2042 0:00	2042	0	0	0	1	0	3.7	1	0	3.7
01/01/2043 0:00	2043	0	0	0	1	0	2.7	2	0	3
01/01/2044 0:00	2044	0	0	0	1	0	2	1	0	3.7
01/01/2045 0:00	2045	0	0	0	1	0	3	1	0	2
01/01/2046 0:00	2046	0	0	0	1	0	2	1	0	2.7
01/01/2047 0:00	2047	0	0	0	0	0	1	1	0	2
01/01/2048 0:00	2048	0	0	0	1	0	2	1.5	0.3	3.7
01/01/2049 0:00	2049	0	0	0	1	0	3	1	0	2
01/01/2050 0:00	2050	0	0	0	1	0	2.7	1	0	3.7
01/01/2051 0:00	2051	0	0	0	1	0	3	1	0	2.7
01/01/2052 0:00	2052	0	0	0	1	0	3.7	1	0	3
01/01/2053 0:00	2053	0	0	0	1	0	2.7	1	0	3
01/01/2054 0:00	2054	0	0	0	1	0	3	2	0	2.7
01/01/2055 0:00	2055	0	0	0	1	0	2	1	0	2
01/01/2056 0:00	2056	0	0	0	1	0	3	1.5	0	3
01/01/2057 0:00	2057	0	0	0	1	0	3	1	0	3
01/01/2058 0:00	2058	0	0	0	1	0	2	1	0	2
01/01/2059 0:00	2059	0	0	0	1	0	2	2	0	3
01/01/2060 0:00	2060	0	0	0	1	0	3	1	0	4

01/01/2061 0:00	2061	0	0	0	1	0	3	1	0	2.7
01/01/2062 0:00	2062	0	0	0	1	0	2	1	0	3
01/01/2063 0:00	2063	0	0	0	1	0	3	1	0	3
01/01/2064 0:00	2064	0	0	0	1	0	3	2	0.3	3
01/01/2065 0:00	2065	0	0	0	1	0	2.7	1	0	3
01/01/2066 0:00	2066	0	0	0	1	0	2.7	1	0	2
01/01/2067 0:00	2067	0	0	0	1	0	2	1	0	2.7
01/01/2068 0:00	2068	0	0	0	1	0	3	1.5	0	3.7
01/01/2069 0:00	2069	0	0	0	1	0	2.7	1	0	4
01/01/2070 0:00	2070	0	0	0	2	0	3	1	0	3
01/01/2071 0:00	2071	0	0	0	1.5	0	4	1	0	3.7
01/01/2072 0:00	2072	0	0	0	1.5	0	3	1	0	4
01/01/2073 0:00	2073	0	0	0	1	0	2.7	1	0	3
01/01/2074 0:00	2074	0	0	0	1	0	4	1	0	3
01/01/2075 0:00	2075	0	0	0	1	0	2.7	1	0	4
01/01/2076 0:00	2076	0	0	0	1	0	2.7	1.5	0	2.7
01/01/2077 0:00	2077	0	0	0	1	0	3	1	0	2.7
01/01/2078 0:00	2078	0	0	0	1.5	0	2.7	2	0	3
01/01/2079 0:00	2079	0	0	0	2	0.3	3.7	1.5	0	3.7
01/01/2080 0:00	2080	0	0	0	1	0	2.7	1	0	3
01/01/2081 0:00	2081	0	0	0	1	0	3.7	1	0	2.7
01/01/2082 0:00	2082	0	0	0	1	0	3	1	0	3
01/01/2083 0:00	2083	0	0	0	1	0	2.7	2	0	4
01/01/2084 0:00	2084	0	0	0	1	0	2	1.5	0	3
01/01/2085 0:00	2085	0	0	0	1	0	2.7	1	0	3.7
01/01/2086 0:00	2086	0	0	0	1	0	2	1	0	3.7
01/01/2087 0:00	2087	0	0	0	1	0	2.7	1	0	3.7
01/01/2088 0:00	2088	0	0	0	0.5	0	2	2	0	4
01/01/2089 0:00	2089	0	0	0	1	0	2.7	1.5	0	3.7
01/01/2090 0:00	2090	0	0	0	2	0	3.7	1	0	2
01/01/2091 0:00	2091	0	0	0	1	0	2	1	0	2
01/01/2092 0:00	2092	0	0	0	1	0	3	1	0	4.4
01/01/2093 0:00	2093	0	0	0	1	0	3	1	0	3
01/01/2094 0:00	2094	0	0	0	1	0	4	1	0	3
01/01/2095 0:00	2095	0	0	0	0	0	2.7	2	0.3	4
01/01/2096 0:00	2096	0	0	0	1	0	2	1.5	0	3
01/01/2097 0:00	2097	0	0	0	1	0	3	1	0	3
01/01/2098 0:00	2098	0	0	0	1	0	2	1	0	3

01/01/2099 0:00	2099	0	0	0	1	0	2	1	0	3

Appendix C:

Greenhouse Gas Emissions Calculations

Greenhouse Gas Emission Summary

Source	Scenario	Emissions (tonne/year)			
		CO2	CH4	N2O	CO2e
100-year Global Warming Potential (GWP)[1]:		1	25	298	
Direct GHG Emissions					
On-Road Mobile Combustion	CONST_Ann	1,560	0.07	0.08	1,586
	OPS_Ann	541	0.02	0.03	551
	DECOM_Ann	357	0.01	0.02	363
Off-Road Mobile Combustion	CONST_Ann	6,507	0.18	0.55	6,676
	OPS_Ann	3,119	0.08	0.26	3,200
	DECOM_Ann	3,485	0.09	0.30	3,575
Stationary Combustion	CONST_Ann	18,570	0	0	18,647
	OPS_Ann	8,092	0	1	8,251
	DECOM_Ann	20,952	0	0	21,081
Land Use Change	CONST_Ann	4,130			4,130
	OPS_Ann	0			0
	DECOM_Ann	0			0
Acquired Energy GHG Emissions					
Provincially Supplied Power	CONST_Ann				0
	OPS_Ann				18,700
	DECOM_Ann				0

Notes:

(1) GWPs specified by ECCC follow the 100-year values from the IPCC "Fourth Assessment Report" (AR4)

Greenhouse Gas Emission Summary by Scenario

Scenario	Emissions (tonne/year)			
	CO2	CH4	N2O	CO2e
Direct GHG Emissions				
CONST_Ann	30,767	0	1	31,039
OPS_Ann	11,752	0	1	12,002
DECOM_Ann	24,794	0	1	25,019
Acquired Energy GHG Emissions				
CONST_Ann				0
OPS_Ann				18,700
DECOM_Ann				0
TOTAL GHG Emissions (CO2e/yr)				
CONST_Ann	**Construction**			**31,039**
OPS_Ann	**Operations**			**30,702**
DECOM_Ann	**Decommissioning**			**25,019**

On-Road Mobile Combustion

Scenario	Source	Type	EF Type	Engine Tier	Fuel	Engine Size (hp)	Fuel Cons. (L/h)	Annual hours	Fuel (L)	Emission Factors (g/L fuel)			Emissions (tonne/year)		
										CO2	CH4	N2O	CO2	CH4	N2O
CONST_Ann	Pick-up trucks	LDGT	On-road	Tier 2	Gasoline	430	4.9	8,574	42,182	2307.3	0.14	0.022	97.3	5.9E-03	9.3E-04
CONST_Ann	Crew van	LDGT	On-road	Tier 2	Gasoline	350	6.2	3,211	19,843	2307.3	0.14	0.022	45.8	2.8E-03	4.4E-04
CONST_Ann	Ambulance	LDGT	On-road	Tier 2	Gasoline	255	9.7	0	0	2307.3	0.14	0.022	0.0	0.0E+00	0.0E+00
CONST_Ann	Fire Truck	HDDV	On-road	Tier 2	Diesel	300	19.6	0	0	2680.5	0.11	0.151	0.0	0.0E+00	0.0E+00
CONST_Ann	MaxPERF truck	HDDV	On-road	Tier 2	Diesel	510	76.7	265	20,338	2680.5	0.11	0.151	54.5	2.2E-03	3.1E-03
CONST_Ann	Delivery/Freight	HDDV	On-road	Tier 2	Diesel	510	76.7	1,098	84,234	2680.5	0.11	0.151	225.8	9.3E-03	1.3E-02
CONST_Ann	Cement Truck	HDDV	On-road	Tier 2	Diesel	750	102.4	4,140	423,936	2680.5	0.11	0.151	1136.4	4.7E-02	6.4E-02
OPS_Ann	Pick-up trucks	LDGT	On-road	Tier 2	Gasoline	430	4.9	7,539	37,094	2680.5	0.11	0.151	99.4	4.1E-03	5.6E-03
OPS_Ann	Crew van	LDGT	On-road	Tier 2	Gasoline	350	6.2	3,211	19,843	2680.5	0.11	0.151	53.2	2.2E-03	3.0E-03
OPS_Ann	Ambulance	LDGT	On-road	Tier 2	Gasoline	255	9.7	151	1,457	2680.5	0.11	0.151	3.9	1.6E-04	2.2E-04
OPS_Ann	Fire Truck	HDDV	On-road	Tier 2	Diesel	300	19.6	151	2,956	2680.5	0.11	0.151	7.9	3.3E-04	4.5E-04
OPS_Ann	MaxPERF truck	HDDV	On-road	Tier 2	Diesel	510	76.7	368	28,271	2680.5	0.11	0.151	75.8	3.1E-03	4.3E-03
OPS_Ann	Delivery/Freight	HDDV	On-road	Tier 2	Diesel	510	76.7	1,464	112,312	2680.5	0.11	0.151	301.1	1.2E-02	1.7E-02
DECOM_Ann	Pick-up trucks	LDGT	On-road	Tier 2	Gasoline	430	4.9	7,539	37,094	2680.5	0.11	0.151	99.4	4.1E-03	5.6E-03
DECOM_Ann	Crew van	LDGT	On-road	Tier 2	Gasoline	350	6.2	3,211	19,843	2680.5	0.11	0.151	53.2	2.2E-03	3.0E-03
DECOM_Ann	Ambulance	LDGT	On-road	Tier 2	Gasoline	255	9.7	151	1,457	2680.5	0.11	0.151	3.9	1.6E-04	2.2E-04
DECOM_Ann	Fire Truck	HDDV	On-road	Tier 2	Diesel	300	19.6	151	2,956	2680.5	0.11	0.151	7.9	3.3E-04	4.5E-04
DECOM_Ann	MaxPERF truck	HDDV	On-road	Tier 2	Diesel	510	76.7	0	0	2680.5	0.11	0.151	0.0	0.0E+00	0.0E+00
DECOM_Ann	Delivery/Freight	HDDV	On-road	Tier 2	Diesel	510	76.7	936	71,828	2680.5	0.11	0.151	192.5	7.9E-03	1.1E-02

Off-Road Mobile Combustion

Scenario	Source Type	No. of Equip.	Utlization	Weighted No. of Equipment	Fuel Consumption (L/hr)	Annual Operation (hr)	Fuel Used (L)	Emission Factors (g/L fuel)			Emissions (tonne/year)		
								CO2	CH4	N2O	CO2	CH4	N2O
CONST_Ann	Water truck	1	33%	0.33	19.6	2,760	54,102	2680.5	0.073	0.227	145.0	0.0	0.0
CONST_Ann	Dozer	2	33%	0.67	110.0	5,520	607,200	2680.5	0.073	0.227	1627.6	0.0	0.1
CONST_Ann	Forklift	3	50%	1.50	13.7	12,420	169,906	2680.5	0.073	0.227	455.4	0.0	0.0
CONST_Ann	Man lift	2	25%	0.50	6.0	4,140	24,716	2680.5	0.073	0.227	66.3	0.0	0.0
CONST_Ann	Skid steer	3	50%	1.50	12.8	12,420	158,976	2680.5	0.073	0.227	426.1	0.0	0.0
CONST_Ann	Flat deck truck	1	25%	0.25	37.5	2,070	77,666	2680.5	0.073	0.227	208.2	0.0	0.0
CONST_Ann	Vacuum truck	2	33%	0.67	51.1	5,520	282,182	2680.5	0.073	0.227	756.4	0.0	0.1
CONST_Ann	Crane	1	17%	0.17	42.0	1,380	57,960	2680.5	0.073	0.227	155.4	0.0	0.0
CONST_Ann	DR drill rig	2	34%	0.67	88.0	5,558	489,087	2680.5	0.073	0.227	1311.0	0.0	0.1
CONST_Ann	Mud rotary drill rig	2	34%	0.67	76.7	5,558	426,395	2680.5	0.073	0.227	1143.0	0.0	0.1
CONST_Ann	Grader	1	1%	0.01	42.0	51	2,134	2680.5	0.073	0.227	5.7	0.0	0.0
CONST_Ann	Grader	1	0%	0.00	42.0	9	394	2680.5	0.073	0.227	1.1	0.0	0.0
CONST_Ann	Grader	1	0%	0.00	42.0	9	372	2680.5	0.073	0.227	1.0	0.0	0.0
CONST_Ann	Grader	1	1%	0.01	42.0	46	1,948	2680.5	0.073	0.227	5.2	0.0	0.0
CONST_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
CONST_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
CONST_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
CONST_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
CONST_Ann	Wheel loader	1	4%	0.04	13.7	310	4,243	2680.5	0.073	0.227	11.4	0.0	0.0
CONST_Ann	Wheel loader	1	4%	0.04	13.7	310	4,243	2680.5	0.073	0.227	11.4	0.0	0.0

CONST_Ann	Haul truck	1	8%	0.08	50.0	662	33,087	2680.5	0.073	0.227	88.7	0.0	0.0
CONST_Ann	Haul truck	1	8%	0.08	50.0	662	33,087	2680.5	0.073	0.227	88.7	0.0	0.0
OPS_Ann	Water truck	1	21%	0.21	19.6	1,741	34,118	2680.5	0.073	0.227	91.5	0.0	0.0
OPS_Ann	Water truck	1	4%	0.04	19.6	318	6,233	2680.5	0.073	0.227	16.7	0.0	0.0
OPS_Ann	Water truck	1	4%	0.04	19.6	301	5,905	2680.5	0.073	0.227	15.8	0.0	0.0
OPS_Ann	Water truck	1	19%	0.19	19.6	1,573	30,838	2680.5	0.073	0.227	82.7	0.0	0.0
OPS_Ann	Forklift	1	24%	0.24	13.7	1,967	26,902	2680.5	0.073	0.227	72.1	0.0	0.0
OPS_Ann	Forklift	1	24%	0.24	13.7	1,967	26,902	2680.5	0.073	0.227	72.1	0.0	0.0
OPS_Ann	Forklift	1	24%	0.24	13.7	1,967	26,902	2680.5	0.073	0.227	72.1	0.0	0.0
OPS_Ann	Man lift	2	24%	0.48	6.0	3,933	23,480	2680.5	0.073	0.227	62.9	0.0	0.0
OPS_Ann	Skid steer	2	32%	0.63	12.8	5,244	67,123	2680.5	0.073	0.227	179.9	0.0	0.0
OPS_Ann	Flat deck truck	1	24%	0.24	37.5	1,967	73,783	2680.5	0.073	0.227	197.8	0.0	0.0
OPS_Ann	Vacuum truck	2	24%	0.48	51.1	3,933	201,055	2680.5	0.073	0.227	538.9	0.0	0.0
OPS_Ann	Crane	1	4%	0.04	42.0	328	13,766	2680.5	0.073	0.227	36.9	0.0	0.0
OPS_Ann	DR drill rig	2	22%	0.45	88.0	3,705	326,058	2680.5	0.073	0.227	874.0	0.0	0.1
OPS_Ann	Mud rotary drill rig	2	22%	0.45	76.7	3,705	284,263	2680.5	0.073	0.227	762.0	0.0	0.1
OPS_Ann	Grader	1	1%	0.01	42.0	51	2,134	2680.5	0.073	0.227	5.7	0.0	0.0
OPS_Ann	Grader	1	0%	0.00	42.0	9	394	2680.5	0.073	0.227	1.1	0.0	0.0
OPS_Ann	Grader	1	0%	0.00	42.0	9	372	2680.5	0.073	0.227	1.0	0.0	0.0
OPS_Ann	Grader	1	1%	0.01	42.0	46	1,948	2680.5	0.073	0.227	5.2	0.0	0.0
OPS_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
OPS_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
OPS_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
OPS_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
OPS_Ann	Wheel loader	1	5%	0.05	13.7	414	5,658	2680.5	0.073	0.227	15.2	0.0	0.0
OPS_Ann	Wheel loader	1	5%	0.05	13.7	414	5,658	2680.5	0.073	0.227	15.2	0.0	0.0
DECOM_Ann	Water truck	1	15%	0.15	19.6	1,221	23,943	2680.5	0.073	0.227	64.2	0.0	0.0
DECOM_Ann	Water truck	1	3%	0.03	19.6	223	4,374	2680.5	0.073	0.227	11.7	0.0	0.0
DECOM_Ann	Water truck	1	3%	0.03	19.6	211	4,144	2680.5	0.073	0.227	11.1	0.0	0.0
DECOM_Ann	Water truck	1	13%	0.13	19.6	1,104	21,641	2680.5	0.073	0.227	58.0	0.0	0.0
DECOM_Ann	Dozer	1	33%	0.17	110.0	1,380	151,800	2680.5	0.073	0.227	406.9	0.0	0.0
DECOM_Ann	Dozer	1	33%	0.03	110.0	230	25,300	2680.5	0.073	0.227	67.8	0.0	0.0
DECOM_Ann	Forklift	1	50%	0.50	13.7	4,140	56,635	2680.5	0.073	0.227	151.8	0.0	0.0
DECOM_Ann	Forklift	1	50%	0.50	13.7	4,140	56,635	2680.5	0.073	0.227	151.8	0.0	0.0
DECOM_Ann	Forklift	1	50%	0.50	13.7	4,140	56,635	2680.5	0.073	0.227	151.8	0.0	0.0
DECOM_Ann	Man lift	2	25%	0.50	6.0	4,140	24,716	2680.5	0.073	0.227	66.3	0.0	0.0
DECOM_Ann	Wheel loader	4	50%	2.00	13.7	16,560	226,541	2680.5	0.073	0.227	607.2	0.0	0.1
DECOM_Ann	Skid steer	3	50%	1.50	12.8	12,420	158,976	2680.5	0.073	0.227	426.1	0.0	0.0
DECOM_Ann	Flat deck truck	1	25%	0.25	37.5	2,070	77,666	2680.5	0.073	0.227	208.2	0.0	0.0
DECOM_Ann	Vacuum truck	2	33%	0.67	51.1	5,520	282,182	2680.5	0.073	0.227	756.4	0.0	0.1
DECOM_Ann	Crane	1	17%	0.17	42.0	1,380	57,960	2680.5	0.073	0.227	155.4	0.0	0.0
DECOM_Ann	DR drill rig	0	0%	0.00	88.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
DECOM_Ann	Mud rotary drill rig	0	0%	0.00	76.7	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
DECOM_Ann	Grader	1	1%	0.01	42.0	51	2,134	2680.5	0.073	0.227	5.7	0.0	0.0
DECOM_Ann	Grader	1	0%	0.00	42.0	9	394	2680.5	0.073	0.227	1.1	0.0	0.0
DECOM_Ann	Grader	1	0%	0.00	42.0	9	372	2680.5	0.073	0.227	1.0	0.0	0.0
DECOM_Ann	Grader	1	1%	0.01	42.0	46	1,948	2680.5	0.073	0.227	5.2	0.0	0.0
DECOM_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
DECOM_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
DECOM_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
DECOM_Ann	Grader	1	0%	0.00	42.0	0	0	2680.5	0.073	0.227	0.0	0.0	0.0
DECOM_Ann	Haul truck	1	8%	0.08	50.0	662	33,087	2680.5	0.073	0.227	88.7	0.0	0.0
DECOM_Ann	Haul truck	1	8%	0.08	50.0	662	33,087	2680.5	0.073	0.227	88.7	0.0	0.0

Stationary Combustion

Scenario	Activity	Fuel Type	Fuel Cons. (L/hr)	Daily Operating hours	Annual Fuel Use (L)	Emission Factors (g/L fuel)			Emissions (tonne/year)		
						CO2	CH4	N2O	CO2	CH4	N2O
CONST_Ann	Propane heating	Propane	-	-	386,211	1515	0.024	0.108	585.1	0.0	0.0
CONST_Ann	Generator C3512	Diesel	356.8	24	3,125,568	2753	0.026	0.031	8604.7	0.1	0.1
CONST_Ann	Generator C3512	Diesel	356.8	24	3,125,568	2753	0.026	0.031	8604.7	0.1	0.1
CONST_Ann	Generator C15	Diesel	106.1	0	0	2753	0.026	0.031	0.0	0.0	0.0
CONST_Ann	Generator C15	Diesel	106.1	0	0	2753	0.026	0.031	0.0	0.0	0.0
CONST_Ann	Portable Generators	Diesel	16.1	48	281,722	2753	0.026	0.031	775.6	0.0	0.0
OPS_Ann	Propane heating	Propane	-	-	4,740,276	1515	0.024	0.108	7181.5	0.1	0.5
OPS_Ann	Generator C3512	Diesel	356.8	2	260,464	2753	0.026	0.031	717.1	0.0	0.0
OPS_Ann	Generator C3512	Diesel	356.8	0	0	2753	0.026	0.031	0.0	0.0	0.0
OPS_Ann	Generator C15	Diesel	106.1	0	0	2753	0.026	0.031	0.0	0.0	0.0
OPS_Ann	Generator C15	Diesel	106.1	0	0	2753	0.026	0.031	0.0	0.0	0.0
OPS_Ann	Portable Generators	Diesel	16.1	12	70,430	2753	0.026	0.031	193.9	0.0	0.0
DECOM_Ann	Propane heating	Propane	-	-	1,958,278	1515	0.024	0.108	2966.8	0.0	0.2
DECOM_Ann	Generator C3512	Diesel	356.8	24	3,125,568	2753	0.026	0.031	8604.7	0.1	0.1
DECOM_Ann	Generator C3512	Diesel	356.8	24	3,125,568	2753	0.026	0.031	8604.7	0.1	0.1
DECOM_Ann	Generator C15	Diesel	106.1	0	0	2753	0.026	0.031	0.0	0.0	0.0
DECOM_Ann	Generator C15	Diesel	106.1	0	0	2753	0.026	0.031	0.0	0.0	0.0
DECOM_Ann	Portable Generators	Diesel	16.1	48	281,722	2753	0.026	0.031	775.6	0.0	0.0

Land Use Change

Scenario	Activity	Emissions (t CO2/yr)
CONST_Ann	Clearing and grubbing	4,130
OPS_Ann	No change	0
DECOM_Ann	No change	0

Acquired Energy

Scenario	Energy Source	Emission Intensity (t CO2eq/GWh)	Annual Power Requirement (GWh)	Emissions (t CO2 eq/yr)
CONST_Ann	Generators	N/A	N/A	0
OPS_Ann	Provincial Grid	404.3	46.3	18,700
DECOM_Ann	Generators	N/A	N/A	0

Land Change Calculations

Parameter	Value	Unit	Reference
Area to be excavated	169.6	ha	[1]
B-After	0	tonnes/ha	[2]
B-Before - Trees	32	t C/ha	[2]
B-Before - Shrubs	1.5	t C/ha	[2]
Percent area of tree coverage	37.8%		[3]
Percent area of shrub coverage	62.2%		[3]
Area of tree coverage	64.1	ha	
Area of shrub coverage	105.5	ha	
carbon fraction (CF)	0.51	t C/t biomas	[4]
deltaC-conversion	1126	t C/yr	
emissions of CO2e	4130	t CO2e/yr	

note: since CL and CG are each 0, deltaC-conversion = deltaCB (from Eq. 2-15)

[1] Civil - earthworks quantities.xlsx

[2] SACC Guide

[3] Denison EIS Ch. 11

[4] Table 4.3 of IPCC 2006, for boreal forest, conifers - median value

Appendix D:

Summary of Precipitation Values Presented in the EIS

Attachment IR-236

Number	IR-236
Comment From	ECCC ERAD
Category	Fish and fish habitat
Page # in EIS	
Section # in EIS	Section 8.2.4.2.3 and Section 8.4.7.6, Aquatic Environment
Comment	This response has not been accepted. The Proponent made a correlation between precipitation and the Probable Maximum Precipitation (PMP). However, annual maximum and PMP cannot be correlated as they are two separate concepts that require different statistical methods to verify. The Proponent provided two tables which displayed precipitation data under current, existing, and future climate scenarios for two nearby lakes. These were provided to support the Proponent's response, however, the calculations used to achieve the table figures within the response or Attachment: IR-236 were not provided. As one value cannot be used to infer the other, reviewing the calculations is required to support the Proponent's conclusions. Please see the following requests: 1. In Table 3 of Attachment: IR-236, the historical mean value (1976 to 2005) for the Maximum 1-Day Precipitation is 24.1 mm and is indicated as measured. However, this estimate appears to be derived from ensembles of climate modeled historical precipitation. Thus, proponent to insert a footnote at Table 3 that indicate the total annual as well as maximum 1-day are estimates based on ensembles of climate modeled historical precipitation. The Proponent needs to provide the calculations that were used to reach the conclusions found within Tables 2 and 3 of Attachment: IR-236. Reviewing the calculation will allow for verification of the Proponent's conclusions. If the currently used data sources do not allow for accurate representation of their conclusions, the Proponent should use complete regional observational data sources to support the conclusions in Tables 2 and 3. 2. The analysis of mean maximum one day and mean annual total precipitation [1976-2005] based on weather station (Climate ID 4063755) at Key Lake is roughly 32mm and 470mm respectively. Thus, include both modeled and observed historical precipitation statistics in the EIS for context. Measured data should take precedence over modeled data. The Proponent is taking an ensemble of modeled data to "predict" historical data when measured data is available and can validate the models. Without strong justification, it is not appropriate to replace measured data with "predicted" modeled data.

Response:

The original response to IR-236 is provided here in its entirety as well as updates that are required for the second round of IRs from the FIRT. This is for the purposes of adding this IR Attachment as an Appendix to Appendix 6-C of Section 6 of the revised Draft EIS.

During the Draft EIS review by the FIRT, there were information requirements (IRs; mainly IR-235 and IR-236, and to a lesser extent IR-103 and IR-104) related to current and future climate precipitation, as well as the probable maximum precipitation event. The information in Attachment IR-236 will be added as *Appendix D Summary of Precipitation Values Presented in the EIS* to Appendix 6-C in the final EIS. The advancement of Project design and the site drainage plan are more closely linked to detailed design to support the licensing process and the precipitation information provided herein and in the revised Draft EIS to support an EA decision is adequate. This new appendix to Appendix 6-C serves to provide clarifications only.

The probable maximum precipitation (PMP) event used for feasibility engineering designs is 493 mm. The PMP value has been extrapolated from Key Lake data presented in the Canadian Climate Program (1994). Denison reviewed the update to the Canadian Climate Program (1994) report provided in Atmospheric Environment Branch (1999) which shows PMP at the approximate Wheeler River Project location at 489.3 mm. Denison retained the higher of the two PMP values, i.e., 493 mm, for design purposes. As an example, during a PMP, water requiring management will report to the wellfield runoff pond which will be sized to accommodate a PMP event at the site. This pond has been sized to 38,200 m^3 (*excluding a freeboard of 1 meter*). From the wellfield runoff pond, water will then be sent to the process water pond for treatment if required. In EIS Section 2.8 Project Design Features, Denison notes that "Ponds will be designed to maintain a minimum freeboard of at least 1.0 m to allow for continued functioning during a probable maximum precipitation (PMP) event."

Tables 1 to 4 below provide a summary of precipitation information for both current / existing climate and future climate under different emissions scenarios, in order to 1) summarize precipitation data from various sections of the EIS (Section 6 including Appendix 6-C, Section 8, and Section 15) and 2) provide context on the PMP of 493 mm in comparison to precipitation values (annual precipitation, maximum 1-day precipitation, and 1:100 year, 24 hour return).

With specific reference to the second round IR comments response the following is noted:

1) Table 3 has been updated to represent the Total Annual and Maximum 1-Day precipitation event for Tomblin Lake as provided from the Climate Atlas of Canada.
2) The information provided in Section 6, Appendix 6-C, Table 10 provides both the historical data (2011 to 2022) and the predicted values for the future periods for both Total Annual Precipitation and Maximum 1-Day Precipitation (see Table 2 below). As such, Denison has used the available measured data from the Key Lake data station for presentation in Appendix 6-C. With the update provided to Table 3 (see #1 above), the information provided for the period from 1976 to 2005 has also been updated to represent measured data.

Denison has used measured data where applicable and this IR will be included as Appendix D in Appendix 6-C of Section 6.

Table 1: Precipitation - Existing Climate – Comparisons of Observed Annual Average Precipitation and Maximum 24-hour Precipitation to PMP

Precipitation-related metric	Value	Notes on Source of Data	Location in EIS and comment on how this information was used in the EIS	Commentary on metric compared to PMP (493 mm)
Annual average precipitation	456 mm	Recorded from Key Lake in the period from 2011-2020, ECCC station 4063753 Available at: climate.weather.gc.ca	Presented in 6.1.3.1.2 Precipitation and Appendix 6-C. Provides point of comparison for selected Project PMP.	***PMP is similar to annual precipitation***
Annual average precipitation	483 mm	Canadian Climate Normals 1981-2010 Station Data, Key Lake, Saskatchewan. Available at: climate.weather.gc.ca	Presented in 6.1.3.1.2 Precipitation and Appendix 6-C. Provides point of comparison for selected Project PMP.	***PMP is similar to annual precipitation***
Maximum 24-hour precipitation	45.9 mm	Occurred on August 8, 2020. Recorded from Key Lake in the period from 2011-2020, ECCC station 4063753 Available at: climate.weather.gc.ca	Presented in 6.1.3.1.2 Precipitation and Appendix 6-C. Provides point of comparison for selected Project PMP.	***24-hr event is 10.7 x lower than PMP***
Maximum 24-hour precipitation	72 mm	Occurred July 12, 1998. Canadian Climate Normals 1981-2010 Station Data, Key Lake, Saskatchewan. Available at: climate.weather.gc.ca	Presented in 6.1.3.1.2 Precipitation and Appendix 6-C. Provides point of comparison for selected Project PMP.	***24-hr event is 6.8 x lower than PMP***
1 in 100 year, 24 hour return	79.9 mm	Calculated using IDF_CC Tool for the Wheeler River Project. Available at: www.idf-cc-uwo.ca	8.1.3.4 Climate Change Influenced Extreme Events and Appendix 8-B. Provides point of comparison for water management design and understanding rainfall associated with 1:100-year storms.	***1:100 is 6.2 x lower than PMP***

Precipitation-related metric	Value	Notes on Source of Data	Location in EIS and comment on how this information was used in the EIS	Commentary on metric compared to PMP (493 mm)
1 in 100 year, 24 hour return	56.4 mm	Return Period Estimate based on data from the Key Lake Mine using the IDF_CC Tool (~32 km away from Wheeler River Project). Available at: www.idf-cc-uwo.ca	8.1.3.4 Climate Change Influenced Extreme Events and Appendix 8-B. Provides point of comparison for water management design and understanding rainfall associated with 1:100-year storms.	***1:100 is 8.7 x lower than PMP***

Table 2: Precipitation – Future Climate - Existing and Predicted Precipitation Data for Key Lake (provided in EIS, Appendix 6-C, Table 10)

Year	Total Annual (mm)				Maximum 1-day (mm)			
	Measured	RCP 2.6	RCP 4.5	RCP 8.5	Measured	RCP 2.6	RCP 4.5	RCP 8.5
2011-2020	455	518	509	508	48	29	27	27
2030		528	503	537		27	24	26
2040		487	498	514		28	29	24
2050		504	524	520		26	29	33
2060		513	515	523		26	33	26
2070		527	534	568		29	31	28
2080		539	551	547		30	33	28
2090		543	545	548		31	32	35
2100		546	535	559		23	25	28
Overall Increase:		28	26	51		-6	-2	1

Table 3: Precipitation – Future Climate - Historical and Future Precipitation Data (Total Annual and Maximum 1-day) for Tomblin Lake, Climate Atlas (provided in EIS, Section 15, Table 15.5-1 and 15.5-2)

Period	Total Annual (mm)			Maximum 1-day (mm)		
	Historical	RCP 4.5	RCP 8.5	Measured	RCP 4.5	RCP 8.5
Historical mean (1976-2005)	495.7			27.9		
Near Term (2021-2050)		484	487		25.9	25.9
Far Term (2051-2080)		500	509		26.7	27.5

Table 4: Precipitation – Future Climate - Predicted Precipitation (1:100 year, 24-hour return) for Key Lake and Wheeler River Project, 2020 to 2050 using IDF_CC Tool (provided in EIS Section 8)

Location	1:100 year, 24-hour return
Key Lake Mine	62.0
Wheeler River Project	88.6

Date (for drafting version control): January 30, 2024

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

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Appendix 6-D
Baseline Air Quality Monitoring Report: Denison Mines – Wheeler River Project

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September 2022

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1.0 INTRODUCTION

Independent Environmental Consultants (IEC) was retained by Denison Mines Corp. (Denison) to assist in the completion of a baseline air quality monitoring program in support of the Environmental Impact Statement (EIS) for the Wheeler River Project (the Project). The Project site is located approximately 35 km north of Cameco's Key Lake uranium operation and approximately 4 km west of Highway 914. Denison is proposing to apply an innovative approach to uranium mining called In-Situ Recovery (ISR), which is used extensively internationally but has yet to be used in Canada. This approach eliminates the need for large open pits, shafts, and underground mine workings that are the norm for uranium mining in Canada to-date.

The scope of the baseline air monitoring program was developed with consideration to the potential Project-environment interactions that may exist during the construction, operation, decommissioning, and closure of the Project site, and the contaminants of potential concern (COPCs) that may be associated with these activities. Based on the description of the Project site and processes from the Pre-Feasibility Study [1], the projected activities during the various Project stages that have the potential to impact air quality include the following:

- Site preparation and earthworks activities during construction,
- Construction activity associated with building the access road and other mine site roads,
- Construction activity associated with building infrastructure,
- Increased road traffic on Highway 914 (construction crews, site personnel, deliveries, yellowcake shipping, etc.),
- Air traffic to/from the new airstrip,
- Operation of mobile equipment on-site (mining equipment, haul trucks, light-duty trucks, etc.),
- Operation of the standby diesel power generating station,
- Drilling activities in the ISR wellfield,
- Fugitive dust from unpaved roads, windblown dust,
- Radon emissions from ISR wellfield operations,
- Emissions from the ISR plant operations,
- Building demolition, and
- Re-grading and re-vegetation of site.

This report outlines the regulatory context of the baseline program in relation to the broader Environmental Assessment (EA) process, rationale for the selection of COPCs, measurement methodologies for each COPC inclusive of quality assurance and quality control (QA/QC) procedures, and the results of the air quality baseline monitoring program. The report is concluded with key observations from the monitoring program.

2.0 REGULATORY CONTEXT

The baseline air quality monitoring program is intended to support the development of an eventual EA for the Wheeler River Project, by establishing the existing air quality conditions prior to the construction and operation of the Project. As the baseline work will form the basis of the EA work pertaining to air quality (i.e., assessment of air quality impacts), it is important to consider the requirements of the EA process for the assessment of air quality in the scoping of the baseline program. As the Project is a proposed uranium mining operation, an EA will be required that will need to meet both Federal and Provincial EA processes.

2.1 PROVINCIAL REQUIREMENTS

The Provincial EA process is overseen by the Saskatchewan Ministry of Environment (SkMOE). As the baseline program involves measurements of air quality parameters, the SkMOE air quality monitoring guidance and requirements as outlined in its 2012 publication *Air Monitoring Guideline for Saskatchewan* [2] (the *Monitoring Guideline*) were followed in the development of the baseline program. This document outlines relevant information, such as permissible instrumentation and siting requirements that facilities are required to follow when completing ambient air monitoring in Saskatchewan. The Monitoring Guideline also includes SkMOE ambient air quality criteria; however, it should be noted that these criteria are not the most current and have been superseded by those in the Saskatchewan Environmental Quality Standard (SEQS) [3]. The Saskatchewan Ambient Air Quality Standards (SAAQS) are summarized in Table 20 of the SEQS, and the Saskatchewan Environmental Code identifies in Division E.1.2 that these standards must be met for industrial sources, including mine sites [4]. As such, the Project would need to be able to demonstrate compliance with the SAAQS in the impact assessment supporting the Provincial EA. These criteria identify the contaminants of interest to the SkMOE that should be considered for relevance during the baseline work. Not all of the contaminants listed in Table 20 of the SEQS are relevant to the Project and proposed operations; those that are relevant are summarized in Table 1.

Table 1: Saskatchewan Ambient Air Quality Standards

Pollutant	Average Concentration for Applicable Time Period (µg/m^3)				
	1-hr	8-hr	24-hr	30-day	Annual
Particulate Matter ($PM_{2.5}$)			28[1]		10
Particulate Matter (PM_{10})			50		
Total Suspended Particulates (TSP)			100		60[2]
Nitrogen dioxide	300 (159 ppb)		200 (106 ppb)		45[3] (24 ppb)
Sulphur dioxide	450 (172 ppb)		125 (48 ppb)		20[3] (8 ppb)

Pollutant	Average Concentration for Applicable Time Period (µg/m³)				
	1-hr	8-hr	24-hr	30-day	Annual
Carbon monoxide	15,000 (13,000 ppb)	6,000 (5,000 ppb)			

Notes:
[1] The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations.
[2] Geometric means
[3] Arithmetic means

While carbon monoxide is relevant to the Project (as it is a combustion product, and there are a number of proposed combustion sources associated with operations), it is not measurable without access to power.

2.2 FEDERAL REQUIREMENTS

As the Project is a proposed uranium mining operation, a Federal EA will be triggered under the Canadian Environmental Assessment Act (CEAA), with the Canadian Nuclear Safety Commission (CNSC) acting as the lead agency. As a result, the baseline assessment framework has been developed to align with Federal standards and guidance. The Project will be expected to demonstrate compliance with the Canadian Ambient Air Quality Standards (CAAQS), and the monitoring program will be expected to include other ambient atmospheric parameters of interest to the CNSC, such as radon and gamma. The CAAQS have been developed by the Canadian Council of Ministers of the Environment (CCME) [5], and have been adopted federally by Environment and Climate Change Canada (ECCC), and are presented in Table 2.

Table 2: Canadian Ambient Air Quality Standards

Pollutant	Averaging Time	Numerical Value		
		2015	2020	2025
Fine particulate matter ($PM_{2.5}$)	24-hr [1]	28 µg/m³	27 µg/m³	
	Annual [2]	10 µg/m³	8.8 µg/m³	
Sulphur dioxide (SO_2)	1-hr [4]		183.4 µg/m³ (70 ppb)	170.3 µg/m³ (65 ppb)
	Annual [5]		13.1 µg/m³ (5 ppb)	10.5 µg/m³ (4 ppb)
Nitrogen dioxide (NO_2)	1-hr [6]		112.8 µg/m³ (60 ppb)	79 µg/m³ (42 ppb)
	Annual [5]		32.0 µg/m³ (17 ppb)	22.6 µg/m³ (12 ppb)

Notes:
[1] 3-year average of the annual 98th percentile of the daily 24-hr average concentrations
[2] 3-year average of the annual average of all 1-hr concentrations
[3] 3-year average of the annual 4th highest of the daily maximum 8-hr concentrations
[4] 3-year average of the annual 99th percentile of the daily maximum 1-hr average concentrations
[5] the average over a single year of all 1-hr average concentrations
[6] 3-year average of the annual 98th percentile of the daily maximum 1-hr average concentrations

2.3 ADDITIONAL GUIDANCE

Particulate matter of less than 10 micron (PM_{10}) was identified as a COPC for the Project and included in the monitoring program. However, there is no annual provincial or federal limit currently in force. The WHO provides an annual standard for PM_{10} of 20 µg/m^3 [6] which will be used for comparative purposes in the assessment. In addition, when updating the provincial air quality standards from what is published in the SkMOE Monitoring Guideline to the current SAAQS, the standard for settleable particulates was removed. The standard for settleable particulates was formerly 2.0 mg/cm^2/30-days [2] and has been included in this assessment for comparison to the measured levels.

3.0 SAMPLING METHODOLOGIES

Sampling methodologies were selected with consideration to the regulatory context, project setting, contaminant of concern, and industry standard practice. Section 2.3 of the SkMOE Monitoring Guideline identifies that analyzers "*used for an ambient air monitoring program within the province must satisfy the requirements of the US EPA equivalent reference methods for ambient air monitoring*" [2]. As a result of this requirement, the U.S. EPA *List of Designated Reference and Equivalent Methods* [7] was referenced when scoping the program to select equipment that would be acceptable to the SkMOE. Many of the instruments included in the U.S. EPA list are dependent upon access to a dedicated AC power supply and temperature-controlled enclosure. As the site is currently in the exploration phase, there is insufficient access to power to operate such equipment. It should be noted that the SkMOE does acknowledge that access to power may be a limiting factor for some projects and identifies in section 2.6 of the Monitoring Guideline that sampling using passive means is acceptable for such circumstances [2]. As such, where U.S. EPA reference or equivalent methods were either not available or not feasible, passive methods were considered.

3.1 SETTLEABLE PARTICULATES (DUSTFALL)

3.1.1 Equipment and Operation

Section 2.6 of the SkMOE Monitoring Guideline indicates that sampling using passive means is acceptable for areas where there is no access to power [2]. Dustfall was included in the baseline air quality monitoring program as it provided a cost-effective means to provide robust spatial coverage for particulate monitoring, and the resulting data on the dust deposition rate is of use to other EA disciplines such as the Human Health Risk Assessment (HHRA) component.

The dustfall monitoring procedure applied at the site was based on ASTM Standard D1739:1998 [8] and procedures from the British Columbia Environmental Lab Manual [9], with supplies and analysis being provided by ALS Environmental (ALS). Samples of dustfall are collected in open-topped polymer containers, which are inserted to a stand-mounted holder equipped with a wind shield and bird ring. The dustfall containers provided by ALS feature a tight-fitting screw lid, which is removed at the time of exposure and re-fitted at the time of retrieval. At the time of deployment, a 50% isopropanol solution is added as an anti-freezing agent and algae inhibitor. The containers are then placed in the holders and left open to the atmosphere for a period of 30 days (+/- 2 days) to collect settling particles. The field protocol outlines that periodic checks should be completed where possible to ensure that there is always some liquid in the container (to assist with entrainment of dust), and if not, to add deionized water to the container. At the end of the exposure period, the samples are resealed

by fixing the screw lid in place. Field sheets are used to keep track of the sample location, the start and end dates, and the amount of liquids added to the container. The full field protocol and an example field sheet is provided in Appendix A.

3.1.2 Siting

Siting criteria are provided in ASTM Standard D1739:1998, which outlines that there should be no structures higher than 1 m within 20 m of the container (or objects within 20 m should be less than 30° from the horizontal at the container top), and that the container should be approximately 2 m above the ground [8]. These criteria are similar those from the Monitoring Guideline, which for passive equipment outlines that the height above ground should be between 1-3 m, and the elevation angle should be less than 30° from the sample inlet to the top of any obstacle [2]. Monitoring was completed at six (6) locations at the Project site (see Figure 1).

3.1.3 Sampling Schedule

The SkMOE criterion for settleable particulates is presented in terms of a deposition rate on a 30-day basis (2.0 mg/cm^2/30-days). The ASTM Standard outlines that the canister should be exposed to the atmosphere for a period of 30 days, +/- 2 days. This requirement appears in the field protocol, provided in Appendix A. The dustfall sample schedule that was followed in support of this study is summarized in Table 3.

Table 3: Dustfall Sampling Schedule (2018-2021)

Year	Round	Deployed	Retrieved	Average Exposure Period (days)
2018/2019	2019-1	October 2018	January 2019	113
	2019-2	January 2019	May 2019	110
2020	2020-1	July	August	34.9
	2020-2	August	September/October	34.1
	2020-3	September/October	November	33.6
2021	2021-1	June	July	32.0
	2021-2	July	August	38.0
	2021-3	August	September	35.4
	2021-4	September	October	30.5

NOTES:
[1] All results were prorated to a daily average exposure period by ALS. These were prorated to a period of 30 days for this report, in order to compare the results to the SkMOE standard. The results of the program are discussed in section 4.2.

3.1.4 Calibration and QA/QC

As the dustfall sampling is a passive method, there are no calibration requirements. A number of QA/QC procedures were written into the field protocol to ensure sample integrity. The following general approaches were applied:

- sample containers were kept sealed until the moment of deployment in the field,

- duplicate samples were collected at each site, to account for the possibility of a compromised sample,
- an algae inhibiting solution (50% isopropanol) was added to the container upon deployment to avoid sample contamination due to algae build-up,
- detailed field notes were maintained by the technicians to track the exact deployment and retrieval dates and times, location IDs, and any relevant observations,
- upon retrieval, the container lids were firmly screwed into place. Prior to shipping, the lids were taped to ensure they would not loosen during shipping, and
- the field technicians did not attempt to remove any debris from the canisters upon collection – the field technicians only contacted the external surface of the containers.

3.2 NITROGEN OXIDES AND SULPHUR DIOXIDE

3.2.1 Equipment and Operation

A passive sampling system developed by Bureau Veritas Laboratories (BVL) was used for the measurement of nitrogen dioxide and sulphur dioxide in ambient air. While the passive method is not a recognized U.S. EPA reference or equivalent method for NO_2 or SO_2, the SkMOE Monitoring Guideline does allow for the use of passive systems in areas where there is limited access to power [2]. The U.S. EPA Reference and Equivalent methods for NO_2 and SO_2 each require a continuous power source to operate and are generally rack-mounted systems that are intended to operate in an indoor, temperature-controlled environment, with a sample inlet extending out of the shelter and sample air being drawn via an electric pump. Such a system is not feasible for operation at this stage of the Project development, and so passive samplers were used to estimate the existing baseline condition.

The BVL Passive Air Sampling System (PASS) consists of a domed rain shelter with three slots on the underside for the installation of cartridges that are specially treated for the collection of various air contaminants. Cartridges for NO_2 and SO_2 were applied in this program. The cartridges are provided by BVL in sealed containers and are deployed simply by unsealing the cartridge in the field and installing it to the rain shelter. The cartridges are then exposed to the atmosphere for the approximately 30 days. Upon completion of the sample period, the cartridges are collected from the rain shelters and re-sealed in the sample containers. A field monitoring protocol for the passive samplers was developed by IEC and provided to the field team with IEC providing remote support. The field protocol is provided in Appendix A.

3.2.2 Siting

As noted previously, the SkMOE outlines siting criteria for static monitors in Section 2.2.2 of the Monitoring Guideline. These criteria include a sampler height above ground of between 1-3 m, and an elevation angle of less than 30° from the sampler inlet to the top of any nearby obstacle [2]. This matches exactly with the siting

criteria recommended by BVL for its sampling system. Monitoring was completed at two (2) locations, as shown in Figure 1.

3.2.3 Sampling Schedule

The exposure period recommended by BVL for the passive samplers is 30 days. The sample schedule that was followed in support of this study is summarized in Table 4.

Table 4: Passive Gaseous Compound Sampling Schedule (2019-2021)

Year	Round	Deployed	Retrieved	Average Exposure Period (days)
2019	2019-1	August	September	34.9
	2019-2	September	October	26.0
	2019-3	October	November	23.0
2020	2020-1	July	August	33.6
	2020-2	August	September/October	35.1
	2020-3	September/October	November	31.9
2021	2021-1	June	July	32.1
	2021-2	July	August	38.0
	2021-3	August	September	34.8
	2021-4	September	October	30.9

3.2.4 Calibration and QA/AC

The selected sampling method is a passive system, and so there are no equipment calibration requirements; however, there are a number of QA/AC measures that need to be observed to maintain sample integrity. These procedures are included in the field protocol that is provided for the sampling system in Appendix A. In general, the practices employed to ensure sample integrity included the following:

- duplicate samples were collected at each site, to account for the possibility of a compromised sample,
- samplers were kept in the sealed plastic bags and storage tins until the moment of deployment in the field,
- samplers were handled carefully by the field technicians, touching only the rim of the sampler and not the diffusion barrier,
- field technicians kept field notes to track the deployment and retrieval dates, sampler IDs, sample locations, and any relevant observations,
- technician field notes were used to ensure that the samplers were returned to the containers matching the sample ID for the sample location,
- upon retrieval, the samplers were returned to the associated plastic bag and sealed, prior to returning them to the metal container,

- the metal containers containing the retrieved samples were sealed with Teflon tape, to avoid contamination, and
- blank samples for each contaminant were requested from BVL for each round of sampling and returned to the lab with the collected samples.

3.3 EXTERNAL GAMMA

Gamma is not included in the list of standards from the SkMOE or ECCC; however, due to the nature of the operation (uranium mining) and oversight by the CNSC during the EA stage, it was recommended that the baseline monitoring program include the establishment of baseline gamma conditions. This would allow for the tracking of levels as the Project moves through its life-cycle.

3.3.1 Equipment and Operation

Gamma is measured using dosimeters, which were provided by the supplier with an environmental enclosure (a waterproof plastic pouch) for ease of set-up (i.e., can attach to a vertical surface such as a tree or post). The dosimeters are then exposed to the atmosphere for a period of approximately 90 days. The dosimeters used in this program were InLight® dosimeters developed by Landauer. The InLight® dosimeter provides results using optically stimulated luminescence (OSL) technology. The dosimeter has a window that opens to aluminum, copper and plastic filters, and an aluminum oxide detector slide. After the exposure period, the analysis of the dosimeter involves using OSL technology, whereby an LED array is used to stimulate the aluminum oxide detectors, and the emitted light is detected and measured by a photomultiplier tube (PMT). The amount of light measured by the PMT is directly proportional to the radiation dose. The minimum detectable dose of gamma radiation is 1 µSv (0.1 mrem) for photons with energies above 15 keV.

Each shipment of dosimeters is provided with two control dosimeters. The dosimeters begin detecting radiation as soon as they are shipped from the lab, and so the control dosimeters provide necessary information on the radiation doses received during the shipment and deployment/retrieval activities. As per the protocol provided in Appendix A, the “transit control” dosimeter is to be returned to Landauer immediately (as soon as possible) upon arriving at the field site. This is used to calculate the dose received during shipping. The “deploy control” is brought to each of the monitoring locations, but not deployed. After the dosimeters that are being exposed at the sample locations are installed, the “deploy control” is stored in a safe place at the work site until the exposure period is over. At that point, the “deploy control” is taken along for the removal of the exposed dosimeters, and all dosimeters are returned to Landauer for analysis. The “deploy control” represents the conditions leading up to and following the exposure period. The results from the exposed dosimeters are adjusted based on the “transit control” and “deploy control” results, to provide a net exposure.

3.3.2 Siting

The gamma dosimeters were positioned at two locations at the site, with one positioned upwind and one positioned downwind of the approximate area where Project activities are expected to occur. The monitoring locations were co-located with other monitoring equipment (Radon1 and Radon10). Refer to Figure 1 for the positions of the gamma monitoring locations.

3.3.3 Sampling Schedule

As noted above, the dosimeters for measurement of external gamma are generally exposed to the atmosphere for a period of approximately 90 days. The sampling schedule for the external gamma monitoring campaigns completed in support of this project are summarized in Table 5.

Table 5: Passive Gaseous Compound Sampling Schedule (2019-2021)

Year	Round	Deployed	Retrieved	Average Exposure Period (days)
2019	2019-1	September	November	50
2020	2020-1	July	November	102
2021	2021-1	February/March	June	100
	2021-2	June	September	105

3.3.4 Calibration and QA/QC

The selected sampling method is a passive system, and so there are no equipment calibration requirements; however, there are a number of QA/AC measures that need to be observed to maintain sample integrity. These procedures are included in the field protocol that is provided for the sampling system in Appendix A. In general, the practices employed to ensure sample integrity included the following:

- samplers were kept sealed until the moment of deployment in the field,
- field technicians kept field notes to track the deployment and retrieval dates, sampler IDs, sample locations, and any relevant observations, and
- control samples (deploy and travel) were provided by the laboratory for each round of sampling and returned to the laboratory as instructed (transit control returned upon receipt, deploy control returned with samplers).

3.4 RADON

Radon is not included in the list of standards from the SkMOE or ECCC; however, due to the nature of the proposed operation, Denison has been completing regular radon monitoring since 2016 at the Wheeler River site. The continued operation of this network of samplers will allow for the tracking of levels as the Project moves through its life-cycle.

3.4.1 Equipment and Operation

Radon in an outdoor ambient setting is typically collected using passive long-term radon detectors. For this program, the detectors were Rapidos® alpha-track detectors from Radonova. In these systems, the detector is installed in a weather-protective casing that is then attached to a post or other vertical mount (e.g., tree), and exposed to the ambient air for three (3) months (90 days). Within the detector, alpha particles released during radon decay collide with a CR-39 chip, which leaves a track in the chip. The tracks are chemically etched and counted in the laboratory to determine the radon dose received in the detector, and to calculate a

concentration in ambient air. Upon retrieval, the passive sampler is returned to the laboratory for analysis, along with the field and travel blanks supplied by the manufacturer, per the manufacturer instructions.

3.4.2 Siting

Radon monitoring at the Wheeler River Project site commenced in 2016 at ten stations around the site. As shown in Figure 1, the radon monitors are located upwind of the site (i.e., to the north-west) and continue through the site to the south-east. The radon detectors were installed at eye-level, within canisters that are designed by the manufacturer of the detectors for outdoor installation. Two canisters, each holding one detector were installed at each site, in order to help ensure that a radon result is obtained for each location during each campaign in the event that one of the detectors is compromised.

3.4.3 Sampling Schedule

The radon samplers were generally deployed for periods of 1 to 3 months. A summary the deploy and retrieval dates for each sampling campaign, as well as the number of exposure days included in each campaign, is provided in Table 6.

Table 6: Radon Sampling Schedule

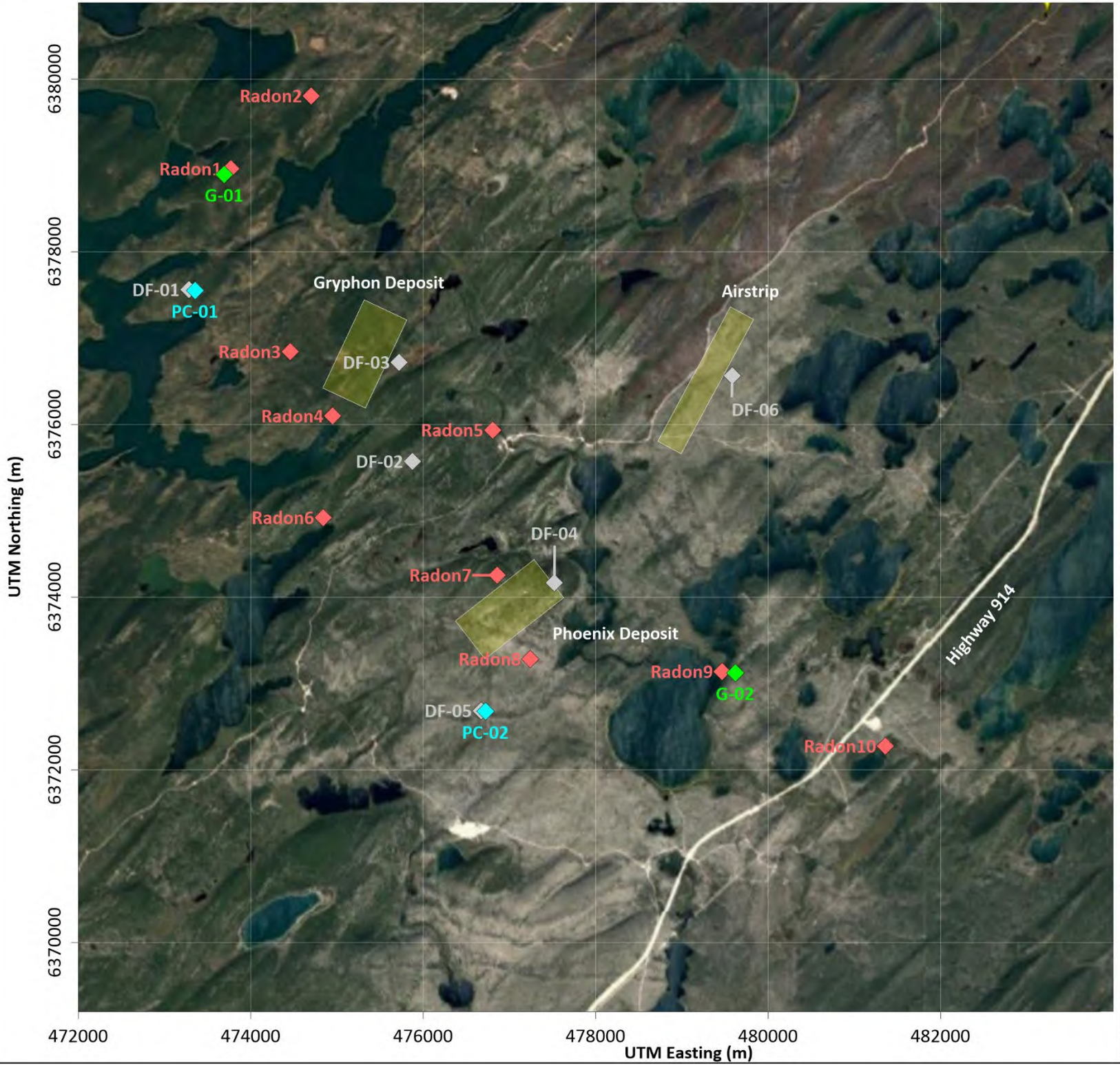
Year	Campaign	Deployed	Retrieved	Average Exposure Period (days)
2016	2016-1	September	January (2017)	123
2017	2017-1	January	June	133
	2017-2	June	August	80
	2017-3	August	January (2018)	144
2018	2018-1	January	March	64
	2018-2	March	July	112
	2018-3	July	September	52
	2018-4	October	January (2019)	112
2019	2019-1	January	May	109
	2019-2	May	September	136
	2019-3	September	February (2020)	132
2020	2020-1	February	July	170
	2020-2	July	November	103
	2020-3	November	February (2021)	106
2021	2021-1	June	September	105

3.4.4 Calibration and QA/AC

The selected sampling method is a passive system, and so there are no equipment calibration requirements; however, there are a number of QA/AC measures that need to be observed to maintain sample integrity. These

procedures are included in the field protocol that is provided for the sampling system in Appendix A. In general, the practices employed to ensure sample integrity included the following:

- samplers were kept in the sealed radon-proof bags until the moment of deployment in the field,
- field technicians kept field notes to track the deployment and retrieval dates, sampler IDs, sample locations, and any relevant observations, and
- transit control samples were provided by the laboratory for each round of sampling and returned to the laboratory with the collected samples.



LEGEND:

- Dustfall Monitor
- Passive NO2/SO2 Monitor
- Gamma Monitor
- Radon Monitor

NOTES:

SCALE:

0 m 1000 m 2000 m

REVISIONS:

No.	Date	By	Revision

REFERENCE:

Basemap: Google Earth
UTM Zone 13, WGS84

Denison Mines

Air Quality Monitoring Locations

Wheeler River Project

Drawn By:	Approved By:	Figure No.:
NZS	PLK	1
Date: Feb. 2022	Project No.: SX18-0064	

4.0 RESULTS AND DISCUSSION

The sample media collected as discussed throughout section 3.0 were provided to accredited laboratories for analysis. The laboratory certificates of analysis were used in conjunction with the data collected in the field to derive air concentrations for comparison to the criteria presented in Section 0. The results are discussed in the following sections.

4.1 SETTLEABLE PARTICULATES (DUSTFALL)

As described in section 3.1, deposition of settleable particulates were measured using dustfall jars. The laboratory analysis determines the total dustfall loading (mg) that was collected in each jar, and uses the surface area of the jar, and information on the deployment period to calculate the dustfall deposition rate in $mg/dm^2/day$ in accordance with the B.C. Environmental Lab Manual [9]. The dustfall is reported in terms of "fixed", "volatile", and "total", with the "total" dustfall representing the water soluble and insoluble material collected in the container, the "fixed" dustfall representing only the inorganic component of the total, and "volatile" representing the organic component of the total. Summary information for the data set is provided in Table 7, which includes the results for total dustfall only. It should be noted that samples were collected in duplicate at each location, and the results in Table 7 include both of the co-located samples (e.g., 14 samples collected at DF-01 represent two samples for each of the seven campaigns). The detailed results, including fixed, volatile, and total dustfall for each campaign are provided in Appendix B, and the laboratory Certificates of Analysis (CofA) are provided in Appendix C.

Table 7: Summary of Settleable Particulate Monitoring Results

Parameter	Unit	Monitoring Location					
		DF-01	DF-02	DF-03	DF-04	DF-05	DF-06
n	--	18	18	18	18	18	16
n<DL	--	9	7	10	5	6	5
average detectable	mg/cm2/30-day	0.16	0.17	0.09	0.10	0.18	0.08
maximum	mg/cm2/30-day	0.56	0.91	0.14	0.26	0.77	0.17
minimum	mg/cm2/30-day	0.03	0.03	0.03	0.03	0.03	0.03
average	mg/cm2/30-day	0.10	0.12	0.06	0.08	0.13	0.06
SkMOE AAQC	**mg/cm2/30-day**	**2**	**2**	**2**	**2**	**2**	**2**

As would be expected in a natural, undisturbed environment, the average and maximum levels of settleable particulate are well below the SkMOE criteria of 2 mg/cm^2/30-days. The maximum dustfall amount from the various campaigns was 0.91 mg/cm^2/30-days, which was collected at DF-02A in the summer of 2021 (July-August). This value represents approximately 46% of the SkMOE standard for settleable particulates. The next highest value of 0.77 mg/cm^2/30-days (39% of the SkMOE standard) was measured during the same period at location DF-05A.

The predominant wind direction at the site is from the north-west, making DF-01 the upwind monitoring location, and the rest of the monitors downwind at various locations throughout the site. The results in Table X indicate that the average levels of settleable particulates at DF-01 were not the lowest amongst the various locations; however, it should be noted that the averages are being influenced by a sample collected at DF-01A in October 2021 which was 0.56 mg/cm2/30-days. The paired sample at this location had a result that was an order of magnitude lower, at 0.054 mg/cm2/30-days. If this result is excluded from the summaries, then the weighted average (i.e., including non-detectable results at the detection limit) was 0.06 mg/cm2/30-days, which is the same as the averages at DF-03 and DF-06 (both located at the north end of the site). As such, 0.06 mg/cm^2/30-days may be considered an average baseline level for the area.

A metals analysis was completed on the dustfall samples collected in the September 2021 and October 2021 campaigns. The complete results of the metals analysis are provided in Appendix B, and the certificates of analysis from the laboratory are provided in Appendix C. Most of the metals that were included in the analysis were not present at detectable levels. The metals that were generally detectable in one or both campaigns included aluminum, barium, calcium, copper, iron, lead, magnesium, manganese, phosphorous, potassium, silicon, sodium, strontium, and uranium. There are no SAAQS or CAAQS for metals in dustfall. A summary of the detectable metals that are also to be represented as COPC in the Air Quality effects assessment is provided as a percentage by mass of the fixed (i.e., insoluble) dustfall in Table 8.

Table 8: Summary of Metals Composition in Fixed Dustfall

Parameter	Composition (%)											
	Arsenic (As)	Cadmium (Cd)*	Chromium (Cr)*	Cobalt (Co)*	Copper (Cu)	Lead (Pb)	Molybdenum (Mo)	Nickel (Ni)*	Selenium (Se)*	Uranium (U)	Vanadium (V)*	Zinc (Zn)
average	0.0015%	0.0006%	0.0057%	0.0012%	0.0136%	0.0013%	0.0058%	0.0057%	0.0115%	0.0004%	0.0115%	0.042%
maximum	0.0015%	0.0007%	0.0072%	0.0015%	0.0359%	0.0018%	0.0100%	0.0072%	0.0145%	0.0012%	0.0145%	0.056%

Notes:
*metal was not detectable in any sample; composition percentages based on the detection limit for the sample and were calculated only for samples where there was detectable fixed dustfall

4.2 NITROGEN OXIDES AND SULPHUR DIOXIDE

As discussed in section 3.2, baseline concentrations of NO_2 and SO_2 in the study area were assessed at two locations using passive samplers. The laboratory uses meteorological data, information on the deployment period to report, and the submitted blank samples, to provide air concentration data directly in the certificates of analysis. The air concentrations represent the average concentration for the deployment period, and so are not directly comparable to the criteria identified in section 0. To facilitate a comparison of the measured levels to the criteria, a conservative approach to adjusting the averaging period[1] was applied to the data. Summary information for the data set is provided in Table 9, Table 10, while detailed results are provided in Appendix B. Certificates of analysis from the laboratory are provided in Appendix C. The results show that the existing levels of NO_2 and SO_2 are well below the applicable criteria, as would be expected for this remote location.

Table 9: Summary of NO_2 and SO_2 Monitoring Results at PC-01

Parameter	NO_2 Concentration (µg/m3)				SO_2 Concentration (µg/m3)			
	Period	Annual	24-hr	1-hr	MP	Annual	24-hr	1-hr
Average monitoring period	32.0 days							
n	20				18			
n<DL	18				10			
average detectable	0.28	0.15	0.76	1.8	0.33	0.17	0.88	2.1
maximum detectable	0.38	0.19	0.99	2.4	0.52	0.27	1.4	3.4
minimum	0.19	0.09	0.45	1.1	0.26	0.12	0.63	1.5
weighted average	0.20	0.10	0.52	1.3	0.29	0.15	0.77	1.9
SAAQS	-	45	200	300	-	20	125	450
CAAQS (2025)	-	22.6	-	79	-	10.5	-	170.3

[1] Ontario Regulation 419/05 [12] provides the following method for scaling average concentrations for different time averaging periods:

$C_0 = C_1 * \left(\frac{t_1}{t_0}\right)^{0.28}$; where C_0 and C_1 are the air concentrations at time t_0 and t_1, respectively.

Table 10: Summary of NO_2 and SO_2 Monitoring Results at PC-02

Parameter	NO_2 Concentration (µg/m3)				SO_2 Concentration (µg/m3)			
	Period	Annual	24-hr	1-hr	MP	Annual	24-hr	1-hr
Average monitoring period	31.2 days							
n	20				20			
n<DL	18				17			
average detectable	0.28	0.13	0.67	1.6	0.52	0.27	1.4	3.5
maximum detectable	0.38	0.17	0.90	2.2	0.79	0.39	2.1	5.0
minimum	0.19	0.09	0.45	1.1	0.26	0.12	0.63	1.5
weighted average	0.20	0.10	0.51	1.3	0.30	0.15	0.79	1.9
SAAQS	-	45	200	300	-	20	125	450
CAAQS (2025)	-	22.6	-	79	-	10.5	-	170.3

The average detectable concentrations disregard any sample results that were below the detection limit, whereas the weighted average includes the non-detects, which were included in the average at the detection limit. It should be reiterated that these projected concentrations are averages from the measured values, which are considered monthly averages. For instance, the projected 1-hour concentration of NO_2 from the highest measured monthly average at Foran-P3 is 2.2 µg/m^3; however, actual hourly concentrations of NO_2 would have fluctuated about this level to some degree over the course of the measurement period. This comparison is simply intended to demonstrate how average conditions compare to the SAAQS and CAAQS, and these tables show that the measured results are well below both the SAAQS and CAAQS.

4.3 External Gamma

As discussed in Section 3.2, long-term baseline gamma doses were assessed at two locations using dosimeters. It should be reiterated that the gamma dose is not measured directly from the dosimeter, as the dosimeters register gamma during transportation from the laboratory to the site and continue to register gamma on the return shipment back to the laboratory after sampling. Control samples are used to calculate a net dose from the gross dosage that the dosimeter deployed in the field registered. The results of the external gamma monitoring program are provided in Table 11. It should be noted that the adjustment from a gross dose to a net dose resulted in negative values in some instances. This would indicate that the baseline gamma at the Project site is very low.

Table 11: Summary of External Gamma Monitoring

Location ID	Start Date	End Date	Exposure Days	Exposure (mSv)	
				Gross	Net
G-01	2019-09-25	2019-11-14	50	0.252	0.008
	2020-07-25	2020-11-03	101	Destroyed in field	
	2021-03-11	2021-06-08	89	0.469	-0.139
	2021-06-08	2021-09-21	105	0.31	-0.129
G-02	2019-09-26	2019-11-14	49	0.22	-0.024
	2020-07-24	2020-11-03	102	0.218	-0.098
	2021-02-17	2021-06-08	111	0.289	-0.06
	2021-06-08	2021-09-22	106	0.242	-0.197

4.4 RADON

Monitoring of baseline levels of radon have been occurring at the Wheeler River site since 2016, using alpha-track etch monitors, at ten locations around the site as shown in Figure 1. A statistical summary of the data collected at each of the locations is provided in Table 12. The full monitoring results for each station are provided in Appendix B, with certificates of analysis from the laboratory provided in Appendix C.

Table 12: Statistical Summary of Radon Monitoring Data (2016-2021)

Location	n	n<DL	Average Detectable (Bq/m^3)	Max Detectable (Bq/m^3)	Minimum (Bq/m^3)	Weighted Average (Bq/m^3)	Detectable Range (Bq/m^3)
Radon 1	26	17	4.8 ± 3.3	9 ± 3	< 3	5.0	0 to 13
Radon 2	26	17	4.7 ± 3.0	8 ± 3	< 3	4.8	0 to 11
Radon 3	32	17	4.6 ± 2.8	9 ± 3	< 2	4.6	0 to 12
Radon 4	31	17	3.9 ± 2.9	10 ± 3	< 3	4.4	0 to 13
Radon 5	30	13	5.1 ± 2.8	12 ± 4	< 3	5.2	0 to 15
Radon 6	32	18	5.9 ± 3.1	19 ± 4	< 3	5.1	0 to 23
Radon 7	32	18	6.2 ± 3.1	19 ± 4	< 3	5.7	0 to 23
Radon 8	32	21	4.0 ± 3.2	5 ± 5	< 3	4.3	0 to 10
Radon 9	31	22	5.0 ± 3.1	9 ± 4	< 3	4.5	0 to 13
Radon 10	30	16	3.8 ± 2.8	6 ± 3	< 3	3.9	0 to 9

The maximum radon levels at the monitoring locations ranged from 9 Bq/m^3 at Radon 10 to 23 Bq/m^3 at Radon 6 and Radon 7. These maximums account for uncertainty measures from the laboratory (e.g., the maximum result at Radon 10 was reported by the laboratory as 6 ± 3 Bq/m^3 and reported in Table 12 as 9 Bq/m^3). Radon locations 6 and 7 (where the maximum concentrations were measured) are each located towards the west side of the site, between the Phoenix and Gryphon deposits, while location 10 (where the lowest concentration was measured) is located furthest to the south-east of the site, next to Highway 914. With the exception of locations 6 and 7, the maximum radon concentrations ranged from 9 to 15 Bq/m^3. In the CNSC *Regulatory Oversight Report for Uranium Mines and Mills in Canada: 2016* [10], it is stated that the regional baseline in northern Saskatchewan is less than 7.4 Bq/m^3 to 25 Bq/m^3. All results from the baseline monitoring program are within this range.

5.0 CONCLUSIONS

Denison is proposing to develop a uranium mine at the Wheeler River property in northern Saskatchewan, which would utilize an ISR process for extracting uranium from the ore body and thereby eliminate the need for open pits, shafts and underground workings, and tailings storage that are associated with other uranium mines in the area. The Wheeler River Project site is located approximately 35 km north of Cameco's Key Lake uranium operation and approximately 4 km west of Highway 914. In preparation for the development of an EIS, Denison has been completing baseline air monitoring at the Project site since 2016. To-date, the program has included measurement of radon, dustfall, trace gases (NO_2 and SO_2), and external gamma. The results of the measurements indicate that the baseline levels of the COPC of interest are well below the provincial and federal air quality criteria that have been adopted for comparison and are within ranges that would be expected in an undeveloped remote site. The measured baseline concentrations will be used in conjunction with the predictive modelling of future impacts associated with the project, being completed in support of the EIS for the Project.

6.0 REFERENCES

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[8] ASTM International, "Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter) Designation D1739-98," ASTM, 1998.

[9] Province of British Columbia Ministry of Environment, "British Columbia Environmental Laboratory Manual," BC MOE, 2015.

[10] Canadian Nuclear Safety Commission (CNSC), "Regulatory Oversight Report for Uranium Mines and Mills in Canada: 2016," CNSC, Ottawa, 2018.

[11] Government of Ontario, *O.Reg. 419/05: Air Pollution - Local Air Quality,* 2005.

[12] Canadian Nuclear Safety Commission, "Nuclear Safety and Control Act, Radiation Protection Regularions," Minister of Justice, Ottawa, 2000.

Appendix A:

Field Protocols

1. Purpose

The Wheeler River Project Atmospheric Dustfall Monitoring Procedure has been developed to meet the following objectives:

- To establish baseline atmospheric dustfall conditions in the Project area;
- To determine the extent and magnitude of atmospheric dustfall at selected locations representative of short-term Project activities as well as predict long-term impacts; and
- To determine seasonal variations in dustfall among selected sampling locations.

2. Applicable To

- Environment Manager
- Project Geologists
- Environmental Consultants
- Field Technicians

3. General Information

It is anticipated that the largest amount of fugitive dust emissions (particulate matter) generated by Project activities will be associated with vehicle transportation along site access roads (e.g., the Gryphon Mine Access Road) and the Main Wheeler River Site Access Road. However, dust emissions are also anticipated to be generated by various mining activities/ equipment at point-source locations (e.g., mine ventilation equipment, drilling and construction activities). The Wheeler River Atmospheric Dustfall Monitoring Program has been developed to collect pre-development atmospheric dustfall baseline conditions, as well as ongoing conditions as they may be influenced throughout various mine lifecycle stages (e.g., construction and operational activities).

4. Information on Current Set-Up

Dustfall stations were established in October 2018. Each sampling station includes two dustfall sampling stands approximately 20 - 50 feet apart. This will allow for sampling in duplicate at each station. Each dustfall stand is constructed of a steel hollow post (~ 2 m) and terminal bowl shaped holder for the dust collection vessel (refer to Figure 1). The terminal bowl is topped with bird spikes (zip ties) to prevent birds from perching, as well as contamination by bird fecal matter. Stands were installed at each location by driving approx. 12 inches of the steel stand post into the ground, and then stabilizing the stand with guywires (galvanized aircraft cable (1/16”)) attached to fence stakes also pounded into the ground.

Each station was constructed such that the top of each sample container is a minimum of 2.4 m above ground surface, and installed such that all obstructions are less than 30° above the horizontal where possible (Figure 2).

Dust collection vessels (canisters) are provided by the laboratory. They contain deionized water plus algaecide in summer, and deionized water plus alcohol in winter. Canisters are placed in the holder and left out for a 3 to 6 month sampling window. At completion of the monitoring period, canisters are collected and shipped to an accredited laboratory for analysis of total, fixed and volatile insoluble particulate matter.

5. Sampling Equipment

- Site-specific personal protective equipment;
- Canister lids labelled with stand IDs and previous sampling date/time;

- Camera;
- GPS;
- Field book and blank laboratory Chain of Custody (CoC);
- Laboratory-prepared dustfall collection canisters with algaecide or alcohol;
- Permanent black labelling marker (e.g., Sharpie);
- Bags to store lids; and
- Cable cutters, hammer, cable clamps, and other tools for making repairs to stands as required.

Figure 1 – Dustfall Sampling Stand

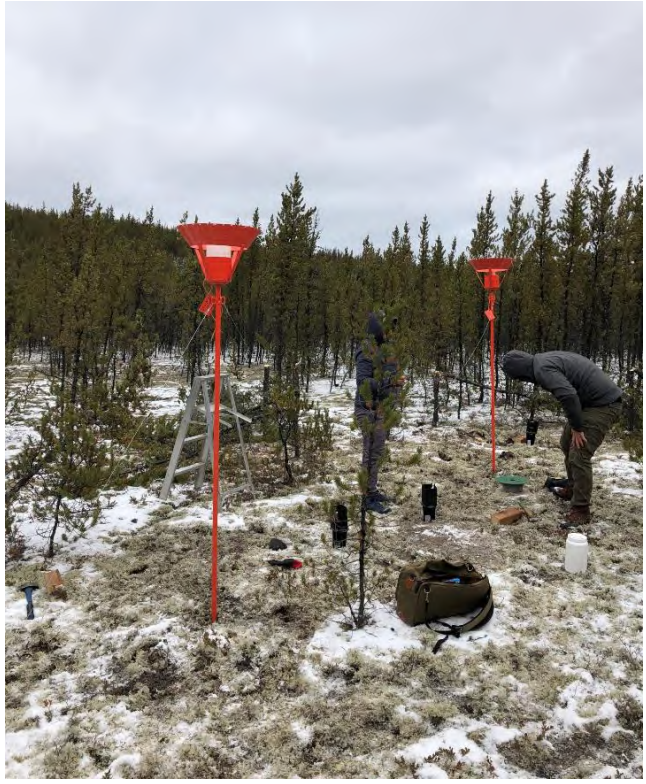


Figure 2 – Setting-up the Dustfall Stands

6. Methodology

Passive dustfall monitoring methods are used to quantify deposition rates of fugitive dust emissions originating from various mine activities (e.g., ore transport corridors, mine ventilation) throughout the various mine lifecycle stages (e.g., construction, operation and decommissioning).

Dustfall Monitoring Locations

Six baseline atmospheric dustfall sampling stations were established in October 2018. To the greatest extent possible, sample site locations were selected based on the following criteria:

- Low-lying (away from crests or ridge lines, etc.) areas to allow for dust collection as a result of gravity settling;

- Open areas (e.g. areas recent impacted by forest fire or meadows) with trees and other obstructions (e.g., buildings) that are less than 30° above horizontal viewed from the site location;
- Co-located near passive ambient radon monitoring stations to facilitate change out of both monitors during the same sampling campaign; and
- Accessible via all-terrain vehicle or snowmobile.

Table 1 provides sample station locations and descriptions. Figure 3 shows the location of dustfall sampling stations.

Table 1 – Dustfall Sampling Stations

Dustfall Station ID	Location UTM Coordinates	Description
DF-01	0473864 m E 6378112 m N	Reference station approx. 2.5 km northwest (upwind of prevailing winds) of the Wheeler River Project Study Area
DF-02	0475527 m E 6375928 m N	0.5 km east (downwind) of the Gryphon Mine Access Road
DF-03	0475722 m E 6376721 m N	0.75 km east (downwind) of proposed Gryphon Mine activities (e.g., mine ventilation infrastructure, haul roads, production shaft)
DF-04	0477521 m E 6374168 m N	0.5 km east of proposed Phoenix ISR activities (adjacent to Lake LA-5)
DF-05	0476638 m E 6372046 m N	0.5 km east of the midway point of the Main Wheeler River Access Road
DF-06	0479583 m E 6376566 m N	0.5 km east of proposed airstrip, adjacent to lake

Monitoring Procedure

Each sample station consists of two dustfall stands with laboratory-provided canisters containing a liquid solution (de-ionized water with algaecide for summer months and deionized water with alcohol for winter months) that is open to the air for approximately three to six months (to align with Radon Monitoring Program). Each canister is placed in the holding cup approximately two meters above the ground surface (refer to Figures 1 and 2). The dustfall sample canisters are to be collected and replaced at the end each sampling period, capped, and dropped off at ALS lab in Saskatoon (or shipped to ALS Environmental Laboratory in Burnaby, BC) for analysis of total, fixed and volatile insoluble particulate matter.

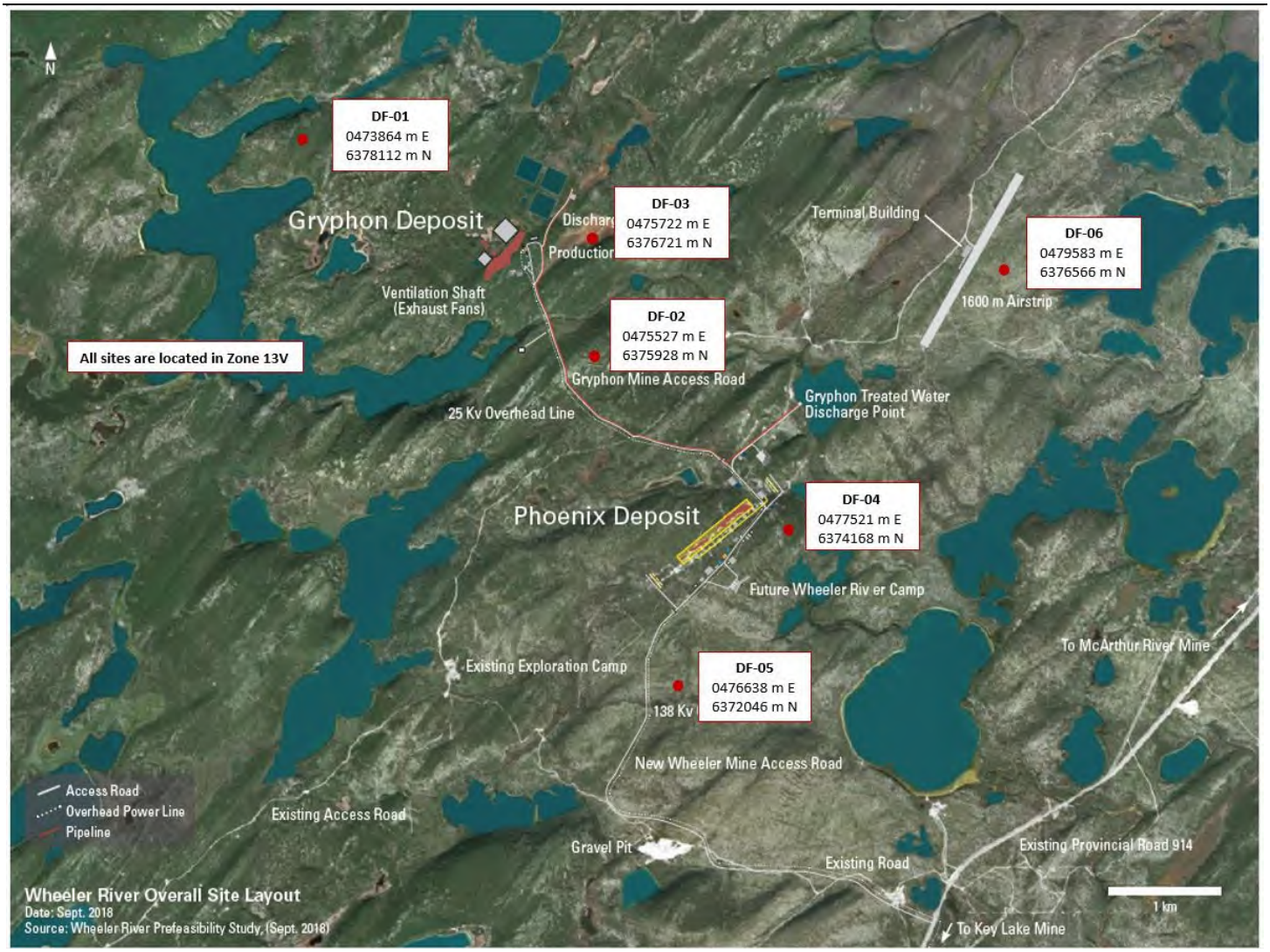


Figure 3 – Dustfall Sampling Locations

The following steps outline the process for changing out dustfall canisters:

1. Order 14 new dustfall canisters prior to each sampling campaign and have them shipped to site.
2. Upon arrival at each sampling location, make note of any unusual condition(s) of the dustfall stand, or of the surrounding area (e.g., evidence of wildlife, human tampering, equipment operating in proximity, etc.);
3. Select the corresponding canister lid, which will be labelled with the stand ID (e.g., DF-01) and the date/time of the previous collection event.
4. Record the date/time of the sampling event on the lid. The lid will now have the date and time when the canister was deployed as well as the date/time during when it was collected.
5. Place the lid on the canister. Ensure that it is secured tightly to avoid leakage during transport.
6. Remove the canister from the stand holding cup and place it in a cooler.

7. Retrieve a new prepared canister and label the lid with the stand ID (e.g., DF-01) and the date/time.
8. Remove the lid before placing the prepared canister in the stand holder.
9. Place the lid in a plastic bag and store on-site until it is time to change out the canister. Before placing the lid in the bag, wipe or rinse the interior of the lid so that remnant alcohol is not introduced into the plastic bag. If alcohol is in the bag, it may remove information written on the lid in permanent marker.
10. Upon returning from sampling, prepare the laboratory Chain of Custody (CoC) provided in Attachment A.
11. Place the lids that were removed from the deployed canisters in a safe location where they can be easily retrieved for the next collection event.
12. Ensure collected canisters are accurately labelled in accordance with the laboratory CoC. Select analysis of total, fixed and volatile insoluble particulate matter.
13. Package cooler(s) containing collected canisters for laboratory shipment.
14. Drop off coolers at ALS Environmental Laboratory in Saskatoon (819 58 Street East, Saskatoon SK S7K 6X5) or ship coolers to ALS in BC (8081 Lougheed Highway, Burnaby BC V5A 1W9).

7. Closing

Laboratory analytical results are compared to the Canadian Ambient Air Quality Objectives (CAAQOs). Additionally, future results will be reviewed to evaluate concentrations generated by mine activities in comparison to background levels and reference sites. Finally, by using wind direction and speed data available through localized climate data, the effect of wind on dustfall deposition originating from fugitive emissions sources can be further investigated.

8. Attachment

ALS Laboratory Chain of Custody Form.

Excel version of ALS CoC is also available on their website under 'Downloads' section
https://www.alsglobal.com/locations/americas/north-america/canada/saskatchewan/saskatoon-environmental

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	
Contact:	
Phone:	
Company address below will appear on the final report	
Street:	
City/Province:	
Postal Code:	
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

Email 3

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	☐	1 Business day [E1 - 100%]	☐
3 day [P3-25%]	☐	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	☐
2 day [P2-50%]	☐		

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	Q70196
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	DUSTFALLS-T.DM2-VA															SAMPLES ON HOLD	Sample is hazardous (please provide further det	NUMBER OF CONTAINERS

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO

Are samples for human consumption/ use?
☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No	☐
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No	☐
Cooling Initiated ☐					

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Principles of Operation

A passive (or diffusive) sampler is a device which is capable of taking samples of gas or vapor pollutants from air at a rate controlled by a physical process such as diffusion through a static air layer or permeation through a membrane. However, it does not involve the active movement of the air through the sampler.

The Bureau Veritas (formerly Maxxam) Passive Air Sampling System (PASS) was developed with the support of *Alberta Environment* (AENV, formerly named *Alberta Environmental Protection*, or AEP), *Alberta Innovates* (formerly named *Alberta Research Council*, or ARC)*, Clean Air Strategic Alliance of Alberta* (CASA) and the *National Research Council of Canada* (NRC). It was designed for downward-facing installation and has been validated under extreme weather conditions. It has a durable, all-season top cover (to shelter against rain, snow and wildlife) and the user can install up to three samplers per shelter. The unit itself can be secured to any support system with strapping or hose clamps.

Required Equipment: Passive Air Sampling System (PASS)

A sampling unit consists of one (1) rain shelter and three (3) passive samplers (one for SO_2, NOx, and NO_2), as shown in Figure 1. The tools required for monitoring are provided in the subsequent table.

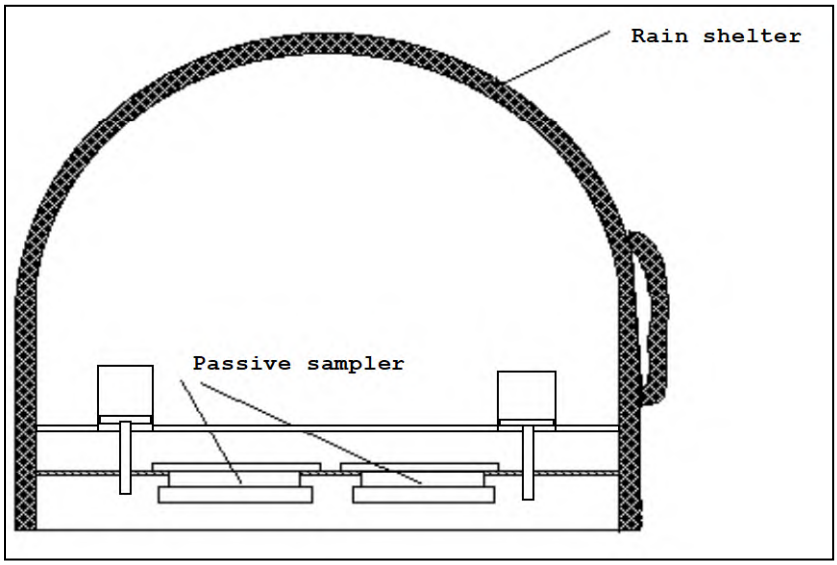


Figure 1: Cross Section of Rain Shelter

Sample Deployment	Sample Retrieval
Rain shelter Passive samplers Hose clamps or zip ties Screwdriver (for hose clamps) Latex or nitrile gloves Field binder Digital camera	Metal containers for deployed passive samplers (incl. plastic caps and plastic bags Latex or nitrile gloves Teflon tape Field binder Digital camera

Installing passive samplers

Each rain shelter will house one (1) SO_2 passive sampler, one (1) NOx passive sampler, and one (1) NO_2 passive sampler. To install the PASS, complete the following steps:

1. Find a suitable location or supporting structure that can be used to secure the rain shelter using hose clamps (or similar) so that the underside of the rain shelter faces down towards the ground (see Figure 2). The bottom of the rain shelter should measure 1-3 meters above the ground (see Figure 3).

Figure 2: Rain Shelter In Place

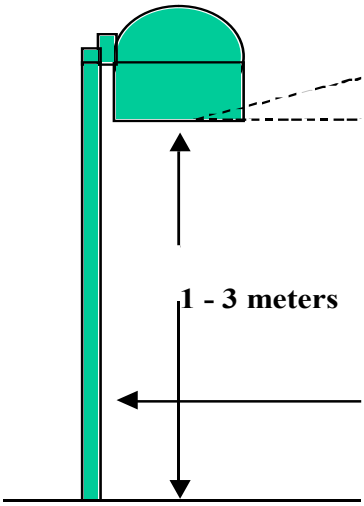


Figure 3: Height Above Ground

NOTE: Monitoring locations should not be close to roadways. The distance between the monitoring location and the roadway should be more than 10 m. The monitoring site should be located away from nearby obstructions such as buildings, trees, etc. The ideal monitoring site should be more than 20 m from the nearest tree canopy (drip line), and the top of the nearest obstruction should be less than 30° from a horizontal plane at the sampler inlet.

2. Using latex or nitrile gloves, remove one of the passive samplers from its protective metal container and the resealable plastic bag (Figure 4). Store the plastic bag inside of the container for future re-use. When handling a passive sampler:

   IMPORTANT: Do not to touch the diffusion barrier (the white centre); hold the sampler by the plastic edge (see Figure 4). Do not let the passive sampler contact the ground.

   Carefully remove the protective plastic cap on the passive sampler. Keep the plastic cap with the metal protective container also.

Figure 4 – Passive Sampler Re-Sealable Bag and Metal Container

3. Holding the passive sampler with the coloured side facing toward the ground, push up any of the three buttons on the rain shelter and slide the sampler towards the centre of the rain shelter (see Figure 5). Make sure that the button falls back down after the passive sampler has moved to the centre.

Figure 5 – Installation of Passive Samplers

4. Record the exposure starting date and time of day on the field sampling sheet provided.

5. Repeat steps 2-4 for the remaining two (2) passive samplers.

IMPORTANT: Do not open passive samplers labelled "Blank". Keep stored until the others are to be sent for analysis.

Removing passive samplers

1. Record the exposure end date and time of day on the field sampling sheet provided. The total exposure time should be about 30 days ± 2 days.

2. Holding the edge of a passive sampler, slide it away from the centre of the rain shelter to remove it.

3. Find the corresponding metal container for the passive sampler (ensure that the colour coding is followed). Place the plastic cap back on the passive sampler and put it back into the plastic bag. Finally, place into the protective metal container and seal the container with Teflon tape to preserve sample integrity.

4. Fill out a Bureau Veritas chain of custody form for all samples, and forward all passive samplers, including those labelled "Blank" to the lab. Samples should be sent to the lab as soon as possible after retrieval.

Storing unexposed passive samplers

1. Passive samplers that are not installed/exposed can be stored at room temperature for no longer than one month OR in a refrigerator at 4°C for no longer than 3 months.

Passive Sampling Rate Calculation

1. The sampling rates for the passive media depend on many factors such as temperature, relative humidity, wind direction, wind speed, sampler structure, and collection media. An equation, which accounts for variations in temperature, relative humidity, and wind speed, is used by the lab to calculate sampling rates.

   NOTE: These sampling rate calculations will be completed by Bureau Veritas, which may contact the sender in order to request on-site meteorological data.

Principles of Operation

The Landauer InLight low level dosimeter measures environmental radiation from high energy photons (X and gamma rays; energies >15 keV) and beta particles (energies >500 keV). For X and gamma rays, the dosimeter has a minimum detectable dose of 0.1 mrem (1 µSv). The dosimeter is built on an assembly that includes a case with copper and plastic filters and an aluminum oxide detector slide with four positions. The dosimeters are contained within a plastic weather-proof sleeve and marked with a unique serial number and barcode. The dosimeters operate passively (i.e., they do not involve the active movement of the air through the dosimeter) and are fully compliant with ANSI N545-1977, NRC Regulatory Guide 4.13 and HPS Draft Standard N13.29 specifications.

Required Equipment: Landauer InLight low level dosimeter(s)

A sampling unit consists of one (1) or more dosimeters suitable for field sampling and two (2) control dosimeters. Landauer ships multiple dosimeters together in packages. Within the package, each dosimeter is contained within its own protective sleeve and each sleeve is marked with a unique serial number that should be recorded to track chain of custody.

The two control dosimeters are integral to the measurement campaign and care must be taken to treat them appropriately. Photographs of the dosimeters and controls are provided in Figure 1. The tools required for deploying the dosimeters are listed in the subsequent table.

Figure 1: Dosimeter Package and Contents

Sample Deployment	Sample Retrieval
Field dosimeter(s) Transit control dosimeter Deploy control dosimeter Duct tape or zip ties Field binder Digital camera	Field dosimeter(s) Knife or cutters Field binder Digital camera

Installing passive samplers

To deploy the dosimeters, complete the following steps:

1. In an appropriate staging area at the field site (e.g., environmental trailer), open the package containing the dosimeters. Identify the control dosimeters, which are marked and should be employed as follows:

   - The control dosimeter marked "**transit control**" should be sent back to Landauer immediately. This control dosimeter is used to characterize the amount of radiation absorbed by the dosimeters during travel to/from the field site.
   - The second control dosimeter marked "**deploy control**" should be kept in a safe location at the field site for the duration of the sampling but should <u>not</u> be deployed in the field. Once the field sampling is completed and the other dosimeters are collected, the deploy control dosimeter should be packaged with the dosimeters and all the dosimeters should be sent back to Landauer together.

2. Find a suitable location or supporting structure that can be used to securely affix the field dosimeter. For convenience, the dosimeter can be co-located with the Radon samplers.

3. Taking care not to puncture or damage the protective case on the dosimeter, use a zip tie or duct tape (or other secure mounting method) to securely affix the field dosimeter to the mounting point.

4. Record the serial number, exposure starting date and time of day on the field sampling sheet provided. Take a digital photograph of the deployed dosimeter once it is securely affixed.

5. Repeat steps 2-4 for the remaining dosimeters.

   IMPORTANT: Do not deploy dosimeters labelled "Control". Follow the procedure outlined in Step #1.

Removing passive samplers

1. Record the serial number, exposure end date and time of day on the field sampling sheet provided. The total exposure time should be about 90 days ± 2 days.

2. Taking care not to puncture or damage the protective case on the dosimeter, use a knife or cutters to cut the zip tie or duct tape that was used to affix the field dosimeter to the mounting point.

3. Fill out a chain of custody form for all dosimeters and repackage the dosimeters for return shipment. Forward all dosimeters, including those marked “deploy control” that have been safely set aside, back to the Landauer lab for analysis. Dosimeters should be sent to the lab as soon as possible after retrieval.

Purpose:

This procedure describes the steps to deploy, take down, and change passive radon detectors which are used to monitor ambient radon gas (Rn-222).

Applicable To:

- Environment Manager
- Project Geologists
- Environmental Consultants

General Information:

- Rapidos are high-sensitivity radon detectors. The Rapido high-sensitivity radon detectors will be referred to as *detectors* in this procedure.
- The detectors are small, black, plastic, puck-shaped devices. They are received in individual radon-resistant bags. DO NOT open the bags until the detectors are at their monitoring station and are ready to be deployed. The measurement of radon begins when the radon-proof bag is opened. Do not use a detector that has been exposed to atmospheric conditions. Do not worry about mishandling the detectors or trying to avoid touching certain areas: the CR39 chip is protected inside of the actual device.
- The detectors can be deployed (i.e., left outside in the protective canister) for 1 to 3 months. This is when they will be measuring ambient radon for the Wheeler River baseline program. At the end of the monitoring period, the detectors will be taken down and sent to Landauer for analysis.
- On the bottom of each detectors is a unique serial number.
- Protective canisters were installed at eye-level on tree trunks. The canisters can be reused over and over again with new detectors. The canisters can house one or two radon detectors and protect the detectors from rain, debris, etc.

Equipment Required:

- Detectors
- Protective canisters (will require new ones when setting up any new stations, otherwise reuse the canisters already mounted to trees)
- Outdoor assembly kits
- Spare zip ties
- Spare wing nuts
- A field book to record notes
- GPS
- Landauer detector and commission information form (or information from form transcribed into field notebook)
- Camera
- Transit control detectors (required at take down only)

Information on Current Set-Up:

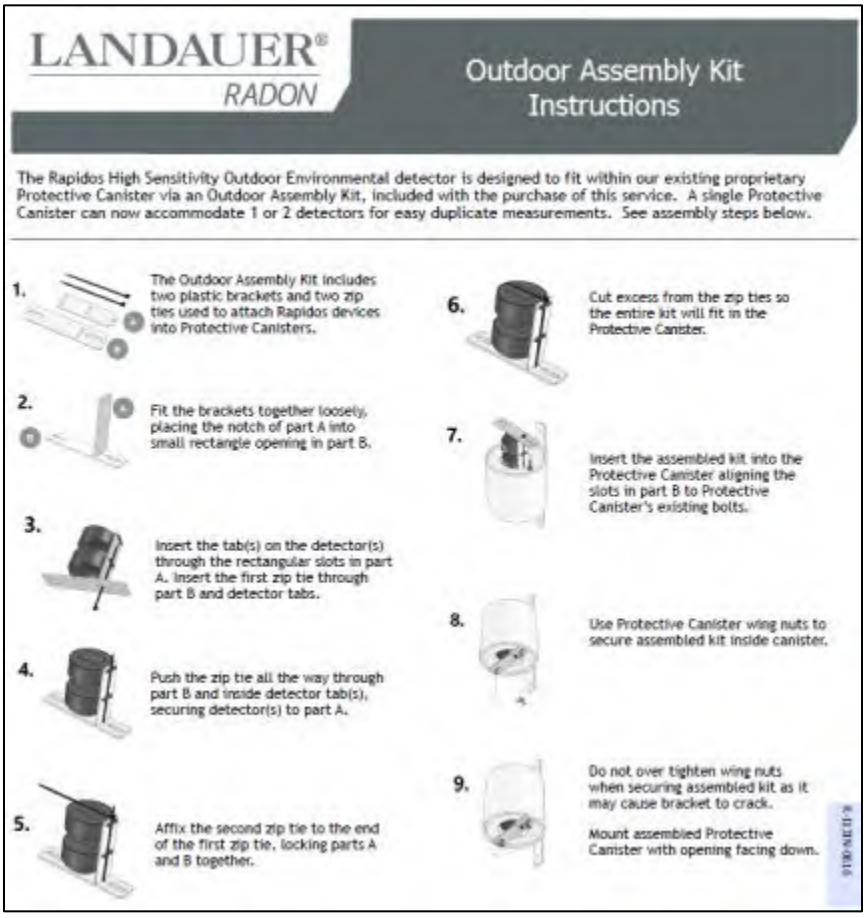
Twenty (20) protective canisters were set-up in September 2016 at the monitoring stations shown in Figure 1 and described in Table 1. Photos 1-10 have a few images of the stations. There are ten (10) monitoring stations: Radon-1 to Radon-10. At each station, two canisters were deployed within 2m of one another; i.e., each station has an A and B canister, e.g. Radon-4A and Radon-4B. This set-up provides duplicate radon readings at the same station. We decided to use separate canisters (and deploy one detector per canister) since one of the risks with this equipment is that bears and other animals have been known to chew on and destroy the plastic canisters. It was strategic to have two canisters at each station, with one detector per canister to minimize potential detector loss if a canister at a station gets destroyed. Having duplicate readings at each station will help to ensure we are successful in collecting radon data at each station during each monitoring period.

Procedure for Initial Set-Up:

If any new stations are required, the following steps should be followed:

1) Attach the protective canister to a tree at eye-height using the equipment in the boxes. Important: the opening of the canister faces down.
2) Write the monitoring station number on the outside of the canister in large font in permanent marker so it is clearly visible, e.g. Radon-11A or Radon-11B.
3) Use a handheld GPS to get the UTMs for each canister station. Record the UTMs in a field notebook.

4) Put **one detector inside each canister**
   a) Take the detector out of the radon-resistant bag
   b) Record the serial number and the corresponding monitoring station number in the field notebook
   c) Record the start date and time - month, day, year, hour, minute
   d) Use the outdoor assembly kit (two plastic brackets and two zip ties provided in the boxes) to attach a detector into the canister (note: we are only putting one detector in each canister, although the instructions show the option of having two detectors per canister):



5) Record any additional notes, for instance: description of location (side of hill, flat area, heavily forested area), any nearby activity (e.g. drilling), detector number, start date/time, any comments on the detector or canister. These notes will help us interpret any unusual results.
6) Take a photograph of the final set-up of each monitoring station. Record the photo number in the field book or make sure the monitoring station number on the outside of the canister is visible in the photo.
7) Plan to leave the detectors up for three (3) months.

Procedure for Take-Down:

The detectors can be taken down after approximately three (3) months of monitoring ambient radon concentrations.

1) The canister stays on the tree and can be reused. The detector is the only thing that needs to be removed.
2) Disassemble and separate detectors from the outdoor assembly kit by cutting the zip tie.
3) Return only the detectors, not the assembly kit or protective canister to Landauer. Like the canister, the plastic brackets from the outdoor assembly kit can also be reused.
4) Write the take-down date and time (month, day, year, hour, minute) in the field book. Double check the serial number on the detector removed with the serial number in the field book for the particular location. The numbers must match.
5) A number of transit control detectors are enclosed in the boxes. The transit control kit detectors should remain in their radon proof bags until the detectors are taken down (i.e., the end of the measurement period). Upon retrieving the detectors from the canisters, open the Transit Control Kit detector bags and keep them with the field detectors, returning them all to the laboratory together.
   a) Please record the numbers of the transit controls. The transit control numbers need to be entered online with the commission management information.
6) Transit control detectors allow us to accurately measure the radon level present at the monitoring station during the deployment period and not any radon exposure experienced during travel from site to the laboratory.
7) If deploying a new detector, record the replacement detector serial number in the field book for the appropriate location. Write the date of the replacement detector in the field book.
8) Shipping:
   a) Make sure the transit control detectors are opened (i.e., no longer in their radon-proof bags) and included with the detectors retrieved from the field. Package all the detectors together in as small a box as possible to minimize detectors shifting during transit.
   b) Use FedEx to ship the detectors with the transit controls to: Landauer Radon Inc., 900 Oakmont Lane, Suite 207, Westmont, IL USA 60559.
   c) Note on the return duties form that the detectors are being returned to USA for analysis. This may help alleviate some of the duty/tax rate. Use the harmonization code: 903010.
9) The cost for analysis was paid when the detectors were purchased.
10) Prior to shipping, enter the detector and commission information, comments, start/end times, transit control numbers, etc. online at: www.radonline.com

Ordering New Detectors:

Denison's current account is set up to order new detectors 'on-demand.' Phone Landauer customer service (ph. 1-800-528-8327) and place an order for 20 high sensitivity Rapidos detectors and 1 transit control kit. Denison's account number at Landauer is 18460.

Records:

- Electronic copy of all field notes – scanned and PDFd, saved on the G drive (G:\Project Development\Wheeler River\EH&S\Atmospheric Environment\Radon Monitoring)
- Copy of commission information

References:

- *Landauer Rapidos information sheet (attached)*
- *Landauer Outdoor Assembly Kit Instructions (attached)*
- *Blank commission form (attached)*

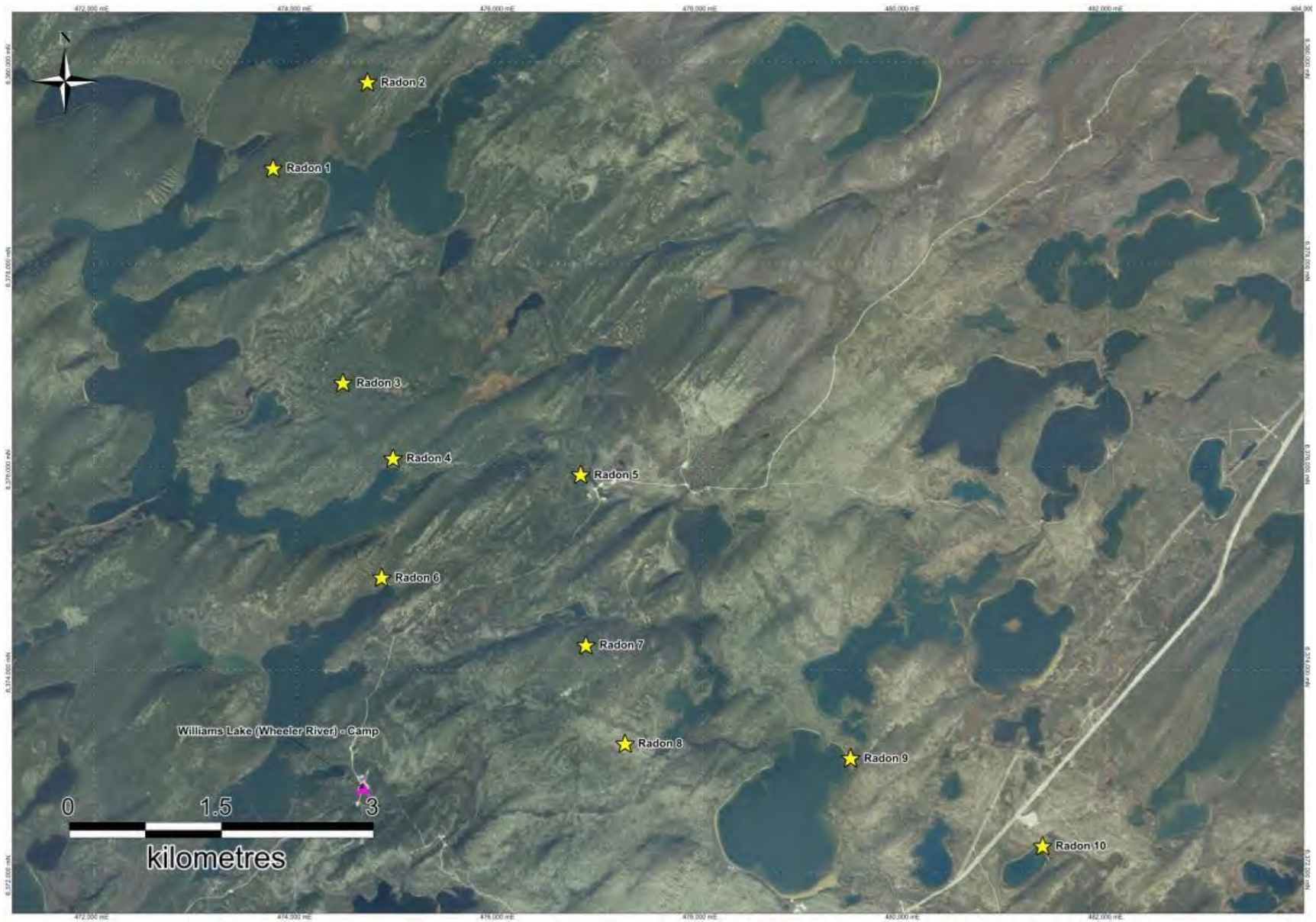


Figure 1: Location of Wheeler River Project radon monitoring stations, Radon 1 to Radon 10

Table 1: Description of radon monitoring stations established in September 2016.

Detector Station	GPS marked locations as installed September 2016. +/- 3m		Elevation from GPS +/- 6m	Location description	Access
	Easting	Northing	(m asl)		
Radon 1	473770	6378961	550	Forest on small hill. Middle of forest.	Old forest road. A truck might be able to drive here in the winter or any 4x4 small vehicle in summer. Good access but far from Gryphon.
Radon 2	474702	6379807	518	Thick forest along an old trail, on a small hill and some 1km or more from a lake.	The last 0.5km is overgrown and rough with tall shrubs, 4x4 quad only or walk.
Radon 3	474457	6376843	532	Thick forest of small trees. The tree cover is slightly more sparse at the site chosen. This is about 200m short of the planned coordinates because of difficult access.	Walking trail only for few 100's m from end of drill roads that end currently at WR-666 drill site. The trail is flagged with red tape.
Radon 4	474951	6376099	529	One of the roads at Gryphon deposit drilling sites. Nearest former drill site is about 50m away.	Follow road to Gryphon past the creek bridge, then up hill and to the left toward the drill supply area, but turn left and down toward the lake before that. There are many old drill pads in that area.
Radon 5	476804	6375936	513	In thick forest but near edge of open mossy meadow with small trees near a small lake (~100m away).	Main road from Wheeler Camp, until a small bridge on a creek. Before the bridge, on West side (left), a small rough path starts from the main road. After the trail ends, one needs to follow the lake shore. One can drive by truck and then walk 300m.
Radon 6	474841	6374922	534	The site is near a road to Gryphon deposit drill area, near a bend in road, below a small hill. The forest has larger trees at this spot and is more open.	This is along the main road to Gryphon drilling area. Easy truck access.
Radon 7	476857	6374255	546	This site is in the middle of forest, along an old seismic line. In September 2016 there was a drill rig set up about few 100's m away drilling one of the SRK holes. The drill pad is not heard or visible from this spot.	The best access is from the Phoenix drill sites, along one small road, and then along a seismic line. 4x4 quad only or walk. It is at least 100m from the road.
Radon 8	477240	6373284	518	Sparse forest below a hill W of Phoenix deposit.	From the main road to Phoenix deposit, there is a smaller road that leads to near this site. Part of the road is steep and eroded so a truck might not make it. After the road, there is no trail, only tracks of 4x4, but it is an easy walking distance and forest is very open.
Radon 9	479466	6373139	500	At end of trail on narrow peninsula between two lakes.	Access is from main road from Key Lake, then past a bridge on Icelander river and along road following the power line, and two more roads into the forest. The furthest trail ends at this spot.
Radon 10	481359	6372275	502	Sparse forest about 50m from small lake, between small road and lake shore.	E side of main road between McArthur and Key Lake, along a small trail, north of the Icelander River bridge. Access road is beside gravel pile, and the site is to the left between road and lake. Can drive a truck near to this site.

Note: UTM coordinates (meters), Zone 13, NAD 83

Photo 1: Station Radon 1 as set-up in September 2016

Photo 2: Station Radon 2 as set-up in September 2016

Photo 3: Station Radon 3 as set-up in September 2016

Photo 4: Station Radon 4 as set-up in September 2016

Photo 5: Station Radon 5 as set-up in September 2016

Photo 6: Station Radon 6 as set-up in September 2016

Photo 7: Station Radon 7 as set-up in September 2016

Photo 8: Station Radon 8 as set-up in September 2016

Photo 9: Station Radon 9 as set-up in September 2016

Photo 10: Station Radon 10 as set-up in September 2016

ATTACHMENTS

- *Landauer Rapidos information sheet*

LANDAUER®
RADON

Rapidos
A High-Sensitivity Detector

Rapidos High Sensititivy Detectors offer the opportunity to measure very low concentrations of radon gas--for example in connection with environmental outdoor measurements, mining and prospecting for uranium. The detectors are also suitable for surveys of houses and buildings in areas where a very low radon concentration is indicated.

Alpha track detector for low concentrations

- Detector consists of a film element located within a pod made from a special antistatic plastic
- Radon enters into the detector by diffusion - non thoron sensitive
- Analysis is performed using a state-of-the-art image scanner
- Transit control detectors allow the accurate measurement of only the radon level present at the survey site
- Additional specially designed Protective Cannister is available for outdoor applications

Technical Specifications

Detector Application	High Sensitivity Detector
Lowest Detection Limit (Bq/m³)	10 Bqm³ at 1 month measurement 5 Bqm³ at 2 month measurement 4 Bqm³ at 3 month measurement or longer
Normal Exposure Duration	1 - 3 months
Uncertainty (%)	15% at 224 kBqh/m³ (3 month at 10 Bq/m³)
Basis of Uncertainty	1 sd
Detector Sensitivity (tracks cm^{-2} kBq^{-1} h^{-1} m^3)	4.4
Typical Background (kBqh/m^{-3})	4
Standard Deviation on Background (kBq h m^{-3})	1
Detector Diameter (mm)	58 (63.5 with hanger)
Detector Height (mm)	40 (43 with clip)
Detector Holder Type	Closed, with filter
Detector Holder Design	Rapidos own, black
Detector Holder Antistatic Measures	Conducting holder
Detector Material	CR39/PADC

LANDAUER®
RADON
The global leader in radon measurement

LANDAUER RADON is a pioneer in radon detection, having manufactured and analyzed alpha track detectors for more than 30 years. Our devices are used globally by a broad spectrum of users including scientifically astute, industry-leading practitioners. LANDAUER RADON'S measurement methods are accredited by SWEDAC (Swedish Board of Accreditation and Conformity Assessment) to the ISO17025 standard using the measurement protocols of the EPA (Environmental Protection Agency), HPA (Health Protection Agency, UK) and SSM (Swedish Radiation Protection Institute. LANDAUER RADON'S laboratory is accredited by NRPP (National Radon Proficiency Program) and C-NRPP (Canadian National Radon Proficiency Program).

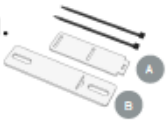
Corporate Office: 900 Oakmont Lane, Suite 207 Westmont, IL 60559 www.landauerradon.com T: 331 814 2200 F: 331 814 2214 help@landauerradon.com

- *Landauer Outdoor Assembly Kit Instructions*

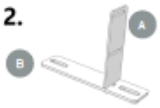
LANDAUER® RADON

Outdoor Assembly Kit Instructions

The Rapidos High Sensitivity Outdoor Environmental detector is designed to fit within our existing proprietary Protective Canister via an Outdoor Assembly Kit, included with the purchase of this service. A single Protective Canister can now accommodate 1 or 2 detectors for easy duplicate measurements. See assembly steps below.

1. 

The Outdoor Assembly Kit includes two plastic brackets and two zip ties used to attach Rapidos devices into Protective Canisters.

2. 

Fit the brackets together loosely, placing the notch of part A into small rectangle opening in part B.

3.
Insert the tab(s) on the detector(s) through the rectangular slots in part A. Insert the first zip tie through part B and detector tabs.

4.
Push the zip tie all the way through part B and inside detector tab(s), securing detector(s) to part A.

5.
Affix the second zip tie to the end of the first zip tie, locking parts A and B together.

6.
Cut excess from the zip ties so the entire kit will fit in the Protective Canister.

7.
Insert the assembled kit into the Protective Canister aligning the slots in part B to Protective Canister's existing bolts.

8.
Use Protective Canister wing nuts to secure assembled kit inside canister.

9.
Do not over tighten wing nuts when securing assembled kit as it may cause bracket to crack.

Mount assembled Protective Canister with opening facing down.

R-113N-0516

When returning detectors for analysis, disassemble and separate detectors from kit by cutting the zip tie. Return only the detectors, not the Assembly Kit or Protective Canister. Like the canister, the plastic brackets can be reused.

Return Detectors To:
Landauer Radon, Inc.
900 Oakmont Lane Suite 207
Westmont, IL 60559

For more information contact our Customer Service department at 331.814.2200 or customerservice@landauerradon.com.

Blank commission form

FILL IN DETECTOR AND COMMISSION INFORMATION Please note the time format used is International Standard.

Rapidos® High-Sensitivity Test Data

Fill in detector number (bottom of the detector)		Start Date/Time M M D D Y Y H H M M	End Date/Time M M D D Y Y H H M M	Location	Detector comment	Location type
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

FILL IN THE COMMISSION ADDRESS

Site:.....

Address:.....

.....

City:.....

State:.....

Postal code:.....

Building id: .....

Commission number: **4645989**

FILL IN THE TRANSIT CONTROL DETECTORS

1

2

3

Use this character
0= Out-door
1= In-door
2= Under ground

If the measurement was performed by a certified measurement specialist, certification license no:.....

Test data given by (signature): .....

Printed name:

Appendix B:

Detailed Result Summary Tables

Summary of Dustfall Results at All Locations

Sample ID	Lab ID	Lab Report	Start			End			Days	Particulates (mg/dm2.day)					
										Total		Fixed		Volatile	
			Date	Time	Timestamp	Date	Time	Timestamp		Result	DL	Result	DL	Result	DL
DF-01A	L2225060-1	L2225060	02-Oct-18	13:55	2018-10-02 13:55	22-Jan-19	12:20	2019-01-22 12:20	111.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01B	L2225060-2		02-Oct-18	13:55	2018-10-02 13:55	22-Jan-19	12:15	2019-01-22 12:15	111.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02A	L2225060-3		02-Oct-18	13:55	2018-10-02 13:55	22-Jan-19	15:55	2019-01-22 15:55	112.1	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02B	L2225060-4		02-Oct-18	13:55	2018-10-02 13:55	22-Jan-19	15:50	2019-01-22 15:50	112.1	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03A	L2225060-5		02-Oct-18	13:55	2018-10-02 13:55	22-Jan-19	13:30	2019-01-22 13:30	112.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03B	L2225060-6		02-Oct-18	13:55	2018-10-02 13:55	22-Jan-19	13:25	2019-01-22 13:25	112.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04A	L2225060-7		02-Oct-18	13:55	2018-10-02 13:55	23-Jan-19	12:30	2019-01-23 12:30	112.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04B	L2225060-8		02-Oct-18	13:55	2018-10-02 13:55	23-Jan-19	12:35	2019-01-23 12:35	112.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-05A	L2225060-9		02-Oct-18	13:55	2018-10-02 13:55	24-Jan-19	11:15	2019-01-24 11:15	113.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-05B	L2225060-10		02-Oct-18	13:55	2018-10-02 13:55	24-Jan-19	11:20	2019-01-24 11:20	113.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01A	L2274915-1	L2274915	22-Jan-19	12:20	2019-01-22 12:20	12-May-19	9:40	2019-05-12 9:40	109.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01B	L2274915-2		22-Jan-19	12:15	2019-01-22 12:15	12-May-19	9:45	2019-05-12 9:45	109.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02A	L2274915-3		22-Jan-19	15:55	2019-01-22 15:55	12-May-19	11:40	2019-05-12 11:40	109.8	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02B	L2274915-4		22-Jan-19	15:50	2019-01-22 15:50	12-May-19	11:45	2019-05-12 11:45	109.8	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03A	L2274915-5		22-Jan-19	13:30	2019-01-22 13:30	12-May-19	10:20	2019-05-12 10:20	109.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03B	L2274915-6		22-Jan-19	13:25	2019-01-22 13:25	12-May-19	10:25	2019-05-12 10:25	109.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04A	L2274915-7		23-Jan-19	12:30	2019-01-23 12:30	12-May-19	15:00	2019-05-12 15:00	109.1	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04B	L2274915-8		23-Jan-19	12:35	2019-01-23 12:35	12-May-19	15:05	2019-05-12 15:05	109.1	0.14	0.1	< 0.1	0.1	0.12	0.1
DF-05A	L2274915-9		24-Jan-19	11:15	2019-01-24 11:15	13-May-19	9:30	2019-05-13 9:30	108.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-05B	L2274915-10		24-Jan-19	11:20	2019-01-24 11:20	13-May-19	9:35	2019-05-13 9:35	108.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-06A	L2274915-11		02-Oct-18	13:55	2018-10-02 13:55	12-May-19	14:00	2019-05-12 14:00	222.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-06B	L2274915-12		02-Oct-18	13:55	2018-10-02 13:55	12-May-19	14:05	2019-05-12 14:05	222.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01A	L2496899-1	L2496899	25-Jul-20	16:20	2020-07-25 16:20	28-Aug-20	10:34	2020-08-28 10:34	33.8	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01B	L2496899-2		25-Jul-20	16:20	2020-07-25 16:20	28-Aug-20	10:34	2020-08-28 10:34	33.8	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02A	L2496899-3		24-Jul-20	12:10	2020-07-24 12:10	28-Aug-20	9:34	2020-08-28 9:34	34.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02B	L2496899-4		24-Jul-20	12:10	2020-07-24 12:10	28-Aug-20	9:34	2020-08-28 9:34	34.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03A	L2496899-5		24-Jul-20	12:30	2020-07-24 12:30	28-Aug-20	10:04	2020-08-28 10:04	34.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03B	L2496899-6		24-Jul-20	12:30	2020-07-24 12:30	28-Aug-20	10:02	2020-08-28 10:02	34.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04A	L2496899-7		23-Jul-20	17:30	2020-07-23 17:30	28-Aug-20	15:50	2020-08-28 15:50	35.9	0.15	0.1	< 0.1	0.1	0.11	0.1
DF-04B	L2496899-8		23-Jul-20	17:30	2020-07-23 17:30	28-Aug-20	15:50	2020-08-28 15:50	35.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-05A	L2496899-9		23-Jul-20	15:55	2020-07-23 15:55	28-Aug-20	15:09	2020-08-28 15:09	36.0	0.18	0.1	< 0.1	0.1	0.11	0.1
DF-05B	L2496899-10		23-Jul-20	16:15	2020-07-23 16:15	28-Aug-20	15:09	2020-08-28 15:09	36.0	0.3	0.1	0.11	0.1	0.2	0.1
DF-06A	L2496899-11		25-Jul-20	10:20	2020-07-25 10:20	28-Aug-20	13:57	2020-08-28 13:57	34.2	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-06B	L2496899-12		25-Jul-20	10:20	2020-07-25 10:20	28-Aug-20	13:57	2020-08-28 13:57	34.2	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01A	L2514481-1	L2514481	28-Aug-20	10:34	2020-08-28 10:34	02-Oct-20	14:00	2020-10-02 14:00	35.1	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01B	L2514481-2		28-Aug-20	10:34	2020-08-28 10:34	02-Oct-20	14:00	2020-10-02 14:00	35.1	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02A	L2514481-3		28-Aug-20	9:34	2020-08-28 9:34	02-Oct-20	15:15	2020-10-02 15:15	35.2	0.12	0.1	< 0.1	0.1	< 0.1	0.1

Summary of Dustfall Results at All Locations

Sample ID	Lab ID	Lab Report	Start			End			Days	Particulates (mg/dm2.day)					
										Total		Fixed		Volatile	
			Date	Time	Timestamp	Date	Time	Timestamp		Result	DL	Result	DL	Result	DL
DF-02B	L2514481-4		28-Aug-20	9:34	2020-08-28 9:34	02-Oct-20	15:15	2020-10-02 15:15	35.2	0.12	0.1	< 0.1	0.1	< 0.1	0.1
DF-03A	L2514481-5		28-Aug-20	10:04	2020-08-28 10:04	02-Oct-20	14:40	2020-10-02 14:40	35.2	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03B	L2514481-6		28-Aug-20	10:02	2020-08-28 10:02	02-Oct-20	14:40	2020-10-02 14:40	35.2	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04A	L2514481-7		28-Aug-20	15:50	2020-08-28 15:50	30-Sep-20	15:30	2020-09-30 15:30	33.0	0.12	0.1	< 0.1	0.1	< 0.1	0.1
DF-04B	L2514481-8		28-Aug-20	15:50	2020-08-28 15:50	30-Sep-20	15:30	2020-09-30 15:30	33.0	0.25	0.1	< 0.1	0.1	0.19	0.1
DF-05A	L2514481-9		28-Aug-20	15:09	2020-08-28 15:09	30-Sep-20	15:08	2020-09-30 15:08	33.0	0.14	0.1	< 0.1	0.1	< 0.1	0.1
DF-05B	L2514481-10		28-Aug-20	15:09	2020-08-28 15:09	30-Sep-20	15:08	2020-09-30 15:08	33.0	0.2	0.1	< 0.1	0.1	0.13	0.1
DF-06A	L2514481-11		28-Aug-20	13:57	2020-08-28 13:57	30-Sep-20	14:15	2020-09-30 14:15	33.0	0.12	0.1	< 0.1	0.1	< 0.1	0.1
DF-06B	L2514481-12		28-Aug-20	13:57	2020-08-28 13:57	30-Sep-20	14:15	2020-09-30 14:15	33.0	0.15	0.1	< 0.1	0.1	0.1	0.1
DF-01A	L2527762-1	L2527762	02-Oct-20	14:00	2020-10-02 14:00	03-Nov-20	11:30	2020-11-03 11:30	31.9	0.47	0.1	< 0.1	0.1	0.41	0.1
DF-01B	L2527762-2		02-Oct-20	14:00	2020-10-02 14:00	03-Nov-20	11:30	2020-11-03 11:30	31.9	0.66	0.1	< 0.1	0.1	0.6	0.1
DF-02A	L2527762-3		02-Oct-20	15:15	2020-10-02 15:15	03-Nov-20	13:40	2020-11-03 13:40	31.9	0.28	0.1	< 0.1	0.1	0.26	0.1
DF-02B	L2527762-4		02-Oct-20	15:15	2020-10-02 15:15	03-Nov-20	13:40	2020-11-03 13:40	31.9	0.18	0.1	< 0.1	0.1	0.16	0.1
DF-03A	L2527762-5		02-Oct-20	14:40	2020-10-02 14:40	03-Nov-20	12:30	2020-11-03 12:30	31.9	0.18	0.1	< 0.1	0.1	0.16	0.1
DF-03B	L2527762-6		02-Oct-20	14:40	2020-10-02 14:40	03-Nov-20	12:30	2020-11-03 12:30	31.9	0.17	0.1	< 0.1	0.1	0.14	0.1
DF-04A	L2527762-7		30-Sep-20	15:30	2020-09-30 15:30	04-Nov-20	13:00	2020-11-04 13:00	34.9	0.17	0.1	< 0.1	0.1	0.12	0.1
DF-04B	L2527762-8		30-Sep-20	15:30	2020-09-30 15:30	04-Nov-20	13:00	2020-11-04 13:00	34.9	0.15	0.1	< 0.1	0.1	0.1	0.1
DF-05A	L2527762-9		30-Sep-20	15:08	2020-09-30 15:08	04-Nov-20	14:00	2020-11-04 14:00	35.0	0.12	0.1	< 0.1	0.1	< 0.1	0.1
DF-05B	L2527762-10		30-Sep-20	15:08	2020-09-30 15:08	04-Nov-20	14:00	2020-11-04 14:00	35.0	0.28	0.1	< 0.1	0.1	0.22	0.1
DF-06A	L2527762-11		30-Sep-20	14:15	2020-09-30 14:15	05-Nov-20	9:30	2020-11-05 9:30	35.8	0.12	0.1	< 0.1	0.1	0.1	0.1
DF-06B	L2527762-12		30-Sep-20	14:15	2020-09-30 14:15	05-Nov-20	9:30	2020-11-05 9:30	35.8	0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-01A	L2613303-1	L2613303	08-Jun-21	10:15	2021-06-08 10:15	10-Jul-21	13:50	2021-07-10 13:50	32.1	0.63	0.1	< 0.1	0.1	0.54	0.1
DF-01B	L2613303-2		08-Jun-21	10:15	2021-06-08 10:15	10-Jul-21	13:50	2021-07-10 13:50	32.1	0.56	0.1	< 0.1	0.1	0.48	0.1
DF-02A	L2613303-3		08-Jun-21	12:00	2021-06-08 12:00	10-Jul-21	13:05	2021-07-10 13:05	32.0	0.77	0.1	0.14	0.1	0.63	0.1
DF-02B	L2613303-4		08-Jun-21	12:00	2021-06-08 12:00	10-Jul-21	13:05	2021-07-10 13:05	32.0	0.42	0.1	< 0.1	0.1	0.33	0.1
DF-03A	L2613303-5		08-Jun-21	10:55	2021-06-08 10:55	10-Jul-21	13:20	2021-07-10 13:20	32.1	0.42	0.1	< 0.1	0.1	0.32	0.1
DF-03B	L2613303-6		08-Jun-21	10:55	2021-06-08 10:55	10-Jul-21	13:20	2021-07-10 13:20	32.1	0.46	0.1	< 0.1	0.1	0.39	0.1
DF-04A	L2613303-7		08-Jun-21	9:10	2021-06-08 9:10	10-Jul-21	9:55	2021-07-10 9:55	32.0	0.82	0.1	0.14	0.1	0.69	0.1
DF-04B	L2613303-8		08-Jun-21	9:10	2021-06-08 9:10	10-Jul-21	9:55	2021-07-10 9:55	32.0	0.86	0.1	0.11	0.1	0.75	0.1
DF-05A	L2613303-9		08-Jun-21	9:35	2021-06-08 9:35	10-Jul-21	9:20	2021-07-10 9:20	32.0	0.49	0.1	< 0.1	0.1	0.40	0.1
DF-05B	L2613303-10		08-Jun-21	9:35	2021-06-08 9:35	10-Jul-21	9:20	2021-07-10 9:20	32.0	0.44	0.1	< 0.1	0.1	0.36	0.1
DF-06A	L2613303-11		08-Jun-21	14:30	2021-06-08 14:30	10-Jul-21	8:15	2021-07-10 8:15	31.7	0.51	0.1	< 0.1	0.1	0.42	0.1
DF-06B	L2613303-12		08-Jun-21	14:30	2021-06-08 14:30	10-Jul-21	8:15	2021-07-10 8:15	31.7	0.4	0.1	< 0.1	0.1	0.32	0.1
DF-01A	L2629159-1	L2629159	10-Jul-21	13:50	2021-07-10 13:50	17-Aug-21	14:50	2021-08-17 14:50	38.0	0.21	0.1	< 0.1	0.1	0.15	0.1
DF-01B	L2629159-2		10-Jul-21	13:50	2021-07-10 13:50	17-Aug-21	14:50	2021-08-17 14:50	38.0	0.17	0.1	< 0.1	0.1	0.12	0.1
DF-02A	L2629159-3		10-Jul-21	13:05	2021-07-10 13:05	17-Aug-21	13:20	2021-08-17 13:20	38.0	3.03	0.1	0.42	0.1	2.61	0.1
DF-02B	L2629159-4		10-Jul-21	13:05	2021-07-10 13:05	17-Aug-21	13:20	2021-08-17 13:20	38.0	0.39	0.1	0.12	0.1	0.27	0.1

Summary of Dustfall Results at All Locations

Sample ID	Lab ID	Lab Report	Start			End			Days	Particulates (mg/dm2.day)					
										Total		Fixed		Volatile	
			Date	Time	Timestamp	Date	Time	Timestamp		Result	DL	Result	DL	Result	DL
DF-03A	L2629159-5		10-Jul-21	13:20	2021-07-10 13:20	17-Aug-21	14:20	2021-08-17 14:20	38.0	0.29	0.1	0.11	0.1	0.19	0.1
DF-03B	L2629159-6		10-Jul-21	13:20	2021-07-10 13:20	17-Aug-21	14:20	2021-08-17 14:20	38.0	0.2	0.1	0.1	0.1	< 0.1	0.1
DF-04A	L2629159-7		10-Jul-21	9:55	2021-07-10 9:55	17-Aug-21	10:30	2021-08-17 10:30	38.0	0.38	0.1	0.17	0.1	0.22	0.1
DF-04B	L2629159-8		10-Jul-21	9:55	2021-07-10 9:55	17-Aug-21	10:30	2021-08-17 10:30	38.0	0.59	0.1	0.23	0.1	0.36	0.1
DF-05A	L2629159-9		10-Jul-21	9:20	2021-07-10 9:20	17-Aug-21	10:00	2021-08-17 10:00	38.0	2.58	0.1	0.52	0.1	2.06	0.1
DF-05B	L2629159-10		10-Jul-21	9:20	2021-07-10 9:20	17-Aug-21	10:00	2021-08-17 10:00	38.0	1.61	0.1	0.42	0.1	1.19	0.1
DF-06A	L2629159-11		10-Jul-21	8:15	2021-07-10 8:15	17-Aug-21	9:00	2021-08-17 9:00	38.0	0.58	0.1	0.2	0.1	0.38	0.1
DF-06B	L2629159-12		10-Jul-21	8:15	2021-07-10 8:15	17-Aug-21	9:00	2021-08-17 9:00	38.0	0.46	0.1	0.16	0.1	0.3	0.1
DF-01A	L2643294-1	L2643294	17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:45	2021-09-21 10:45	34.8	0.11	0.1	< 0.1	0.1	< 0.1	0.1
DF-01B	L2643294-2		17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:45	2021-09-21 10:45	34.8	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-02A	L2643294-3		17-Aug-21	13:20	2021-08-17 13:20	21-Sep-21	11:55	2021-09-21 11:55	34.9	0.14	0.1	< 0.1	0.1	0.14	0.1
DF-02B	L2643294-4		17-Aug-21	13:20	2021-08-17 13:20	21-Sep-21	11:55	2021-09-21 11:55	34.9	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03A	L2643294-5		17-Aug-21	14:20	2021-08-17 14:20	21-Sep-21	9:30	2021-09-21 9:30	34.8	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-03B	L2643294-6		17-Aug-21	14:20	2021-08-17 14:20	21-Sep-21	9:30	2021-09-21 9:30	34.8	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04A	L2643294-7		17-Aug-21	10:30	2021-08-17 10:30	22-Sep-21	11:25	2021-09-22 11:25	36.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-04B	L2643294-8		17-Aug-21	10:30	2021-08-17 10:30	22-Sep-21	11:25	2021-09-22 11:25	36.0	0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-05A	L2643294-9		17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	10:55	2021-09-22 10:55	36.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-05B	L2643294-10		17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	10:55	2021-09-22 10:55	36.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-06A	L2643294-11		17-Aug-21	9:00	2021-08-17 9:00	22-Sep-21	8:25	2021-09-22 8:25	36.0	< 0.1	0.1	< 0.1	0.1	< 0.1	0.1
DF-06B	L2643294-12		17-Aug-21	9:00	2021-08-17 9:00	22-Sep-21	8:25	2021-09-22 8:25	36.0	0.12	0.1	< 0.1	0.1	< 0.1	0.1
DF-01A	L2655042-1	L2655042	21-Sep-21	10:45	2021-09-21 10:45	22-Oct-21	8:35	2021-10-22 8:35	30.9	1.88	0.1	0.22	0.1	1.66	0.1
DF-01B	L2655042-2		21-Sep-21	10:45	2021-09-21 10:45	22-Oct-21	8:35	2021-10-22 8:35	30.9	0.18	0.1	0.11	0.1	< 0.1	0.1
DF-02A	L2655042-3		21-Sep-21	11:55	2021-09-21 11:55	22-Oct-21	8:00	2021-10-22 8:00	30.8	0.45	0.1	0.12	0.1	0.32	0.1
DF-02B	L2655042-4		21-Sep-21	11:55	2021-09-21 11:55	22-Oct-21	8:00	2021-10-22 8:00	30.8	0.3	0.1	0.15	0.1	0.16	0.1
DF-03A	L2655042-5		21-Sep-21	9:30	2021-09-21 9:30	22-Oct-21	8:15	2021-10-22 8:15	30.9	0.34	0.1	0.13	0.1	0.21	0.1
DF-03B	L2655042-6		21-Sep-21	9:30	2021-09-21 9:30	22-Oct-21	8:15	2021-10-22 8:15	30.9	0.46	0.1	0.13	0.1	0.33	0.1
DF-04A	L2655042-7		22-Sep-21	11:25	2021-09-22 11:25	22-Oct-21	13:35	2021-10-22 13:35	30.1	0.25	0.1	0.12	0.1	0.13	0.1
DF-04B	L2655042-8		22-Sep-21	11:25	2021-09-22 11:25	22-Oct-21	13:35	2021-10-22 13:35	30.1	0.23	0.1	< 0.1	0.1	0.16	0.1
DF-05A	L2655042-9		22-Sep-21	10:55	2021-09-22 10:55	22-Oct-21	13:15	2021-10-22 13:15	30.1	0.5	0.1	0.11	0.1	0.39	0.1
DF-05B	L2655042-10		22-Sep-21	10:55	2021-09-22 10:55	22-Oct-21	13:15	2021-10-22 13:15	30.1	0.31	0.1	0.11	0.1	0.2	0.1
DF-06A	L2655042-11		22-Sep-21	8:25	2021-09-22 8:25	22-Oct-21	10:05	2021-10-22 10:05	30.1	0.21	0.1	< 0.1	0.1	0.12	0.1
DF-06B	L2655042-12		22-Sep-21	8:25	2021-09-22 8:25	22-Oct-21	10:05	2021-10-22 10:05	30.1	0.16	0.1	< 0.1	0.1	0.12	0.1

Summary of Dustfall Metals Results

Sample ID	Start			End			Days	Metals (mg/dm2.day)															
	Date	Time	Timestamp	Date	Time	Timestamp		Aluminum (Al)	Antimony (Sb)	Arsenic (As)	Barium (Ba)	Beryllium (Be)	Bismuth (Bi)	Boron (B)	Cadmium (Cd)	Calcium (Ca)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Lithium (Li)	Magnesium (Mg)
DF-01A	17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:45	2021-09-21 10:45	34.8	2.99E-04	< 2.80E-06	< 2.80E-06	1.20E-05	< 1.40E-05	< 1.40E-05	< 2.80E-04	< 1.40E-06	2.51E-03	< 1.40E-05	< 2.80E-06	< 1.40E-05	< 8.40E-04	< 1.40E-06	< 1.40E-04	6.30E-04
DF-01B	17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:45	2021-09-21 10:45	34.8	2.08E-04	< 2.90E-06	< 2.90E-06	1.15E-05	< 1.50E-05	< 1.50E-05	< 2.90E-04	< 1.50E-06	2.34E-03	< 1.50E-05	< 2.90E-06	< 2.90E-05	1.14E-03	< 1.50E-06	< 1.50E-04	6.90E-04
DF-02A	17-Aug-21	13:20	2021-08-17 13:20	21-Sep-21	11:55	2021-09-21 11:55	34.9	2.49E-04	< 2.70E-06	< 2.70E-06	1.44E-05	< 1.40E-05	< 1.40E-05	< 2.70E-04	< 1.40E-06	2.48E-03	< 1.40E-05	< 2.70E-06	< 1.40E-05	< 8.20E-04	< 1.40E-06	< 1.40E-04	6.70E-04
DF-02B	17-Aug-21	13:20	2021-08-17 13:20	21-Sep-21	11:55	2021-09-21 11:55	34.9	1.68E-04	< 2.90E-06	< 2.90E-06	9.00E-06	< 1.40E-05	< 1.40E-05	< 2.90E-04	< 1.40E-06	2.20E-03	< 1.40E-05	< 2.90E-06	< 1.40E-05	< 8.70E-04	< 1.40E-06	< 1.40E-04	5.00E-04
DF-03A	17-Aug-21	14:20	2021-08-17 14:20	21-Sep-21	9:30	2021-09-21 9:30	34.8	2.25E-04	< 2.40E-06	< 2.40E-06	1.08E-05	< 1.20E-05	< 1.20E-05	< 2.40E-04	< 1.20E-06	2.37E-03	< 1.20E-05	< 2.40E-06	< 2.40E-05	< 7.10E-04	< 1.20E-06	< 1.20E-04	5.20E-04
DF-03B	17-Aug-21	14:20	2021-08-17 14:20	21-Sep-21	9:30	2021-09-21 9:30	34.8	2.14E-04	< 2.50E-06	< 2.50E-06	1.09E-05	< 1.30E-05	< 1.30E-05	< 2.50E-04	< 1.30E-06	2.30E-03	< 1.30E-05	< 2.50E-06	< 1.30E-05	< 7.60E-04	< 1.30E-06	< 1.30E-04	6.20E-04
DF-04A	17-Aug-21	10:30	2021-08-17 10:30	22-Sep-21	11:25	2021-09-22 11:25	36.0	2.85E-04	< 3.00E-06	< 3.00E-06	1.10E-05	< 1.50E-05	< 1.50E-05	< 3.00E-04	< 1.50E-06	2.73E-03	< 1.50E-05	< 3.00E-06	< 1.50E-05	< 8.90E-04	< 1.50E-06	< 1.50E-04	7.70E-04
DF-04B	17-Aug-21	10:30	2021-08-17 10:30	22-Sep-21	11:25	2021-09-22 11:25	36.0	3.50E-04	< 2.90E-06	< 2.90E-06	1.08E-05	< 1.40E-05	< 1.40E-05	< 2.90E-04	< 1.40E-06	2.32E-03	< 1.40E-05	< 2.90E-06	< 1.40E-05	< 8.60E-04	< 1.40E-06	< 1.40E-04	6.80E-04
DF-05A	17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	10:55	2021-09-22 10:55	36.0	2.54E-04	< 2.30E-06	< 2.30E-06	9.40E-06	< 1.20E-05	< 1.20E-05	< 2.30E-04	< 1.20E-06	2.41E-03	< 1.20E-05	< 2.30E-06	< 2.30E-05	< 6.90E-04	< 1.20E-06	< 1.20E-04	5.60E-04
DF-05B	17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	10:55	2021-09-22 10:55	36.0	2.40E-04	< 2.50E-06	< 2.50E-06	1.07E-05	< 1.30E-05	< 1.30E-05	< 2.50E-04	< 1.30E-06	2.24E-03	< 1.30E-05	< 2.50E-06	< 2.50E-05	< 7.50E-04	< 1.30E-06	< 1.30E-04	4.70E-04
DF-06A	17-Aug-21	9:00	2021-08-17 9:00	22-Sep-21	8:25	2021-09-22 8:25	36.0	2.65E-04	< 2.30E-06	< 2.30E-06	1.13E-05	< 1.10E-05	< 1.10E-05	< 2.30E-04	< 1.10E-06	2.50E-03	< 1.10E-05	< 2.30E-06	< 1.10E-05	< 6.80E-04	< 1.10E-06	< 1.10E-04	6.00E-04
DF-06B	17-Aug-21	9:00	2021-08-17 9:00	22-Sep-21	8:25	2021-09-22 8:25	36.0	2.22E-04	< 2.30E-06	< 2.30E-06	9.30E-06	< 1.20E-05	< 1.20E-05	< 2.30E-04	< 1.20E-06	2.30E-03	< 1.20E-05	< 2.30E-06	< 1.20E-05	< 6.90E-04	< 1.20E-06	< 1.20E-04	6.70E-04
DF-01A	21-Sep-21	10:45	2021-09-21 10:45	22-Oct-21	8:35	2021-10-22 8:35	30.9	2.09E-03	< 1.70E-06	< 1.70E-06	4.96E-05	< 8.40E-06	< 8.40E-06	< 1.70E-04	< 8.40E-07	1.07E-02	< 8.40E-06	< 1.70E-06	7.90E-05	2.55E-03	2.86E-06	< 8.40E-05	3.33E-03
DF-01B	21-Sep-21	10:45	2021-09-21 10:45	22-Oct-21	8:35	2021-10-22 8:35	30.9	1.64E-03	< 1.40E-06	1.60E-06	4.20E-05	< 7.00E-06	< 7.00E-06	< 1.40E-04	< 7.00E-07	1.03E-02	< 7.00E-06	< 1.40E-06	7.00E-06	1.96E-03	1.82E-06	< 7.00E-05	3.25E-03
DF-02A	21-Sep-21	11:55	2021-09-21 11:55	22-Oct-21	8:00	2021-10-22 8:00	30.8	1.24E-03	< 1.40E-06	< 1.40E-06	4.97E-05	< 7.00E-06	< 7.00E-06	< 1.40E-04	< 7.00E-07	1.57E-02	< 7.00E-06	< 1.40E-06	1.32E-05	1.50E-03	1.49E-06	< 7.00E-05	4.21E-03
DF-02B	21-Sep-21	11:55	2021-09-21 11:55	22-Oct-21	8:00	2021-10-22 8:00	30.8	1.16E-03	< 1.30E-06	< 1.30E-06	3.80E-05	< 6.40E-06	< 6.40E-06	< 1.30E-04	< 6.40E-07	1.40E-02	< 6.40E-06	< 1.30E-06	2.67E-05	1.44E-03	2.72E-06	< 6.40E-05	3.89E-03
DF-03A	21-Sep-21	9:30	2021-09-21 9:30	22-Oct-21	8:15	2021-10-22 8:15	30.9	8.40E-04	< 1.60E-06	< 1.60E-06	3.86E-05	< 7.90E-06	< 7.90E-06	< 1.60E-04	< 7.90E-07	1.66E-02	< 7.90E-06	< 1.60E-06	9.80E-06	1.13E-03	1.46E-06	< 7.90E-05	4.53E-03
DF-03B	21-Sep-21	9:30	2021-09-21 9:30	22-Oct-21	8:15	2021-10-22 8:15	30.9	8.02E-04	< 1.50E-06	< 1.50E-06	4.28E-05	< 7.30E-06	< 7.30E-06	< 1.50E-04	< 7.30E-07	1.88E-02	< 7.30E-06	< 1.50E-06	1.01E-05	1.01E-03	1.12E-06	< 7.30E-05	5.21E-03
DF-04A	22-Sep-21	11:25	2021-09-22 11:25	22-Oct-21	13:35	2021-10-22 13:35	30.1	1.40E-03	< 1.40E-06	< 1.40E-06	3.35E-05	< 7.00E-06	< 7.00E-06	< 1.40E-04	< 7.00E-07	9.92E-03	< 7.00E-06	< 1.40E-06	7.30E-06	1.63E-03	1.64E-06	< 7.00E-05	3.04E-03
DF-04B	22-Sep-21	11:25	2021-09-22 11:25	22-Oct-21	13:35	2021-10-22 13:35	30.1	8.55E-04	< 1.50E-06	< 1.50E-06	3.57E-05	< 7.60E-06	< 7.60E-06	< 1.50E-04	< 7.60E-07	9.72E-03	< 7.60E-06	< 1.50E-06	< 7.60E-06	9.50E-04	1.15E-06	< 7.60E-05	2.84E-03
DF-05A	22-Sep-21	10:55	2021-09-22 10:55	22-Oct-21	13:15	2021-10-22 13:15	30.1	1.14E-03	< 1.60E-06	< 1.60E-06	3.50E-05	< 7.90E-06	< 7.90E-06	< 1.60E-04	< 7.90E-07	1.46E-02	< 7.90E-06	< 1.60E-06	1.85E-05	1.27E-03	1.37E-06	< 7.90E-05	4.68E-03
DF-05B	22-Sep-21	10:55	2021-09-22 10:55	22-Oct-21	13:15	2021-10-22 13:15	30.1	8.42E-04	< 1.40E-06	< 1.40E-06	3.86E-05	< 7.00E-06	< 7.00E-06	< 1.40E-04	< 7.00E-07	1.16E-02	< 7.00E-06	< 1.40E-06	2.24E-05	9.80E-04	1.59E-06	< 7.00E-05	3.74E-03
DF-06A	22-Sep-21	8:25	2021-09-22 8:25	22-Oct-21	10:05	2021-10-22 10:05	30.1	9.04E-04	< 1.30E-06	< 1.30E-06	4.78E-05	< 6.70E-06	< 6.70E-06	< 1.30E-04	< 6.70E-07	8.98E-03	< 6.70E-06	< 1.30E-06	6.70E-06	1.26E-03	1.30E-06	< 6.70E-05	2.74E-03
DF-06B	22-Sep-21	8:25	2021-09-22 8:25	22-Oct-21	10:05	2021-10-22 10:05	30.1	6.91E-04	2.10E-06	< 1.40E-06	2.86E-05	< 7.00E-06	< 7.00E-06	< 1.40E-04	< 7.00E-07	8.68E-03	< 7.00E-06	< 1.40E-06	< 7.00E-06	9.00E-04	1.08E-06	< 7.00E-05	2.68E-03

Summary of Dustfall Metals Results

Sample ID	Start			End			Days	Metals (mg/dm2.day)																
	Date	Time	Timestamp	Date	Time	Timestamp		Manganese (Mn)	Molybdenum (Mo)	Nickel (Ni)	Phosphorus (P)	Potassium (K)	Selenium (Se)	Silicon (Si)	Silver (Ag)	Sodium (Na)	Strontium (Sr)	Thallium (Tl)	Tin (Sn)	Titanium (Ti)	Uranium (U)	Vanadium (V)	Zinc (Zn)
DF-01A	17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:45	2021-09-21 10:45	34.8	5.12E-05	< 1.40E-06	< 1.40E-05	< 1.40E-03	1.70E-03	< 2.80E-05	< 1.40E-03	< 2.80E-07	< 1.40E-03	5.80E-06	< 2.80E-06	< 2.80E-06	< 2.80E-04	< 2.80E-07	< 2.80E-05	< 8.40E-05
DF-01B	17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:45	2021-09-21 10:45	34.8	6.13E-05	1.50E-06	< 1.50E-05	< 1.50E-03	2.10E-03	< 2.90E-05	< 1.50E-03	< 2.90E-07	< 1.50E-03	6.10E-06	< 2.90E-06	< 2.90E-06	< 2.90E-04	< 2.90E-07	< 2.90E-05	< 8.80E-05
DF-02A	17-Aug-21	13:20	2021-08-17 13:20	21-Sep-21	11:55	2021-09-21 11:55	34.9	1.09E-04	< 1.40E-06	< 1.40E-05	< 1.40E-03	2.40E-03	< 2.70E-05	< 1.40E-03	< 2.70E-07	< 1.40E-03	7.90E-06	< 2.70E-06	< 2.70E-06	< 2.70E-04	< 2.70E-07	< 2.70E-05	< 8.20E-05
DF-02B	17-Aug-21	13:20	2021-08-17 13:20	21-Sep-21	11:55	2021-09-21 11:55	34.9	4.89E-05	< 1.40E-06	< 1.40E-05	< 1.40E-03	2.60E-03	< 2.90E-05	< 1.40E-03	< 2.90E-07	< 1.40E-03	4.90E-06	< 2.90E-06	< 2.90E-06	< 2.90E-04	< 2.90E-07	< 2.90E-05	< 8.70E-05
DF-03A	17-Aug-21	14:20	2021-08-17 14:20	21-Sep-21	9:30	2021-09-21 9:30	34.8	4.58E-05	< 1.20E-06	< 1.20E-05	< 1.20E-03	< 1.20E-03	< 2.40E-05	< 1.20E-03	< 2.40E-07	< 1.20E-03	5.20E-06	< 2.40E-06	< 2.40E-06	< 2.40E-04	< 2.40E-07	< 2.40E-05	< 7.10E-05
DF-03B	17-Aug-21	14:20	2021-08-17 14:20	21-Sep-21	9:30	2021-09-21 9:30	34.8	4.95E-05	< 1.30E-06	< 1.30E-05	1.50E-03	1.30E-03	< 2.50E-05	< 1.30E-03	< 2.50E-07	< 1.30E-03	6.30E-06	< 2.50E-06	< 2.50E-06	< 2.50E-04	< 2.50E-07	< 2.50E-05	< 7.60E-05
DF-04A	17-Aug-21	10:30	2021-08-17 10:30	22-Sep-21	11:25	2021-09-22 11:25	36.0	6.26E-05	< 1.50E-06	< 1.50E-05	< 1.50E-03	1.90E-03	< 3.00E-05	< 1.50E-03	< 3.00E-07	< 1.50E-03	6.30E-06	< 3.00E-06	< 3.00E-06	< 3.00E-04	< 3.00E-07	< 3.00E-05	< 8.90E-05
DF-04B	17-Aug-21	10:30	2021-08-17 10:30	22-Sep-21	11:25	2021-09-22 11:25	36.0	6.96E-05	< 1.40E-06	< 1.40E-05	2.10E-03	3.90E-03	< 2.90E-05	< 1.40E-03	< 2.90E-07	< 1.40E-03	6.40E-06	< 2.90E-06	< 2.90E-06	< 2.90E-04	5.40E-07	< 2.90E-05	< 8.60E-05
DF-05A	17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	10:55	2021-09-22 10:55	36.0	4.33E-05	< 1.20E-06	< 1.20E-05	< 1.20E-03	1.40E-03	< 2.30E-05	< 1.20E-03	< 2.30E-07	< 1.20E-03	6.90E-06	< 2.30E-06	< 2.30E-06	< 2.30E-04	< 2.30E-07	< 2.30E-05	< 6.90E-05
DF-05B	17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	10:55	2021-09-22 10:55	36.0	4.72E-05	< 1.30E-06	< 1.30E-05	< 1.30E-03	< 1.30E-03	< 2.50E-05	< 1.30E-03	< 2.50E-07	< 1.30E-03	5.00E-06	< 2.50E-06	< 2.50E-06	< 2.50E-04	< 2.50E-07	< 2.50E-05	< 7.50E-05
DF-06A	17-Aug-21	9:00	2021-08-17 9:00	22-Sep-21	8:25	2021-09-22 8:25	36.0	5.01E-05	< 1.10E-06	< 1.10E-05	1.30E-03	2.10E-03	< 2.30E-05	< 1.10E-03	< 2.30E-07	< 1.10E-03	5.50E-06	< 2.30E-06	< 2.30E-06	< 2.30E-04	< 2.30E-07	< 2.30E-05	< 6.80E-05
DF-06B	17-Aug-21	9:00	2021-08-17 9:00	22-Sep-21	8:25	2021-09-22 8:25	36.0	8.83E-05	< 1.20E-06	< 1.20E-05	2.60E-03	3.90E-03	< 2.30E-05	< 1.20E-03	< 2.30E-07	< 1.20E-03	5.20E-06	< 2.30E-06	< 2.30E-06	< 2.30E-04	< 2.30E-07	< 2.30E-05	< 6.90E-05
DF-01A	21-Sep-21	10:45	2021-09-21 10:45	22-Oct-21	8:35	2021-10-22 8:35	30.9	1.61E-04	< 8.40E-07	< 8.40E-06	1.65E-03	2.62E-03	< 1.70E-05	4.73E-03	< 5.10E-07	2.79E-03	2.77E-05	< 1.70E-06	< 1.70E-06	< 1.70E-04	2.20E-07	< 1.70E-05	< 5.10E-05
DF-01B	21-Sep-21	10:45	2021-09-21 10:45	22-Oct-21	8:35	2021-10-22 8:35	30.9	1.47E-04	< 7.00E-07	< 7.00E-06	1.33E-03	2.59E-03	< 1.40E-05	3.43E-03	< 2.80E-07	2.47E-03	2.82E-05	< 1.40E-06	< 1.40E-06	< 1.40E-04	1.40E-07	< 1.40E-05	< 4.20E-05
DF-02A	21-Sep-21	11:55	2021-09-21 11:55	22-Oct-21	8:00	2021-10-22 8:00	30.8	2.49E-04	< 7.00E-07	< 7.00E-06	7.72E-03	6.29E-03	< 1.40E-05	2.77E-03	< 2.80E-07	2.95E-03	1.11E-04	< 1.40E-06	< 1.40E-06	< 1.40E-04	< 1.40E-07	< 1.40E-05	6.70E-05
DF-02B	21-Sep-21	11:55	2021-09-21 11:55	22-Oct-21	8:00	2021-10-22 8:00	30.8	1.11E-04	< 6.40E-07	< 6.40E-06	6.04E-03	4.91E-03	< 1.30E-05	3.08E-03	< 2.60E-07	2.67E-03	7.28E-05	< 1.30E-06	< 1.30E-06	< 1.30E-04	< 1.30E-07	< 1.30E-05	4.10E-05
DF-03A	21-Sep-21	9:30	2021-09-21 9:30	22-Oct-21	8:15	2021-10-22 8:15	30.9	1.07E-04	< 7.90E-07	< 7.90E-06	1.07E-02	7.56E-03	< 1.60E-05	1.65E-03	< 3.10E-07	3.83E-03	1.27E-04	< 1.60E-06	< 1.60E-06	< 1.60E-04	< 1.60E-07	< 1.60E-05	< 4.70E-05
DF-03B	21-Sep-21	9:30	2021-09-21 9:30	22-Oct-21	8:15	2021-10-22 8:15	30.9	9.26E-05	< 7.30E-07	< 7.30E-06	1.59E-02	1.07E-02	< 1.50E-05	1.94E-03	< 1.50E-07	4.87E-03	1.99E-04	< 1.50E-06	< 1.50E-06	< 1.50E-04	< 1.50E-07	< 1.50E-05	< 4.40E-05
DF-04A	22-Sep-21	11:25	2021-09-22 11:25	22-Oct-21	13:35	2021-10-22 13:35	30.1	9.99E-05	< 7.00E-07	< 7.00E-06	3.83E-03	4.31E-03	< 1.40E-05	3.90E-03	< 1.40E-07	2.25E-03	3.76E-05	< 1.40E-06	< 1.40E-06	< 1.40E-04	1.45E-06	< 1.40E-05	< 4.20E-05
DF-04B	22-Sep-21	11:25	2021-09-22 11:25	22-Oct-21	13:35	2021-10-22 13:35	30.1	7.66E-05	< 7.60E-07	< 7.60E-06	3.67E-03	3.37E-03	< 1.50E-05	1.91E-03	< 1.50E-07	2.12E-03	3.07E-05	< 1.50E-06	< 1.50E-06	< 1.50E-04	3.00E-07	< 1.50E-05	< 4.50E-05
DF-05A	22-Sep-21	10:55	2021-09-22 10:55	22-Oct-21	13:15	2021-10-22 13:15	30.1	1.06E-04	1.10E-05	< 7.90E-06	1.29E-02	1.17E-02	< 1.60E-05	2.53E-03	< 1.60E-07	4.52E-03	1.04E-04	< 1.60E-06	< 1.60E-06	< 1.60E-04	< 1.60E-07	< 1.60E-05	< 4.70E-05
DF-05B	22-Sep-21	10:55	2021-09-22 10:55	22-Oct-21	13:15	2021-10-22 13:15	30.1	1.34E-04	< 7.00E-07	< 7.00E-06	7.27E-03	7.92E-03	< 1.40E-05	1.88E-03	< 1.40E-07	4.09E-03	4.94E-05	< 1.40E-06	< 1.40E-06	< 1.40E-04	< 1.40E-07	< 1.40E-05	4.60E-05
DF-06A	22-Sep-21	8:25	2021-09-22 8:25	22-Oct-21	10:05	2021-10-22 10:05	30.1	8.86E-05	< 6.70E-07	< 6.70E-06	3.14E-03	3.59E-03	< 1.30E-05	2.13E-03	< 1.30E-07	2.43E-03	2.19E-05	< 1.30E-06	< 1.30E-06	< 1.30E-04	1.50E-07	< 1.30E-05	< 4.00E-05
DF-06B	22-Sep-21	8:25	2021-09-22 8:25	22-Oct-21	10:05	2021-10-22 10:05	30.1	7.47E-05	< 7.00E-07	< 7.00E-06	2.97E-03	3.72E-03	< 1.40E-05	1.59E-03	< 1.40E-07	2.28E-03	2.12E-05	< 1.40E-06	< 1.40E-06	< 1.40E-04	< 1.40E-07	< 1.40E-05	< 4.20E-05

Summary of Dustfall Results at All Locations

Sample ID	BV Labs ID	Start			End			Days	NO_2 (ppb)		SO_2 (ppb)		NO_2 (µg/m3)		SO_2 (µg/m3)	
		Date	Time	Timestamp	Date	Time	Timestamp		Results	RDL	Results	RDL	Results	RDL	Results	RDL
PC-01A	WQ7292	22-Aug-19	15:30	2019-08-22 15:30	26-Sep-19	12:10	2019-09-26 12:10	34.9	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01B	WQ7293	22-Aug-19	15:30	2019-08-22 15:30	26-Sep-19	12:10	2019-09-26 12:10	34.9	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02A	WQ7294	22-Aug-19	14:00	2019-08-22 14:00	26-Sep-19	8:30	2019-09-26 8:30	34.8	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02B	WQ7295	22-Aug-19	14:00	2019-08-22 14:00	26-Sep-19	8:30	2019-09-26 8:30	34.8	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01A	WU5855	26-Sep-19	12:10	2019-09-26 12:10	22-Oct-19	11:25	2019-10-22 11:25	26.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01B	WU5856	26-Sep-19	12:15	2019-09-26 12:15	22-Oct-19	11:25	2019-10-22 11:25	26.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02A	WU5857	26-Sep-19	8:45	2019-09-26 8:45	23-Oct-19	8:30	2019-10-23 8:30	27.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02B	WU5858	26-Sep-19	8:42	2019-09-26 8:42	23-Oct-19	8:30	2019-10-23 8:30	27.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01A	WY7556	22-Oct-19	11:25	2019-10-22 11:25	14-Nov-19	11:00	2019-11-14 11:00	23.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01B	WY7557	22-Oct-19	11:25	2019-10-22 11:25	14-Nov-19	11:00	2019-11-14 11:00	23.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02A	WY7558	23-Oct-19	8:30	2019-10-23 8:30	14-Nov-19	15:35	2019-11-14 15:35	22.3	0.2	0.1	< 0.1	0.1	0.38	0.19	< 0.26	0.26
PC-02B	WY7559	23-Oct-19	8:30	2019-10-23 8:30	14-Nov-19	15:35	2019-11-14 15:35	22.3	0.1	0.1	< 0.1	0.1	0.19	0.19	< 0.26	0.26
PC-01A	YJ4049	25-Jul-20	20:10	2020-07-25 20:10	28-Aug-20	10:45	2020-08-28 10:45	33.6	< 0.1	0.1	0.1	0.1	< 0.19	0.19	0.26	0.26
PC-01B	YJ4050	25-Jul-20	20:10	2020-07-25 20:10	28-Aug-20	10:45	2020-08-28 10:45	33.6	< 0.1	0.1	0.1	0.1	< 0.19	0.19	0.26	0.26
PC-02A	YJ4051	03-Aug-20	16:15	2020-08-03 16:15	28-Aug-20	15:15	2020-08-28 15:15	25.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02B	YJ4052	03-Aug-20	16:15	2020-08-03 16:15	28-Aug-20	15:15	2020-08-28 15:15	25.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01A	YP8078	28-Aug-20	10:45	2020-08-28 10:45	02-Oct-20	14:00	2020-10-02 14:00	35.1	< 0.1	0.1	DAMAGED	0.1	< 0.19	0.19	DAMAGED	0.26
PC-01B	YP8079	28-Aug-20	10:45	2020-08-28 10:45	02-Oct-20	14:00	2020-10-02 14:00	35.1	< 0.1	0.1	DAMAGED	0.1	< 0.19	0.19	DAMAGED	0.26
PC-02A	YP8080	28-Aug-20	15:15	2020-08-28 15:15	30-Sep-20	15:08	2020-09-30 15:08	33.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02B	YP8081	28-Aug-20	15:15	2020-08-28 15:15	30-Sep-20	15:08	2020-09-30 15:08	33.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01A	YV7760	02-Oct-20	14:00	2020-10-02 14:00	03-Nov-20	11:30	2020-11-03 11:30	31.9	< 0.1	0.1	0.1	0.1	< 0.19	0.19	0.26	0.26
PC-01B	YV7761	02-Oct-20	14:00	2020-10-02 14:00	03-Nov-20	11:30	2020-11-03 11:30	31.9	0.2	0.1	0.2	0.1	0.38	0.19	0.52	0.26
PC-02A	YV7762	30-Sep-20	15:08	2020-09-30 15:08	04-Nov-20	14:00	2020-11-04 14:00	35.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02B	YV7763	30-Sep-20	15:08	2020-09-30 15:08	04-Nov-20	14:00	2020-11-04 14:00	35.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01A	ABP974	08-Jun-21	10:15	2021-06-08 10:15	10-Jul-21	13:50	2021-07-10 13:50	32.1	< 0.1	0.1	0.2	0.1	< 0.19	0.19	0.52	0.26
PC-01B	ABP975	08-Jun-21	10:15	2021-06-08 10:15	10-Jul-21	13:50	2021-07-10 13:50	32.1	< 0.1	0.1	0.1	0.1	< 0.19	0.19	0.26	0.26
PC-02A	ABP976	09-Jun-21	9:35	2021-06-09 9:35	10-Jul-21	9:20	2021-07-10 9:20	31.0	< 0.1	0.1	0.3	0.1	< 0.19	0.19	0.79	0.26
PC-02B	ABP977	09-Jun-21	9:35	2021-06-09 9:35	10-Jul-21	9:20	2021-07-10 9:20	31.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01A	AEK149	10-Jul-21	13:50	2021-07-10 13:50	17-Aug-21	14:50	2021-08-17 14:50	38.0	0.1	0.1	0.1	0.1	0.19	0.19	0.26	0.26
PC-01B	AEK150	10-Jul-21	13:50	2021-07-10 13:50	17-Aug-21	14:50	2021-08-17 14:50	38.0	< 0.1	0.1	0.1	0.1	< 0.19	0.19	0.26	0.26
PC-02A	AEK151	10-Jul-21	9:20	2021-07-10 9:20	17-Aug-21	10:00	2021-08-17 10:00	38.0	< 0.1	0.1	0.1	0.1	< 0.19	0.19	0.26	0.26
PC-02B	AEK152	10-Jul-21	9:20	2021-07-10 9:20	17-Aug-21	10:00	2021-08-17 10:00	38.0	< 0.1	0.1	0.2	0.1	< 0.19	0.19	0.52	0.26
PC-01A	AGX507	17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:50	2021-09-21 10:50	34.8	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01B	AGX508	17-Aug-21	14:50	2021-08-17 14:50	21-Sep-21	10:50	2021-09-21 10:50	34.8	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02A	AGX509	17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	11:00	2021-09-22 11:00	36.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02B	AGX510	17-Aug-21	10:00	2021-08-17 10:00	22-Sep-21	11:00	2021-09-22 11:00	36.0	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-01A	AJP416	21-Sep-21	10:50	2021-09-21 10:50	22-Oct-21	8:35	2021-10-22 8:35	30.9	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26

Summary of Dustfall Results at All Locations

Sample ID	BV Labs ID	Start			End			Days	NO_2 (ppb)		SO_2 (ppb)		NO_2 (µg/m3)		SO_2 (µg/m3)	
		Date	Time	Timestamp	Date	Time	Timestamp		Results	RDL	Results	RDL	Results	RDL	Results	RDL
PC-01B	AJP417	21-Sep-21	10:50	2021-09-21 10:50	22-Oct-21	8:35	2021-10-22 8:35	30.9	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02A	AJP418	22-Sep-21	11:00	2021-09-22 11:00	22-Oct-21	13:15	2021-10-22 13:15	30.1	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26
PC-02B	AJP419	22-Sep-21	11:00	2021-09-22 11:00	22-Oct-21	13:15	2021-10-22 13:15	30.1	< 0.1	0.1	< 0.1	0.1	< 0.19	0.19	< 0.26	0.26

Summary of Gamma Reports (Landauer)

Report	Dosimeter	Monitoring Period		Location	Client ID	Dosimeter	Exposure (Dose mSv)		Inception	Field Sheets				
Date	Receipt	From	To	ID		S/N	Gross	Net	Date	Sample ID	Start Date	Start Time	End Date	End Time
2019-12-04	2019-11-21	2019-08-25	2020-08-24	-	Transit control	EX00054148R	-	-	Jul-18		Shipped with below dosimeters			
				00003	Area Monitor 3	EX00061653R	0.252	0.008	Oct-18	G-01	2019-09-25	12:10	2019-11-14	11:10
				00004	Area Monitor 4	EX00051359N	0.22	-0.024	Oct-18	G-02	2019-09-26	10:04	2019-11-14	14:50
		2019-06-01	2020-05-31	-	Deploy control	EX000248102	-	-	Jul-18		Shipped with above dosimeters			
2020-10-23	2020-10-21	2020-10-05	2021-10-04	-	Transit control	EX00086459A	-	-	Jul-18					
2020-12-01	2020-11-21	2020-07-20	2021-07-19	-	Deploy control dose	EX00061362Y	0.316	-	Jul-18					
				00008	Area Monitor 8	EX00064099K				G-01	2020-07-25	15:10	Destroyed in field	
				00007	Area Monitor 7	EX00071155V	0.218	-0.098	Jul-20	G-02	2020-07-24	16:10	03-Nov-20	16:10
					Deploy control dose	EX00080477I	0.349	-						
					Area Monitor 1	EX000205524	0.469	-0.139		G-01	2021-03-11	10:00	2021-06-08	9:50
					Area Monitor 2	EX00051638L	0.289	-0.06		G-02	2021-02-17	13:00	2021-06-08	15:50
2021-10-18	2021-10-13	2021-05-01	2022-04-30	-	Deploy control dose	EX00023020I	0.439	-	Oct-20					
				00021	Area Monitor 1	EX000026508	0.31	-0.129	May-21	G-01	2021-06-08	9:50	2021-09-21	9:55
				00022	Area Monitor 2	EX00086517G	0.242	-0.197	May-21	G-02	2021-06-08	15:50	2021-09-22	10:00

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)			
314919	314919-2	3149192	Radon 1A	Radon1A	2016-09-24	2017-01-27	125	<	3		
970682	970682-1	9706821	Radon 1B	Radon1B	2016-09-24	2017-01-27	125		6	±	2
575188	575188-8	5751888	Radon 2A	Radon2A	2016-09-24	2017-01-27	125	<	3		
582429	582429-7	5824297	Radon 3A	Radon3A	2016-09-24	2017-01-25	123		4	±	2
769560	769560-4	7695604	Radon 3B	Radon3B	2016-09-24	2017-01-25	123		3	±	3
548755	548755-8	5487558	Radon 4A	Radon4A	2016-09-25	2017-01-25	122		3	±	3
346551	346551-5	3465515	Radon 4B	Radon4B	2016-09-25	2017-01-25	122		3	±	3
975561	975561-2	9755612	Radon 5A	Radon5A	2016-09-26	2017-01-28	124	<	3		
748416	748416-5	7484165	Radon 5B	Radon5B	2016-09-26	2017-01-28	124	<	3		
441650	441650-9	4416509	Radon 6A	Radon6A	2016-09-25	2017-01-25	122		6	±	3
996809	996809-0	9968090	Radon 6B	Radon6B	2016-09-25	2017-01-25	122	<	3		
969893	969893-7	9698937	Radon 7A	Radon7A	2016-09-26	2017-01-25	121		4	±	3
975850	975850-9	9758509	Radon 7B	Radon7B	2016-09-26	2017-01-25	121	<	3		
642724	642724-9	6427249	Radon 8A	Radon8A	2016-09-26	2017-01-25	121		3	±	3
383553	383553-5	3835535	Radon 8B	Radon8B	2016-09-26	2017-01-25	121		3	±	2
334012	334012-2	3340122	Radon 9A	Radon9A	2016-09-26	2017-01-28	124		3	±	2
536455	536455-9	5364559	Radon 9B	Radon9B	2016-09-26	2017-01-28	124	<	3		
159276	159276-5	1592765	Radon 10A	Radon10A	2016-09-27	2017-01-25	120		5	±	3
373050	373050-4	3730504	Radon 10B	Radon10B	2016-09-27	2017-01-25	120		3	±	3
328723	328723-2	3287232	Radon 1	Radon1A	27-01-2017	12-06-2017	136		5	±	2
327210	327210-1	3272101	Radon 1	Radon1B	27-01-2017	12-06-2017	136	<	3		
326445	326445-4	3264454	Radon 2	Radon2A	27-01-2017	12-06-2017	136	<	3		
327356	327356-2	3273562	Radon 2	Radon2B	27-01-2017	12-06-2017	136	<	3		
327338	327338-0	3273380	Radon 3	Radon3A	25-01-2017	06-06-2017	132		4	±	2
328610	328610-1	3286101	Radon 3	Radon3B	25-01-2017	06-06-2017	132		3	±	2
327658	327658-1	3276581	Radon 4	Radon4A	25-01-2017	06-06-2017	132		3	±	2
328231	328231-6	3282316	Radon 4	Radon4B	25-01-2017	06-06-2017	132	<	3		
328355	328355-3	3283553	Radon 5	Radon5A	28-01-2017	06-06-2017	129		3	±	2
327382	327382-8	3273828	Radon 5	Radon5B	28-01-2017	06-06-2017	129		3	±	2
326438	326438-9	3264389	Radon 6	Radon6A	25-01-2017	06-06-2017	132		3	±	2
327076	327076-6	3270766	Radon 6	Radon6B	25-01-2017	06-06-2017	132		4	±	2
328533	328533-5	3285335	Radon 7	Radon7A	25-01-2017	06-06-2017	132	<	3		
327721	327721-7	3277217	Radon 7	Radon7B	25-01-2017	06-06-2017	132		3	±	2
327519	327519-5	3275195	Radon 8	Radon8A	25-01-2017	06-06-2017	132	<	3		
327374	327374-5	3273745	Radon 8	Radon8B	25-01-2017	06-06-2017	132	<	3		
326718	326718-4	3267184	Radon 9	Radon9A	25-01-2017	06-06-2017	132	<	3		
327167	327167-3	3271673	Radon 9	Radon9B	25-01-2017	06-06-2017	132	<	3		
326734	326734-1	3267341	Radon 10	Radon10A	25-01-2017	06-06-2017	132		3	±	2
326676	326676-4	3266764	Radon 10	Radon10B	25-01-2017	06-06-2017	132		3	±	2
631010	631010-6	6310106	Radon 1	Radon1A	2017-06-12	2017-08-26	75		7	±	6
656823	656823-2	6568232	Radon 1	Radon1B	2017-06-12	2017-08-26	75	<	7		

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)		
523339	523339-0	5233390	Radon 2	Radon2A	2017-06-12	2017-08-26	75	< 7		
746692	746692-3	7466923	Radon 2	Radon2B	2017-06-12	2017-08-26	75	< 7		
519145	519145-7	5191457	Radon 3	Radon3A	2017-06-06	2017-08-26	81	< 6		
610676	610676-9	6106769	Radon 3	Radon3B	2017-06-06	2017-08-26	81	< 6		
768462	768462-4	7684624	Radon 4	Radon4A	2017-06-06	2017-08-26	81	< 4		
206806	206806-2	2068062	Radon 4	Radon4B	2017-06-06	2017-08-26	81	< 7		
671098	671098-2	6710982	Radon 5	Radon5A	2017-06-06	2017-08-26	81	< 7		
178627	178627-6	1786276	Radon 5	Radon5B	2017-06-06	2017-08-26	81	< 7		
318816	318816-6	3188166	Radon 6	Radon6A	2017-06-06	2017-08-26	81	< 7		
713115	713115-4	7131154	Radon 6	Radon6B	2017-06-06	2017-08-26	81	< 7		
206854	206854-2	2068542	Radon 7	Radon7A	2017-06-06	2017-08-26	81	< 7		
415406	415406-8	4154068	Radon 7	Radon7B	2017-06-06	2017-08-26	81	< 7		
184216	184216-0	1842160	Radon 8	Radon8A	2017-06-06	2017-08-26	81	< 6		
388350	388350-1	3883501	Radon 8	Radon8B	2017-06-06	2017-08-26	81	< 3		
211128	211128-4	2111284	Radon 9	Radon9A	2017-06-06	2017-08-26	81	< 7		
792116	792116-6	7921166	Radon 10	Radon10A	2017-06-06	2017-08-26	81	< 6		
228364	228364-6	2283646	Radon 10	Radon10B	2017-06-06	2017-08-26	81	< 6		
597946	597946-3	5979463	Radon 1	Radon1A	2017-08-26	2018-01-17	144	3	±	3
630266	630266-5	6302665	Radon 1	Radon1B	2017-08-26	2018-01-17	144	9	±	3
219889	219889-3	2198893	Radon 2	Radon2A	2017-08-26	2018-01-17	144	5	±	3
251164	251164-0	2511640	Radon 2	Radon2B	2017-08-26	2018-01-17	144	5	±	3
251160	251160-8	2511608	Radon 3	Radon3A	2017-08-26	2018-01-17	144	5	±	3
173571	173571-1	1735711	Radon 3	Radon3B	2017-08-26	2018-01-17	144	3	±	3
771018	771018-9	7710189	Radon 4	Radon4A	2017-08-26	2018-01-17	144	4	±	3
148017	148017-7	1480177	Radon 4	Radon4B	2017-08-26	2018-01-17	144	3	±	3
168902	168902-5	1689025	Radon 5	Radon5A	2017-08-26	2018-01-17	144	5	±	3
233073	233073-6	2330736	Radon 5	Radon5B	2017-08-26	2018-01-17	144	10	±	3
219678	219678-0	2196780	Radon 6	Radon6A	2017-08-26	2018-01-17	144	3	±	3
219768	219768-9	2197689	Radon 6	Radon6B	2017-08-26	2018-01-17	144	3	±	3
330747	330747-7	3307477	Radon 7	Radon7A	2017-08-26	2018-01-17	144	4	±	3
372417	372417-6	3724176	Radon 7	Radon7B	2017-08-26	2018-01-17	144	4	±	3
174702	174702-1	1747021	Radon 8	Radon8A	2017-08-26	2018-01-17	144	4	±	3
564339	564339-0	5643390	Radon 8	Radon8B	2017-08-26	2018-01-17	144	5	±	3
728740	728740-2	7287402	Radon 9	Radon9A	2017-08-26	2018-01-17	144	3	±	3
627381	627381-7	6273817	Radon 9	Radon9B	2017-08-26	2018-01-17	144	4	±	3
227202	227202-9	2272029	Radon 10	Radon10A	2017-08-26	2018-01-17	144	5	±	3
592211	592211-7	5922117	RADON 1	Radon1A	2018-01-17	2018-03-23	65	< 11		
738373	738373-0	7383730	RADON 1	Radon1B	2018-01-17	2018-03-23	65	< 11		
570451	570451-5	5704515	RADON 2	Radon2A	2018-01-17	2018-03-23	65	< 11		
631448	631448-8	6314488	RADON 2	Radon2B	2018-01-17	2018-03-23	65	< 11		
546632	546632-1	5466321	RADON 3	Radon3A	2018-01-19	2018-03-23	63	< 11		

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)			
628209	628209-9	6282099	RADON 3	Radon3B	2018-01-19	2018-03-23	63	<	11		
931236	931236-4	9312364	RADON 4	Radon4A	2018-01-17	2018-03-23	65	<	11		
965810	965810-5	9658105	RADON 4	Radon4B	2018-01-19	2018-03-23	63	<	11		
965335	965335-3	9653353	RADON 5	Radon5A	2018-01-17	2018-03-23	65	<	11		
931302	931302-4	9313024	RADON 5	Radon5B	2018-01-17	2018-03-23	65	<	11		
632099	632099-8	6320998	RADON 6	Radon6A	2018-01-17	2018-03-23	65	<	6		
965480	965480-7	9654807	RADON 6	Radon6B	2018-01-17	2018-03-23	65	<	11		
628669	628669-4	6286694	RADON 7	Radon7A	2018-01-17	2018-03-23	65	<	11		
628783	628783-3	6287833	RADON 7	Radon7B	2018-01-17	2018-03-23	65	<	11		
594425	594425-1	5944251	RADON 8	Radon8A	2018-01-19	2018-03-23	63	<	6		
594915	594915-1	5949151	RADON 8	Radon8B	2018-01-19	2018-03-23	63	<	11		
546617	546617-2	5466172	RADON 9	Radon9A	2018-01-19	2018-03-23	63	<	11		
576162	576162-2	5761622	RADON 9	Radon9B	2018-01-19	2018-03-23	63		9	±	4
594930	594930-0	5949300	RADON 10	Radon10A	2018-01-19	2018-03-23	63	<	6		
615494	615494-2	6154942	RADON 1	Radon1A	2018-03-23	2018-07-13	112	<	3		
614573	614573-4	6145734	RADON 1	Radon1B	2018-03-23	2018-07-13	112		3	±	3
615514	615514-7	6155147	RADON 2	Radon2A	2018-03-23	2018-07-13	112	<	3		
277949	277949-4	2779494	RADON 2	Radon2B	2018-03-23	2018-07-13	112	<	3		
615266	615266-4	6152664	RADON 3	Radon3A	2018-03-23	2018-07-13	112	<	3		
277887	277887-6	2778876	RADON 3	Radon3B	2018-03-23	2018-07-13	112	<	3		
604811	604811-0	6048110	RADON 4	Radon4A	2018-03-23	2018-07-13	112	<	3		
615565	615565-9	6155659	RADON 4	Radon4B	2018-03-23	2018-07-13	112	<	3		
604370	604370-7	6043707	RADON 5	Radon5A	2018-03-23	2018-07-13	112		4	±	3
606121	606121-2	6061212	RADON 6	Radon6A	2018-03-23	2018-07-13	112		3	±	3
607838	607838-0	6078380	RADON 6	Radon6B	2018-03-23	2018-07-13	112	<	3		
606135	606135-2	6061352	RADON 7	Radon7A	2018-03-23	2018-07-13	112	<	3		
615439	615439-7	6154397	RADON 7	Radon7B	2018-03-23	2018-07-13	112	<	3		
278256	278256-3	2782563	RADON 8	Radon8A	2018-03-23	2018-07-13	112	<	3		
612673	612673-4	6126734	RADON 8	Radon8B	2018-03-23	2018-07-13	112	<	3		
615438	615438-9	6154389	RADON 9	Radon9A	2018-03-23	2018-07-13	112	<	3		
606176	606176-6	6061766	RADON 9	Radon9B	2018-03-23	2018-07-13	112	<	3		
608479	608479-2	6084792	RADON 10	Radon10A	2018-03-23	2018-07-13	112	<	3		
606156	606156-8	6061568	RADON 10	Radon10B	2018-03-23	2018-07-13	112	<	3		
534464	534464-3	5344643	RADON 1	Radon1A	2018-07-13	2018-09-03	52	<	6		
532939	532939-6	5329396	RADON 1	Radon1B	2018-07-13	2018-09-03	52	<	5		
534764	534764-6	5347646	RADON 2	Radon2A	2018-07-13	2018-09-03	52	<	5		
534656	534656-4	5346564	RADON 2	Radon2B	2018-07-13	2018-09-03	52	<	4		
534792	534792-7	5347927	RADON 3	Radon3A	2018-07-13	2018-09-03	52	<	4		
532576	532576-6	5325766	RADON 3	Radon3B	2018-07-13	2018-09-03	52	<	4		
534109	534109-4	5341094	RADON 4	Radon4A	2018-07-13	2018-09-03	52	<	5		
535204	535204-2	5352042	RADON 5	Radon5A	2018-07-13	2018-09-03	52	<	5		

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)			
534580	534580-6	5345806	RADON 5	Radon5B	2018-07-13	2018-09-03	52		4	±	3
535516	535516-9	5355169	RADON 6	Radon6A	2018-07-13	2018-09-03	52	<	4		
559313	559313-2	5593132	RADON 6	Radon6B	2018-07-13	2018-09-03	52	<	4		
535576	535576-3	5355763	RADON 7	Radon7A	2018-07-13	2018-09-03	52	<	6		
534289	534289-4	5342894	RADON 7	Radon7B	2018-07-13	2018-09-03	52	<	6		
532567	532567-5	5325675	RADON 8	Radon8A	2018-07-13	2018-09-03	52	<	4		
533950	533950-2	5339502	RADON 8	Radon8B	2018-07-13	2018-09-03	52	<	6		
534044	534044-3	5340443	RADON 9	Radon9A	2018-07-13	2018-09-03	52	<	4		
534501	534501-2	5345012	RADON 9	Radon9B	2018-07-13	2018-09-07	56	<	4		
534995	534995-6	5349956	RADON 10	Radon10A	2018-07-13	2018-09-03	52	<	5		
534955	534955-0	5349550	RADON 10	Radon10B	2018-07-13	2018-09-03	52		4	±	3
724910	724910-5	7249105	Radon 1-A	Radon1A	2018-10-03	2019-01-22	111	<	3		
751311	751311-2	7513112	Radon 1-B	Radon1B	2018-10-03	2019-01-22	111		3	±	3
563363	563363-1	5633631	Radon 2-A	Radon2A	2018-10-03	2019-01-22	111	<	3		
985167	985167-6	9851676	Radon 2-B	Radon2B	2018-10-03	2019-01-22	111		4	±	3
794085	794085-1	7940851	Radon 3-A	Radon3A	2018-10-03	2019-01-22	111	<	3		
233893	233893-7	2338937	Radon 3-B	Radon3B	2018-10-03	2019-01-22	111		3	±	3
183443	183443-1	1834431	Radon 4-A	Radon4A	2018-10-03	2019-01-23	112	<	3		
190992	190992-8	1909928	Radon 4-B	Radon4B	2018-10-03	2019-01-23	112		3	±	3
168409	168409-1	1684091	Radon 5-A	Radon5A	2018-10-03	2019-01-23	112		4	±	3
222494	222494-7	2224947	Radon 5-B	Radon5B	2018-10-03	2019-01-23	112		3	±	3
742701	742701-6	7427016	Radon 6-A	Radon6A	2018-10-03	2019-01-22	111	<	3		
667361	667361-0	6673610	Radon 6-B	Radon6B	2018-10-03	2019-01-22	111		3	±	3
555031	555031-4	5550314	Radon 7-A	Radon7A	2018-10-03	2019-01-23	112	<	3		
556395	556395-2	5563952	Radon 7-B	Radon7B	2018-10-03	2019-01-23	112		3	±	3
979014	979014-8	9790148	Radon 8-A	Radon8A	2018-10-03	2019-01-23	112	<	3		
945982	945982-7	9459827	Radon 8-B	Radon8B	2018-10-03	2019-01-23	112	<	3		
977289	977289-8	9772898	Radon 9-A	Radon9A	2018-10-03	2019-01-24	113	<	3		
594231	594231-3	5942313	Radon 9-B	Radon9B	2018-10-03	2019-01-24	113	<	3		
164164	164164-6	1641646	Radon 10-A	Radon10A	2018-10-03	2019-01-24	113		4	±	3
105056	105056-6	1050566	Radon 10-B	Radon10B	2018-10-03	2019-01-24	113		3	±	3
143034	143034-7	1430347	Radon-1A	Radon1A	2019-01-22	2019-05-12	110	<	4		
142928	142928-1	1429281	Radon-1B	Radon1B	2019-01-22	2019-05-12	110	<	6		
335475	335475-0	3354750	Radon-2A	Radon2A	2019-01-22	2019-05-12	110		3	±	3
209800	209800-2	2098002	Radon-2B	Radon2B	2019-01-22	2019-05-12	110	<	4		
129519	129519-5	1295195	Radon-3A	Radon3A	2019-01-22	2019-05-12	110	<	5		
143630	143630-2	1436302	Radon-3B	Radon3B	2019-01-22	2019-05-12	110		3	±	3
377270	377270-4	3772704	Radon-4A	Radon4A	2019-01-23	2019-05-12	109	<	3		
377966	377966-7	3779667	Radon-4B	Radon4B	2019-01-23	2019-05-12	109	<	5		
128478	128478-5	1284785	Radon-5A	Radon5A	2019-01-23	2019-05-12	109	<	3		
334614	334614-5	3346145	Radon-5B	Radon5B	2019-01-23	2019-05-12	109	<	4		

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)			
143678	143678-1	1436781	Radon-6A	Radon6A	2019-01-22	2019-05-12	110	<	4		
335632	335632-6	3356326	Radon-6B	Radon6B	2019-01-22	2019-05-12	110	<	4		
334970	334970-1	3349701	Radon-7A	Radon7A	2019-01-23	2019-05-12	109	<	3		
334118	334118-7	3341187	Radon-7B	Radon7B	2019-01-23	2019-05-12	109		4	±	3
143512	143512-2	1435122	Radon-8A	Radon8A	2019-01-23	2019-05-12	109	<	4		
340366	340366-4	3403664	Radon-8B	Radon8B	2019-01-23	2019-05-12	109		3	±	3
145062	145062-6	1450626	Radon-9A	Radon9A	2019-01-24	2019-05-13	109	<	3		
143270	143270-7	1432707	Radon-9B	Radon9B	2019-01-24	2019-05-13	109	<	4		
326949	326949-5	3269495	Radon-10A	Radon10A	2019-01-24	2019-05-13	109		3	±	3
375595	375595-6	3755956	Radon-10B	Radon10B	2019-01-24	2019-05-13	109	<	3		
421708	421708-9	4217089	Radon-1A	Radon1A	2019-05-12	2019-09-25	136	<	3		
430190	430190-9	4301909	Radon-1B	Radon1B	2019-05-12	2019-09-25	136	<	4		
731677	731677-1	7316771	Radon-2A	Radon2A	2019-05-12	2019-09-25	136		6	±	3
271265	271265-1	2712651	Radon-2B	Radon2B	2019-05-12	2019-09-25	136		3	±	3
787451	787451-4	7874514	Radon-3A	Radon3A	2019-05-12	2019-09-25	136		6	±	3
794898	794898-7	7948987	Radon-3B	Radon3B	2019-05-12	2019-09-25	136		3	±	3
386143	386143-2	3861432	Radon-4A	Radon4A	2019-05-12	2019-09-25	136	<	3		
496398	496398-9	4963989	Radon-4B	Radon4B	2019-05-12	2019-09-25	136		3	±	3
771857	771857-0	7718570	Radon-5A	Radon5A	2019-05-12	2019-09-26	137		12	±	3
346396	346396-5	3463965	Radon-5B	Radon5B	2019-05-12	2019-09-26	137		5	±	3
157102	157102-5	1571025	Radon-6A	Radon6A	2019-05-12	2019-09-25	136		5	±	3
324426	324426-6	3244266	Radon-6B	Radon6B	2019-05-12	2019-09-25	136	<	3		
600407	600407-1	6004071	Radon-7A	Radon7A	2019-05-12	2019-09-26	137		19	±	4
385254	385254-8	3852548	Radon-7B	Radon7B	2019-05-12	2019-09-26	137		12	±	3
795844	795844-0	7958440	Radon-8A	Radon8A	2019-05-12	2019-09-25	136		3	±	3
689429	689429-9	6894299	Radon-8B	Radon8B	2019-05-12	2019-09-25	136		4	±	3
524479	524479-3	5244793	Radon-9A	Radon9A	2019-05-13	2019-09-26	136		6	±	3
993493	993493-6	9934936	Radon-9B	Radon9B	2019-05-13	2019-09-26	136		7	±	3
914532	914532-7	9145327	Radon-10A	Radon10A	2019-05-13	2019-09-26	136		3	±	3
994946	994946-2	9949462	Radon-10B	Radon10B	2019-05-13	2019-09-26	136		5	±	3
339220	339220-6	3392206	Radon 1-A	Radon1A	2019-09-25	2020-02-06	134	<	4		
415534	415534-7	4155347	Radon 1-B	Radon1B	2019-09-25	2020-02-06	134		3	±	3
945665	945665-8	9456658	Radon 2-A	Radon2A	2019-09-25	2020-02-06	134		4	±	3
182624	182624-7	1826247	Radon 2-B	Radon2B	2019-09-25	2020-02-06	134	<	4		
310857	310857-8	3108578	Radon 3-A	Radon3A	2019-09-25	2020-02-06	134	<	2		
382993	382993-4	3829934	Radon 3-B	Radon3B	2019-09-25	2020-02-06	134		3	±	2
344686	344686-1	3446861	Radon 4-A	Radon4A	2019-09-25	2020-02-06	134		4	±	3
119649	119649-2	1196492	Radon 4-B	Radon4B	2019-09-25	2020-02-06	134		2	±	2
467529	467529-4	4675294	Radon 5-A	Radon5A	2019-09-26	2020-02-06	133		3	±	2
593581	593581-2	5935812	Radon 5-B	Radon5B	2019-09-26	2020-02-06	133		4	±	2
152891	152891-8	1528918	Radon 6-A	Radon6A	2019-09-25	2020-01-21	118		19	±	4

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)			
262394	262394-0	2623940	Radon 6-B	Radon6B	2019-09-25	2020-01-21	118		14	±	4
472921	472921-6	4729216	Radon 7-A	Radon7A	2019-09-26	2020-02-07	134		4	±	2
197031	197031-8	1970318	Radon 7-B	Radon7B	2019-09-26	2020-02-07	134		3	±	2
361270	361270-2	3612702	Radon 8-A	Radon8A	2019-09-25	2020-02-07	135		5	±	3
648339	648339-0	6483390	Radon 8-B	Radon8B	2019-09-25	2020-02-07	135	<	4		
451442	451442-8	4514428	Radon 9-A	Radon9A	2019-09-26	2020-02-07	134	<	4		
949464	949464-2	9494642	Radon 9-B	Radon9B	2019-09-26	2020-02-07	134		2	±	2
176973	176973-6	1769736	Radon 10-A	Radon10A	2019-09-26	2020-02-07	134		4	±	3
774882	774882-5	7748825	Radon 10-B	Radon10B	2019-09-26	2020-02-07	134		2	±	2
221593	221593-7	2215937	Radon-2A	Radon2A	2020-02-06	2020-07-25	170		4	±	3
644943	644943-3	6449433	Radon-2B	Radon2B	2020-02-06	2020-07-25	170		8	±	3
761140	761140-3	7611403	Radon-3A	Radon3A	2020-02-06	2020-07-24	169		9	±	3
231885	231885-5	2318855	Radon-3B	Radon3B	2020-02-06	2020-07-24	169		5	±	3
280558	280558-8	2805588	Radon-4A	Radon4A	2020-02-06	2020-07-25	170		5	±	3
263265	263265-1	2632651	Radon-4B	Radon4B	2020-02-06	2020-07-25	170		10	±	3
295613	295613-4	2956134	Radon-5A	Radon5A	2020-02-06	2020-07-24	169		9	±	3
118311	118311-0	1183110	Radon-5B	Radon5B	2020-02-06	2020-07-24	169		4	±	3
350177	350177-2	3501772	Radon-6A	Radon6A	2020-01-21	2020-07-24	185		5	±	3
986215	986215-2	9862152	Radon-6B	Radon6B	2020-01-21	2020-07-24	185		7	±	3
345718	345718-1	3457181	Radon-7A	Radon7A	2020-02-07	2020-07-23	167		6	±	4
159420	159420-9	1594209	Radon-7B	Radon7B	2020-02-07	2020-07-23	167		7	±	4
657220	657220-0	6572200	Radon-8A	Radon8A	2020-02-07	2020-07-23	167		5	±	4
911167	911167-5	9111675	Radon-8B	Radon8B	2020-02-07	2020-07-23	167	<	3		
245665	245665-5	2456655	Radon-9A	Radon9A	2020-02-07	2020-07-24	168	<	3		
197252	197252-0	1972520	Radon-9B	Radon9B	2020-02-07	2020-07-24	168		4	±	4
280737	280737-8	2807378	Radon-10A	Radon10A	2020-02-07	2020-07-25	169	<	3		
243646	243646-7	2436467	Radon-10B	Radon10B	2020-02-07	2020-07-25	169		6	±	3
699605	699605-2	6996052	Radon 1A	Radon1A	2020-07-25	2020-11-03	101	<	5		
947477	947477-6	9474776	Radon 1B	Radon1B	2020-07-25	2020-11-03	101	<	5		
233238	233238-5	2332385	Radon 2A	Radon2A	2020-07-25	2020-11-03	101	<	3		
723976	723976-7	7239767	Radon 2B	Radon2B	2020-07-25	2020-11-03	101	<	5		
405482	405482-1	4054821	Radon 3A	Radon3A	2020-07-24	2020-11-03	102	<	3		
547196	547196-6	5471966	Radon 3B	Radon3B	2020-07-24	2020-11-03	102		3	±	3
176744	176744-1	1767441	Radon 4A	Radon4A	2020-07-25	2020-11-03	101	<	3		
585217	585217-3	5852173	Radon 4B	Radon4B	2020-07-25	2020-11-03	101		3	±	3
258302	258302-9	2583029	Radon 5B	Radon5B	2020-07-24	2020-11-03	102	<	3		
351592	351592-1	3515921	Radon 6A	Radon6A	2020-07-24	2020-11-03	102	<	3		
671825	671825-8	6718258	Radon 6B	Radon6B	2020-07-24	2020-11-03	102		3	±	3
669513	669513-4	6695134	Radon 7A	Radon7A	2020-07-23	2020-11-04	104	<	3		
280764	280764-2	2807642	Radon 7B	Radon7B	2020-07-23	2020-11-04	104	<	5		
902442	902442-3	9024423	Radon 8A	Radon8A	2020-07-23	2020-11-05	105	<	3		

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)			
481604	481604-7	4816047	Radon 8B	Radon8B	2020-07-23	2020-11-05	105	<	3		
194347	194347-1	1943471	Radon 9A	Radon9A	2020-07-24	2020-11-05	104	<	5		
466645	466645-9	4666459	Radon 9B	Radon9B	2020-07-24	2020-11-05	104	<	3		
132460	132460-7	1324607	Radon 10A	Radon10A	2020-07-25	2020-11-05	103	<	3		
736361	736361-7	7363617	Radon 10B	Radon10B	2020-07-25	2020-11-05	103	<	3		
127659	127659-1	1276591	Radon-3A	Radon3A	2020-11-03	2021-02-18	107	<	7		
426440	426440-4	4264404	Radon-3B	Radon3B	2020-11-03	2021-02-18	107		6	±	4
464408	464408-4	4644084	Radon-4A	Radon4A	2020-11-03	2021-02-18	107	<	7		
661183	661183-4	6611834	Radon-4B	Radon4B	2020-11-03	2021-02-18	107	<	6		
433299	433299-5	4332995	Radon-5A	Radon5A	2020-11-03	2021-02-18	107		6	±	4
903490	903490-1	9034901	Radon-5B	Radon5B	2020-11-03	2021-02-18	107	<	7		
451091	451091-3	4510913	Radon-6A	Radon6A	2020-11-03	2021-02-18	107	<	5		
947547	947547-6	9475476	Radon-6B	Radon6B	2020-11-03	2021-02-18	107		5	±	4
619196	619196-9	6191969	Radon-7A	Radon7A	2020-11-04	2021-02-17	105	<	5		
348529	348529-9	3485299	Radon-7B	Radon7B	2020-11-04	2021-02-17	105	<	7		
934585	934585-1	9345851	Radon-8A	Radon8A	2020-11-05	2021-02-17	104		5	±	5
386101	386101-0	3861010	Radon-8B	Radon8B	2020-11-05	2021-02-17	104	<	7		
366585	366585-8	3665858	Radon-9A	Radon9A	2020-11-05	2021-02-17	104	<	7		
268862	268862-0	2688620	Radon-9B	Radon9B	2020-11-05	2021-02-17	104	<	6		
518308	518308-2	5183082	Radon-10A	Radon10A	2020-11-05	2021-02-17	104	<	5		
140816	140816-0	1408160	Radon-10B	Radon10B	2020-11-05	2021-02-17	104	<	5		
302048	302048-4	3020484	3-A	Radon3A	2021-02-18	2021-06-08	110	<	5		
566682	566682-1	5666821	3-B	Radon3B	2021-02-18	2021-06-08	110	<	3		
306998	306998-6	3069986	4-A	Radon4A	2021-02-18	2021-06-08	110	<	3		
674800	674800-8	6748008	4-B	Radon4B	2021-02-18	2021-06-08	110	<	3		
563882	563882-0	5638820	5-A	Radon5A	2021-02-18	2021-06-08	110	<	3		
946452	946452-0	9464520	5-B	Radon5B	2021-02-18	2021-06-08	110	<	3		
545221	545221-4	5452214	6-A	Radon6A	2021-02-18	2021-06-08	110	<	3		
758401	758401-4	7584014	6-B	Radon6B	2021-02-18	2021-06-08	110	<	3		
454518	454518-2	4545182	7-A	Radon7A	2021-02-17	2021-06-09	112	<	5		
779887	779887-9	7798879	7-B	Radon7B	2021-02-17	2021-06-09	112	<	5		
931677	931677-9	9316779	8-A	Radon8A	2021-02-17	2021-06-09	112	<	3		
955607	955607-7	9556077	8-B	Radon8B	2021-02-17	2021-06-09	112	<	5		
375675	375675-6	3756756	9-A	Radon9A	2021-02-17	2021-06-08	111		7	±	4
674719	674719-0	6747190	9-B	Radon9B	2021-02-17	2021-06-08	111	<	5		
134411	134411-8	1344118	10-A	Radon10A	2021-02-17	2021-06-08	111	<	3		
626137	626137-4	6261374	10-B	Radon10B	2021-02-17	2021-06-08	111	<	3		
939709	939709-2	9397092	1A	Radon1A	2021-06-08	2021-09-21	105	<	4		
521692	521692-4	5216924	1B	Radon1B	2021-06-08	2021-09-21	105		4	±	3
280829	280829-3	2808293	2A	Radon2A	2021-06-08	2021-09-21	105	<	4		
277051	277051-9	2770519	3A	Radon3A	2021-06-08	2021-09-21	105	<	4		

Summary of Radon Sampling (2016-2021)

Detector	Detector Check No.	Detector/ Check ID	Location	Location ID	Start Date	Stop Date	Days Sampled	Radon conc. Rounded (Bq/m3)			
148078	148078-9	1480789	3B	Radon3B	2021-06-08	2021-09-21	105	<	5		
438812	438812-0	4388120	4A	Radon4A	2021-06-08	2021-09-21	105		4	±	3
658969	658969-1	6589691	4B	Radon4B	2021-06-08	2021-09-21	105		4	±	3
767721	767721-4	7677214	5A	Radon5A	2021-06-08	2021-09-21	105		4	±	3
696374	696374-8	6963748	5B	Radon5B	2021-06-08	2021-09-21	105		4	±	3
161028	161028-6	1610286	6A	Radon6A	2021-06-08	2021-09-21	105	<	4		
416451	416451-3	4164513	6B	Radon6B	2021-06-08	2021-09-21	105	<	4		
368371	368371-1	3683711	7A	Radon7A	2021-06-09	2021-09-21	104		7	±	4
781946	781946-9	7819469	7B	Radon7B	2021-06-09	2021-09-21	104		5	±	3
226419	226419-0	2264190	8A	Radon8A	2021-06-09	2021-09-21	104	<	6		
801195	801195-9	8011959	8B	Radon8B	2021-06-09	2021-09-21	104		4	±	3
147329	147329-7	1473297	9A	Radon9A	2021-06-08	2021-09-22	106	<	4		
749949	749949-4	7499494	9B	Radon9B	2021-06-08	2021-09-22	106	<	5		
308375	308375-5	3083755	10A	Radon10A	2021-06-08	2021-09-22	106	<	4		
350617	350617-7	3506177	10B	Radon10B	2021-06-08	2021-09-22	106	<	4		

Appendix C:

Laboratory Certificates of Analysis

DENISON MINES CORP.
ATTN: Pam Bennett
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

Date Received: 25-JAN-19
Report Date: 01-FEB-19 17:22 (MT)
Version: FINAL

Client Phone: 306-652-8201

Certificate of Analysis

Lab Work Order #: L2225060
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2225060-1 DF-01-A							
Sampled By: J. SHAVER on 22-JAN-19 @ 12:20							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-2 DF-01-B							
Sampled By: J. SHAVER on 22-JAN-19 @ 12:15							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-3 DF-02-A							
Sampled By: J. SHAVER on 22-JAN-19 @ 15:55							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-4 DF-02-B							
Sampled By: J. SHAVER on 22-JAN-19 @ 15:50							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-5 DF-03-A							
Sampled By: J. SHAVER on 22-JAN-19 @ 13:30							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-6 DF-03-B							
Sampled By: J. SHAVER on 22-JAN-19 @ 13:25							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-7 DF-04-A							
Sampled By: J. SHAVER on 22-JAN-19 @ 12:30							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2225060-7 DF-04-A							
Sampled By: J. SHAVER on 22-JAN-19 @ 12:30							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-8 DF-04-B							
Sampled By: J. SHAVER on 22-JAN-19 @ 12:35							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-9 DF-05-A							
Sampled By: J. SHAVER on 24-JAN-19 @ 11:15							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
L2225060-10 DF-05-B							
Sampled By: J. SHAVER on 24-JAN-19 @ 11:20							
Matrix:							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Fixed Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154
Volatile Dustfall	<0.10		0.10	mg/dm2.day		28-JAN-19	R4479154

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-T.DM2-VA	Dustfall	Dustfalls Total+Fixed & Vol (mg/dm2.day)	BCMOE DUSTFALLS

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L2225060-COFC

COC Number: 17 -

Report To	Contact and company name below will appear on the final report
Company:	Denison Mines
Contact:	Pam Bennett
Phone:	306-652-8201 x107
	Company address below will appear on the final report
Street:	230 22nd ST East, Suite 200
City/Province:	Saskatoon, SK
Postal Code:	S7K 0E9
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax pbennett@denisonmines.com

Email 2

Email 3

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax dhassell@denisonmines.com

Email 2 pbennett@denisonmines.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	☐	1 Business day [E1 - 100%]	☐
3 day [P3-25%]	☐	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	☐
2 day [P2-50%]	☐		

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q70196

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Kaitlyn Gardner Sampler: J.Shaver

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	DUSTFALLS-T.DM2-VA	SAMPLES ON HOLD	Sample is hazardous (please provide further deta	NUMBER OF CONTAINERS
					P			
	DF-01-A	22-Jan-19	12:20		R			1
	DF-01-B	22-Jan-19	12:15		R			1
	DF-02-A	22-Jan-19	15:55		R			1
	DF-02-B	22-Jan-19	15:50		R			1
	DF-03-A	22-Jan-19	13:30		R			1
	DF-03-B	22-Jan-19	13:25		R			1
	DF-04-A	23-Jan-19	12:30		R			1
	DF-04-B	23-Jan-19	12:35		R			1
	DF-05-A	24-Jan-19	11:15		R			1
	DF-05-B	24-Jan-19	11:20		R			1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?

☐ YES ☑ NO

Are samples for human consumption/ use?

☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
3°							

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: Jan 25/19	Time: 12:15pm	Received by: ADM	Date: 25-JAN-19	Time: 12:15	Received by: ADM	Date: 25-JAN-19	Time: 12:36

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

[redacted]

DENISON MINES CORP.
ATTN: Pam Bennett
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

Date Received: 16-MAY-19
Report Date: 24-MAY-19 18:09 (MT)
Version: FINAL

Client Phone: 306-652-8201

Certificate of Analysis

Lab Work Order #: L2274915
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

[redacted]

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: #819-58th St E., Saskatoon, SK S7K 6X5 Canada | Phone: +1 306 668 8370 | Fax: +1 306 668 8383

[redacted]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2274915-1 DF-01-A (DEPLOYED JAN 22, 2019 12:20PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 09:40							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-2 DF-01-B (DEPLOYED JAN 22, 2019 12:15PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 09:45							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-3 DF-02-A (DEPLOYED JAN 22, 2019 3:55PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 11:40							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-4 DF-02-B (DEPLOYED JAN 22, 2019 3:50PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 11:45							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-5 DF-03-A (DEPLOYED JAN 22, 2019 1:30PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 10:20							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-6 DF-03-B (DEPLOYED JAN 22, 2019 1:25PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 10:25							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-7 DF-04-A (DEPLOYED JAN 23, 2019 12:30PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 15:00							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2274915-7 DF-04-A (DEPLOYED JAN 23, 2019 12:30PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 15:00							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-8 DF-04-B (DEPLOYED JAN 23, 2019 12:35PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 15:05							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.14		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	0.12		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-9 DF-05-A (DEPLOYED JAN 24, 2019 11:15AM)							
Sampled By: J. SHAVER on 13-MAY-19 @ 09:30							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-10 DF-05-B (DEPLOYED JAN 24, 2019 11:20AM)							
Sampled By: J. SHAVER on 13-MAY-19 @ 09:35							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-11 DF-06-A (DEPLOYED OCT 2, 2019 1:55PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 14:00							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
L2274915-12 DF-06-B (DEPLOYED OCT 2, 2019 1:50PM)							
Sampled By: J. SHAVER on 12-MAY-19 @ 14:05							
Matrix: WATER							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Fixed Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894
Volatile Dustfall	<0.10		0.10	mg/dm2.day		22-MAY-19	R4641894

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-T.DM2-VA	Dustfall	Dustfalls Total+Fixed & Vol (mg/dm2.day)	BCMOE DUSTFALLS

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2274915-COFC

COC Number: 17 -

Report To	Contact and company name below will appear on the final report
Company:	Denison Mines
Contact:	Pam Bennett
Phone:	306-652-8201 x107
	Company address below will appear on the final report
Street:	230 22nd ST East, Suite 200
City/Province:	Saskatoon, SK
Postal Code:	S7K 0E9
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax pbennett@denisonmines.com

Email 2 jshaver@denisonenvironmental.com

Email 3

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax dhassell@denisonmines.com

Email 2 pbennett@denisonmines.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	☐	1 Business day [E1 - 100%]	☐
3 day [P3-25%]	☐	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	☐
2 day [P2-50%]	☐		

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	Q70196
Job #:	
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only):	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Kaitlyn Gardner	Sampler: J.Shaver

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	DUSTFALLS-T.DM2-VA	SAMPLES ON HOLD	Sample is hazardous (please provide further detail	NUMBER OF CONTAINERS
					P			
	DF-01-A (Deployed Jan 22, 2019 12:20pm)	12-May-19	9:40am	Water	R			1
	DF-01-B (Deployed Jan 22, 2019 12:15pm)	12-May-19	9:45am	Water	R			1
	DF-02-A (Deployed Jan 22, 2019 3:55pm)	12-May-19	11:40am	Water	R			1
	DF-02-B (Deployed Jan 22, 2019 3:50pm)	12-May-19	11:45am	Water	R			1
	DF-03-A (Deployed Jan 22, 2019 1:30pm)	12-May-19	10:20am	Water	R			1
	DF-03-B (Deployed Jan 22, 2019 1:25pm)	12-May-19	10:25am	Water	R			1
	DF-04-A (Deployed Jan 23, 2019 12:30pm)	12-May-19	3:00pm	Water	R			1
	DF-04-B (Deployed Jan 23, 2019 12:35pm)	12-May-19	3:05pm	Water	R			1
	DF-05-A (Deployed Jan 24, 2019 11:15am)	13-May-19	9:30am	Water	R			1
	DF-05-B (Deployed Jan 24, 2019 11:20am)	13-May-19	9:35am	Water	R			1
	DF-06-A (Deployed Oct 2, 2018 1:55pm)	12-May-19	2:00pm	Water	R			1
	DF-06-B (Deployed Oct 2, 2018 1:50pm)	12-May-19	2:05pm	Water	R			1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
10	8	13	12				

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: May 16, 2019	Time: 3:50pm	Received by:	Date: 16/5/19	Time: 3:50	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Report To	Dana Harris, Denison Mines Corp. 230 22nd St. East, Suite 200 Saskatoon, SK S7K 0E9	**Date Received** **Report Date** **Report Revision** **Version**	31-Aug-2020 15:05 12-Sep-2020 19:21 1 FINAL
Client Phone	306-652-8201		

Certificate of Analysis

Lab Work Order #	L2496899
Project P.O. #	WRE_E0220018
Job Reference	
Legal Site Description	
C of C Numbers	

Case Narrative/Comments

Brian Morgan, B.Sc. Hons.
Client Services Manager

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Sample Summary L2496899

Job Reference	
Report To	Dana Harris, Denison Mines Corp.
Date Received	31-Aug-2020 15:05
Report Date	12-Sep-2020 19:21
Report Version	1

Sample Details

ALS Sample ID	Client Sample ID	Matrix	Date Sampled	Time Sampled	Qualifier
L2496899-1	DF-01A	DUSTFALL	28-Aug-20	10:34	
L2496899-2	DF-01B	DUSTFALL	28-Aug-20	10:34	
L2496899-3	DF-02A	DUSTFALL	28-Aug-20	09:34	
L2496899-4	DF-02B	DUSTFALL	28-Aug-20	09:34	
L2496899-5	DF-03A	DUSTFALL	28-Aug-20	10:04	
L2496899-6	DF-03B	DUSTFALL	28-Aug-20	10:02	
L2496899-7	DF-04A	DUSTFALL	28-Aug-20	15:50	
L2496899-8	DF-04B	DUSTFALL	28-Aug-20	15:50	
L2496899-9	DF-05A	DUSTFALL	28-Aug-20	15:09	
L2496899-10	DF-05B	DUSTFALL	28-Aug-20	15:09	
L2496899-11	DF-06A	DUSTFALL	28-Aug-20	13:57	
L2496899-12	DF-06B	DUSTFALL	28-Aug-20	13:57	

Results Summary L2496899

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 31-Aug-2020 15:05
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Report Version 1

Client Sample ID			DF-01A	DF-01B	DF-02A	DF-02B	DF-03A	DF-03B	DF-04A	DF-04B	DF-05A	DF-05B	DF-06A	DF-06B
Date Sampled			28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020
Time Sampled			10:34	10:34	9:34	9:34	10:04	10:02	15:50	15:50	15:09	15:09	13:57	13:57
ALS Sample ID			L2496899-1	L2496899-2	L2496899-3	L2496899-4	L2496899-5	L2496899-6	L2496899-7	L2496899-8	L2496899-9	L2496899-10	L2496899-11	L2496899-12
Parameter	Lowest Detection Limit	Units	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall
Particulates (Dustfall)														
Fixed Dustfall	0.10	mg/dm2.day	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10
Volatile Dustfall	0.10	mg/dm2.day	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	0.11	0.20	<0.10	<0.10
Total Dustfall	0.10	mg/dm2.day	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.15	<0.10	0.18	0.30	<0.10	<0.10

Results of Analysis L2496899

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 31-Aug-2020 15:05
Report Date 12-Sep-2020 19:21
Report Version 1

Parameter	ALS ID	Client Sample ID	ALS Test Code	Results	Detection Limit	Units	Qual	Date Sampled	Time Sampled	Prep Date	Analysis Date	QC Lot	QC Eval	Hold Time Eval	Matrix	Class
Particulates (Dustfall)																
Fixed Dustfall	L2496899-1	DF-01A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-1	DF-01A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-1	DF-01A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-2	DF-01B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-2	DF-01B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-2	DF-01B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-3	DF-02A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	09:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-3	DF-02A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	09:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-3	DF-02A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	09:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-4	DF-02B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	09:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-4	DF-02B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	09:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-4	DF-02B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	09:34		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-5	DF-03A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:04		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-5	DF-03A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:04		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-5	DF-03A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:04		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-6	DF-03B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:02		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-6	DF-03B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:02		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-6	DF-03B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	10:02		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-7	DF-04A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	15:50		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-7	DF-04A	DUSTFALLS-T.DM2-VA	0.11	0.10	mg/dm2.day		28-Aug-20	15:50		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-7	DF-04A	DUSTFALLS-T.DM2-VA	0.15	0.10	mg/dm2.day		28-Aug-20	15:50		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-8	DF-04B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	15:50		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-8	DF-04B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	15:50		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-8	DF-04B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	15:50		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-9	DF-05A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	15:09		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-9	DF-05A	DUSTFALLS-T.DM2-VA	0.11	0.10	mg/dm2.day		28-Aug-20	15:09		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-9	DF-05A	DUSTFALLS-T.DM2-VA	0.18	0.10	mg/dm2.day		28-Aug-20	15:09		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-10	DF-05B	DUSTFALLS-T.DM2-VA	0.11	0.10	mg/dm2.day		28-Aug-20	15:09		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-10	DF-05B	DUSTFALLS-T.DM2-VA	0.20	0.10	mg/dm2.day		28-Aug-20	15:09		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-10	DF-05B	DUSTFALLS-T.DM2-VA	0.30	0.10	mg/dm2.day		28-Aug-20	15:09		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-11	DF-06A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	13:57		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-11	DF-06A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	13:57		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-11	DF-06A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	13:57		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2496899-12	DF-06B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	13:57		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2496899-12	DF-06B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	13:57		10-Sep-20	1367890	✓	✓	Dustfall	Particulates
Total Dustfall	L2496899-12	DF-06B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		28-Aug-20	13:57		10-Sep-20	1367890	✓	✓	Dustfall	Particulates

Evaluation Legend
✓ QC Lot met ALS Data Quality Objectives or Test result met ALS Hold Time Recommendations

Quality Control L2496899

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 31-Aug-2020 15:05
Report Date 12-Sep-2020 19:21
Report Version 1

QC Type	Analyte	QC Lot #	ALS QC ID	Result	Target	Units	%	Limit	Units	Qual	Eval	Matrix	Class
Particulates (Dustfall)													
LCS	Fixed Dustfall	1367890	WG3401721-2	8.14	7.81	mg/dm2.day	104.2	85-115	%		✓	Dustfall	Particulates
LCS	Volatile Dustfall	1367890	WG3401721-2	4.09	4.24	mg/dm2.day	96.4	85-115	%		✓	Dustfall	Particulates
LCS	Total Dustfall	1367890	WG3401721-2	12.2	12.1	mg/dm2.day	101.5	85-115	%		✓	Dustfall	Particulates
MB	Fixed Dustfall	1367890	WG3401721-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates
MB	Volatile Dustfall	1367890	WG3401721-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates
MB	Total Dustfall	1367890	WG3401721-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates

Evaluation Legend
✓ QC Lot met ALS Data Quality Objectives

Methodology L2496899

Job Reference	
Report To	Dana Harris, Denison Mines Corp.
Date Received	31-Aug-2020 15:05
Report Date	12-Sep-2020 19:21
Report Version	1

ALS Test Code	ALS Test Description	Lab Location	Matrix	Method Reference	Methodology Description
Particulates (Dustfall)					
DUSTFALLS-T.DM2-VA	Dustfalls Total+Fixed & Vol (mg/dm2.day)	Vancouver	Dustfall	BCMOE DUSTFALLS	Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

Detection Limits L2496899

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 31-Aug-2020 15:05
Report Date 12-Sep-2020 19:21
Report Version 1

Client Sample ID		DF-01A	DF-01B	DF-02A	DF-02B	DF-03A	DF-03B	DF-04A	DF-04B	DF-05A	DF-05B	DF-06A	DF-06B
Date Sampled		28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020	28-Aug-2020
Time Sampled		10:34	10:34	9:34	9:34	10:04	10:02	15:50	15:50	15:09	15:09	13:57	13:57
ALS Sample ID		L2496899-1	L2496899-2	L2496899-3	L2496899-4	L2496899-5	L2496899-6	L2496899-7	L2496899-8	L2496899-9	L2496899-10	L2496899-11	L2496899-12
Parameter	Units	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall
Particulates (Dustfall)													
Fixed Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Volatile Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

Report To	Dana Harris, Denison Mines Corp. 230 22nd St. East, Suite 200 Saskatoon, SK S7K 0E9	**Date Received** **Report Date** **Report Revision** **Version**	8-Oct-2020 16:00 19-Oct-2020 18:45 1 FINAL
Client Phone	306-652-8201		

Certificate of Analysis

Lab Work Order #	L2514481
Project P.O. #	WRE_E0220018
Job Reference	
Legal Site Description	
C of C Numbers	

Case Narrative/Comments

Brian Morgan, B.Sc. Hons.
Client Services Manager

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Sample Summary L2514481

Job Reference	
Report To	Dana Harris, Denison Mines Corp.
Date Received	8-Oct-2020 16:00
Report Date	19-Oct-2020 18:45
Report Version	1

Sample Details

ALS Sample ID	Client Sample ID	Matrix	Date Sampled	Time Sampled	Qualifier
L2514481-1	DF-01A	WATER	02-Oct-20	14:00	
L2514481-2	DF-01B	WATER	02-Oct-20	14:00	
L2514481-3	DF-02A	WATER	02-Oct-20	15:15	
L2514481-4	DF-02B	WATER	02-Oct-20	15:15	
L2514481-5	DF-03A	WATER	02-Oct-20	14:40	
L2514481-6	DF-03B	WATER	02-Oct-20	14:40	
L2514481-7	DF-04A	WATER	30-Sep-20	15:30	
L2514481-8	DF-04B	WATER	30-Sep-20	15:30	
L2514481-9	DF-05A	WATER	30-Sep-20	15:08	
L2514481-10	DF-05B	WATER	30-Sep-20	15:08	
L2514481-11	DF-06A	WATER	30-Sep-20	14:15	
L2514481-12	DF-06B	WATER	30-Sep-20	14:15	

Results Summary L2514481

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 8-Oct-2020 16:00
Report Date 19-Oct-2020 18:45
Report Version 1

Client Sample ID			DF-01A	DF-01B	DF-02A	DF-02B	DF-03A	DF-03B	DF-04A	DF-04B	DF-05A	DF-05B	DF-06A	DF-06B
Date Sampled			2-Oct-2020	2-Oct-2020	2-Oct-2020	2-Oct-2020	2-Oct-2020	2-Oct-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020
Time Sampled			14:00	14:00	15:15	15:15	14:40	14:40	15:30	15:30	15:08	15:08	14:15	14:15
ALS Sample ID			L2514481-1	L2514481-2	L2514481-3	L2514481-4	L2514481-5	L2514481-6	L2514481-7	L2514481-8	L2514481-9	L2514481-10	L2514481-11	L2514481-12
Parameter	Lowest Detection Limit	Units	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall
Particulates (Dustfall)														
Fixed Dustfall	0.10	mg/dm2.day	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Dustfall	0.10	mg/dm2.day	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19	<0.10	0.13	<0.10	0.10
Total Dustfall	0.10	mg/dm2.day	<0.10	<0.10	0.12	0.12	<0.10	<0.10	0.12	0.25	0.14	0.20	0.12	0.15

Results of Analysis L2514481

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 8-Oct-2020 16:00
Report Date 19-Oct-2020 18:45
Report Version 1

Parameter	ALS ID	Client Sample ID	ALS Test Code	Results	Detection Limit	Units	Qual	Date Sampled	Time Sampled	Prep Date	Analysis Date	QC Lot	QC Eval	Hold Time Eval	Matrix	Class
Particulates (Dustfall)																
Fixed Dustfall	L2514481-1	DF-01A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:00		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-1	DF-01A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:00		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-1	DF-01A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:00		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-2	DF-01B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:00		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-2	DF-01B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:00		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-2	DF-01B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:00		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-3	DF-02A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	15:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-3	DF-02A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	15:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-3	DF-02A	DUSTFALLS-T.DM2-VA	0.12	0.10	mg/dm2.day		02-Oct-20	15:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-4	DF-02B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	15:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-4	DF-02B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	15:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-4	DF-02B	DUSTFALLS-T.DM2-VA	0.12	0.10	mg/dm2.day		02-Oct-20	15:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-5	DF-03A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:40		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-5	DF-03A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:40		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-5	DF-03A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:40		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-6	DF-03B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:40		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-6	DF-03B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:40		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-6	DF-03B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		02-Oct-20	14:40		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-7	DF-04A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	15:30		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-7	DF-04A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	15:30		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-7	DF-04A	DUSTFALLS-T.DM2-VA	0.12	0.10	mg/dm2.day		30-Sep-20	15:30		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-8	DF-04B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	15:30		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-8	DF-04B	DUSTFALLS-T.DM2-VA	0.19	0.10	mg/dm2.day		30-Sep-20	15:30		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-8	DF-04B	DUSTFALLS-T.DM2-VA	0.25	0.10	mg/dm2.day		30-Sep-20	15:30		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-9	DF-05A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	15:08		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-9	DF-05A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	15:08		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-9	DF-05A	DUSTFALLS-T.DM2-VA	0.14	0.10	mg/dm2.day		30-Sep-20	15:08		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-10	DF-05B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	15:08		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-10	DF-05B	DUSTFALLS-T.DM2-VA	0.13	0.10	mg/dm2.day		30-Sep-20	15:08		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-10	DF-05B	DUSTFALLS-T.DM2-VA	0.20	0.10	mg/dm2.day		30-Sep-20	15:08		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-11	DF-06A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	14:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-11	DF-06A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	14:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-11	DF-06A	DUSTFALLS-T.DM2-VA	0.12	0.10	mg/dm2.day		30-Sep-20	14:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2514481-12	DF-06B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		30-Sep-20	14:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2514481-12	DF-06B	DUSTFALLS-T.DM2-VA	0.10	0.10	mg/dm2.day		30-Sep-20	14:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates
Total Dustfall	L2514481-12	DF-06B	DUSTFALLS-T.DM2-VA	0.15	0.10	mg/dm2.day		30-Sep-20	14:15		16-Oct-20	1387623	✓	✓	Dustfall	Particulates

Evaluation Legend

✓ QC Lot met ALS Data Quality Objectives or Test result met ALS Hold Time Recommendations

Quality Control L2514481

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 8-Oct-2020 16:00
Report Date 19-Oct-2020 18:45
Report Version 1

QC Type	Analyte	QC Lot #	ALS QC ID	Result	Target	Units	%	Limit	Units	Qual	Eval	Matrix	Class
Particulates (Dustfall)													
LCS	Fixed Dustfall	1387623	WG3425982-2	8.24	7.81	mg/dm2.day	105.5	85-115	%		✓	Dustfall	Particulates
LCS	Volatile Dustfall	1387623	WG3425982-2	3.81	4.24	mg/dm2.day	89.8	85-115	%		✓	Dustfall	Particulates
LCS	Total Dustfall	1387623	WG3425982-2	12.0	12.1	mg/dm2.day	99.99	85-115	%		✓	Dustfall	Particulates
MB	Fixed Dustfall	1387623	WG3425982-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates
MB	Volatile Dustfall	1387623	WG3425982-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates
MB	Total Dustfall	1387623	WG3425982-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates

Evaluation Legend
✓ QC Lot met ALS Data Quality Objectives

Methodology L2514481

Job Reference	
Report To	Dana Harris, Denison Mines Corp.
Date Received	8-Oct-2020 16:00
Report Date	19-Oct-2020 18:45
Report Version	1

ALS Test Code	ALS Test Description	Lab Location	Matrix	Method Reference	Methodology Description
Particulates (Dustfall)					
DUSTFALLS-T.DM2-VA	Dustfalls Total+Fixed & Vol (mg/dm2.day)	Vancouver	Dustfall	BCMOE DUSTFALLS	Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

Detection Limits L2514481

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 8-Oct-2020 16:00
Report Date 19-Oct-2020 18:45
Report Version 1

Client Sample ID		DF-01A	DF-01B	DF-02A	DF-02B	DF-03A	DF-03B	DF-04A	DF-04B	DF-05A	DF-05B	DF-06A	DF-06B
Date Sampled		2-Oct-2020	2-Oct-2020	2-Oct-2020	2-Oct-2020	2-Oct-2020	2-Oct-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020	30-Sep-2020
Time Sampled		14:00	14:00	15:15	15:15	14:40	14:40	15:30	15:30	15:08	15:08	14:15	14:15
ALS Sample ID		L2514481-1	L2514481-2	L2514481-3	L2514481-4	L2514481-5	L2514481-6	L2514481-7	L2514481-8	L2514481-9	L2514481-10	L2514481-11	L2514481-12
Parameter	Units	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall
Particulates (Dustfall)													
Fixed Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Volatile Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

Report To	Dana Harris, Denison Mines Corp. 230 22nd St. East, Suite 200 Saskatoon, SK S7K 0E9	**Date Received** **Report Date** **Report Revision** **Version**	10-Nov-2020 08:30 20-Nov-2020 07:48 1 FINAL
Client Phone	306-652-8201		

Certificate of Analysis

Lab Work Order # L2527762
Project P.O. #
Job Reference
Legal Site Description
C of C Numbers

Case Narrative/Comments

Brian Morgan, B.Sc. Hons.
Client Services Manager

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Sample Summary L2527762

Job Reference	
Report To	Dana Harris, Denison Mines Corp.
Date Received	10-Nov-2020 8:30
Report Date	20-Nov-2020 7:48
Report Version	1

Sample Details

ALS Sample ID	Client Sample ID	Matrix	Date Sampled	Time Sampled	Qualifier
L2527762-1	DF-01-A	WATER	03-Nov-20	08:00	
L2527762-2	DF-01-B	WATER	03-Nov-20	08:00	
L2527762-3	DF-02-A	WATER	03-Nov-20	08:00	
L2527762-4	DF-02-B	WATER	03-Nov-20	08:00	
L2527762-5	DF-03-A	WATER	03-Nov-20	08:00	
L2527762-6	DF-03-B	WATER	03-Nov-20	08:00	
L2527762-7	DF-04-A	WATER	03-Nov-20	08:00	
L2527762-8	DF-04-B	WATER	03-Nov-20	08:00	
L2527762-9	DF-05-A	WATER	03-Nov-20	08:00	
L2527762-10	DF-05-B	WATER	03-Nov-20	08:00	
L2527762-11	DF-06-A	WATER	03-Nov-20	08:00	
L2527762-12	DF-06-B	WATER	03-Nov-20	08:00	

Results Summary L2527762

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 10-Nov-2020 8:30
Report Date 20-Nov-2020 7:48
Report Version 1

Client Sample ID			DF-01-A	DF-01-B	DF-02-A	DF-02-B	DF-03-A	DF-03-B	DF-04-A	DF-04-B	DF-05-A	DF-05-B	DF-06-A	DF-06-B
Date Sampled			3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020
Time Sampled			8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00
ALS Sample ID			L2527762-1	L2527762-2	L2527762-3	L2527762-4	L2527762-5	L2527762-6	L2527762-7	L2527762-8	L2527762-9	L2527762-10	L2527762-11	L2527762-12
Parameter	Lowest Detection Limit	Units	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall
Particulates (Dustfall)														
Fixed Dustfall	0.10	mg/dm2.day	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Dustfall	0.10	mg/dm2.day	0.41	0.60	0.26	0.16	0.16	0.14	0.12	0.10	<0.10	0.22	0.10	<0.10
Total Dustfall	0.10	mg/dm2.day	0.47	0.66	0.28	0.18	0.18	0.17	0.17	0.15	0.12	0.28	0.12	0.10

Results of Analysis L2527762

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 10-Nov-2020 8:30
Report Date 20-Nov-2020 7:48
Report Version 1

Parameter	ALS ID	Client Sample ID	ALS Test Code	Results	Detection Limit	Units	Qual	Date Sampled	Time Sampled	Prep Date	Analysis Date	QC Lot	QC Eval	Hold Time Eval	Matrix	Class
Particulates (Dustfall)																
Fixed Dustfall	L2527762-1	DF-01-A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-1	DF-01-A	DUSTFALLS-T.DM2-VA	0.41	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-1	DF-01-A	DUSTFALLS-T.DM2-VA	0.47	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-2	DF-01-B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-2	DF-01-B	DUSTFALLS-T.DM2-VA	0.60	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-2	DF-01-B	DUSTFALLS-T.DM2-VA	0.66	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-3	DF-02-A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-3	DF-02-A	DUSTFALLS-T.DM2-VA	0.26	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-3	DF-02-A	DUSTFALLS-T.DM2-VA	0.28	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-4	DF-02-B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-4	DF-02-B	DUSTFALLS-T.DM2-VA	0.16	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-4	DF-02-B	DUSTFALLS-T.DM2-VA	0.18	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-5	DF-03-A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-5	DF-03-A	DUSTFALLS-T.DM2-VA	0.16	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-5	DF-03-A	DUSTFALLS-T.DM2-VA	0.18	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-6	DF-03-B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-6	DF-03-B	DUSTFALLS-T.DM2-VA	0.14	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-6	DF-03-B	DUSTFALLS-T.DM2-VA	0.17	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-7	DF-04-A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-7	DF-04-A	DUSTFALLS-T.DM2-VA	0.12	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-7	DF-04-A	DUSTFALLS-T.DM2-VA	0.17	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-8	DF-04-B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-8	DF-04-B	DUSTFALLS-T.DM2-VA	0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-8	DF-04-B	DUSTFALLS-T.DM2-VA	0.15	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-9	DF-05-A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-9	DF-05-A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-9	DF-05-A	DUSTFALLS-T.DM2-VA	0.12	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-10	DF-05-B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-10	DF-05-B	DUSTFALLS-T.DM2-VA	0.22	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-10	DF-05-B	DUSTFALLS-T.DM2-VA	0.28	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-11	DF-06-A	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-11	DF-06-A	DUSTFALLS-T.DM2-VA	0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-11	DF-06-A	DUSTFALLS-T.DM2-VA	0.12	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Fixed Dustfall	L2527762-12	DF-06-B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Volatile Dustfall	L2527762-12	DF-06-B	DUSTFALLS-T.DM2-VA	<0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates
Total Dustfall	L2527762-12	DF-06-B	DUSTFALLS-T.DM2-VA	0.10	0.10	mg/dm2.day		03-Nov-20	08:00		17-Nov-20	1404519	✓	✓	Dustfall	Particulates

Evaluation Legend
✓ QC Lot met ALS Data Quality Objectives or Test result met ALS Hold Time Recommendations

Quality Control L2527762

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 10-Nov-2020 8:30
Report Date 20-Nov-2020 7:48
Report Version 1

QC Type	Analyte	QC Lot #	ALS QC ID	Result	Target	Units	%	Limit	Units	Qual	Eval	Matrix	Class
Particulates (Dustfall)													
LCS	Fixed Dustfall	1404519	WG3446562-2	8.32	7.81	mg/dm2.day	106.5	85-115	%		✓	Dustfall	Particulates
LCS	Volatile Dustfall	1404519	WG3446562-2	4.09	4.24	mg/dm2.day	96.4	85-115	%		✓	Dustfall	Particulates
LCS	Total Dustfall	1404519	WG3446562-2	12.4	12.1	mg/dm2.day	103.0	85-115	%		✓	Dustfall	Particulates
MB	Fixed Dustfall	1404519	WG3446562-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates
MB	Volatile Dustfall	1404519	WG3446562-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates
MB	Total Dustfall	1404519	WG3446562-1	<0.10		mg/dm2.day	-	<0.10	mg/dm2.day		✓	Dustfall	Particulates

Evaluation Legend
✓ QC Lot met ALS Data Quality Objectives

Methodology L2527762

Job Reference	
Report To	Dana Harris, Denison Mines Corp.
Date Received	10-Nov-2020 8:30
Report Date	20-Nov-2020 7:48
Report Version	1

ALS Test Code	ALS Test Description	Lab Location	Matrix	Method Reference	Methodology Description
Particulates (Dustfall)					
DUSTFALLS-T.DM2-VA	Dustfalls Total+Fixed & Vol (mg/dm2.day)	Vancouver	Dustfall	BCMOE DUSTFALLS	Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

Detection Limits L2527762

Job Reference
Report To Dana Harris, Denison Mines Corp.
Date Received 10-Nov-2020 8:30
Report Date 20-Nov-2020 7:48
Report Version 1

Client Sample ID		DF-01-A	DF-01-B	DF-02-A	DF-02-B	DF-03-A	DF-03-B	DF-04-A	DF-04-B	DF-05-A	DF-05-B	DF-06-A	DF-06-B
Date Sampled		3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020	3-Nov-2020
Time Sampled		8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00
ALS Sample ID		L2527762-1	L2527762-2	L2527762-3	L2527762-4	L2527762-5	L2527762-6	L2527762-7	L2527762-8	L2527762-9	L2527762-10	L2527762-11	L2527762-12
Parameter	Units	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall	Dustfall
Particulates (Dustfall)													
Fixed Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Volatile Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total Dustfall	mg/dm2.day	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10

Denison Mines Corp.
ATTN: Jenn Skilnick
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

Date Received: 23-SEP-21
Report Date: 14-OCT-21 17:32 (MT)
Version: FINAL

Client Phone: 306-652-8201

Certificate of Analysis

Lab Work Order #: L2643294
Project P.O. #: WRE_E0221097
Job Reference:
C of C Numbers:
Legal Site Desc:

Brian Morgan, B.Sc. Hons.
Client Services Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-1 DF-01A AUG17/21 @ 14:50							
Sampled By: J. SKILNICK on 21-SEP-21 @ 10:45							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.11		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000299		0.000084	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000028		0.0000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000028		0.0000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000120		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00028		0.00028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00251		0.00056	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000028		0.0000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00084		0.00084	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00014		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00063		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000512		0.0000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0017		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000028		0.000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000028		0.00000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000058		0.0000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000028		0.0000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000028		0.0000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00028		0.00028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000028		0.00000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000028		0.000028	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000084		0.000084	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-2 DF-01B AUG17/21 @ 14:50							
Sampled By: J. SKILNICK on 21-SEP-21 @ 10:45							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000208		0.000088	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-2 DF-01B AUG17/21 @ 14:50							
Sampled By: J. SKILNICK on 21-SEP-21 @ 10:45							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Arsenic (As)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000115		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00029		0.00029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000015		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00234		0.00059	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000029	DLB	0.000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000015		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	0.00114		0.00088	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00015		0.00015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00069		0.00015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000613		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	0.0000015		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0015		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0021		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000029		0.000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0015		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000029		0.00000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0015		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000061		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00029		0.00029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000029		0.00000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000029		0.000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000088		0.000088	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-3 DF-02A AUG17/21 @ 13:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 11:55							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.14		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	0.14		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000249		0.0000821	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval				days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000027		0.0000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000027		0.0000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000144		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00027		0.00027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00248		0.00055	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-3 DF-02A AUG17/21 @ 13:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 11:55							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Cobalt (Co)-Total	<0.0000027		0.0000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00082		0.00082	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00014		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00067		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.000109		0.0000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0024		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000027		0.000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000027		0.00000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000079		0.0000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000027		0.0000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000027		0.0000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00027		0.00027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000027		0.00000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000027		0.000027	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000082		0.000082	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-4 DF-02B AUG17/21 @ 13:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 11:55							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000168		0.0000871	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000090		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00029		0.00029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00220		0.00058	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00087		0.00087	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00014		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00050		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000489		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-4 DF-02B AUG17/21 @ 13:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 11:55							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Nickel (Ni)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0026		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000029		0.000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000029		0.00000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000049		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00029		0.00029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000029		0.00000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000029		0.000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000087		0.000087	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-5 DF-03A AUG17/21 @ 14:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 09:30							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000225		0.0000711	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval				days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000024		0.0000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000024		0.0000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000108		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00024		0.00024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00237		0.00047	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000024		0.0000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000024	DLB	0.000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00071		0.00071	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00012		0.00012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00052		0.00012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000458		0.0000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000024		0.000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000024		0.00000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-5 DF-03A AUG17/21 @ 14:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 09:30							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Strontium (Sr)-Total	0.0000052		0.0000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000024		0.0000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000024		0.0000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00024		0.00024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000024		0.00000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000024		0.000024	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000071		0.000071	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-6 DF-03B AUG17/21 @ 14:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 09:30							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000214		0.0000761	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval				days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000109		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00025		0.00025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000013		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00230		0.00051	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000013		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00076		0.00076	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00013		0.00013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00062		0.00013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000495		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000013		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	0.0015		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0013		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000025		0.000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0013		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000025		0.00000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0013		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000063		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00025		0.00025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000025		0.00000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000025		0.000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000076		0.000076	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-6 DF-03B AUG17/21 @ 14:20							
Sampled By: J. SKILNICK on 21-SEP-21 @ 09:30							
Matrix: DUSTFALL							
L2643294-7 DF-04A AUG17/21 @ 10:30							
Sampled By: J. SKILNICK on 21-SEP-21 @ 11:25							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000285		0.000089	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000030		0.0000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000030		0.0000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000110		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00030		0.00030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000015		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00273		0.00059	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000030		0.0000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000015		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00089		0.00089	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00015		0.00015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00077		0.00015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000626		0.0000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000015		0.0000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000015		0.000015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0015		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0019		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000030		0.000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0015		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000030		0.00000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0015		0.0015	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000063		0.0000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000030		0.0000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000030		0.0000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00030		0.00030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000030		0.00000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000030		0.000030	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000089		0.000089	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-8 DF-04B AUG17/21 @ 10:30							
Sampled By: J. SKILNICK on 21-SEP-21 @ 11:25							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-8 DF-04B AUG17/21 @ 10:30							
Sampled By: J. SKILNICK on 21-SEP-21 @ 11:25							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000350		0.000086	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000108		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00029		0.00029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00232		0.00057	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00086		0.00086	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00014		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00068		0.00014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000696		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000014		0.0000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000014		0.000014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	0.0021		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0039		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000029		0.000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000029		0.00000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0014		0.0014	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000064		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000029		0.0000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00029		0.00029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	0.00000054		0.00000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000029		0.000029	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000086		0.000086	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-9 DF-05A AUG17/21 @ 10:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 10:55							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000254		0.000069	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000094		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00023		0.00023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-9 DF-05A AUG17/21 @ 10:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 10:55							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Cadmium (Cd)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00241		0.00046	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000023	DLB	0.000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00069		0.00069	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00012		0.00012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00056		0.00012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000433		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0014		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000023		0.000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000023		0.00000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000069		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00023		0.00023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000023		0.00000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000023		0.000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000069		0.000069	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-10 DF-05B AUG17/21 @ 10:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 10:55							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000240		0.000075	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000107		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00025		0.00025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000013		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00224		0.00050	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000025	DLB	0.000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000013		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00075		0.00075	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00013		0.00013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-10 DF-05B AUG17/21 @ 10:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 10:55							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Magnesium (Mg)-Total	0.00047		0.00013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000472		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000013		0.0000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000013		0.000013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	<0.0013		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	<0.0013		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000025		0.000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0013		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000025		0.00000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0013		0.0013	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000050		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000025		0.0000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00025		0.00025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000025		0.00000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000025		0.000025	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000075		0.000075	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-11 DF-06A AUG17/21 @ 9:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 08:25							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000265		0.0000681	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval				days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000113		0.0000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000011		0.000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000011		0.000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00023		0.00023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000011		0.0000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00250		0.00045	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000011		0.000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000011		0.000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000011		0.0000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00068		0.00068	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00011		0.00011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00060		0.00011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000501		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000011		0.0000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000011		0.000011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	0.0013		0.0011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0021		0.0011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000023		0.000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0011		0.0011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-11 DF-06A AUG17/21 @ 9:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 08:25							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
Silver (Ag)-Total	<0.00000023		0.00000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0011		0.0011	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000055		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00023		0.00023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000023		0.00000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Vanadium (V)-Total	<0.000023		0.000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000068		0.000068	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
L2643294-12 DF-06B AUG17/21 @ 9:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 08:25							
Matrix: DUSTFALL							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.12		0.10	mg/dm2.day		07-OCT-21	R5617699
Fixed Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Volatile Dustfall	<0.10		0.10	mg/dm2.day		07-OCT-21	R5617699
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000222		0.0000691	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Interval			1	days		07-OCT-21	R5612583
Antimony (Sb)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Arsenic (As)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Barium (Ba)-Total	0.0000093		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Beryllium (Be)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Bismuth (Bi)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Boron (B)-Total	<0.00023		0.00023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cadmium (Cd)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Calcium (Ca)-Total	0.00230		0.00046	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Chromium (Cr)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Cobalt (Co)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Copper (Cu)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lead (Pb)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Iron (Fe)-Total	<0.00069		0.00069	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Lithium (Li)-Total	<0.00012		0.00012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Magnesium (Mg)-Total	0.00067		0.00012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Manganese (Mn)-Total	0.0000883		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Molybdenum (Mo)-Total	<0.0000012		0.0000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Nickel (Ni)-Total	<0.000012		0.000012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Phosphorus (P)-Total	0.0026		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Potassium (K)-Total	0.0039		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Selenium (Se)-Total	<0.000023		0.000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silicon (Si)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Silver (Ag)-Total	<0.00000023		0.00000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Sodium (Na)-Total	<0.0012		0.0012	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Strontium (Sr)-Total	0.0000052		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Thallium (Tl)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Tin (Sn)-Total	<0.0000023		0.0000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Titanium (Ti)-Total	<0.00023		0.00023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Uranium (U)-Total	<0.00000023		0.0000002	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2643294-12 DF-06B AUG17/21 @ 9:00							
Sampled By: J. SKILNICK on 21-SEP-21 @ 08:25							
Matrix: DUSTFALL							
Total Metals in Dustfalls by ICPMS							
			3				
Vanadium (V)-Total	<0.000023		0.000023	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473
Zinc (Zn)-Total	<0.000069		0.000069	mg/dm2.day	07-OCT-21	11-OCT-21	R5617473

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-T.DM2-VA	Dustfall	Dustfalls Total+Fixed & Vol (mg/dm2.day)	BCMOE DUSTFALLS

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2643294 Report Date: 14-OCT-21

Client: Denison Mines Corp.
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

Contact: Jenn Skilnick

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
DUSTFALLS-T.DM2-VA	**Dustfall**							
Batch R5617699								
WG3633486-2 LCS								
Total Dustfall			97.9		%		85-115	07-OCT-21
Fixed Dustfall			104.4		%		85-115	07-OCT-21
Volatile Dustfall			86.0		%		85-115	07-OCT-21
WG3633486-1 MB								
Total Dustfall			<0.10		mg/dm2.day		0.1	07-OCT-21
Fixed Dustfall			<0.10		mg/dm2.day		0.1	07-OCT-21
Volatile Dustfall			<0.10		mg/dm2.day		0.1	07-OCT-21
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5617473								
WG3633001-3 DUP		**L2643294-1**						
Aluminum (Al)-Total		0.000299	0.000318		mg/dm2.day	6.5	20	11-OCT-21
Antimony (Sb)-Total		<0.0000028	<0.0000028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Arsenic (As)-Total		<0.0000028	<0.0000028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Barium (Ba)-Total		0.0000120	0.0000112		mg/dm2.day	6.2	20	11-OCT-21
Beryllium (Be)-Total		<0.000014	<0.000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Bismuth (Bi)-Total		<0.000014	<0.000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Boron (B)-Total		<0.00028	<0.00028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Cadmium (Cd)-Total		<0.0000014	<0.0000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Calcium (Ca)-Total		0.00251	0.00237		mg/dm2.day	5.9	20	11-OCT-21
Chromium (Cr)-Total		<0.000014	<0.000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Cobalt (Co)-Total		<0.0000028	<0.0000028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Copper (Cu)-Total		<0.000014	<0.000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Lead (Pb)-Total		<0.0000014	<0.0000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Iron (Fe)-Total		<0.00084	<0.00084	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Lithium (Li)-Total		<0.00014	<0.00014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Magnesium (Mg)-Total		0.00063	0.00056		mg/dm2.day	11	20	11-OCT-21
Manganese (Mn)-Total		0.0000512	0.0000437		mg/dm2.day	16	20	11-OCT-21
Molybdenum (Mo)-Total		<0.0000014	<0.0000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Nickel (Ni)-Total		<0.000014	<0.000014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Phosphorus (P)-Total		<0.0014	<0.0014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Potassium (K)-Total		0.0017	0.0016		mg/dm2.day	7.9	20	11-OCT-21
Selenium (Se)-Total		<0.000028	<0.000028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Silicon (Si)-Total		<0.0014	<0.0014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Silver (Ag)-Total		<0.00000028	<0.0000002	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5617473								
WG3633001-3 DUP		**L2643294-1**						
Sodium (Na)-Total		<0.0014	<0.0014	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Strontium (Sr)-Total		0.0000058	0.0000058		mg/dm2.day	0.2	20	11-OCT-21
Thallium (Tl)-Total		<0.0000028	<0.0000028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Tin (Sn)-Total		<0.0000028	<0.0000028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Titanium (Ti)-Total		<0.00028	<0.00028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Uranium (U)-Total		<0.00000028	<0.0000002	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Vanadium (V)-Total		<0.000028	<0.000028	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
Zinc (Zn)-Total		<0.000084	<0.000084	RPD-NA	mg/dm2.day	N/A	20	11-OCT-21
WG3633001-2 LCS								
Aluminum (Al)-Total			104.5		%		80-120	11-OCT-21
Antimony (Sb)-Total			108.9		%		80-120	11-OCT-21
Arsenic (As)-Total			99.4		%		80-120	11-OCT-21
Barium (Ba)-Total			97.8		%		80-120	11-OCT-21
Beryllium (Be)-Total			107.8		%		80-120	11-OCT-21
Bismuth (Bi)-Total			95.5		%		80-120	11-OCT-21
Boron (B)-Total			99.1		%		80-120	11-OCT-21
Cadmium (Cd)-Total			101.5		%		80-120	11-OCT-21
Calcium (Ca)-Total			106.7		%		80-120	11-OCT-21
Chromium (Cr)-Total			100.8		%		80-120	11-OCT-21
Cobalt (Co)-Total			100.0		%		80-120	11-OCT-21
Copper (Cu)-Total			101.4		%		80-120	11-OCT-21
Lead (Pb)-Total			105.0		%		80-120	11-OCT-21
Iron (Fe)-Total			105.2		%		80-120	11-OCT-21
Lithium (Li)-Total			107.0		%		80-120	11-OCT-21
Magnesium (Mg)-Total			99.1		%		80-120	11-OCT-21
Manganese (Mn)-Total			100.0		%		80-120	11-OCT-21
Molybdenum (Mo)-Total			106.1		%		80-120	11-OCT-21
Nickel (Ni)-Total			102.0		%		80-120	11-OCT-21
Phosphorus (P)-Total			102.1		%		80-120	11-OCT-21
Potassium (K)-Total			103.2		%		80-120	11-OCT-21
Selenium (Se)-Total			111.1		%		80-120	11-OCT-21
Silicon (Si)-Total			106.2		%		80-120	11-OCT-21
Silver (Ag)-Total			100.7		%		80-120	11-OCT-21
Sodium (Na)-Total			103.1		%		80-120	11-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5617473								
WG3633001-2 LCS								
Strontium (Sr)-Total			111.9		%		80-120	11-OCT-21
Thallium (Tl)-Total			87.5		%		80-120	11-OCT-21
Tin (Sn)-Total			101.1		%		80-120	11-OCT-21
Titanium (Ti)-Total			96.5		%		80-120	11-OCT-21
Uranium (U)-Total			106.2		%		80-120	11-OCT-21
Vanadium (V)-Total			99.2		%		80-120	11-OCT-21
Zinc (Zn)-Total			106.8		%		80-120	11-OCT-21
WG3633001-1 MB								
Aluminum (Al)-Total			<0.000079		mg/dm2.day		0.000079	11-OCT-21
Antimony (Sb)-Total			<0.0000026		mg/dm2.day		0.0000026	11-OCT-21
Arsenic (As)-Total			<0.0000026		mg/dm2.day		0.0000026	11-OCT-21
Barium (Ba)-Total			<0.0000013		mg/dm2.day		0.0000013	11-OCT-21
Beryllium (Be)-Total			<0.000013		mg/dm2.day		0.000013	11-OCT-21
Bismuth (Bi)-Total			<0.000013		mg/dm2.day		0.000013	11-OCT-21
Boron (B)-Total			<0.00026		mg/dm2.day		0.00026	11-OCT-21
Cadmium (Cd)-Total			<0.0000013		mg/dm2.day		0.0000013	11-OCT-21
Calcium (Ca)-Total			<0.00052		mg/dm2.day		0.00052	11-OCT-21
Chromium (Cr)-Total			<0.000013		mg/dm2.day		0.000013	11-OCT-21
Cobalt (Co)-Total			<0.0000026		mg/dm2.day		0.0000026	11-OCT-21
Copper (Cu)-Total			0.000020	MB-LOR	mg/dm2.day		0.000013	11-OCT-21
Lead (Pb)-Total			<0.0000013		mg/dm2.day		0.0000013	11-OCT-21
Iron (Fe)-Total			<0.00079		mg/dm2.day		0.00079	11-OCT-21
Lithium (Li)-Total			<0.00013		mg/dm2.day		0.00013	11-OCT-21
Magnesium (Mg)-Total			<0.00013		mg/dm2.day		0.00013	11-OCT-21
Manganese (Mn)-Total			0.0000030	B	mg/dm2.day		0.0000026	11-OCT-21
Molybdenum (Mo)-Total			<0.0000013		mg/dm2.day		0.0000013	11-OCT-21
Nickel (Ni)-Total			<0.000013		mg/dm2.day		0.000013	11-OCT-21
Phosphorus (P)-Total			<0.0013		mg/dm2.day		0.0013	11-OCT-21
Potassium (K)-Total			<0.0013		mg/dm2.day		0.0013	11-OCT-21
Selenium (Se)-Total			<0.000026		mg/dm2.day		0.000026	11-OCT-21
Silicon (Si)-Total			<0.0013		mg/dm2.day		0.0013	11-OCT-21
Silver (Ag)-Total			<0.0000002		mg/dm2.day		0.00000026	11-OCT-21
Sodium (Na)-Total			<0.0013		mg/dm2.day		0.0013	11-OCT-21
Strontium (Sr)-Total			<0.0000026		mg/dm2.day		0.0000026	11-OCT-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5617473								
WG3633001-1 MB								
Thallium (Tl)-Total			<0.0000026		mg/dm2.day		0.0000026	11-OCT-21
Tin (Sn)-Total			<0.0000026		mg/dm2.day		0.0000026	11-OCT-21
Titanium (Ti)-Total			<0.00026		mg/dm2.day		0.00026	11-OCT-21
Uranium (U)-Total			<0.0000002		mg/dm2.day		0.00000026	11-OCT-21
Vanadium (V)-Total			<0.000026		mg/dm2.day		0.000026	11-OCT-21
Zinc (Zn)-Total			<0.000079		mg/dm2.day		0.000079	11-OCT-21

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2643294-COFC

COC Number: 17 - 866339

Page of

Report To	Contact and company name below will appear on the final report
Company:	Denison Mines Corp.
Contact:	Jenn Skilnick
Phone:	306 - 281 - 8305
	Company address below will appear on the final report
Street:	230 22nd St East, Suite 200
City/Province:	Saskatoon, SK
Postal Code:	S7K 0E9
Invoice To	Same as Report To [✓] YES [ ] NO
	Copy of Invoice with Report [✓] YES [ ] NO
Company:	Denison Mines Corp
Contact:	Dana Harris

Report Format / Distribution

Select Report Format: [✓] PDF [✓] EXCEL [ ] EDD (DIGITAL)

Quality Control (QC) Report with Report [ ] YES [ ] NO

[ ] Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: [✓] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax jskilnick@denisonmines.com

Email 2

Email 3

Invoice Distribution

Select Invoice Distribution: [✓] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax payables.saskatoon@denisonmines.com

Email 2 dharris@denisonmines.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] [✓] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	[ ]	1 Business day [E - 100%]	[ ]
3 day [P3-25%]	[ ]	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	[ ]
2 day [P2-50%]	[ ]		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q 84693

Job #:

PO / AFE: WRE-E0221097

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler: J. Skilnick

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Total/+Fix Vol	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	DF-01A Aug 17/21 @ 1450 (start date/time)	21-09-21	10:45	dustfall	1	✓		
	DF-01B Aug 17/21 @ 14:50	21-09-21	10:45		1	✓		
	DF-02A Aug 17/21 @ 13:20	21-09-21	11:55		1	✓		
	DF-02B Aug 17/21 @ 13:20	21-09-21	11:55		1	✓		
	DF-03A Aug 17/21 @ 14:20	21-09-21	9:30		1	✓		
	DF-03B Aug 17/21 @ 14:20	21-09-21	9:30		1	✓		
	DF-04A Aug 17/21 @ 10:30	22-09-21	11:25		1	✓		
	DF-04B Aug 17/21 @ 10:30	22-09-21	11:25		1	✓		
	DF-05A Aug 17/21 @ 10:00	22-09-21	10:55		1	✓		
	DF-05B Aug 17/21 @ 10:00	22-09-21	10:55		1	✓		
	DF-06A Aug 17/21 @ 9:00	22-09-21	8:25		1	✓		
	DF-06B Aug 17/21 @ 9:00	22-09-21	8:25		1	✓		

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [✓] NO

Are samples for human consumption/ use? [ ] YES [✓] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
5.6	

SHIPMENT RELEASE (client use)

Released by: J. Skilnick Date: Time:

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: Date: 27-9-21 Time: 150

FINAL SHIPMENT RECEPTION (lab use only)

Received by: Date: 23 Sep 21 Time: 9:10

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Denison Mines Corp.
ATTN: Jennifer Skilnick
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

Date Received: 25-OCT-21
Report Date: 09-NOV-21 14:55 (MT)
Version: FINAL

Client Phone: 306-652-8201

Certificate of Analysis

Lab Work Order #: L2655042
Project P.O. #: WRE-E0221091
Job Reference:
C of C Numbers:
Legal Site Desc:

Brian Morgan, B.Sc. Hons.
Client Services Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-1 DF-01A 21-SEP-21 @1045							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:35							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	1.88		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.22		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	1.66		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.00209		0.0000511	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000017		0.0000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000017		0.0000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000496		0.00000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000084		0.0000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000084		0.0000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00017		0.00017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000084		0.00000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.0107		0.00034	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000084		0.0000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000017		0.0000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000790		0.0000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000286		0.00000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00255		0.00051	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000084		0.000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00333		0.000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.000161		0.0000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000084		0.00000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000084		0.0000084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00165		0.00084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00262		0.00084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000017		0.000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00473		0.00084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000051	DLB	0.00000051	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00279		0.00084	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000277		0.0000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000017		0.0000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000017		0.0000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00017		0.00017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	0.00000022		0.00000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000017		0.000017	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000051		0.000051	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-2 DF-01B 21-SEP-21 @1045							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:35							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.18		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.11		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	<0.10		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-2 DF-01B 21-SEP-21 @1045							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:35							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.00164		0.0000421	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	0.0000016		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000420		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.0103		0.00028	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000182		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00196		0.00042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000070		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00325		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.000147		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00133		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00259		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00343		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000028	DLB	0.00000028	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00247		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000282		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	0.00000014		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000042		0.000042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-3 DF-02A 21-SEP-21 @1155							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:00							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.45		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.12		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.32		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.00124		0.0000421	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000497		0.0000007	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-3 DF-02A 21-SEP-21 @1155							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:00							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Beryllium (Be)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.0157		0.00028	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000132		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000149		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00150		0.00042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000070		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00421		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.000249		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00772		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00629		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00277		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000028	DLB	0.00000028	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00295		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.000111		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	<0.00000014		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	0.000067		0.000042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-4 DF-02B 21-SEP-21 @1155							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:00							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.30		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.15		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.16		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.00116		0.000038	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval			1	days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000380		0.00000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000064		0.0000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000064		0.0000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00013		0.00013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000064		0.0000006	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-4 DF-02B 21-SEP-21 @1155							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:00							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Calcium (Ca)-Total	0.0140		0.00026	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000064		0.0000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000267		0.0000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000272		0.00000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00144		0.00038	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000064		0.000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00389		0.000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.000111		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000064		0.00000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000064		0.0000064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00604		0.00064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00491		0.00064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000013		0.000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00308		0.00064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000026	DLB	0.00000026	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00267		0.00064	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000728		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00013		0.00013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	<0.00000013		0.00000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000013		0.000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	0.000041		0.000038	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-5 DF-03A 21-SEP-21 @930							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:15							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.34		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.13		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.21		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000840		0.000047	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval			1	days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000386		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00016		0.00016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000079		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.0166		0.00031	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000098		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-5 DF-03A 21-SEP-21 @930							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:15							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Lead (Pb)-Total	0.00000146		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00113		0.00047	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000079		0.000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00453		0.000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.000107		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000079		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.0107		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00756		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000016		0.000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00165		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000031	DLB	0.00000031	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00383		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.000127		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00016		0.00016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	<0.00000016		0.00000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000016		0.000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000047		0.000047	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-6 DF-03B 21-SEP-21 @930							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:15							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.46		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.13		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.33		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000802		0.0000441	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000428		0.00000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000073		0.0000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000073		0.0000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00015		0.00015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000073		0.00000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.0188		0.00029	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000073		0.0000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000101		0.0000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000112		0.00000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00101		0.00044	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000073		0.000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00521		0.000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-6 DF-03B 21-SEP-21 @930							
Sampled By: J. Skilnick on 22-OCT-21 @ 08:15							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Manganese (Mn)-Total	0.0000926		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000073		0.00000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000073		0.0000073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.0159		0.00073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.0107		0.00073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000015		0.000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00194		0.00073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000015		0.00000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00487		0.00073	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.000199		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00015		0.00015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	<0.00000015		0.00000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000015		0.000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000044		0.000044	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-7 DF-04A 21-SEP-21 @1125							
Sampled By: J. Skilnick on 22-OCT-21 @ 13:35							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.25		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.12		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.13		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.00140		0.0000421	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000335		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.00992		0.00028	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000073		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000164		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00163		0.00042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000070		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00304		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.0000999		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00383		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-7 DF-04A 21-SEP-21 @1125							
Sampled By: J. Skilnick on 22-OCT-21 @ 13:35							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Potassium (K)-Total	0.00431		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00390		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000014		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00225		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000376		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	0.00000145		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000042		0.000042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-8 DF-04B 21-SEP-21 @1125							
Sampled By: J. Skilnick on 22-OCT-21 @ 13:35							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.23		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	<0.10		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.16		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000855		0.000045	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval			1	days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000357		0.00000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000076		0.0000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000076		0.0000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00015		0.00015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000076		0.00000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.00972		0.00030	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000076		0.0000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	<0.0000076		0.0000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000115		0.00000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00095		0.00045	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000076		0.000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00284		0.000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.0000766		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000076		0.00000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000076		0.0000076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00367		0.00076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00337		0.00076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000015		0.000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00191		0.00076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000015		0.00000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-8 DF-04B 21-SEP-21 @1125							
Sampled By: J. Skilnick on 22-OCT-21 @ 13:35							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Sodium (Na)-Total	0.00212		0.00076	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000307		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000015		0.0000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00015		0.00015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	0.00000030		0.00000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000015		0.000015	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000045		0.000045	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-9 DF-05A 21-SEP-21 @1055							
Sampled By: J. Skilnick on 22-OCT-21 @ 13:15							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.50		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.11		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.39		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.00114		0.0000471	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000350		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00016		0.00016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000079		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.0146		0.00031	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000185		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000137		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00127		0.00047	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000079		0.000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00468		0.000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.000106		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	0.0000110		0.00000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000079		0.0000079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.0129		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.0117		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000016		0.000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00253		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000016		0.00000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00452		0.00079	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.000104		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000016		0.0000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00016		0.00016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-9 DF-05A 21-SEP-21 @1055							
Sampled By: J. Skilnick on 22-OCT-21 @ 13:15							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Uranium (U)-Total	<0.00000016		0.00000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000016		0.000016	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000047		0.000047	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-10 DF-05B 21-SEP-21 @1055							
Sampled By: J. Skilnick on 22-OCT-21 @ 13:15							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.31		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	0.11		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.20		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000842		0.0000421	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000386		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.0116		0.00028	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000224		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000159		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00098		0.00042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000070		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00374		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.000134		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00727		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00792		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00188		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000014		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00409		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000494		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	<0.00000014		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	0.000046		0.000042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-11 DF-06A 21-SEP-21 @825							
Sampled By: J. Skilnick on 22-OCT-21 @ 10:05							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.21		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	<0.10		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.12		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000904		0.0000401	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000478		0.00000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000067		0.0000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000067		0.0000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00013		0.00013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000067		0.00000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.00898		0.00027	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000067		0.0000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	0.0000067		0.0000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000130		0.00000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00126		0.00040	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000067		0.000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00274		0.000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.0000886		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000067		0.00000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000067		0.0000067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00314		0.00067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00359		0.00067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000013		0.000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00213		0.00067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000013		0.00000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00243		0.00067	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000219		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000013		0.0000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00013		0.00013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	0.00000015		0.00000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000013		0.000013	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000040		0.000040	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
L2655042-12 DF-06B 21-SEP-21 @825							
Sampled By: J. Skilnick on 22-OCT-21 @ 10:05							
Matrix: Dustfall							
Dustfalls Total+Fixed & Vol (mg/dm2.day)							
Total Dustfall	0.16		0.10	mg/dm2.day		02-NOV-21	R5636015
Fixed Dustfall	<0.10		0.10	mg/dm2.day		02-NOV-21	R5636015
Volatile Dustfall	0.12		0.10	mg/dm2.day		02-NOV-21	R5636015
Total Metals in Dustfalls by ICPMS							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2655042-12 DF-06B 21-SEP-21 @825							
Sampled By: J. Skilnick on 22-OCT-21 @ 10:05							
Matrix: Dustfall							
Total Metals in Dustfalls by ICPMS							
Aluminum (Al)-Total	0.000691		0.0000421	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Interval				days		02-NOV-21	R5634144
Antimony (Sb)-Total	0.0000021		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Arsenic (As)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Barium (Ba)-Total	0.0000286		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Beryllium (Be)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Bismuth (Bi)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Boron (B)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cadmium (Cd)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Calcium (Ca)-Total	0.00868		0.00028	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Chromium (Cr)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Cobalt (Co)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Copper (Cu)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lead (Pb)-Total	0.00000108		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Iron (Fe)-Total	0.00090		0.00042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Lithium (Li)-Total	<0.000070		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Magnesium (Mg)-Total	0.00268		0.000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Manganese (Mn)-Total	0.0000747		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Molybdenum (Mo)-Total	<0.00000070		0.00000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Nickel (Ni)-Total	<0.0000070		0.0000070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Phosphorus (P)-Total	0.00297		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Potassium (K)-Total	0.00372		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Selenium (Se)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silicon (Si)-Total	0.00159		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Silver (Ag)-Total	<0.00000014		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Sodium (Na)-Total	0.00228		0.00070	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Strontium (Sr)-Total	0.0000212		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Thallium (Tl)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Tin (Sn)-Total	<0.0000014		0.0000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Titanium (Ti)-Total	<0.00014		0.00014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Uranium (U)-Total	<0.00000014		0.00000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Vanadium (V)-Total	<0.000014		0.000014	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335
Zinc (Zn)-Total	<0.000042		0.000042	mg/dm2.day	02-NOV-21	02-NOV-21	R5638335

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-T.DM2-VA	Dustfall	Dustfalls Total+Fixed & Vol (mg/dm2.day)	BCMOE DUSTFALLS

Dustfall analysis is carried out in accordance with procedures published by the B.C. Ministry of Environment Laboratory.

MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2655042 Report Date: 09-NOV-21

Client: Denison Mines Corp.
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

Contact: Jennifer Skilnick

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
DUSTFALLS-T.DM2-VA	**Dustfall**							
Batch R5636015								
WG3650506-2 LCS								
Total Dustfall			100.6		%		85-115	02-NOV-21
Fixed Dustfall			106.0		%		85-115	02-NOV-21
Volatile Dustfall			90.9		%		85-115	02-NOV-21
WG3650506-1 MB								
Total Dustfall			<0.10		mg/dm2.day		0.1	02-NOV-21
Fixed Dustfall			<0.10		mg/dm2.day		0.1	02-NOV-21
Volatile Dustfall			<0.10		mg/dm2.day		0.1	02-NOV-21
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5638335								
WG3650068-3 DUP		**L2655042-1**						
Aluminum (Al)-Total		0.00209	0.00226		mg/dm2.day	8.0	20	02-NOV-21
Antimony (Sb)-Total		<0.0000017	<0.0000017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Arsenic (As)-Total		<0.0000017	0.0000018	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Barium (Ba)-Total		0.0000496	0.0000490		mg/dm2.day	1.1	20	02-NOV-21
Beryllium (Be)-Total		<0.0000084	<0.0000084	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Bismuth (Bi)-Total		<0.0000084	<0.0000084	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Boron (B)-Total		<0.00017	<0.00017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Cadmium (Cd)-Total		<0.00000084	<0.0000008	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Calcium (Ca)-Total		0.0107	0.0108		mg/dm2.day	0.7	20	02-NOV-21
Chromium (Cr)-Total		<0.0000084	<0.0000084	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Cobalt (Co)-Total		<0.0000017	<0.0000017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Copper (Cu)-Total		0.0000790	0.0000113	DUP-H	mg/dm2.day	0.000067	0.0000168	02-NOV-21
Lead (Pb)-Total		0.00000286	0.00000278		mg/dm2.day	3.0	20	02-NOV-21
Iron (Fe)-Total		0.00255	0.00265		mg/dm2.day	3.9	20	02-NOV-21
Lithium (Li)-Total		<0.000084	<0.000084	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Magnesium (Mg)-Total		0.00333	0.00322		mg/dm2.day	3.4	20	02-NOV-21
Manganese (Mn)-Total		0.000161	0.000163		mg/dm2.day	1.2	20	02-NOV-21
Molybdenum (Mo)-Total		<0.00000084	<0.0000008	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Nickel (Ni)-Total		<0.0000084	<0.0000084	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Phosphorus (P)-Total		0.00165	0.00185		mg/dm2.day	12	20	02-NOV-21
Potassium (K)-Total		0.00262	0.00247		mg/dm2.day	5.9	20	02-NOV-21
Selenium (Se)-Total		<0.000017	<0.000017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Silicon (Si)-Total		0.00473	0.00504		mg/dm2.day	6.4	20	02-NOV-21
Silver (Ag)-Total		<0.00000051	<0.0000005	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5638335								
WG3650068-3 DUP		**L2655042-1**						
Sodium (Na)-Total		0.00279	0.00264		mg/dm2.day	5.6	20	02-NOV-21
Strontium (Sr)-Total		0.0000277	0.0000267		mg/dm2.day	3.8	20	02-NOV-21
Thallium (Tl)-Total		<0.0000017	<0.0000017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Tin (Sn)-Total		<0.0000017	<0.0000017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Titanium (Ti)-Total		<0.00017	<0.00017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Uranium (U)-Total		0.00000022	0.00000021		mg/dm2.day	6.4	20	02-NOV-21
Vanadium (V)-Total		<0.000017	<0.000017	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
Zinc (Zn)-Total		<0.000051	<0.000051	RPD-NA	mg/dm2.day	N/A	20	02-NOV-21
WG3650068-2 LCS								
Aluminum (Al)-Total			105.5		%		80-120	02-NOV-21
Antimony (Sb)-Total			109.7		%		80-120	02-NOV-21
Arsenic (As)-Total			102.5		%		80-120	02-NOV-21
Barium (Ba)-Total			105.4		%		80-120	02-NOV-21
Beryllium (Be)-Total			103.7		%		80-120	02-NOV-21
Bismuth (Bi)-Total			103.4		%		80-120	02-NOV-21
Boron (B)-Total			96.2		%		80-120	02-NOV-21
Cadmium (Cd)-Total			102.8		%		80-120	02-NOV-21
Calcium (Ca)-Total			105.9		%		80-120	02-NOV-21
Chromium (Cr)-Total			103.0		%		80-120	02-NOV-21
Cobalt (Co)-Total			101.3		%		80-120	02-NOV-21
Copper (Cu)-Total			100.2		%		80-120	02-NOV-21
Lead (Pb)-Total			101.4		%		80-120	02-NOV-21
Iron (Fe)-Total			106.5		%		80-120	02-NOV-21
Lithium (Li)-Total			107.1		%		80-120	02-NOV-21
Magnesium (Mg)-Total			100.7		%		80-120	02-NOV-21
Manganese (Mn)-Total			99.2		%		80-120	02-NOV-21
Molybdenum (Mo)-Total			103.7		%		80-120	02-NOV-21
Nickel (Ni)-Total			101.6		%		80-120	02-NOV-21
Phosphorus (P)-Total			92.0		%		80-120	02-NOV-21
Potassium (K)-Total			102.2		%		80-120	02-NOV-21
Selenium (Se)-Total			110.1		%		80-120	02-NOV-21
Silicon (Si)-Total			106.8		%		80-120	02-NOV-21
Silver (Ag)-Total			92.8		%		80-120	02-NOV-21
Sodium (Na)-Total			102.9		%		80-120	02-NOV-21

Quality Control Report

Workorder: L2655042 Report Date: 09-NOV-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5638335								
WG3650068-2 LCS								
Strontium (Sr)-Total			103.4		%		80-120	02-NOV-21
Thallium (Tl)-Total			101.1		%		80-120	02-NOV-21
Tin (Sn)-Total			102.6		%		80-120	02-NOV-21
Titanium (Ti)-Total			91.5		%		80-120	02-NOV-21
Uranium (U)-Total			103.1		%		80-120	02-NOV-21
Vanadium (V)-Total			105.3		%		80-120	02-NOV-21
Zinc (Zn)-Total			102.4		%		80-120	02-NOV-21
WG3650068-1 MB								
Aluminum (Al)-Total			<0.000079		mg/dm2.day		0.000079	02-NOV-21
Antimony (Sb)-Total			<0.0000026		mg/dm2.day		0.0000026	02-NOV-21
Arsenic (As)-Total			<0.0000026		mg/dm2.day		0.0000026	02-NOV-21
Barium (Ba)-Total			<0.0000013		mg/dm2.day		0.0000013	02-NOV-21
Beryllium (Be)-Total			<0.000013		mg/dm2.day		0.000013	02-NOV-21
Bismuth (Bi)-Total			<0.000013		mg/dm2.day		0.000013	02-NOV-21
Boron (B)-Total			<0.00026		mg/dm2.day		0.00026	02-NOV-21
Cadmium (Cd)-Total			<0.0000013		mg/dm2.day		0.0000013	02-NOV-21
Calcium (Ca)-Total			<0.00052		mg/dm2.day		0.00052	02-NOV-21
Chromium (Cr)-Total			<0.000013		mg/dm2.day		0.000013	02-NOV-21
Cobalt (Co)-Total			<0.0000026		mg/dm2.day		0.0000026	02-NOV-21
Copper (Cu)-Total			<0.000013		mg/dm2.day		0.000013	02-NOV-21
Lead (Pb)-Total			<0.0000013		mg/dm2.day		0.0000013	02-NOV-21
Iron (Fe)-Total			<0.00079		mg/dm2.day		0.00079	02-NOV-21
Lithium (Li)-Total			<0.00013		mg/dm2.day		0.00013	02-NOV-21
Magnesium (Mg)-Total			<0.00013		mg/dm2.day		0.00013	02-NOV-21
Manganese (Mn)-Total			<0.0000026		mg/dm2.day		0.0000026	02-NOV-21
Molybdenum (Mo)-Total			<0.0000013		mg/dm2.day		0.0000013	02-NOV-21
Nickel (Ni)-Total			<0.000013		mg/dm2.day		0.000013	02-NOV-21
Phosphorus (P)-Total			<0.0013		mg/dm2.day		0.0013	02-NOV-21
Potassium (K)-Total			<0.0013		mg/dm2.day		0.0013	02-NOV-21
Selenium (Se)-Total			<0.000026		mg/dm2.day		0.000026	02-NOV-21
Silicon (Si)-Total			<0.0013		mg/dm2.day		0.0013	02-NOV-21
Silver (Ag)-Total			0.00000063	MB-LOR	mg/dm2.day		0.00000026	02-NOV-21
Sodium (Na)-Total			<0.0013		mg/dm2.day		0.0013	02-NOV-21
Strontium (Sr)-Total			<0.0000026		mg/dm2.day		0.0000026	02-NOV-21

Quality Control Report

Workorder: L2655042 Report Date: 09-NOV-21

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DUST(DM2)-MS-VA	**Dustfall**							
Batch R5638335								
WG3650068-1 MB								
Thallium (Tl)-Total			<0.0000026		mg/dm2.day		0.0000026	02-NOV-21
Tin (Sn)-Total			<0.0000026		mg/dm2.day		0.0000026	02-NOV-21
Titanium (Ti)-Total			<0.00026		mg/dm2.day		0.00026	02-NOV-21
Uranium (U)-Total			<0.0000002		mg/dm2.day		0.00000026	02-NOV-21
Vanadium (V)-Total			<0.000026		mg/dm2.day		0.000026	02-NOV-21
Zinc (Zn)-Total			<0.000079		mg/dm2.day		0.000079	02-NOV-21

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L2655042-COFC

COC Number: 17 - 866338

Page of

Report To	Contact and company name below will appear on the final report
Company:	Denison Mines Corp.
Contact:	Jennifer Skilnick
Phone:	306-281-8305
	Company address below will appear on the final report
Street:	230 22nd St. East, Suite 200
City/Province:	Saskatoon, SK
Postal Code:	S7K 0E9
Invoice To	Same as Report To [✓] YES [ ] NO
	Copy of Invoice with Report [✓] YES [ ] NO
Company:	Denison Mines Corp.
Contact:	Dana Harris

Report Format / Distribution

Select Report Format: [✓] PDF [✓] EXCEL [ ] EDD (DIGITAL)

Quality Control (QC) Report with Report [ ] YES [ ] NO

[ ] Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: [✓] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax jskilnick@denisonmines.com

Email 2 jswitzer@denisonmines.com

Email 3

Invoice Distribution

Select Invoice Distribution: [✓] EMAIL [ ] MAIL [ ] FAX

Email 1 or Fax payables.saskatoon@denisonmines.com

Email 2 dharris@denisonmines.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] [✓] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	[ ]	1 Business day [E - 100%]	[ ]
3 day [P3-25%]	[ ]	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	[ ]
2 day [P2-50%]	[ ]		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q84693

Job #:

PO / AFE: WRE-E0221091

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#

Major/Minor Code: Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler: J. SKILNICK

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Total+Fixed & Vol	Total metals	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	DF-01A 21-Sept-21 @ 1045	22-Oct-21	8:35	dustfall	1	✓	✓		
	DF-01B 21-Sept-21 @ 1045	22-Oct-21	8:35		1	✓	✓		
	DF-02A 21-Sept-21 @ 1155	22-Oct-21	8:00		1	✓	✓		
	DF-02B 21-Sept-21 @ 1155	22-Oct-21	8:00		1	✓	✓		
	DF-03A 21-Sept-21 @ 930	22-Oct-21	8:15		1	✓	✓		
	DF-03B 21-Sept-21 @ 930	22-Oct-21	8:15		1	✓	✓		
	DF-04A 21-Sept-21 @ 1125	22-Oct-21	~~11~~ 13:35		1	✓	✓		
	DF-04B 21-Sept-21 @ 1125	22-Oct-21	13:35		1	✓	✓		
	DF-05A 21-Sept-21 @ 1055	22-Oct-21	13:15		1	✓	✓		
	DF-05B 21-Sept-21 @ 1055	22-Oct-21	13:15		1	✓	✓		
	DF-06A 21-Sept-21 @ 825	22-Oct-21	10:05		1	✓	✓		
	DF-06B 21-Sept-21 @ 825	22-Oct-21	10:05		1	✓	✓		

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [✓] NO

Are samples for human consumption/ use? [ ] YES [✓] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [ ] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
12.6°C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by: LWH	Date: 25 Oct 21	Time: 10:14	Received by: JSH	Date: 25 Oct 21	Time: 10:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Denison Mines Corp.

BV Labs Job Number: C062979
Report Date: 2020/09/09

Client Project #: DENISON MINES
Site Location: Denison Mines
Your P.O. #: WRE_E0220051
Sampler Initials: ME

RESULTS OF CHEMICAL ANALYSES OF AIR

BV Labs ID		YJ4049	YJ4050	YJ4051	YJ4052		
Sampling Date		2020-07-25 20:10	2020-07-25 20:10	2020-08-03 16:15	2020-08-03 16:15		
	UNITS	**PC-01A**	**PC-01B**	**PC-02A**	**PC-02B**	**RDL**	**QC Batch**
Passive Monitoring							
Calculated NO2	ppb	<0.1	<0.1	<0.1	<0.1	0.1	9985531
Calculated SO2	ppb	0.1	0.1	<0.1	<0.1	0.1	9985149

RDL = Reportable Detection Limit

Results relate only to the items tested.

GENERAL COMMENTS

Results relate only to the items tested.

Report Date: 2020/09/09

Denison Mines Corp.
Attention: DANA HARRIS
Client Project #: DENISON MINES
Your P.O. #:WRE_E0220051
Site Location: Denison Mines

Quality Assurance Report
BV Labs Job Number: C062979

QA/QC Bat	Init	QC Type	Parameter	Date Analy	Value	Recovery	UNITS	QC Limits
9985149	OZ	Spiked Blank	Calculated SO2			101	%	90 - 110
9985149	OZ	Method Blank	Calculated SO2		<0.1		ppb	
9985531	YL6	Spiked Blank	Calculated NO2			99	%	90 - 110
9985531	YL6	Method Blank	Calculated NO2		<0.1		ppb	

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Denison Mines Corp.

BV Labs Job Number: C074134
Report Date: 2020/10/20

Client Project #: DENISON MINES
Site Location: Denison Mines
Your P.O. #: WRE_E0220075
Sampler Initials: MT

RESULTS OF CHEMICAL ANALYSES OF AIR

BV Labs ID		YP8078	YP8079	YP8080	YP8081		
Sampling Date		2020-08-28 10:45	2020-08-28 10:45	2020-08-28 15:15	2020-08-28 15:15		
	UNITS	**PC-01A**	**PC-01B**	**PC-02A**	**PC-02B**	**RDL**	**QC Batch**
Passive Monitoring							
Calculated NO2	ppb	<0.1	<0.1	<0.1	<0.1	0.1	A044328
Calculated SO2	ppb	DAMAGED	DAMAGED	<0.1	<0.1	0.1	A042191

RDL = Reportable Detection Limit

Results relate only to the items tested.

GENERAL COMMENTS

Sample YP8078 [PC-01A] : SO2 - Notes on COC indicate damage by wildlife during sampling.

Sample YP8079 [PC-01B] : SO2 - Notes on COC indicate damage by wildlife during sampling.

Results relate only to the items tested.

Report Date: 2020/10/20

Denison Mines Corp.
Attention: DANA HARRIS
Client Project #: DENISON MINES
Your P.O. #:WRE_E0220075
Site Location: Denison Mines

Quality Assurance Report
BV Labs Job Number: C074134

QA/QC Bat	Init	QC Type	Parameter	Date Analy	Value	Recovery	UNITS	QC Limits
A042191	OZ	Spiked Blank	Calculated SO2			101	%	90 - 110
A042191	OZ	Method Blank	Calculated SO2		<0.1		ppb	
A044328	YL6	Spiked Blank	Calculated NO2			98	%	90 - 110
A044328	YL6	Method Blank	Calculated NO2		<0.1		ppb	

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Denison Mines Corp.

BV Labs Job Number: C083751
Report Date: 2020/11/24

Client Project #: DENISON MINES
Site Location: Denison Mines
Your P.O. #: WRE_E0220075
Sampler Initials: MT

RESULTS OF CHEMICAL ANALYSES OF AIR

BV Labs ID		YV7760	YV7761	YV7762	YV7763		
Sampling Date		2020-10-02 14:00	2020-10-02 14:00	2020-09-30 15:08	2020-09-30 15:08		
	UNITS	**PC-01A**	**PC-01B**	**PC-02A**	**PC-02B**	**RDL**	**QC Batch**
Passive Monitoring							
Calculated NO2	ppb	<0.1	0.2	<0.1	<0.1	0.1	A090671
Calculated SO2	ppb	0.1	0.2	<0.1	<0.1	0.1	A088698

RDL = Reportable Detection Limit

Results relate only to the items tested.

GENERAL COMMENTS

Results relate only to the items tested.

Report Date: 2020/11/24

Denison Mines Corp.
Attention: DANA HARRIS
Client Project #: DENISON MINES
Your P.O. #:WRE_E0220075
Site Location: Denison Mines

Quality Assurance Report
BV Labs Job Number: C083751

QA/QC Bat	Init	QC Type	Parameter	Date Analy	Value	Recovery	UNITS	QC Limits
A088698	OZ	Spiked Blank	Calculated SO2			103	%	90 - 110
A088698	OZ	Method Blank	Calculated SO2		<0.1		ppb	
A090671	YL6	Spiked Blank	Calculated NO2			97	%	90 - 110
A090671	YL6	Method Blank	Calculated NO2		<0.1		ppb	

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Your P.O. #: WRE_E0221096
Your Project #: DENISON MINES
Site#: 2021/08/17 - 2021/09/22
Site Location: Denison Mines

Attention: DANA HARRIS

Denison Mines Corp.
SASKATOON SK
230 22 St E
Saskatoon, SK
CANADA S7K 0E9

Report Date: 2021/10/06
Report #: R3081301
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C172584
Received: 2021/09/28, 11:59

Sample Matrix: Air
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
NO2 Passive Analysis	4	2021/10/04	2021/10/06	PTC SOP-00148	Passive NO2 in ATM
SO2 Passive Analysis	4	2021/09/28	2021/10/06	PTC SOP-00149	Passive SO2 in ATM

This report shall not be reproduced except in full, without the written approval of the laboratory.
Results relate only to the items tested.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Levi Manchak, Project Manager SR
Email: Levi.MANCHAK@bureauveritas.com
Phone# (780)378-8542
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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BV Labs Job #: C172584
Report Date: 2021/10/06

Denison Mines Corp.
Client Project #: DENISON MINES
Site Location: Denison Mines
Your P.O. #: WRE_E0221096
Sampler Initials: JS

RESULTS OF CHEMICAL ANALYSES OF AIR

BV Labs ID		AGX507	AGX508	AGX509	AGX510		
Sampling Date		2021/08/17 14:50	2021/08/17 14:50	2021/08/17 10:00	2021/08/17 10:00		
	UNITS	**PC-01A**	**PC-01B**	**PC-02A**	**PC-02B**	**RDL**	**QC Batch**
Passive Monitoring							
Calculated NO2	ppb	<0.1	<0.1	<0.1	<0.1	0.1	A374536
Calculated SO2	ppb	<0.1	<0.1	<0.1	<0.1	0.1	A368976
RDL = Reportable Detection Limit							

Bureau Veritas Laboratories Edmonton: 6744 - 50th Street T6B 3M9 Telephone (780) 378-8500 Fax (780) 378-8699

BV Labs Job #: C172584
Report Date: 2021/10/06

Denison Mines Corp.
Client Project #: DENISON MINES
Site Location: Denison Mines
Your P.O. #: WRE_E0221096
Sampler Initials: JS

GENERAL COMMENTS

Results relate only to the items tested.

Bureau Veritas Laboratories Edmonton: 6744 - 50th Street T6B 3M9 Telephone (780) 378-8500 Fax (780) 378-8699

BV Labs Job #: C172584
Report Date: 2021/10/06

QUALITY ASSURANCE REPORT

Denison Mines Corp.
Client Project #: DENISON MINES
Site Location: Denison Mines
Your P.O. #: WRE_E0221096
Sampler Initials: JS

			Spiked Blank		Method Blank	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**Value**	**UNITS**
A368976	Calculated SO2		100	90 - 110	<0.1	ppb
A374536	Calculated NO2		107	90 - 110	<0.1	ppb

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Bureau Veritas Laboratories Edmonton: 6744 - 50th Street T6B 3M9 Telephone (780) 378-8500 Fax (780) 378-8699

BV Labs Job #: C172584
Report Date: 2021/10/06

Denison Mines Corp.
Client Project #: DENISON MINES
Site Location: Denison Mines
Your P.O. #: WRE_E0221096
Sampler Initials: JS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Yang Liu

Yang Liu, Analyst II

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CANADA NORTH
ENVIRONMENTAL SERVICES
C/O JOCELYN HOWERY
211 WHEELER STREET
SASKATOON, SK S7P 0A4
Canada

Report Date (YYYY-MM-DD)	2018-12-05
Page	1 of 1
Dosimeter Received	2018-12-03
QC Release	CHA
Analytical Work Order	1833300442

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Technical: (800) 438-3241

Environmental Dosimetry Report

Account : 720925 Subaccount : 1459881 Series: X9

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2018-07-01 to	2018-07-31	Q3	2018			
00000	V03NH	Deploy Control Control not used in assessment.						2018-07	EX00081724M
	V03NH	Control Dose Used	0.409						
00002	V03NH	AREA MONITOR 2	0.411	0.003				2018-07	EX00081722Q
Monitoring Period:			2018-10-15 to	2018-11-14	Q4	2018			
00000	V03NH	Deploy Control						2018-07	EX00080674K

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.

- Minimum Detectable Dose - nominally 0.1 mrem (1 μSv), reporting to tenths of a millirem ambient dose equivalent.

- Detection Capabilities:

  Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1 μSv to 10 Sv).

  Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200 μSv to 10 Sv).

Control Dosimeter

A minimum of two control dosimeters are provided per shipment. The first is for field deployment/retrieval used to measure exposure during shipment and placement/collection. The second is for transit used to measure exposure during shipment only. Both control dosimeters assigned to a shipment should accompany that shipment both from and to LANDAUER. Do not use the control dosimeters for any other purpose. Store dosimeters away from radiation when not in use along with the control dosimeter(s) of the same use date.

Dosimetry reports show gross and net dosage. Gross dosage includes the dosage to the controls. LANDAUER's background subtraction protocol is:

1. Subtract the deployment/retrieval control; or if not returned to LANDAUER
2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

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C/O JOCELYN HOWERY
211 WHEELER STREET
SASKATOON, SK S7P 0A4
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Report Date (YYYY-MM-DD)	2019-04-03
Page	1 of 1
Dosimeter Received	2019-04-01
QC Release	LCA
Analytical Work Order	1908800417

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Environmental Dosimetry Report

Account : 720925 Subaccount : 1459881 Series: X9

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2018-10-15 to	2018-11-14	Q4	2018			
	V03NH	Average Control Dose	0.34						
00003	V03NH	AREA MONITOR 3	0.234	-0.106				2018-10	EX00080847D
00004	V03NH	AREA MONITOR 4	0.257	-0.084				2018-10	EX00080848B
Monitoring Period:			2019-01-15 to	2020-01-14	Q1	2019			
00000	V03NH	Deploy Control						2018-07	EX00080712S

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.

- Minimum Detectable Dose - nominally 0.1 mrem (1 μSv), reporting to tenths of a millirem ambient dose equivalent.

- Detection Capabilities:

  Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1 μSv to 10 Sv).

  Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200 μSv to 10 Sv).

Control Dosimeter

A minimum of two control dosimeters are provided per shipment. The first is for field deployment/retrieval used to measure exposure during shipment and placement/collection. The second is for transit used to measure exposure during shipment only. Both control dosimeters assigned to a shipment should accompany that shipment both from and to LANDAUER. Do not use the control dosimeters for any other purpose. Store dosimeters away from radiation when not in use along with the control dosimeter(s) of the same use date.

Dosimetry reports show gross and net dosage. Gross dosage includes the dosage to the controls. LANDAUER's background subtraction protocol is:

1. Subtract the deployment/retrieval control; or if not returned to LANDAUER
2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

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Report Date (YYYY-MM-DD)	2019-08-29
Page	1 of 1
Dosimeter Received	2019-08-28
QC Release	CHA
Analytical Work Order	1923900004

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Technical: (800) 438-3241

Environmental Dosimetry Report

Account : 720925 Subaccount : 1459881 Series: X9

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2019-01-15 to	2020-01-14	Q1	2019			
	V03NH	Average Control Dose	0.46						
00005	V03NH	AREA MONITOR 5	0.357	-0.107				2019-01	EX00080713Q
00006	V03NH	AREA MONITOR 6	0.37	-0.094				2019-01	EX00080676G

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.

- Minimum Detectable Dose - nominally 0.1 mrem (1 μSv), reporting to tenths of a millirem ambient dose equivalent.

- Detection Capabilities:

  Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1 μSv to 10 Sv).

  Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200 μSv to 10 Sv).

Control Dosimeter

A minimum of two control dosimeters are provided per shipment. The first is for field deployment/retrieval used to measure exposure during shipment and placement/collection. The second is for transit used to measure exposure during shipment only. Both control dosimeters assigned to a shipment should accompany that shipment both from and to LANDAUER. Do not use the control dosimeters for any other purpose. Store dosimeters away from radiation when not in use along with the control dosimeter(s) of the same use date.

Dosimetry reports show gross and net dosage. Gross dosage includes the dosage to the controls. LANDAUER's background subtraction protocol is:

1. Subtract the deployment/retrieval control; or if not returned to LANDAUER
2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

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Report Date (YYYY-MM-DD)	2019-11-20
Page	1 of 1
Dosimeter Received	2019-11-11
QC Release	CHA
Analytical Work Order	1931200165

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Technical: (800) 438-3241

Environmental Dosimetry Report

Account : 720925

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2019-08-25 to	2020-08-24	Q3	2019			
00000	V03NH	Transit Control						2018-07	EX00020427Z

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.

- Minimum Detectable Dose - nominally 0.1 mrem (1 μSv), reporting to tenths of a millirem ambient dose equivalent.

- Detection Capabilities:

  Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1 μSv to 10 Sv).

  Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200 μSv to 10 Sv).

Control Dosimeter

A minimum of two control dosimeters are provided per shipment. The first is for field deployment/retrieval used to measure exposure during shipment and placement/collection. The second is for transit used to measure exposure during shipment only. Both control dosimeters assigned to a shipment should accompany that shipment both from and to LANDAUER. Do not use the control dosimeters for any other purpose. Store dosimeters away from radiation when not in use along with the control dosimeter(s) of the same use date.

Dosimetry reports show gross and net dosage. Gross dosage includes the dosage to the controls. LANDAUER's background subtraction protocol is:

1. Subtract the deployment/retrieval control; or if not returned to LANDAUER
2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

LANDAUER, Inc.
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Technical: (800) 438-3241

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ENVIRONMENTAL SERVICES
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SASKATOON, SK S7P 0A4
Canada

Report Date (YYYY-MM-DD)	2019-12-04
Page	1 of 1
Dosimeter Received	2019-11-21
QC Release	CHA
Analytical Work Order	1932400045

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Technical: (800) 438-3241

Environmental Dosimetry Report

Account : 720925 Subaccount : 1459881 Series: X9

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2019-06-01 to	2020-05-31	Q2	2019			
00000	V03NH	Deploy Control						2018-07	EX000248102
Monitoring Period:			2019-08-25 to	2020-08-24	Q3	2019			
00003	V03NH	AREA MONITOR 3	0.252	0.008				2018-10	EX00061653R
00004	V03NH	AREA MONITOR 4	0.22	-0.024				2018-10	EX00051359N

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.

- Minimum Detectable Dose - nominally 0.1 mrem (1 μSv), reporting to tenths of a millirem ambient dose equivalent.

- Detection Capabilities:

  Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1 μSv to 10 Sv).

  Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200 μSv to 10 Sv).

Control Dosimeter

A minimum of two control dosimeters are provided per shipment. The first is for field deployment/retrieval used to measure exposure during shipment and placement/collection. The second is for transit used to measure exposure during shipment only. Both control dosimeters assigned to a shipment should accompany that shipment both from and to LANDAUER. Do not use the control dosimeters for any other purpose. Store dosimeters away from radiation when not in use along with the control dosimeter(s) of the same use date.

Dosimetry reports show gross and net dosage. Gross dosage includes the dosage to the controls. LANDAUER's background subtraction protocol is:

1. Subtract the deployment/retrieval control; or if not returned to LANDAUER
2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

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Report Date (YYYY-MM-DD)	2020-06-19
Page	1 of 1
Dosimeter Received	2020-06-17
QC Release	KCO
Analytical Work Order	2016900004

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Technical: (800) 438-3241

Environmental Dosimetry Report

Account : 720925 Subaccount : 1459881 Series: X9

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2019-08-25 to	2020-08-24	Q3	2019			
	V03NH	Average Control Dose	0.62						
00003	V03NH	AREA MONITOR 3	0.457	-0.161				2018-10	EX000005726
00004	V03NH	AREA MONITOR 4	0.464	-0.154				2018-10	EX00081901Q

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.

- Minimum Detectable Dose - nominally 0.1 mrem (1 μSv), reporting to tenths of a millirem ambient dose equivalent.

- Detection Capabilities:

  Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1 μSv to 10 Sv).

  Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200 μSv to 10 Sv).

Control Dosimeter

A minimum of two control dosimeters are provided per shipment. The first is for field deployment/retrieval used to measure exposure during shipment and placement/collection. The second is for transit used to measure exposure during shipment only. Both control dosimeters assigned to a shipment should accompany that shipment both from and to LANDAUER. Do not use the control dosimeters for any other purpose. Store dosimeters away from radiation when not in use along with the control dosimeter(s) of the same use date.

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1. Subtract the deployment/retrieval control; or if not returned to LANDAUER
2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

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Report Date (YYYY-MM-DD)	2020-10-23
Page	1 of 1
Dosimeter Received	2020-10-21
QC Release	CHA
Analytical Work Order	2029500017

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Technical: (800) 438-3241

Environmental Dosimetry Report

Account : 720925

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2020-10-05 to	2021-10-04	Q4	2020			
00000	V03NH	Transit Control						2018-07	EX00086459A

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

Technical Specifications

- Fully meets ANSI N545-1977, NRC Regulatory Guide 4.13, and HPS Draft Standard N13.29 for environmental dosimetry.

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1. Subtract the deployment/retrieval control; or if not returned to LANDAUER
2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

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Report Date (YYYY-MM-DD)	2020-12-01
Page	1 of 1
Dosimeter Received	2020-11-21
QC Release	CHA
Analytical Work Order	2032400198

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Technical: (800) 438-3241

Environmental Dosimetry Report

Account : 720925 Subaccount : 1459881 Series: X9

Location ID Number	Dosimeter Type	Identifier (Client Supplied)	Exposure (Ambient Dose mSv)		Net Cumulative Totals (mSv)			Inception Date (YYYY-MM)	Serial Number
			Gross	Net	Quarter to Date	Year to Date	Permanent		
Monitoring Period:			2020-07-20 to	2021-07-19	Q3	2020			
00000	V03NH	Deploy Control						2018-07	EX00061362Y
	V03NH	Control Dose Used	0.316						
00007	V03NH	AREA MONITOR 7	0.218	-0.098				2020-07	EX00071155V

General Information

The Environmental dosimeter is for both indoor and outdoor use, and is designed to withstand extremes of temperature, humidity, precipitation, and other environmental conditions. InLight dosimeters are built on an assembly of a case component with copper and plastic filters along with a four-positioned aluminum oxide detector slide component. Both the case and slide are uniquely bar coded with serial numbers for chain of custody and sensitivity identification. The InLight dosimeter is sealed within a heavy-duty vinyl tamper resistant pouch that has multiple slots to permit several methods of attachment for easy deployment.

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- Detection Capabilities:

  Photons (x and gamma rays) with energies above 15 keV nominally: 0.1 mrem to 1000 rem (1 μSv to 10 Sv).

  Beta particles with energies greater than approximately 500 keV average energy: 20 mrem to 1000 rem (200 μSv to 10 Sv).

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2. Subtract the transit control.

Environmental Dosimetry Report Information

Location ID Number

Unique number assigned by LANDAUER.

Dosimeter Type

Dosimeter Type	Analytical Sensitivity	Minimum Detectable Dose Level (mrem)
V03NH	High	0.1
V03NN	Standard	5.0
V06NH	High	0.1
V06NN	Standard	5.0

Identifier

Location name supplied by customer.

Exposure Ambient Dose (mrem)

Gross: Gross exposure before control subtraction.
Net: Net exposure after control subtraction.

Net Cumulative Totals (mrem)

Quarter to Date, Year to Date, and Permanent are accumulated net ambient exposure.

Inception Date

The date LANDAUER began keeping dosimeter records for a given dosimeter for a monitoring location on the current account.

Serial Number

Dosimeter serial number.

U.S. Patents

6,316,782; 6,127,685; 5,892,234

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REPORT NUMBER
4645989:1

REPORT DATE
2017-03-02

REPORT PAGE
1 of 3

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2017-02-20**.
They were measured **2017-03-02**.

Test data have been given by Pamela Bennett

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
328087 (10 ± 4 kBqh/m3)

TRANSIT DETECTOR 2:
327474 (11 ± 4 kBqh/m3)

TRANSIT DETECTOR 3:
327581 (15 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
441650-9 [Rapidos®]	*2016-09-25 – 2017-01-25*	*Radon 6A*	*Out-door*	6 ± 3 Bq/m³
996809-0 [Rapidos®]	*2016-09-25 – 2017-01-25*	*Radon 6B*	*Out-door*	< 3 Bq/m³
969893-7 [Rapidos®]	*2016-09-26 – 2017-01-25*	*Radon 7A*	*Out-door*	4 ± 3 Bq/m³
975850-9 [Rapidos®]	*2016-09-26 – 2017-01-25*	*Radon 7B*	*Out-door*	< 3 Bq/m³
642724-9 [Rapidos®]	*2016-09-26 – 2017-01-25*	*Radon 8A*	*Out-door*	3 ± 3 Bq/m³
383553-5 [Rapidos®]	*2016-09-26 – 2017-01-25*	*Radon 8B*		3 ± 2 Bq/m³
334012-2 [Rapidos®]	*2016-09-26 – 2017-01-28*	*Radon 9A*	*Out-door*	3 ± 2 Bq/m³
536455-9 [Rapidos®]	*2016-09-26 – 2017-01-28*	*Radon 9B*	*Out-door*	< 3 Bq/m³
159276-5 [Rapidos®]	*2016-09-27 – 2017-01-25*	*Radon 10A*	*Out-door*	5 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Testing
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REPORT DATE
2017-03-02

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2017-02-20**.
They were measured **2017-03-02**.

Test data have been given by Pamela Bennett

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
373050-4 [Rapidos®]	*2016-09-27 – 2017-01-25*	*Radon 10B*	*Out-door*	3 ± 3 Bq/m³
314919-2 [Rapidos®]	*2016-09-24 – 2017-01-27*	*Radon 1A*	*Out-door*	< 3 Bq/m³
970682-1 [Rapidos®]	*2016-09-24 – 2017-01-27*	*Radon 1B*	*Out-door*	6 ± 2 Bq/m³
575188-8 [Rapidos®]	*2016-09-24 – 2017-01-27*	*Radon 2A*	*Out-door*	< 3 Bq/m³
582429-7 [Rapidos®]	*2016-09-24 – 2017-01-25*	*Radon 3A*	*Out-door*	4 ± 2 Bq/m³
769560-4 [Rapidos®]	*2016-09-24 – 2017-01-25*	*Radon 3B*	*Out-door*	3 ± 3 Bq/m³
548755-8 [Rapidos®]	*2016-09-25 – 2017-01-25*	*Radon 4A*	*Out-door*	3 ± 3 Bq/m³
346551-5 [Rapidos®]	*2016-09-25 – 2017-01-25*	*Radon 4B*	*Out-door*	3 ± 3 Bq/m³
975561-2 [Rapidos®]	*2016-09-26 – 2017-01-28*	*Radon 5A*	*Out-door*	< 3 Bq/m³
748416-5 [Rapidos®]	*2016-09-26 – 2017-01-28*	*Radon 5B*	*Out-door*	< 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Testing
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RADONOVA INC.
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331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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Testing
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REPORT NUMBER
4727897:1

REPORT DATE
2017-06-28

REPORT PAGE
1 of 3

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

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Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2017-06-21**.
They were measured **2017-06-28**.

Test data have been given by David Hamilton

Property data and address

MEASURE SITE ADDRESS
Wheeler River Exploration Camp
Wheel River SK XXX XXX

BUILDING ID

TRANSIT DETECTOR 1:
945606 (0 ± 6 kBqh/m3)

TRANSIT DETECTOR 2:
478136 (0 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
661984 (0 ± 6 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
328723-2 [Rapidos®]	*2017-01-27 – 2017-06-12*	*Radon 1, 473370/6378961*	*Out-door*	5 ± 2 Bq/m³
327210-1 [Rapidos®]	*2017-01-27 – 2017-06-12*	*Radon 1, 473370/6378961*	*Out-door*	< 3 Bq/m³
326445-4 [Rapidos®]	*2017-01-27 – 2017-06-12*	*Radon 2, 474702/6379807*	*Out-door*	< 3 Bq/m³
327356-2 [Rapidos®]	*2017-01-27 – 2017-06-12*	*Radon 2, 474702/6379807*	*Out-door*	< 3 Bq/m³
327338-0 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 3, 474457/6376843*	*Out-door*	4 ± 2 Bq/m³
328610-1 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 3, 474457/6376843*	*Out-door*	3 ± 2 Bq/m³
327658-1 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 4, 474951/6376099*	*Out-door*	3 ± 2 Bq/m³
328231-6 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 4, 474951/6376099*	*Out-door*	< 3 Bq/m³
328355-3 [Rapidos®]	*2017-01-28 – 2017-06-06*	*Radon 5, 476804/6375936*	*Out-door*	3 ± 2 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
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331.814.2200, help@radonova.com

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2017-06-21**.
They were measured **2017-06-28**.

Test data have been given by David Hamilton

Property data and address

MEASURE SITE ADDRESS
Wheeler River Exploration Camp
Wheel River SK XXX XXX

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
327382-8 [Rapidos®]	*2017-01-28 – 2017-06-06*	*Radon 5, 476804/6375936*	*Out-door*	3 ± 2 Bq/m³
326438-9 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 6, 476804/6374922*	*Out-door*	3 ± 2 Bq/m³
327076-6 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 6, 476804/6374922*	*Out-door*	4 ± 2 Bq/m³
328533-5 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 7, 476857/6374255*	*Out-door*	< 3 Bq/m³
327721-7 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 7, 476857/6374255*	*Out-door*	3 ± 2 Bq/m³
327519-5 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 8, 477240/6373284*	*Out-door*	< 3 Bq/m³
327374-5 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 8, 477240/6373284*	*Out-door*	< 3 Bq/m³
326718-4 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 9, 479466/6373139*	*Out-door*	< 3 Bq/m³
327167-3 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 9, 479466/6373139*	*Out-door*	< 3 Bq/m³
326734-1 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 10, 481359/6372277*	*Out-door*	3 ± 2 Bq/m³
326676-4 [Rapidos®]	*2017-01-25 – 2017-06-06*	*Radon 10, 481359/6372277*	*Out-door*	3 ± 2 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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2017-09-21

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2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2017-09-12**.
They were measured **2017-09-18**.

Test data have been given by David Hamilton

Property data and address

MEASURE SITE ADDRESS
Wheeler River Exploration Camp
Wheel River SK XXX XXX

BUILDING ID

TRANSIT DETECTOR 1:
179770 (11 ± 6 kBqh/m3)

TRANSIT DETECTOR 2:
216425 (3 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
259586 (9 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
631010-6 [Rapidos®]	*2017-06-12 – 2017-08-26*	*Radon 1, 473770/6378961*	*Out-door*	7 ± 6 Bq/m³
656823-2 [Rapidos®]	*2017-06-12 – 2017-08-26*	*Radon 1, 473770/6378961*	*Out-door*	< 7 Bq/m³
523339-0 [Rapidos®]	*2017-06-12 – 2017-08-26*	*Radon 2, 474702/6379807*	*Out-door*	< 7 Bq/m³
746692-3 [Rapidos®]	*2017-06-12 – 2017-08-26*	*Radon 2, 474702/6379807*	*Out-door*	< 7 Bq/m³
519145-7 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 3, 474457/6376843*	*Out-door*	< 6 Bq/m³
610676-9 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 3, 474457/6376843*	*Out-door*	< 6 Bq/m³
768462-4 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 4, 474951/6376099*	*Out-door*	< 4 Bq/m³
206806-2 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 4, 474951/6376099*	*Out-door*	< 7 Bq/m³
671098-2 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 5, 476804/6375936*	*Out-door*	< 7 Bq/m³

Comment to the results

Film in detector 505993-6 (Radon 9 - 479466/6373139) was borken/missing and can not be reported.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Pamela Bennett
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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2017-09-12**.
They were measured **2017-09-18**.

Test data have been given by David Hamilton

Property data and address

MEASURE SITE ADDRESS
Wheeler River Exploration Camp
Wheel River SK XXX XXX

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
178627-6 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 5, 476804/6375936*	*Out-door*	< 7 Bq/m³
318816-6 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 6, 474841/6374922*	*Out-door*	< 7 Bq/m³
713115-4 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 6, 474841/6374922*	*Out-door*	< 7 Bq/m³
206854-2 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 7, 476857/6374255*	*Out-door*	< 7 Bq/m³
415406-8 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 7, 476857/6374255*	*Out-door*	< 7 Bq/m³
184216-0 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 8, 477240/6373284*	*Out-door*	< 6 Bq/m³
388350-1 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 8, 477240/6373284*	*Out-door*	< 3 Bq/m³
211128-4 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 9, 479466/6373139*	*Out-door*	< 7 Bq/m³
792116-6 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 10, 481359/6372277*	*Out-door*	< 6 Bq/m³
228364-6 [Rapidos®]	*2017-06-06 – 2017-08-26*	*Radon 10, 481359/6372277*	*Out-door*	< 6 Bq/m³

Comment to the results

Film in detector 505993-6 (Radon 9 - 479466/6373139) was borken/missing and can not be reported.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

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Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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REPORT NUMBER
4736915:1

REPORT DATE
2018-02-05

REPORT PAGE
1 of 3

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2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-01-26**.
They were measured **2018-01-31**.

Test data have been given by DENISON MINES

Property data and address

MEASURE SITE ADDRESS
230 22ND ST
SASKATOON SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
570427 (0 ± 8 kBqh/m3)

TRANSIT DETECTOR 2:
592218 (0 ± 8 kBqh/m3)

TRANSIT DETECTOR 3:
628198 (0 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
597946-3 [Rapidos®]	*2017-08-26 – 2018-01-17*	*473770/6378961, Radon 1*	*Out-door*	3 ± 3 Bq/m³
630266-5 [Rapidos®]	*2017-08-26 – 2018-01-17*	*473770/6378961, Radon 1*	*Out-door*	9 ± 3 Bq/m³
219889-3 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474702/6379807, Radon 2*	*Out-door*	5 ± 3 Bq/m³
251164-0 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474702/6379807, Radon 2*	*Out-door*	5 ± 3 Bq/m³
251160-8 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474457/6376843, Radon 3*	*Out-door*	5 ± 3 Bq/m³
173571-1 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474457/6376843, Radon 3*		3 ± 3 Bq/m³
771018-9 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474951/6376099, Radon 4*	*Out-door*	4 ± 3 Bq/m³
148017-7 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474951/6376099, Radon 4*		3 ± 3 Bq/m³
168902-5 [Rapidos®]	*2017-08-26 – 2018-01-17*	*476804/6375936, Radon 5*	*Out-door*	5 ± 3 Bq/m³

Comment to the results

Detector # 132967-1 on COC, not returned. Detector #965502-8 returned unopened.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT NUMBER
4736915:1

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2018-02-05

REPORT PAGE
2 of 3

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BY
Denison Mines

REPORT RECEIVER(S)

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230 22nd Street East
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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-01-26**.
They were measured **2018-01-31**.

Test data have been given by DENISON MINES

Property data and address

MEASURE SITE ADDRESS
230 22ND ST
SASKATOON SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
233073-6 [Rapidos®]	*2017-08-26 – 2018-01-17*	*476804/6375936, Radon 5*	*Out-door*	10 ± 3 Bq/m³
219678-0 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474841/6374922, Radon 6*	*Out-door*	3 ± 3 Bq/m³
219768-9 [Rapidos®]	*2017-08-26 – 2018-01-17*	*474841/6374922, Radon 6*	*Out-door*	3 ± 3 Bq/m³
330747-7 [Rapidos®]	*2017-08-26 – 2018-01-17*	*476857/6374255, Radon 7*	*Out-door*	4 ± 3 Bq/m³
372417-6 [Rapidos®]	*2017-08-26 – 2018-01-17*	*476857/6374255, Radon 7*	*Out-door*	4 ± 3 Bq/m³
174702-1 [Rapidos®]	*2017-08-26 – 2018-01-17*	*477240/6373284, Radon 8*	*Out-door*	4 ± 3 Bq/m³
564339-0 [Rapidos®]	*2017-08-26 – 2018-01-17*	*477240/6373284, Radon 8*	*Out-door*	5 ± 3 Bq/m³
728740-2 [Rapidos®]	*2017-08-26 – 2018-01-17*	*479466/6373139, Radon 9*	*Out-door*	3 ± 3 Bq/m³
627381-7 [Rapidos®]	*2017-08-26 – 2018-01-17*	*479466/6373139, Radon 9*	*Out-door*	4 ± 3 Bq/m³
227202-9 [Rapidos®]	*2017-08-26 – 2018-01-17*	*481359/6372277, Radon 10*	*Out-door*	5 ± 3 Bq/m³
965502-8 [Rapidos®]	–			**< 7 kBqh/m³**

Comment to the results

Detector # 132967-1 on COC, not returned. Detector #965502-8 returned unopened.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
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Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

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Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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900 Oakmont Lane Suite 207
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The global leader in radon measurement

REPORT NUMBER
4827105:2

REPORT DATE
2019-12-03

REPORT PAGE
1 of 3

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-04-03**.
They were measured **2018-04-06**.

Test data have been given by DENISON MINES

Property data and address

MEASURE SITE ADDRESS
230 22ND ST
SASKATOON SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
462400 (6 ± 4 kBqh/m3)

TRANSIT DETECTOR 2:
265318 (1 ± 4 kBqh/m3)

TRANSIT DETECTOR 3:
657179 (4 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
570451-5 [Rapidos®]	*2018-01-17 – 2018-03-23*	*474702/6379807, RADON 2*	*Out-door*	< 11 Bq/m³
631448-8 [Rapidos®]	*2018-01-17 – 2018-03-23*	*474702/6379807, RADON 2*	*Out-door*	< 11 Bq/m³
592211-7 [Rapidos®]	*2018-01-17 – 2018-03-23*	*473770/6378961, RADON 1*	*Out-door*	< 11 Bq/m³
738373-0 [Rapidos®]	*2018-01-17 – 2018-03-23*	*473770/6378961, RADON 1*	*Out-door*	< 11 Bq/m³
628209-9 [Rapidos®]	*2018-01-19 – 2018-03-23*	*474457/6376843, RADON 3*	*Out-door*	< 11 Bq/m³
546632-1 [Rapidos®]	*2018-01-19 – 2018-03-23*	*474457/6376843, RADON 3*	*Out-door*	< 11 Bq/m³
965810-5 [Rapidos®]	*2018-01-19 – 2018-03-23*	*474951/6376099, RADON 4*	*Out-door*	< 11 Bq/m³
931236-4 [Rapidos®]	*2018-01-17 – 2018-03-23*	*474951/6376099, RADON 4*	*Out-door*	< 11 Bq/m³
965335-3 [Rapidos®]	*2018-01-17 – 2018-03-23*	*476804/6375936, RADON 5*	*Out-door*	< 11 Bq/m³

Comment to the results

This report replaces 4827105:1. Reason: new or corrected measurement information has been received.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

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Pamela Bennett
230 22nd Street East
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Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-04-03**.
They were measured **2018-04-06**.

Test data have been given by DENISON MINES

Property data and address

MEASURE SITE ADDRESS
230 22ND ST
SASKATOON SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
931302-4 [Rapidos®]	*2018-01-17 – 2018-03-23*	*476804/6375936, RADON 5*	*Out-door*	< 11 Bq/m³
632099-8 [Rapidos®]	*2018-01-17 – 2018-03-23*	*474841/6374922, RADON 6*	*Out-door*	< 6 Bq/m³
965480-7 [Rapidos®]	*2018-01-17 – 2018-03-23*	*474841/6374922, RADON 6*	*Out-door*	< 11 Bq/m³
628669-4 [Rapidos®]	*2018-01-17 – 2018-03-23*	*476857/6374255, RADON 7*	*Out-door*	< 11 Bq/m³
628783-3 [Rapidos®]	*2018-01-17 – 2018-03-23*	*476857/6374255, RADON 7*	*Out-door*	< 11 Bq/m³
594425-1 [Rapidos®]	*2018-01-19 – 2018-03-23*	*477240/6373284, RADON 8*	*Out-door*	< 6 Bq/m³
594915-1 [Rapidos®]	*2018-01-19 – 2018-03-23*	*477240/6373284, RADON 8*	*Out-door*	< 11 Bq/m³
546617-2 [Rapidos®]	*2018-01-19 – 2018-03-23*	*479466/6373139, RADON 9*	*Out-door*	< 11 Bq/m³
576162-2 [Rapidos®]	*2018-01-19 – 2018-03-23*	*479466/ 6373139, RADON 9*	*Out-door*	9 ± 4 Bq/m³
594930-0 [Rapidos®]	*2018-01-19 – 2018-03-23*	*481359/6372277, RADON 10*	*Out-door*	< 6 Bq/m³

Comment to the results

This report replaces 4827105:1. Reason: new or corrected measurement information has been received.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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4856004:1

REPORT DATE
2018-07-27

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2021-04-23

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N/A

BY
Denison Mines

REPORT RECEIVER(S)

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Pamela Bennett
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Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-07-23**.
They were measured **2018-07-27**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID

TRANSIT DETECTOR 1:
532660 (2 ± 6 kBqh/m3)

TRANSIT DETECTOR 2:
534427 (4 ± 4 kBqh/m3)

TRANSIT DETECTOR 3:
534866 (1 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
615494-2 [Rapidos®]	*2018-03-23 – 2018-07-13*	*473770 / 6378961, RADON 1*	*Out-door*	< 3 Bq/m³
614573-4 [Rapidos®]	*2018-03-23 – 2018-07-13*	*473770 / 6378961, RADON 1*	*Out-door*	3 ± 3 Bq/m³
615514-7 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474702 / 6379807, RADON 2*	*Out-door*	< 3 Bq/m³
277949-4 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474702 / 6379807, RADON 2*	*Out-door*	< 3 Bq/m³
615266-4 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474457 / 6376843, RADON 3*	*Out-door*	< 3 Bq/m³
277887-6 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474457 / 6376843, RADON 3*	*Out-door*	< 3 Bq/m³
604811-0 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474951 / 6376099, RADON 4*	*Out-door*	< 3 Bq/m³
615565-9 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474951 / 6376099, RADON 4*	*Out-door*	< 3 Bq/m³
604370-7 [Rapidos®]	*2018-03-23 – 2018-07-13*	*476804 / 6375936, RADON 5*	*Out-door*	4 ± 3 Bq/m³

Comment to the results

Detector 606137-8, 476804 / 6375936, Out-door was damaged and the chip inside was missing. Not possible to report.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2018-07-27

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

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Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-07-23**.
They were measured **2018-07-27**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
606121-2 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474841 / 6374922, RADON 6*	*Out-door*	3 ± 3 Bq/m³
607838-0 [Rapidos®]	*2018-03-23 – 2018-07-13*	*474841 / 6374922, RADON 6*	*Out-door*	< 3 Bq/m³
606135-2 [Rapidos®]	*2018-03-23 – 2018-07-13*	*476857 / 6374255, RADON 7*	*Out-door*	< 3 Bq/m³
615439-7 [Rapidos®]	*2018-03-23 – 2018-07-13*	*476857 / 6374255, RADON 7*	*Out-door*	< 3 Bq/m³
278256-3 [Rapidos®]	*2018-03-23 – 2018-07-13*	*477240 / 6373284, RADON 8*	*Out-door*	< 3 Bq/m³
612673-4 [Rapidos®]	*2018-03-23 – 2018-07-13*	*477240 / 6373284, RADON 8*	*Out-door*	< 3 Bq/m³
615438-9 [Rapidos®]	*2018-03-23 – 2018-07-13*	*479466 / 6373139, RADON 9*	*Out-door*	< 3 Bq/m³
606176-6 [Rapidos®]	*2018-03-23 – 2018-07-13*	*479466 / 6373139, RADON 9*	*Out-door*	< 3 Bq/m³
608479-2 [Rapidos®]	*2018-03-23 – 2018-07-13*	*481359 / 6372277, RADON 10*	*Out-door*	< 3 Bq/m³
606156-8 [Rapidos®]	*2018-03-23 – 2018-07-13*	*481359 / 6372277, RADON 10*	*Out-door*	< 3 Bq/m³

Comment to the results

Detector 606137-8, 476804 / 6375936, Out-door was damaged and the chip inside was missing. Not possible to report.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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REPORT NUMBER
4856005:2

REPORT DATE
2019-12-03

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1 of 3

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2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

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230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-10-10**.
They were measured **2018-10-16**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID

TRANSIT DETECTOR 1: *532660*

TRANSIT DETECTOR 2: *534427*

TRANSIT DETECTOR 3: *534866*

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
534464-3 [Rapidos®]	*2018-07-13 – 2018-10-03*	*473770 / 6378961, RADON 1*	*Out-door*	< 6 Bq/m³
532939-6 [Rapidos®]	*2018-07-13 – 2018-10-03*	*473770 / 6378961, RADON 1*	*Out-door*	< 5 Bq/m³
534764-6 [Rapidos®]	*2018-07-13 – 2018-10-03*	*474702 / 6379807, RADON 2*	*Out-door*	< 5 Bq/m³
534656-4 [Rapidos®]	*2018-07-13 – 2018-10-03*	*474702 / 6379807, RADON 2*	*Out-door*	< 4 Bq/m³
534792-7 [Rapidos®]	*2018-07-13 – 2018-10-03*	*474457 / 6376843, RADON 3*	*Out-door*	< 4 Bq/m³
532576-6 [Rapidos®]	*2018-07-13 – 2018-10-03*	*474457 / 6376843, RADON 3*	*Out-door*	< 4 Bq/m³
534109-4 [Rapidos®]	*2018-07-13 – 2018-10-03*	*474951 / 6376099, RADON 4*	*Out-door*	< 5 Bq/m³
535204-2 [Rapidos®]	*2018-07-13 – 2018-10-03*	*476804 / 6375936, RADON 5*	*Out-door*	< 5 Bq/m³
534580-6 [Rapidos®]	*2018-07-13 – 2018-10-03*	*476804 / 6375936, RADON 5*	*Out-door*	4 ± 3 Bq/m³

Comment to the results

This report replaces 4856005:1. Reason: new or corrected measurement information has been received.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2018-10-10**.
They were measured **2018-10-16**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
535516-9 [Rapidos®]	*2018-07-13 – 2018-10-03*	*474841 / 6374922, RADON 6*	*Out-door*	< 4 Bq/m³
559313-2 [Rapidos®]	*2018-07-13 – 2018-10-03*	*474841 / 6374922, RADON 6*	*Out-door*	< 4 Bq/m³
535576-3 [Rapidos®]	*2018-07-13 – 2018-10-03*	*476857 / 6374255, RADON 7*	*Out-door*	< 6 Bq/m³
534289-4 [Rapidos®]	*2018-07-13 – 2018-10-03*	*476857 / 6374255, RADON 7*	*Out-door*	< 6 Bq/m³
532567-5 [Rapidos®]	*2018-07-13 – 2018-10-03*	*477240 / 6373284, RADON 8*	*Out-door*	< 4 Bq/m³
533950-2 [Rapidos®]	*2018-07-13 – 2018-10-03*	*477240 / 6373284, RADON 8*	*Out-door*	< 6 Bq/m³
534044-3 [Rapidos®]	*2018-07-13 – 2018-10-03*	*479466 / 6373139, RADON 9*	*Out-door*	< 4 Bq/m³
534501-2 [Rapidos®]	*2018-07-13 – 2018-10-03*	*479466 / 6373139, RADON 9*	*Out-door*	< 4 Bq/m³
534995-6 [Rapidos®]	*2018-07-13 – 2018-10-03*	*481359 / 6372277, RADON 10*	*Out-door*	< 5 Bq/m³
534955-0 [Rapidos®]	*2018-07-13 – 2018-10-03*	*481359 / 6372277, RADON 10*	*Out-door*	4 ± 3 Bq/m³

Comment to the results

This report replaces 4856005:1. Reason: new or corrected measurement information has been received.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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Testing
ISO/IEC 17025

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REPORT NUMBER
4891688:1

REPORT DATE
2019-02-08

REPORT PAGE
1 of 3

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2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-02-01**.
They were measured **2019-02-07**.

Test data have been given by Jason Shaver

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
701774 (1 ± 6 kBqh/m3)

TRANSIT DETECTOR 2:
164042 (2 ± 4 kBqh/m3)

TRANSIT DETECTOR 3:
182447 (3 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
724910-5 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"473770 , 6378961", Radon 1-A*	*Out-door*	< 3 Bq/m³
751311-2 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"473770 , 6378961", Radon 1-B*	*Out-door*	3 ± 3 Bq/m³
563363-1 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"474702 , 6379807", Radon 2-A*	*Out-door*	< 3 Bq/m³
985167-6 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"474702 , 6379807", Radon 2-B*	*Out-door*	4 ± 3 Bq/m³
794085-1 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"474457 , 6376843", Radon 3-A*	*Out-door*	< 3 Bq/m³
233893-7 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"474457 , 6376843", Radon 3-B*	*Out-door*	3 ± 3 Bq/m³
183443-1 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"474951 , 6376099", Radon 4-A*	*Out-door*	< 3 Bq/m³
190992-8 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"474951 , 6376099", Radon 4-B*	*Out-door*	3 ± 3 Bq/m³
168409-1 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"476804 , 6375936", Radon 5-A*	*Out-door*	4 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Pamela Bennett
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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-02-01**.
They were measured **2019-02-07**.

Test data have been given by Jason Shaver

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
222494-7 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"476804 , 6375936", Radon 5-B*	*Out-door*	3 ± 3 Bq/m³
742701-6 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"474841 , 6374922", Radon 6-A*	*Out-door*	< 3 Bq/m³
667361-0 [Rapidos®]	*2018-10-03 – 2019-01-22*	*"474841 , 6374922", Radon 6-B*	*Out-door*	3 ± 3 Bq/m³
555031-4 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"476857 , 6374255", Radon 7-A*	*Out-door*	< 3 Bq/m³
556395-2 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"476857 , 6374255", Radon 7-B*	*Out-door*	3 ± 3 Bq/m³
979014-8 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"477240 , 6373284", Radon 8-A*	*Out-door*	< 3 Bq/m³
945982-7 [Rapidos®]	*2018-10-03 – 2019-01-23*	*"477240 , 6373284", Radon 8-B*	*Out-door*	< 3 Bq/m³
977289-8 [Rapidos®]	*2018-10-03 – 2019-01-24*	*"479466 , 6373139", Radon 9-A*	*Out-door*	< 3 Bq/m³
594231-3 [Rapidos®]	*2018-10-03 – 2019-01-24*	*"479466 , 6373139", Radon 9-B*	*Out-door*	< 3 Bq/m³
164164-6 [Rapidos®]	*2018-10-03 – 2019-01-24*	*"481359 , 6372277", Radon 10-A*	*Out-door*	4 ± 3 Bq/m³
105056-6 [Rapidos®]	*2018-10-03 – 2019-01-24*	*"481359 , 6372277", Radon 10-B*	*Out-door*	3 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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4929887:1

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REPORT PAGE
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2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-05-30**.
They were measured **2019-06-05**.

Test data have been given by Jason Shaver

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
130341 (16 ± 10 kBqh/m3)

TRANSIT DETECTOR 2:
381716 (1 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
520674

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
143034-7 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 1-A*	*Out-door*	< 4 Bq/m³
142928-1 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 1-B*	*Out-door*	< 6 Bq/m³
335475-0 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 2-A*	*Out-door*	3 ± 3 Bq/m³
209800-2 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 2-B*	*Out-door*	< 4 Bq/m³
129519-5 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 3-A*	*Out-door*	< 5 Bq/m³
143630-2 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 3-B*	*Out-door*	3 ± 3 Bq/m³
377270-4 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 4-A*	*Out-door*	< 3 Bq/m³
377966-7 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 4-B*	*Out-door*	< 5 Bq/m³
128478-5 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 5-A*	*Out-door*	< 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2019-06-06

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2021-04-23

OWN ID
N/A

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Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
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Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-05-30**.
They were measured **2019-06-05**.

Test data have been given by Jason Shaver

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
334614-5 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 5-B*	*Out-door*	< 4 Bq/m³
143678-1 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 6-A*	*Out-door*	< 4 Bq/m³
335632-6 [Rapidos®]	*2019-01-22 – 2019-05-12*	*Wheeler, Radon 6-B*	*Out-door*	< 4 Bq/m³
334970-1 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 7-A*	*Out-door*	< 3 Bq/m³
334118-7 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 7-B*	*Out-door*	4 ± 3 Bq/m³
143512-2 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 8-A*	*Out-door*	< 4 Bq/m³
340366-4 [Rapidos®]	*2019-01-23 – 2019-05-12*	*Wheeler, Radon 8-B*	*Out-door*	3 ± 3 Bq/m³
145062-6 [Rapidos®]	*2019-01-24 – 2019-05-13*	*Wheeler, Radon 9-A*	*Out-door*	< 3 Bq/m³
143270-7 [Rapidos®]	*2019-01-24 – 2019-05-13*	*Wheeler, Radon 9-B*	*Out-door*	< 4 Bq/m³
326949-5 [Rapidos®]	*2019-01-24 – 2019-05-13*	*Wheeler, Radon 10-A*	*Out-door*	3 ± 3 Bq/m³
375595-6 [Rapidos®]	*2019-01-24 – 2019-05-13*	*Wheeler, Radon 10-B*	*Out-door*	< 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-10-03**.
They were measured **2019-10-08**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID
Wheeler River

TRANSIT DETECTOR 1:
261965 (10 ± 6 kBqh/m3)

TRANSIT DETECTOR 2:
485028 (12 ± 4 kBqh/m3)

TRANSIT DETECTOR 3:
300591 (22 ± 6 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
766047-5 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 41 Bq/m³
179097-1 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 34 Bq/m³
299607-2 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 34 Bq/m³
119104-8 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 41 Bq/m³
366509-8 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 34 Bq/m³
181579-4 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 41 Bq/m³
135898-5 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 41 Bq/m³
269759-7 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 34 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2019-10-11

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-10-03**.
They were measured **2019-10-08**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID
Wheeler River

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
378358-6 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 41 Bq/m³
388225-5 [Rapidos®]	*2019-09-12 – 2019-09-30*	*Phoenix*	*Out-door*	< 41 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

SWEDAC ACKREDITERING
Accred. no. 1489
Testing
ISO/IEC 17025

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5461455:1

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2019-10-25

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2021-04-23

OWN ID
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BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-10-18**.
They were measured **2019-10-22**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID

TRANSIT DETECTOR 1:
271066 (9 ± 6 kBqh/m3)

TRANSIT DETECTOR 2:
361393 (9 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
247270 (9 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
597723-6 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**< 13 kBqh/m³**
299768-2 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**8 ± 6 kBqh/m³**
531709-4 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**8 ± 6 kBqh/m³**
685869-0 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**< 13 kBqh/m³**
314804-6 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**< 7 kBqh/m³**
384821-5 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**14 ± 6 kBqh/m³**
253782-7 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**9 ± 6 kBqh/m³**
270050-8 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**< 13 kBqh/m³**

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
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Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-10-18**.
They were measured **2019-10-22**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
438793-2 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**< 7 kBqh/m³**
267572-6 [Rapidos®]	*2019-09-30 –*	*Phoenix*	*Out-door*	**< 13 kBqh/m³**

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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REPORT DATE
2019-10-11

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-10-03**.
They were measured **2019-10-08**.

Test data have been given by Jason Shaver

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
421708-9 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 1-B*		< 4 Bq/m³
430190-9 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 1-A*		< 3 Bq/m³
731677-1 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 2-A*		6 ± 3 Bq/m³
271265-1 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 2-B*		3 ± 3 Bq/m³
787451-4 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 3-A*		6 ± 3 Bq/m³
794898-7 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 3-B*		3 ± 3 Bq/m³
386143-2 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 4-A*		< 3 Bq/m³
496398-9 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 4-B*		3 ± 3 Bq/m³
771857-0 [Rapidos®]	*2019-05-12 – 2019-09-26*	*Wheeler, Radon 5-A*		12 ± 3 Bq/m³
346396-5 [Rapidos®]	*2019-05-12 – 2019-09-26*	*Wheeler, Radon 5-B*		5 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2019-10-11

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BY
Denison Mines

REPORT RECEIVER(S)

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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-10-03**.
They were measured **2019-10-08**.

Test data have been given by Jason Shaver

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
157102-5 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 6-A*		5 ± 3 Bq/m³
324426-6 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 6-B*		< 3 Bq/m³
600407-1 [Rapidos®]	*2019-05-12 – 2019-09-26*	*Wheeler, Radon 7-A*		19 ± 4 Bq/m³
385254-8 [Rapidos®]	*2019-05-12 – 2019-09-26*	*Wheeler, Radon 7-B*		12 ± 3 Bq/m³
795844-0 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 8-A*		3 ± 3 Bq/m³
689429-9 [Rapidos®]	*2019-05-12 – 2019-09-25*	*Wheeler, Radon 8-B*		4 ± 3 Bq/m³
524479-3 [Rapidos®]	*2019-05-13 – 2019-09-26*	*Wheeler, Radon 9-A*		6 ± 3 Bq/m³
993493-6 [Rapidos®]	*2019-05-13 – 2019-09-26*	*Wheeler, Radon 9-B*		7 ± 3 Bq/m³
914532-7 [Rapidos®]	*2019-05-13 – 2019-09-26*	*Wheeler, Radon 10-A*		3 ± 3 Bq/m³
994946-2 [Rapidos®]	*2019-05-13 – 2019-09-26*	*Wheeler, Radon 10-B*		5 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

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Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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REPORT NUMBER
5462811:1

REPORT DATE
2020-02-19

REPORT PAGE
1 of 3

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-02-11**.
They were measured **2020-02-18**.

Test data have been given by Jennifer Skilnick

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
756479

TRANSIT DETECTOR 2:
779240

TRANSIT DETECTOR 3:
432280 (9 ± 8 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
339220-6 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 1-A*	*Out-door*	< 4 Bq/m³
415534-7 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 1-B*	*Out-door*	3 ± 3 Bq/m³
945665-8 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 2-A*	*Out-door*	4 ± 3 Bq/m³
182624-7 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 2-B*	*Out-door*	< 4 Bq/m³
310857-8 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 3-A*	*Out-door*	< 2 Bq/m³
382993-4 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 3-B*	*Out-door*	3 ± 2 Bq/m³
344686-1 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 4-A*	*Out-door*	4 ± 3 Bq/m³
119649-2 [Rapidos®]	*2019-09-25 – 2020-02-06*	*Wheeler, Radon 4-B*	*Out-door*	2 ± 2 Bq/m³
593581-2 [Rapidos®]	*2019-09-26 – 2020-02-06*	*Wheeler, Radon 5-B*	*Out-door*	4 ± 2 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2020-02-19

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

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Pamela Bennett
230 22nd Street East
Suite 200
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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-02-11**.
They were measured **2020-02-18**.

Test data have been given by Jennifer Skilnick

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
152891-8 [Rapidos®]	*2019-09-25 – 2020-01-21*	*Wheeler, Radon 6-A*	*Out-door*	19 ± 4 Bq/m³
262394-0 [Rapidos®]	*2019-09-25 – 2020-01-21*	*Wheeler, Radon 6-B*	*Out-door*	14 ± 4 Bq/m³
472921-6 [Rapidos®]	*2019-09-26 – 2020-02-07*	*Wheeler, Radon 7-A*	*Out-door*	4 ± 2 Bq/m³
197031-8 [Rapidos®]	*2019-09-26 – 2020-02-07*	*Wheeler, Radon 7-B*	*Out-door*	3 ± 2 Bq/m³
361270-2 [Rapidos®]	*2019-09-25 – 2020-02-07*	*Wheeler, Radon 8-A*	*Out-door*	5 ± 3 Bq/m³
648339-0 [Rapidos®]	*2019-09-25 – 2020-02-07*	*Wheeler, Radon 8-B*	*Out-door*	< 4 Bq/m³
451442-8 [Rapidos®]	*2019-09-26 – 2020-02-07*	*Wheeler, Radon 9-A*	*Out-door*	< 4 Bq/m³
949464-2 [Rapidos®]	*2019-09-26 – 2020-02-07*	*Wheeler, Radon 9-B*	*Out-door*	2 ± 2 Bq/m³
176973-6 [Rapidos®]	*2019-09-26 – 2020-02-07*	*Wheeler, Radon 10-A*	*Out-door*	4 ± 3 Bq/m³
774882-5 [Rapidos®]	*2019-09-26 – 2020-02-07*	*Wheeler, Radon 10-B*	*Out-door*	2 ± 2 Bq/m³
467529-4 [Rapidos®]	*2019-09-26 – 2020-02-06*	*Wheeler, Radon 5-A*	*Out-door*	3 ± 2 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

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Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

SWEDAC ACKREDITERING
Accred. no. 1489
Testing
ISO/IEC 17025

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RADONOVA INC.
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REPORT NUMBER
5498730:1

REPORT DATE
2020-08-05

REPORT PAGE
1 of 3

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-07-30**.
They were measured **2020-08-05**.

Test data have been given by Dana Harris

Property data and address

MEASURE SITE ADDRESS
Wheeler River
Wheeler River Project Site
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
924786 (8 ± 4 kBqh/m3)

TRANSIT DETECTOR 2:
987771 (8 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
693060 (8 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
350177-2 [Rapidos®]	*2020-01-21 – 2020-07-24*	*Wheeler River, Radon-6A*	*Out-door*	5 ± 3 Bq/m³
986215-2 [Rapidos®]	*2020-01-21 – 2020-07-24*	*Wheeler River, Radon-6B*	*Out-door*	7 ± 3 Bq/m³
221593-7 [Rapidos®]	*2020-02-06 – 2020-07-25*	*Wheeler River, Radon-2A*	*Out-door*	4 ± 3 Bq/m³
644943-3 [Rapidos®]	*2020-02-06 – 2020-07-25*	*Wheeler River, Radon-2B*	*Out-door*	8 ± 3 Bq/m³
761140-3 [Rapidos®]	*2020-02-06 – 2020-07-24*	*Wheeler River, Radon-3A*	*Out-door*	9 ± 3 Bq/m³
231885-5 [Rapidos®]	*2020-02-06 – 2020-07-24*	*Wheeler River, Radon-3B*	*Out-door*	5 ± 3 Bq/m³
280558-8 [Rapidos®]	*2020-02-06 – 2020-07-25*	*Wheeler River, Radon-4A*	*Out-door*	5 ± 3 Bq/m³
263265-1 [Rapidos®]	*2020-02-06 – 2020-07-25*	*Wheeler River, Radon-4B*	*Out-door*	10 ± 3 Bq/m³
295613-4 [Rapidos®]	*2020-02-06 – 2020-07-24*	*Wheeler River, Radon-5A*	*Out-door*	9 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2020-08-05

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-07-30**.
They were measured **2020-08-05**.

Test data have been given by Dana Harris

Property data and address

MEASURE SITE ADDRESS
Wheeler River
Wheeler River Project Site
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
118311-0 [Rapidos®]	*2020-02-06 – 2020-07-24*	*Wheeler River, Radon-5B*	*Out-door*	4 ± 3 Bq/m³
345718-1 [Rapidos®]	*2020-02-07 – 2020-07-23*	*Wheeler River, Radon-7A*	*Out-door*	6 ± 4 Bq/m³
159420-9 [Rapidos®]	*2020-02-07 – 2020-07-23*	*Wheeler River, Radon-7B*	*Out-door*	7 ± 4 Bq/m³
657220-0 [Rapidos®]	*2020-02-07 – 2020-07-23*	*Wheeler River, Radon-8A*	*Out-door*	5 ± 4 Bq/m³
911167-5 [Rapidos®]	*2020-02-07 – 2020-07-23*	*Wheeler River, Radon-8B*	*Out-door*	< 3 Bq/m³
245665-5 [Rapidos®]	*2020-02-07 – 2020-07-24*	*Wheeler River, Radon-9A*	*Out-door*	< 3 Bq/m³
197252-0 [Rapidos®]	*2020-02-07 – 2020-07-24*	*Wheeler River, Radon-9B*	*Out-door*	4 ± 4 Bq/m³
280737-8 [Rapidos®]	*2020-02-07 – 2020-07-25*	*Wheeler River, Radon-10A*	*Out-door*	< 3 Bq/m³
243646-7 [Rapidos®]	*2020-02-07 – 2020-07-25*	*Wheeler River, Radon-10B*	*Out-door*	6 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

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The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

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5529866:1

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REPORT DATE
2019-11-11

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2021-04-23

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N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-11-05**.
They were measured **2019-11-08**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS
Phoenix Site

BUILDING ID
Phoenix Site

TRANSIT DETECTOR 1:
368089 (11 ± 8 kBqh/m3)

TRANSIT DETECTOR 2:
288869

TRANSIT DETECTOR 3:
356927 (13 ± 6 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
557059-3 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 24 Bq/m³
269572-4 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 24 Bq/m³
248158-8 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 43 Bq/m³
795201-3 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 19 Bq/m³
376111-1 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 29 Bq/m³
281219-6 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 43 Bq/m³
326207-8 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 43 Bq/m³
153281-1 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 25 Bq/m³
294974-1 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 25 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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331.814.2200, help@radonova.com

REPORT DATE
2019-11-11

PRINT DATE
2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-11-05**.
They were measured **2019-11-08**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS
Phoenix Site

BUILDING ID
Phoenix Site

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
592734-8 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 24 Bq/m³
158629-6 [Rapidos®]	*2019-10-14 – 2019-10-28*	*Phoenix*	*Out-door*	< 29 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

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Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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5544861:1

REPORT DATE
2019-11-26

REPORT PAGE
1 of 3

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2021-04-23

OWN ID
N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-11-20**.
They were measured **2019-11-26**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID
Phoenix Zone

TRANSIT DETECTOR 1:
358638 (44 ± 8 kBqh/m3)

TRANSIT DETECTOR 2:
149779 (46 ± 8 kBqh/m3)

TRANSIT DETECTOR 3:
939267 (42 ± 8 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
283457-0 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	155 ± 42 Bq/m³
491724-1 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*		72 ± 29 Bq/m³
315249-3 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	69 ± 29 Bq/m³
247005-2 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	< 30 Bq/m³
316175-9 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	32 ± 24 Bq/m³
917216-4 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	< 23 Bq/m³
781288-6 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	79 ± 29 Bq/m³
482176-5 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	69 ± 29 Bq/m³
284297-9 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	39 ± 24 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Denison Mines Corp
Pamela Bennett
230 22nd Street East
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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2019-11-20**.
They were measured **2019-11-26**.

No person has signed the record card and verified that the instructions have been followed.

Property data and address

MEASURE SITE ADDRESS

BUILDING ID
Phoenix Zone

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
902995-0 [Rapidos®]	*2019-10-28 – 2019-11-15*	*Outside*	*Out-door*	< 30 Bq/m³
677620-7 [Rapidos®]	*2019-10-28 – 2019-11-15*		*Out-door*	< 33 Bq/m³
990692-6 [Rapidos®]	*2019-10-28 – 2019-11-15*		*Out-door*	< 33 Bq/m³
191999-2 [Rapidos®]	*2019-10-28 – 2019-11-15*		*Out-door*	< 30 Bq/m³
765926-1 [Rapidos®]	*2019-10-28 – 2019-11-15*		*Out-door*	< 30 Bq/m³
486529-1 [Rapidos®]	*2019-10-28 – 2019-11-15*		*Out-door*	< 30 Bq/m³
298585-1 [Rapidos®]	*2019-10-28 – 2019-11-15*		*Out-door*	39 ± 29 Bq/m³
280057-1 [Rapidos®]	*2019-10-28 – 2019-11-15*		*Out-door*	44 ± 24 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

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Measured radon concentrations

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The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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REPORT NUMBER
5646641:1

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2020-11-19

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2021-04-23

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N/A

BY
Denison Mines

REPORT RECEIVER(S)

Denison Mines Corp
Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-11-13**.
They were measured **2020-11-19**.

Test data have been given by Dana Harris

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project Area
230 22 St E
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
348666 (10 ± 4 kBqh/m3)

TRANSIT DETECTOR 2:
628249 (15 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
915347 (13 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
699605-2 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon 1A*	*Out-door*	< 5 Bq/m³
947477-6 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon 1B*	*Out-door*	< 5 Bq/m³
233238-5 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon 2A*	*Out-door*	< 3 Bq/m³
723976-7 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon 2B*	*Out-door*	< 5 Bq/m³
405482-1 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon 3A*	*Out-door*	< 3 Bq/m³
547196-6 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon 3B*	*Out-door*	3 ± 3 Bq/m³
176744-1 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon 4A*	*Out-door*	< 3 Bq/m³
585217-3 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon 4B*	*Out-door*	3 ± 3 Bq/m³
991329-4 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon 5A-missing*	*Out-door*	**DNR**

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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2021-04-23

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Pamela Bennett
230 22nd Street East
Suite 200
Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-11-13**.
They were measured **2020-11-19**.

Test data have been given by Dana Harris

Property data and address

MEASURE SITE ADDRESS
Wheeler River Project Area
230 22 St E
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
258302-9 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon 5B*	*Out-door*	< 3 Bq/m³
351592-1 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon 6A*	*Out-door*	< 3 Bq/m³
671825-8 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon 6B*	*Out-door*	3 ± 3 Bq/m³
669513-4 [Rapidos®]	*2020-07-23 – 2020-11-04*	*Radon 7A*	*Out-door*	< 3 Bq/m³
280764-2 [Rapidos®]	*2020-07-23 – 2020-11-04*	*Radon 7B*	*Out-door*	< 5 Bq/m³
902442-3 [Rapidos®]	*2020-07-23 – 2020-11-05*	*Radon 8A*	*Out-door*	< 3 Bq/m³
481604-7 [Rapidos®]	*2020-07-23 – 2020-11-05*	*Radon 8B*	*Out-door*	< 3 Bq/m³
194347-1 [Rapidos®]	*2020-07-24 – 2020-11-05*	*Radon 9A*	*Out-door*	< 5 Bq/m³
466645-9 [Rapidos®]	*2020-07-24 – 2020-11-05*	*Radon 9B*	*Out-door*	< 3 Bq/m³
132460-7 [Rapidos®]	*2020-07-25 – 2020-11-05*	*Radon 10A*	*Out-door*	< 3 Bq/m³
736361-7 [Rapidos®]	*2020-07-25 – 2020-11-05*	*Radon 10B*	*Out-door*	< 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-11-13**.
They were measured **2020-11-19**.

Test data have been given by Janna Switzer

Property data and address

MEASURE SITE ADDRESS
Denison Mines
230 22 St E
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
348666 (10 ± 4 kBqh/m3)

TRANSIT DETECTOR 2:
628249 (15 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
915347 (13 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
258302-9 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon-5B*		< 3 Bq/m³
176744-1 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon-4A*		< 3 Bq/m³
132460-7 [Rapidos®]	*2020-07-25 – 2020-11-05*	*Radon-10A*		< 3 Bq/m³
351592-1 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon-6A*		< 3 Bq/m³
481604-7 [Rapidos®]	*2020-07-23 – 2020-11-05*	*Radon-8B*		< 3 Bq/m³
194347-1 [Rapidos®]	*2020-07-24 – 2020-11-05*	*Radon-9A*		< 5 Bq/m³
699605-2 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon-1A*		< 5 Bq/m³
585217-3 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon-4B*		3 ± 3 Bq/m³
902442-3 [Rapidos®]	*2020-07-23 – 2020-11-05*	*Radon-8A*		< 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2020-11-19

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2021-04-23

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Denison Mines

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Pamela Bennett
230 22nd Street East
Suite 200
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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2020-11-13**.
They were measured **2020-11-19**.

Test data have been given by Janna Switzer

Property data and address

MEASURE SITE ADDRESS
Denison Mines
230 22 St E
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
466645-9 [Rapidos®]	*2020-07-24 – 2020-11-05*	*Radon-9B*		< 3 Bq/m³
671825-8 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon-6B*		3 ± 3 Bq/m³
669513-4 [Rapidos®]	*2020-07-23 – 2020-11-04*	*Radon-7A*		< 3 Bq/m³
405482-1 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon-3A*		< 3 Bq/m³
280764-2 [Rapidos®]	*2020-07-23 – 2020-11-04*	*Radon-7B*		< 5 Bq/m³
947477-6 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon-1B*		< 5 Bq/m³
547196-6 [Rapidos®]	*2020-07-24 – 2020-11-03*	*Radon-3B*		3 ± 3 Bq/m³
736361-7 [Rapidos®]	*2020-07-25 – 2020-11-05*	*Radon-10B*		< 3 Bq/m³
723976-7 [Rapidos®]	*2020-07-25 – 2020-11-03*	*Radon-2B*		< 5 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

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Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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2021-03-05

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2021-04-23

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N/A

BY
Denison Mines

REPORT RECEIVER(S)

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Pamela Bennett
230 22nd Street East
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Saskatoon SK S7K 0E9
CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2021-02-24**.
They were measured **2021-03-02**.

Test data have been given by Janna Switzer

Property data and address

MEASURE SITE ADDRESS
Denison Mines
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

BUILDING ID

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
127659-1 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-3A*	*Out-door*	< 7 Bq/m³
426440-4 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-3B*	*Out-door*	6 ± 4 Bq/m³
464408-4 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-4A*	*Out-door*	< 7 Bq/m³
661183-4 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-4B*	*Out-door*	< 6 Bq/m³
433299-5 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-5A*	*Out-door*	6 ± 4 Bq/m³
903490-1 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-5B*	*Out-door*	< 7 Bq/m³
451091-3 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-6A*	*Out-door*	< 5 Bq/m³
947547-6 [Rapidos®]	*2020-11-03 – 2021-02-18*	*Radon-6B*	*Out-door*	5 ± 4 Bq/m³
619196-9 [Rapidos®]	*2020-11-04 – 2021-02-17*	*Radon-7A*	*Out-door*	< 5 Bq/m³
348529-9 [Rapidos®]	*2020-11-04 – 2021-02-17*	*Radon-7B*	*Out-door*	< 7 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Pamela Bennett
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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2021-02-24**.
They were measured **2021-03-02**.

Test data have been given by Janna Switzer

Property data and address

MEASURE SITE ADDRESS
Denison Mines
230 22nd St. East, Suite 200
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
934585-1 [Rapidos®]	*2020-11-05 – 2021-02-17*	*Radon-8A*	*Out-door*	5 ± 5 Bq/m³
386101-0 [Rapidos®]	*2020-11-05 – 2021-02-17*	*Radon-8B*	*Out-door*	< 7 Bq/m³
366585-8 [Rapidos®]	*2020-11-05 – 2021-02-17*	*Radon-9A*	*Out-door*	< 7 Bq/m³
268862-0 [Rapidos®]	*2020-11-05 – 2021-02-17*	*Radon-9B*	*Out-door*	< 6 Bq/m³
518308-2 [Rapidos®]	*2020-11-05 – 2021-02-17*	*Radon-10A*	*Out-door*	< 5 Bq/m³
140816-0 [Rapidos®]	*2020-11-05 – 2021-02-17*	*Radon-10B*	*Out-door*	< 5 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

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RADONOVA INC.
900 Oakmont Lane Suite 207
Westmont IL 60559
331.814.2200, help@radonova.com

Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

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Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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BY
Denison Mines

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Denison Mines Corp.

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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2021-06-18**.
They were measured **2021-06-22**.

Test data have been given by Jennifer Skilnick

Property data and address

MEASURE SITE ADDRESS
Denison Mines Corp.
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
626137-4 [Rapidos®]	*2021-02-17 – 2021-06-08*	*10-B*	*Out-door*	< 3 Bq/m³
375675-6 [Rapidos®]	*2021-02-17 – 2021-06-08*	*9-A*	*Out-door*	7 ± 4 Bq/m³
134411-8 [Rapidos®]	*2021-02-17 – 2021-06-08*	*10-A*	*Out-door*	< 3 Bq/m³
931677-9 [Rapidos®]	*2021-02-17 – 2021-06-09*	*8-A*	*Out-door*	< 3 Bq/m³
758401-4 [Rapidos®]	*2021-02-18 – 2021-06-08*	*6-B*	*Out-door*	< 3 Bq/m³
674719-0 [Rapidos®]	*2021-02-17 – 2021-06-08*	*9-B*	*Out-door*	< 5 Bq/m³
779887-9 [Rapidos®]	*2021-02-17 – 2021-06-09*	*7-B*	*Out-door*	< 5 Bq/m³
454518-2 [Rapidos®]	*2021-02-17 – 2021-06-09*	*7-A*	*Out-door*	< 5 Bq/m³
545221-4 [Rapidos®]	*2021-02-18 – 2021-06-08*	*6-A*	*Out-door*	< 3 Bq/m³
946452-0 [Rapidos®]	*2021-02-18 – 2021-06-08*	*5-B*	*Out-door*	< 3 Bq/m³

Comment to the results

The registered transit detectors 605077, 980972 & 674432 were not returned.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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REPORT DATE
2021-06-23

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2021-06-23

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Denison Mines Corp.

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CANADA

RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2021-06-18**.
They were measured **2021-06-22**.

Test data have been given by Jennifer Skilnick

Property data and address

MEASURE SITE ADDRESS
Denison Mines Corp.
Wheeler River Project Area
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
955607-7 [Rapidos®]	*2021-02-17 – 2021-06-09*	*8-B*	*Out-door*	< 5 Bq/m³
674800-8 [Rapidos®]	*2021-02-18 – 2021-06-08*	*4-B*	*Out-door*	< 3 Bq/m³
302048-4 [Rapidos®]	*2021-02-18 – 2021-06-08*	*3-A*	*Out-door*	< 5 Bq/m³
563882-0 [Rapidos®]	*2021-02-18 – 2021-06-08*	*5-A*	*Out-door*	< 3 Bq/m³
306998-6 [Rapidos®]	*2021-02-18 – 2021-06-08*	*4-A*	*Out-door*	< 3 Bq/m³
566682-1 [Rapidos®]	*2021-02-18 – 2021-06-08*	*3-B*	*Out-door*	< 3 Bq/m³

Comment to the results

The registered transit detectors 605077, 980972 & 674432 were not returned.

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Measurement method: Closed alpha-track detector (Rapidos® High Sensitivity)

The radon measurement was performed with a closed alpha-track detector following the quality assurance guidance given in CNRPP-AL-DF-v6. The detector container is manufactured from electrically conducting plastic. Through a small slit (filter), radon gas enters the detector. The track-detecting material (film) inside the detector is hit by alpha particles generated by the radon entering the container and the decay products formed from it. On the film, the alpha particles make small tracks which are enlarged through chemical etching and later analyzed via our proprietary Track-Etch(R) methodology to determine the radon exposure.

Transit detectors are used for the return delivery of the high-sensitivity detectors in order to make a more accurate background subtraction.

Radonova Laboratories AB (P.O. Box 6522, SE-751 38 Uppsala, Sweden) is accredited (no. 1489) by SWEDAC to conduct radon-gas measurements using the closed alpha-track detector method. The analysis equipment is checked daily and the detectors are calibrated at regular intervals. CNRPP License CRT 201475.

Measured radon concentrations

For each detector, the measured value of the radon concentration is provided. For each value an uncertainty associated with the measurement to a 95% confidence level is also provided. For example a measurement result of 200 ± 30 Bq/m³ means that the radon concentration is most likely contained in the range 170 - 230 Bq/m³. If the start or end date of the measurement has not been provided, the radon concentration cannot be calculated. In such cases, the total exposure in kBqh/m³ will be reported. The average radon concentration can be calculated by dividing the total exposure with the number of measured hours and multiplying that result with 1000. The reported measured values are related to the detectors as received by Radonova Laboratories AB. Detector deployment is not performed by Radonova Laboratories AB. Measurement information such as monitoring period (dates) and placement location is provided to Radonova Laboratories AB by the end user.

The average transit exposure has been subtracted in the reported radon concentrations.

Codes on non-reportable detectors

DNR	Not Reported – Detector Not Returned
VTW	Not Reported – Visibly Tampered With
FBD	Not Reported – Film Broken or Damaged
LIL	Not Reported – Lost in Lab
DTO	Not Reported – Detector Too Old

Signature on the report

With the signature on the report, the person responsible for the radon analysis at Radonova Laboratories AB hereby certifies that the measurement procedures follows the guidance in accordance with CNRPP-AL-DF-v6 and that the demands from SWEDAC are fulfilled.

Measurement information displayed in italics on report has been provided by the customer.

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1 of 3

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2021-10-08

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BY
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RADON MONITORING REPORT

Description of the measurement

The measurement was performed with a closed high-sensitivity alpha-track detector.

The detector(s) arrived to Radonova Laboratories AB **2021-09-28**.
They were measured **2021-10-04**.

Test data have been given by Jennifer Skilnick

Property data and address

MEASURE SITE ADDRESS
Denison Mines Corp
Wheeler River
Saskatoon SK S7K 0E9

BUILDING ID

TRANSIT DETECTOR 1:
344310 (8 ± 4 kBqh/m3)

TRANSIT DETECTOR 2:
676489 (3 ± 6 kBqh/m3)

TRANSIT DETECTOR 3:
813970 (2 ± 4 kBqh/m3)

Test results

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
939709-2 [Rapidos®]	*2021-06-08 – 2021-09-21*	*1A*	*Out-door*	< 4 Bq/m³
521692-4 [Rapidos®]	*2021-06-08 – 2021-09-21*	*1B*	*Out-door*	4 ± 3 Bq/m³
280829-3 [Rapidos®]	*2021-06-08 – 2021-09-21*	*2A*	*Out-door*	< 4 Bq/m³
277051-9 [Rapidos®]	*2021-06-08 – 2021-09-21*	*3A*	*Out-door*	< 4 Bq/m³
148078-9 [Rapidos®]	*2021-06-08 – 2021-09-21*	*3B*	*Out-door*	< 5 Bq/m³
438812-0 [Rapidos®]	*2021-06-08 – 2021-09-21*	*4A*	*Out-door*	4 ± 3 Bq/m³
658969-1 [Rapidos®]	*2021-06-08 – 2021-09-21*	*4B*	*Out-door*	4 ± 3 Bq/m³
767721-4 [Rapidos®]	*2021-06-08 – 2021-09-21*	*5A*	*Out-door*	4 ± 3 Bq/m³
696374-8 [Rapidos®]	*2021-06-08 – 2021-09-21*	*5B*	*Out-door*	4 ± 3 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Denison Mines Corp

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Denison Mines Corp
Wheeler River
Saskatoon SK S7K 0E9

BUILDING ID

DETECTOR	MEASUREMENT PERIOD	DESCRIPTION / LOCATION	LOCATION TYPE	RADON RESULT
161028-6 [Rapidos®]	*2021-06-08 – 2021-09-21*	*6A*	*Out-door*	< 4 Bq/m³
416451-3 [Rapidos®]	*2021-06-08 – 2021-09-21*	*6B*	*Out-door*	< 4 Bq/m³
368371-1 [Rapidos®]	*2021-06-09 – 2021-09-21*	*7A*	*Out-door*	7 ± 4 Bq/m³
781946-9 [Rapidos®]	*2021-06-09 – 2021-09-21*	*7B*	*Out-door*	5 ± 3 Bq/m³
226419-0 [Rapidos®]	*2021-06-09 – 2021-09-21*	*8A*	*Out-door*	< 6 Bq/m³
801195-9 [Rapidos®]	*2021-06-09 – 2021-09-21*	*8B*	*Out-door*	4 ± 3 Bq/m³
147329-7 [Rapidos®]	*2021-06-08 – 2021-09-22*	*9A*	*Out-door*	< 4 Bq/m³
749949-4 [Rapidos®]	*2021-06-08 – 2021-09-22*	*9B*	*Out-door*	< 5 Bq/m³
308375-5 [Rapidos®]	*2021-06-08 – 2021-09-22*	*10A*	*Out-door*	< 4 Bq/m³
350617-7 [Rapidos®]	*2021-06-08 – 2021-09-22*	*10B*	*Out-door*	< 4 Bq/m³

Comment to the results

Tryggve Rönnqvist (Electronically signed)

Signature Radonova Laboratories AB Laboratory Measurement Specialist

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Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

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PEOPLE, PARTNERSHIPS AND PASSION.

Annex 6-E
Acoustic Assessment Technical Supporting Document
Denison Mines – Wheeler River Project

Prepared for:

Denison Mines

230 22nd St. East, Suite 200
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Prepared by:

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IEC Project No.: SX19-0043

January 2024

DOCUMENT APPROVAL

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TECHNICAL REVIEW

Position	Name	Signature	Date
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MANAGEMENT REVIEW

Position	Name	Signature	Date
Vice President	Paul Kirby, M.Sc. CET, EP		

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3	Updated draft to remove duplication of discussion with EIS	NZS	PLK	20 Jul 2022
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6	Minor revisions to address IRs	NZS	PLK	19Jan2024

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APPENDICES

Appendix A: Assessment Scenarios and Sound Level Data

1.0 INTRODUCTION

This technical report is supplementary to the discussion of the noise impact assessment provided in the main body of the Environmental Impact Statement (EIS) report (Section 6 – Atmospheric and Acoustic Environment). The purpose of this supplemental report is to provide additional technical background details on the assessment methodology, assessment scenarios, source identification and characterization, predictive modelling, and modelling outputs.

2.0 ASSESSMENT SCENARIOS

The Wheeler River Project (the Project) will be completed in four phases: construction, operation, decommissioning, and post-decommissioning. As the nature of operations in each phase differs, the noise assessment scenarios were developed with consideration to each of these phases so as to effectively bound the potential noise effects of the Project over its entire life cycle. Based on the description of associated activities the Construction and Operations scenarios have the greatest potential to influence off-site sound levels. The Decommissioning phase is expected to be similar in nature to the construction phase; however, will not involve as much equipment and truck traffic, there will be no drilling, and the freeze plant will no longer be operating. As such, the Construction stage is expected to bound (i.e., have greater potential for impacts relative to) the Decommissioning stage. The Post-decommissioning phase will involve the least amount of activity of all of the phases, as it primarily involves monitoring conditions at the site over time. As such, the assessment of the Site Construction and Operations phases is expected to fully bound the noise impacts from the Project. These scenarios are discussed in further detail in the following sections.

2.1 CONSTRUCTION SCENARIO

The Construction scenario was based on the activities associated with the first year of construction, which, as planned, involves the most equipment operating on the site during the three-year construction phase. During this first year it is projected that there will be surface facilities construction occurring simultaneously with wellfield drill mobilizations, drilling of freeze holes and ISR wells, and partial operation of the freeze plant. The maximum scenario that was modelled includes the following general activities:

- Surface construction occurring at the ISR Plant location,
- Operation of a concrete batch plant and crusher,
- Freeze plant constructed and operating (partial operation, 2 of 6 units operating),
- Drill rigs operating in the wellfield (ISR wells),
- Deposit of drill waste in the clean waste pile,
- Power supplied by two (2) 1.1 MW generator sets, operating near the Freeze Plant and ISR plant,
- Power supplied by two (2) 450 kW generator sets, operating near the accommodations centre and the operations centre,
- Various vehicle movements (fuel, food, supplies for construction and wellfield development, on-site traffic), and
- Air traffic associated with construction crew changes.

The detailed source inventory for the Construction scenario, and approach to the characterization of each source are discussed in Section 3.0.

2.2 OPERATIONS SCENARIO

The Operations scenario was based on activities being completed in the late stages of the operations phase, with work being completed in Phase 5 of the deposit. Well drilling would continue, and the freeze plant was assumed to be operating at maximum capacity (all 6 skids running). While the site will be powered from the provincial grid at this stage, the power generators were assumed to be operating under emergency conditions as a worst-case scenario. The general activities included in the operations scenario include:

- Full operation of the ISR plant,
- Full operation of the freeze plant (6 out of 6 units operating),
- Drill rigs operating in the wellfield,
- Operation of a concrete batch plant and crusher,
- Deposit of drill waste in the clean waste pile,
- Power supplied by two (2) 1.1 MW generator sets, operating near the Freeze Plant and ISR plant,
- Power supplied by two (2) 450 kW generator sets, operating near the accommodations centre and the operations centre,
- Electrical utilities operating (i.e., transformers),
- Shipping of yellowcake product,
- Various vehicle movements (fuel, food, raw materials, on-site traffic), and
- Air traffic associated with personnel changes.

The detailed source inventory for the Operations scenario, and approach to the characterization of each source are discussed in Section 3.0.

3.0 SOURCE CHARACTERIZATION

The inventory of noise sources for the Construction and Operations scenarios were developed using information provided by Denison. This information included the process flow diagrams, planned construction fleet, initial equipment lists for the ISR process, freeze plant and utilities, as well as information on the process outlined in the Prefeasibility Study [1] and the Project Description [2] reports. The sound power levels (a measure of the sound energy output of a source) were then derived for each identified source based on available information and/or conservative assumptions.

Sound power levels were generally established using manufacturer specifications, historic measurement data from similar sites, or engineering calculation methods referenced from scientific literature. The inputs for the calculations were derived from available manufacturer specifications and the equipment lists provided by Denison. The list of noise sources associated with the Site Construction and Operation scenarios are summarized in Table 1 and Table 2, respectively. These tables provide an indication of the method used to characterize the sound output of the source, as well as a summary of the key parameters used to estimate the sound levels. As a conservative measure, all power ratings for equipment identified in the Denison equipment list for the ISR process were doubled.

Upon establishing the source sound levels for inclusion in the predictive modelling, the list was reviewed to determine whether there were any sources with special sound characteristics such as tonality or impulse noise. Health Canada (2017) recommends the application of source adjustments in accordance with ISO 1996-1 for

such sources as these are associated with increased annoyance. No tonal or impulsive noise sources were identified in the Construction or Operation scenarios.

Table 1: Noise Source Inventory for Site Construction

Activity	Noise Sources	Method (See Notes)	Key Parameters
Surface construction at ISR Plant	Crane operation	1	260 hp
	Concrete batch plant/crusher	1, 2	750 hp
	Haul truck loading	1	116 hp wheel loader
	Skid steer operation	1	47 hp
Freeze plant (partial operation)	Brine circulation pump (x3)	3	100 hp, 1800 rpm
	Air-cooled condenser (x2)	4	3 hp per fan, 12 fans per unit
	Building radiated noise (x2 chillers)	5, 6	310-ton cooling capacity each
	Haul truck loading	1	116 hp wheel loader
Wellfield activity	Skid steer operation (x2)	1	47 hp (each)
	Bulldozer operation	1	913 hp
	Wheel loader activity	1	116 hp
	Mud rotary drill rig	1	470 hp
	Diamond drill rig	1	525 hp
Clean waste pile activity	Bulldozer operation	1	913 hp
	Wheel loader operation	1	116 hp
Power generation	1.1 MW generators (x2)	7	1.1 MW, 1800 rpm, turbocharged
	450 kW generators (x2)	8	CAT C15
Fuelling	Propane pumps (x2)	3	25 hp, 1800 rpm
Traffic	Fuel/propane deliveries	9	7.5 trucks/day, 35 kph
	Food deliveries	9	2 trucks/day, 35 kph
	Surface construction deliveries	9	7.5 trucks/day, 35 kph
	Wellfield deliveries	9	6 trucks/day, 35 kph
	Wellfield mobilizations	9	30 trucks/day, 35 kph
	Drill waste to clean waste pile	9	14.5 trips/day (wheel loader), 35 kph
	ISR construction – haul truck to clean waste pile	9	24 trucks/day, 35 kph
	Freeze plant const. – haul truck to clean waste pile	9	24 trucks/day, 35 kph
	Crew van between camp and airstrip	9	5 trips/day, 35 kph
	Crew van between camp and Operations Centre	9	20 trips/day, 35 kph
	Crew van between camp and ISR site	9	20 trips/day, 35 kph

Activity	Noise Sources	Method (See Notes)	Key Parameters
	Air traffic to and from site	10	9 flights per week

Notes:
1: Diesel engine [3]; 2: IEC database; 3: Pumps [3]; 4: Air-cooled condensers [4]; 5: Chillers [4]; 6: Building radiated noise (interior to exterior) [5]; 7: Diesel generator [3]; 8: Manufacturer data; 9: FHWA on-road vehicles [4]; 10: Integrated Noise Model (INM) [6].

Table 2: Noise Source Inventory for Operations

Activity	Noise Sources	Method (See Notes)	Key Parameters
ISR plant operations	Building radiated noise: process area	1, 2, 3	Interior SPL calculated at 90.2 dBA
	Building radiated noise: dryer area	1, 2, 3	Interior SPL calculated at 97.6 dBA
Freeze plant (full operation)	Brine circulation pump (x3)	1	100 hp, 1800 rpm
	Air-cooled condenser (x6)	4	3 hp per fan, 12 fans per unit
	Building radiated noise (x6 chillers)	3, 5	310-ton cooling capacity each
Wellfield activity	Wheel loader activity	6	116 hp
	Mud rotary drill rig	6	470 hp
	Diamond drill rig	6	525 hp
	Building radiated noise: pumphouse	3	Interior SPL assumed to be 85 dBA
	Wellfield to ISR booster pumps (x4)	1	100 hp
Concrete production	Concrete batch plant and crusher	6, 7	750 hp
Clean waste pile activity	Wheel loader operation	6	116 hp
Fuelling	Propane pumps (x2)	1	25 hp, 1800 rpm
Power generation	1.1 MW generators (x2)	8	1.1 MW, 1800 rpm, turbocharged
	450 kW generators (x2)	9	CAT C15
Utilities	Main substation transformer (x1)	10	12.5 MVA
	ISR air compressors transformer (x1)	10	3 MVA
	ISR plant transformers (x2)	10	1 MVA
	Freeze plant modules transformer (x1)	10	7.5 MVA
	Freeze plant pumps/controls transformer (x1)	10	1 MVA
	Operations Centre transformer (x1)	10	1 MVA
	Camp transformer (x1)	10	1 MVA
Traffic	Yellowcake shipping	11	2.5 trucks/day, 35 kph
	Reagent deliveries	11	10 trucks/day, 35 kph
	Fuel/propane deliveries	11	7.5 trucks/day, 35 kph

Activity	Noise Sources	Method (See Notes)	Key Parameters
	Food deliveries	11	2 trucks/day, 35 kph
	Material deliveries	11	3 trucks/day, 35 kph
	Wellfield deliveries	11	3 trucks/day, 35 kph
	Wellfield mobilizations	11	30 trucks/day, 35 kph
	Drill waste to clean waste pile	11	9.6 trips/day (wheel loader), 35 kph
	Crew van between camp and airstrip	11	5 trips/day, 35 kph
	Crew van between camp and Ops Ctr.	11	20 trips/day, 35 kph
	Crew van between camp and ISR site	11	20 trips/day, 35 kph
	Air Traffic to and from site	12	4.5 flights per week

Notes: 1: Pumps [3]; 2: Electric motors [3]; 3: Building-radiated noise (interior to exterior) [5]; 4: Air-cooled condensers [4]; 5: Chillers [4]; 6: Diesel engines [3]; 7: IEC Database; 8: Diesel Generator [3]; 9: Manufacturer data; 10 Transformers [3]; 11: FHWA on-road vehicles [4]; 12: Integrated Noise Model [6].

A detailed source summary table is provided in Appendix A, which shows all of the sources included in the predictive modelling and an indication of whether they were active for the Construction scenario, the Operations scenario, or both, the overall sound power level, as well as the octave band data.

4.0 PREDICTIVE MODELLING

The propagation of sound from Project activities associated with the Site Construction and Operations scenarios was predicted using the software package Cadna-A, from DataKustik GmbH [5]. The calculation methodology that is implemented in the Cadna-A model is based directly on ISO Standard 9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* [7], which is the calculation standard recommended under the Alberta Directive that has been adopted in this assessment [8]. This model can also be used to predict the Ldn metric required under the Health Canada guidance [9]. Air traffic was also assessed within the same Cadna-A model, using a module [6] that implements the Integrated Noise Model (INM) developed by the Federal Aviation Administration (FAA) in the United States.

The premise of the ISO standard, and therefore of the predictive model used in this assessment, is to quantify the various ways in which the sound energy from a noise source (e.g., a drill rig) attenuates as it reaches a receptor (e.g., an off-site cabin). The attenuation parameters include the attenuation due to distance (geometrical divergence), attenuation due to the atmosphere (e.g., relative humidity, temperature), attenuation due to the intervening ground type[1], and attenuation due to obstacles such as natural terrain variations, buildings, or barrier walls. Other parameters that factor into the calculation include source directivity[2], and the effect of other meteorological conditions such as wind. The model calculates the sound attenuation between all

[1] Note this may also be a negative attenuation (i.e., a reflection). For example, if the ground between a source and receptor is hard, such as pavement, or otherwise acoustically reflective, such as water.
[2] While many sources are omnidirectional (e.g., a pump would be expected to radiate sound equally in all directions), others are directional (e.g., vertical stacks with airflow that directs the noise upwards).

sources and all receptors input to the model, and logarithmically sums the individual source contributions at each receptor to provide an overall predicted sound level for each receptor. In a similar manner, a receptor grid can be established in the model space, with the same calculation occurring at each node point. This data can then be used to visually plot the sound propagation from the facility being modelled as a contour map.

4.1 MODEL CONFIGURATION

The spatial bounds that have been selected for the assessment, as presented in the EIS, are physically represented in the model space. A scaled 3D representation of the facility and its surroundings are constructed in the model using digital terrain mapping and information on the planned building layouts. This is typically scaled using the UTM coordinate system, for ease of exporting and importing data to and from various mapping software (e.g., GIS, AutoCAD, plotting software). The model space is then further populated with the noise sources that have been identified in the inventorying process described in Section 3.0, and the sound power levels established for these sources are assigned. Similarly, the identified sensitive points of reception that are within the LSA are plotted at the coordinates that have been established.

The temporal bounds that have been discussed in the EIS are represented in two ways:

- Establishing the assessment scenarios (i.e., with regard to the project phase being assessed); and
- Configuring the reference time for the predictions in the model.

The assessment scenarios are configured by inputting all of the identified noise sources to the model, and then identifying those associated with the Construction scenario, the Operations scenario, and which are operational in both scenarios. Controls are then set up in the model to automatically switch sources (and any other related infrastructure, if applicable[3]) on and off, depending on the scenario that is being run.

The temporal boundaries for the predictions are established in the model configuration by establishing the reference times for calculations. Reference times were established in accordance with the guidance documents, which identify that the Ld is the 15-hour period between 07:00 and 22:00, Ln is the 9-hour period between 22:00 and 07:00, and the Ldn is the 24-hour period that combines the Ld and Ln, with a +10 dB penalty for night-time hours [9]. Since the +10 dB penalty is inherent in the Ldn metric (i.e., the Ldn definition includes the +10 dB penalty), the model automatically accounts for it when this parameter is selected for assessment.

There are a number of other configuration parameters that affect the model predictions. These have been set to with the objective of maximizing the conservatism of the calculations, while also reasonably reflecting conditions at the site. These parameters are discussed briefly in Table 3.

[3] For example, the Operations scenario will include the ISR plant as a fully constructed building; however, this building would not yet be constructed in the Site Construction scenario. As such, the controls would be set in the model to turn off not only the ISR Operations sources in the Site Construction run, but also the building itself.

Table 3: Miscellaneous Acoustic Model Configuration Settings

Parameter	Setting	Rationale
Temperature, relative humidity	10°C, 90%	Resulted in maximum predictions
Wind	default	ISO 9613-2 calculations assume a moderate downwind condition for all receptor noise calculations (up to 5 m/s [18 km/h])
Orders of reflection [1]	3	Typical setting for a conservative assessment
Surface absorption [2]	0.37	Buildings set to "Structured Façade", which uses an absorption coefficient of 0.37 (or 2 dB reflection loss).
Ground absorption	Global: 1 Local: 0	The global setting was set to 1 (absorptive) as much of the surrounding area is vegetated. Reflective surfaces such as the Project site and waterbodies were set to 0 (reflective).
Receptor heights	1.5 m above grade	All receptors were assumed to be at an average standing height, which is typically considered to be 1.5 m for such assessments.

Notes:
[1] "Orders of reflection" refers to how many reflections the model will consider when determining possible source-receptor paths.
[2] A measure of the amount of sound energy that is lost (or absorbed) when sound reflects off of a surface such as a building wall.

4.2 SOURCE CONFIGURATION

4.2.1 Industrial Sources

There are four main industrial source types available in the model: point sources, line sources, horizontal area sources, and vertical area sources. Each of the sources identified in the development of the source inventories was assigned the source type that most accurately matched its physical characteristics. Examples of point sources include stack tips, pumps, and stationary equipment such as drill rigs. Line sources were used to define the vehicle traffic routes, and the vehicles were then set up as moving points along those lines and assigned the associated number of trips per hour calculated for each. Horizontal area sources have been used to represent the roofs of buildings (radiating noise from sources operating within), and designated areas within which the pieces of mobile equipment were assumed to be operating. Vertical area sources are generally used to represent building walls that are radiating noise from sources operating within (or sides of enclosures, such as those for the generator units).

The sound power levels associated with the sources that represent the building envelopes were calculated by first establishing the interior sound pressure level expected in the building, and then estimating the transmission of sound through the applicable building component (wall or roof). The interior sound pressure level is established using the sound power levels of the sources operating inside of the building, as well as the reflective characteristics of the interior building surfaces. The building is then enveloped with area sources, and the interior sound level is used with the transmission loss of the building component to calculate the sound power level of the exterior surface. The transmission losses were based on 16-gauge steel panel, with the exception of the generator enclosures, which were based on fibreglass reinforced panels (FRP) per the design information provided by Denison. Images of the model set-up, rendered in 3D, are provided in Figure 1 and Figure 2.

4.2.2 Air Traffic Sources

Noise caused by flights arriving and departing the airstrip were assessed using the FLG module in Cadna-A [6], which implements the algorithms from the FAA air traffic noise model INM. INM includes a database of commercial aircraft that are in common use in North America, inclusive of sound power and directivity during both departure and approach. The airstrip was positioned in the model using a reference coordinate, its magnetic headings and proposed length of 1,600 m. It was assumed that flights may arrive and depart either from the north or south, resulting the development of four distinct air routes. The fleets for the various carriers that service northern Saskatchewan mines were reviewed, and a representative aircraft was selected for crew changes. The ATR-42 is a turbo-prop aircraft in common use for regional transport to mine sites and carries up to 52 personnel so is typical for crew changes. The de Havilland DASH 8 is an equivalent aircraft which appears in the INM database and was applied in this assessment. Denison anticipates up to nine flights per week, while the model is configured to predict the maximum 24-hour period. To be conservative, it was assumed that there could be four flights arriving and departing in the same 24-hr period. These were split evenly between among the defined air routes.

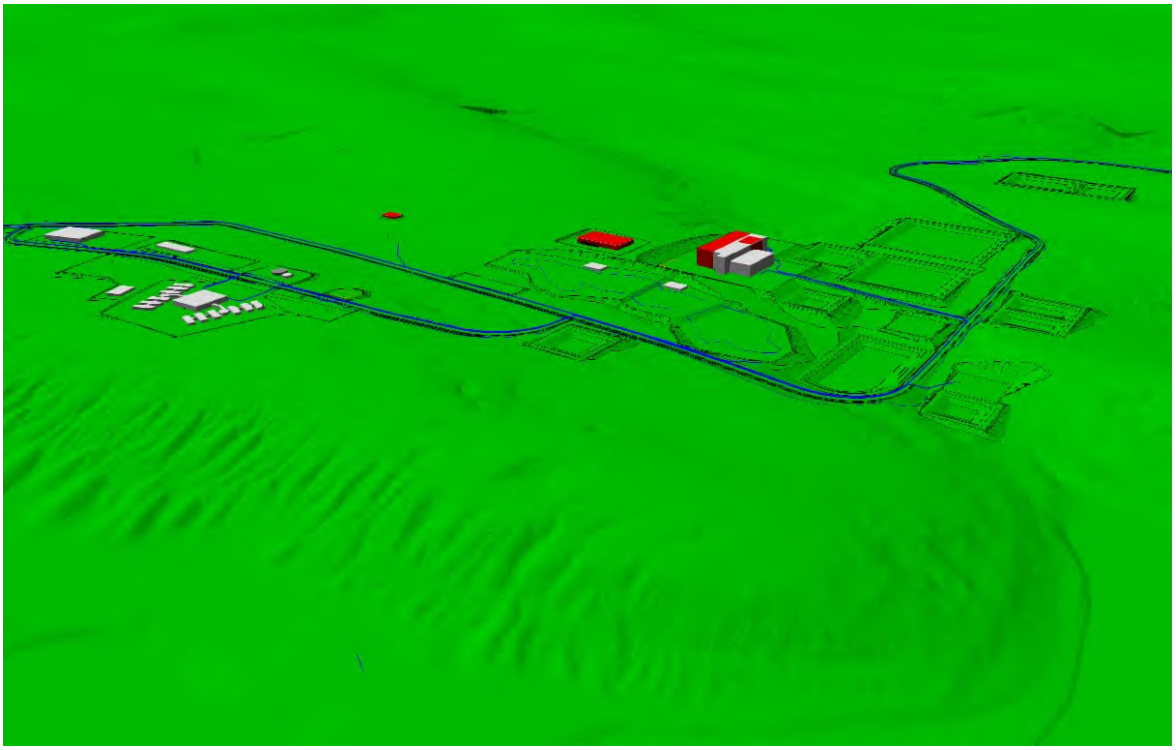


Figure 1: 3D Model View (Looking West)

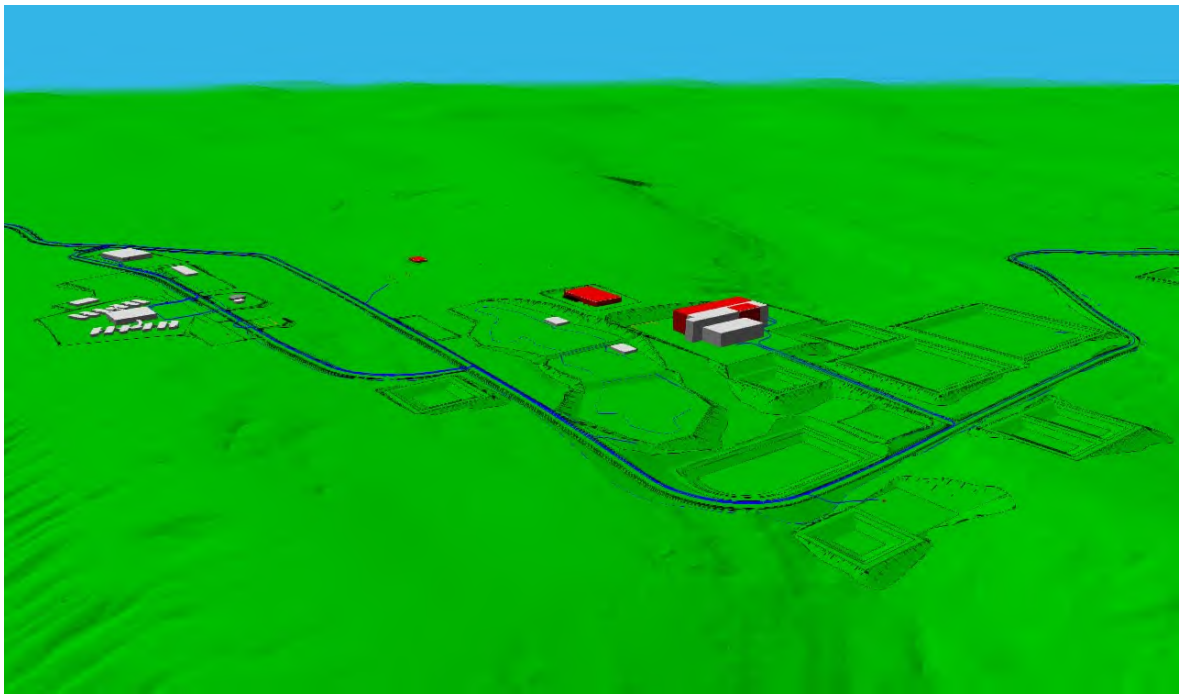
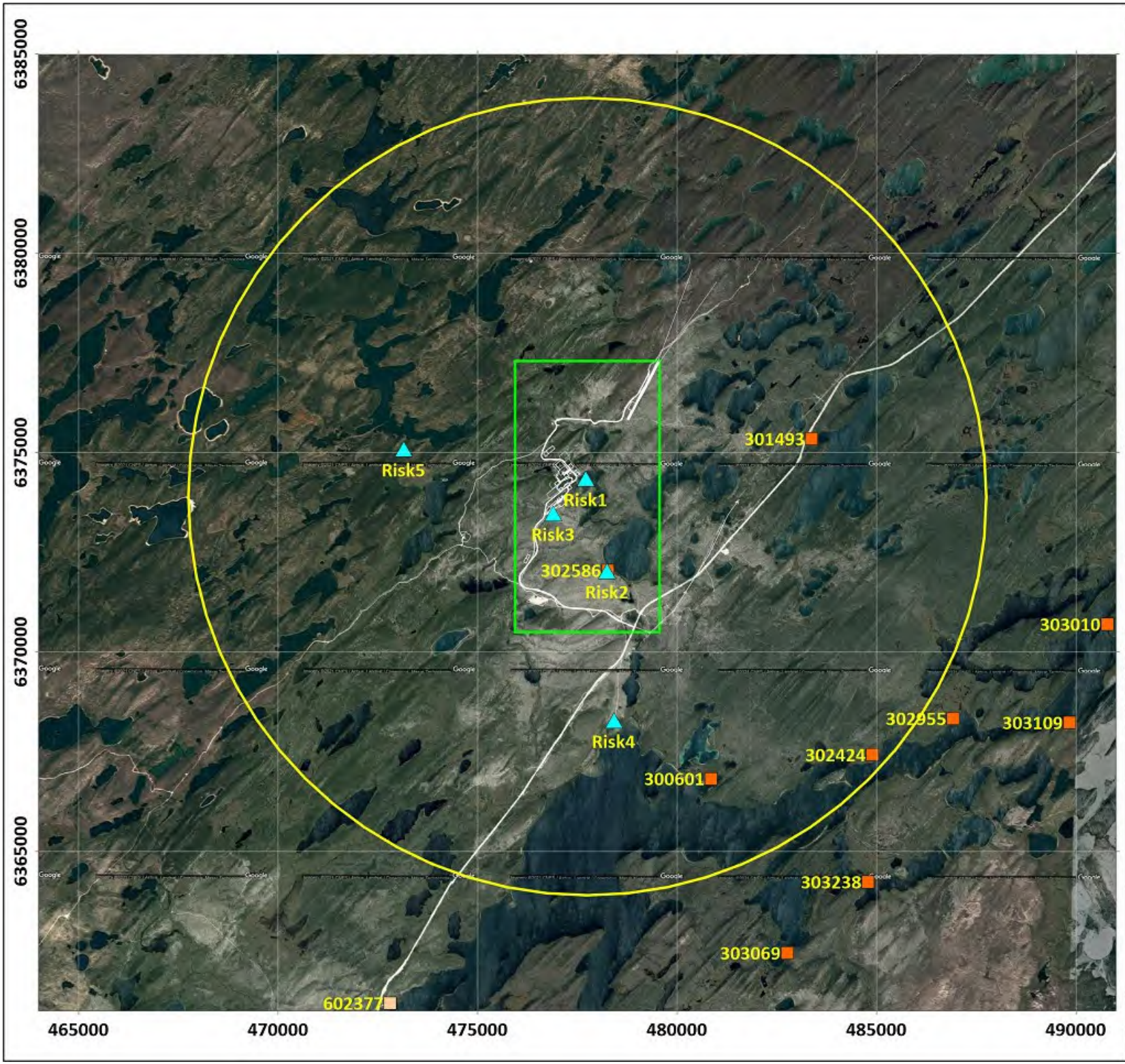


Figure 2: 3D Model View (Looking South-West)

4.3 POINTS OF RECEPTION

Points of reception are discrete locations at which sound levels are predicted in the modelling. These represent the locations at which the sound environment has been identified as a VC, and therefore at which the assessment of noise effects will be evaluated. There are no communities located near to the Project site. The nearest community in terms of straight-line distance is the northern settlement of Wollaston Lake and the neighbouring reserve of Lac La Hache, which are approximately 150 km away. The nearest community in terms of access by road is Pinehouse, which is approximately 260 km away.

There are a number of lease areas in the vicinity of the Project site, and it has been assumed that these contain cabins for purposes of this assessment. As such, these locations have been included as points of reception in the model if they are located within the LSA. In addition, locations of interest to the *Human Health and Ecological Risk Assessment* have been included in the model, which include various types of human locations (nearest seasonal residence, trapping location, and worker camp), and an ecological location. It should be noted that the ecological risk location (Risk1) has not been assessed in against the adopted criteria, which is for human receptors only. In addition, the camp location (Risk3) has not been assessed against the adopted criteria, as it is on-site and associated with the Project, and therefore not representative of a sensitive community. A map depicting the locations of sensitive receptors used in this assessment is included in Figure 3.



LEGEND:

- Project Area
- Local Study Area
- Recreational Land Use Lease
- Traditional Land Use Lease
- Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

SCALE:

metres (m)

0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

Basemap: Google Earth

Denison Mines

Noise Assessment Study Areas and Receptor Locations

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	7
Date: Mar. 2022	Project No.: SX19-0043	

5.0 MODELLING RESULTS

5.1 FEDERAL GUIDANCE

The Health Canada criteria for noise assessment include both an absolute limit of 75 dBA (Ldn), and a relative limit of an increase in %HA of no greater than 6.5% [9]. The conservative assessment scenarios defined in Section 3.0 were modelled in accordance with the procedures detailed in Section 4.0, and the results of this assessment are summarized in Table 4.

The predicted future Ldn values at the leased properties were generally predicted to remain equal to or within 0.4 dBA of the baseline levels during both construction and operations, with the exception of one leased location (302586) and one risk location (Risk2), which are located on the same property. Property 302586 is a seasonal recreational cabin located to the south-east of the Wheeler River site, at the edge of McGowan Lake. This location is approximately 1.3 km from the access road connecting to Highway 914. The baseline Ldn of 37.6 dBA applied at the sensitive receptors in this assessment does not include haulage of ore between McArthur River and Key Lake on Highway 914, as this activity has not occurred since 2017 (see Section 6.2.3 of the EIS). If such traffic were to resume, there is potential for the baseline level to increase at this location, which would also increase the baseline %HA and thereby increase the potential for an exceedance of the Health Canada criteria. Based on traffic volumes documented as part of the Millennium Project EA and summarized in a memo prepared by Denison [10], the estimated daily truck traffic on Highway 914 when McArthur River and Key Lake are operating is approximately 58 trucks per day. A model was prepared that estimated the contributing sound levels of this amount of traffic on Highway 914 at each of the sensitive receptors included in the assessment. At location 302586/Risk2 the predicted Ldn due to truck traffic was 18.3 dBA, which would not change the predicted sound levels when added on a logarithmic basis and therefore not change the assessment results based on the Health Canada Guideline.

At Property 302586, the baseline Ldn was predicted to increase by 4.7 dBA during construction, from 37.6 dBA to 42.3 dBA. In terms of %HA, this represents a +0.4% difference. If the baseline and future Ldn values are increased by +10 dB each, per Health Canada recommendation for locations that are expected to be highly sensitive to noise, the increase in %HA at this location changes to +1.3%. The increase is primarily related to the use of heavy equipment in the development of the wellfield and the generators, as well as truck traffic accessing the site from Highway 914. During operations, the increase from baseline at this location was predicted to be 2.8 dBA, from 37.6 dBA to 40.4 dBA. When these are adjusted by +10 dB as above, the resulting change in %HA is +0.7%. During operations, the sound levels at this location are attributable to the heavy equipment operating in the wellfield, use of the emergency generators (included as a worst-case scenario), and traffic along the access road from Highway 914.

The predictive modelling indicates that the Project does not cause an adverse effect with regard to the Health Canada Guideline at any of the identified receptors, as the future conditions remain below 75 dBA and the %HA does not increase by more than 6.5% at any receptor identified.

Contour plots depicting the sound propagation (in Ldn) and increase in %HA from the Construction and Operations phases are provided in

Figure 4 to Figure 7. Note that these represent the predicted noise from the site added to the baseline Ldn of 37.6 dBA. These plots show that the sound level contours during construction and operations return to the baseline level within the LSA, with the exception of a small extension to the north-east which is associated with the daytime incoming/outgoing flights at the airstrip. During construction, the Ldn sound levels are predicted to return to background within approximately 6 kilometres of main activity areas, while the Operations Ldn sound levels are predicted to return to background within approximately 4 kilometres of the main activity areas.

In addition to the Ldn and %HA assessment methods, the Health Canada Guideline also recommends assessing the potential for low frequency noise (LFN) impacts such as noise- induced vibration or rattles in building structures [9]. The recommended approach from ANSI is to combine the predicted receptor sound levels in the 16 to 63 Hz octave bands and compare the total to a criterion of 70 dBZ. The maximum prediction for this assessment was 44 dBZ, and, therefore, LFN is not predicted to be a concern for the Project.

5.2 PROVINCIAL GUIDANCE

The PSLs for the Project under the Alberta Directive are 40 dBA (Ld) and 36 dBA (Ln). The conservative assessment scenarios defined in Section 2.0 were modelled in accordance with the procedures detailed in Section 4.0 to predict Ld and Ln sound levels at each identified receptor, and the results of this assessment are summarized in Table 5 and Table 6.

At the leased properties, the sound levels generally remained equal to the baseline sound level, or increased by less than 0.5 dBA, with the exception of the property identified as 302586/Risk2. As noted in the previous section, this receptor is located to the south-east of the Wheeler River site, adjacent to McGowan Lake. During construction, the daytime and night-time sound levels increased over baseline conditions by 5.1 dBA and 4.6 dBA, respectively, and the future levels were found to be less than the established PSLs. The increases in sound level at this location are primarily associated with the construction equipment being used in the development of the wellfield. During operations, the increases are 3.4 dBA and 2.8 dBA during the daytime and night-time, respectively, and are predicted to be below the PSLs.

Contour plots depicting the sound propagation in Ld and Ln for both Construction and Operations are provided in Figure 8 to Figure 11. Note that these depict the future predicted sound levels from the site activities added to the ambient sound levels discussed in Section 6.2.3 of the EIS. The extent of displayed contours represents the return to the established baseline conditions, while the applicable PSL is shown as a blue line. During both construction and operations, the daytime and night-time sound levels are predicted to return to baseline conditions within the LSA, with the exception of some influence of the flight paths associated with use of the airstrip during the daytime hours. The PSLs for daytime and night-time during construction are met within 2 km and 2.5 km of the main activity area at the site, respectively; both of which are well within the LSA spatial boundary. During operations, the PSLs are met within approximately 1 km during the daytime, and 1.5 km during the night-time.

Table 4: Health Canada Guideline Effects Assessment (Construction and Operations)

Name	ID	Baseline Condition (1)			Construction					Operations				
		Ldn (dBA)	Ldn-Adj. (2) (dBA)	%HA	Ldn (dBA)	Total Ldn (3) (dBA)	Ldn-Adj. (2) (dBA)	%HA	Δ%HA	Ldn (dBA)	Total Ldn (3) (dBA)	Ldn-Adj. (2) (dBA)	%HA	Δ%HA
Leased property	300601	37.6	47.6	1.6	21.3	37.7	47.7	1.6	**0.0**	18.9	37.7	47.7	1.6	**0.0**
Leased property	301493	37.6	47.6	1.6	26.4	37.9	47.9	1.7	**0.1**	23.0	37.7	47.7	1.6	**0.0**
Leased property	302424	37.6	47.6	1.6	14.4	37.6	47.6	1.6	**0.0**	14.5	37.6	47.6	1.6	**0.0**
Leased property	302586	37.6	47.6	1.6	40.4	42.3	52.3	2.9	**1.3**	37.3	40.4	50.4	2.3	**0.7**
Leased property	302955	37.6	47.6	1.6	10.9	37.6	47.6	1.6	**0.0**	10.9	37.6	47.6	1.6	**0.0**
Leased property	303010	37.6	47.6	1.6	6.2	37.6	47.6	1.6	**0.0**	6.2	37.6	47.6	1.6	**0.0**
Leased property	303069	37.6	47.6	1.6	14.0	37.6	47.6	1.6	**0.0**	14.0	37.6	47.6	1.6	**0.0**
Leased property	303109	37.6	47.6	1.6	6.4	37.6	47.6	1.6	**0.0**	6.4	37.6	47.6	1.6	**0.0**
Leased property	303238	37.6	47.6	1.6	11.8	37.6	47.6	1.6	**0.0**	11.8	37.6	47.6	1.6	**0.0**
Leased property	602377	37.6	47.6	1.6	16.6	37.6	47.6	1.6	**0.0**	16.6	37.6	47.6	1.6	**0.0**
Risk - ecological on-site (4)	Risk1	37.6	N/A	N/A	59.4	59.4	N/A	N/A	**N/A**	45.7	46.3	N/A	N/A	**N/A**
Risk - human: seasonal resident at McGowan Lake	Risk2	37.6	47.6	1.6	40.4	42.3	52.3	2.9	**1.3**	37.3	40.4	50.4	2.3	**0.7**
Risk - human: camp worker (4)	Risk3	37.6	N/A	N/A	51.6	51.8	N/A	N/A	**N/A**	51.7	51.9	N/A	N/A	**N/A**
Risk - human: seasonal resident at Russell Lake	Risk4	37.6	47.6	1.6	27.0	38.0	48.0	1.7	**0.1**	24.4	37.8	47.8	1.6	**0.0**
Risk - reference receptor location	Risk5	37.6	47.6	1.6	34.6	39.4	49.4	2.0	**0.4**	32.0	38.7	48.7	1.8	**0.2**

Notes:
(1) The baseline condition (or background condition) was established in the measurement program discussed in Section 5.1.
(2) Per Health Canada guidance, the measured/predicted Ldn should be adjusted by +10 dBA for quiet rural or remote settings [9].
(3) The "Total Ldn" represents the baseline Ldn added logarithmically to the model-predicted Ldn.

Name	ID	Baseline Condition (1)			Construction					Operations				
		Ldn (dBA)	Ldn-Adj. (2) (dBA)	%HA	Ldn (dBA)	Total Ldn (3) (dBA)	Ldn-Adj. (2) (dBA)	%HA	Δ%HA	Ldn (dBA)	Total Ldn (3) (dBA)	Ldn-Adj. (2) (dBA)	%HA	Δ%HA
(4) These are not receptors in terms of the Health Canada Guideline, and so only the model results are displayed.														

Table 5: Alberta Directive Effects Assessment (Construction)

Name	ID	Baseline Condition (1)		Construction Only (2)		Total Construction (3)		PSL		Difference (Total – PSL)	
		Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)
Leased property	300601	30.7	31.3	17.6	14.2	30.9	31.4	40	36	-9.1	-4.6
Leased property	301493	30.7	31.3	21.7	19.7	31.2	31.6	40	36	-8.8	-4.4
Leased property	302424	30.7	31.3	16.3	0	30.9	31.3	40	36	-9.1	-4.7
Leased property	302586	30.7	31.3	34.2	34.0	35.8	35.9	40	36	-4.2	-0.1
Leased property	302955	30.7	31.3	12.8	0	30.8	31.3	40	36	-9.2	-4.7
Leased property	303010	30.7	31.3	8.3	0	30.7	31.3	40	36	-9.3	-4.7
Leased property	303069	30.7	31.3	15.9	0	30.8	31.3	40	36	-9.2	-4.7
Leased property	303109	30.7	31.3	8.5	0	30.7	31.3	40	36	-9.3	-4.7
Leased property	303238	30.7	31.3	13.7	0	30.8	31.3	40	36	-9.2	-4.7
Leased property	602377	30.7	31.3	18.7	0	31.0	31.3	40	36	-9.0	-4.7
Risk - ecological on-site (4)	Risk1	30.7	31.3	53.0	53.0	53.1	53.0	N/A	N/A	N/A	N/A
Risk - human: seasonal resident at McGowan Lake	Risk2	30.7	31.3	34.2	34.0	35.8	35.9	40	36	-4.2	-0.1

Name	ID	Baseline Condition (1)		Construction Only (2)		Total Construction (3)		PSL		Difference (Total – PSL)	
		Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)
Risk - human: camp worker (4)	Risk3	30.7	31.3	45.3	45.2	45.4	45.4	N/A	N/A	N/A	N/A
Risk - human: seasonal resident at Russell Lake	Risk4	30.7	31.3	21.6	20.4	31.2	31.6	40	36	-8.8	-4.4
Risk - reference receptor location	Risk5	30.7	31.3	28.3	28.2	32.7	33.0	40	36	-7.3	-3.0

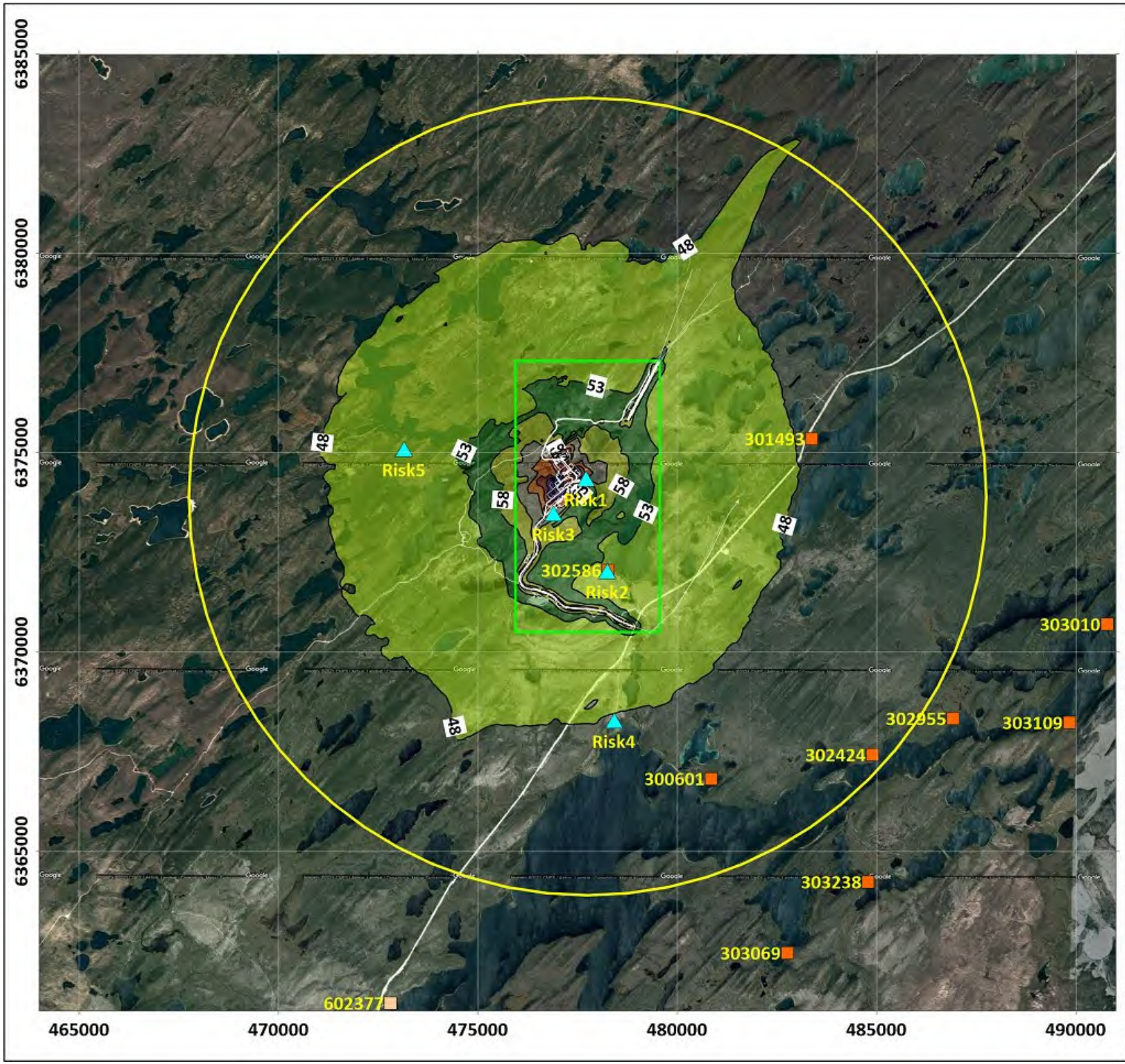
Notes:
(1) The Baseline Condition (or background condition) was established in the measurement program discussed in Section 5.2.
(2) The Construction Only sound level is the contribution from the Project only, determined via predictive modelling.
(3) The Total Construction sound level is the logarithmic addition of the baseline sound level to the modelled project sound level.
(4) These receptors are not community locations and therefore only the modelling results are displayed.

Table 6: Alberta Directive Effects Assessment (Operations)

Name	ID	Baseline Condition (1)		Operations Only (2)		Total Operations (3)		PSL		Difference (Total – PSL)	
		Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)
leased property	300601	30.7	31.3	16.6	11.1	30.9	31.3	40	36	-9.1	-4.7
leased property	301493	30.7	31.3	19.8	15.7	31.0	31.4	40	36	-9.0	-4.6
leased property	302424	30.7	31.3	16.3	0	30.9	31.3	40	36	-9.1	-4.7
leased property	302586	30.7	31.3	31.4	30.7	34.1	34.0	40	36	-5.9	-2.0
leased property	302955	30.7	31.3	12.8	0	30.8	31.3	40	36	-9.2	-4.7
leased property	303010	30.7	31.3	8.3	0	30.7	31.3	40	36	-9.3	-4.7
leased property	303069	30.7	31.3	15.9	0	30.8	31.3	40	36	-9.2	-4.7
leased property	303109	30.7	31.3	8.5	0	30.7	31.3	40	36	-9.3	-4.7

Name	ID	Baseline Condition (1)		Operations Only (2)		Total Operations (3)		PSL		Difference (Total – PSL)	
		Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)
leased property	303238	30.7	31.3	13.7	0	30.8	31.3	40	36	-9.2	-4.7
leased property	602377	30.7	31.3	18.7	0	31.0	31.3	40	36	-9.0	-4.7
risk - ecological on-site (4)	Risk1	30.7	31.3	41.5	38.7	41.8	39.4	N/A	N/A	N/A	N/A
risk – human: seasonal resident at McGowan Lake	Risk2	30.7	31.3	31.4	30.8	34.1	34.1	40	36	-5.9	-1.9
risk - human: camp worker (4)	Risk3	30.7	31.3	45.3	45.2	45.4	45.4	N/A	N/A	N/A	N/A
risk - human: seasonal resident at Russell Lake	Risk4	30.7	31.3	19.9	17.6	31.0	31.5	40	36	-9.0	-4.5
risk - reference receptor location	Risk5	30.7	31.3	26.0	25.5	32.0	32.3	40	36	-8.0	-3.7

Notes:
(1) The Baseline Condition (or background condition) was established in the measurement program discussed in Section 5.2.
(2) The Operations Only sound level is the contribution from the Project only, determined via predictive modelling.
(3) The Total Operations sound level is the logarithmic addition of the baseline sound level to the modelled project sound level.
(4) These receptors are not community locations and therefore only the modelling results are displayed.



LEGEND:

Adjusted Ldn (Ldn+10 dBA): 88, 83, 78, 73, 68, 63, 58, 53, 48

- Project Area
- Local Study Area
- Recreational Land Use Lease
- Traditional Land Use Lease
- Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

Baseline Ldn = 37.6 dBA
Adjusted Baseline Ldn = 47.8 dBA

SCALE:

metres (m)
0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

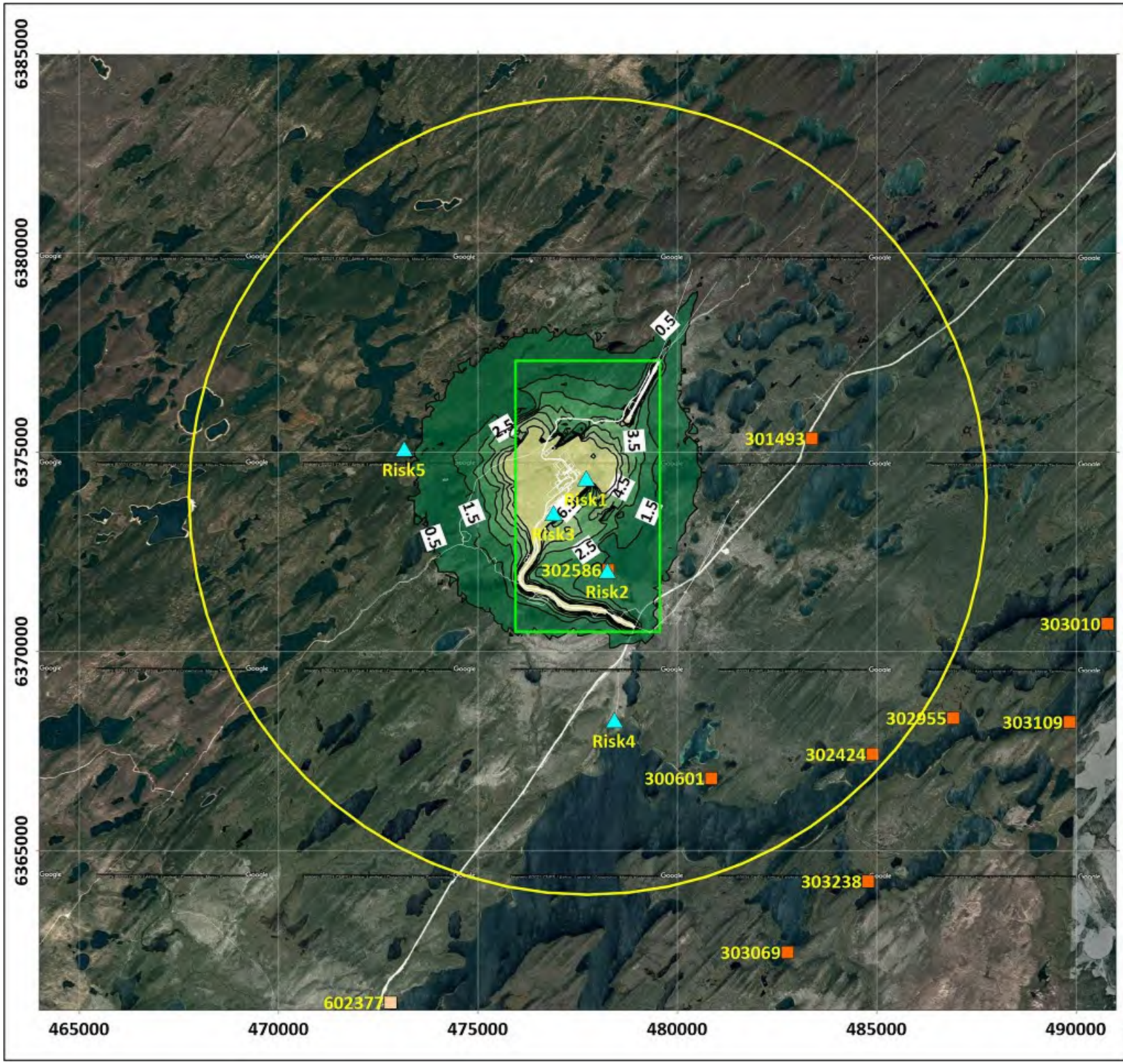
Basemap: Google Earth

Denison Mines

Prediction Results:
Construction Day-Night Level (Ldn)

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	8
Date: Mar. 2022	Project No.: SX19-0043	



LEGEND:

Change in %HA: 6.5, 5.5, 4.5, 3.5, 2.5, 1.5, 0.5

Project Area

Local Study Area

Recreational Land Use Lease

Traditional Land Use Lease

Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

SCALE:

metres (m)

0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

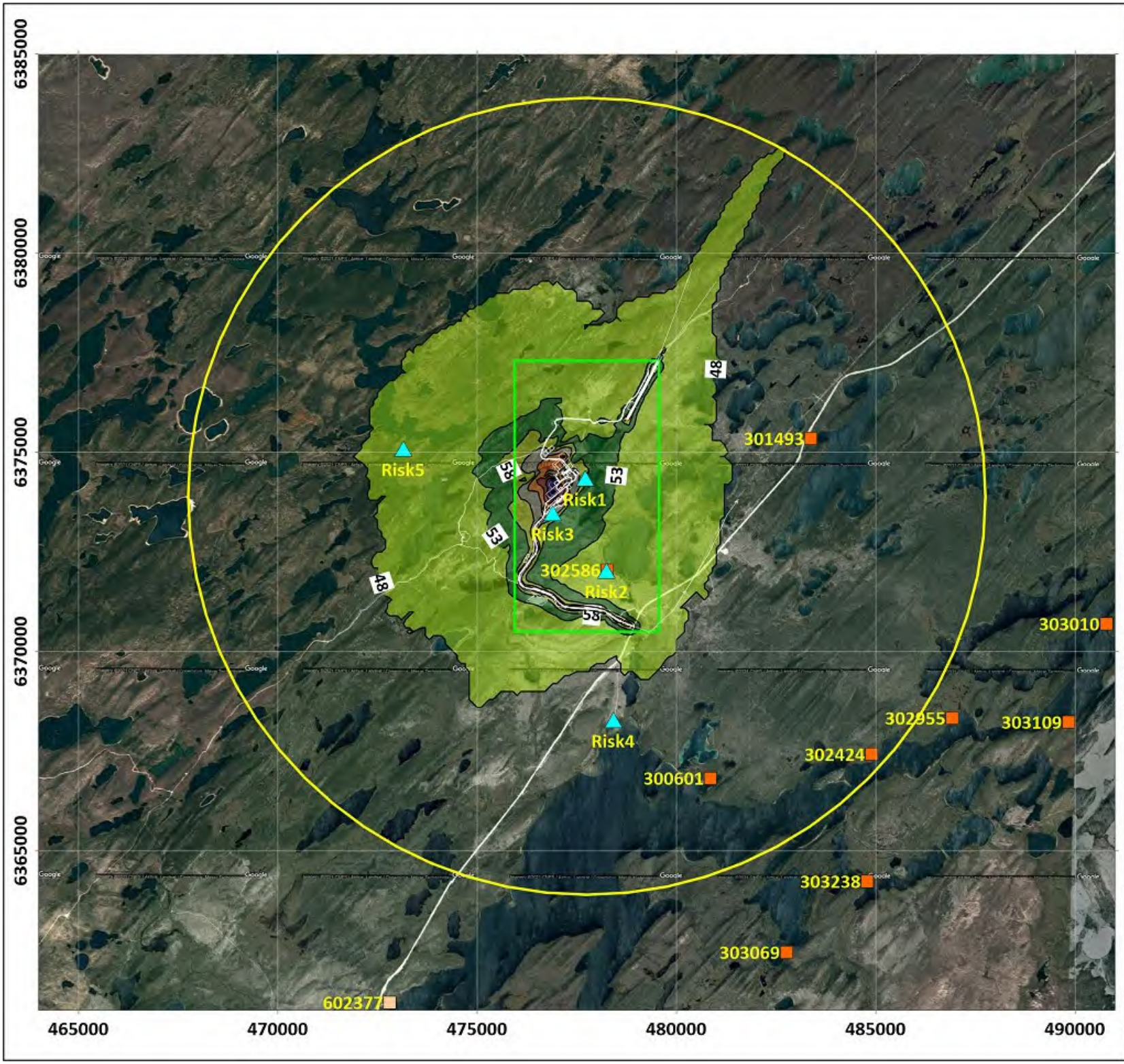
Basemap: Google Earth

Denison Mines

Prediction Results:
Construction Change in %HA

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	9
Date: Mar. 2022	Project No.: SX19-0043	



LEGEND:

Adjusted Ldn (Ldn+10 dBA): 88, 83, 78, 73, 68, 63, 58, 53, 48

Project Area

Local Study Area

Recreational Land Use Lease

Traditional Land Use Lease

Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

Baseline Ldn = 37.6 dBA
Adjusted Baseline Ldn = 47.8 dBA

SCALE:

metres (m)

0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

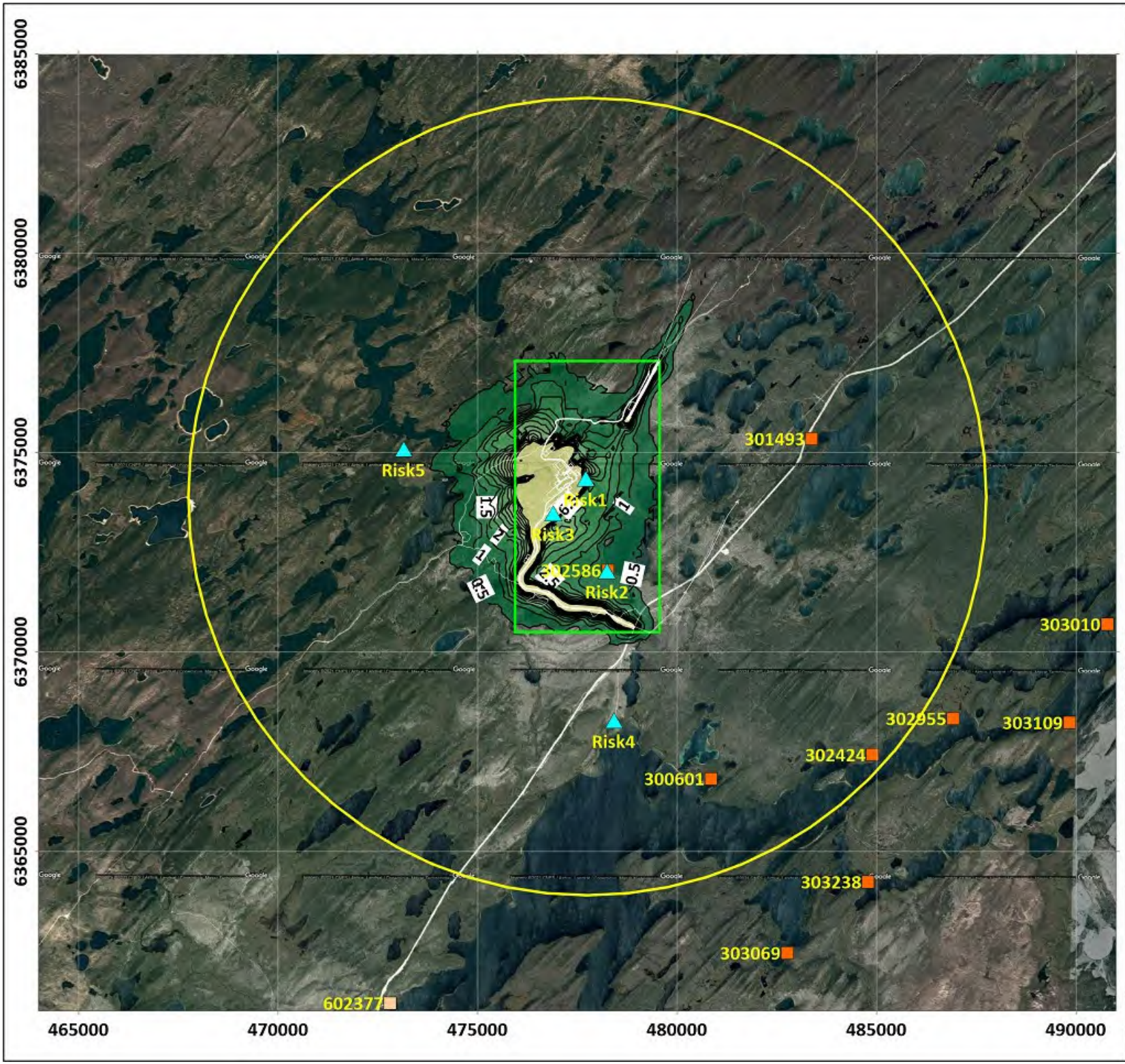
Basemap: Google Earth

Denison Mines

Prediction Results:
Operations Day-Night Level (Ldn)

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	10
Date: Mar. 2022	Project No.: SX19-0043	



LEGEND:

Change in %HA: 0.5, 1.5, 2.5, 3.5, 4.5, 5.5, 6.5

Project Area

Local Study Area

Recreational Land Use Lease

Traditional Land Use Lease

Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

SCALE:

metres (m)

0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

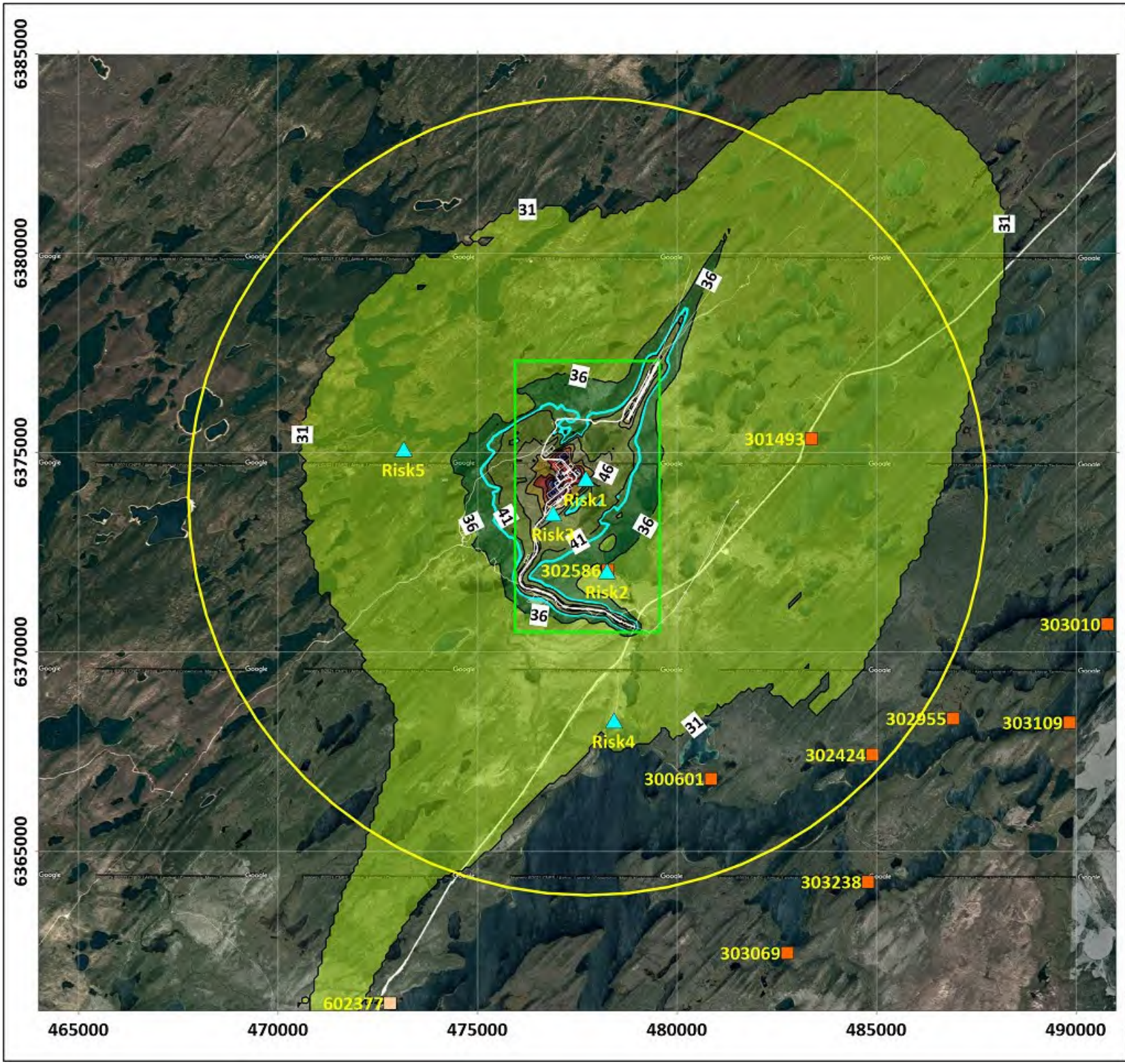
Basemap: Google Earth

Denison Mines

Prediction Results:
Operations Change in %HA

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	11
Date: Mar. 2022	Project No.: SX19-0043	



LEGEND:

Sound Level (dBA): 76, 71, 66, 61, 56, 51, 46, 41, 40, 36, 31

- Project Area
- Local Study Area
- Recreational Land Use Lease
- Traditional Land Use Lease
- Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

Baseline Ld = 30.7 dBA

SCALE:

metres (m)
0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

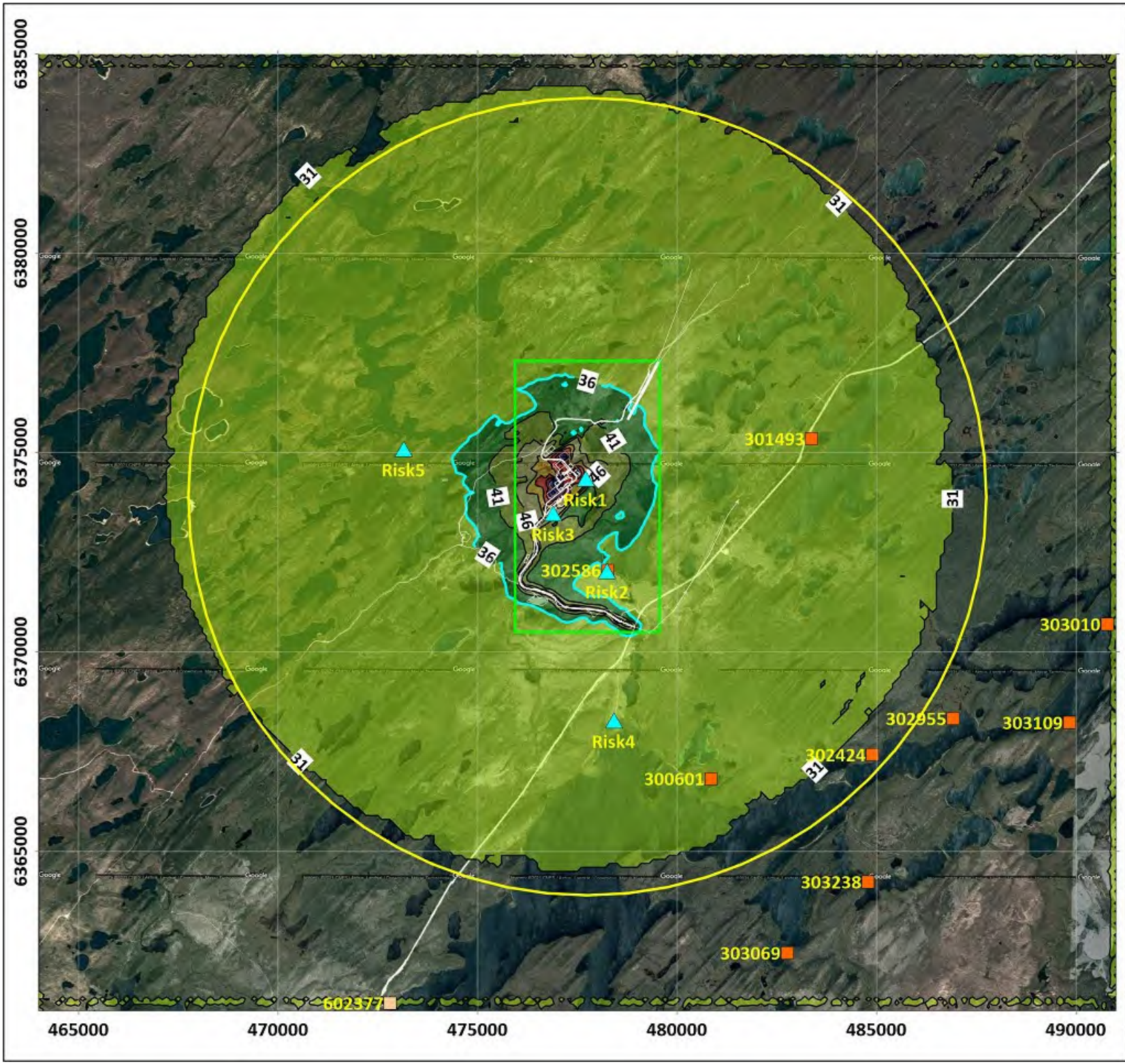
Basemap: Google Earth

Denison Mines

Prediction Results:
Construction Daytime Ld

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	12
Date: Mar. 2022	Project No.: SX19-0043	



LEGEND:

Sound Level (dBA): 76, 71, 66, 61, 56, 51, 46, 41, 36, 31

Project Area

Local Study Area

Recreational Land Use Lease

Traditional Land Use Lease

Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

Baseline Ln = 31.3 dBA

SCALE:

metres (m)

0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

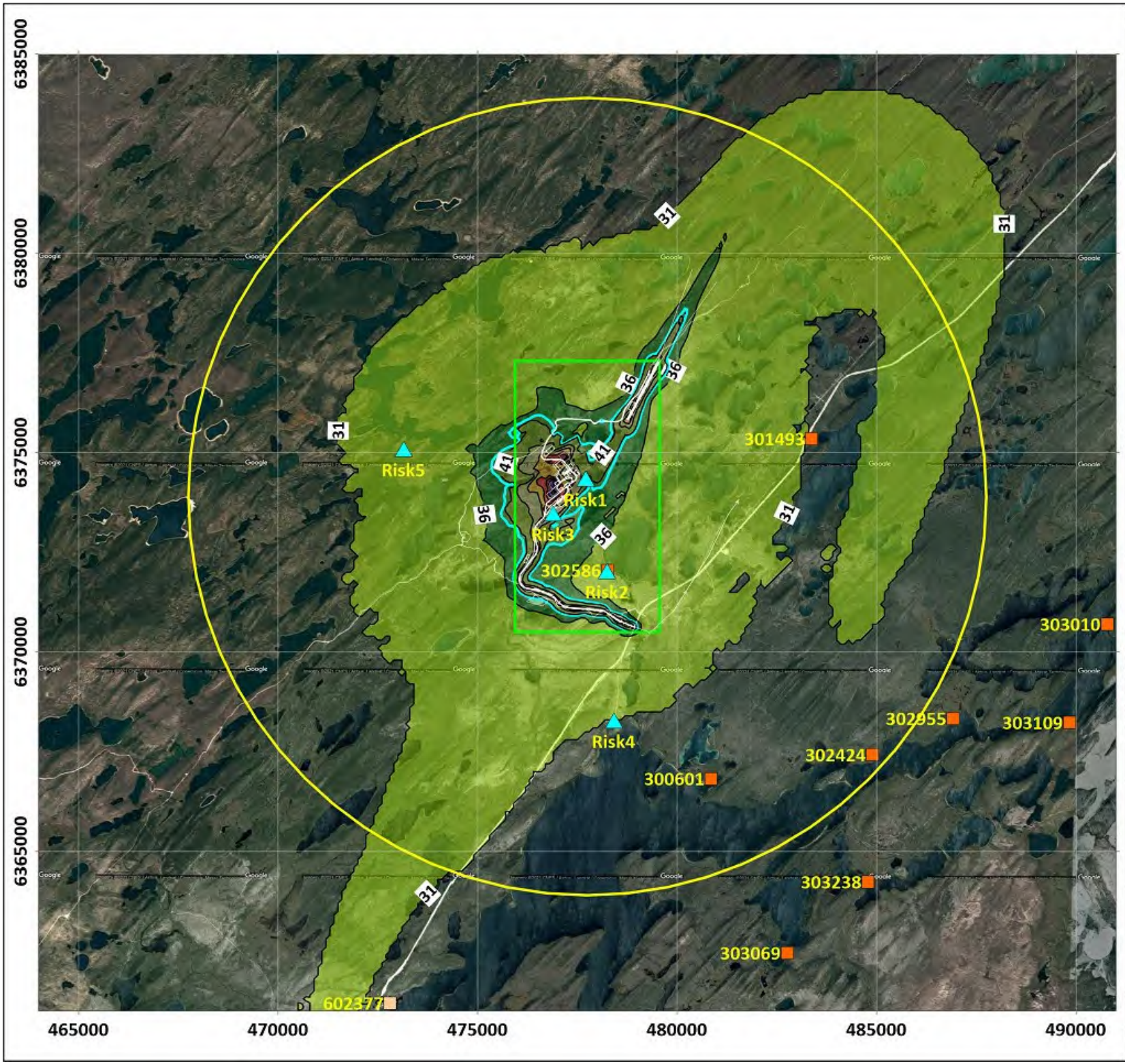
Basemap: Google Earth

Denison Mines

Prediction Results:
Construction Night-time Ln

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	13
Date: Mar. 2022	Project No.: SX19-0043	



LEGEND:

Sound Level (dBA): 76, 71, 66, 61, 56, 51, 46, 41, 40, 36, 31

- Project Area
- Local Study Area
- Recreational Land Use Lease
- Traditional Land Use Lease
- Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

Baseline Ld = 30.7 dBA

SCALE:

metres (m)
0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

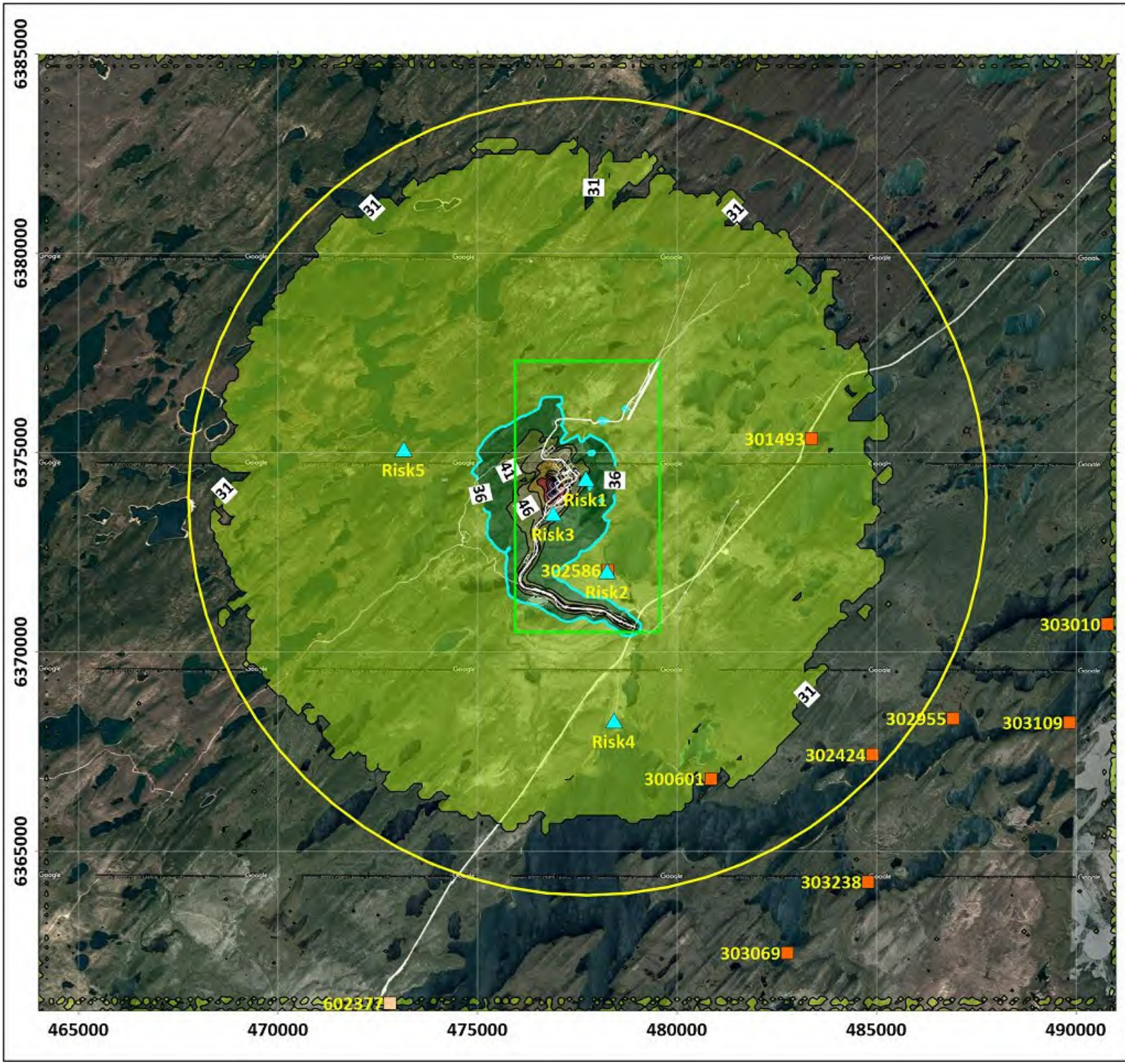
Basemap: Google Earth

Denison Mines

Prediction Results:
Operations Daytime Ld

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	14
Date: Mar. 2022	Project No.: SX19-0043	



LEGEND:

Sound Level (dBA): 76, 71, 66, 61, 56, 51, 46, 41, 36, 31

- Project Area
- Local Study Area
- Recreational Land Use Lease
- Traditional Land Use Lease
- Risk Receptor

NOTES:

Border Coordinates in UTM
UTM Zone 13, WGS84
Basemap: Google Maps 2021

Baseline Ln = 31.3 dBA

SCALE:

metres (m)
0 1000 2000 3000 4000 5000

REVISIONS:

No.	Date	By	Revision

REFERENCE:

Basemap: Google Earth

Denison Mines

Prediction Results:
Operations Night-time Ln

Wheeler River Project, Saskatchewan

Drawn By:	Approved By:	Figure No.:
NZS	PLK	15
Date: Mar. 2022	Project No.: SX19-0043	

6.0 RECOMMENDED CONSTRUCTION PRACTICES

The following construction practices are recommended based on industry best practices for reducing the likelihood of impacts during construction projects.

Administrative controls

- Planning truck routes to minimize separation distance to the nearest receptors,
- Maximizing the distance between the planned construction staging areas and equipment locations and the sensitive receptors,
- Planning to use the least impactful construction method available,
- Ensuring those potentially impacted by construction noise are aware of how to lodge complaints,
- Complete regular inspections of equipment to ensure it is in good working order, and
- Minimize night-time operations.

Physical controls

- Select mobile construction equipment that is appropriately sized for its task,
- Ensure all exhausts (e.g., mobile equipment, generators) are outfitted with effective muffling devices that are in good working condition,
- Selecting low-noise tools and equipment where available,
- Avoid dropping material from height, and
- Turn off equipment when not being used.

6.1 NOISE COMPLAINT AND RESPONSE PROCEDURE

Beyond administrative and physical controls, a community complaints and response procedure and the response procedure consistent with the appropriate Health Canada guidance would be developed. Details would be developed at a later time, but the following provides a conceptual basis for the procedure. Prior to the commencement of the first routine noise monitoring campaign during Construction, Indigenous Groups and other Interested Parties will be notified of the monitoring schedule and planned locations. Initially, the proposed locations will be the same locations as were used in the baseline program for direct comparison of the data to the baseline conditions. These locations may be revised or expanded upon to include other locations based on feedback received. At the same time, Indigenous Groups and other Interested Parties will also be notified of how noise complaints may be registered. If a noise complaint is received, the associated monitoring would then take place at the location of the complainant. Upon receiving a noise complaint, the responsible Denison environmental staff will implement a complaints response and resolution process, documented using a complaints management form. The information to be recorded during the registration of the complaint will include the name and contact details of the complainant, the nature of the complaint, a description of the possible source(s) at the site associated with the complaint. Sound levels will then be monitored at the location of the complainant according to the description below, and a recommended action will be identified within two days with a timeline for implementation. Follow-up with the complainant will then take place to ensure that the issue has been resolved and follow-up monitoring will be completed where appropriate. Once the complainant

is satisfied that that the issue has been resolved, the complaint will be formally closed out and a summary report will be completed by Denison and kept on file.

7.0 REFERENCES

[1] Denison Mines, "Prefeasibility Study Report for the Wheeler River Uranium Project Saskatchewan Canada," Denison Mines, Saskatoon, 2018.

[2] Denison Mines, "Wheeler River Project Provincial Technical Proposal and Federal Project Description," Denison Mines, Saskatoon, May 2019 (Revised Dec. 2020).

[3] D. H. C. Bies, "Engineering Noise Control: Theory and Practice, 4th Edition," CRC Press, New York, 2009.

[4] L. Miller, "Noise Control for Buildings and Manufacturing Plants," Bolt Beranek and Newman Inc., Cambridge, 1981.

[5] DataKustik GmbH, "Cadna-A Reference Manual (Version 2021 MR1)," DataKustik, Gilching, 2020.

[6] DataKustik GmbH, "Introduction to Cadna-A INM," DataKustik, 2013.

[7] International Organization for Standardization (ISO), "Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation," ISO, Geneva, 1996.

[8] Alberta Energy Regulator (AER), "Directive 038: Noise Control," AER, Calgary, 2007 (Updated 2013).

[9] Health Canada, "Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise," Health Canada, Ottawa, 2017.

[10] Denison Mines, "Memorandum re: Traffic Volumes," February 10, 2021.

Appendix A:

Assessment Scenarios and Sound Level Data

Table A-1: Assessment Scenarios and Sound Level Data

Source ID	Source Description	Number of Identical Sources	Sound Power Level (dBA)	Active Status		Octave Band Centre Frequency (Hz); Sound Power Level (dB)									Overall	
				Construction	Operations	31.5	63	125	250	500	1000	2000	4000	8000	dB	dBA
Point Sources																
FP_ACC1Fan(x)	Freeze Plant: ACC Unit 1 Fan	12	94.0	●	●	94.8	97.8	97.8	94.8	91.8	87.8	84.8	81.8	73.8	103.2	94.0
FP_ACC2Fan(x)	Freeze Plant: ACC Unit 2 Fan	12	94.0	●	●	94.8	97.8	97.8	94.8	91.8	87.8	84.8	81.8	73.8	103.2	94.0
FP_ACC3Fan(x)	Freeze Plant: ACC Unit 3 Fan	12	94.0	○	●	94.8	97.8	97.8	94.8	91.8	87.8	84.8	81.8	73.8	103.2	94.0
FP_ACC4Fan(x)	Freeze Plant: ACC Unit 4 Fan	12	94.0	○	●	94.8	97.8	97.8	94.8	91.8	87.8	84.8	81.8	73.8	103.2	94.0
FP_ACC5Fan(x)	Freeze Plant: ACC Unit 5 Fan	12	94.0	○	●	94.8	97.8	97.8	94.8	91.8	87.8	84.8	81.8	73.8	103.2	94.0
FP_ACC6Fan(x)	Freeze Plant: ACC Unit 6 Fan	12	94.0	○	●	94.8	97.8	97.8	94.8	91.8	87.8	84.8	81.8	73.8	103.2	94.0
Gen1_Exh	Generator 1: Exhaust	1	109.4	●	●		118.1	117.1	109.1	105.1	105.1	100.1	90.1	81.1	121.2	109.4
Gen2_Exh	Generator 2: Exhaust	1	109.4	●	●		118.1	117.1	109.1	105.1	105.1	100.1	90.1	81.1	121.2	109.4
FP_BCP(x)	Freeze Plant: Brine Circulation Pump	3	99.3	●	●		89.7	90.7	92.7	92.7	95.7	92.7	88.7	82.7	100.9	99.3
Const_U_PFP1	Utilities (Construction): Propane Fuel Pump (ISR Plant)	1	94.6	●	○		85.0	86.0	88.0	88.0	91.0	88.0	84.0	78.0	96.2	94.6
Const_U_PFP2	Utilities (Construction): Propane Fuel Pump (Camp)	1	94.6	●	○		85.0	86.0	88.0	88.0	91.0	88.0	84.0	78.0	96.2	94.6
U_PFP1	Utilities (Operations): Propane Fuel Pump (ISR Plant)	1	94.6	○	●		85.0	86.0	88.0	88.0	91.0	88.0	84.0	78.0	96.2	94.6
U_PFP2	Utilities (Operations): Propane Fuel Pump (Camp)	1	94.6	○	●		85.0	86.0	88.0	88.0	91.0	88.0	84.0	78.0	96.2	94.6
U_TMS	Utilities: Main Substation Transformer	1	92.1	○	●	88.7	94.7	96.7	91.7	91.7	85.7	80.7	75.7	68.7	100.7	92.1
U_TFPM	Utilities: Freeze Plant Modules Transformer	1	87.9	○	●	84.5	90.5	92.5	87.5	87.5	81.5	76.5	71.5	64.5	96.5	87.9
U_TFPPC	Utilities: Freeze Plant Pumps/Controls Transformer	1	81.0	○	●	77.6	83.6	85.6	80.6	80.6	74.6	69.6	64.6	57.6	89.6	81.0
U_TISRAC	Utilities: ISR Plant Air Compressors Transformer	1	84.6	○	●	81.2	87.2	89.2	84.2	84.2	78.2	73.2	68.2	61.2	93.2	84.6
U_TISRP(x)	Utilities: ISR Plant Process Transformer	2	81.0	○	●	77.6	83.6	85.6	80.6	80.6	74.6	69.6	64.6	57.6	89.6	81.0
U_TOP	Utilities: Operations Centre Transformer	1	81.0	○	●	77.6	83.6	85.6	80.6	80.6	74.6	69.6	64.6	57.6	89.6	81.0
U_TC	Utilities: Camp Transformer	1	81.0	○	●	77.6	83.6	85.6	80.6	80.6	74.6	69.6	64.6	57.6	89.6	81.0
Const_CraneISR	Construction: Crane at ISR Plant	1	109.2	●	○		102.9	107.9	110.9	105.9	103.9	100.9	94.9	88.9	114.5	109.2
Const_CementMix	Construction: Cement Truck/Mixer	1	117.8	●	○		111.5	116.5	119.5	114.5	112.5	109.5	103.5	97.5	123.1	117.8
Const_HTLoad_ISR	Construction: Haul Truck Loading (ISR)	1	109.7	●	○		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
Const_HTLoad_FP	Construction: Haul Truck Loading (Freeze Plant)	1	109.7	●	○		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
Const_LoaderCWP2	Wellfield (Construction): Loader at Clean Waste Pile (Shaping)	1	109.7	●	○		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
Const_WF_LoaderWell	Wellfield (Construction): Loader at Wellfield	1	109.7	●	○		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
Const_WF_LoaderCWP	Wellfield (Construction): Loader at Clean Waste Pile	1	109.7	●	○		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7

Source ID	Source Description	Number of Identical Sources	Sound Power Level (dBA)	Active Status		Octave Band Centre Frequency (Hz); Sound Power Level (dB)									Overall	
				Construction	Operations	31.5	63	125	250	500	1000	2000	4000	8000	dB	dBA
WF_LoaderCWP	Wellfield (Operations): Loader at Clean Waste Pile	1	109.7	○	●		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
WF_LoaderWell	Wellfield (Operations): Loader at Wellfield	1	109.7	○	●		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
WF_BP(x)	Wellfield: Booster Pump	4	99.3	○	●		89.7	90.7	92.7	92.7	95.7	92.7	88.7	82.7	100.9	99.3
Const_WF_DiamondDrill1	Wellfield (Construction): Diamond Drill Rig	2	113.2	●	○		106.9	111.9	114.9	109.9	107.9	104.9	98.9	92.9	118.5	113.2
Const_WF_MudRotaryDrill1	Wellfield (Construction): Mud Rotary Drill Rig	2	112.8	●	○		106.5	111.5	114.5	109.5	107.5	104.5	98.5	92.5	118.1	112.8
WF_DiamondDrill1	Wellfield: Diamond Drill Rig (Operations)	2	113.2	○	●		106.9	111.9	114.9	109.9	107.9	104.9	98.9	92.9	118.5	113.2
WF_MudRotaryDrill1	Wellfield: Mud Rotary Drill Rig (Operations)	2	112.8	○	●		106.5	111.5	114.5	109.5	107.5	104.5	98.5	92.5	118.1	112.8
Const_Crusher	Wellfield (Construction): Crusher at Borrow Pit	1	120.3	●	○		124	122	122	116	116	115	114	110	128.5	120.3
WF_Crusher	Wellfield (Operations): Crusher at Borrow Pit	1	120.3	○	●		124	122	122	116	116	115	114	110	128.5	120.3
Line Sources [1]																
CTraffic_Fuel	Construction Traffic: Fuel/propane deliveries	1	96.7	●	○		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
CTraffic_Food	Construction Traffic: Food deliveries	1	86.5	●	○		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
CTraffic_Offsite	Construction Traffic: Off-site trucks from Highway 914 to Gate	1	109.6	●	○		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
CTraffic_SurfaceConst	Construction Traffic: Surface construction deliveries	1	96.2	●	○		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
CTraffic_Wellfield	Construction Traffic: Wellfield deliveries	1	93.6	●	○		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
CTraffic_WellMob	Construction Traffic: Wellfield mobilizations	1	100.6	●	○		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
CTraffic_Airstrip	Construction Traffic: Airstrip Traffic	1	87.6	●	○	95.0	98.0	102.0	101.0	98.0	94.0	91.0	84.0	77.0	106.8	99.9
CTraffic_CleanWaste	Construction Traffic: Drill waste to clean pile	1	94.2	●	○		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
CTraffic_VantoOps	Construction Traffic: Crew Van to Operations Centre	1	83.2	●	○	95.0	98.0	102.0	101.0	98.0	94.0	91.0	84.0	77.0	106.8	99.9
CTraffic_VantoISR	Construction Traffic: Crew Van to ISR	1	88.1	●	○	95.0	98.0	102.0	101.0	98.0	94.0	91.0	84.0	77.0	106.8	99.9
CTraffic_HT_ISRCWP	Construction Traffic: Haul Truck, ISR to Clean Waste Pile	1	104.5	●	○		110.6	115.6	118.6	113.6	111.6	108.6	102.6	96.6	122.2	116.9
CTraffic_HT_FPCWP	Construction Traffic: Haul Truck, Freeze Plant Clean Waste Pile	1	102.4	●	○		110.6	115.6	118.6	113.6	111.6	108.6	102.6	96.6	122.2	116.9
OpsTraffic_Yellowcake	Operations Traffic: Yellowcake shipping	1	91.7	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
OpsTraffic_Fuel	Operations Traffic: Fuel/propane deliveries	1	96.7	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
OpsTraffic_Food	Operations Traffic: Food deliveries	1	86.5	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
OpsTraffic_Materials	Operations Traffic: Materials	1	93.5	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
OpsTraffic_Offsite	Operations Traffic: Off-site trucks from Highway 914 to Gate	1	110.0	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
OpsTraffic_Reagents	Operations Traffic: Reagents	1	97.7	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
OpsTraffic_Wellfield	Operations Traffic: Wellfield deliveries	1	91.4	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5

Source ID	Source Description	Number of Identical Sources	Sound Power Level (dBA)	Active Status		Octave Band Centre Frequency (Hz); Sound Power Level (dB)									Overall	
				Construction	Operations	31.5	63	125	250	500	1000	2000	4000	8000	dB	dBA
OpsTraffic_WellMob	Operations Traffic: Wellfield mobilizations	1	100.6	○	●		105.2	110.2	113.2	108.2	106.2	103.2	97.2	91.2	116.8	111.5
OpsTraffic_CleanWaste	Operations Traffic: Drill waste to clean pile	1	92.4	○	●		103.4	108.4	111.4	106.4	104.4	101.4	95.4	89.4	115.0	109.7
OpsTraffic_Airstrip	Operations Traffic: Airstrip Traffic	1	87.6	○	●	95.0	98.0	102.0	101.0	98.0	94.0	91.0	84.0	77.0	106.8	99.9
OpsTraffic_VantoISR	Operations Traffic: Crew Van to ISR	1	88.1	○	●	95.0	98.0	102.0	101.0	98.0	94.0	91.0	84.0	77.0	106.8	99.9
OpsTraffic_VantoOps	Operations Traffic: Crew Van to Operations Centre	1	83.2	○	●	95.0	98.0	102.0	101.0	98.0	94.0	91.0	84.0	77.0	106.8	99.9
Area Sources																
Const_Dozer_WF	Construction: Bulldozer (Wellfield)	1	118.7	●	○		112.4	117.4	120.4	115.4	113.4	110.4	104.4	98.4	124.0	118.7
Const_SS_ISR	Construction: Skid Steer (ISR Plant)	1	105.8	●	○		99.5	104.5	107.5	102.5	100.5	97.5	91.5	85.5	111.1	105.8
Const_SS_WF1	Construction: Skid Steer (Wellfield 1)	1	105.8	●	○		99.5	104.5	107.5	102.5	100.5	97.5	91.5	85.5	111.1	105.8
Const_SS_WF2	Construction: Skid Steer (Wellfield 2)	1	105.8	●	○		99.5	104.5	107.5	102.5	100.5	97.5	91.5	85.5	111.1	105.8
Const_Dozer_CWP	Construction: Bulldozer (Clean Waste Pile)	1	118.7	●	○		112.4	117.4	120.4	115.4	113.4	110.4	104.4	98.4	124.0	118.7
FP2_Roof	Freeze Plant: Roof (2 Units) [2]	1	86.8	●	○	70.7	74.0	76.6	86.7	82.6	78.6	74.4	71.1	70.1	89.3	84.6
FP6_Roof	Freeze Plant: Roof (6 Units) [2]	1	91.6	○	●	75.5	78.8	81.4	91.5	87.4	83.4	79.2	75.9	74.9	94.1	89.3
Gen1_Top1	Generator 1: Enclosure Top [2]	1	99.0	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen1_Top2	Generator 1: Enclosure Top [2]	1	94.9	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Top1	Generator 2: Enclosure Top [2]	1	99.0	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Top2	Generator 2: Enclosure Top [2]	1	94.9	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
ISR_Roof	ISR Plant: Process Area Roof [2]	1	86.9	○	●		82.0	82.4	81.8	83.5	84.5	84.1	83.1	76.9	91.8	90.2
ISR_DRoof	ISR Plant: Dryer/Calciner Area Roof [2]	1	88.4	○	●	90.3	87.8	89.2	88.5	91.2	91.2	91.6	90.8	83.8	99.4	97.6
WF_PHR	Wellfield: Pumphouse Roof [2]	1	78.4	○	●										85.0	
CGen_roof	Camp Generator - roof	1	97.5	●	●											
OGen_roof	Operations Centre Generator - roof	1	97.5	●	●											
Vertical Area Sources																
FP2_Walls	Freeze Plant: Walls (2 Units) [2]	1	86.1	●	○	70.7	74.0	76.6	86.7	82.6	78.6	74.4	71.1	70.1	89.3	84.6
FP6_Walls	Freeze Plant: Walls (6 Units) [2]	1	90.9	●	●	75.5	78.8	81.4	91.5	87.4	83.4	79.2	75.9	74.9	94.1	89.3
Gen1_Intake	Generator 1: Air Intake [2]	1	105.4	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen1_Discharge	Generator 1: Discharge Opening [2]	1	120.5	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen1_Side1	Generator 1: Enclosure Side [2]	1	97.1	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen1_Side2	Generator 1: Enclosure Side [2]	1	99.4	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9

Source ID	Source Description	Number of Identical Sources	Sound Power Level (dBA)	Active Status		Octave Band Centre Frequency (Hz); Sound Power Level (dB)									Overall	
				Construction	Operations	31.5	63	125	250	500	1000	2000	4000	8000	dB	dBA
Gen1_Side3	Generator 1: Enclosure Side [2]	1	97.1	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen1_Side4	Generator 1: Enclosure Side [2]	1	99.5	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen1_Side5	Generator 1: Enclosure Side [2]	1	96.8	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen1_Side6	Generator 1: Enclosure Side [2]	1	93.5	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Intake	Generator 2: Air Intake [2]	1	105.4	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Discharge	Generator 2: Discharge Opening [2]	1	120.5	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Side1	Generator 2: Enclosure Side [2]	1	97.1	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Side2	Generator 2: Enclosure Side [2]	1	99.4	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Side3	Generator 2: Enclosure Side [2]	1	97.1	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Side4	Generator 2: Enclosure Side [2]	1	99.5	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Side5	Generator 2: Enclosure Side [2]	1	96.8	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
Gen2_Side6	Generator 2: Enclosure Side [2]	1	93.5	●	●	105.2	111.0	116.5	116.5	113.8	115.8	113.8	107.0	101.0	123.0	119.9
ISR_PW	ISR Plant: Process Area Walls [2]	1	88.5	○	●		82.0	82.4	81.8	83.5	84.5	84.1	83.1	76.9	91.8	90.2
ISR_DCW1	ISR Plant: Dryer/Calciner Area Wall [2]	1	87.3	○	●	90.3	87.8	89.2	88.5	91.2	91.2	91.6	90.8	83.8	99.4	97.6
ISR_DCW2	ISR Plant: Dryer/Calciner Area Wall [2]	1	79.0	○	●	90.3	87.8	89.2	88.5	91.2	91.2	91.6	90.8	83.8	99.4	97.6
WF_PHW	Wellfield: Pumphouse Walls [2]	1	76.1	○	●										85.0	
CGen_walls	Camp Generator: Walls	1	102.8	●	●											
OGen_walls	Operations Centre Generator: Walls	1	102.8	●	●											

Notes:

[1] For the line sources, the octave band sound power data is the unadjusted sound power, while the Lw provided is adjusted for the active time based on the route length and speed of travel.

[2] For area and vertical area sources that represent building envelopes, the octave band data is the interior sound pressure level in the room, and the Lw is the calculated sound power based on the transmission loss of the building and size of the building component.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

WHEELER RIVER PROJECT BASELINE GEOLOGY AND HYDROGEOLOGY

REPORT PREPARED FOR:

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EXECUTIVE SUMMARY

The objective of the information presented in this report was to develop a geological and hydrogeological conceptual site model (CSM) for the Wheeler River Project. The development of the CSM has relied on an extensive data set of geological, hydrogeological, hydrochemical and geochemical information developed for the Project through drilling activities to date, and on similar information from regional studies. The following are the components of the CSM that establish the geology in the Project area and the existing (baseline) groundwater flow and quality conditions.

Geology

The Wheeler River uranium deposit is located on the eastern margin of the Athabasca Basin of northern Saskatchewan. Like other uranium deposits on the eastern portion of the Basin, the Phoenix deposit is located at the base of the sandstones and conglomerates of the Athabasca Supergroup, just above the unconformity with the underlying metasedimentary gneisses and other basement rocks of the Wollaston Supergroup.

The Phoenix ore bodies are long and narrow (approximately 25-50 m wide) and directly overly or are near a graphitic pelite unit. The ore bodies are associated with a reverse fault, termed the WS Shear, that has a 55-degree (northeast to southwest) azimuth, and a 55-degree dip to the southeast. Faults within the basement rocks trend in a similar northeast-southwest direction as the WS Shear Zone and are well defined in the basement rocks. There are also several west-east trending cross-faults that lie roughly perpendicular the WS Shear zone that propagate through the ore zone and basement rocks. These faults and fracture systems play an important role in groundwater flow and the evolution of geochemical signatures.

The Phoenix deposit is overlain and underlain by a natural barrier unit or halo that has limited the release or subsurface migration of uranium, and other chemical constituents associated with the mineralization in the deposit, outside of the ore body itself. This natural barrier zone has limited the migration of chemical constituents in groundwater for more than 1 billion years.

The Athabasca Supergroup sandstones are subdivided into the Manitou Falls Group that consist of coarse-to fine-grained hematite-rich conglomerates that lie along thin stratigraphic horizons and silty sandstones. The Athabasca Supergroup sandstones consist almost entirely of quartz, and any detrital feldspar that was present was altered to clay minerals, such as kaolinite and illite, during the 200-million-year long period of diagenesis that occurred in the Basin.

Some portions of the Manitou Falls Group were silicified during diagenesis whereby quartz cement sealed the sandstone's primary porosity and effectively reduced the groundwater flow through the matrix of the sandstone, and made it prone to brittle fracturing. Other areas of the Manitou Falls Group , particularly the sandstones above the WS Shear Zone and associated splays, underwent hydrothermal alteration and desilicification of the sandstone. This alteration is interpreted to increase the porosity and permeability of the sandstones in these areas. In

addition to alteration, the sandstones have also been faulted and fractured, which also affects the movement of groundwater through these units. Faults in the sandstone represent reactivated brittle basement faults along the northeast-southwest trending WS shear zone, or responses to volume adjustments in the sandstone during hydrothermal alteration and mineralization.

Hydrogeology

The primary hydrogeological units which influence groundwater flow within the Basin include:

- Upper overburden unit defining the water table and upper shallow groundwater flow system.
- Athabasca Sandstone Supergroup subdivided into 3 units including upper and lower aquifers, separated by an intervening aquitard zone.
- Basement rocks subdivided into an upper weathered (Paleoweathered) and underlying competent basement aquitard.

Two groundwater flow regimes were identified in the local basin stratigraphy. The uppermost flow system is unconfined and includes groundwater flow through the overburden and Upper Sandstone Aquifer. The lower semi-regional system is confined by the Intermediate Sandstone Aquitard, and includes flow through the Lower Sandstone Aquifer, and locally, in the Ore Zone Aquifer.

Horizontal groundwater flow in the deeper semi-regional flow system is generally directed from the west to the east and southeast, as interpreted by water level observations and groundwater chemistry. Groundwater flow within the Overburden and Upper Sandstone Aquifer is influenced by ground surface topography and surface water features. Flow in this upper groundwater flow regime is derived from recharge in the local area, whereas groundwater flow within the semi-regional groundwater flow system is derived from a combination of regional groundwater flow from upgradient sources, and vertical flow through the Intermediate Sandstone Aquitard. Vertical gradients are interpreted to be directed downward in areas west of the Phoenix deposit, and upward beneath the surrounding surface water bodies, including Whitefish and Williams Lakes.

Local to the Phoenix deposit, shallow groundwater in the overburden and the Upper Sandstone Aquifer is conceptualized to discharge into Whitefish Lake, which is located approximately 500 m east of the deposit. The water level elevations observed between the Phoenix deposit and the lake exhibit lateral gradients toward the lake and upward hydraulic gradients from the Lower Sandstone Aquifer (and Ore Zone) into Whitefish Lake through the Desilicified Zone in the Intermediate Sandstone Aquitard. It is interpreted that the elevated hydraulic conductivity value represented by the Desilicified Zone creates a preferential pathway for water to discharge into Whitefish Lake, rather than continuing to stay in the Lower Sandstone Aquifer and discharge to Russell Lake. This conclusion is also supported by streamflow measurements, that suggest that local groundwater discharge is sustaining streamflow to Whitefish Lake and other lakes in the study area, even in low precipitation periods.

Groundwater Quality

Groundwater was collected from each of the hydrostratigraphic units at the site. The groundwater is characterized by low mineralization. Concentrations of radiological and several other dissolved constituents in groundwater associated with the uranium deposit in the Phoenix study area are generally orders of magnitude lower in overlying hydrostratigraphic units and surface water than they are in the ore zone groundwater samples. This is evidence of the very low mass flux of those constituents from the Ore zone and discontinuous barrier zone aquitard that envelopes the ore zone.

The measured groundwater chemistry supports the presence of a Local Flow System, an Intermediate Sandstone Aquitard and a Lower Sandstone Aquifer in the study area. The chemistry of the groundwater in the Local Flow system is that of recharge water that is of relatively low pH, from contact with organic matter in the upper soil profile, and that has become mineralized through dissolution of quartz, feldspars, kaolinite and illite.

The chemistry of groundwater in the Intermediate Sandstone Aquitard is similar in terms of major ion composition to that of the Local Flow System, but a longer residence time in the aquitard of similar mineralogical composition to the overlying bedrock and sediments has led to more mineralization of the water, but without a change in overall hydrochemical type. Higher relative variability in the groundwater chemistry sampled from monitoring wells in the Intermediate Sandstone Aquitard may reflect the localized influence of desilicification on the flow conditions, and consequently on groundwater conditions, in a subset of these wells.

The Lower Sandstone Aquifer is characterized spatially by two types of groundwater. The first groundwater type is most similar to that observed in the Local Flow System. This is suggested to reflect hydraulically active fractures and fault systems that allow fresh recharge water to penetrate and mix with deeper waters in the Lower Aquifer. The second type of groundwater was within the zone of thermal alteration around the ore zone and has a relatively high degree of mineralization, thought to be a result of dissolution of remnant halide salts present on grain boundaries and in intragranular pores within the rock matrix at depth in the Athabasca Sandstones.

Groundwater quality results suggest that connectivity between the Upper Sandstone Aquifer and Intermediate Aquifer is limited. Again, desilicification of these Formations to the northeast of the Ore zone may affect this interaction on a localized scale. Further, although limited in number of samples available, groundwater quality in the Paleoweathered zone suggests a distinct geochemical environment in groundwater from that of the overlying Athabasca Supergroup sandstones.

Summary

The geological, hydrological, mineralogical, geochemical and hydrochemistry information collected to date for the study area provides a good baseline to understand potential changes

to the groundwater environment, during mining operations and post closure. The information has been integrated into a graphical CSM in this report.

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1.0 INTRODUCTION

1.1 Background and Study Objectives

The Wheeler River Project proposes the development of the high-grade Phoenix uranium deposit as an in situ recovery (ISR) mining operation with on-site processing. Denison Mines Corp. (Denison) is the operator of the Wheeler River Joint Venture and holds a 90% interest (directly or through its subsidiaries). JCU (Canada) Exploration Company Ltd. owns the remaining 10% of the joint venture. The Project is located approximately 35 km north-northeast of Cameco's Key Lake Operation and 35 km southwest of Cameco's McArthur River Operation in the eastern portion of the Athabasca Basin region in northern Saskatchewan (see Figure 1).

For the project to advance, Denison must obtain federal and provincial approval of the Wheeler River Environmental Assessment (EA).

This Baseline Geology and Hydrogeology Report has been prepared as part of the Environmental Impact Statement (EIS) submission. The objective of the Geology and Hydrogeology Assessment within the Wheeler River Project EA is to identify and evaluate potential influences of mining and post-mining on the geological and hydrogeological system and nearby surface water features.

The Geology and Hydrogeology Assessment EIS scope is composed of five primary components, presented in Figure 2, and outlined as follows:

- Technical review and evaluation of available data and data inputs;
- Preparation of a Baseline Geology and Hydrogeology Report (this report) through a technical review and summary of existing geological and hydrogeological data, including the development of a hydrogeological Conceptual Site Model (CSM);
- Development of a 3-D hydrogeological model for groundwater flow modelling of baseline conditions and conditions over the life of mine, and to model chemical transport in Post-Decommissioning;
- Development of a Groundwater Monitoring Plan over the life of mine; and
- Preparation of the Geology and Groundwater section within the EIS.

The Baseline Geology and Hydrogeological Report builds on the Phoenix deposit geological model developed by Denison (Denison, 2022a), which uses geological and numeric modelling functionalities in Leapfrog Geo™ 2021.2. The model includes lithology, structure and alteration models from field data collected over more than 16 years of exploration activities.

The outcome of this report is the development of a robust CSM that will help inform the development of a numerical groundwater flow and transport model and the design of associated field programs, including the Groundwater Monitoring Plan. The Groundwater Monitoring Plan will be developed based on the outcomes and the results of the numerical

groundwater flow model. Groundwater monitoring will be designed to demonstrate compliance with regulations and predictions, and to monitor for any changes in groundwater conditions during operations relative to current baseline conditions.

This Baseline Geology and Hydrogeology Report outlines the key geological and hydrogeological feature associated with the study area. These include:

Hydrology: The study area lies within the within the southern portion of the Icelander River drainage area of the Wheeler River watershed, which is part of the Churchill River Basin. The general surface water flow direction is from the north toward the south. All surface water in the area drains toward Russell Lake, which is located about 6 km south of the Phoenix deposit.

Regional and Site Geology: Several areas of uranium mineralization amendable to in situ recovery (ISR) have been defined on the Wheeler River Property. The Phoenix deposit is the focus of this project, and it is geologically situated at or immediately above the unconformity between the Athabasca Basin sandstone and underlying older basement rocks, approximately 400 metres below surface.

Structure, Alteration and Mineralization: Regional structural trend(s), alteration and faulting were evaluated using lithologic and geotechnical data collected from vertical and oriented drill core across the Phoenix deposit area. Alterations and mineralization were examined where their presence was interpreted to alter the local groundwater flow directions, gradients, or groundwater quality.

Hydrostratigraphic Framework: Major hydrostratigraphic units were interpreted based on regional information and interpretations of hydraulic tests conducted in the study area. This included interpreted stratigraphy/lithology, structural geology, groundwater flow direction(s) including variability in flow directions, existence of preferential flow paths (both natural and manmade), estimated hydraulic conductivity values, and horizontal and vertical gradients. The major hydrostratigraphic units identified include overburden aquifer, upper Athabasca sandstone aquifer, intermediate sandstone aquitard, lower sandstone aquifer, a barrier zone aquitard overlying and underlying the ore zone, the ore zone, the paleoweathered zone of the underlying basement rock, and, lowermost, the basement aquitard. Information from field testing included pumping tests, field packer tests, resistivity geophysical surveys, as well as laboratory permeability tests were used alongside geotechnical drill hole data to understand the hydrogeological and geological stratigraphy of the study area. Further, the recharge and potential discharge areas were interpreted with emphasis on downgradient receptors and sensitive surface water bodies.

Factors Affecting Groundwater Flow Conditions: Several factors affect groundwater flow including the position of open hole drill holes, faults or fractures, recharge zones and hydraulic stresses, other non-mine related water takers, climate and precipitation, amongst others.

Baseline Groundwater Geochemical Conditions: The geochemical evaluation was used to document groundwater quality prior to mining operations. Results to date have indicated that groundwater quality is typical of that observed in other studies across the Athabasca Basin.

1.2 Goal of the Conceptual Site Model

A conceptual site model was prepared as part of this Baseline Geology and Hydrogeology Report to present the relevant geological, hydrogeological framework, surface water features and chemical distributions. Development of the conceptual model included the characterization of; a) spatial extent of key aquifers and aquitards based on the extensive geological model and data inputs; b) groundwater recharge and discharge areas; c) groundwater flow directions and gradients within and between key aquifers d) sensitive surface water receptors, and e) baseline groundwater constituent concentrations, evolution and chemical spatial distributions. The model also considers open boreholes, faults and fractures, alteration zones, hydraulic stresses, and non-mine related water takings.

A conceptual hydrogeological model is a descriptive summary, which may be accompanied by a graphical representation of the hydrogeological framework that describes the groundwater flow system(s). The conceptual model must retain sufficient complexity so that the actual components of the groundwater flow system are adequately described. Ultimately, the conceptual site model informs the development of the numerical groundwater model and groundwater monitoring plans which are used to assess the potential changes to the hydrologic systems from activities during the pre, operation and post operational mining periods. Specifically, the development of the CSM will facilitate evaluation of:

- groundwater flow in the vicinity of the planned mine;
- potential locations of groundwater wells to supply water for mining activities;
- potential groundwater pathways from the mine chamber toward potential receptors;
- field operation and site monitoring, groundwater monitoring plans;
- mine waste disposal options; and
- future risk assessment and risk management plans.

The linkages between the various studies and the final outcomes are illustrated on Figure 2.

The following sections describe the conceptual understanding of the current physical environment, and hydrogeologic setting present in the study area (Figure 2). This sets the foundation for comparison or predictions of future changes to groundwater conditions that are expected during mining and following mine closure. While the conceptual understanding may evolve as new data are collected, there is a strong scientific basis for the conceptual site model developed and presented in this report.

2.0 PHYSICAL ENVIRONMENT

The Phoenix uranium deposit lies in northern Saskatchewan in the southeastern reaches of the Athabasca Basin. The deposit is located approximately 400 m below ground surface at the unconformable contact between Athabasca Supergroup sandstones and underlying Canadian Shield basement rocks. The following sections describe the ground surface topography, surface water features and geology of the area.

2.1 Topography

Ground surface topography has been shaped by glacial and fluvial processes active in the area for tens of thousands of years. The most important topographic features in the study area are northeast to southwest trending drumlins and eskers, with lowland areas consisting of well drained glaciofluvial outwash sands and gravels, and poorly drained till plains with associated muskeg/ wetlands. Ground surface varies from a high of approximately 600 metres above sea level (m asl) on a topographic high located between the Phoenix and Gryphon deposits, to a low of 494 m asl at McGowan Lake in the southeast (Figure 1). Ground surface topography overlying the Phoenix deposit, as noted on a local digital elevation model, ranges from 520 to 550 m asl.

2.2 Surface Water Features

Surface water features such as rivers, streams, wetlands, and lakes can act as features that recharge the underlying groundwater flow system, or as a local or regional groundwater discharge features and can be important features in a hydrogeologic conceptual model.

The Phoenix deposit lies within the southern portion of the Icelander River drainage area of the Wheeler River watershed, which is part of the Churchill River Basin. The general surface water flow direction is from the north toward the south. All surface water in the area drains toward Russell Lake, which is located about 6 km south of the Phoenix deposit. Ecometrix (2020a) developed a baseline hydrology description for the area surrounding the Phoenix deposit. Over the entire monitoring program (2011 to 2018), lake and pond surface water elevations ranged from 520 m asl in the Icelander River drainage area headwater (Kratchkowsky Lake) to 488 m asl at Russell Lake.

The Russell Lake Water Survey of Canada hydrometric station (06DA005) is the only hydrometric station located within the area, and the station lies downstream of Russell Lake approximately 25 km east of the Phoenix deposit. The annual average monthly discharge from 2011 to 2018 was approximately 15 m^3/s, and it drains a catchment of 3,030 square kilometres (km^2; Ecometrix, 2020a).

Local to the Phoenix deposit, groundwater is conceptualized to discharge into Whitefish Lake, which is located approximately 500 m east of the deposit and has a lake level of approximately 500 m asl (Ecometrix, 2020a). Other major lakes in the area include Kratchkowsky Lake and Williams Lake, located west of the Phoenix deposit, which have lake levels of 520 and 518 m asl, respectively (Figure 1). McGowan Lake, located southeast of

Whitefish Lake and 2 km from the deposit, has a lake elevation of 494 m asl (6 m lower than Whitefish).

Discharge to streamflow as recorded in streamflow stations located along the streams and rivers located east of the Phoenix deposit were measured to be consistently increasing from above Whitefish Lake to below McGowan Lake (Ecometrix, 2020a). Similarly, discharge to streamflow as recorded in stations along the drainage west of the Phoenix deposit were also measured to increase. Low flow discharge per unit area is estimated to be approximately 125 mm/yr. This indicates that local groundwater discharge is sustaining streamflow even in low precipitation periods.

2.3 Geology/Stratigraphy

The Phoenix uranium deposit is located on the eastern margin of the Athabasca Basin of northern Saskatchewan. Like other uranium deposits on the eastern portion of the Basin, the uranium deposits are located at the unconformity between sandstones and conglomerates of the Athabasca Supergroup, and the underlying metasedimentary gneisses and other basement rocks of the Wollaston Supergroup.

Understanding the geologic history from a regional and local scale provides a foundation for the development of a conceptual hydrostratigraphic model. Through review of other uranium mines in the area, the geologic units present in Phoenix deposit closely resemble those present at Cigar Lake. Both ore deposits are present at the contact between the Canadian Shield basement rock and overlying Athabasca Supergroup sandstones. In both places, the ore deposit is overlain by a natural barrier unit or halo comprised of clays and sulphide-cemented rock that represent important hydraulic and geochemical control zones that have reduced, but not eliminated the release or subsurface migration of uranium. A general summary of the characterization of the geologic units present in the Phoenix area from basement to overburden are summarized in the following sections.

2.3.1 Basement Rock

Basement rocks beneath the Phoenix and Gryphon deposits are Paleoproterozoic-aged metasedimentary, metavolcanics and granitic gneisses and schists (Figure 3). These basement rocks are part of the Wollaston Domain of the Trans Hudson Orogen and include graphitic and non-graphitic pelitic, semipelitic gneisses, pegmatites, quartzite, calc-silicate rocks, and felsic and quartz feldspathic granitoid gneisses (Figure 3; Yeo and Delaney, 2007). Pegmatitic veins, dykes and intrusions are common in all units with garnet, cordierite, and sillimanite existing in the pelitic strata, indicating an upper amphibolite grade of metamorphism (SRK Consulting, 2018).

The basement rocks have undergone several periods of alteration following their original deposition, and these include:

- metamorphism;

- alteration post-metamorphism (less than1800 Ma) and prior to deposition of the Athabasca Supergroup sandstones (1700 Ma; Adlahka, 2021; Toma et al., 2022);
- paleoweathering on the basement surface prior to subsidence and Basin formation; and,
- hydrothermal alteration associated with the uranium ore mineralization. The most intense areas of hydrothermal alteration occur alongside the highest-grade mineralization, and alteration decreases, and disappears, in all directions with distance away from the ore zone.

2.3.2 Unconformity and Paleoweathered Basement Rocks

A major unconformity separates the basement rock from the overlying Athabasca Supergroup sandstones. This unconformity represents the period when the basement rock was exposed and subject to weathering and erosion. A paleoweathered zone of weathered, fractured, and faulted basement rock was mapped beneath the Phoenix site below the unconformity, and it is interpreted to range in thickness from 3 to over 80 m, with the greatest thicknesses coinciding with faults, including the WS Shear zone.

The paleoweathered basement zone displays a mineralogical, and associated colour, zonation extending from the unconformity down to competent basement rock, established prior to the mineralization-associated hydrothermal alteration (Macdonald, 1980, Harvey and Bethune, 2007). The deepest zone, closes to competent rock, is the dominantly chlorite and illite “green zone”. This grades into the “red zone” dominated by hematite, chlorite and illite (alteration product of kaolinite). The red zone is capped locally by a thin bleached zone at the unconformity, where the bulk of the hematite has been removed (Wilson, 1986). The sequence can also be crosscut along fractures/ overprinted by hydrothermal alteration, such as that related to ore genesis, which are characterized by yellowish to white clay-rich zones (Wilson, 1986).

The top of the unconformity or paleoweathered surface reflects the competence of the basement rocks and is the result of millions of years of tectonic stresses and erosion when the basement rocks were exposed. The elevation at the top of the unconformity within the Phoenix area ranges from a high of approximately 310 m asl along the quartzite ridge (Figure 3) approximately 2.5 km southwest of Phoenix to 120 m asl in the area 500 m northwest of Phoenix near well GWR-025.

"Quartzite ridges" are a topographic feature regionally of the sub-Athabasca unconformity surface (Li et al., 2015). They are an alteration facies resulting from pre-Athabasca group basement silicification, that cause relief at the unconformity surface of up to 200 m (Card, 2014). A quartzite ridge occurs to the west of the Pheonix deposit with a southwest-northeast trend, which parallels the Phoenix deposit. The elevation at the top of the unconformity within the Phoenix area is approximately 310 m asl along the quartzite ridge, in comparison to an elevation of approximately 150 m asl beneath the deposit (Appendix 7-A). The quartzite ridge is interpreted as a low permeability zone that acts as a

barrier to fluid flow, and played a role in controlling alteration patterns and mineralization (Card, 2014; Li et al., 2015).

2.3.3 Uranium Ore Deposit (including Discontinuous Envelope of Clay and Sulphide-Cemented Rock)

The Phoenix ore deposit lies proximal to the unconformity between the basement rocks and the overlying Athabasca sandstone. The Phoenix ore bodies are long and narrow (approximately 25-50 m wide) and directly overly or are near a graphitic pelite unit (Figure 3). The ore bodies are associated with a reverse fault, termed the WS Shear, that has a 55-degree (northeast to southwest) azimuth, and a 55-degree dip to the southeast (Figure 3). The WS Shear zone lies at the base of the graphitic pelite and the east edge of the quartzite ridge (Figure 3; Arseneau and Revering, 2010). The quartzite ridge is interpreted to have acted as a support for thrusting and reverse faulting (Kerr, 2010; Kerr et al., 2011). Deformation within the WS Shear fault occurred primarily by fracturing, and to a lesser degree, by ductile shearing.

Several unconformity-type uranium deposits on the eastern portion of the Athabasca Basin are found along the unconformity between reducing metamorphic and igneous basement rocks, and overlying oxidized Athabasca Supergroup sandstones (Alexandre, 2020). These ore bodies are typically contained in a discontinuous envelope of clay alteration and a sulphide-cemented rock zone that extends into the overlying sandstone, and the underlying basement. At Phoenix, this black clay-rich zone is approximately 3 m thick on average and locally hydraulically isolates the ore zone from the overlying sandstones and underlying weathered basement rock.

There are uncertainties associated with the depositional models for the ore zone, but a plausible model suggests there was ductile faulting and subsequent weathering and erosion of the various basement rock lithologies. These faults were reactivated after the deposition of the Athabasca Supergroup sandstones along weak graphite-rich ductile shear zones. At the Phoenix site, this included the WS Shear zone, and the Hanging Wall Shear zone (Arseneau and Revering, 2010). Uranium (VI)-bearing oxidizing basinal fluids within the sandstone reacted with reducing fluids in the basement, and uranium (VI) was reduced to uranium (IV), and uraninite was precipitated (Alexandre, 2020). Uranium (VI) is hexavalent uranium (U^{+6}) and uranium (IV) is tetravalent uranium (U^{+4}).

Faults in the sandstone overlying the ore zone and in the underlying basement rocks trend in similar directions to the WS Shear Zone and are well defined in the basement rocks. These faults are interpreted to represent brittle reactivation and damage zone faults, and splay upwards into near vertical faults in the overlying sandstone units. There are also multiple west-east trending faults (perpendicular cross-faults) that propagate through the ore zone and basement rocks that were identified by Denison. Available lithologic and water level data is limited but suggests these faults do not extend far into the overlying sandstone.

2.3.4 Athabasca Supergroup Sandstones and Conglomerates

Overlying the basement rock are consolidated sandstones and conglomerates of the Athabasca Supergroup that were deposited 1.5 to 1.74 billion years ago (Creaser and Stasiuk, 2007). These sedimentary rocks are horizontally bedded and were deposited in an intracontinental sedimentary basin initially marked by alluvial fans, braided rivers and possibly shallow-marine or lacustrine to eolian environments (Ramaekers and Catuneanu, 2004; Rameakers, 1990).

In the Phoenix area, the Athabasca Supergroup sandstones include the Manitou Falls Group of formations. The Group consist of coarse to fine-grained hematite-rich conglomerates that lie along thin stratigraphic horizons and silty sandstones (Ramaekers 1990), as thoroughly oxidized redbed sequences (Jefferson, 2007). Median iron oxide (Fe_2O_3) concentrations of 0.24% have been measured regionally in unmineralized Athabasca Supergroup sandstones (Alexandre, 2020).

The sandstones are differentiated by their proportions of conglomerate beds and presence of clay intraclasts as outlined in Table 2-1 (Bosman and Ramaekers, 2015; Ramaekers et al. 2007). Sandstone and conglomerate beds of the Read Formation (Table 2-1) that directly overlie the basement rocks host most of the uranium mineralization associated with the Phoenix deposit; some mineralization lies within the underlying paleoweathered basement. Table 2-1 outlines the thicknesses of the lithologic units that lie within a 2 km buffer area surrounding the Phoenix deposit. These surfaces were provided by Denison and are based on interpolation of core data drilled throughout the area.

Table 2-1: Athabasca Supergroup Sandstone Formations and Lithofacies Descriptions

Group/ Formation	Description	Thickness in Phoenix Deposit Area (m)
Manitou Falls Group MFd- Dunlop Formation	Finer-grained well sorted quartz arenite (sand size particles) with abundant (>1%) clay intraclasts (Ramaekers, 1980), and thicker beds of well sorted medium grained quartz arenite. Interpreted to be a distal portion of a large, braided stream, estuary, or braid delta (Hiatt and Kyser, 2007).	5 to 50
Manitou Falls Group - MFc- Collins Formation	Quartz arenite with rare (<1%) clay intraclasts, and conglomerate beds that are less than 2 cm thick (Ramaekers, 1980). Grain sizes of sands of the formation are coarsest at the base and finest at the top, representing decreased fluvial stream energy with time.	50 to 160
Manitou Falls Group - MFb- Bird Formation	Interbedded quartz arenite and clast supported conglomerate beds that are greater than 2 cm thick; distinguished from Read Fm and MFc by presence of >1-2% conglomerates beds (Ramaekers, 1980). Like MFc, grain sizes of sands in MFb fine upward from the base to the top of the formation, representing decreased fluvial stream energy with time.	50 to 130

Group/ Formation	Description	Thickness in Phoenix Deposit Area (m)
Manitou Falls Group - MFa - Read Formation	Poorly sorted quartz arenite, coarse quartz arenite, and pink to maroon quartz-rich pebble conglomerate, local red quartz siltstone to mudstone intraclasts and interbeds with desiccation cracks (Ramaekers, 1980). The unit has been subdivided into three informal members; 1) conglomerate to mudstone; 2) quartz arenite; and 3) quartz arenite with intraclasts (Bosman and Ramaekers, 2015). The Read Formation is abbreviated in this report as MFa, and MFr in Bosman and Ramaekers (2015).	Absent along the quartzite ridge. Reaches a maximum thickness of over 200 m.

The characteristics described in Table 2-1 are regional descriptions for the Athabasca Basin units; local-scale variations are expected due to the variability in fluvial or alluvial fan systems, including the randomness of channel erosion and amalgamation. As noted in Table 2-1, the Read Formation is absent above the quartzite ridge suggesting uplift of the basement along the thrust faults prior to or during their deposition (SRK Consulting, 2018).

Researchers have documented the nature of the lithofacies and the sequence stratigraphy of the Manitou Falls and Read Formations (Ramaekers, 1980; Hiatt and Kyser, 2007); however, diagenetic processes have greatly impacted the geotechnical and hydrogeological properties of the sandstones. The Athabasca Supergroup sandstones consist almost entirely of quartz (Ramaekers 1990), and any detrital feldspar that was present was altered to clay minerals, such as kaolinite and illite, during the 200-million-year long period of diagenesis that impacted Basin (Sibbald et al., 1976; Hoeve and Quirt, 1984). Portions of the subsurface within the Athabasca Basin have undergone extensive hydrothermal alteration including chloritization, tourmalization (dravite), hematization, illitization, dolomitization as well as silicification and desilicification. Portions of the Manitou Falls Group were silicified during diagenesis whereby quartz cement sealed the sandstone's primary porosity (Alexandre, 2020; Ng et al., 2013). The silicification process reduces the groundwater flow through the matrix of the sandstone, but also makes the sandstone prone to brittle fracturing and the introduction of secondary porosity.

Hydrothermal alteration is focused along the WS Shear Zone and associated splays and is interpreted to have propagated upwards in the sandstone hundreds of metres above the unconformity, with decreasing alteration of the sandstone moving west of the WS Shear Zone.

In addition to hydrothermal alteration, the Athabasca Supergroup sandstones have also been faulted and fractured, and these features can impact the movement of groundwater through these units. Faults in the sandstone have similar orientations to that of the WS Shear, and most of these faults represent reactivated brittle basement faults along the shear zones, or responses to volume adjustments in the sandstone during hydrothermal alteration and mineralization.

2.3.5 Overburden

Surficial geology in the area is a product of thousands of years of Quaternary-aged glacial and proglacial depositional processes. The regional geomorphology is typical of the Athabasca Plain Region and is dominated by landforms associated with continental glaciation, such as drumlins, eskers, outwash plains and till plains. Drumlins and eskers present in the Wheeler River area trend in a northeast to southwest direction and form topographic highs on the landscape. Drumlins rise over 50 m above the surrounding land surface in some areas, including the drumlin lying between the Phoenix and Gryphon deposits (Figure 1).

Based on regional-scale 1:250,000 scale mapping (Figure 4) and descriptions from borehole logs that describe surficial sediments, the surface deposits in the area consist predominantly of outwash sand and glacial till, with organic and alluvial sediments (Power, 2014; Campbell, 2007; Schreiner, 1984).

Overburden ranges in thickness from less than a few metres on low lying areas, to over 100 m in the northwestern reaches of Whitefish Lake where weathering and glacial erosion of the sandstone bedrock formed a bedrock valley or "trough". As the trough is infilled largely by permeable glacial outwash materials, it has the potential to be a hydrogeological feature of interest in the area due to its potential influence on local groundwater flow patterns and gradients. Discussion of the feature and its hydrogeologic influence is further discussed in Section 3.3.

Outside of the bedrock trough, the overburden is interpreted to contain up to three distinct sand-rich subglacial till sheets, and three intervening stratified sand units (Campbell, 2007). As glaciers advanced from the northeast to southwest, the three tills incorporated the underlying sandstones of the Athabasca Basin and are described as sandy and bouldery to cobbly with some (approximately 10 to 20%) silt and clay. The core of the drumlins is composed of till with igneous and metamorphic clasts (pebbles) derived from distal sources; however, the upper 0.5 to 2 m of sediment that drapes over the drumlins is interpreted to be sandstone-rich till (Campbell, 2007).

Within the Phoenix area, grain size analysis was conducted on unconsolidated sands samples in monitoring wells GWR-033 and GWR-036, both located on the western side of Whitefish Lake. A grain size sample was collected in GWR-033 from approximately 9 m below ground surface, and the sample consisted of 8.8% clay-sized grains (less than 4 µm). Comparable results were seen in a sample collected approximately 13 m below surface at well GWR-036, which had 8.1% clay-sized grains (less than 4 µm). Five additional sand horizons were sampled in the overburden at GWR-036, and the clay size grain content ranged from a high of 9.2% (approximately 35 m below surface) to a low of 1.1% (approximately 36.5 m below surface).

2.4 Structural Geology; Faulting and Fracturing

Faulting and fractures of sedimentary and crystalline rocks can add complexity to hydrogeological systems such as the Athabasca Sandstone Supergroup and older basement crystalline rocks.

Figure 3 illustrates the locations of major and minor faults and illustrates their interpreted lateral off-set generated within basement rocks as interpreted by Denison staff. Of particular interest is the WS Shear zone, interpreted to be the zone along which hydrothermal fluids historically propagated upwards through the basement rocks to deposit the uranium in the existing ore zones.

In addition to the WS Shear zone, there is a zone of desilicified sandstone located northeast of the Phoenix site. In this area variations in tectonic stresses within the lower portions of the Athabasca Supergroup resulted in a region of enhanced fracturing and hydrothermal alteration (i.e., desilicification). The zone of alteration was noted to lie above and northeast of the Phoenix deposit to Whitefish Lake where cores are logged as having very low rock quality designation (RQD) values, high fracture intensity and high friability. Geophysical surveys undertaken in the area (Quantec Geoscience, 2014) identify a change in the orientation of resistivity anomalies located 350 to 400 m below surface in an area west of Whitefish Lake. Figure 5 illustrates the location of these anomalies and the areas of low resistivity, which are interpreted to be associated with the zone of desilicification, and enhanced fracturing and friability. Where fracture apertures in this zone of alteration are significantly large, and not infilled with clay particles or other minerals, the fractures could represent preferential groundwater flow paths. Clay infill of fractures has been noted within the Manitou Falls Group, Bird Formation (MFb) in borehole logs in the Phoenix deposit area and was documented in core photos taken by Denison. Additional discussion of the role of fracturing and faulting on the groundwater flow conditions are outlined in Section 3.8.

3.0 HYDROGEOLOGICAL SETTING

Precipitation, ground surface topography, water table elevation and the spatial distribution and connectivity of geologic units influence the flow of groundwater through a given area. As discussed in Section 2.3, the subsurface in the Phoenix area consists of overburden sediments, fractured sandstone and basement rock. Groundwater flow through the unconsolidated porous media is a function of the distribution of the grain sizes within the porous media that controls the hydraulic conductivity. However, groundwater flow (and contaminant transport) in fractured sandstone bedrock aquifers is more complex as the intergranular pore spaces are often discontinuous which can result in very low permeability of the rock matrix. Groundwater flow in the rock is dominated by flow through fractures in the rock (i.e., secondary porosity).

3.1 Monitoring Activities

3.1.1 Surface Water Hydrology

Denison has been monitoring groundwater and surface water stations for several years as a means of characterizing the baseline hydrogeologic and hydrologic conditions. A baseline hydrology report prepared from data collected for the project from 2011-2019, outlines the existing characterization work that was completed in the area (Ecometrix, 2020a). From 2011 to 2014 water elevation surveys were established at nine stream stations and eleven lake stations. Flow rates were measured manually, and water level data loggers were installed in the nine stream stations to measure the water elevations. Rating curves for flow rate versus water elevation were subsequently developed (Ecometrix, 2020a). Seven additional stream stations and four additional lake and pond stations were established and monitored in 2016 to 2018 to augment the 2011 to 2014 data. Water level elevations were collected in 2016 to 2018 to validate existing rating curves or to establish rating curves for new monitoring locations. Additional details on the monitoring locations and interpretations can be found in the baseline hydrology report (Ecometrix, 2020a).

3.1.2 Groundwater Monitoring Network

Groundwater wells were drilled in 2019, 2020, and 2021 across the Phoenix area to improve the understanding of groundwater flow directions, gradients and the hydrogeologic characteristics of the subsurface units. Table 3-1 outlines the well completion details for the monitoring wells within the Phoenix area and their associated water level elevations; the locations of these wells are illustrated on Figure 6. All monitoring wells are vertical except GWR-008, GWR-009 and GWR-012, which are inclined wells that dip at 80°, 65° and 78°, respectively. Borehole logs with well completion details are provided as Appendix A.

Table 3-1: Monitoring Well Completion Details

Well Name	Screened Unit (Hydrostratigraphic Unit; Table 3-2)	Screen Top	Screen Bottom	Observed Water Level	Water Level Snapshot Date
		Elevation (m asl)			
GWR-002	Overburden (Overburden Aquifer)	522.7	516.7	Dry	2019-06
GWR-003	Overburden (Overburden Aquifer)	470.8	464.8	503.69	2019-11
				504.78	2020-09
				503.71	2019-08
GWR-005	Overburden (Overburden Aquifer)	385.5	379.6	501.99	2019-11
				502.65	2020-09
GWR-006	Overburden (Overburden Aquifer)	507.7	501.8	514.33	2019-11
				515.13	2020-09
GWR-007	Overburden (Overburden Aquifer)	518.2	512.2	514.12	2019-08
GWR-008	MFa (Lower Sandstone Aquifer)	169.1	163.3	502.04	2019-11
				502.40	2020-09
				499.98	2019-08
GWR-009	MFb (Intermediate Sandstone Aquitard)	288.2	282.8	503.18	2019-11
				501.94	2020-09
				502.08	2019-08
GWR-011	MFa (Lower Sandstone Aquifer)	180.2	174.2	500.84	2019-11
				502.74	2020-09
GWR-012	MFa (Lower Sandstone Aquifer)	169.4	163.6	500.82	2019-11
				502.25	2020-09
				501.19	2019-08
GWR-013	MFb (Intermediate Sandstone Aquitard)	273.6	267.7	504.55	2020-09
GWR-014	MFc (Intermediate Sandstone Aquitard)	351.0	345.1	501.42	2019-11
				501.80	2020-09
GWR-025	MFa (Lower Sandstone Aquifer)	149.3	143.3	501.99	2019-11
				502.90	2020-09
				502.47	2019-08
GWR-027	MFb (Intermediate Sandstone Aquitard)	249.3	243.3	500.66	2019-11
				501.41	2020-09
GWR-028	MFb (Intermediate Sandstone Aquitard)	244.0	238.0	510.93	2019-11
				511.00	2020-09
GWR-029	MFa (Lower Sandstone Aquifer)	175.2	169.3	514.86	2019-11
				514.98	2020-09
				514.62	2019-08
GWR-031	Ore Zone and Barrier Zones (Ore Zone, Barrier Aquitards))	134.4	127.1	501.54	2019-11
				501.22	2020-09
GWR-032	MFa, Ore Zone, Barrier Zones, Basement Aquitard (Ore Zone and Lower Sandstone Aquifer)	139.2	127.8	501.63	2020-09

Well Name	Screened Unit (Hydrostratigraphic Unit; Table 3-2)	Screen Top	Screen Bottom	Observed Water Level	Water Level Snapshot Date
		Elevation (m asl)			
GWR-033	MFa (Lower Sandstone Aquifer)	158.4	152.4	502.63	2020-09
GWR-034	MFb (Intermediate Sandstone Aquitard)	289.0	283.0	502.17	2020-09
GWR-035	Overburden/MFd Upper Sandstone Aquifer)	494.2	491.2	501.60	2020-09
GWR-036	Overburden (Overburden Aquifer)	462.9	456.9	502.25	2020-09
GWR-037	MFd (Upper Sandstone Aquifer)	444.3	438.3	502.45	2020-09
GWR-038	MFa/ Read Formation Sandstone, Clay Barrier Zones, Ore Zone, Basement Aquitard (Lower Sandstone Aquifer, Barrier Zones, Ore Zone, Basement Aquitard)	150.7	123.5	na	
GWR-039		151.2	124.0	na	
GWR-040		152.1	124.9	na	
GWR-041		155.1	128.0	na	
GWR-042		153.2	126.0	na	
GWR-044		133.9	125.9	502.68	2021-09
GWR-046	MFc	391.4	388.5	504.07	2021-09
GWR-047	MFb	261.4	258.5	503.27	2021-09
GWR-048	MFa	160.0	160.6	502.90	2021-09
na – water level elevation data not available					

Monitoring wells were also installed along the Phoenix deposit with the screened intervals often extending from the lower sandstone (MFa/ Read Formation), through the ore zone into the underlying weathered basement rock; however, static water levels and water quality samples were not recorded in these wells. These wells include GWR-001, -004, -010, -015, -016, -018, -019, -022, -023, -024, -026, -043, -044, and -045, and borehole logs for these wells are in Appendix A. Transducers were installed in these wells as well as additional wells listed in Table 3-1 as part of various studies, and hydrographs are illustrated in Appendix B. Packer and hydraulic testing were also undertaken on boreholes within the area for over 5 years, and the test details and interpreted conductivity values are listed in Appendix C and discussed in Section 3.4.

3.2 Data Sources

Denison has organized their geologic and geotechnical data with a database that was provided for use in the project. The database contains a wide range of data including major lithologies, and various geotechnical fields including estimates of rock quality designation (RQD), fracture intensity, core recovery percentages, alteration, amongst many others for most of the exploration core holes in the area.

Denison also provided tables of the percentage of clay minerals (normative clay content) calculated for the exploration boreholes and groundwater wells. Denison calculated the clay percentages for kaolinite, illite, dravite and chlorites from the bulk geochemical composition of the sandstones using an in-house set of linear equations that govern the distribution of

oxides into minerals of interest. Key oxide inputs are Al_2O_3, Fe_2O_3, K_2O, and MgO in percent and B in ppm.

In addition to the geotechnical data, all the available historic and recent hydraulic testing data and interpreted hydraulic conductivity values was assembled and tabulated (see Appendix D). This data was used alongside water level elevation data recorded in 22 environmental groundwater wells (green diamonds; Figure 6), and 390 water levels recorded in over 150 open hole core holes (purple squares; Figure 6).

3.3 Hydrostratigraphic Units

Hydrostratigraphic units can be derived from stratigraphic or lithologic units based on their general hydrogeologic properties. Units that can transmit reasonable volumes of water are referred to as aquifers, while units that do not readily transmit water are referred to as aquitards. As the hydraulic conductivity in fractured rock settings is generally dominated by secondary porosity features such as faults and fractures, the hydrostratigraphic units do not necessarily align with lithologic, geologic, or stratigraphic boundaries. In addition, geologic or stratigraphic units that have similar hydrogeologic properties are often grouped together to form hydrostratigraphic units.

In the fractured rock environment, coarse-grained sandstones may have lower hydraulic conductivity values than fine-grained sandstones if the rock has been altered following deposition. For example, enhanced fluid flow through relatively clay-free sandstone aquifers can cause cementation, which substantially reduces the porosity and permeability of the rock matrix, but also makes the rock brittle and subject to enhanced fracturing. If post-deposition cementation is extensive, once highly porous, and permeable sandstone units can become aquitards if unfractured (Hiatt et al., 2003). However, fracturing of the rock post-cementation can increase its ability to transmit groundwater. As such, when characterizing groundwater flow through bedrock environments the matrix porosity and the degree of interconnected fracturing together influence the hydraulic conductivity of aquifer and aquitard units.

3.3.1 Methodology Used to Characterize Hydrostratigraphic Units

Identifying the vertical and horizontal extent of aquifers and aquitards within the subsurface requires the generation and interpretation of many cross-cutting two-dimensional cross-sections. Once the two-dimensional cross-sections are interpreted, three-dimensional hydrostratigraphic layers can be created throughout the subsurface. These three-dimensional hydrostratigraphic units then form the basis for the layers within numerical groundwater flow models that can be used to simulate groundwater flow and contaminant transport and fate.

Within the Phoenix area, cross-sections were generated and used to subdivide the subsurface into nine (9) hydrostratigraphic units (Table 3-2). Figure 7 illustrates the locations of cross-sections that were generated as part of the study (see Appendix E for a complete

list of cross-sections). The interpreted hydrostratigraphic units form a stacked sequence of aquifers and aquitards.

Table 3-2: Hydrostratigraphic Units beneath Phoenix

<table>
<tr><th colspan="2">Lithologic Unit</th><th colspan="2">Hydrostratigraphic Unit (Aquifer/ Aquitard)</th></tr>
<tr><td colspan="2">Overburden</td><td colspan="2">Overburden Aquifer</td></tr>
<tr><td rowspan="4">Athabasca Supergroup/ Manitou Falls Group</td><td>Dunlop Formation– MFd</td><td colspan="2" rowspan="2">Upper Sandstone Aquifer</td></tr>
<tr><td>Collins Formation - MFc</td></tr>
<tr><td>Bird Formation - MFb</td><td rowspan="2">Intermediate Sandstone Aquitard</td><td rowspan="3">Desilicified Zone Aquifer</td></tr>
<tr><td>Read Fm (MFa)</td><td>Lower Sandstone</td></tr>
<tr><td colspan="2">Upper Barrier Zone (Clay zone and sulphide-cemented rock zone)</td><td colspan="2">Aquitard (overlying the ore zone)</td></tr>
<tr><td colspan="2">Ore Zone (high grade friable zone)</td><td colspan="2">Ore Zone Aquifer</td></tr>
<tr><td colspan="2">Lower Barrier Zone (Clay zone and sulphide-cemented rock zone)</td><td colspan="2">Aquitard (underlying the ore zone)</td></tr>
<tr><td colspan="2">Paleoweathered and Competent Basement</td><td colspan="2">Basement Aquitard</td></tr>
</table>

The hydrostratigraphic units presented in Table 3-2 were derived by overlaying geotechnical data on cross-section to evaluate trends in the datasets that aligned with the results of hydraulic testing completed in the Phoenix and Gryphon areas. Data visualized along the angled and vertical oriented boreholes in cross-section included the following:

- Lithology: interpreted lithologic unit (Figure 8)
- Fracture frequency: quantitative measure of fracturing per metre (Figure 9)
- Friability: qualitative measure of the friability of the rock (Figure 10)
- Normative clay content: quantitative percentage of total clays within the core (Figure 11)
- Discrete temperature measurement (Figure 11)
- RQD: quantitative measure of the competence of the rock (Figure 12)
- Core recovery: quantitative measure of the percentage of core recovered (Figure 13)
- Hydraulic conductivity estimates from hydraulic testing (Figure 13)
- Water level elevations in wells and open holes (Figures 8 to 13)

The above attributes were selected from the wealth of available data types as they were interpreted to provide the greatest hydrogeologic insight. An area illustrated on Figures 9, 10 and 12 as a "zone of alteration" was identified northeast of the Phoenix deposit. This zone of desilicification, enhanced fracture frequency and elevated friability is interpreted to be the result of the merging of two different tectonic stress fields in the area (Quantec Geoscience, 2014). In general, regions of high friability, low RQD, and low core recovery were interpreted to have resulted when hydrothermal fluid and gases were released along the shear zone and propagated along zones of weakness in the rock including fractured and

faulted bedrock. These desilicified zones are interpreted to have elevated hydraulic conductivity values compared to the unaltered bedrock, particularly where the normative clay content of the rock is low. Normative clay content is interpreted to have the ability to seal fractures in the rock where the clay content is sufficient; normative clay is observed to be elevated throughout portions of the lower portion of the Manitou Falls Group Bird Formation (MFb) and the Manitou Falls Group Collins Formation (MFc).

The combination of the fracture frequency and normative clay content features is interpreted to have the greatest influence on the observed hydraulic conductivity trends in the area surrounding the Phoenix deposit. The degree of fracturing results in the potential capability to transmit water, and thus have zones of enhanced hydraulic conductivity. This potential enhancement of hydraulic conductivity is counter-acted where sufficient clay content is present, as the clays in the rock tend to infill and seal the available fractures. The conceptual understanding of how the combinations of lithology, fracture frequency and normative clay relate to relative hydraulic conductivity values are listed in Table 3-3.

Table 3-3: Combinations of Lithologic and Geotechnical Parameters that Influence Hydraulic Conductivity Values in Fractured Bedrock

Lithology	Fracture Frequency	Normative Clay Content	Hydraulic Conductivity Value
Basement	Low	High[1]	Very Low
	High	High[1]	Moderate
Sandstone	Low	High	Low
	High	Low	Moderate to High
[1]*Normative clay content in the basement rocks is high throughout the area*			

Interpreted hydraulic conductivity values from hydraulic testing conducted were used to extend the interpretations of relative hydraulic conductivity values to areas where hydraulic conductivity data was missing but estimates of fracture frequency and normative clay were available. Observed water levels which integrate hydrogeologic conditions between observation locations, were also used to support the hydrogeologic interpretations locally and extend the interpretations to areas where hydraulic conductivity data was sparse.

Cross-sections were used to illustrate the changes in geological and geotechnical data within the subsurface. Trends in the data were visualized and the combination of fracture frequency, normative clay content and lithology (i.e., overburden, sandstone, basement, etc.) were used to subdivide the subsurface into aquifer and aquitard units. Figure 14 illustrates the hydrostratigraphic units in cross-section, alongside the normative clay values, interpreted lithologic surfaces and hydraulic conductivity values interpreted from packer or pumping tests.

3.4 Hydrostratigraphic Units and their Hydraulic Conductivity Values

Hydraulic conductivity values were assembled through a review of earlier site reporting (Golder 2014; Scibek 2019; Petrotek 2020) as well as analysis of recent borehole testing by Denison and analyzed by Ecometrix. A summary of all available hydraulic conductivity

estimates is contained within Appendix C and summarized in Table 3-4. The wide range in hydraulic conductivity values cited in Table 3-4 is typical of a fractured rock environment and the variation is due to the presence of smaller-scale zones that have hydraulic conductivity values that are higher or lower than the conductivity value of the bulk rock. As such, the geomean value is considered representative of the units on a whole as the distribution of wells are considered random and not indicative of specific trends. Analysis of hydraulic testing analysis completed is contained within Appendix C.

Table 3-4: Summary of Hydrostratigraphic Unit Properties

Hydrostratigraphic Units	Field-Based Hydraulic Conductivity (m/s)		Effective Porosity (%)	Storage[2]
	Range	Geomean[1]		
Overburden Aquifer/ Aquitard	3×10^{-6} and 2×10^{-4}	-	25% (sand); 18% (till)	20% (Sy)
Upper Sandstone Aquifer	4×10^{-7} to 1×10^{-4}	3.7×10^{-6}	1 to 5%	1×10^{-5} (Ss)
Intermediate Bedrock Aquitard	1×10^{-10} to 3.8×10^{-6}	8.4×10^{-9}	1 to 10%	
Desilicified Zone	1×10^{-6} to 2×10^{-5}	4.8×10^{-6}		
Lower Sandstone Aquifer	7.8×10^{-8} to 3×10^{-5}	2.2×10^{-6}		
Upper and Lower Barrier Zone Aquitard (clay zones and sulphide-cemented rock)	Hydraulic tests have not been completed on these units as they are relatively thin in comparison to overlying/ underlying units.			1×10^{-6} (Ss)
Ore Zone Aquifer				
Basement Aquitard	1.1×10^{-11} to 1.1×10^{-5}	4.8×10^{-9}		

[1] A geomean value was not calculated for the Overburden Aquifer/Aquitard or the Upper and Lower Barrier zone as only two measurements were available for each unit
[2] Sy values expressed as percent of total volume
[2] Ss values expressed in units of 1/m
3 Screened intervals of the wells often intercept the ore zone and upper or lower barrier zones; elevated conductivity values were interpreted to reflect the ore zone aquifer and lower values reflect the barrier zone aquitard.

3.4.1 Overburden Aquifer

Overburden in the Phoenix area is a mixture of sand and gravel outwash, and coarse-grained sandy till with 10 - 20% silt and clay. Coarse-grained till is interpreted to lie within the centre and along the surface of the drumlins present in the area. Outwash sediments flank the sides of the drumlins and in some lowland areas. There is a range of expected hydraulic conductivity values within the overburden units reflecting the range of grain size of the overburden sediments.

Two hydraulic tests were conducted in 2020 by Denison, which were subsequently analyzed by the Ecometrix team (Appendix C), and the hydraulic conductivity values associated with the overburden aquifers were 2×10^{-4} and 3×10^{-6} m/s, respectively (Appendix C). The higher

value was interpreted to reflect the contact between the overburden and upper weathered bedrock surface, and the lower is representative of a fine sand with moderate silt content.

3.4.2 Upper Sandstone Aquifer

The Upper Sandstone Aquifer is comprised of fine to medium-grained sandstone, that has a very low (less than 3%) normative clay content. Groundwater flow within the sandstone is controlled by the fracture spacing, orientation, connectivity, and aperture thickness, as well as the permeability of the matrix, which has been influenced by diagenesis and alteration.

The hydraulic conductivity values of this unit are expected to vary depending on the cementation, alteration and fracturing of the sandstone. Five packer and pumping tests were conducted on this hydrostratigraphic unit with four of the five tests conducted on core hole WR-555 (Golder, 2014; Appendix C). Interpreted hydraulic conductivity values from the hydraulic tests ranged from 4×10^{-7} to 1×10^{-4} m/s, with a geomean of 3.7×10^{-6} m/s (Appendix C).

3.4.3 Intermediate Sandstone Aquitard

The Intermediate Sandstone Aquitard is comprised of competent fractured sandstone, that has normative clay contents that vary from 4 to 10%. Like the upper sandstone aquifer, groundwater flow within this unit is controlled by fracture spacing, orientation, connectivity, and aperture thickness; however, the normative clay content in this hydrostratigraphic unit is conceptualized to reduce or seal the fracture apertures, reduce their connectivity and in turn, reduce the hydraulic conductivity of the unit. Denison staff noted that fractures observed in core drilled that intercepts the Bird and Collin's Formations of the Manitou Falls Group (MFb and MFc) often had red hematite smearing or clay that appears to have healed once open fractures (Personal comm., Chad Sorba, January 2021).

Hydraulic conductivity values of the Intermediate Sandstone Aquitard are expected to vary within the unit depending on the cementation, alteration and fracturing of the sandstone, but in general, lower conductivity values are conceptualized. Twenty packer and pumping tests were conducted on this hydrostratigraphic unit with twelve tests being conducted on core hole WR-695 located in the Gryphon area (Golder, 2014; Appendix C). Hydraulic conductivity values ranged from 1×10^{-10} to 3.8×10^{-6} m/s (Appendix C), with a geomean of 8.4×10^{-9} m/s.

3.4.4 Desilicified Zone

There is a distinct zone in the area overlying and east of the Phoenix deposit where the Athabasca Supergroup Sandstone bedrock was subject to hydrothermal alternation resulting in desilicification of the sandstone. The Desilicified Zone is most noticeable in the Intermediate Sandstone Aquitard as the desilicified zone is characterized by poor RQD values (Figure 12), and enhanced fracture and friability (Figures 9 and 10, respectively) which are in sharp contrast to the rock qualities of the Intermediate Sandstone Aquitard. The

hydraulic properties of the Lower Sandstone Aquifer are similar to the Desilicified Zone, and portions of the Lower Sandstone Aquifer are interpreted to have been subject to hydrothermal alteration.

Matrix desilicification has effectively resulted in completely to partially unconsolidated sands, with corresponding hydraulic conductivity values measured. Figure 10 illustrates core that was drilled through the desilicified zone at well GWR-016 at an elevation of approximately 146-160 m asl, in the Lower Sandstone Aquifer, overlying the ore zone. Thermal alteration affects the matrix in the affected hydrostratigraphic units differently, with the most striking change being the increased relative rock friability in the Intermediate Sandstone Aquitard. Thermal alteration can also result in changes in the concentration and/or speciation of iron in the matrix. Bleaching – being loss of diagenetic hematite – can be prevalent, and at depth (generally within the Lower Sandstone Aquifer), pyrite replaces oxidized iron minerals.

Hydraulic conductivity values of the Desilicified Zone are expected to vary depending on the alteration and local extent of friability of the sandstone, but in general, higher hydraulic conductivity values are conceptualized. Packer and pumping tests were conducted on this hydrostratigraphic unit and interpreted hydraulic conductivity values ranged from 1×10^{-6} to 2×10^{-5} m/s (Appendix C), with a geomean of 4.8×10^{-6} m/s.

3.4.5 Lower Sandstone Aquifer

The Lower Sandstone Aquifer is comprised of fractured and faulted sandstone that overlies the basement bedrock units. This unit has a consistently low normative clay content (< 4%), and this trend of low clays is observed in core hole data across the Phoenix and Gryphon areas.

As the normative clay content in this aquifer unit is very low, the hydraulic conductivity value in this unit is generally higher than the overlying sandstone aquitard. However, exceptions exist where the fracture spacing or connectivity are low, leading to isolated lower hydraulic conductivity values. Eighteen packer and pumping tests were conducted on this hydrostratigraphic unit with six of those tests being conducted on exploration hole WR-695 located in the Gryphon area (Golder, 2014; Appendix C). Hydraulic conductivity values ranged from 7.8×10^{-8} to 3×10^{-5} m/s (Appendix C), with a geomean of 2.2×10^{-6} m/s.

3.4.6 Upper and Lower Barrier Zone Aquitard (Clay Zones and Sulphide-Cemented Rock Zone)

There is a discontinuous clay-rich matrix and sulphide-cemented rock envelope that surrounds the Phoenix uranium ore zone; this feature has played a role in the preservation of the Phoenix ore zone for millions of years. This aquitard zone is thin (generally less than 5 m above and below the ore zone) and is interpreted to have a low hydraulic conductivity value when compared to the fractured and altered sandstone of the overlying Lower Sandstone Aquifer. As such, these aquitards are interpreted to have greatly reduced the

hydraulic connection between the high-grade friable ore zone and the overlying and underlying aquifers.

Hydraulic conductivity values interpreted from hydraulic tests have not been exclusively conducted on the upper or lower barrier zone aquitards as these units are thin at the majority of the monitoring wells (i.e., less than 5 m). The hydraulic conductivity values are conceptualized to be approximately 1 x 10^{-9} m/s, a value that is informed by the interpreted hydraulic conductivity value from hydraulic tests conducted on the barrier zones, and ore zone aquifer (Appendix C).

3.4.7 Ore Zone Aquifer

The high-grade friable portion of the ore zone itself has varying properties along the length of the Phoenix deposit. Due to the length of the monitoring well screens and the relatively thinner width of the high-grade portion of the ore zone, there are no wells that are screened exclusively across this aquifer. However, testing in ongoing to confirm that water quality in these wells is reflective of the high-grade portion of the ore zone.

Hydraulic conductivity values interpreted from hydraulic tests have not been exclusively conducted on the ore zone, so the estimates of hydraulic conductivity values are interpreted to be approximately 1 x 10^{-6} to 1 x 10^{-7} m/s. This value is informed by Petrotek (2020) packer testing conducted at GWR-023 whereby the packers isolated the ore zone and barrier zone aquitards above and below the ore zone. Hydraulic conductivity values ranged from 1.0 x 10^{-7} to 5.3 x 10^{-7} with a geomean of 2.3 x 10^{-7} (Appendix C), which is interpreted to be a representative value for the ore zone aquifer.

3.4.8 Basement Aquitard

The basement aquitard is made up of the upper paleoweathered zone and the lower competent basement rock. The paleoweathered zone is characterized by geochemical zonation in iron and clay minerals and reflecting weathering and hydrothermal alteration (Section 2.3.2). The hydraulic properties within this zone will vary widely reflecting fractures and faults and clay-rich nature of the matrix. Elevated hydraulic conductivity values are expected to be limited to the primary fault zones, including the WS Shear where the rock is more fractured. Lower hydraulic conductivity values are observed in areas where the basement rocks are competent, and the fracture frequency is low. Where unfractured, the basement rocks have very low permeability and porosity values.

Packer tests in these areas have yielded hydraulic conductivity values ranging from 1.1 x 10^{-11} m/s to 1.1 x 10^{-5} m/s (Appendix C), with a geomean of 4.8 x 10^{-9} m/s. Hydraulic conductivities estimated from core analysis of the paleoweathered zone core produced values that ranged from 2.5 x 10^{-11} to 7.8 x 10^{-9} with a geomean of 6.2 x 10^{-10} m/s (Denison, 2022b). These values are lower than the hydraulic testing data but align with the hydraulic testing estimates conducted on competent basement rock.

Thirty-five packer and pumping tests have been conducted on this hydrostratigraphic unit (Appendix C). Hydraulic conductivity values ranged from 1.1 x 10^{-11} m/s to 1.1 x 10^{-5} m/s (Appendix C), with a geomean of 4.8 x 10^{-9} m/s.

3.5 Additional Hydraulic Properties

3.5.1 Anisotropy

Sedimentary geological units such as sandstones and overburden tills and outwash sediments typically have horizontal hydraulic conductivity values that are greater than the vertical hydraulic conductivity values due to preferential flow paths along bedding planes. Detailed information describing the vertical hydraulic conductivity in the overburden sediments, sandstone or underlying basement rock in the Phoenix area is not available; however, based on literature and professional judgement, an anisotropy ratio of 10 horizontal to 1 vertical was interpreted for the overburden and sandstone hydrostratigraphic units. An anisotropy ratio of 1:1 was interpreted for the basement aquitard hydrostratigraphic units as the orientation of fracturing within these rocks is not expected to follow bedding-planes.

3.5.2 Porosity

In the Phoenix area, the upper overburden aquifer unit is made up of unconsolidated coarse-grained sediment. Within porous media such as sand-rich till, most of the total porosity is expected to be interconnected; as such the effective porosity, total porosity and specific yield values are expected to all be similar. Effective porosity represents the fraction of the porous media that is connected and provides a path for groundwater to travel from one point to another. In the Phoenix area, the effective porosity of the overburden aquifer is expected to be approximately 25 percent on the coarse-grained sandy outwash, 18 percent where the overburden is dominated by sand-rich tills that contain 10-30% silt and clay, and 20% where the sandstone is desilicified.

In fractured bedrock aquifers, porosity consists of the space between grains (primary porosity), and fractures and dissolution features (secondary porosity). A proportion of the primary and secondary porosity features will be disconnected and will not act as pathways for groundwater flow or contaminant transport. Based on permeameter testing completed on rock core samples (Scibek, 2019), the total porosity within the sandstone units is estimated to average from 10 to 20%, whereas the fracture volume that leads to effective porosity is estimated to be much lower (i.e., 1 x 10^{-5}). The total porosity plays a role in the overall transport and fate of contaminants, but effective porosity values are of interest in characterizing the timing associated with the transport of constituents in groundwater.

The potential effective porosity values of the bedrock aquifers and aquitards in the study area will be a combination of the interconnected portions of primary and secondary porosity features. Effective porosity is best measured using a tracer test; in the absence of

site-specific data, effective porosity values for the bedrock units are estimated to range from 1 to 10% based on literature values (Freeze and Cherry, 1979).

3.5.3 Storage

Groundwater storage refers to the amount of water released from storage due to a unit change in pressure head. Within confined or fully saturated units, specific storage (Ss) results from water that is released due to compaction of the aquifer and expansion of water. Within unconfined aquifers, specific yield (Sy) incorporates the specific storage components as well as the drainage of pores at the water table. Within fully-saturated zones, storativity (S), also referred to as the storage coefficient, is the product of the specific storage and the saturated thickness of the tested zone.

Golder (2014) performed hydraulic testing on ten unique intervals in Well WR-555 and as part of this work they estimated storativity of the various units. Based on the interpreted hydrostratigraphic units, Golder (2014) noted the following storativity values:

- Upper Sandstone Aquifer (3 tests): range from 1.6×10^{-5} to 8.6×10^{-5}
- Intermediate Sandstone Aquitard (3 tests): 8.4×10^{-5}
- Lower Sandstone Aquifer (2 tests): 8.6×10^{-5} to 1.6×10^{-4}
- Basement (2 tests): 8.0×10^{-5} to 9.4×10^{-5}

Petrotek (2020) estimated storativity values through analysis of pumping test data conducted on the Phoenix ore zone. The storativity values in the Phoenix ore zone (i.e., Basement Aquitard) were estimated to range widely from 1.3×10^{-4} to 1×10^{-9} (Petrotek, 2020), with an overall average of 2.4×10^{-5} in Test Area 1, and 1.2×10^{-4} in Test Area 2, which are consistent with the basement storativity values estimated by Golder (2014).

3.6 Groundwater Flow Systems

Hydrogeological information was reviewed to understand the current groundwater flow directions and gradients across the study area. While there is an abundance of water level data, 390 of the 433 water level elevations were collected in open hole wells (Figure 15) that extend hundreds of metres into the subsurface. Water levels observed in these open holes represent blended water level elevations that are not representative of only one hydrostratigraphic unit. Consequently, the following sections outline the groundwater flow directions and gradients that were interpreted though review of observed water level data in regional monitoring wells that represent discretely screened intervals of the subsurface.

In general, groundwater flow in the Phoenix area is conceptualized to occur in two groundwater flow regimes; an upper flow regime that is influenced by local ground surface topography, streams and lakes, and a deeper semi-regional groundwater flow regime that is influenced by rivers and regional lake systems. In the upper or local groundwater flow regime, groundwater recharges locally and flows through the Overburden and Upper Sandstone Aquifers and discharges to nearby surface water features. In the deeper,

confined, semi-regional groundwater flow regime, groundwater is primarily sourced from the regional-flow system, west of the study area, and in part by water flowing downward through the overlying aquifers and aquitards to the Lower Sandstone Aquifer. Based on site geochemical observations, local recharge to the Lower Sandstone Aquifer may be enhanced along regional fault zones that cross-connect the shallow and deep aquifers.

3.6.1 Local Flow System: Overburden and Upper Sandstone Aquifers

Groundwater level elevations representative of the Overburden and Upper Sandstone Aquifer were limited to seven locations in the Phoenix area. While the two aquifers have different hydraulic properties, where they are hydraulically connected water levels are expected to be similar.

Figure 16 illustrates the water level elevations observed in monitoring wells screened across the Overburden (green labels) and Upper Sandstone Aquifer (orange labels). Surface water elevations in the major lakes are also illustrated on Figure 16 as pink levels alongside the ground surface topography. As illustrated on Figure 16, the water levels in this upper system are interpreted to mimic ground surface topography and flow from the upland areas as part of a local groundwater flow system and discharge into the lakes and streams, which are groundwater discharge features.

3.6.2 Semi-Regional Flow System: Lower Sandstone Aquifer

Groundwater level elevations observed in the Intermediate Sandstone Aquitard, Lower Sandstone Aquifer and Ore Zone Aquifer are illustrated on Figure 17. The hydraulic properties of the aquifer units differ, but on a broad scale, we expect similar water levels in these aquifer units.

Groundwater flow in the semi-regional groundwater flow regime is conceptualized to be dominated by flow through the Lower Sandstone Aquifer. As illustrated on Figure 17, groundwater in the Lower Sandstone Aquifer unit is interpreted to flow from the highs of approximately 515 m asl in the west, towards the groundwater elevation lows that are located near Whitefish Lake, which as a lake stage of 500 m asl (Figure 17). The lake stages for McGowan Lake (2 km east of Whitefish; Figure 17) and Russell Lake (6 km south of Phoenix deposit) are 494 and 488 m asl, respectively. While there is hydraulic potential for regional groundwater to flow toward and discharge to McGowan or Russell Lakes, the Intermediate Sandstone Aquitard is intact in the area south of the Phoenix deposit, so the Lower Sandstone Aquifer is interpreted to hydraulically separate the Semi-Regional Flow System from the overlying Upper Flow System. The presence of the Desilicified Zone forms a hydraulic connection between the Local and Semi-Regional groundwater flow system in this area, and this interpretation is supported by available water level data in monitoring wells and boreholes throughout the area.

3.6.3 Water Level Variability

Hydrographs were generated using available data recorded from transducers installed in the Phoenix area. Pressure transducers record changes in pressure within wells, and barometric pressure is also recorded in barologgers in the Phoenix area to support barometric correction of the pressure transducer data. Barometric correction is completed to remove noise due to fluctuations in barometric pressure from transient water level data. With the barometric pressure effects removed from the hydrograph, improved analysis of water level and gradient changes due to actual fluctuations in the groundwater flow system can be achieved. Most monitoring wells at Phoenix have transducers that are non-vented, so barometric correction is recommended to remove the barometric pressure signal from the water level transducer data. This is a complicated process as barometric efficiency recorded in each well is dependent on how confined the well screen is, well construction, amount of storage in the well, and the well depth, as each of these factors influences the degree of pressure delay and pressure muting between barometric pressure changes at surface and those experienced pressure change within the well itself (see Rasmussen and Crawford, 1997). As the monitoring wells are screened at various depths below surface across the Site, a rigorous barometric correction involving complex signal processing was not undertaken as part of this project. Instead, a simpler "direct subtraction of barometric pressure" approach was used acknowledging barometric efficiency-related noise is still present in some hydrographs. This was considered appropriate for this Baseline Report as the transducer data was collected and reviewed to discern long-term trends or changes in vertical gradients. A more exhaustive barometric correction was not necessary to illustrate the long-term water level variability present in the transducer data.

Appendix B illustrates the variability in water level elevations in monitoring wells across the Phoenix area on an hourly basis. Wells were grouped by their spatial location and to allow for comparison of vertical gradients for monitoring wells that lie close to one another. The hydrographs illustrate that the variations in water levels collected in 2020 and 2021 are generally less than 20 cm and similar water level variability is observed in shallow and deep monitoring wells. During the observation period, the vertical gradients within the well clustered remained constant, except for GWR-008 and GWR-009 where interpreted hydraulic testing in the ore zone reversed the gradients for a short period of time due to pumping and injection hydraulic testing. (Note: GWR-033 to GWR-035 and GWR-036 are vented transducers that do not require any corrections).

3.7 Vertical Gradients

Vertical gradients are interpreted to be generally downward at the Phoenix deposit site, transitioning to upward beneath the surrounding surface water bodies (i.e., Whitefish and Williams Lakes). Calculation of vertical gradient values is complicated by the few snapshots of water level data available, and the distance between available well “clusters” located southwest, northwest, southeast and within the Phoenix deposit (further description of the clusters is provide in Section 4.0 and Figure 19).

Recognizing this, vertical gradient calculations were conducted using water levels collected in the nested monitoring wells located southeast of Phoenix on the west side of Whitefish Lake, and two wells located east of Phoenix also on the west side of Whitefish Lake. These five wells were drilled and instrumented in 2020 to help address data gaps identified in this study.

One well nest within the Phoenix area consists of a well screened in the Lower Sandstone Aquifer (GWR-033; Read Formation), another screened in the Intermediate Sandstone Aquitard (GWR-034; MFb), and a third well screened in the Upper Sandstone Aquifer (GWR-035; MFd). A second well nest consists of a deeper well screened at the interface between the overburden and sandstone bedrock (GWR-036; MFd), and a shallower well screened in the overburden approximately 50 m below surface (GWR-037). Water levels were collected in all wells in September 2020 and vertical gradients were calculated (Table 3-5). Upward gradients (positive values in Table 3-5) were observed between each set of well pairs in the two well nests (see Figure 19 for location of well nests), which was expected as Whitefish Lake is conceptualized as a local and regional groundwater discharge location. The Whitefish Lake stage elevation is approximately 500 m asl, indicating groundwater moves vertically through the subsurface units and discharges into Whitefish Lake in the vicinity of these two well nests.

Table 3-5: Vertical Gradients in Nested Wells

Well Nest	Name	Hydrostratigraphic Unit	Screen Midpoint	Water Level Elevation	Head Difference (m)	Vertical Gradient (m/m)
			Elevation (m asl)			
WR-607 Cluster	GWR-035	Upper Sandstone Aquifer	492.70	501.60	0.57	0.002
	GWR-034	Intermediate Sandstone Aquitard	218.00	502.17		
	GWR-034	Intermediate Sandstone Aquitard	218.00	502.17	0.46	0.007
	GWR-033	Lower Sandstone Aquifer	155.40	502.63		
LA-5 Cluster	GWR-036	Overburden	459.90	502.25	0.20	0.011
	GWR-037	Upper Sandstone Aquifer	441.30	502.45		

Based on water levels in monitoring wells and core holes in the area, areas west and southwest of Phoenix are interpreted as having downward vertical gradients with an estimated magnitude of approximately 0.015 m/m. Groundwater is interpreted to flow from surface through the Intermediate Sandstone Aquitard to the Lower Sandstone Aquifer.

3.7.1 Groundwater – Surface Water Interaction

Available surface water data and reporting was reviewed to evaluate the potential interaction of groundwater and surface water in the vicinity of the Phoenix deposit. The following are some of the lines of evidence that indicate interaction between the groundwater and surface water flow systems, and these are discussed further in the underlying subsections:

- Areas of increasing surface water flow (i.e., streamflow), outside of typically high precipitation time periods. Increasing streamflow along a watercourse in dry periods can typically be attributed to groundwater discharge and is referred to as baseflow. The change in streamflow between monitoring stations can provide volumetric groundwater discharge estimates.

- Areas where the stream temperature is similar to the groundwater temperature. In summer, areas of colder surface water can be evidence of groundwater discharge, while in winter areas that resist freezing over may reflect higher local groundwater discharge rates.

Where groundwater naturally discharges to surface water, groundwater level elevations in nearby monitoring wells will on average be higher than surface water elevations.

3.7.1.1 Increased Surface Water Flow

A review of streamflow rates in the vicinity of Phoenix deposit was undertaken to evaluate areas where groundwater discharge may be preferentially occurring. Stream discharge rates observed during low flow periods were selected for the comparison as they are inferred to be more representative of conditions when groundwater discharge will be driving streamflow differences. The review focused on stream gauging stations from Whitefish Lake (SA-6 and SA-2; Figure 2-10) to downstream of McGowan Lake (SA-1) (Ecometrix, 2020a). Stream flow data suggest incremental increases during low flow periods above McGowan Lake, which indicates groundwater contribution to Whitefish Lake. Streamflow records indicate periods of incremental gains and losses within McGowan Lake meaning that these data do not conclusively indicate continuous groundwater discharge to McGowan Lake. Streamflow analysis within the Williams Lake drainage area similarly suggests modest groundwater discharge is occurring to Williams Lake and associated tributaries.

3.7.1.2 Streamflow Temperature

Groundwater discharge to streams will maintain a relatively constant temperature year-round. As such groundwater discharge zones may be evident as areas of the stream that do not ice-over completely during cold winter months, or areas that maintain cooler water conditions during summer months. From the available baseline hydrology reporting (Ecometrix, 2020a), photographs at streamflow stations SA-2 and SA-6 (upstream and downstream of Whitefish Lake) indicate areas of open water during March 2018. Such open

water conditions in March may indicate groundwater discharge that slightly warms the stream and prevents ice formation; it is noted that the mean air temperature in March is -12°C.

3.7.1.3 Hydraulic Head Data

Groundwater and surface water levels were compared to assess linkages between the two flow systems (Figures 16 and 17). As Figure 16 illustrates, the groundwater level elevations observed in monitoring wells screened in the overburden and upper Athabasca Supergroup sandstone formations east of the Phoenix deposit are higher than the lake level elevation in Whitefish Lake. Groundwater flow trends from west to east suggesting shallow groundwater flows through the overburden and Upper Sandstone Aquifer and discharges into Whitefish Lake.

Figure 17 illustrates the water level elevations for wells that are screened in the Lower Sandstone Aquifer in the semi-regional groundwater flow system. Similar to the shallow groundwater flow system, water levels in the deep groundwater flow system vary from 501 to 514 m asl and are higher than the water level elevations in Whitefish Lake (500 m asl). As such, groundwater is interpreted to move along the semi-regional flow system and discharge into Whitefish Lake via the Desilicified Zone. The lake stage elevation for Whitefish Lake is higher than the lake stage for McGowan Lake so there is potential for groundwater to remain deep and discharge into McGowan Lake; however, the water levels recorded in the monitoring wells between Phoenix and Whitefish Lake consistently show upward gradients throughout the Desilicified Zones into Whitefish Lake.

3.7.2 Groundwater Recharge

Groundwater recharge is the portion of precipitation that infiltrates to the groundwater system and is not lost to evapotranspiration, interflow, or overland flow to rivers or creeks. The percentage of precipitation that ends up as groundwater recharge is a function of the hydraulic conductivity of surficial sediments, land use, topography, and the soil moisture content.

In the Wheeler River area, groundwater recharge is the primary driver of groundwater flow. Recharge rates are conceptualized to be greatest in the areas where outwash sands are present at surface, lower where tills are present at surface, and absent where groundwater discharges to surface, such as at Whitefish Lake.

Average groundwater recharge rates can be estimated by dividing low flow values from a gauged stream by the catchment area. This approach assumes that water recharging within the catchment area discharges into the river and sustains the flow in the summer months when precipitation is low. This is a reasonable assumption if the catchment area is large and groundwater flow out the catchment is considered minimal.

A Water Survey of Canada streamflow gauge lies approximately 30 km east of the study area, on the downgradient end of Russell Lake. The average monthly streamflow from 2011

to 2018 is illustrated on Figure 18 and the average river low flow is approximately 15 m^3/s (Ecometrix, 2020a). The catchment area upstream of this gauge is approximately 3,030 km^2 (Ecometrix, 2020a), which equates to an average groundwater recharge rate within the catchment of approximately 156 mm/year. Higher groundwater recharge values (over 200 mm/year) are expected on the outwash sands, and values lower than 125 mm/year are expected on areas where till lies at surface. These values are also supported by observed stream baseflow at site gauges SB-3 (Williams Lake drainage area) and SB-1 (Icelander River drainage area) from which local recharge rates are estimated to be between 100 to 140 mm/year (Ecometrix, 2020a).

The estimated average annual recharge rate for the Phoenix site of 156 mm/year is comparable to recharge rates estimated by Golder (2013) for the Key Lake area where recharge rates of 270 mm/year, 150, and 50 mm/year were estimated on outwash sands, drumlins and till plains, respectively.

3.8 Hydraulic Influence of Fault Zones and Drill Holes

3.8.1 Fault Zones

Broadly speaking, fault zones can act as barriers to groundwater flow or as groundwater conduits depending on the nature of the fault zone and the material within it. If the fault zone consists of finely ground rock and clay (fault gouge) or intruded material (e.g., diabase), the fault may have very low hydraulic conductivity compared with the host rock and form a barrier to flow. Such low-permeability faults may be apparent from significant differences in groundwater levels across the fault or appear as hydraulic boundaries in aquifer (pumping) tests.

Conversely, if a fault zone consists of one or more continuous open fractures, then it may act as a conduit. Under natural conditions, evidence for such conduit faults may be seen in geophysical surveys (contrasting conductivity), perturbations in groundwater levels and temperature, or the occurrence of fault related springs and discharge zones.

When the groundwater system is pumped, such as in an aquifer test or extended flow test, a conduit fault may manifest as a source of recharge, representing an apparent boundary, and/or cause anomalous drawdown in monitoring wells connected to the fault. On a regional (or basin) scale the influence of faulting on groundwater flow depends on numerous factors including the permeability of the fault(s) and their orientation with respect to the geological strata and dominant recharge and discharge zones.

The potential regional effects of faulting when faults acted as conduits could include:

- Concentration of flow within fault zones which may enhance recharge or discharge, particularly where there are inclined or low-angle conduit faults within or between those zones.

- Enhanced vertical groundwater movement through units assumed to be regional semi confining aquitards, which may be evident through geochemical signatures.
- Anisotropy. Faults or joints that have a dominant orientation can impart a preferred flow direction on intersected groundwater systems.

When faults acted as barriers, the regional effects of faulting could include:

- Limited flow within fault zones which may impede regional recharge, discharge or flow.
- Changes in anisotropy where faults that have a dominant orientation but are clogged with low permeability clays can create a barrier to preferred flow directions within dislocated groundwater systems.
- Compartmentalisation of the regional flow with differences in groundwater level and/or flow direction between fault-bounded blocks.
- Hydraulic sheltering or isolation where stagnant zones are formed.

3.8.1.1 Observations Pertinent to Faults at Phoenix

Vertical fracture or fault zones that hydraulically connect the Local (upper) and Semi-Regional (lower) groundwater flow regimes are present throughout the Athabasca Basin (Ramaekers, 1981; Kotzer and Kyser, 1990; Sibbald et al., 1990). The distribution of monitoring wells outside of the Phoenix ore zone area makes it difficult to identify these features with confidence, but these features may exist between data points.

Hydrogeologic impacts of faults can be observed in groundwater monitoring data and used to better understand fault continuity and fault infill characteristics. To characterize the presence of faults that extend through the Athabasca Sandstone Supergroup, various data sets were reviewed including water level elevations, redox characteristics, groundwater chemistry trends, and discrete temperature data.

Water level trends throughout the region surrounding the Phoenix deposit are largely consistent across the area (see Figures 15 to 17). Large scale faults that extend from ground surface through the sandstone into the top of basement rock were not evident in core; however, water levels in the deep sandstone and basement rocks in the areas west of the Phoenix ore zone (i.e., GWR-029 has a water level of 515 m asl; Figure 17) are higher than those in the ore zone (approximately 501 to 502 m asl; Figure 17). One potential interpretation is that the WS Shear zone in the area southwest of the ore zone may extend to ground surface and underlie the stream near GWR-029. The surface water level in the stream is interpreted to be 516 to 517 m asl, which is similar to the observed water level of 514 m asl in GWR-029. It is interpreted that the fault may act as a preferential pathway for water to flow quickly from surface and this stream into the Lower Aquifer thereby recharging the lower groundwater flow system in this area (Figure 29). This interpretation is supported by groundwater quality within the Lower Sandstone Aquifer at GWR-029. The groundwater quality observed in the shallow wells across the site are very similar to those observed in GWR-029 (Section 4), suggesting a connection between the two groundwater

flow systems. The similarities in water level elevations and water quality are interpreted to be due to the presence of this local fault. Discrete temperature data collected in boreholes was also reviewed and indicate a wide variability of temperatures along boreholes (Figure 11); however, the variability in temperature could not be correlated with faults.

3.8.2 Exploration Boreholes

Exploration boreholes drilled in the Phoenix area, where left partially plugged to protect surficial aquifers, have the potential to provide preferential flow paths between the overburden and Upper and Lower Sandstone Aquifers. Exploration holes were reportedly grouted approximately 10 to 20 m above and below the ore zone, resulting in open holes remaining throughout the overlying materials. These portions of the open holes may act as open conduits for groundwater flow through the 400 m of Athabasca Supergroup Sandstones. There are over 200 boreholes that lie within 100 m of the Phoenix ore zone, most of which were drilled as HQ and NQ diameter boreholes, which have diameters of 96- and 76-mm diameters, respectively.

The impact of these boreholes may be influencing the local vertical gradients observed in monitoring wells close to the Phoenix deposit, but as all observation wells local to the ore zone are screened at considerable depth (i.e., over 200 m), it is difficult to understand the potential influence of these open holes.

3.9 Groundwater Demand

The only current groundwater supply well in the Phoenix area is the camp water supply well that is located over 2 km southwest of the Phoenix deposit. The screened interval of the well and the water demands are not known but are expected to be very low given the size of the camp and the number of employees.

4.0 GROUNDWATER CHEMISTRY

The following Sections provide an overview of the analytical results for groundwater quality collected from the monitoring well network in 2019-2021. Groundwater chemistry is explored in more detail to inform the understanding of groundwater flow systems at the Site developed based on the geology and hydraulic properties of the subsurface in the previous section.

4.1 Groundwater Monitoring Network and Database

4.1.1 Athabasca Supergroup Sandstones

Groundwater monitoring at proximal upgradient locations and in the study area surrounding the Phoenix deposit occurs in the GWR-series wells. The GWR-series wells were installed in all lateral directions around the ore zone and, for the most part, were advanced in groups of three. The groups of three wells targeted each of the local and regional groundwater flow zones, including: a) the Overburden and Upper Sandstone Aquifers (overburden, MFd, and upper MFc); b) the Intermediate Sandstone Aquitard (lower MFc and upper MFb), and c) the Lower Sandstone Aquifer (Lower MFb and MFa). These groups of wells are referred to as "clusters" and they are shown in Figure19. The Formation in which the well is screened is indicated on the figure.

In contrast to the other regional well clusters, the cluster most proximal to Whitefish Lake ("LA-5 Cluster") is made up of two wells – a shallower well screened at the interface of the overburden and the MFd (GWR-036), and a slightly deeper well, still in the upper MFd (GWR-037). This well nest was installed to evaluate groundwater quality and vertical gradients close to groundwater discharge to Whitefish Lake, as discussed in Section 3.7.

Overlying the Phoenix deposit are five discrete interval monitoring wells that were sampled as part of the baseline program. These wells are GWR-011 (MFa) and GWR-013 (MFb), GWR-046 (MFc), GWR-047 (MFb), and GWR-048 (MFa).

A subset of the monitoring wells outlined above are installed at locations where the sandstone matrix is desilicified. Wells screened in desilicified Lower Sandstone Aquifer sediments include GWR-008, GWR-012 and GWR-011. Wells screened in desilicified Intermediate Sandstone Aquitard sediments include GWR-009, GWR-013 and GWR-047. Wells screened in desilicified Upper Sandstone Aquifer sediments include GWR-014 and GWR-037.

4.1.2 Ore Zone and Basement Rock Units

One monitoring well, GWR-031, is installed across ore zone and Paleoweathered zone. Groundwater quality from this well is considered most reflective of Paleoweathered zone hydrochemistry of the wells installed in the study area.

Monitoring wells been installed within or across the ore zone include GWR-032, GWR-038. GWR-039, GWR-040, GWR-041 and GWR-042.

Monitoring well GWR-004 was installed in the Basement Aquitard in Phase 3 of the Phoenix deposit, but due to the small drill/core size, cannot support sampling. An attempt was made to sample the basement rock as part of the Gryphon Shaft Pilot Hole Drill Support Program (SRK, 2018b). Due to low permeability and groundwater recovery, it was not possible to collect a sample from the basement rock. Water quality for these zones is available from information available from Cigar Lake (AECL, 1994) and the Millennium Project Environmental Impact Statement: Annex D, Regional Geology and Hydrogeology (Cameco, 2012).

4.1.3 Sampling Programs

Sampling of groundwater from the GWR-series wells for physical (temperature, field-measured) and chemical analyses occurred in 2019 (GWR-032 only), 2020 and 2021. All monitoring wells in the groundwater monitoring well network, listed in Table 3-1, have been sampled at least once, with the following exceptions:

- monitoring wells GWR-002 and GWR-007 are installed in overburden and were dry during sampling events in 2020 and 2021.
- monitoring wells GWR-028 and GWR-027, both installed in the MFb, are damaged and can not be sampled.

GWR-series groundwater wells sampled during one or more sampling event from 2019-2021 are indicated with green symbols in Figure 19. Field sampling methodology is provided as Appendix F.

4.2 Analytical Results Overview

The results of the groundwater quality analyses are presented by well cluster and the Phoenix ore zone area in Table 4-1. Field data sheets for the sampling events are provided as Appendix G. Analytical results and QA/QC on the samples are provided in Appendix H.

Metals and trace elements in groundwater were measured as dissolved concentrations, on field-filtered and acidified samples. The dissolved species are the most relevant form of these elements for fate and transport in the subsurface. The constituents measured in the dissolved phase are outlined in Table 4-1**.** For ease, a direct reference to constituents being measured in the dissolved phase is not made in the discussion that follows below – for example if the concentration or behaviour of Fe in the subsurface is discussed, it is the dissolved form of Fe in groundwater.

Groundwater quality from monitoring wells GWR-034, GWR-038 through GWR-042 is not included in the discussion here below on groundwater quality associated with the Project. These groundwaters, for reasons of well integrity (GWR-034) and inadvertent introduction

of dissolved KCl tracer into the wells (GWR-038 through GWR-042) are not considered to yield groundwater reflective of formation water.

Generally, groundwater associated with the Athabasca Sandstone Supergroup and overburden is of circumneutral pH, relatively low total dissolved solids (TDS; < 250 mg/L), and low to moderate alkalinity (10-126 mg/L). However, there are important deviations from these general groundwater qualities that are examined in more detail spatially (laterally, and by depth/hydrostratigraphic unit) in Section 4.3. Groundwater in the ore zone is circumneutral, but with higher TDS (>500 mg/L) and with, generally, higher concentrations of metals and other trace elements than measured in groundwater from Athabasca Sandstone Supergroup and overburden.

As noted above, a subset of the monitoring wells are screened in desilicified sediments of the Lower Sandstone and Upper Sandstone Aquifers and Intermediate Sandstone Aquitard. As such, groundwater quality in these wells was compared to each other (i.e., within the desilicified sediments) and to the other samples collected in their respective flow system/hydrostratigraphic unit. The objective of this comparison was to determine if a groundwater quality could be identified that was unique to the desilicified sediments (i.e., a groundwater quality unique to the Desilicified Zone). Determined through the comparison was that groundwater quality primarily reflects the flow system/hydrostratigraphic unit, meaning, for example, the water quality in GWR-009 is more comparable to the groundwater quality in samples from the Intermediate Sandstone Aquitard than to the wells in the desilicified zone, taken as a group. As such, groundwater quality was evaluated further by grouping the wells according to the hydrostratigraphic unit (or, where possible, flow system) in which the wells are installed, as outlined in Table 3-1:

a) Local Groundwater Flow System, comprising the Overburden and Upper Sandstone Aquifers (the overburden wells with those installed in the MFd);
b) Intermediate Bedrock Aquifer (MFc and MFb wells);
c) Lower Sandstone Aquifer (MFa wells); and
d) The ore zone samples.

Summary statistics (maximum, minimum and median value) are provided as Table 4-2. In addition to the groundwater results, analytical results for surface water samples collected as part of the Wheeler River Project: Baseline Aquatic Environment Study (Ecometrix, 2020b) are also included, so that the quality of groundwater versus that in surface water can be understood in the region surrounding the Phoenix deposit.

Presented in Appendix I is groundwater quality at the Site in relation to potable water guidelines. Water is not used regionally for domestic use (Appendix I), and future use, particularly of water from the deeper aquifers is not anticipated; as such, the comparison of site date to the potable water guidelines is not an evaluation of risk to humans from consumption of groundwater in the Project Area. Exceedances of health-based and aesthetic guidelines occur in all hydrostratigraphic at the Site. The frequency of exceedances is higher in the deeper hydrostratigraphic units and in the ore zone.

Table 4-1: Groundwater Water Monitoring Results

Well Cluster	Units	Upgradient Cluster[a]				NW Cluster[b]				SE Cluster[c]				WR-607 Cluster[d]						Downgradient Cluster					
Groundwater Monitoring Well		GWR-006		GWR-029		GWR-003		GWR-025		GWR-008		GWR-009		GWR-033		GWR-034		GWR-035		GWR-005		GWR-014		GWR-012	
Lithology		OB		Mfa		OB		MFa		MFa		MFb		MFa		MFb		OB / MFd		OB		MFc		MFa	
Hydrostratigraphic Unit		OB		LSA		OB		LSA		LSA/DSZ		ISA/DSZ		LSA		ISA		USA		OB		USA/DSZ		LSA/DSZ	
Sampling Date		2020-08-22	2021-04-14	2020-08-30	2021-04-12	2020-08-16	2021-04-18	2020-08-22	2021-04-17	2020-09-06	2021-04-09	2020-09-14	2021-04-10	2020-11-03	2021-05-25	2020-10-30	2021-05-24	2020-11-03	2021-05-24	2020-08-29	2021-05-22	2020-08-29	2021-05-21	2020-08-29	2021-05-23
Field Parameters																									
Field pH	pH units	6.75	6.90	6.46	7.30	6.35	5.86	6.49	7.06	6.92	7.42	10.87	7.67	7.02	7.32	8.77	7.57	6.48	6.30	7.49	6.8	11.38*	9.77	6.94	7.17
Field Temp.	°C	6.7	4.8	6.5	3.6	14.6	5.1	9.6	4.1	9.1	3.9	5.9	3.3	6.5	7.5	2.8	7.2	4.3	5.4	10.4	6.3	8.4	6.2	11.5	7.9
Field Conductivity	µS/cm	53.1	92.8	56.7	108	28.2	17.2	668	1392	71.9	98.9	153	362.1	229.9	461.9	303.3	666	40.3	71	68.2	97.5	275.6	270.3	351.8	602
ORP	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field SPC	µS/cm	80.4	150.9	87.6	183.1	35.3	27.8	946	2315	102	165.7	241	618	351.4	694	520	1007	66.7	113.6	93.4	150.5	397.2	421.5	470.5	896
Field TDS	mg/L	52	98	57	119	23	18	615	1505	66	108	157	402	231	451	343	654	43	74	61	98	259	274	306	582
Diss. O2	mg/L	3.76	4.70	2.48	12.83	9.05	3.82	3.15	12.35	7.53	12.56	3.00	12.47	3.22	6.09	9.52	5.16	3.87	8.01	2.33	11.82	1.07	12.20	1.63	11.61
Fe2+	mg/L	1.0	1.3	2.0	-	0.0	0.0	2.0	1.0	2.5	1.5	0	1.5	2.0	1.0	0.0	0.0	0.5	0.0	2.0	1.5	0.0	0.0	2.0	1.5
Analytical Results																									
Bicarbonate	mg/L	35	35	33	29	12	17	51	35	55	39	<1	188	43	51	166	156	22	27	34	26	115	76	112	77
Carbonate	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	49	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	18	<1	<1
Chloride	mg/L	10	1.4	6.1	6.1	0.1	<0.1	233	319	3	2.7	0.3	0.4	57	67	<1	<1	5.8	5.7	3.3	3.3	0.4	0.4	81	86
Hydroxide	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	46	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	15	<1	<1
pH	pH units	7.04	7.32	7.14	7.36	6.76	6.88	6.9	6.96	7.44	7.16	10.06	7.59	7.48	7.43	8.07	7.63	7.04	6.79	6.99	6.8	7.68	9.05	7.62	7.24
Specific conductivity	µS/cm	71	61	72	68	27	19	918	1110	86	69	215	289	331	334	481	480	54	46	70	49	190	175	452	416
Sum of ions	mg/L	75	64	56	54	20	23	488	610	78	56	127	252	191	194	329	318	44	44	57	43	190	138	284	245
Total alkalinity	mg/L	29	29	27	24	10	14	42	29	45	32	87	154	35	42	136	128	18	22	28	21	94	92	92	63
Total hardness	mg/L	30	32	21	21	12	8	222	283	24	17	53	104	59	73	21	19	14	12	11	9	84	45	121	106
Ammonia as nitrogen	mg/L	0.15	0.17	0.03	0.05	0.09	<0.01	0.08	0.14	0.05	0.08	0.96	0.07	0.12	0.27	0.08	0.19	<0.01	0.03	<0.01	0.01	3.4	1.9	0.35	0.33
Nitrate (calc. from NO2+NO3-N)	mg/L	0.09	0.09	<0.04	<0.04	<0.04	0.13	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.04	<0.04	<0.04	0.09	<0.04	0.04	<0.04	<0.04	0.09	<0.04	<0.04	<0.04
Nitrite	mg/L	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.11	<0.03	<0.03	<0.03	<0.03	0.25	<0.03	<0.03	<0.03	<0.03	0.23	0.11	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.02	0.02	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Ortho-phosphate as P	mg/L	0.13	0.14	0.08	0.02	0.05	0.01	0.08	<0.01	0.12	0.16	0.04	0.2	<0.01	0.01	26	62	<0.01	0.01	0.05	0.02	<0.01	0.06	0.08	0.04
Organic carbon, dissolved	mg/L	2.4	1.3	1.6	1.2	1.4	0.8	2.2	1.1	7	1	10	33	3.4	2	8.7	7.9	2.1	0.4	0.5	0.7	18	8.3	4.1	1.9
Iron (II)	mg/L	-	0.04	-	0.02	-	<0.02	-	0.09	-	-	-	<0.02	-	-	-	-	-	-	-	0.07	-	<0.02	-	-
Fluoride	mg/L	0.14	0.14	0.09	0.1	0.04	0.03	0.21	0.21	0.07	0.17	0.08	0.1	0.09	0.12	0.02	0.02	<0.01	0.02	0.09	0.11	0.08	0.18	0.01	0.24
Total dissolved solids	mg/L	199	178	71	82	64	63	566	653	72	59	139	264	132	209	375	402	50	45	75	51	160	142	274	250
Total suspended solids	mg/L	838	413	<1	6	133	<1	7	17	3	4	9	13	10	8	3	6	3	<1	18	20	13	24	10	26
Calcium	mg/L	4.9	5.2	5.6	5.3	2.9	2.4	66	84	6.8	4.7	20	29	18	23	7.7	6.7	3.5	3	2.9	2.3	33	17	37	31
Magnesium	mg/L	4.3	4.7	1.7	1.9	1.1	0.5	14	18	1.8	1.2	0.8	7.6	3.4	3.8	0.5	0.5	1.3	1	1	0.8	0.4	0.7	7	6.9
Potassium	mg/L	1.8	1.5	1.6	1.5	1	0.3	3.5	4.1	1.7	1.5	8.6	1.2	2.1	2.1	149	148	1.1	0.7	1.1	1.2	6.3	4.4	4.4	3.7
Sodium	mg/L	12	9	5.3	5.5	2.1	1.7	68	83	8.6	5.4	21	23	36	30	3.7	3.9	4.9	3.9	10	6.1	21	15	36	32
Sulfate	mg/L	6.4	7	2.4	4.2	1	0.9	52	67	0.7	0.9	24	2.5	31	17	1.8	2.2	5.9	3	4.5	3	10	4.2	5.9	8.1

Notes

a Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

a Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

c Monitoring Well GRW-007, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry

d The water quality in GRW-034 is considered to reflect influence from drilling fluids and additves, and is not considered reliable. Analysitcal well for this data is not used further in this baseline report.

e Monitoring Well GRW-002, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry

f Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214

g Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L.

h Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.

i The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

Table 4-1: Groundwater Water Monitoring Results continued

Well Cluster	Units	LA-5 Cluster				Paloeweathered Zone		Phoenix Ore Zone[e]															
Groundwater Monitoring Well		GWR-036		GWR-037		GWR-031		GWR-011		GWR-013		GWR-032			GWR-038[i]	GWR-039[i]	GWR-040[i]		GWR-041[i]	GWR-042[i]	GWR-046	GWR-047	GWR-048
Lithology		OB		MFd		PWZ		MFa		MFb		OZ			OZ	OZ	OZ		OZ	OZ	MFc	MFb	Mfa
Hydrostratigraphic Unit		OB		USA/DSZ		PWZ		LSA/DSZ		ISA/DSZ		OZ			OZ	OZ	OZ		OZ	OZ	ISA	ISA/DSZ	LSA
Sampling Date		2020-11-05	2021-04-08	2020-10-24	2021-04-09	2020-08-09	2021-06-04	2020-08-08	2021-06-01	2020-08-09	2021-06-02	2019-11-14[h]	2020-08-08	2021-06-04	2021-09-04	2021-09-05	2021-09-01	2021-09-01 DUP	2021-09-06	2021-09-07	2021-09-14	2021-09-10	2021-09-10
Field Parameters																							
Field pH	pH units	6.45	6.62	6.13	6.02	7.03	7.21	8.70	6.82	9.68	7.35	-	6.79	6.83	7.54	6.74	6.84	6.84	6.88	6.71	6.37	6.47	6.08
Field Temp.	˚C	4.4	3.4	4.8	4.1	11.3	16.8	17.5	7.2	10.5	7.8	-	8.0	18.5	7.7	8.9	11.3	11.3	8	8.6	10.24	9.51	8.44
Field Conductivity	µS/cm	18.3	42.8	26.4	49.1	588	1162	98.5	144.8	174.8	182.7	-	737	1486	7233	23173	11290	11290	9996	16567	136	97	111
ORP	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51.1	-84.5	-57.5
Field SPC	µS/cm	30.5	73.1	43.1	81.1	789	1374	114	219.2	238.4	271.5	-	958	1683	10811	33458	15302	15302	14820	24146	192	138	163
Field TDS	mg/L	20	48	57	53	513	893	74	142	155	176	-	623	1094	7027	21748	9947	9947	9633	15695	123	90	106
Diss. O2	mg/L	9.80	8.36	4.01	3.00	4.62	3.65	4.64	11.91	3.60	11.83	-	1.16	2.26	5.57	4.59	2.57	2.57	6.69	6.28	12.2	3.14	1.74
Fe2+	mg/L	0.0	0.0	0.5	1.0	0.5	0.0	0.0	1.0	0.0	1.0	-	1.5	1.5	-	-	-	-	-	-	-	-	-
Analytical Results																							
Bicarbonate	mg/L	30	16	15	16	167	160	54	41	105	85	155	174	118	104	40	76	76	80	61	86.3	75.2	57
Carbonate	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	24	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	0.2	<0.1	0.4	0.1	151	145	7.4	7.2	0.6	1.3	202	234	220	1600	4760	2560	2580	2270	3590	8.63	6.13	4.14
Hydroxide	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-
pH	pH units	6.96	6.91	6.57	6.38	7.36	7.83	7.83	7.34	9.3	7.76	7.52	7.33	7.4	7.56	6.49	6.98	7.39	6.91	6.51	7.06	7.37	7.08
Specific conductivity	µS/cm	21	35	32	39	810	686	115	99	248	141	965	1000	860	5380	16100	7530	7530	7050	11530	277	160	139
Sum of ions	mg/L	47	28	32	29	504	439	92	71	210	126	566	598	504	3130	9220	4360	4350	4130	6760	-	-	-
Total alkalinity	mg/L	25	13	12	13	137	131	44	34	126	70	127	143	97	85	33	62	62	66	50	70.7	61.6	46.7
Total hardness	mg/L	16	14	8	6	190	148	38	26	57	48	267	256	182	614	2470	1830	1830	1340	1900	89.5	29.4	43.4
Ammonia as nitrogen	mg/L	<0.01	<0.01	0.04	0.02	0.05	0.35	0.26	0.13	0.68	0.02	-	0.31	0.73	-	44	12	12	18	-	0.026	<0.005	<0.005
Nitrate (calc. from NO2+NO3-N)	mg/L	0.49	0.49	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	0.13	<0.4	0.04	<0.04	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.02	<0.02	<0.02
Nitrite	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	-	<0.03	<0.03	-	<0.03	<0.03	<0.03	0.04	-	<0.01	<0.01	<0.01
Nitrite+Nitrate as nitrogen	mg/L	0.11	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.03	-	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05
Ortho-phosphate as P	mg/L	0.09	0.08	0.02	0.04	<0.01	0.01	0.11	0.12	0.03	0.06	-	<0.01	0.01	-	0.04	0.02	<0.01	0.02	-	-	-	-
Organic carbon, dissolved	mg/L	1.1	0.5	3.9	2	68	6.2	3.6	1	7.9	2	-	36	5.8	-	40	19	19	21	-	34.6	8.95	15.6
Iron (II)	mg/L	-	-	-	<0.02	-	<0.02	-	-	-	-	-	-	0.04	-	0.07	-	-	0.05	-	7.77	<0.02	2.3
Fluoride	mg/L	0.01	0.06	<0.01	0.01	0.32	0.42	0.2	0.18	0.13	0.08	0.22	0.19	0.23	0.27	0.14	0.21	0.21	0.21	0.18	0.059	0.074	0.142
Total dissolved solids	mg/L	112	66	90	55	536	393	101	98	182	177	639	628	599	3280	10400	4640	4080	4510	7830	188	132	122
Total suspended solids	mg/L	180	71	<1	<1	5	41	171	34	28	208	-	11	17	-	68	28	26	31	-	-	-	-
Calcium	mg/L	1.2	2.7	2	1.8	58	43	13	7.9	21	14	84	78	55	190	843	590	590	431	665	29.4	8.24	13.1
Magnesium	mg/L	3.2	1.8	0.7	0.4	11	9.9	1.3	1.6	1.1	3.1	14	15	11	34	90	88	88	64	58	3.91	2.14	2.6
Potassium	mg/L	5.3	2.8	1.9	1.8	5.5	5.3	2.4	2	6.7	1.8	5.6	5.4	4.6	955	3000	767	732	975	2000	6.77	4.46	1.89
Sodium	mg/L	3.9	2.9	3.6	2.8	71	69	8.4	6.1	34	15	75	83	81	137	189	203	205	154	152	8.96	18.6	8.87
Sulfate	mg/L	2.6	1.9	8	6.5	40	6.6	5.5	4.7	17	5.2	30	8	13	110	300	71	67	160	230	10.1	2.28	6.26

Notes

a Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

a Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

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f Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214

g Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L.

h Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.

i The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

Table 4-1: Groundwater Water Monitoring Results continued

Well Cluster	Units	Upgradient Cluster[a]				NW Cluster[b]				SE Cluster[c]				WR-607 Cluster[d]						Downgradient Cluster					
Groundwater Monitoring Well		GWR-006		GWR-029		GWR-003		GWR-025		GWR-008		GWR-009		GWR-033		GWR-034		GWR-035		GWR-005		GWR-014		GWR-012	
Lithology		OB		Mfa		OB		MFa		MFa		MFb		MFa		MFb		OB / MFd		OB		MFc		MFa	
Hydrostratigraphic Unit		OB		LSA		OB		LSA		LSA/DSZ		ISA/DSZ		LSA		ISA		USA		OB		USA/DSZ		LSA/DSZ	
Sampling Date		2020-08-22	2021-04-14	2020-08-30	2021-04-12	2020-08-16	2021-04-18	2020-08-22	2021-04-17	2020-09-06	2021-04-09	2020-09-14	2021-04-10	2020-11-03	2021-05-25	2020-10-30	2021-05-24	2020-11-03	2021-05-24	2020-08-29	2021-05-22	2020-08-29	2021-05-21	2020-08-29	2021-05-23
Aluminum, dissolved	mg/L	0.0096	0.016	0.014	<0.0005	0.0065	0.0055	0.0024	<0.0005	0.0081	0.0023	0.012	0.21	0.025	0.0013	0.035	0.2	0.013	0.0058	0.0022	<0.0005	0.02	0.003	0.0038	<0.0005
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	0.0005	<0.0002	0.0055	<0.0002	<0.0002	<0.0002	0.0003	0.0007	<0.0002	<0.0002	<0.0002	<0.0002	0.002	<0.0002	<0.0002	<0.0002
Arsenic, dissolved	ug/L	1.3	0.8	0.3	<0.1	0.2	0.1	<0.1	<0.1	0.1	0.1	3.3	11	2.2	1.8	0.2	0.4	0.2	0.2	1.1	1.4	0.6	0.5	0.2	<0.1
Barium, dissolved	mg/L	0.0081	0.0095	0.0082	0.0053	0.0082	0.0056	0.12	0.11	0.1	0.042	0.059	0.22	0.059	0.059	0.011	0.018	0.015	0.016	0.024	0.015	0.15	0.11	0.25	0.15
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	0.01	0.01	0.04	0.04	<0.01	<0.01	0.32	0.4	0.03	0.03	<0.01	<0.01	0.04	0.05	<0.01	<0.01	<0.01	<0.01	0.03	0.03	0.02	0.02	0.15	0.15
Bromine	ug/L	22	18	85	79	<5	<5	2900	3600	40	34	<5	5	750	860	12	12	76	79	46	47	5	7	1000	1100
Cadmium, dissolved	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	0.00001	0.00001	<0.00001	0.00003	0.00006	0.00002	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0058	<0.0005	<0.0005	0.0048	0.0019	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	0.0002	0.0002	<0.0001	<0.0001	0.0009	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0047	0.0005	0.0005	0.0003	0.0003	0.001	0.0012	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper, dissolved	mg/L	0.0008	<0.0002	<0.0002	<0.0002	0.0017	0.0007	<0.0002	<0.0002	<0.0002	0.0007	0.0008	0.0011	0.0003	<0.0002	0.016	0.025	0.0005	0.0003	<0.0002	<0.0002	0.0004	0.0009	<0.0002	<0.0002
Iron, dissolved	mg/L	0.49	0.53	4.86	2.16	0.039	0.16	16	9.7	3.55	2.81	0.21	15.3	0.47	0.66	0.61	0.75	0.32	0.16	3.71	4.84	0.055	0.064	5.6	1.32
Lead, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.0002	<0.0001	0.011	0.0054	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium, dissolved	ug/L	8.5	9.1	11	13	0.8	0.8	32	40	12	9.9	9	6.3	14	15	0.4	0.7	4	3.1	11	11	12	14	26	28
Manganese, dissolved	mg/L	0.14	0.16	0.23	0.24	0.14	0.073	0.97	1.14	0.4	0.33	0.021	2.75	0.21	0.27	0.019	0.037	0.14	0.23	0.17	0.2	0.0018	0.0037	0.57	0.59
Molybdenum, dissolved	mg/L	0.0012	0.0007	0.0001	<0.0001	0.0012	<0.0001	0.0005	0.0002	0.0003	0.0002	0.0087	0.0038	0.003	0.0026	0.0007	0.0004	0.0008	0.0009	0.0023	0.0007	0.0024	0.0034	0.0023	0.0007
Nickel, dissolved	mg/L	0.0004	0.0004	0.0002	<0.0001	0.0021	0.0017	0.0002	<0.0001	0.0004	0.0002	0.0012	0.0053	0.0011	0.0008	0.0035	0.002	0.005	0.01	0.0003	<0.0001	0.0027	0.0015	0.0006	0.0002
Selenium, dissolved	mg/L	<0.0001	<0.0001	0.0011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0002	<0.0001
Silica, soluble, dissolved	mg/L	23	24.2	17.4	17.2	16.5	17.6	17.8	16.8	25.8	23.9	19.5	30.3	10.9	12.2	5.2	6.9	20.3	19.1	19.9	20.4	15.5	16.3	24.4	21.2
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.034	0.029	0.12	0.12	0.02	0.02	1.88	2.19	0.12	0.1	0.24	0.21	0.3	0.36	0.021	0.022	0.033	0.031	0.057	0.059	0.26	0.15	0.61	0.59
Sulfur	mg/L	2.1	2.3	0.8	1.4	0.33	0.3	17	22	0.23	0.3	8	0.8	10.3	5.7	0.6	0.7	1.97	1	1.5	1	3.3	1.4	2	2.7
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0017	0.0032	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	0.0034	<0.0002	<0.0002	0.0011	0.0051	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Vanadium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0018	<0.0001	<0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.0009	0.0041	0.001	0.0016	0.01	0.009	0.003	0.0026	0.0029	0.0016	0.0014	0.017	0.015	0.004	0.14	0.12	0.0025	0.0045	0.0064	0.0014	0.0007	0.0008	0.0007	0.002
Phosphorus, dissolved	mg/L	0.06	0.02	0.06	<0.01	<0.01	<0.01	0.09	<0.01	0.06	0.1	0.05	0.19	<0.01	0.01	58.4	61	<0.01	<0.01	<0.01	<0.01	0.03	0.07	0.1	<0.01
Radionuclides																									
Uranium, dissolved	ug/L	1.4	0.2	0.2	0.2	0.5	<0.1	0.8	<0.1	2.4	0.7	5.3	22	3.6	0.8	136	87	0.2	<0.1	0.5	0.5	0.3	1.2	0.5	<0.1
Uranium-234 calculated	Bq/L	0.043	0.002	0.004	0.002	0.1	0.001	0.024	0.001	0.043	0.009	0.13	0.27	0.047	0.011	2.4	1.2	0.002	0.003	0.037	0.01	0.037	0.017	0.011	0.002
Uranium-238 calculated	Bq/L	0.043	0.002	0.004	0.002	0.1	0.001	0.024	0.001	0.043	0.009	0.13	0.27	0.047	0.011	2.4	1.2	0.002	0.003	0.037	0.01	0.037	0.017	0.011	0.002
Lead-210	Bq/L	0.09	0.08	0.1	0.07	0.6	0.03	0.08	0.08	<0.02	0.66	0.3	1.1	0.14	0.04	22	5.7	0.03	<0.02	0.28	<0.02	0.08	0.3	0.15	0.1
Polonium-210	Bq/L	0.13	0.22	0.02	0.34	0.2	0.05	0.02	0.18	0.05	0.67	0.07	0.73	0.16	0.12	6.3	4.4	0.06	0.03	0.11	0.02	0.03	0.52	0.03	0.26
Radium-226	Bq/L	0.36	0.06	0.07	0.09	0.27	0.02	0.26	0.29	0.81	0.32	0.33	0.3	1.6	0.13	3.6	0.9	0.14	0.04	0.16	0.03	0.08	0.06	0.17	0.12
Radon-222	Bq/L	32	20	35	<10	86	18	7	<4	38	<4	<3	<4	20	<3	25	8	30	20	15	<5	11	<6	23	<4
Thorium-230	Bq/L	0.12	<0.02	<0.01	0.04	0.08	<0.01	<0.01	0.03	0.01	0.02	0.03	0.22	0.03	<0.01	2.6	0.44	<0.01	<0.01	0.04	<0.01	0.01	<0.01	<0.01	<0.01
Tritium	Bq/L	<15	0.1	<15	0.1	<15	1.1	<15	0.4	<15	0.5	16	1.2	<15	0.5	<15	1.2	<15	0.8	<15	<0.1	19	0.1	<15	<0.1

Notes

a Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

a Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

c Monitoring Well GRW-007, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry

d The water quality in GRW-034 is considered to reflect influence from drilling fluids and additves, and is not considered reliable. Analysitcal well for this data is not used further in this baseline report.

e Monitoring Well GRW-002, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry

f Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214

g Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L.

h Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.

i The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

Table 4-1: Groundwater Water Monitoring Results continued

Well Cluster	Units	LA-5 Cluster				Paloeweathered Zone		Phoenix Ore Zone[e]															
Groundwater Monitoring Well		GWR-036		GWR-037		GWR-031		GWR-011		GWR-013		GWR-032			GWR-038[i]	GWR-039[i]	GWR-040[i]		GWR-041[i]	GWR-042[i]	GWR-046	GWR-047	GWR-048
Lithology		OB		MFd		PWZ		MFa		MFb		OZ			OZ	OZ	OZ		OZ	OZ	MFc	MFb	Mfa
Hydrostratigraphic Unit		OB		USA/DSZ		PWZ		LSA/DSZ		ISA/DSZ		OZ			OZ	OZ	OZ		OZ	OZ	ISA	ISA/DSZ	LSA
Sampling Date		2020-11-05	2021-04-08	2020-10-24	2021-04-09	2020-08-09	2021-06-04	2020-08-08	2021-06-01	2020-08-09	2021-06-02	2019-11-14[h]	2020-08-08	2021-06-04	2021-09-04	2021-09-05	2021-09-01	2021-09-01 DUP	2021-09-06	2021-09-07	2021-09-14	2021-09-10	2021-09-10
Aluminum, dissolved	mg/L	0.15	0.037	0.48	0.06	<0.005	<0.0005	0.0082	0.052	0.025	0.011	0.21	0.0057	0.0006	-	0.005	<0.005	<0.005	0.01	-	0.8	0.0065	0.001
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	0.0003	0.0014	<0.0002	0.0008	<0.0002	0.0003	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	0.00024	<0.0001	<0.0001
Arsenic, dissolved	ug/L	0.2	0.3	0.4	1	1	1.2	4.1	1.3	3.1	0.9	3.4	0.3	0.2	-	<1	<1	<1	<1	-	4.75	3.71	0.85
Barium, dissolved	mg/L	0.0095	0.0057	0.0073	0.0087	0.052	0.035	0.21	0.054	0.041	0.11	0.088	0.083	0.063	-	0.96	0.52	0.52	0.35	-	0.241	0.0626	0.0577
Beryllium, dissolved	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.000167	<0.00002	<0.00002
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	<0.00005	<0.00005	<0.00005
Boron, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	0.5	0.55	0.04	0.04	0.02	<0.01	0.58	0.59	0.43	-	0.4	0.5	0.5	0.5	-	0.023	0.018	0.041
Bromine	ug/L	<5	<5	<5	<5	1100	1500	100	100	8	<5	-	2300	2000	-	15800	9800	9800	6800	-	11	34	57
Cadmium, dissolved	mg/L	0.00001	<0.00001	0.00002	<0.00001	<0.0001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	-	<0.0001	<0.0001	<0.0001	<0.0001	-	0.0000336	<0.000005	<0.000005
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	0.009	0.0008	<0.0005	<0.0005	<0.0005	<0.0005	0.013	0.0011	<0.0005	-	<0.005	<0.005	<0.005	<0.005	-	0.00169	<0.0005	0.00068
Cobalt, dissolved	mg/L	0.0004	0.0002	0.0005	0.0004	0.002	0.0002	<0.0001	<0.0001	<0.0001	0.0001	0.0007	<0.0001	<0.0001	-	0.003	0.001	0.001	0.002	-	0.00584	0.00025	0.00036
Copper, dissolved	mg/L	0.002	0.0006	0.0013	0.0009	<0.002	<0.0002	0.0006	0.0018	0.0006	0.0008	<0.0002	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	0.00629	<0.0002	<0.0002
Iron, dissolved	mg/L	0.12	0.014	1.64	1.38	3.6	0.09	0.012	0.86	0.086	0.014	3.83	6.4	4.2	-	23	8.2	7.7	18.2	-	6.03	11.9	9.62
Lead, dissolved	mg/L	0.0001	<0.0001	0.0002	<0.0001	0.001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0003	0.0005	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.00157	<0.00005	<0.00005
Lithium, dissolved	ug/L	3	2.8	9.2	9	89	90	10	13	8.8	6.2	-	75	65	-	470	250	250	210	-	8.3	9.6	15.5
Manganese, dissolved	mg/L	0.048	0.039	0.12	0.16	0.22	0.13	0.085	0.36	0.026	0.22	0.2	0.24	0.22	-	1.8	0.85	0.83	0.87	-	3.91	2.14	2.6
Molybdenum, dissolved	mg/L	0.0003	0.0007	<0.0001	0.0028	0.062	0.012	0.028	0.0042	0.018	0.0054	0.078	0.0059	0.0038	-	0.008	0.011	0.011	0.045	-	0.00389	0.00374	0.00298
Nickel, dissolved	mg/L	0.0023	0.0018	0.0037	0.0023	0.04	0.0019	0.0003	0.0001	0.0024	0.0018	0.012	0.0014	0.001	-	0.056	0.019	0.02	0.024	-	0.0487	0.00062	0.00066
Selenium, dissolved	mg/L	0.0007	0.0008	0.0001	0.0004	<0.001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	-	0.003	0.002	0.002	0.002	-	0.000359	<0.00005	<0.00005
Silica, soluble, dissolved	mg/L	25.5	26.2	33.4	35.3	10	9.1	22.5	24.1	19.2	22.7	-	13.5	13.3	-	55.7	50.5	51.2	70.2	-	13.1	11.8	11.6
Silver, dissolved	mg/L	<0.00005	<0.00005	0.0001	0.00011	<0.0005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	0.000046	<0.00001	<0.00001
Strontium, dissolved	mg/L	0.012	0.012	0.014	0.012	1.4	1.17	0.13	0.12	0.16	0.08	2.37	2.51	1.66	-	23.5	16.1	16.1	11.2	-	0.115	0.0796	0.169
Sulfur	mg/L	0.87	0.6	2.7	2.1	13	2.2	1.8	1.6	5.7	1.7	-	2.7	4.3	-	100	24	22	53.3	-	8.69	1.34	3.58
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	<0.00001	<0.00001	<0.00001
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.00033	<0.0001	<0.0001
Titanium, dissolved	mg/L	0.0009	0.0004	0.0048	0.0006	<0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	0.00897	<0.0003	<0.0003
Vanadium, dissolved	mg/L	0.0001	0.0004	<0.0001	<0.0001	<0.001	<0.0001	0.0005	<0.0001	0.0019	<0.0001	0.0074	0.0004	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.0012	<0.0005	<0.0005
Zinc, dissolved	mg/L	0.0061	0.0044	0.0067	0.0041	18.4	0.69	0.0018	0.012	0.001	0.0016	2.94	5	2.62	-	0.09	0.01	0.011	0.065	-	0.0125	0.0011	0.0031
Phosphorus, dissolved	mg/L	0.04	0.04	0.01	0.03	<0.1	<0.01	0.15	0.01	0.1	0.01	-	<0.01	<0.01	-	<0.1	<0.1	<0.1	<0.1	-	<0.05	0.13	0.289
Radionuclides																							
Uranium, dissolved	ug/L	0.9	0.1	5.8	0.8	17	50	9	0.7	14	55	299	5.7	11	504	38	10	10	10	564	22.6	0.752	0.488
Uranium-234 calculated	Bq/L	0.042	0.002	0.08	0.01	0.46	10.7	0.36	0.008	0.29	10.5	-	0.21	1.69	-	15.9	0.24	0.56	1	-	-	-	-
Uranium-238 calculated	Bq/L	0.042	0.002	0.08	0.01	0.46	10.7	0.36	0.008	0.29	10.5	-	0.21	1.69	-	15.9	0.24	0.56	1	-	-	-	-
Lead-210	Bq/L	0.14	0.07	0.08	0.05	1100	7300	0.6	0.3	0.4	8	1200	3300	2200	-	2700	5000	5000	2300	-	0.9	1.1	0.46
Polonium-210	Bq/L	0.08	0.05	0.14	0.11	460	650	0.4	0.3	0.4	13	120	260	110	-	460	700	600	420	-	0.65	0.14	1.3
Radium-226	Bq/L	0.22	0.06	0.19	0.03	120	76	1	0.5	0.5	17	300	400	180	-	6200	1500	1100	10000	-	0.93	0.24	0.75
Radon-222	Bq/L	17	20	64	57	5900	12000000	90	<8	34	41	400000[f]	2700000	3800000	-	6000000	6000000	6000000	4000000	-	11	1800	620
Thorium-230	Bq/L	<0.01	0.02	<0.01	<0.01	1.1	30	0.3	<0.1	0.2	4.7	14	2	7	-	21	6	10	6	-	0.2	<0.01	0.01
Tritium	Bq/L	<15	0.8	<15	0.1	<15	910	<15	0.1	<15	0.8	-	950	1800	-	RTR	<15	<15	RTR	-	<40	<40	<40

Notes

a Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

a Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged

c Monitoring Well GRW-007, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry

d The water quality in GRW-034 is considered to reflect influence from drilling fluids and additves, and is not considered reliable. Analysitcal well for this data is not used further in this baseline report.

e Monitoring Well GRW-002, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry

f Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214

g Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L.

h Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.

i The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

4.2.1 Constituent Groupings

Examining the median values, three constituent "groups" emerged. These groups are differentiated by colour in Table 4-2.

Group 1: This group, highlighted in pale green highlighting in Table 4-2, includes constituents for which concentrations in groundwater in all the hydrostratigraphic units and surface water did not vary significantly. This group generally included constituents present in low concentrations, often at or below analytical detection limits, and are not discussed further in the interpretation of groundwater conditions herein.

Group 2: This group, highlighted by pale yellow shading in Table 4-2 includes general groundwater quality indicators, and select trace elements. This group of constituents is evaluated further in Section 4.3.3 as they inform the conceptualization of the groundwater flow systems at the Site.

Group 3: This group, highlighted in blue in Table 4-2, primarily includes radionuclides, but also some trace elements (Cr, V, and Zn). Median concentrations/activities of Group 3 constituents in the ore zone groundwater samples are generally more than two orders of magnitude higher than those in the Athabasca Sandstone Supergroup and overburden hydrostratigraphic units. This is shown in Figure 20, where concentrations of uranium are shown for the Ore Zone Aquifer and overlying hydrostratigraphic units. Uranium concentrations in the Ore Zone Aquifer (GWR-032) have been measured at 299 µg/L and decrease by an order of magnitude or more in the overlying hydrostratigraphic unit. Baseline uranium concentrations are very low (close to or below detection limits) in Whitefish Lake. Elevated levels of these metals/trace elements constituents are, like those of uranium and other radionuclides, attributed to the mineralogy and geochemical conditions within the ore zone.

4.2.2 Groundwater Ageing: Tritium Values

The potential for analysis of tritium concentrations in groundwater to support ageing of groundwater and the development of the CSM for the Wheeler River program was evaluated using the available analytical data and information on tritium concentrations in precipitation. The analysis is presented in Appendix L. It was concluded that, beyond supporting recent groundwater recharge in the overburden and the upper sandstone aquifer – discussed further below (Section 4.3.3) - tritium concentrations in groundwater do not provide a robust means of ageing groundwater in the subsurface for the Wheeler River Project. Tritium concentrations in groundwater will continue to be measured as part of the routine groundwater sampling, to further evaluate the usefulness of this approach for refining the conceptual site model developed for the Wheeler River Project.

Table 4-2: Summary Statistics, Groundwater and Surface Water Quality, Wheeler River Project

Well Cluster	Units	Ore Zone (OZ)				Paleoweathered Zone (PWZ)				Lower Sandstone Aquifer (MFa)				Intermediate Sandstone Aquitard (MFb and MFc)[a]				Local Groundwater Flow System (OB and MFd)				Surface Water[b,c]				Constituent "Group"
		Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	
Field Parameters																										
Field pH	pH units	2	6.83	6.79	6.81	2	7.21	7.03	7.12	13	8.70	6.08	7.02	5	10	6.4	7.4	12	7.5	5.9	6.5	-	-	-	-	(2) 3*
Field Temp.	˚C	2	19	8.0	13	2	17	11.3	14	13	18	3.6	7.5	6	10	3.3	8.1	12	15	3.4	5.0	-	-	-	-	See note d
Field Conductivity	µS/cm	2	1486	737	1112	2	1162	588	875	13	1392.0	56.7	144.8	6	362	97	227	12	98	17	46	-	-	-	-	(2) 3*
ORP	mV	-	-	-	-	-	-	-	-	1	-57.5	-57.5	-	2	51	-85	-17	-	-	-	-	-	-	-	-	
Field SPC	µS/cm	2	1683	958	1321	2	1374	789	1082	13	2315	87.6	219	6	618	138	334	12	151	28	77	-	-	-	-	2
Field TDS	mg/L	2	1094	623	859	2	893	513	703	13	1505	0.11	142	6	402	0	218	12	98	18	53	-	-	-	-	2
Analytical Results																										
Bicarbonate	mg/L	3	174	118	155	2	167	160	164	13	112	29	51	6	188	75.20	85.7	12	35	12	24	32	20	2.0	8.1	2
Carbonate	mg/L	3	<1	<1	-	2	<1	<1	-	13	<1	<1	-	6	18	<1	-	12	<1	<1	-	32	<1	<1	-	2
Chloride	mg/L	3	234	202	220	2	151	145	148	13	319	2.7	7.4	6	8.6	<1	0.85	12	10	<0.1	0.90	32	0.80	0.10	0.37	2
Hydroxide	mg/L	3	<1	<1	-	2	<1	<1	-	13	<1	<1	-	6	<1	<1	-	12	<1	<1	-	32	<1.1	<1	-	See note e
P. alkalinity	mg/L	3	<1	<1	-	2	<1	<1	-	12	<1	<1	-	4	15	<1	-	12	<1	<1	-	32	<1.1	<1	-	See note e
pH	pH units	3	7.52	7.33	7.40	2	7.83	7.36	7.60	13	7.83	6.90	7.34	6	9.1	7.1	7.64	12	7.32	6.38	6.90	32	7.17	6.33	6.8	See note e
Specific conductivity	µS/cm	3	1000	860	965	2	810	686	748	13	1110	68	139	6	289	141	183	12	71	19	43	32	42	12	18	See note e
Sum of ions	mg/L	3	598	504	566	2	504	439	472	12	610	54	142	4	252	126	164	12	75	20	44	32	25	6.0	13	See note e
Total alkalinity	mg/L	3	143	97	127	2	137	131	134	13	92	24	42	6	154	62	81	12	29	10	20	31	16	2.0	6.9	See note e
Total hardness	mg/L	3	267	182	256	2	190	148	169	13	283	17	43	6	104	29	66	12	32	6.0	12	31	12	4.0	5.3	See note e
Ammonia as nitrogen	mg/L	2	1	0.31	0.5	2	0	0.05	0.2	13	0.35	<0.005	0.12	6	3.4	<0.005	0.05	12	0.17	<0.01	0.02	32	1.2	<0.01	-	2
N)	mg/L	3	0.04	<0.04	-	2	<0.04	<0.04	-	13	<0.04	<0.02	-	6	0.13	<0.02	-	12	0.49	<0.04	-	32	0.25	<0.04	-	1
Nitrite	mg/L	2	<0.03	<0.03		2	<0.03	<0.03	-	13	<0.03	<0.01	-	6	0.23	<0.01	-	12	0.05	<0.03	-	-	-	-	-	1
Nitrite+Nitrate as nitrogen	mg/L	2	0.01	<0.01	-	2	<0.01	<0.01	-	13	<0.01	<0.01	-	6	0.05	<0.01	-	12	0.11	<0.01	-	-	-	-	-	1
Ortho-phosphate as P	mg/L	2	0.01	<0.01	-	2	0.01	<0.01	-	12	0.16	<0.01	0.08	4	0	0.005	0.06	12	0.14	0.01	0.05	-	-	-	-	1
Organic carbon, dissolved	mg/L	2	36	6	21	2	68	6	37	13	16	1.0	2.0	6	35	2.0	13.5	12	3.9	0.40	1.2	32	8.40	1.50	2.4	2
Iron (II)		1	0.04	0.04	-	1	<0.02	<0.02	-	3	2.30	0.02	0.09	4	7.8	<0.02	-	4	0.07	<0.02	0.03					2
Fluoride	mg/L	3	0.23	0.19	0.22	2	0.42	0.32	0.37	13	0.24	0.01	0.14	6	0.2	0.06	0.08	12	0.14	0.01	0.04	32	0.06	0.01	0.02	2
Total dissolved solids	mg/L	3	639	599	628	2	536	393	465	13	653	59	122	6	264	132	169	12	199	45	65	32	35.00	11.00	23.17	See note e
Total suspended solids	mg/L	2	17	11.0	14	2	41	5.0	23	12	171	0.5	9.0	4	208	13.0	19	12	838	1.00	19	32	23.00	<1.5	-	1
Calcium	mg/L	3	84	55	78	2	58	43	51	13	84	4.7	13	6	33	8.2	23	12	5.2	1.2	2.8	32	3.50	1.00	1.39	2
Magnesium	mg/L	3	15	11.0	14	2	11	9.9	10	13	18	1.2	2.6	6	7.6	0.40	2.6	12	4.7	0.4	1.1	32	0.70	0.30	0.40	2
Potassium	mg/L	3	6	4.6	5.4	2	6	5.3	5.4	13	4.4	1.5	2.1	6	7	1.2	4	12	5.3	0.3	1.4	32	0.80	0.10	0.35	2
Sodium	mg/L	3	83	75	81	2	71	69	70	13	83	5.3	8.9	6	23	9.0	17	12	12	1.7	3.9	32	1.85	1.14	1.51	2
Sulfate	mg/L	3	30	8.0	13	2	40	6.6	23	13	67	0.70	5.9	6	10	2.3	4.7	12	8.0	0.90	3.8	32	8.30	0.30	0.68	2

Notes

	Shading is used to highlight median values
	Shading is used to indicate "Group 1" constituents - see text for details.
	Shading is used to indicate "Group 2" constituents - see text for details.
	Shading is used to indicate "Group 3" constituents - see text for details.
-	Indicates where median values were not calculated. Median values were only calculated when the frequency of detection for the constituent exceeded 50% of the samples from each group. Where values were below detection, the detection limit was used to calcualate median values.
	Blank Cells mean the constituent was not measured
a	Sample GWR-034 was not included in the summary statistics, as the groundwater was influenced by drilling fluids and additives and is not reflective of natural groundwater.
b	The surface water samples include all 32 lake and stream sample locations reported in Ecometrix, 2020 (Wheeler River Project: Baseline Aquatic Environment Study). Surface water quality at each location was measured on 1-6 occasions. Arithmetic mean values were reported in Ecometrix, 2020 at each location were used herein (i.e. the reported "max" value is the maximum arithmetic mean value, etc.,). This was considered acceptable for the comparison only purposes within this report.
c	Metal and trace element concentrations in the surface water samples are for Total concentrations, not disssolved.
d	Temperature and Dissolved oxygen are likely to be influenced to some extent by ambient conditions, and are thus not considered further in the interpretation of groundwater conditions at the Site.
e	These constituents are considered part of Group 2 but are not discussed further in the interpretation of groundwater conditions at the site because they are correlated to or represented by other parameters being carried forward (e.g. Fe^{2+} by Dissolved Iron; laboratory-measured TDS by field-measured TDS, etc.)
f	U-234 was calculated from U-238 assuming secular equilibrium. This assumption may not hold in the groundwater flow systems. This constittuent is not considered further in the interpretation of groundwater condtions at the Site.
g	Tritium concentrations were very low, with the exception of the ore zone and paleoweathered zone groundwater samples.

Table 4-2: Summary Statistics, Groundwater and Surface Water Quality, Wheeler River Project, Continued

Well Cluster	Units	Ore Zone				Paleoweathered Zone (PWZ)				Lower Sandstone Aquifer (MFa)				Intermediate Sandstone Aquitard (MFb and MFc)[a]				Local Groundwater Flow System (OB and MFd)				Surface Water[b,c]				Constituent "Group"
		Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	
Aluminum, dissolved	mg/L	3	0.21	0.0006	0.01	2	0.0025	0.0005	-	13	0.05	<0.0005	0.002	6	0.8	0.003	0.02	12	0.48	<0.0005	0.01	32	0.028	0.001	0.005	(1) 3*
Antimony, dissolved	mg/L	3	0.00	<0.002	-	2	<0.002	<0.002	-	13	0.001	<0.0001	-	6	0.0007	<0.0001	-	12	<0.0002	<0.0002	-	32	0.00	<0.0002	-	1
Arsenic, dissolved	ug/L	3	3.40	0.2	0.3	2	1.20	1.00	1.1	13	4.1	<0.1	0.20	6	11	0.50	2.3	12	1.4	0.1	0.35	32	0.0003	<0.0001	-	(1) 3*
Barium, dissolved	mg/L	3	0.09	0.063	0.08	2	0.05	0.035	0.04	13	0.25	0.005	0.06	6	0.2	0.06	0.13	12	0.02	0.01	0.01	32	0.01	<0.00215	0.00	1
Beryllium, dissolved	mg/L	3	0.00	<0.0001	-	2	<0.001	<0.001	-	13	<0.0001	<0.00002	-	6	0.0002	<0.00002	-	12	0.0001	<0.0001	-	32	0.00	<0.0001	-	1
Bismuth, dissolved	mg/L	2	<0.002	<0.002	-	2	<0.002	<0.002	-	13	<0.0002	<0.00005	-	6	<0.0002	<0.00005	-	12	<0.0002	<0.0002	-	-	-	-	-	1
Boron, dissolved	mg/L	3	0.6	0.43	0.58	2	0.6	0.50	0.53	13	0.40	0.03	0.04	6	0.02	<0.01	0.02	12	0.03	<0.01	-	32	<0.01	<0.01	-	2
Bromine	µg/L	2	2300	2000	2150	2	1500	1100	1300	13	3600	34	100	6	34	<5	6.0	12	79	5.0	-	-	-	-	-	2
Cadmium, dissolved	mg/L	1	0.00001	<0.00001	-	2	<0.0001	<0.0001	-	13	<0.00001	<0.000005	-	6	0.00003	<0.000005	-	12	0.00005	<0.00001	0.00001	31	0.00	<0.00001	-	(1) 3*
Chromium, dissolved	mg/L	3	0.013	<0.0005	0.001	2	0.009	0.001	0.005	13	0.0007	<0.0005	-	6	0.0058	<0.0005	-	12	<0.0005	<0.0005	-	32	<0.0005	<0.0005	-	3
Cobalt, dissolved	mg/L	3	0.0007	<0.0001	0.00	2	0.0020	0.0002	0.00	13	0.0005	<0.0001	-	6	0.01	<0.0001	0.0002	12	0.001	<0.0001	0.0004	32	0.00	<0.0001	-	(1) 3*
Copper, dissolved	mg/L	3	<0.0002	<0.0002	-	2	<0.002	<0.002	-	13	0.002	<0.0002	-	6	0.01	<0.0002	0.0009	12	0.002	<0.0002	0.001	32	0.00	<0.0002	-	(1) 3*
Iron, dissolved	mg/L	3	6.4	3.83	4.2	2	3.6	0.09	1.8	13	16	0.01	2.8	6	15	0.01	3.05	12	4.8	0.01	0.41	32	9.50	0.01	0.10	(1) 3*
Lead, dissolved	mg/L	3	0.0005	<0.0001	0.0003	2	0.0010	<0.0001	-	13	0.0002	<0.00005	-	6	0.00157	<0.00005	-	12	0.0002	<0.0001	-	32	<0.00012	<0.0001	-	(1) 3*
Lithium, dissolved	µg/L	2	75	65	70	2	90	89	90	13	40	9.9	14	6	14	6.20	9.0	12	11	0.8	6.3	-	-	-	-	1
Manganese, dissolved	mg/L	3	0.2	0.20	0.2	2	0.2	0.13	0.2	13	2.6	0.085	0.4	6	3.9	0.0018	1.18	12	0.2	0.04	0.1	32	0.34	0.003	0.013	2
Molybdenum, dissolved	mg/L	3	0.08	0.004	0.01	2	0.06	0.01	0.04	13	0.03	<0.0001	0.001	6	0.01	0.0024	0.004	12	0.003	0.0001	0.0008	32	<0.00011	<0.0001	-	(1) 3*
Nickel, dissolved	mg/L	3	0.01	0.00	0.00	2	0.04	0.00	0.02	13	0.001	<0.0001	0.0002	6	0.05	0.0006	0.002	12	0.010	<0.0001	0.002	32	0.0003	<0.0001	-	(1) 3*
Selenium, dissolved	mg/L	3	0.0001	0.0001	0.0001	2	<0.001	<0.0001	-	13	0.0011	<0.00005	0.0001	6	0.0004	<0.0001	-	12	0.0008	<0.0001	-	32	<0.0001	<0.0001	-	(1) 3*
Silica, soluble, dissolved	mg/L	2	14	13.3	13	2	10	9.1	10	13	26	11	18	6	30	11.8	16	12	35	17	22	-	-	-	-	2
Silver, dissolved	mg/L	2	0.00005	<0.00005	-	2	<0.0005	<0.0001	-	13	<0.00005	<0.00001	-	6	0.00005	<0.00001	-	12	0.0001	<0.0001	-	32	<0.00005	<0.00005	-	1
Strontium, dissolved	mg/L	3	3	1.7	2.4	2	1	1.2	1.3	13	2.19	0.10	0.17	6	0.26	0.08	0.13	12	0.06	0.01	0.02	32	0.02	0.01	0.01	2
Sulfur	mg/L	2	4	2.7	4	2	13	2.2	8	13	22	0.2	2.0	6	8.7	0.80	1.6	12	2.7	0.30	1.3	-	-	-	-	See note e
Thallium, dissolved	mg/L	3	<0.002	<0.002	-	2	<0.002	<0.002	-	13	<0.0002	<0.00001	-	6	<0.0002	<0.00001	-	12	<0.0002	<0.0002	-	32	<0.0002	<0.0002	-	1
Tin, dissolved	mg/L	3	<0.0001	<0.0001	-	2	<0.001	<0.0001	-	13	<0.0001	<0.0001	-	6	0.0003	<0.0001	-	12	<0.0001	<0.0001	-	32	0.0007	<0.0001	-	1
Titanium, dissolved	mg/L	3	0.0003	<0.0002	-	2	<0.002	<0.0002	-	13	0.0004	<0.0002	-	6	0.009	<0.0002	-	11	0.005	<0.0002	-	32	0.0008	<0.0002	-	1
Vanadium, dissolved	mg/L	3	0.0074	<0.0001	0.0004	2	0.0005	<0.0001	-	13	<0.0005	<0.0001	-	6	0.002	<0.0005	-	12	0.0004	<0.0001	-	32	0.0005	<0.0001	-	3
Zinc, dissolved	mg/L	3	5	2.62	2.9	2	18	0.69	9.5	13	0.015	0.001	0.003	6	0.0	0.0007	0.001	12	0.010	0.001	0.004	32	0.0014	<0.0005	-	3
Phosphorus, dissolved	mg/L	2	<0.01	<0.01	-	2	<0.1	<0.01	-	13	0.29	<0.01	0.06	6	0	<0.05	0.06	12	0.06	<0.01	-	30	0.15	<0.01	-	1
Radionuclides																										
Uranium, dissolved	µg/L	3	299	5.7	11	2	50	17.0	34	13	9.0	0.10	0.70	6	55	0.30	11.60	12	5.8	<0.1	0.5	32	<0.0001	<0.0001	-	3
Uranium-234 calculated	Bq/L	2	2	0.21	0.95	2	11	0.46	5.58	12	0.36	0.001	0.01	4	11	0.02	0.2	12	0.1	0.001	0.0	-	-	-	-	See Note f
Uranium-238 calculated	Bq/L	2	2	0.21	0.95	2	11	0.46	5.58	12	0.36	0.001	0.01	4	11	0.02	0.2	12	0.1	0.001	0.01	32	<0.025	<0.02	-	3
Lead-210	Bq/L	3	3300	1200	2200	2	7300	1100	4200	13	0.66	0.01	0.1	6	8.0	0.08	1.0	12	0.60	<0.02	0.08	32	0.02	<0.005	-	3
Polonium-210	Bq/L	3	260	110	120	2	650	460	555	13	1.3	0.02	0.2	6	13	0.03	0.6	12	0.22	0.02	0.1	32	0.01	<0.005	-	3
Radium-226	Bq/L	3	400	180	300	2	120	76	98	13	1.6	0.07	0.3	6	17	0.06	0.3	12	0.36	0.02	0.1					3
Radon-222	Bq/L	3	3800000	400000	2700000	2	12000000	5900	6002950	13	620	<3	10	6	1800	<4	11	12	86	<5	20	28	<0.013	<0.01	-	3
Thorium-230	Bq/L	3	14	2.0	7.0	2	30	1.1	15.6	13	0.30	<0.01	0.01	6	4.70	<0.01	0.1	12	0.12	<0.01	-					3
Tritium	Bq/L	2	1800	950	1375	2	910	<15	-	13	0.5	0.1	-	6	19	0.1	1.0	12	1.1	0.10	-	-	-	-	-	See Note g

Notes

	Shading is used to highlight median values
	Shading is used to indicate "Group 1" constituents - see text for details.
	Shading is used to indicate "Group 2" constituents - see text for details.
	Shading is used to indicate "Group 3" constituents - see text for details.
(1) 3*	Indicates where a groundwater constituent was categorized as a Group 1 (or 2) constituent based on baseline groundwater quality, but was given a final categorization as a Group 3 constituent based on other information.
-	Indicates where median values were not calculated. Median values were only calculated when the frequency of detection for the constituent exceeded 50% of the samples from each group. Where values were below detection, the detection limit was used to calcualate median values.
	Blank Cells mean the constituent was not measured
a	Sample GWR-034 was not included in the summary statistics, as the groundwater was influenced by drilling fluids and additives and is not reflective of natural groundwater.
b	The surface water samples include all 32 lake and stream sample locations reported in Ecometrix, 2020 (Wheeler River Project: Baseline Aquatic Environment Study). Surface water quality at each location was measured on 1-6 occasions. Arithmetic mean values were reported in Ecometrix, 2020 at each location were used herein (i.e. the reported "max" value is the maximum arithmetic mean value, etc.,). This was considered acceptable for the comparison only purposes within this report.
c	Metal and trace element concentrations in the surface water samples are for Total concentrations, not disssolved.
d	Temperature and Dissolved oxygen are likely to be influenced to some extent by ambient conditions, and are thus not considered further in the interpretation of groundwater conditions at the Site.
e	These constituents are considered part of Group 2 but are not discussed further in the interpretation of groundwater conditions at the site because they are correlated to or represented by other parameters being carried forward (e.g. Fe^{2+} by Dissolved Iron; laboratory-measured TDS by field-measured TDS, etc.)
f	U-234 was calculated from U-238 assuming secular equilibrium. This assumption may not hold in the groundwater flow systems. This constittuent is not considered further in the interpretation of groundwater condtions at the Site.
g	Tritium concentrations were very low, with the exception of the ore zone and paleoweathered zone groundwater samples.

4.3 Interpretation of Hydrochemistry

The interpretation of baseline hydrochemistry is informed by mineralogy and solid-phase elemental concentrations and distributions for the Project area, and on relevant data from other regional assessments.

4.3.1 Mineralogy and Solid-Phase Elemental Distribution

Denison has complied an extensive set of data on mineralogy and elemental concentrations in the bedrock matrices in the Project area. Composite samples were collected from core material every 5-20 m through the Athabasca Sandstones Supergroup and discrete samples collected every 0.5 m within and proximal to the ore zone. Several analytical methods were employed: elemental analysis following total and partial digestions of the solid matrix, infrared mineral analysis (i.e., PIMA) and petrography. Clay mineralogy was determined from the bulk geochemical composition of the samples (elemental analysis) using the normative clay calculation described in Section 3.2. Mineralogy was further evaluated in a subset of location and depth intervals by infrared mineral analysis (i.e., PIMA) and/or petrography.

The mineralogy of the ore zone and bedrock units is broken down into major – representing ≥ 2% w/w components – and minor mineralogical components in Table 4-3. Minor components represent < 2% (w/w), but also classified with "minor" components are those that were identified by petrography, but where a small number of samples results in greater uncertainty about their relative proportion. The ore zone has complex mineralogy, including uraninite, (Fe, Pb, Cu, Zn) sulfides, nickel arsenides, APS minerals, oxide, carbonate, and clay minerals and quartz. The upper and lower clay units, and the paleoweathered zone are dominated by clay minerals and quartz. The Athabasca Sandstone Supergroup are dominated by quartz (greater than 90%), with relatively small proportions of iron and clay minerals. The mineralogy of the overburden has not been evaluated in detail and was not presented in Table 4-3. Grain size analysis on several overburden samples collected as part of a drilling program at the site in 2020, and described in Section 2.3.5, indicate that clay minerals make up from 1.1-9.2% by weight (based on fraction of particles < 4 µm; analytical results provided in Appendix H).

For elemental analysis, both partial and total digestions were done at the Saskatchewan Research Council (SRC). The suite of elements analyzed following digestion differed to a limited extent between the two digestion methods (e.g., major elements such as Ba, Sr were analyzed only following total digestions, whereas some trace elements such as Cd, and Se were analyzed only following partial digestion). The partial digestion consisted of a 8:1 mixture of ultra-pure and concentrated HNO3:HCl and the total digestion consisted of a mixture of ultrapure HF:HNO_3:$HClO_4$. Details of the digestion methodology are provided, for example, in Guffy, 2017. Concentrations resulting from partial digestion are thought to be more relevant to understanding metal and trace element distribution in association with hydrothermal phases (i.e., resulting from the hydrothermal alterations leading to uranium ore genesis, regionally), versus concentrations of metals and trace elements associated also with refractory heavy minerals (Jackson, 2010).

Table 4-3: Mineralogy by Unit

Unit	Mineral	Ideal Formula	Major (≥2% w/w)	Minor (< 2% w/w, or, shown to be present in Petrography or core logging)
Ore Zone	Pyrite	FeS2	X	
	Galena	PbS	X	
	Chalcopyrite	CuFeS2	X	
	Quartz	SiO2	X	
	Chlorite	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	
	Muscovite/Illite	KAl2(Si3Al)O10(OH;F)2	X	
	Kaolinite	Al2Si2O5(OH)4	X	
	Fe-oxy-hyroxides	FeO(OH)·nH2O	X	
	Uraninite	UO2	X	
	UO2.33	U3O7	X	
	UO2.25	U4O9	X	
	Schoepite	UO3:2H2O	X	
	Siderite	FeCO3	X	
	Fluorite	CaF2	X	
	Gersdorffite	NiAsS		X
	Nickeline	NiAs		X
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)		X
	Pyrrhotite	$Fe_{1-x}S$ (x=0-0.17)		X
	Sphalerite	(Zn,Fe)S		X
	Feldspar	KAlSi3O8		X
	Calcite	CaCO3		X
	Apatite	Ca5(PO4)3(F,Cl,OH)		X
	Corundum	Cr2O3		X
	APS Minerals	CaAl3(PO4)(PO3OH)(OH)6		X
Paleoweathered Basement	**Quartz**	SiO2	X	
	Chlorite	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	
	Illite	(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,(H2O)]	X	
	Kaolinite	Al2Si2O5(OH)4	X	
	Hematite	Fe2O3	X	
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)	X	
	Uraninite/Pitchblende	UO2		X
	Chalcopyrite	CuFeS2		X
	Pyrite	FeS2		X
	Galena	PbS		X
Upper and Lower Clay Zones	**Quartz**	SiO2	X	
	Chlorite	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	
	Illite	(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,(H2O)]	X	
	Kaolinite	Al2Si2O5(OH)4	X	
	Hematite	Fe2O3	X	
	Uraninite/Pitchblende	UO2	X	
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)		
	Uranophane	Ca(UO2)2(SiO3OH)2:5H2O		X
	Graphite	C		X
	Carbonates	various		X
	Chalcopyrite	CuFeS2		X
	Pyrite	FeS2		X
Athabasca Sandstones	**Quartz**	SiO2	X	
	Hematite	Fe2O3	X	
	Chlorite[a]	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	X
	Illite[a]	(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,(H2O)]	X	X
	Kaolinite[a]	Al2Si2O5(OH)4	X	X
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)		X
	Pyrite/Sooty Pyrite	FeS2		X

Notes

Uraninite Indicates dominant minerals; can be present at values exceeding 40% w/w

Chlorite Indicates that the clay minerals bolded, combined, represent a dominant phases (i.e. > 40% w/w)

[a] In the Athabasca Sandstones, the relative dominance of the clay minerals varies by HU. The individual and combined clay mineral phases do not always represent a major mineral phase

Elemental results by both total and partial digestion have been summarized in.

Table 4-4 for uranium, thorium and select other metals or trace elements. Elements chosen are those that, based on mineralogy and regional studies (e.g. Alexandre, 2020), are expected to be elevated in the ore zone. Median concentrations have been reported for all elements (number of samples indicated as n). Concentrations of the elements following partial digestion relative to that in the total digestion varies by element and indicates that metal speciation includes more labile and refractory forms. Typically, following both digestion methods, solid-phase concentrations of U and the other elements are one or more orders of magnitude higher in the ore zone than in the overlying Athabasca Sandstone Supergroup and underlying Paleoweathered basement rock.

Within the Athabasca Sandstones Supergroup, the concentrations of most elements shown in Table 4-4 increase with depth, with maximum concentrations being observed either in the MFa of MFb.

Table 4-4: Solid-Phase Elemental Concentrations

Median Metal/Trace Element Concentrations (mg/kg)	MFd (n= 2754-3077)	MFc (n= 7116-8532)	MFb (n= 5279-6086)	Mfa (n=9415-10,436)	Ore Zone			Paleoweathered Basement (n=108)
					Black or Brown Friable High Grade U Zone (n=95)	Brown Redox U Zone (n=46)	Sulphide or Hematite Cemented U Zone (n=34)	
Total Digestion								
As	-	-	-	-	-	-	-	-
Co	0.16	0.37	0.49	0.58	105	85	91	28
Cr	8	9	13	11	119	150	180	155
Cu	1.5	1.2	1.3	3.7	2.32E+03	5.79E+03	1.11E+03	228
Mo	0.1	0.17	0.24	0.18	86	101.5	258.5	5
Ni	1.5	3.4	2.4	4.7	343.5	288.5	239	167
Pb	2.65	3.16	3.56	3.14	4055	3455	4205	83
Se	-	-	-	-	-	-	-	-
Sr	43	87	178	112	279	281	218	169
Th	3.36	11.9	23.2	11.4	73.5	131.5	96	25
U	1	1.16	1.4	2.24	4.18E+04	5.02E+04	7.58E+04	403
V	3	5.2	10.3	8.3	779	1.37E+03	713	310
Zn	2	2	2	3	333	185.5	247	31
Partial Digestion								
As	0.18	0.42	0.71	0.46	176	147	78.5	24
Co	0.06	0.12	0.16	0.22	90.5	63.5	75.5	16
Cr	-	-	-	-	-	-	-	-
Cu	0.65	0.58	0.665	2.02	2.18E+03	5.40E+03	1.05E+03	219
Mo	0.05	0.06	0.07	0.08	76	73	182	3
Ni	0.41	0.88	0.68	1.48	314	257	179	79
Pb	0.506	0.667	0.851	0.6905	3.71E+03	3.14E+03	3.72E+03	46
Se	0.1	0.1	0.1	0.1	4.5	12.5	5	1
Sr	-	-	-	-	-	-	-	-
Th	0.68	2.14	5.36	2.39	-	-	-	-
U	0.21	0.26	0.33	0.58	4.07E+04	4.88E+04	7.49E+04	335
V	0.4	0.9	1.8	1.2	561	892	507	104
Zn	0.6	0.7	0.6	0.7	262	119	77.5	14

Notes:
n= number of samples used to calculated median values; Median values calculated using value of detection limit where value <DL
"-" indicates element not analyzed following digestion by method indicated

The distribution of uranium in the solid phase is shown in Figure 21a. Shown is that uranium concentrations are elevated in the ore zone and underlying basement rock and are relatively enriched in a halo surrounding the ore zone, extending up through the MFa and into the MFb. In Figure 21b, the spatial extent of the MFa and the Desilicified Zone is superimposed over the distribution of uranium concentrations in the solid matrix. Elevated concentrations

of uranium in the MFb plot where the sediments of that Formation have undergone desilicification, suggesting uranium enrichment through the hydrothermal alteration processes. In Figure 22, elemental distributions of select other elements are shown. Copper (Figure 22a) is representative of elements that shows a distribution in solid phase concentrations like that of uranium (along with Ni and Co. Pb does not show enrichment in the halo pattern observed for uranium (Figure 22b). Thorium is understood, regionally, to be enriched in the MFb in association with accessory heavy minerals and aluminophosphate minerals formed through hydrothermal alteration (Mwenifumbo and Bernius, 2007). The median concentration of Th is highest in the MFb of the Athabasca Supergroup Formations (Table 4-4) and the spatial distribution for thorium in Figure 22c shows relative enrichment of this element in the MFb.

4.3.2 Regional Supporting Information

a) Final Report of the AECL/SKB Cigar Lake Analog Study (AECL, 1994)

Groundwater quality in association with the Cigar Lake deposit was studied extensively by AECL and partners from the 1980s through the 1990s, because they were very interested in that deposit as a natural analog for the concept of deep burial/disposal of Canada's nuclear waste. The work done at Cigar Lake has been used to inform the interpretation of groundwater evolution and redox conditions in this report. Data for select groundwater samples have been carried forward for comparison with those from the Phoenix deposit. The data, as reported by AECL (1994), is provided in Appendix J.

b) Millennium Project Environmental Impact Statement: Annex D, Regional Geology and Hydrogeology (Cameco, 2012).

The Millennium uranium deposit is basement-hosted. Work for that project included collection of groundwater chemistry in the hydrostratigraphic units of the overlying Athabasca Sandstone Supergroup and in basement rock beneath the ore zone. Data for select groundwater chemistry samples from that report have been carried into this report to support interpretation. The source data, as reported, is provided in Appendix J.

4.3.3 Hydrochemistry by Hydrostratigraphic Unit

As introduced above, interpretation of the hydrochemistry was informed by the mineralogy, solid phase elemental concentrations and the regional studies, described above. In the sections here below, general hydrochemical patterns/behaviour are first considered, and then differences in the chemistry between hydrostratigraphic units are examined.

Mineralization, Hydrochemical Type, pH and Redox

The major ion composition of groundwater, including the ions Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, SO_4^{2-}, Cl^{-}, HCO_3^{-}, CO_3^{2-}, and F^{-}, pH and redox conditions were evaluated for each of the hydrostratigraphic units. As a first step, the electrical conductivity (as field-measured Specific Conductance (SPC)) was plotted as a function of well depth in Figure 23. Specific

conductance values range from very low in the Local Groundwater Flow System (<100 µS/cm) and surface water (<42 µS/cm; not shown) to a maximum measured value of 946 µS/cm, in monitoring well GWR-025 (MFa). The conductivity in this well exceeds those measured in the ore zone samples. For groundwater in the overburden, and Athabasca Sandstone Supergroup, SPC values in groundwater, in most cases, increases with depth (Figure 23), consistent with increased opportunity for water-rock interactions and associated increasing dissolution and constituent concentrations in the groundwater along the flow path from recharge at ground surface down to depth.

An important exception to the behaviour described above, is the relatively low conductivity values measured in the deeper MFa wells GWR-008, GWR-011 and GWR-029. SPC values in these wells range from 87.6 µS/cm to 114 µS/cm. These SPC values are similar to those measured in the Local Groundwater Flow System and suggest very little further chemical evolution of the groundwater along the groundwater flow path to those locations with respect to recharge.

To build upon the above interpretations, the major ion compositions of groundwater in each of the hydrostratigraphic units were examined using a series of Stiff diagrams (Figures 24 and 25) and Piper plots (Figures 26, 27and 28). Stiff diagrams are graphical representations of the concentrations (in milliequivalents/L) of major ions and the mineralization of a given sample. For example, the Stiff diagrams shown in Figure 24 for LA-5 (surface water sample in Whitefish Lake) show a distinctly different pattern/shape from that in the Intermediate Sandstone, which is in turn different than the pattern for the ore zone, shown in Figure 25. In each diagram, the cation and anion concentrations are plotted to the left and right of the central axis, respectively, and the higher the ion concentration, the further the point is plotted laterally away from the central axis. A polygonal shape is created by connecting all the ions and the filled-in/coloured area of the polygon represents the extent of mineralization (as TDS) of the samples. GWR-032 (Ore Zone) and LA-5 (SW) are "end members" of groundwater chemistry in terms of dissolved constituent concentrations (individual constituents and overall mineralization) in the study area, and this is clear by the much larger area of the (blue) polygon for GWR-032 (Figure 25). The dominant anion in the groundwater chemistry at GWR-032 is $Cl^-$and the dominant cations are Ca^{2+} and Na^+/K^+. Plotted on the same scale, LA-5 has much smaller polygon (lower TDS) and no dominant cations or anions (Figure 24).

Piper plots also presents major ion composition. Each Piper plot is made up of three plots – two ternary plots that show the relative abundances of the cations, as percentages of the total concentrations (again, in milliequivalents) of cations, and anions, as percentages of the total concentration of anions, in the sample, respectively. The third plot is the central diamond, which is a matrix transformation of the two ternary plots. For example, in Figure 26, the red circle presents groundwater sampled in the ore zone (GWR-032). The ternary diagrams show that both samples contain approximately 60% Ca^{2+} and 40% Na^+, and also approximately 60% Cl^- and 40% HCO_3^{2-}. This groundwater is of relatively mixed type - meaning no one cation or anion dominates - and as such, it plots relatively centrally in the diamond. The groundwater in the ore zone is of Ca-Na-Cl-HCO_3 type. Piper plots are

very useful because they allow you to plot many samples in the same diagram and examine the sources and processes leading to the different hydrochemical types observed.

Groundwater data from other projects (Cigar Lake and Millennium) was included with select GWR-series wells in the Piper plot shown in Figure 27, to provide wider regional context to the results from the study area. The major ion composition of shallow groundwater is compared to that in surface waters proximal to the Phoenix deposit in Figure 28.

Local Groundwater Flow System

Groundwater in the overburden has pH values that are circumneutral, but generally more acidic than those measured in the other hydrostratigraphic units or the ore zone. The minimum pH in the Shallow Flow system is 5.86 (Table 4-2). Dissolved silica (SiO_2) concentrations exceeding 33 mg/L in the groundwater evidence silicate mineral dissolution. Stiff diagrams for monitoring well GWR-006 in this groundwater flow system is shown in Figure 24. Groundwater in this flow system is characterized by low mineralization (e.g. TDS for GWR-006 is 52 mg/L; Figure 24), and none of the major cations or anions dominate the hydrochemistry of the groundwater. The groundwater types for the samples in the Local Flow System are of Ca-Na-HCO3 or Na-Ca-HCO3 type (Figure 26), and the samples also contain Mg, K and sulphate (Figure 26). The groundwater chemistry reflects waters in this flow system being recharge waters that become acidified through contact with the organic zone in the upper soil profile. The groundwater becomes mineralized through dissolution of the minerals that characterize these units, including (Table 4-3) quartz and clay minerals, as wells as some parent material/unweathered feldspars (AECL, 1994).

The hydrochemical type of groundwaters samples from the Local Flow System are compared to those from monitoring wells installed in overburden in the area of the Gryphon deposit and from wells installed in shallow sandstone (MFd) at the Millennium deposit in Figure 28. The groundwaters are all the same mixed hydrochemical type and (not shown), mineralization. Data for the surface water samples and the Gryphon overburden groundwater samples are provided in Appendix J.

Also plotted in Figure 28 are surface water samples, taken from Whitefish lake (LA-6 and LA-5; Figure 19) and associated stream location (S2-A) and additional downstream locations including stream sample SA-2, McGowan Lake (LA-1), and Russell Lakes (LAB-1). The surface water samples, for the most part, are of the same hydrochemical type as the groundwater in the Local Groundwater Flow system, consistent with discharge of groundwater from that system to local surface water bodies. The total dissolved solids content of LA-5 (and all other lakes and stream, regionally) are lower than those in the groundwater in the Local Groundwater Flow System discharging to the lake (Table 4-2), reflecting the precipitation/surface runoff inputs into the lakes.

Recharge Conditions: Analysis of tritium values in groundwater from the Local Groundwater flow system is presented in Appendix L. Results suggest that groundwater in this flow system has been recently recharged, in the last approximately 12-25 years, but that residence times can be longer in localized areas of the flow system.

Redox Conditions: At Cigar Lake, decreasing redox potential from the overburden down to the ore zone was observed, with the overall span in redox conditions being those of environmental relevance (i.e., +250 mV to -250 mV (AECL, 1994)), with the most oxidized Eh values in samples from the overburden. In the Phoenix deposit study area, concentrations of dissolved iron vary from values close to the analytical detection limit (i.e., 0.012 mg/L at GWR-011) to several mg/L. Dissolved Fe concentrations greater than 1 mg/L suggest that ferrous ion (Fe^{2+}) is the dominant dissolved iron species and that the groundwater is anoxic. Ferrous ion (field-measured) was detected in several wells installed in the overburden and upper sandstone aquifers. Sulphate was detected in all of the overburden wells. Thus, redox conditions in the Local Flow System are considered to range from oxidized to mildly reducing.

Intermediate Sandstone Aquitard

Five wells installed in the MFd and MFc Formations were sampled as part of the 2019-2020 baseline groundwater monitoring program. These wells are located over the Phoenix deposit (GWR-046, MFc, GWR-013 and GWR-047, MFb), to the south of the Phoenix deposit (GWR-009; SE Cluster; MFb), and close to Whitefish Lake (GWR-014; MFc) (Figure 19).

The hydrochemical type of the samples in the Intermediate Sandstone Aquitard is generally the same as those in the Local Groundwater Flow System (Figure 26), but the samples are more mineralized. This can be seen in Figure 24, by comparing the Stiff diagrams for monitoring well GWR-006 (screened in Overburden) and GWR-009. Compared to groundwater in the Overburden Aquifer, water in the Intermediate Sandstone Aquitard has higher bicarbonate values. Carbonate mineral concentrations are low in all Athabasca Sandstones – they are not even minor components of the mineralogy (Table 3-3). However, the higher bicarbonate concentration, along with the more alkaline pH in this hydrostratigraphic unit, suggests higher relative carbonate mineral content associated with the higher fines in this hydrostratigraphic unit. The overall similarity in hydrochemical type reflects the overall constancy of the geochemical makeup of the Athabasca Sandstones – meaning that groundwaters react with a similar rock matrix/mineral assemblage in the Intermediate Sandstone Aquitard as in the Local Flow system.

The groundwater chemistry in wells sampled in this aquitard unit have shown relatively high variability in groundwater quality between sampling events for those sampled twice (GWR-009, GWR-013 and GWR-014). For example, field-measured pH values in GWR-009, GRW-013 and GWR-014 were more alkaline than would be expected in environmental conditions and fell to circumneutral levels in 2021. The elevated pH values measured are considered to reflect transcription error (August 2020, pH value of 11.98 at GRW-014) and potentially, influence of well construction materials on pH values. The well completion details for GWR-009 and GWR-014 (Appendix A) show a cemented zone immediately above the screened interval. The results for the five wells sampled in the Intermediate Sandstone Aquitard in 2021, as a group, support a circumneutral pH value in this aquifer.

This is also the Formation where groundwater chemistry may be most affected by desilicification of the sediments; GWR-013, GWR-014 and GWR-047 are completed in desilicified sediments of the MFb and MFc. The different in geomean hydraulic conductivities between the Intermediation Sandstone Aquitard (8.4 x 10^{-9} m/s) and the Desilicified Zone (4.8 x 10^{-6} m/s) is approximately 3 orders of magnitude This difference in hydraulic conductivity affects the residence time of the groundwater in the bedrock, and consequently, the groundwater quality.

Redox Conditions: Iron concentrations are variable amongst wells completed in the Intermediate Sandstone Aquitard, ranging from values <0.1 mg/L to > 1 mg/L. Field-measured ORP measurements at GWR-046 and GWR-047 (Table 4-1) are equivalent to Eh values of 251 and 116 mV, respectively. These results align with conditions of low/no oxygen and that are mildly reducing. Because of the higher variability in this unit, emphasis during the phase of mine development should be on monitoring of groundwater quality in this unit and how it is influenced by desilicification.

Lower Sandstone Aquifer

The Lower Sandstone Aquifer is characterized by two distinct hydrochemical types. The first is groundwater with low mineralization. The second groundwater type is much more highly mineralized water that has Cl^- as a dominant anion. The distinct nature of the two groundwater types is shown in Figure 25 through comparison of Stiff diagrams for GWR-029 and GWR-012. The mineralization at GWR-012 is much higher than that at GWR-029, and Cl^-, versus HCO_3^-, is the dominant anion. The mineralization and groundwater major ion composition of GWR-029 is much more similar to overburden well GWR-006 (shown in Figure 24) than to GWR-012. In the Piper plots shown in Figure 26, the distinct geochemical types are evidenced by:

- clustering of groundwater for 3 wells in the Lower Sandstone aquifer with samples from the Intermediate Sandstone Aquitard and local groundwater flow system. This hydrochemical type (dominantly in the Ca/Mg-HCO3 quadrant of the central diamond of the Piper Plot) is shown within the purple circle; versus

- the other three wells from Lower Sandstone Aquifer, that show a higher relative dominance of Cl- as an anion. This shifts the hydrochemical type of the groundwater to the upper portion of the central diamond in the Piper plot, as shown by the purple arrows in Figures 26. This represents the contribution of leaching of halide salts into the groundwater as it moves along the flow path.

These same two distinct hydrochemical types were also observed in the MFa at Cigar Lake.

At the Phoenix study site, the groundwaters of low mineralization were measured in three wells: GWR-029, which is in the inferred upgradient direction to the deposit, and in wells GWR-011 and GWR-009 which are proximal to the ore zone (Figure 19). At Cigar Lake, the MFa sample with low mineralization was also collected from a monitoring well installed in the inferred upgradient direction to the ore deposit. This sample is shown as “CL-LS-R” (Cigar Lake, Lower Sandstone, Recharge) in Figure 27, and as is observed in the Phoenix

study area, is most similar in groundwater type to a sample take in the upper sandstone at Cigar Lake ("CL-US" in Figure 27). On the basis of groundwater chemistry and tritium values in that groundwater, the authors concluded that the groundwater reflected a younger water component that had penetrated to depth along hydraulically active fractures/faults. The same conclusion is made here for the Phoenix study area – meaning that fracture/fault conditions are such that some areas of the MFa are characterized by younger/recharge groundwaters.

The higher mineralization groundwater with Cl^- as the dominant anion was observed at Cigar Lake in groundwater collected from a monitoring well located within the zone of thermal alteration and in the inferred downgradient direction of the ore zone. This sample is shown in Figure 27 as "CL-LS-Out" and is of Na-Cl-HCO_3 type. The reasons for the hydrochemical type observed in that monitoring well, and specifically for the source of chloride to the water, was evaluated in some detail in the Cigar Lake studies. One possible explanation explored was that the groundwater reflected mixing of groundwater in the MFa with groundwater from the basement rock. Groundwater in the basement rock is known to be of Na-Cl type, and this is shown in Figure 27 by samples collected from monitoring wells installed in the Paleoweathered Zone at Cigar Lake ("CL-Alt-Bsmt") and the Basement at Millennium ("Millennium-Bsmt"). This sample represents one endmember hydrochemical type for the basement rock of Na-Cl type. However, the potential for the relatively elevated chloride proportion of anions in groundwater in the MFa to be a result of mixing with groundwater from the basement rocks was ruled out at Cigar Lake as groundwater flow conditions in the MFa were identified as dominantly horizontal, with a component of downward flow to the altered basement.

The source of chloride (in the MFa and the ore zone) was, rather, attributed to leaching of residual salts from the hydrothermal and/or diagenetic formation waters that are still present on grain boundaries and in intragranular pores within the rock matrix at depth. This conclusion was supported by leaching experiments conducted on core collected at the Site. The tests showed that leachable Cl was present in all rocks tested. A linear correlation between Na+K, and Cl+F+Br was found in the leachate and was also observed in groundwater. This composition suggests the residual salts are of simple halide salt composition, corresponding to those observed in primary fluid inclusions in associated hydrothermal quartz.

In the Phoenix study area, the groundwater with high mineralization was sampled from monitoring well GWR-025, located NW of the deposit, to the south of the deposit in well GWR-033, and in GWR-012, located close to LA-5. All these wells are located within, or proximal to the area of low resistivity measured in the area surrounding the Phoenix deposit (Figure 5) that has been interpreted to be associated with zones of desilicification (thermal alteration), and enhanced fracturing and friability. Thus, it is possible that the high mineralization, high salinity groundwater type observed in these wells is limited in extend to disturbed/altered conditions with the presence of remnant halides, in proximity to the ore zones at Phoenix and elsewhere regionally, such as at Cigar Lake. As noted above, the ore zone samples in the Phoenix study are of similar hydrochemical type to that observed in

GRW-033, GWR-012 and GWR-025, suggesting a similar source of elevated chloride in the ore zone.

The above discussion indicates that identifying a specific water quality for the Lower Sandstone Aquifer on a regional scale is likely not possible and will reflect hydraulically active fractures/faults that increase the influence by the recharge-type groundwater water as well as zones of thermal alteration/desilicification that increase the mineralization due dissolution of halite minerals.

When considering potential connectivity between the Lower Sandstone Aquifer and the Intermediate Sandstone Aquitard, there is a distinct lack of chloride in some groundwater sampled from some of the wells in the Intermediate Sandstone Aquitard (GWR-009, GWR-013 and GWR-014; Cl- concentrations < 1 mg/L, Table 4-1) compared to wells in the Lower Sandstone Aquifer. This is demonstrated by comparing the groundwater compositions shown in the Stiff diagrams for GWR-012 (Figure 25) and GWR-009 (Figure 24). Groundwater chemistry at GWR-0 is representative of the high mineralization groundwater type in the Lower Sandstone Aquifer and shows dominance of Cl^- in the major anion composition. This contrasts with the lack of chloride in the hydrochemical compositions shown in the Stiff diagrams for GWR-009 – installed in the Intermediate Sandstone Aquitard. This is consistent with the general interpretation of a downward gradient between these units discussed in Section 3.6.3. However, desilicification of the sediments may change this relationship in a localized fashion.

Redox Conditions: The redox conditions in the Lower Sandstone aquifer will, likewise, vary with the groundwater type observed on a spatial scale. More oxidized conditions are expected in the localized areas of recharge from shallow groundwater. Because of the overall richness of the unaltered sandstones in iron, and the elevated dissolved iron concentrations measured in the MFa, the redox potential in the groundwater is expected to be controlled by the $Fe2+/Fe(OH)_3$ couple, as was concluded for Cigar Lake. The field-measured ORP measurement at GWR-048 (Table 4-1) is equivalent to an Eh value 142.5 mV. This is consistent with anoxic and mildly reducing conditions.

Ore Zone Aquifer

Groundwater in the ore zone is relatively highly mineralized, reflecting the low to moderate hydraulic conductivity of that hydrostratigraphic unit, longer residence times, and the (relatively) higher overall content of minerals other than quartz (Table 4-3). The groundwater hydrochemical type, as noted above, reflects the contribution of salts from hydrothermal and/or diagenetic formation waters.

Redox Conditions: Sulphate was measured in groundwater from the Phoenix ore zone. At Cigar Lake, sulphate in the ore zone samples (see "CL-OZ" in Figure 27; hydrochemical type $Na-Ca-Cl-SO_4-HCO_3$) was attributed to reaction of pyrite within the clay-rich portion of the barrier zone enveloping the ore zone with waters entering the ore zone from the unaltered sandstones. The sulphide content of the clay cap acts as a redox buffer that consumes oxidants such as dissolved oxygen and maintains highly reducing conditions within the ore

zone, and, in turn, the chemical stability of uranium(IV) in solid form. Measured oxidation-reduction potential in the ore zone (data collected during preparations for a tracer test, Petrotek, 2021) is approximately -265 mV. Further supporting strongly reducing conditions in the ore zone is the finding in the Cigar Lake study of methanogenic bacteria being found within the ore zone.

Paleoweathered Zone, within Basement Aquitard

Groundwater quality in monitoring well GWR-031 is considered most reflective of water quality in the paleoweathered zone. The results for this well suggest that groundwater is more highly mineralized in this zone, with higher concentrations of uranium and other metals (e.g., Ni and Zn) than are observed in the overlying Athabasca Supergroup sandstones hydrostratigraphic units. This is consistent with both a very low hydraulic conductivity (and, conversely, high residence time; Section) and high clay content (Table 4-3), and high elemental concentrations of metals and trace elements (Table 4-4).

The paleoweathered zone was sampled at Cigar Lake; analytical results are provided in Appendix J, as samples 199B and 199D. Sample 199D has been referred to in Figure 27 as "CL-Alt-Bsmt". The hydrochemical type of the Cigar Lake paleoweathered zone is Na-Cl-HCO_3 and of GWR-031 for the Phoenix deposit is a more mixed hydrochemical type (Na-Ca-Mg-Cl-HCO3-SO4). In the Cigar Lake study, the hydrochemistry of the sample in the paloeweathered zone was explained by recharge of the basement waters from the overlying flow regime in the Lower Athabasca Sandstones. Evolution of the groundwater chemistry in the paleoweathered zone is aligned with this flow path. The groundwater quality in the paleoweathered zone represents an intermediate along the hydrochemical evolution of groundwater from the hydrochemical type of the Athabasca Group Sandstone hydrogeological units (Ca-Na-HCO3 to Na-Ca-HCO3 type) to one endmember in basement rock (NaCl type). This evolution is a result of water-rock interactions within basement aquitard (including the paleoweathered zone) and is most clearly visualized in the Piper plot by shifts in relative abundance of anions, shown with gold arrows in Figure 27. The difference in hydrochemical types between groundwater from the paleoweathered zone at Cigar Lake (Na-Cl-HCO3 type) and associated with the Phoenix deposit (Na-Ca-Mg-Cl-HCO3-SO4) is likely due to the screened interval of the well, which spans the ore zone, and the paleoweathered zone (Appendix A). Groundwater chemistry in GWR-031 is likely influenced by the hydrochemistry of the ore zone.

Redox Conditions Dissolved iron concentrations in monitoring well GWR-031 have varied from < 0.1 mg/L to >3 mg/L on the two sampling occasions (Table 4-1). At Cigar Lake, measured Eh values were 98-109 mV (Appendix J). Anoxic and mildly reducing conditions are expected.

Although limited in number of samples available, groundwater quality in the paleoweathered zone for both Project and Cigar Lake assessments suggest a distinct geochemical environment from that of the overlying Athabasca Supergroup sandstones hydrostratigraphic units.

4.4 Summary

Groundwater was collected from each of the hydrostratigraphic units at the site. The groundwater is characterized by low mineralization. Concentrations of radiological and several other dissolved constituents measured in groundwater associated with the uranium deposit in the Phoenix study area are generally orders of magnitude lower in overlying hydrostratigraphic units and surface water than they are in the ore zone groundwater samples, as demonstrated in Figure 20. This is evidence of the very low mass flux of those constituents from the ore zone and discontinuous barrier zone aquitard that envelopes the ore zone, over time.

The groundwater chemistry measured supports the presence of a Local Flow System, Intermediate Sandstone Aquitard and Lower Sandstone Aquifer in the study area. The chemistry of the groundwater in the Local Flow system is that of recharge water that is of relatively low pH, from contact with organic matter in the upper soil profile, and that has become mineralized through dissolution of quartz, feldspars, kaolinite and illite. The chemistry of groundwater in the Intermediate Sandstone Aquitard is similar in terms of major ion composition to that of the Local Flow System, but a longer residence time in the aquitard has led to more extensive mineral dissolution and higher mineralization, with a similar hydrochemical type. Higher relative variability in the groundwater chemistry sampled from monitoring wells in the Intermediate Sandstone Aquitard may reflect the localized influence of desilicification on the flow conditions, and consequently on groundwater conditions, in a subset of these wells. The Lower Sandstone Aquifer is characterized spatially by two types of groundwater. The first groundwater type is most similar to that observed in the Local Flow System. This is suggested to reflect hydraulically active fractures and fault systems that allow fresh recharge water to penetrate and mix with deeper waters in the Aquifer. The second type of groundwater was within the zone of thermal alteration around the ore zone and has relatively high mineralization, thought to be a result of dissolution of remnant halide salts present on grain boundaries and in intragranular pores within the rock matrix at depth in the Athabasca Sandstones.

Groundwater quality results suggest that connectivity between the Upper Sandstone Aquifer and Intermediate Aquifer is limited. Again, desilicification of these Formations to the northeast of the ore zone may affect interconnectivity of these units on a localized scale. Although limited in number of samples available, groundwater quality in the Paleoweathered zone for both Project and Cigar Lake assessments suggest a distinct geochemical environment from that of the overlying Athabasca Supergroup sandstones hydrostratigraphic units.

The regional mineralogical, elemental concentrations and groundwater data collected to date for the study area provide a good baseline to understand potential changes to the groundwater environment over the life of mine.

5.0 CONCEPTUAL SITE MODEL SUMMARY

A conceptual site model (CSM) was prepared as part of this Baseline Hydrogeological Report to present the relevant geological and hydrogeological framework, surface water features and baseline chemical distributions. The CSM is a descriptive summary and is accompanied by a graphical representation of the hydrogeological framework that describes our current understanding of components of the groundwater flow system in the Phoenix area (Figure 29).

The CSM forms the basis for the development of the numerical groundwater model and groundwater monitoring plans (Figure 2). The groundwater flow model will be used to assess changes to the hydrogeological system due to pre-, operation and post-operational mining activities and associated groundwater extraction or injection. The main features of the CSM are summarized in the following sections.

5.1 Physical Geography

Ground surface topography in the Phoenix area has been shaped by glacial and fluvial processes active for over tens of thousands of years. The most significant topographic features in the study area are the northwest to southeast trending drumlins and eskers that are separated by lowland areas of well drained glaciofluvial outwash sands and gravels, and poorly drained till plains with associated muskeg / wetlands. Ground surface varies from a high of approximately 600 metres above sea level (m asl) located between the Phoenix and Gryphon deposits, to a low of 494 m asl at McGowan Lake in the southeast (Figure 1). Ground surface topography overlying the Phoenix deposit ranges from 520 to 550 m asl (Figure 1).

5.2 Geological Setting

The Wheeler River uranium deposit is located on the eastern margin of the Athabasca Basin of northern Saskatchewan. Like other uranium deposits on the eastern portion of the Basin, the Phoenix deposit is located at the base of the sandstones and conglomerates of the Athabasca Supergroup, just above the unconformity with the underlying metasedimentary gneisses and other basement rocks of the Wollaston Supergroup.

The Phoenix deposit is overlain and underlain by a natural barrier unit or halo that has limited the release or subsurface migration of uranium, and other chemical constituents associated with the mineralization in the deposit, outside of the ore body itself. This natural barrier zone has limited the migration of chemical constituents in groundwater for more than 1 billion years. A summary of the geologic characterization present in the Phoenix area, from overburden to basement rock, are summarized in the following sections.

5.2.1 Overburden

The regional geomorphology is typical of the Athabasca Plain Region and is dominated by landforms associated with continental glaciation, such as drumlins, eskers, outwash plains and till plains (Figure 4). Drumlins and eskers present in the Wheeler River area trend in a northeast to southwest direction and form topographic highs on the landscape. Drumlins rise over 50 m above the surrounding land surface in some areas, including the drumlin lying between the Phoenix and Gryphon deposits (Figure 4).

Overburden thickness ranges from less than a few metres on low lying areas, to over 100 m in the northwestern reaches of Whitefish Lake where weathering and glacial erosion of the sandstone bedrock formed a bedrock valley or "trough". The overburden is characterized by an abundance of sand and gravel outwash, and sand-rich glacial till that drapes the drumlins and till plains.

5.2.2 Athabasca Supergroup Sandstones and Conglomerates

Overlying the basement rock are consolidated sandstones and conglomerates of the Athabasca Supergroup that were deposited 1.5 to 1.74 billion years ago. These sedimentary rocks are horizontally bedded and were deposited in an intracontinental sedimentary basin initially marked by alluvial fans, braided rivers and possibly shallow-marine or lacustrine to eolian environments.

The Athabasca Supergroup sandstones are subdivided into the Manitou Falls Group including the Read Formation, which consist of coarse- to fine-grained hematite-rich conglomerates that lie along thin stratigraphic horizons and silty sandstones. The sandstones are differentiated by their proportions of conglomerate beds and presence of clay intraclasts.

The Athabasca Supergroup sandstones consist almost entirely of quartz, and any detrital feldspar that was present was altered to clay minerals, such as kaolinite and illite, during the 200-million-year long period of diagenesis that impacted Basin. Some portions of the Manitou Falls Group were silicified during diagenesis whereby quartz cement sealed the sandstone's primary porosity and effectively reduced the groundwater flow through the matrix of the sandstone and made it prone to brittle fracturing. Other areas of the Manitou Falls Group, particularly along the WS Shear Zone and associated splays, underwent hydrothermal alteration and desilicification of the sandstone. This alteration is interpreted to increase the porosity and permeability of the sandstones in these areas.

In addition to alteration, the sandstones have also been faulted and fractured, which also affects the movement of groundwater through these units. Faults in the sandstone represent reactivated brittle basement faults along the northeast-southwest trending WS shear zone, or responses to volume adjustments in the sandstone during hydrothermal alteration and mineralization.

5.2.3 Basement Rock

Basement rocks beneath the Phoenix deposits are Paleoproterozoic-aged metasedimentary, metavolcanics and gneiss and schists (Figure 3). The basement rocks have undergone several periods of alteration, following their original deposition, which affect the hydrogeological setting, and these include:

- metamorphism;
- alteration post-metamorphism (<1800 Ma) and prior to deposition of the Athabasca Supergroup sandstones (1700 Ma; Adlahka, 2021; Toma et al., 2022);
- paleoweathering on the bedrock surface prior to subsidence and Basin formation; and,
- hydrothermal alteration associated with the uranium ore mineralization. The most intense areas of hydrothermal alteration occur alongside the highest-grade mineralization, and alteration decreases, and disappears, in all directions with distance away from the ore zone.

A major unconformity separates the basement rock from the overlying Athabasca Supergroup sandstones. This unconformity represents the period when the basement rock was exposed and subject to weathering and erosion.

The uranium ore deposit lies proximal to the unconformity between the basement rocks and the overlying Athabasca sandstone. The Phoenix ore bodies are long and narrow (approximately 25-50 m wide) and are located within or near a graphitic pelite unit. The uranium deposit has been isolated from the over- and underlying units by a barrier zone consisting of clays and sulphide-cemented rock, that has limited the leaching of uranium and other chemical constituents in the ore over time. This inference – regarding limiting of migration of chemical constituents away from the ore zone by the natural barrier unit – is the authors' professional opinions of the current setting, based on a thorough review and interpretation of available information.

Faults within the basement rocks trend in a similar northeast-southwest direction as the WS Shear Zone and are well defined in the basement rocks. There are also several west-east trending cross-faults that lie roughly perpendicular the WS Shear zone that propagate through the ore zone and basement rocks. These faults and fracture systems play an important role in groundwater flow and the evolution of geochemical signatures.

5.3 Hydrogeological Framework

The hydrogeological units that influence groundwater flow within the Basin presented on Figure 29 and detailed as follows:

- Upper overburden unit defining the water table and upper shallow groundwater flow system.

- Athabasca Sandstone Supergroup subdivided into 3 units including upper and lower aquifers, separated by an intervening aquitard zone.
- Basement rocks subdivided into an upper weathered (Paleoweathered) and underlying competent basement aquitard.

A summary of the geological/lithology units and the corresponding hydrogeological unit is summarized in Table 5-1 as follows:

Table 5-1: Hydrostratigraphic Units at Phoenix

<table>
<tr><th colspan="2">Lithologic Unit</th><th>Hydrostratigraphic Unit (Aquifer/ Aquitard)</th></tr>
<tr><td colspan="2">Overburden</td><td>Overburden Aquifer</td></tr>
<tr><td rowspan="4">Athabasca Supergroup/ Manitou Falls Group</td><td>Dunlop Fm – MFd</td><td rowspan="2">Upper Sandstone Aquifer</td></tr>
<tr><td>Collins Fm – MFc</td></tr>
<tr><td>Bird Fm – MFb</td><td rowspan="2">Intermediate Sandstone Aquitard (and Desilicified Zone Aquifer)</td></tr>
<tr><td>Read Fm (MFa)</td><td>Lower Sandstone Aquifer (and Desilicified Zone Aquifer)</td></tr>
<tr><td colspan="2">Upper Barrier Zone (Clay zone and sulphide-cemented rock)</td><td>Aquitard (overlying the ore zone)</td></tr>
<tr><td colspan="2">Ore Zone (high grade friable zone)</td><td>Ore Zone Aquifer</td></tr>
<tr><td colspan="2">Lower Barrier Zone (Clay zone and sulphide-cemented rock)</td><td>Aquitard (underlying the ore zone)</td></tr>
<tr><td colspan="2">Paleoweathered and Competent Basement</td><td>Basement Aquitard</td></tr>
</table>

5.3.1 Groundwater Flow Systems

As presented on Figure 29, two groundwater flow regimes were identified in the local basin stratigraphy. The uppermost flow system is unconfined and includes groundwater flow through the overburden and Upper Sandstone Aquifer. The lower semi-regional system is confined by the Intermediate Sandstone Aquitard, and includes flow through the Lower Sandstone Aquifer, and locally, in the Ore Zone Aquifer.

Horizontal groundwater flow in the deeper semi-regional flow system is generally directed from the west to the east and southeast, as interpreted by water level and groundwater chemistry observations (Figure 17). Groundwater flow within the Overburden and Upper Sandstone Aquifer is influenced by ground surface topography and surface water features (Figure 16). Flow in this upper groundwater flow regime is derived from recharge in the local area, whereas groundwater flow within the semi-regional groundwater flow system is derived from a combination of regional groundwater flow from upgradient sources, and vertical flow through the Intermediate Sandstone Aquitard. Vertical gradients are

interpreted to be directed downward in areas west of the Phoenix deposit, and upward beneath the surface water bodies such as Whitefish and Williams Lakes.

5.3.2 Aquifer Properties

Hydraulic conductivity, porosity and storage values of the various units are summarized a in Table 5-2.

Table 5-2: Summary of Hydrostratigraphic Unit Properties

Hydrostratigraphic Units	Field-Based Hydraulic Conductivity (m/s)		Effective Porosity (%)	Storage[2]
	Range	Geomean[1]		
Overburden Aquifer/ Aquitard	3×10^{-6} and 2×10^{-4}	-	25% (sand); 18% (till)	20% (Sy)
Upper Sandstone Aquifer	4×10^{-7} to 1×10^{-4}	3.7×10^{-6}	1 to 5%	1×10^{-5} (Ss)
Intermediate Bedrock Aquitard	1×10^{-10} to 3.8×10^{-6}	8.4×10^{-9}	1 to 10%	
Desilicified Zone	1×10^{-6} to 2×10^{-5}	4.8×10^{-6}		
Lower Sandstone Aquifer	7.8×10^{-8} to 3×10^{-5}	2.2×10^{-6}		
Upper and Lower Barrier Zone Aquitard (clay zones and sulphide-cemented rock)	Hydraulic tests have not been completed on these units as they are relatively thin in comparison to overlying/ underlying units.			1×10^{-6} (Ss)
Ore Zone Aquifer				
Basement Aquitard	1.1×10^{-11} to 1.1×10^{-5}	4.8×10^{-9}		

[1] A geomean value was not calculated for the Overburden Aquifer/Aquitard or the Upper and Lower Barrier zone as only two measurements were available for each unit
[2] Sy values expressed as percent of total volume
[2] Ss values expressed in units of 1/m
[3] Screened intervals of the wells often intercept the ore zone and upper or lower barrier zones; elevated conductivity values were interpreted to reflect the ore zone aquifer and lower values reflect the barrier zone aquitard.

Overburden is generally sand-rich with minor silt and clay content, resulting in an aquifer that ranges from high to moderate hydraulic conductivity. Thickness is highly variable, with deposits up to 60 m thick where the underlying sandstone was more intensely fractured and was thus more-easily weathered.

Aquifer zones within the sandstone result from fractured zones (presumably associated with faulting) and areas of lower clay content. Where present, the clay content is interpreted to partially infill fractures, effectively reducing hydraulic conductivity.

The hydraulic properties within the Basement Aquitard unit vary as the properties are dependent on the fracture or fault properties. The highest hydraulic conductivity values are expected along the primary fault zones, including the WS Shear where the rock is more fractured. Lower hydraulic conductivity values are observed in most portions of the

Basement Aquitards where the basement rocks are competent and fracture frequency is low.

5.3.3 Groundwater Recharge and Discharge

Groundwater recharge occurs across much of the study area, and after infiltrating to the water table, flows toward the local streams and surrounding lakes where groundwater discharges to surface. Recharge from the Local Flow System to the Lower Sandstone Aquifer is conceptualized to occur along fault zones and where downward gradients are present.

Local to the Phoenix deposit, shallow groundwater in the overburden and the Upper Sandstone Aquifer are conceptualized to discharge into Whitefish Lake, which is located approximately 500 m east of the deposit and has a lake level of approximately 500 m asl (Figure 17). Other major lakes in the area include Kratchkowsky Lake and Williams Lake, located west of the Phoenix deposit, which have lake levels of 520 and 518 m asl, respectively (Figure 17). McGowan Lake, located southeast of Whitefish Lake and 2 km from the Phoenix deposit, has a lake elevation of 494.4 m asl (6 m lower than Whitefish), while Russell Lake, located 6 km south of the deposit, has a lake elevation of 488 m asl. The water level elevations observed in water levels between the Phoenix deposit and the lake consistently exhibit an upward hydraulic gradient from the Lower Sandstone Aquifer (and ore zone) into Whitefish Lake (Figure 17) through the Desilicified Zone in the Intermediate Sandstone Aquitard. It is interpreted that the elevated hydraulic conductivity value represented by the Desilicified Zone creates a preferential pathway for water to discharge into Whitefish Lake, rather than continuing to stay in the Lower Sandstone Aquifer and discharge to Russell Lake. It is possible that some deeper regional flow, within the Upper Sandstone Aquifer, may discharge to Russell Lake south of the Phoenix site. But, despite the fact there is hydraulic potential for groundwater in the Lower Sandstone Aquifer to discharge to Russell or Mardoc Lakes, the Intermediate Sandstone Aquitard acts to hydraulically separate the Lower Sandstone Aquifer from the overlying Upper Sandstone Aquifer and the local groundwater flow regime in the Russell and Mardoc Lake areas.

Discharge to streamflow as recorded in streamflow stations located along the streams and rivers located east of the Phoenix deposit were measured to be consistently increasing from above Whitefish Lake to below McGowan Lake. Similarly, discharge to streamflow as recorded along the drainage course west of the Phoenix deposit was also measured to increase. Low flow discharge per unit area is estimated to be approximately 125 mm/yr. This indicates that local groundwater discharge is sustaining streamflow even in low precipitation periods.

5.3.4 Faults, Fractures, Vertical Pathways

Faulting of the crystalline basement and sedimentary rocks can give rise to complex hydrogeological systems. In bedrock, faults can act as complex barrier-conduit systems with

low permeability core zones and broader fracture zones that are transmissive in the plane of the fault. Vertical fracture or fault zones that hydraulically connect the local (upper) and semi-regional (lower) groundwater flow regimes are present throughout the Athabasca Basin. Information from fault investigations suggests that faults are likely represented by fracture zones with enhanced permeability and higher groundwater flow rates.

Water level trends throughout the region surrounding the Phoenix deposit are largely consistent across the area. Water levels in monitoring wells screened in the Lower Sandstone Aquifer and Basement Aquitard in areas southwest of the Phoenix deposit (see Figure 17) are higher than expected, suggesting the WS Shear zone or a related fault located southwest of the ore zone may enhance recharge to the lower groundwater flow system in this area. This interpretation is also supported by the groundwater geochemical evaluation (see Figure 17).

It is also recognized that open, unsealed exploration boreholes can create potential vertical migration pathways. These pathways will be considered during the planning and design of the groundwater monitoring plan.

5.3.5 Baseline Groundwater Geochemistry

Groundwater collected from each of the hydrostratigraphic units at the site provides a good regional understanding of baseline groundwater chemistry and has allowed examination of the differences in hydrochemistry between the hydrostratigraphic units. Overall, the groundwater sampled in the study areas is low in mineralization, and this is consistent with the understanding of groundwater in the wider region from other uranium mining projects (e.g., AECL, 1994; Cameco, 2012). From the groundwater data collected, radionuclides and some other dissolved metals/trace elements had concentrations that were higher in the ore zone (by an order of magnitude or more) in comparison to the overlying hydrostratigraphic units and surface water. This gives evidence of the very low mass flux of those constituents from the ore zone and the discontinuous barrier zone aquitard overlying and underlying the ore zone over time.

The groundwater chemistry measured supports the presence of a Local Flow System, Intermediate Sandstone Aquitard and Lower Sandstone Aquifer in the study area. The chemistry of the groundwater in the Local Flow system is that of recharge water that is of relatively low pH, from contact with organic matter in the upper soil profile, and that has become mineralized through dissolution of quartz, feldspars, kaolinite and illite. The chemistry of groundwater in the Intermediate Sandstone Aquitard is similar in terms of major ion composition to that of the Local Flow System, but a longer residence time in the aquitard has led to more extensive mineral dissolution and higher mineralization, with a similar hydrochemical type. Higher relative variability in the groundwater chemistry sampled from monitoring wells in the Intermediate Sandstone Aquitard may reflect the localized influence of desilicification on the flow conditions, and consequently on groundwater conditions, in a subset of these wells. The Lower Sandstone Aquifer is characterized spatially by two types of groundwater. The first groundwater type is most similar to that observed in

the Local Flow System. This is suggested to reflect hydraulically active fractures and fault systems that allow fresh recharge water to penetrate and mix with deeper waters in the Aquifer. The second type of groundwater was within the zone of thermal alteration around the ore zone and has relatively high mineralization, thought to be a result of dissolution of remnant halide salts present on grain boundaries and in intragranular pores within the rock matrix at depth in the Athabasca Sandstones.

Groundwater quality results suggest that connectivity between the Upper Sandstone Aquifer and Intermediate Aquifer is limited. Again, desilicification of these Formations to the northeast of the ore zone may affect interconnectivity of these units on a localized scale. Although limited in number of samples available, groundwater quality in the Paleoweathered zone for both Project and Cigar Lake assessments suggest a distinct geochemical environment from that of the overlying Athabasca Sandstone Supergroup hydrostratigraphic units.

5.4 Links to Other Studies

This conceptual site model provides the basis for building and developing a numerical model to represent groundwater flow and migration of ore zone constituents under pre-development, active mining, and post-mining conditions. The numerical model provides additional insights into the groundwater flow system and potential migration pathways throughout the planned mine activities. The numerical model has been used to evaluate potential migration pathways, assist in mine water and wastewater design, and design an effective groundwater monitoring network.

6.0 STATEMENT OF LIMITATIONS

This report has been prepared for the exclusive use of Denison Mines Corp. Factual information, interpretations and summary comments contained herein are provided for the purpose stated in the Study Objectives (Section 1.1). Under no circumstance may this information be used for purposes other than those specified unless formal authorization is provided by Ecometrix Incorporated.

This report must be read in its entirety as some sections could be falsely interpreted when taken individually or out-of-context. Further, the contents and findings of this document reference and rely on the contents of companion documents and as such the contents of this document should not be interpreted independently.

Hydrogeologic investigations are inexact sciences because groundwater systems are naturally complex, and those conditions must be interpreted between observation and measurement points. Conceptual models are simplifications of reality, and the validity and accuracy of the model depends on the amount and quality of data available for characterization relative to the degree of complexity of the setting. A wealth of data exists in the areas overlying the Phoenix deposit, which increases the confidence in the level of characterization of the groundwater flow system in this area.

Despite the level of care employed, no warranty, express or implied, is made regarding the conditions presented in this report. The insights gained through the characterization process should be used to guide decisions but there may be local level variations in groundwater characteristics in data poor areas or between monitoring stations.

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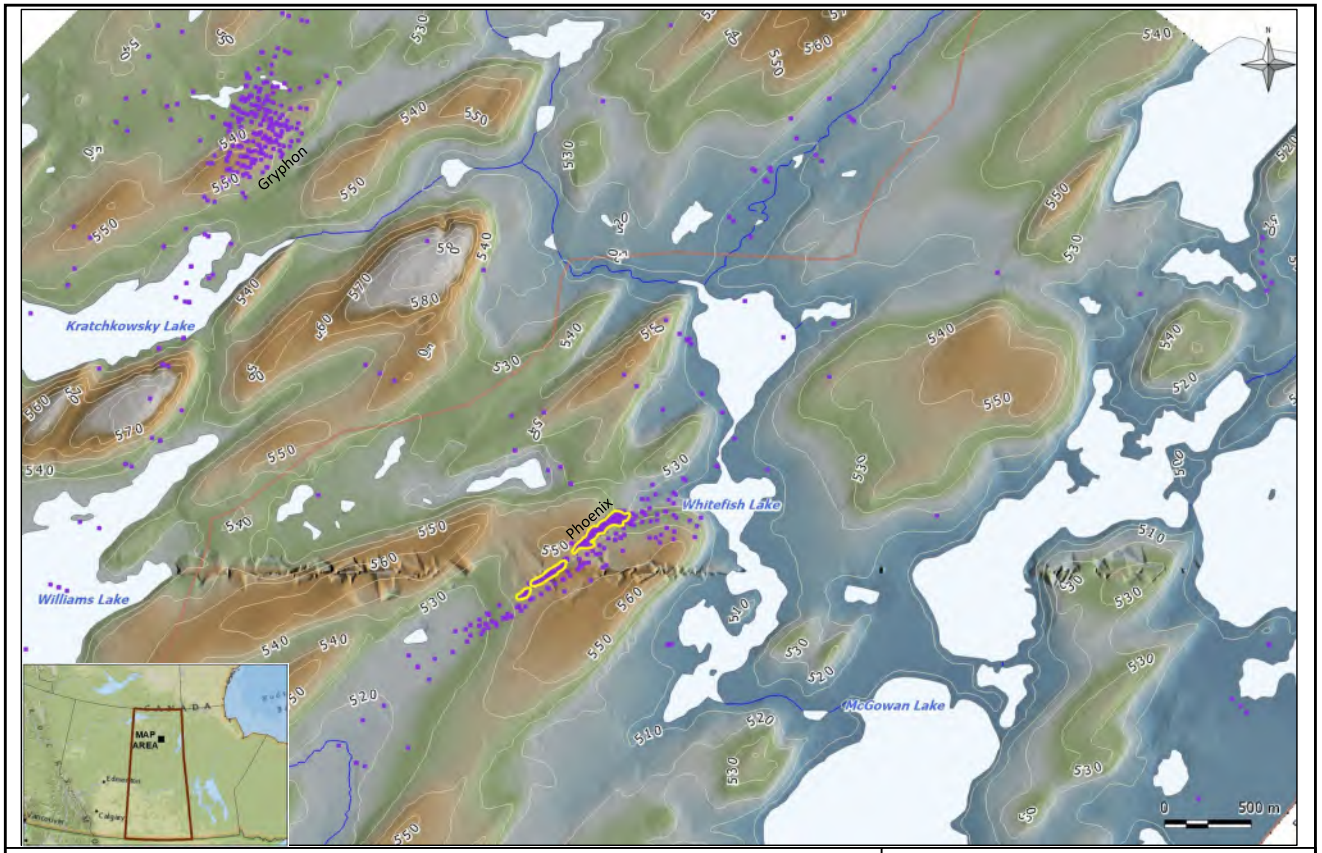
Figures



LEGEND

- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone
- Core Holes/ Wells
- Topographic Contour (10 m)

Ground Surface Topography (DEM; m asl)

592	555	519
584	548	511
577	541	504
570	533	497
562	526	490

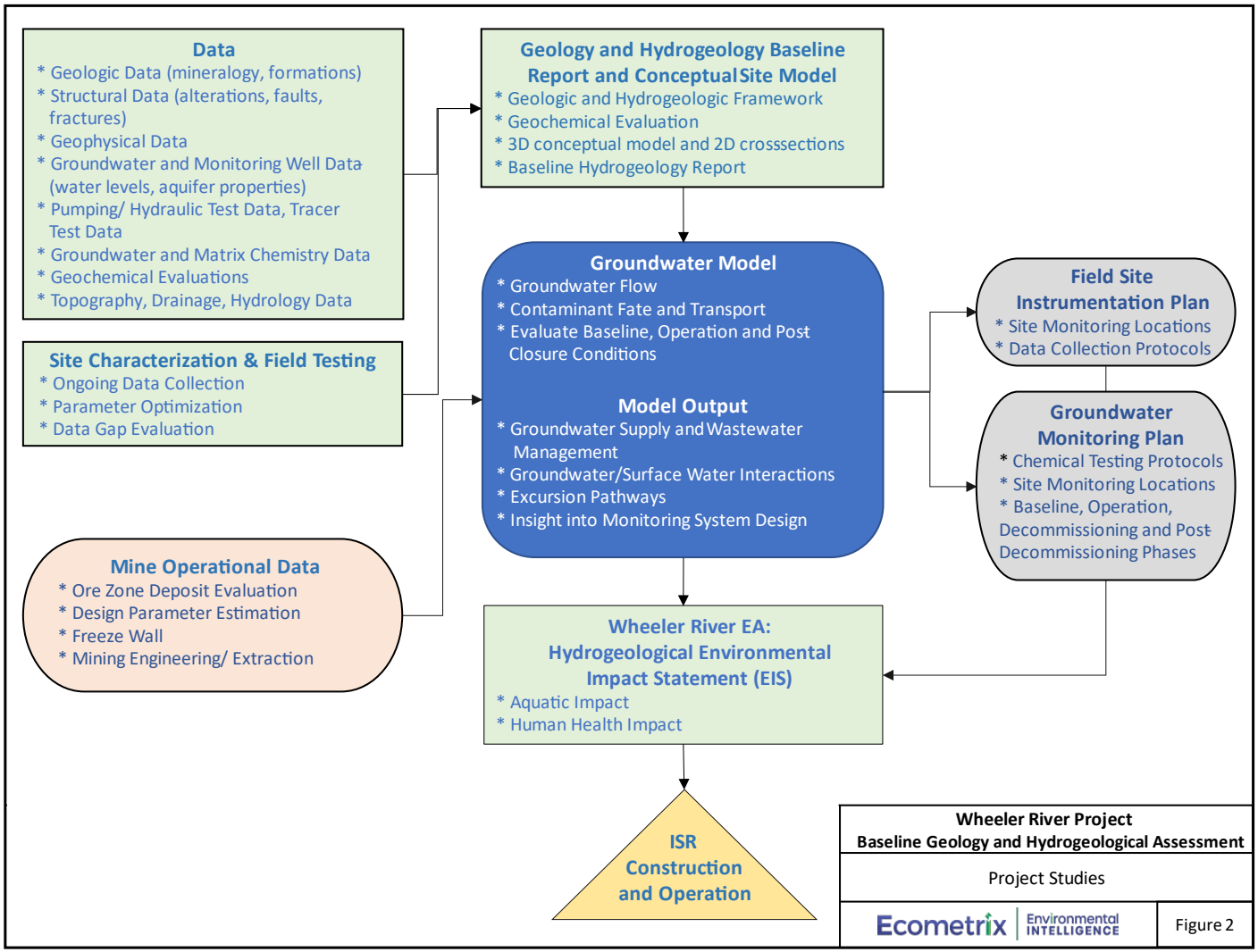
Source: Ground Surface Topography provided by Denison, 2019

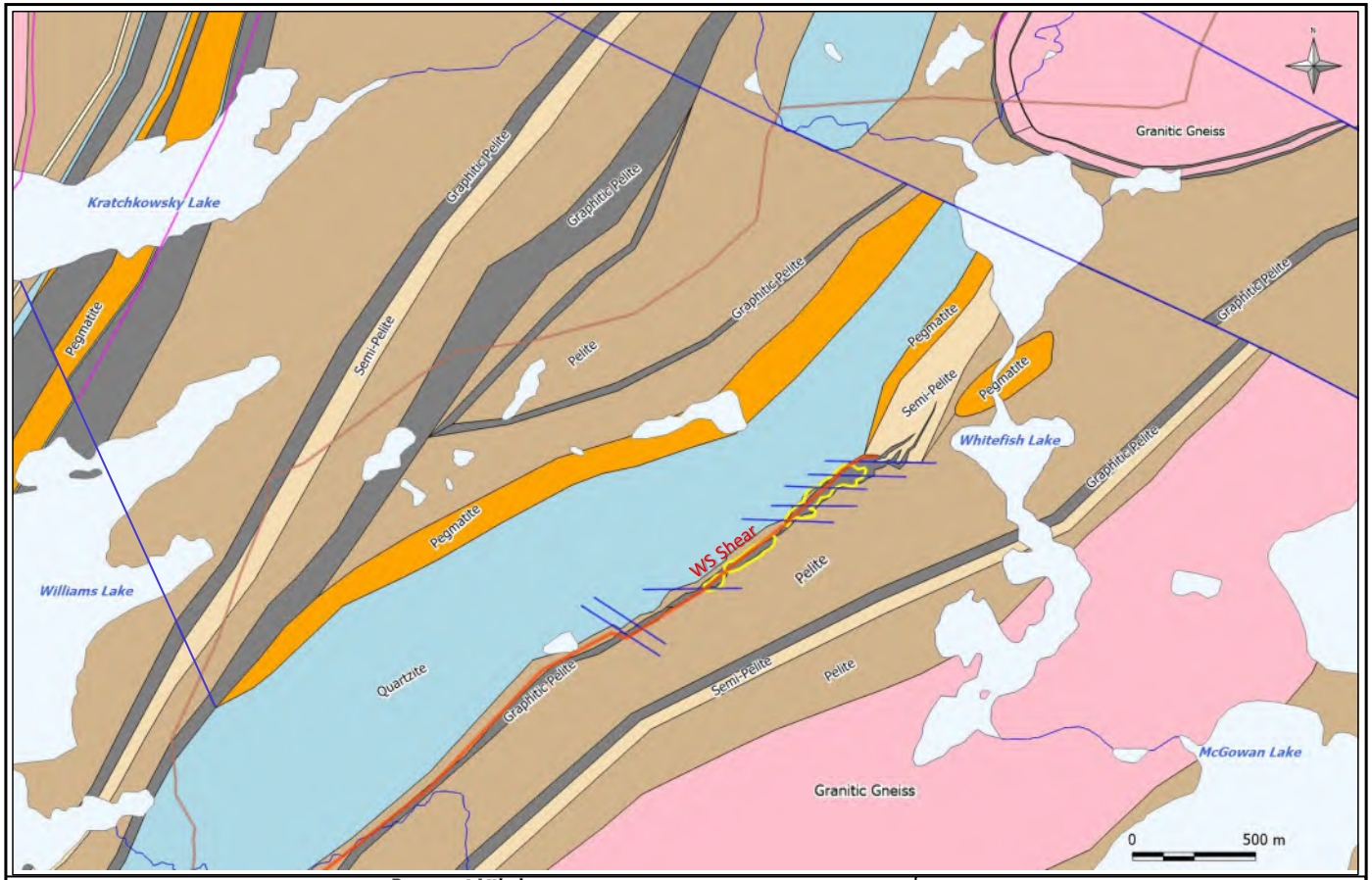
Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Ground Surface Topography and Surface Water Features

Ecometrix | Environmental INTELLIGENCE

Figure 1


Data
* Geologic Data (mineralogy, formations)
* Structural Data (alterations, faults, fractures)
* Geophysical Data
* Groundwater and Monitoring Well Data (water levels, aquifer properties)
* Pumping/ Hydraulic Test Data, Tracer Test Data
* Groundwater and Matrix Chemistry Data
* Geochemical Evaluations
* Topography, Drainage, Hydrology Data
Site Characterization & Field Testing
* Ongoing Data Collection
* Parameter Optimization
* Data Gap Evaluation
Mine Operational Data
* Ore Zone Deposit Evaluation
* Design Parameter Estimation
* Freeze Wall
* Mining Engineering/ Extraction
Geology and Hydrogeology Baseline Report and Conceptual Site Model
* Geologic and Hydrogeologic Framework
* Geochemical Evaluation
* 3D conceptual model and 2D crosssections
* Baseline Hydrogeology Report
Groundwater Model
* Groundwater Flow
* Contaminant Fate and Transport
* Evaluate Baseline, Operation and Post Closure Conditions
Model Output
* Groundwater Supply and Wastewater Management
* Groundwater/Surface Water Interactions
* Excursion Pathways
* Insight into Monitoring System Design
Field Site Instrumentation Plan
* Site Monitoring Locations
* Data Collection Protocols
Groundwater Monitoring Plan
* Chemical Testing Protocols
* Site Monitoring Locations
* Baseline, Operation, Decommissioning and Post Decommissioning Phases
Wheeler River EA: Hydrogeological Environmental Impact Statement (EIS)
* Aquatic Impact
* Human Health Impact
ISR Construction and Operation
Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Project Studies
Ecometrix Environmental INTELLIGENCE
Figure 2



LEGEND

- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone

Basement Lithology

- Calc Silicate
- Granitic Gneiss
- Graphitic Pelite
- Pegmatite
- Pelite
- Quartzite
- Semi-Pelite

Structures

- WS Shear Fault
- Thrust Faults
- Minor Faults

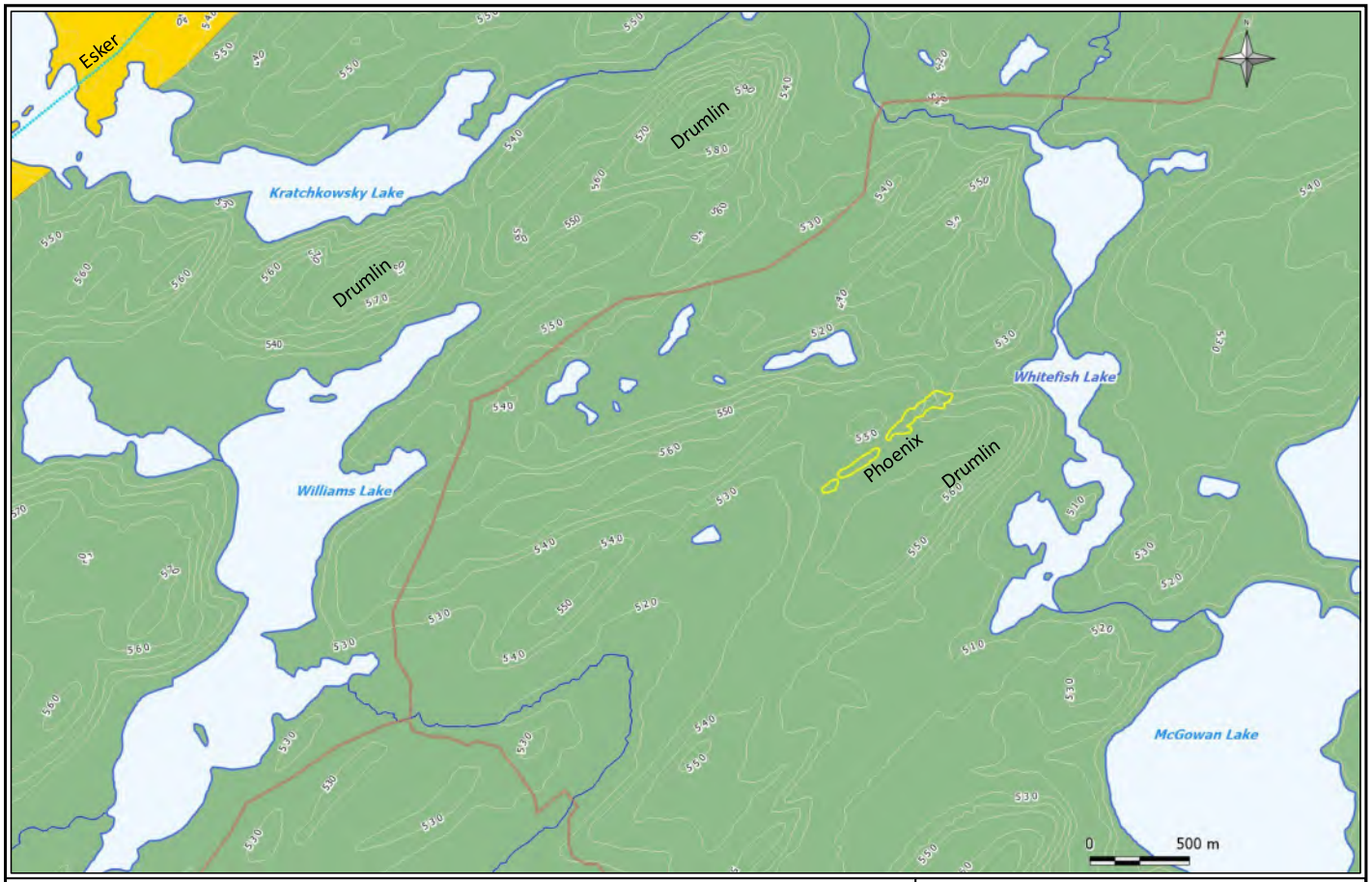
Source: Geology - Saskatchewan Geological Survey, Ministry of Energy and Resources. 1:250,000 Scale. Accessed Online at Saskatchewan GeoHub. gis.saskatchewan.ca . Structural mapping – provided by Denison, 2019

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Basement Lithologies and Structural Features

Ecometrix | Environmental INTELLIGENCE

Figure 3



LEGEND

- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone

Surficial Geology (1:250,000)

- Glaciofluvial Sediments
- Till Plains (Drumlinoid)
- Esker
- Topographic Contour (10 m)

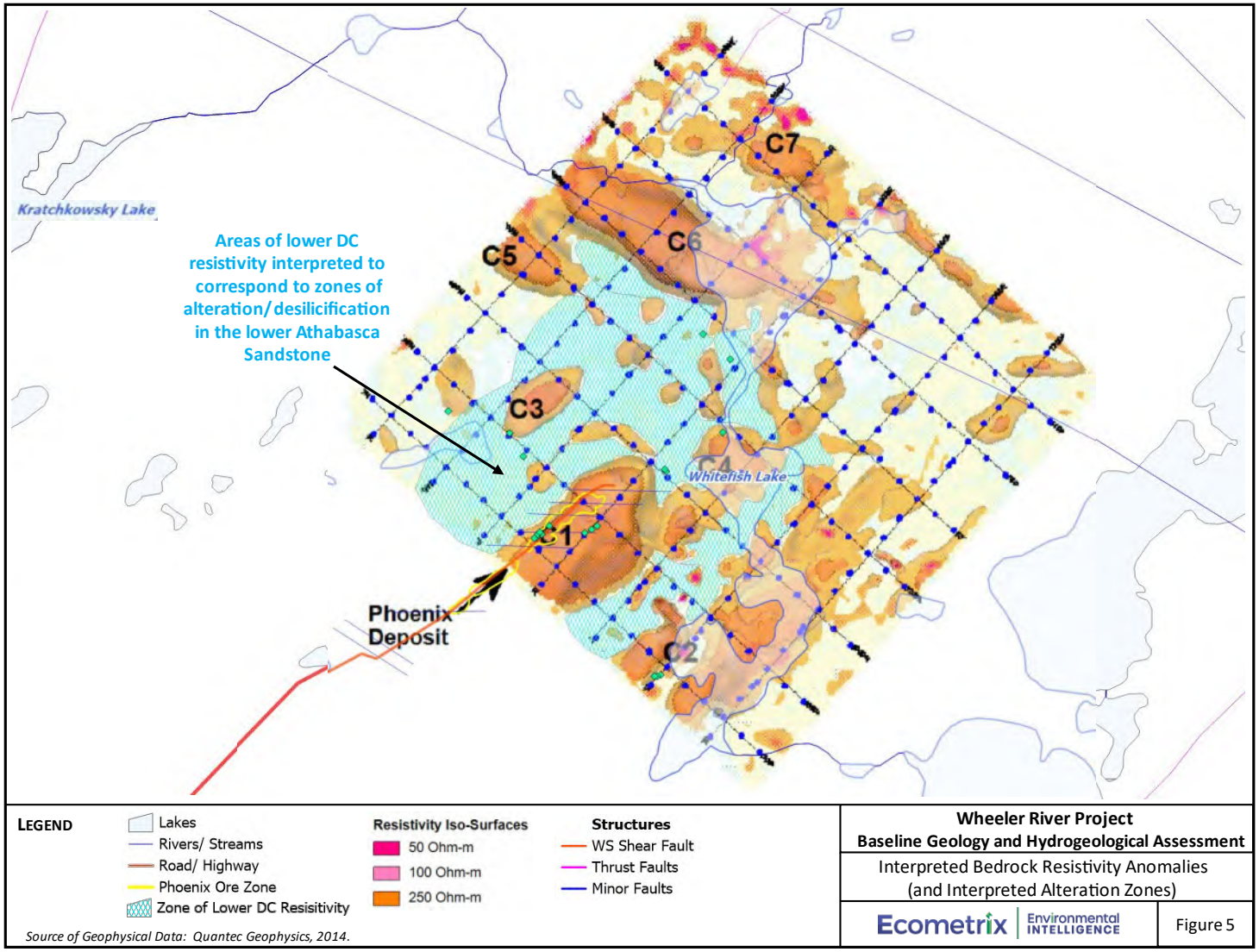
Source: Saskatchewan Geological Survey, Ministry of Energy and Resources. 1:250,000 Scale Surficial Geology. Accessed Online at Saskatchewan GeoHub. gis.saskatchewan.ca

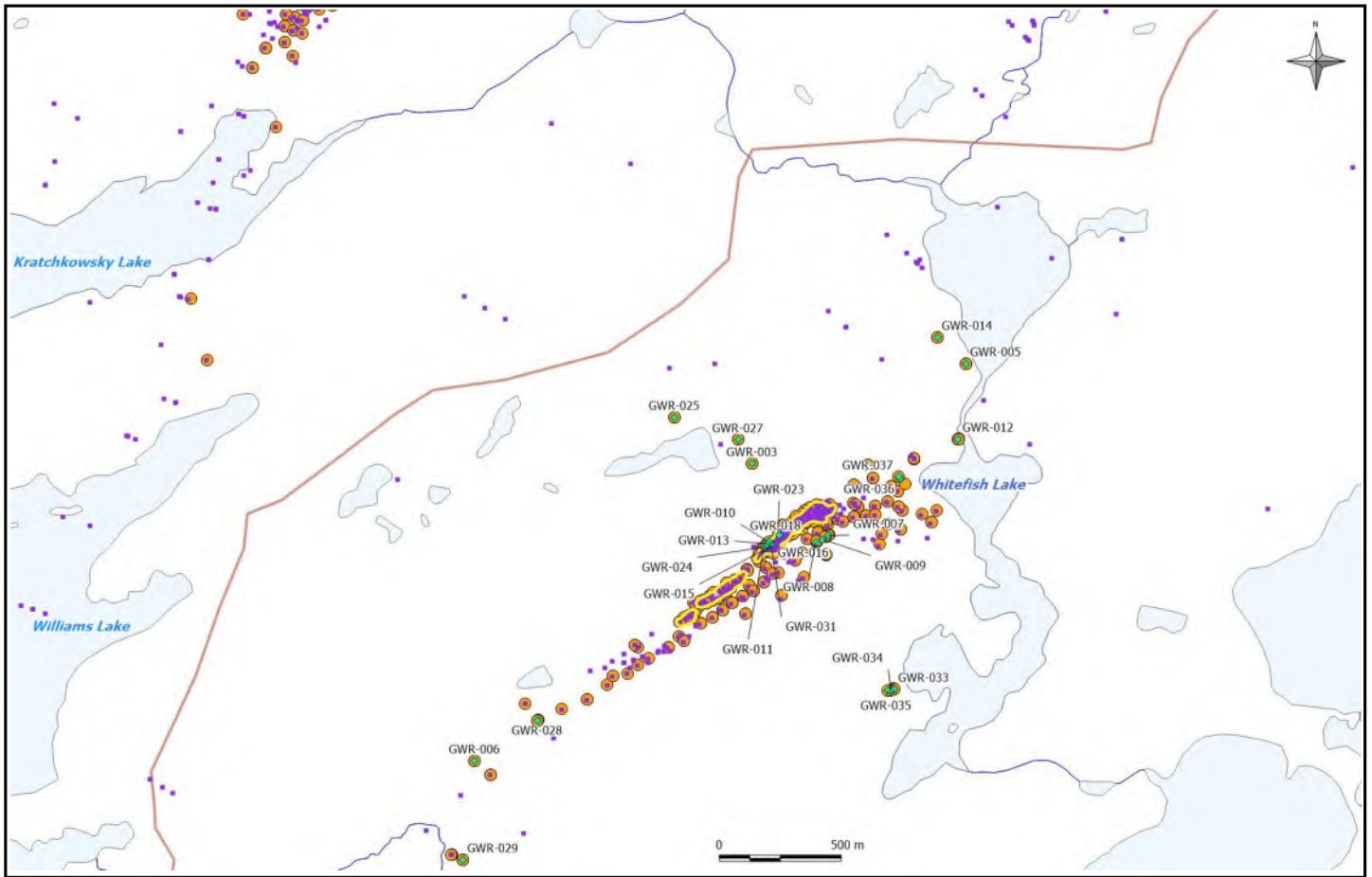
Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Surficial Geology

Ecometrix Environmental INTELLIGENCE

Figure 4


Kratchkowsky Lake
Areas of lower DC resistivity interpreted to correspond to zones of alteration/desilicification in the lower Athabasca Sandstone
C7
C6
C5
C3
C4
Whitefish Lake
C1
C2
Phoenix Deposit
LEGEND
Lakes
Rivers/ Streams
Road/ Highway
Phoenix Ore Zone
Zone of Lower DC Resisitivity
Resistivity Iso-Surfaces
50 Ohm-m
100 Ohm-m
250 Ohm-m
Structures
WS Shear Fault
Thrust Faults
Minor Faults
Source of Geophysical Data: Quantec Geophysics, 2014.
Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Interpreted Bedrock Resistivity Anomalies
(and Interpreted Alteration Zones)
Ecometrix Environmental INTELLIGENCE
Figure 5



LEGEND

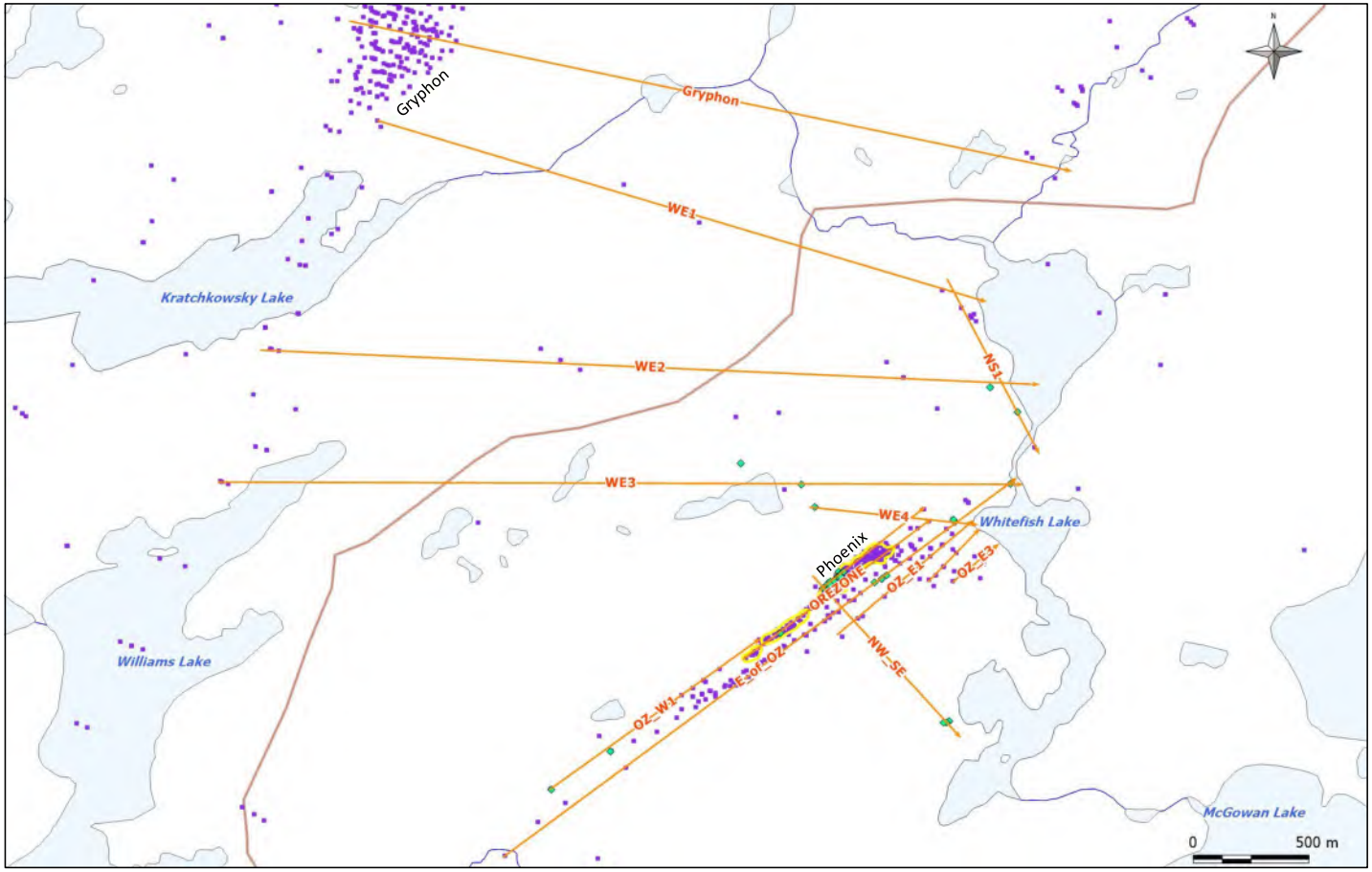
- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone
- Denison Monitoring Wells
- Core Holes
- Water Level Data Point

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Monitoring Well and Borehole Locations

Ecometrix | Environmental INTELLIGENCE

Figure 6



LEGEND

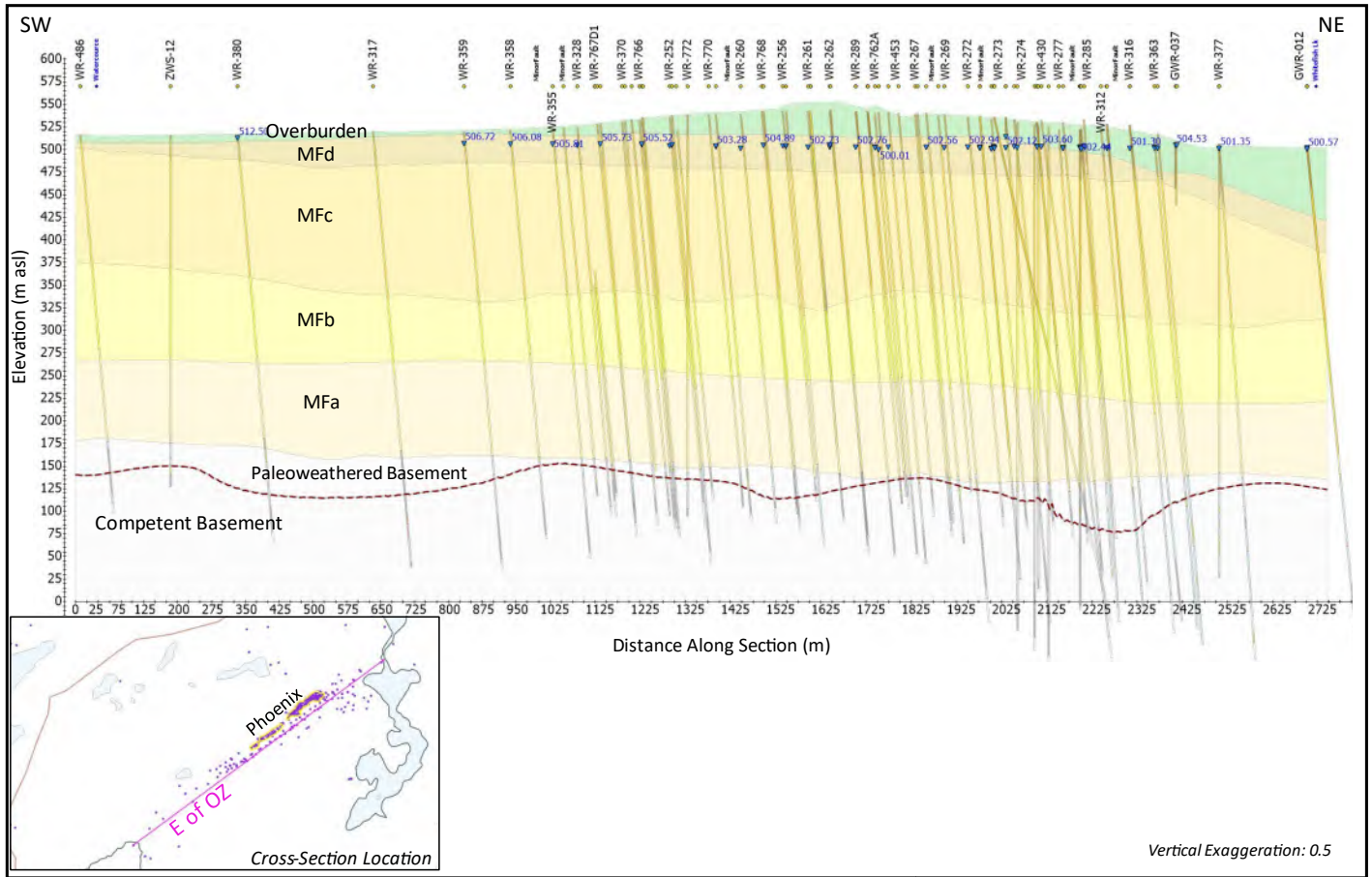
- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone
- Denison Monitoring Wells
- Core Holes
- NS1 Cross-Section Name
- Cross Section Line

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Locations of CrossSections Generated and Interpreted

Ecometrix Environmental INTELLIGENCE

Figure 7



LEGEND

Borehole Lithology
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

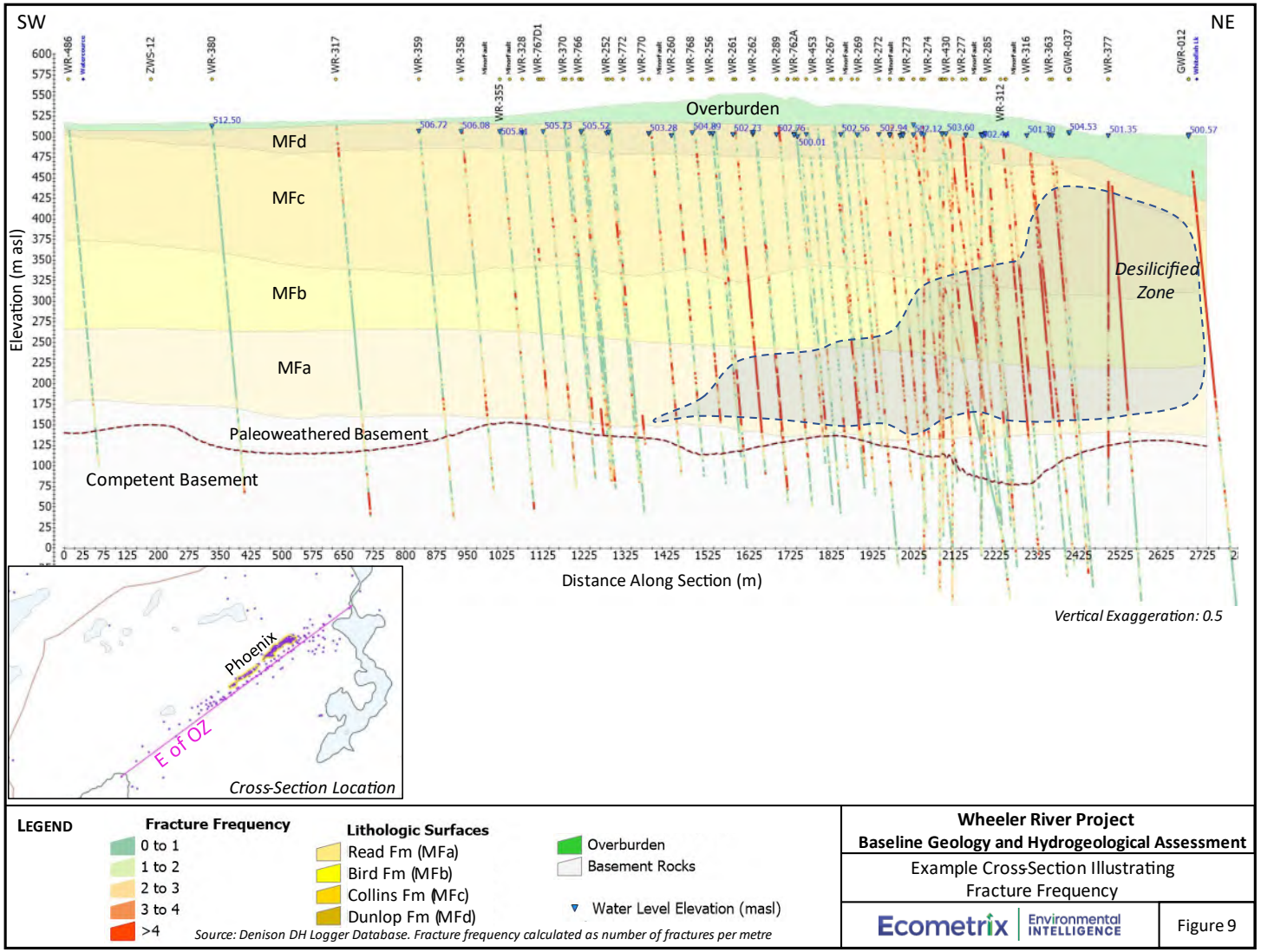
- Overburden
- Basement Rocks
- Water Level Elevation (masl)

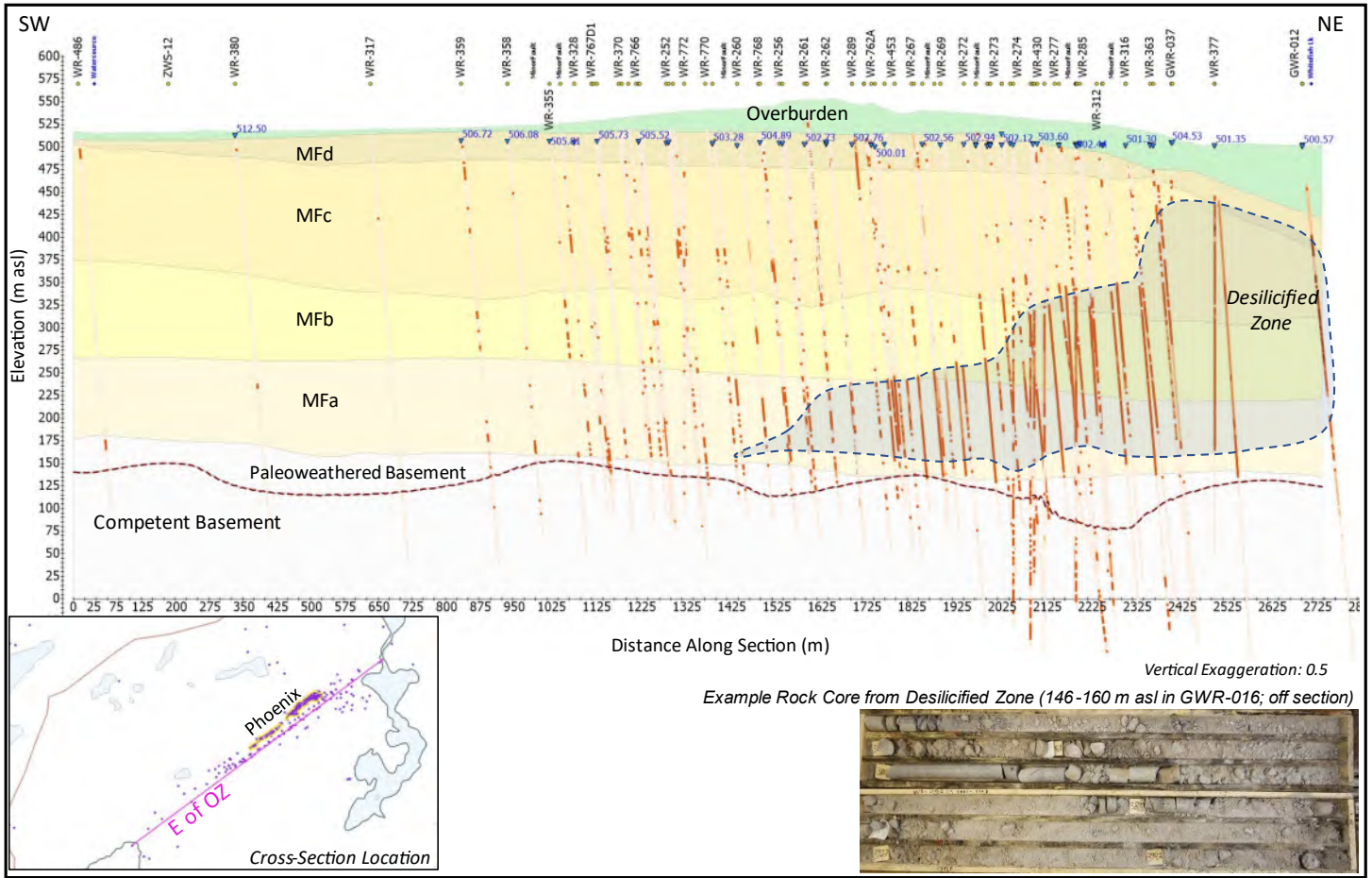
Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Example Cross-Section Illustrating Borehole Lithology and Interpreted Lithologic Surfaces

Ecometrix | Environmental INTELLIGENCE

Figure 8


SW
NE
Elevation (m asl)
Distance Along Section (m)
Overburden
MFd
MFc
MFb
MFa
Paleoweathered Basement
Competent Basement
Desilicified Zone
Vertical Exaggeration: 0.5
Phoenix
E of OZ
Cross-Section Location
LEGEND
Fracture Frequency
0 to 1
1 to 2
2 to 3
3 to 4
>4
Lithologic Surfaces
Read Fm (MFa)
Bird Fm (MFb)
Collins Fm (MFc)
Dunlop Fm (MFd)
Overburden
Basement Rocks
Water Level Elevation (masl)
Source: Denison DH Logger Database. Fracture frequency calculated as number of fractures per metre
Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Example CrossSection Illustrating Fracture Frequency
Ecometrix Environmental INTELLIGENCE
Figure 9



Example Rock Core from Desilicified Zone (146-160 m asl in GWR-016; off section)

LEGEND

Friability
1
2
3
4
5

Lithologic Surfaces
Read Fm (MFa)
Bird Fm (MFb)
Collins Fm (MFc)
Dunlop Fm (MFd)

Overburden
Basement Rocks

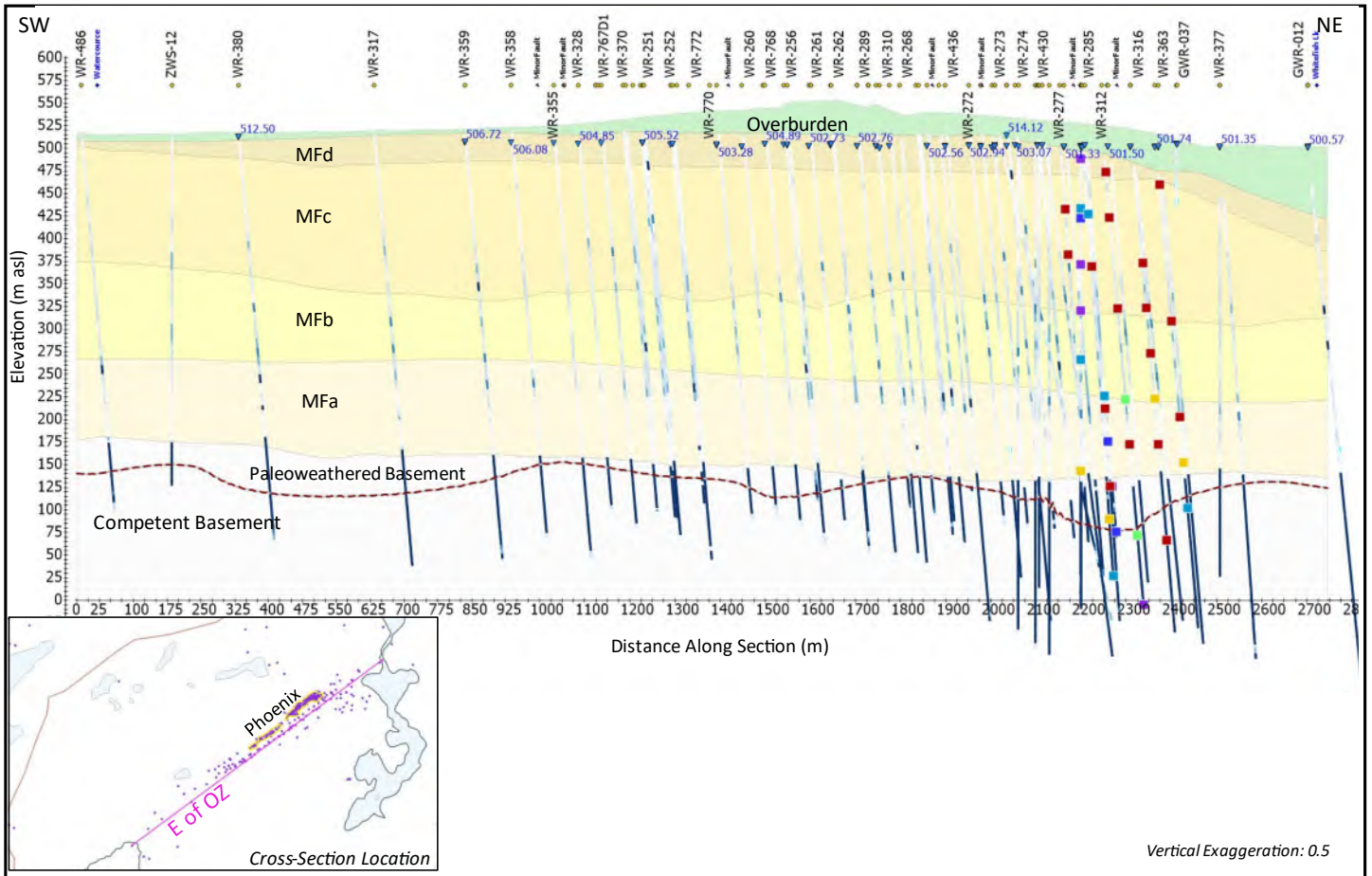
Water Level Elevation (masl)

Source: Denison DH Logger Database. Friability is qualitative measure; 1 is low, 5 is high.

Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Example Cross-Section Illustrating Rock Friability

Ecometrix Environmental INTELLIGENCE

Figure 10



LEGEND

Normative Clay (%)
- <4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- >12

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)
- Overburden
- Basement Rocks
- Water Level Elevation (masl)

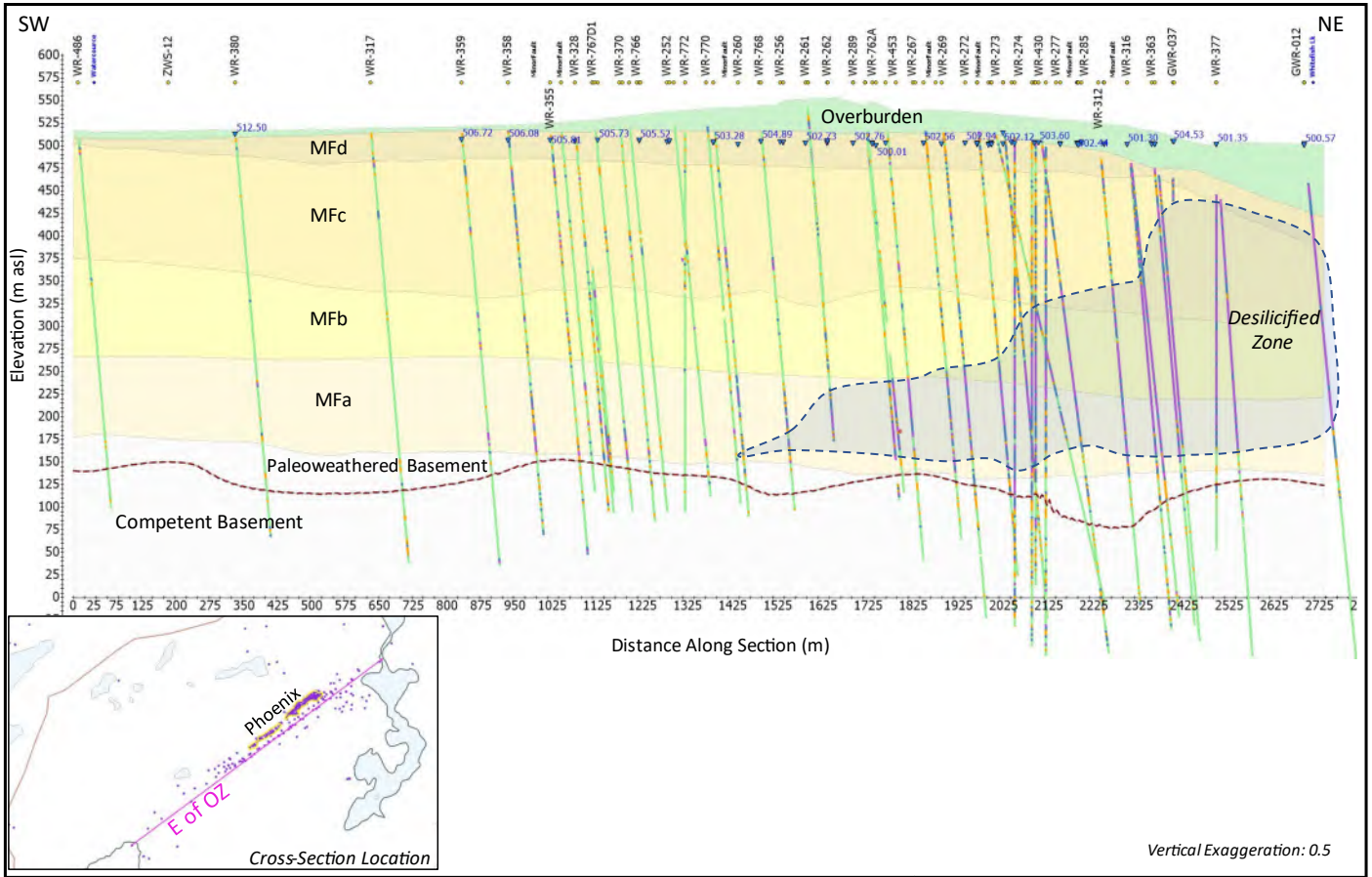
Temperature (deg C)
- <10
- 10 to 12
- 12 to 14
- 14 to 16
- 16 to 18
- >18

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Example Cross-Section Illustrating
Normative Clay Content and Temperature

Ecometrix Environmental INTELLIGENCE

Figure 11



LEGEND

RQD Percentage
- < 30
- 30 to 60
- 60 to 80
- >80

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

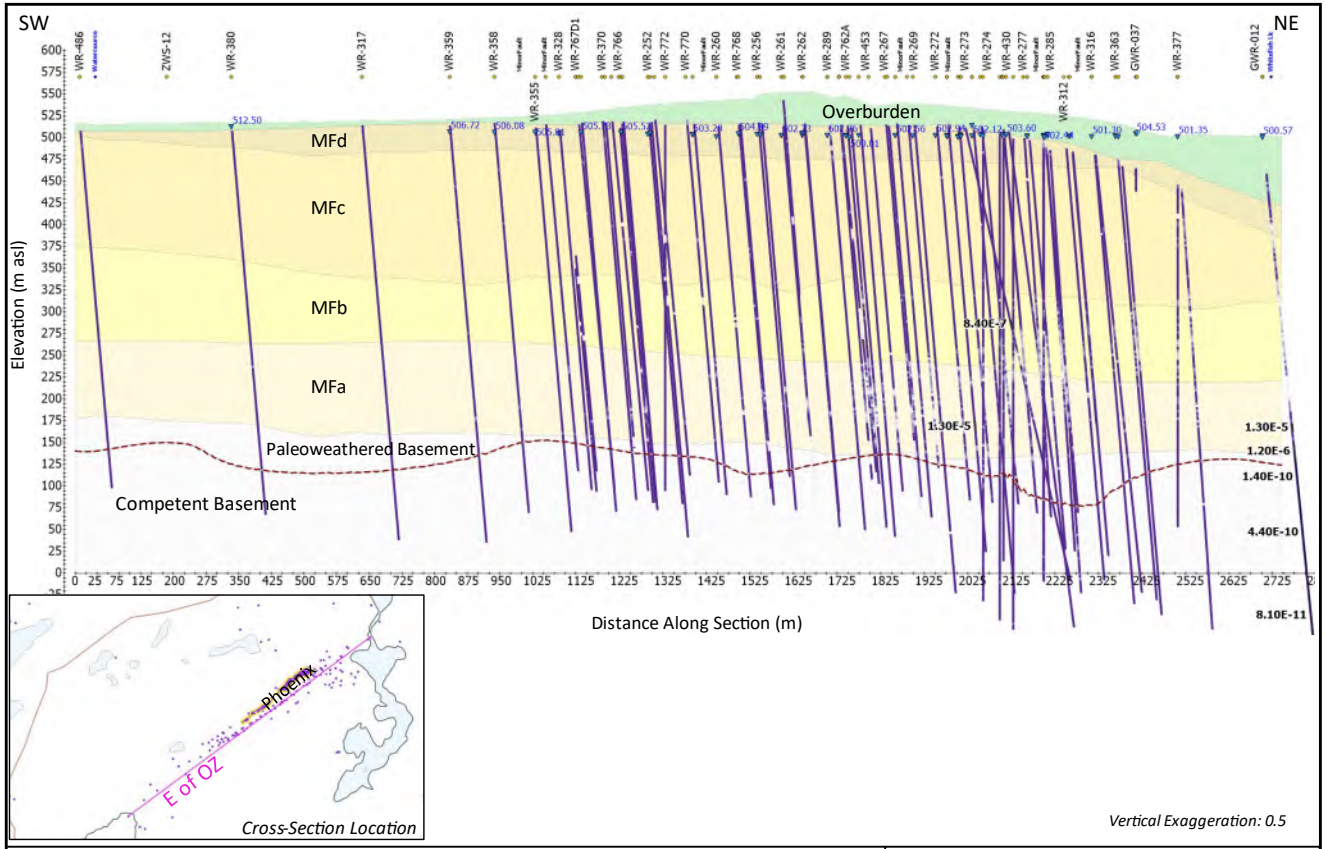
- Overburden
- Basement Rocks
- Water Level Elevation (masl)

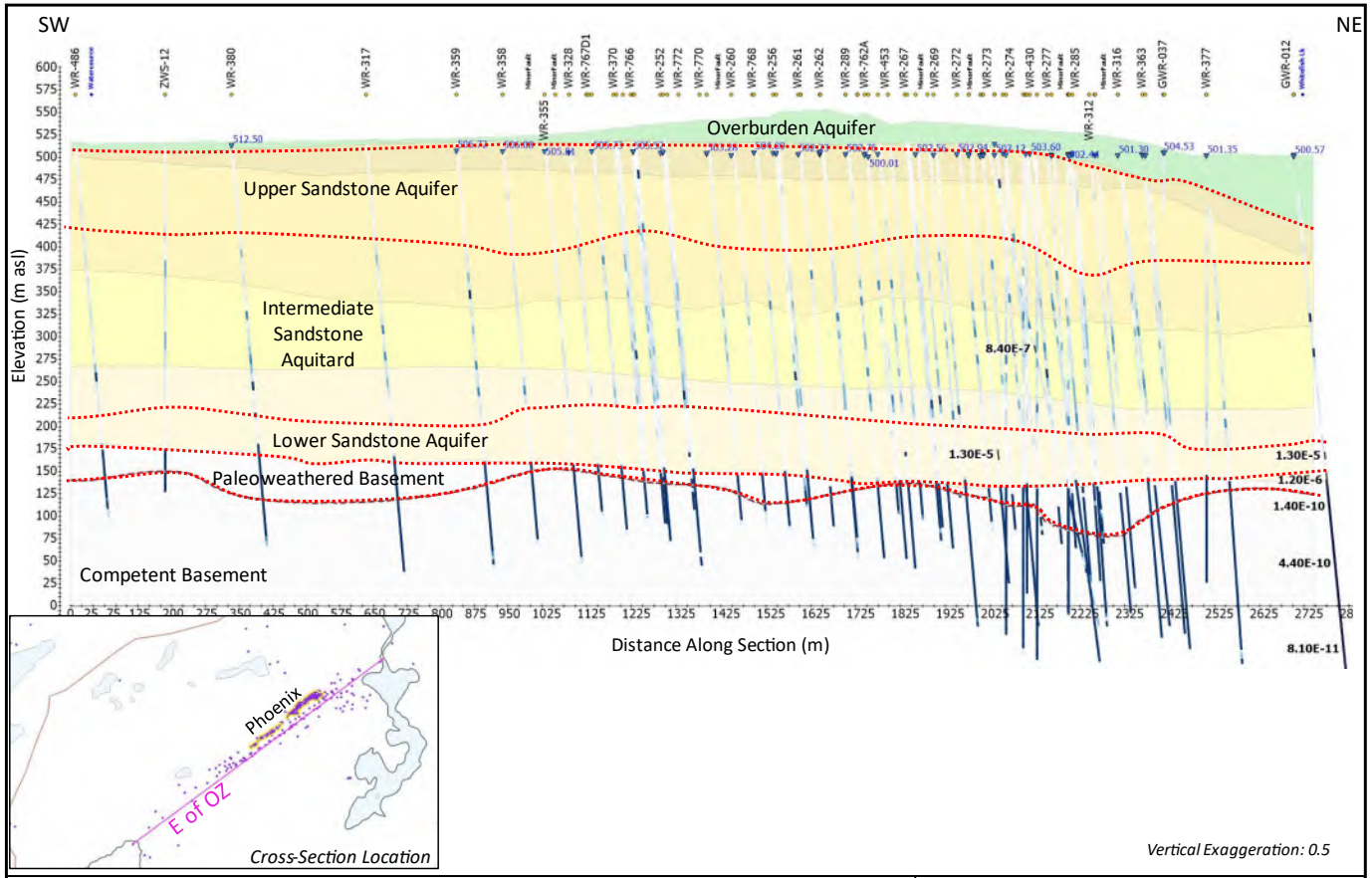
Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Example Cross-Section Illustrating RQD Percentage

Ecometrix Environmental INTELLIGENCE

Figure 12


SW
NE
Elevation (m asl)
Overburden
MFd
MFc
MFb
MFa
Paleoweathered Basement
Competent Basement
8.40E-7
1.30E-5
1.30E-5
1.20E-6
1.40E-10
4.40E-10
8.10E-11
Distance Along Section (m)
Phoenix
E of OZ
Cross-Section Location
Vertical Exaggeration: 0.5
LEGEND
Core Recovery Percentage
<20
20 to 40
40 to 60
60 to 80
>80
Lithologic Surfaces
Read Fm (MFa)
Bird Fm (MFb)
Collins Fm (MFc)
Dunlop Fm (MFd)
Overburden
Basement Rocks
Water Level Elevation (masl)
1E-5 K Estimate (m/s)
Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Example Cross-Section Illustrating
Percentage Core Recovery
Ecometrix Environmental INTELLIGENCE
Figure 13



LEGEND

Normative Clay (%)
- <4
- 4 to 6
- 6 to 8
- 8 to 10
- 10 to 12
- >12

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

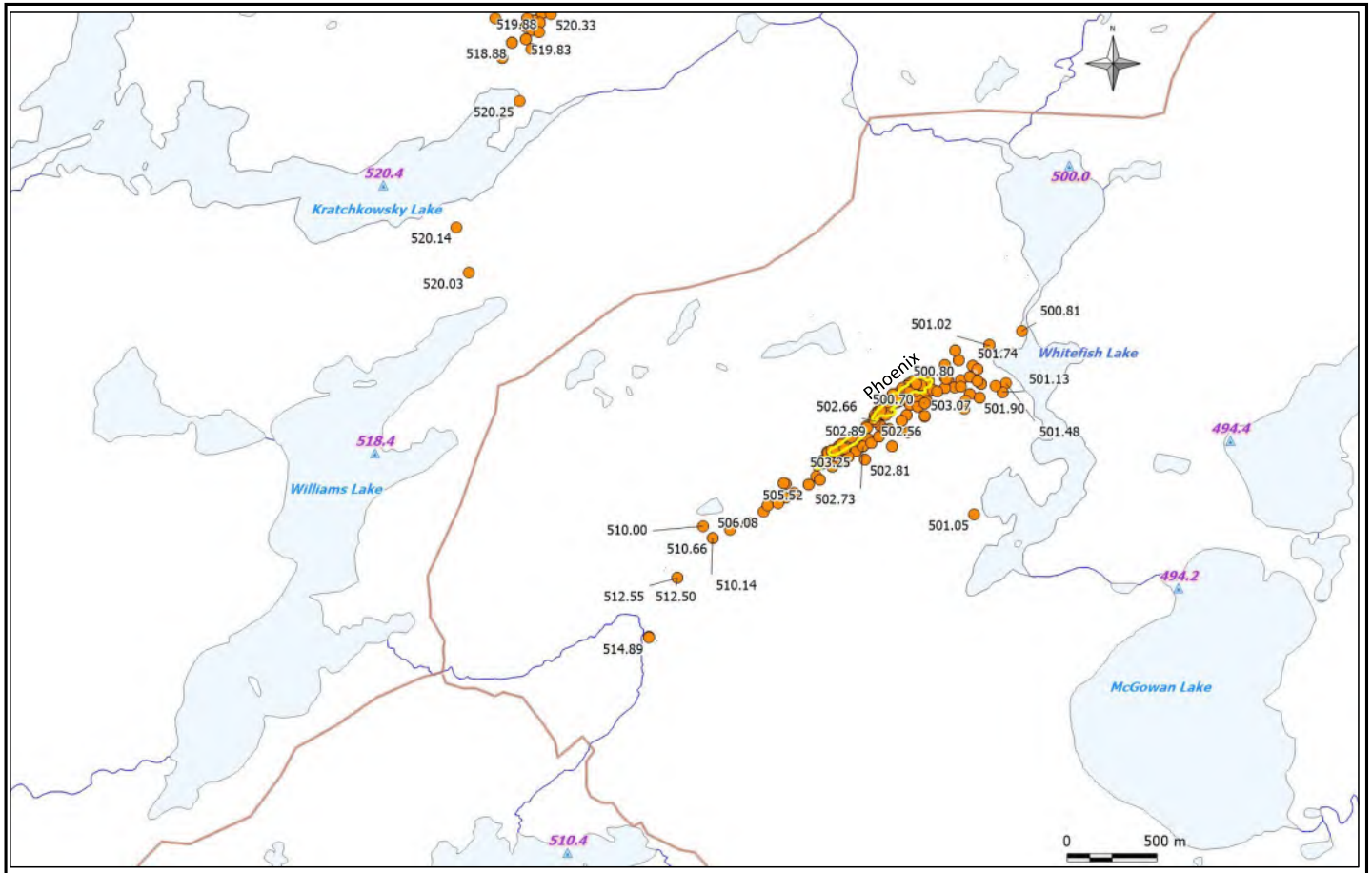
- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)
- Hydrostratigraphic Surface

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Example Cross-Section Illustrating Interpreted Hydrostratigraphic Units (Aquifers/ Aquitards)

Ecometrix Environmental INTELLIGENCE

Figure 14



LEGEND

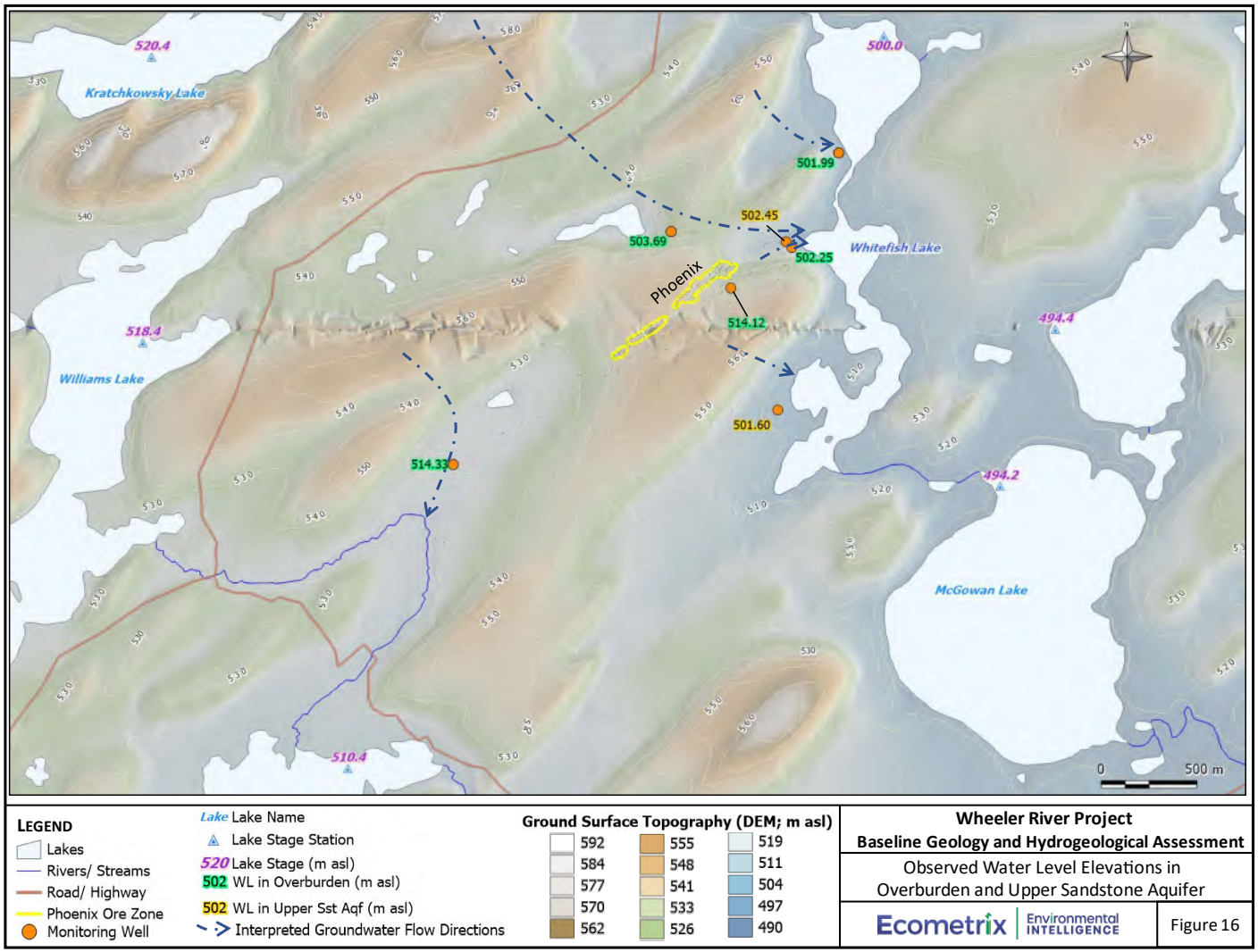
- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone
- Open Hole/ Core Hole
- 502 Water Level in Open Hole
- *Lake* Lake Name
- Lake Stage Station
- *520* Lake Stage (m asl)

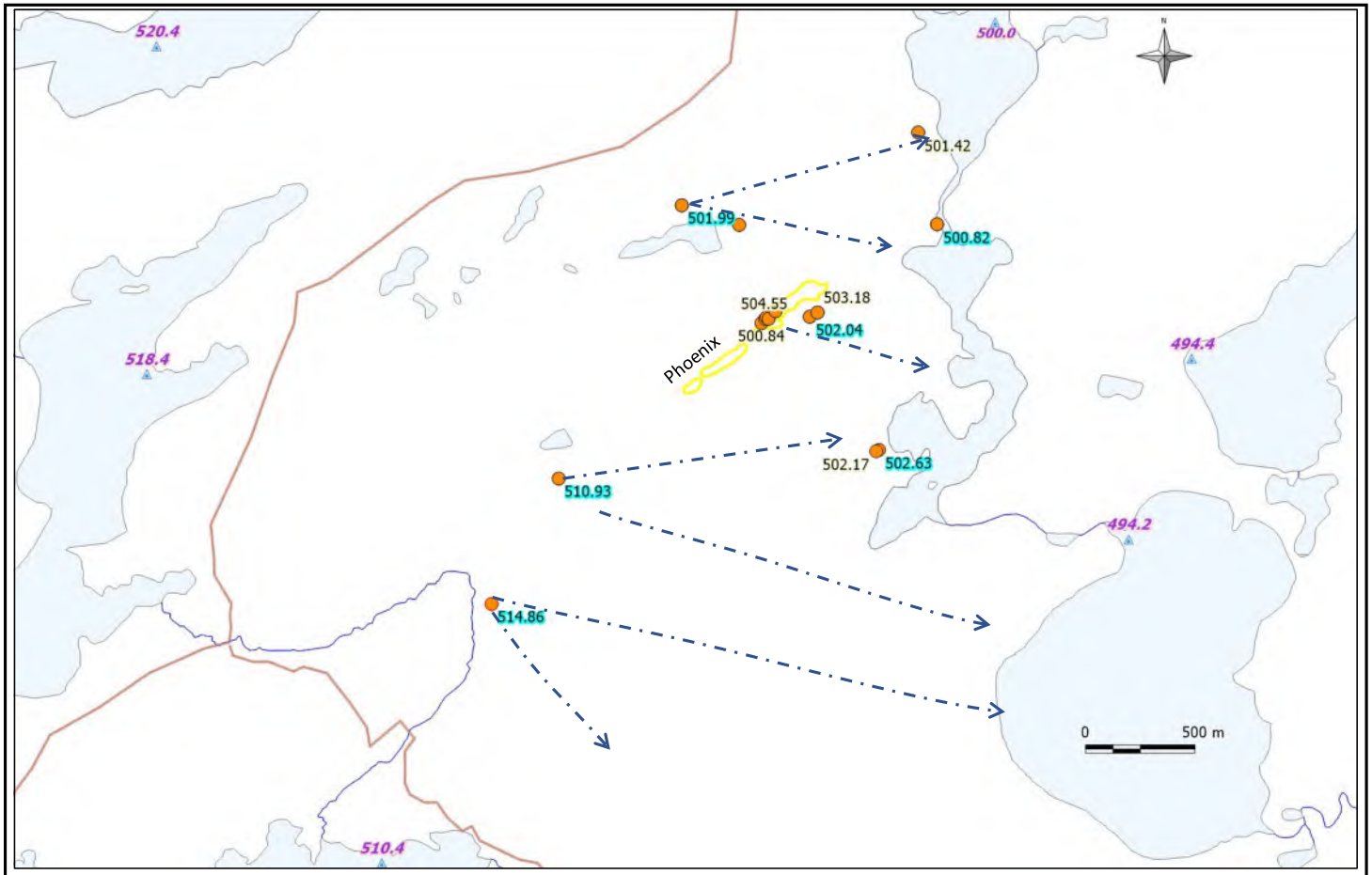
Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Observed Water Level Elevations in Open Holes

Ecometrix Environmental INTELLIGENCE

Figure 15


520.4
Kratchkowsky Lake
500.0
501.99
502.45
503.69
502.25
Whitefish Lake
Phoenix
514.12
518.4
494.4
Williams Lake
501.60
514.33
494.2
McGowan Lake
510.4
0
500 m
LEGEND
Lakes
Rivers/ Streams
Road/ Highway
Phoenix Ore Zone
Monitoring Well
Lake Lake Name
Lake Stage Station
520 Lake Stage (m asl)
502 WL in Overburden (m asl)
502 WL in Upper Sst Aqf (m asl)
Interpreted Groundwater Flow Directions
Ground Surface Topography (DEM; m asl)
592
584
577
570
562
555
548
541
533
526
519
511
504
497
490
Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Observed Water Level Elevations in
Overburden and Upper Sandstone Aquifer
Ecometrix Environmental INTELLIGENCE
Figure 16



LEGEND

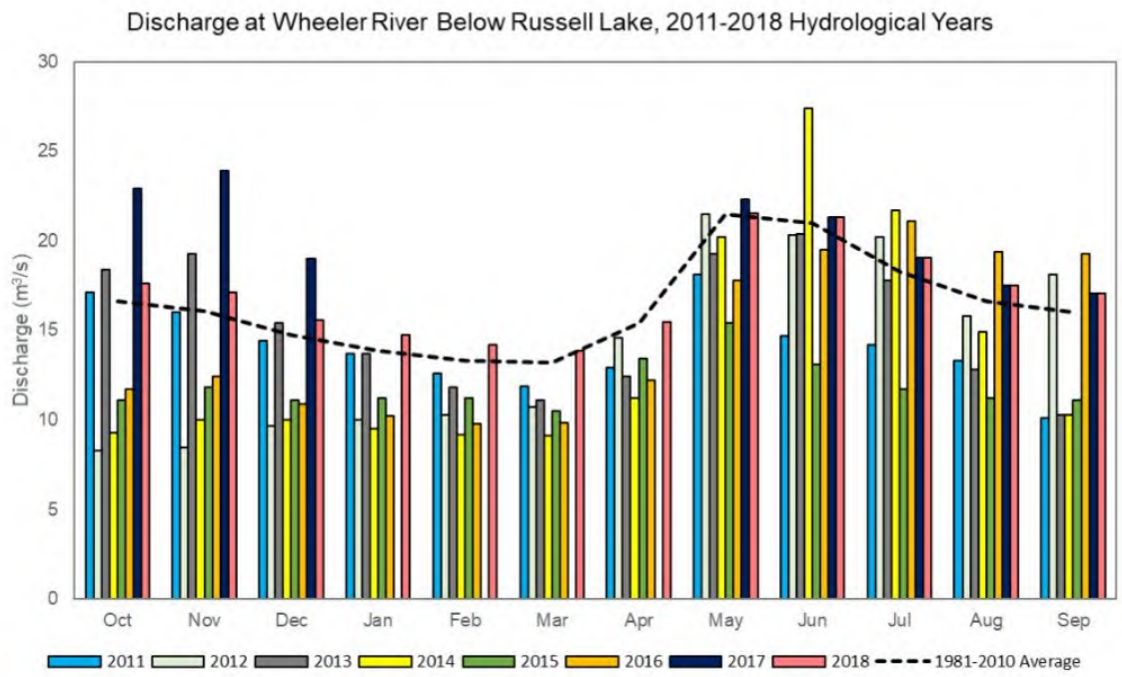
- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone
- Monitoring Well
- Lake Stage Station
- 520 Lake Stage (m asl)
- 500 Water Levels in Basement Aquifer + Lower Sandstone Aquifer
- 500 Water Levels in Intermediate Sandstone Aquitard

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Observed Water Level Elevations in Lower Sandstone Aquifer

Ecometrix Environmental INTELLIGENCE

Figure 17



Temperature norms (daily average per month, °C) reported for the Key Lake Weather Station

Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Avg
-22.3	-18.7	-11.7	-1.9	6.5	13.3	16.3	14.7	8.0	0.0	-11.8	-19.5	-2.3

LEGEND

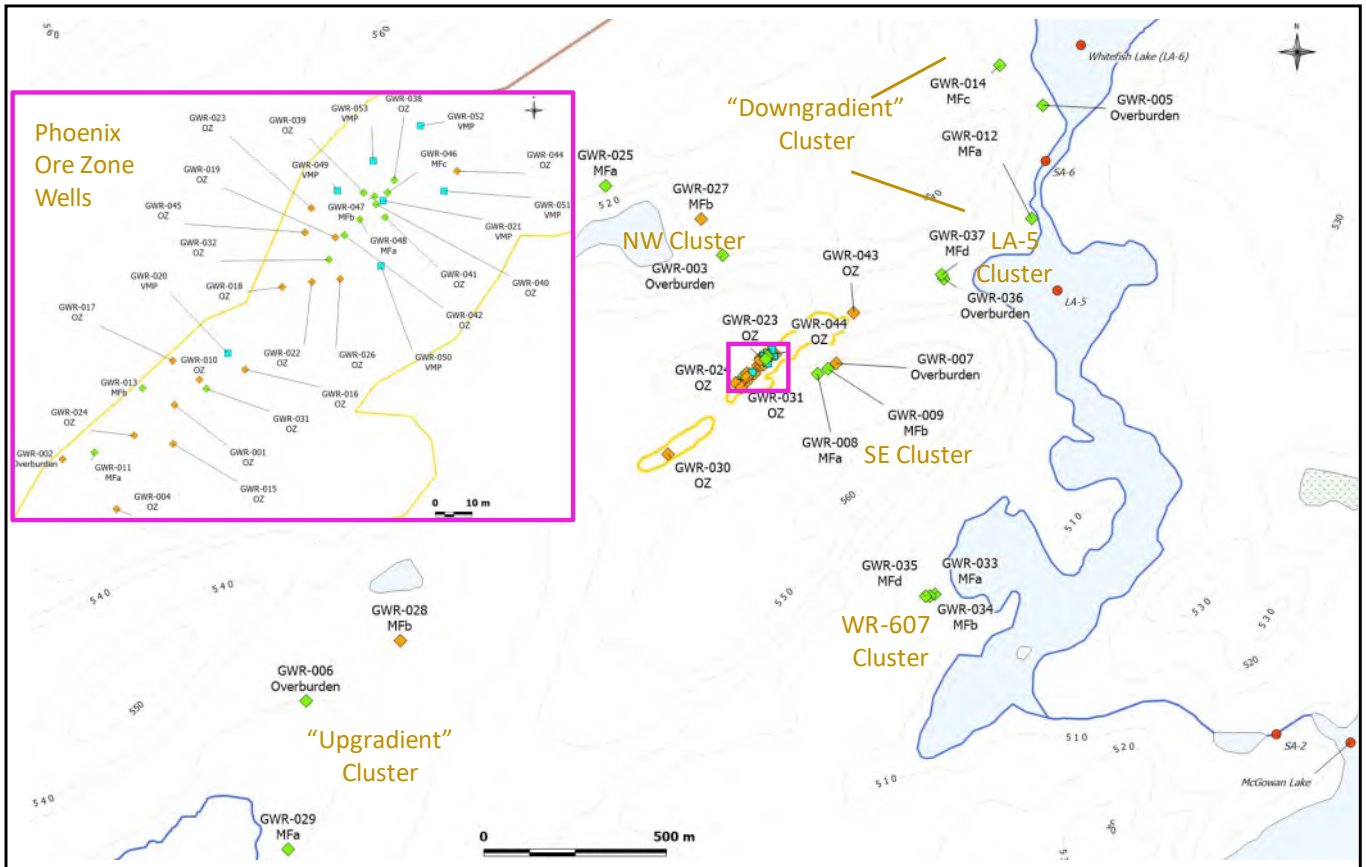
Discharge data unavailable in January to April 2017.

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Wheeler River Mean Monthly Discharge
(2011 to 2018; fromEcometrix, 2019)

Ecometrix Environmental INTELLIGENCE

Figure 18



LEGEND

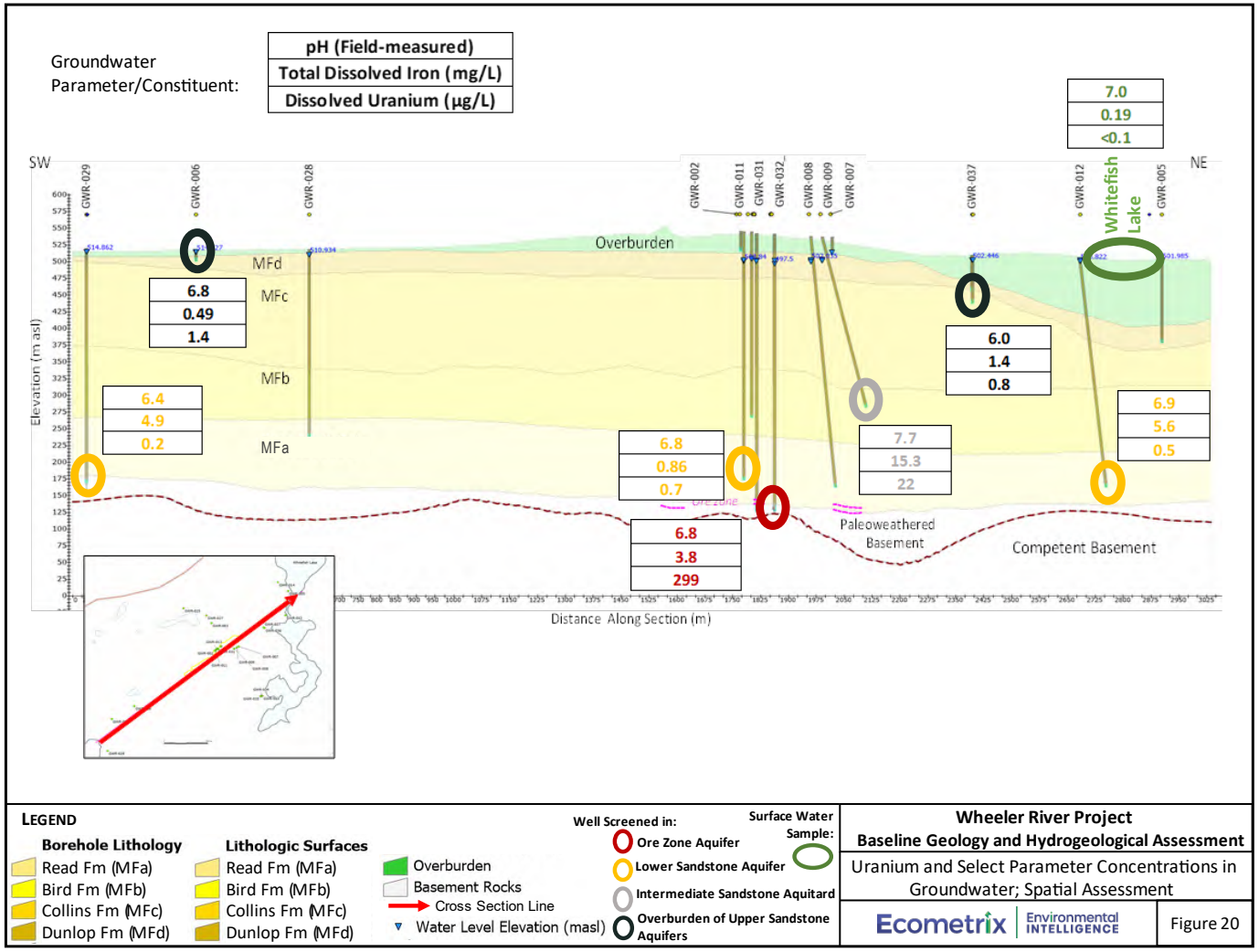
- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone
- 530 10 m Contour Interval
- Surface Topography Contour
- GWR Well Name / Screened Interval
- Monitoring Well (Not Sampled)
- Monitoring Well (Sampled)
- Vibrating Wire Piezometer (VMP)
- Surface Water Sampling Location
- LA-5 Surface Water Location Name
- Wetland

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

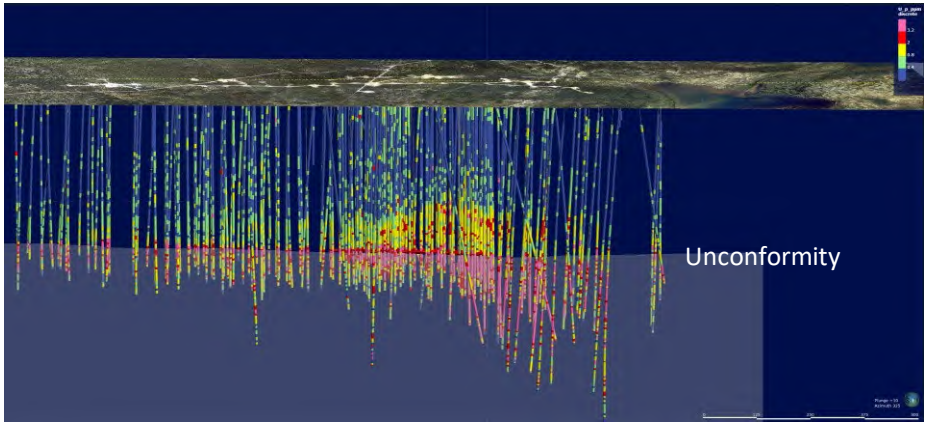
Regional Groundwater Monitoring Well Clusters

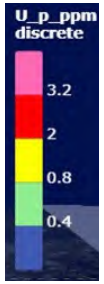
Ecometrix | Environmental INTELLIGENCE

Figure 19

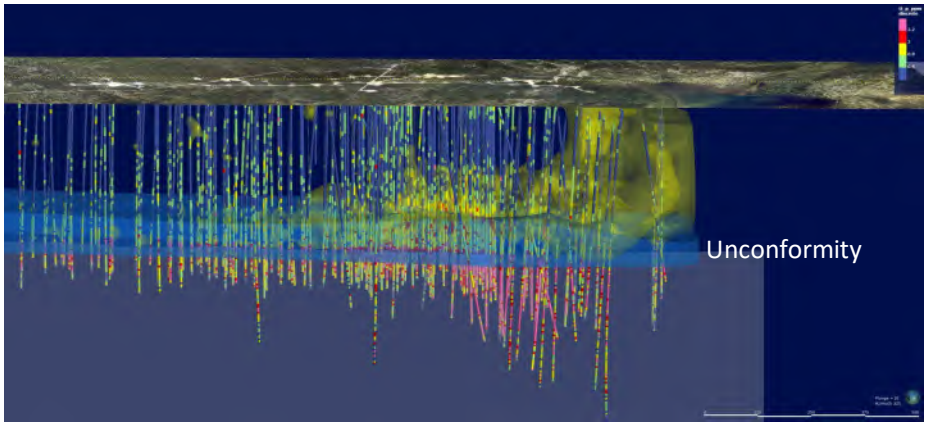

Groundwater Parameter/Constituent:
pH (Field-measured)
Total Dissolved Iron (mg/L)
Dissolved Uranium (µg/L)
SW
NE
GWR-029
GWR-006
GWR-028
GWR-002
GWR-011
GWR-031
GWR-032
GWR-008
GWR-009
GWR-007
GWR-037
GWR-012
GWR-005
Whitefish Lake
Overburden
MFd
MFc
MFb
MFa
Elevation (m asl)
Distance Along Section (m)
Paleoweathered Basement
Competent Basement
6.8
0.49
1.4
6.4
4.9
0.2
6.8
0.86
0.7
6.8
3.8
299
7.7
15.3
22
6.0
1.4
0.8
6.9
5.6
0.5
7.0
0.19
<0.1
LEGEND
Borehole Lithology
Read Fm (MFa)
Bird Fm (MFb)
Collins Fm (MFc)
Dunlop Fm (MFd)
Lithologic Surfaces
Read Fm (MFa)
Bird Fm (MFb)
Collins Fm (MFc)
Dunlop Fm (MFd)
Overburden
Basement Rocks
Cross Section Line
Water Level Elevation (masl)
Well Screened in:
Ore Zone Aquifer
Lower Sandstone Aquifer
Intermediate Sandstone Aquitard
Overburden of Upper Sandstone Aquifers
Surface Water Sample:
Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Uranium and Select Parameter Concentrations in Groundwater; Spatial Assessment
Ecometrix Environmental INTELLIGENCE
Figure 20

a) Uranium distribution in core samples; Partial Digestion





b) Uranium distribution in core samples; Partial Digestion, with MFa and Desilicified Zone geologic model layers shown



LEGEND

Read Formation (MFa) Layer

Desilicified Zone Layer

Cross Section Line

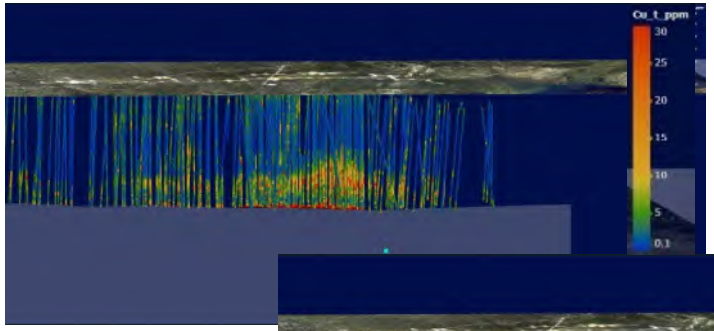
Images are from Denison 3D Geologic Model

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

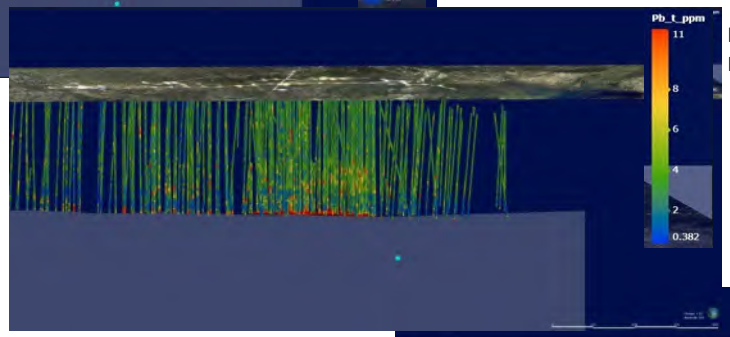
Distribution of Solid-Phase Uranium Concentrations (ppm) in the Subsurface

Ecometrix | Environmental INTELLIGENCE

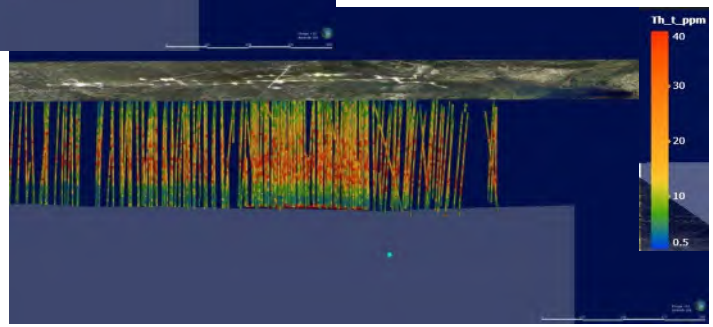
Figure 21



a) Copper distribution in core samples; partial digestion



b) Lead distribution in core samples; partial digestion



c) Thorium distribution in core samples; Partial Digestion

LEGEND

Cross Section Line

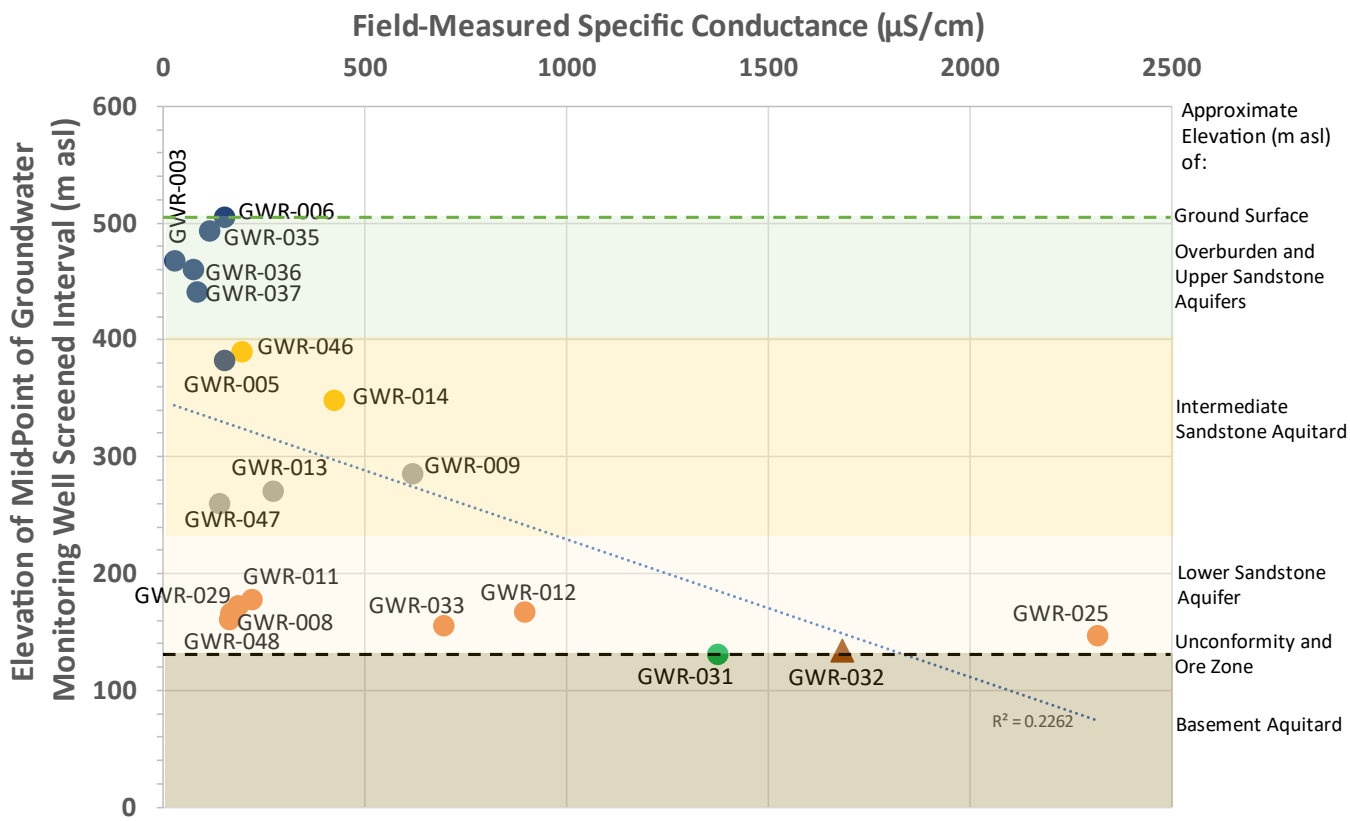
Images are from Denison 3D Geologic Mode

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Distribution of Select Elemental Concentrations (ppm) in the Subsurface

Ecometrix | Environmental INTELLIGENCE

Figure 22



LEGEND

- MFa
- MFb
- MFc
- Overburden and MFd
- Ore Zone
- Paleoweathered Zone
- Linear (Overburden and Athabasca Sandstone Group HUs)

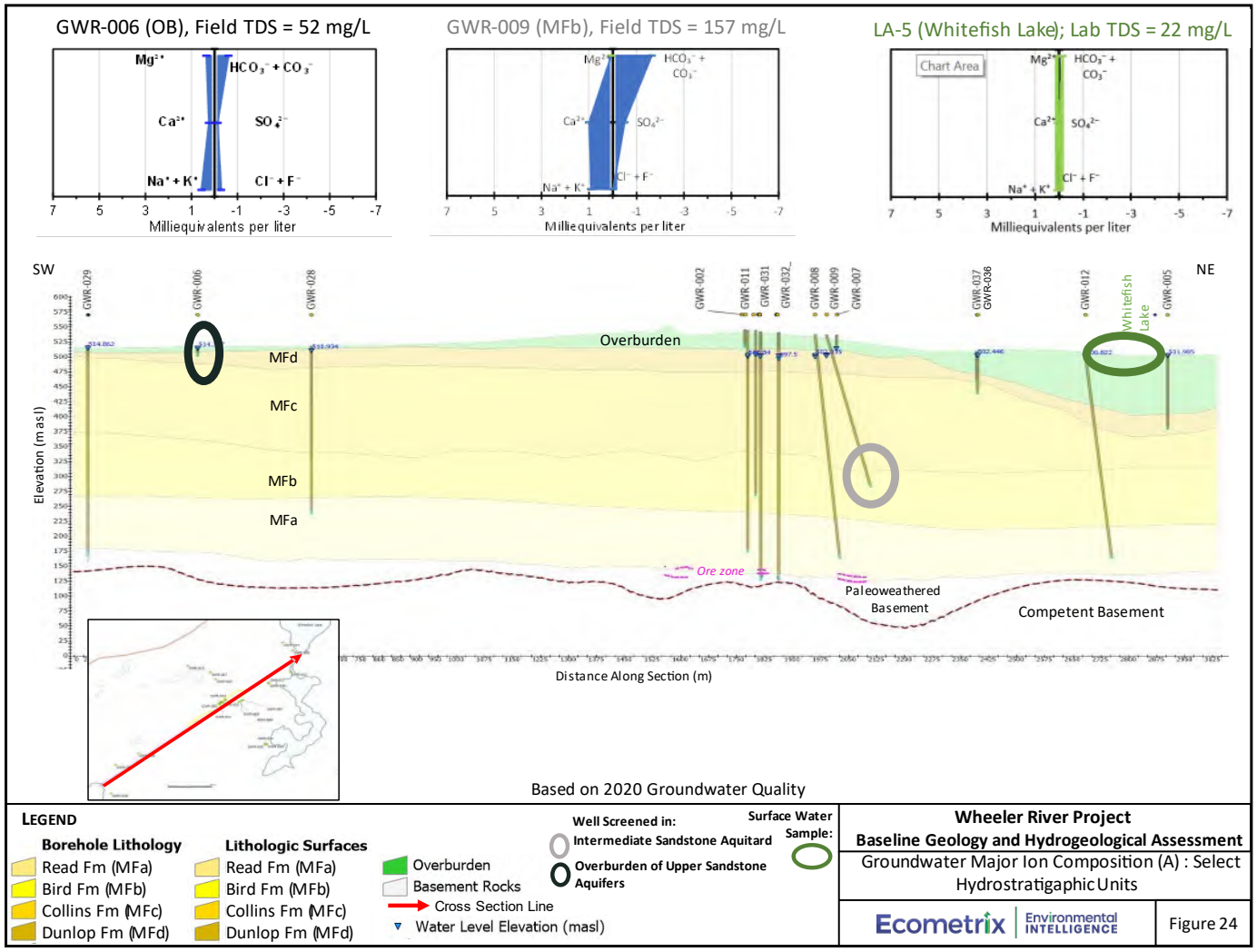
Based on 2021 Groundwater Quality

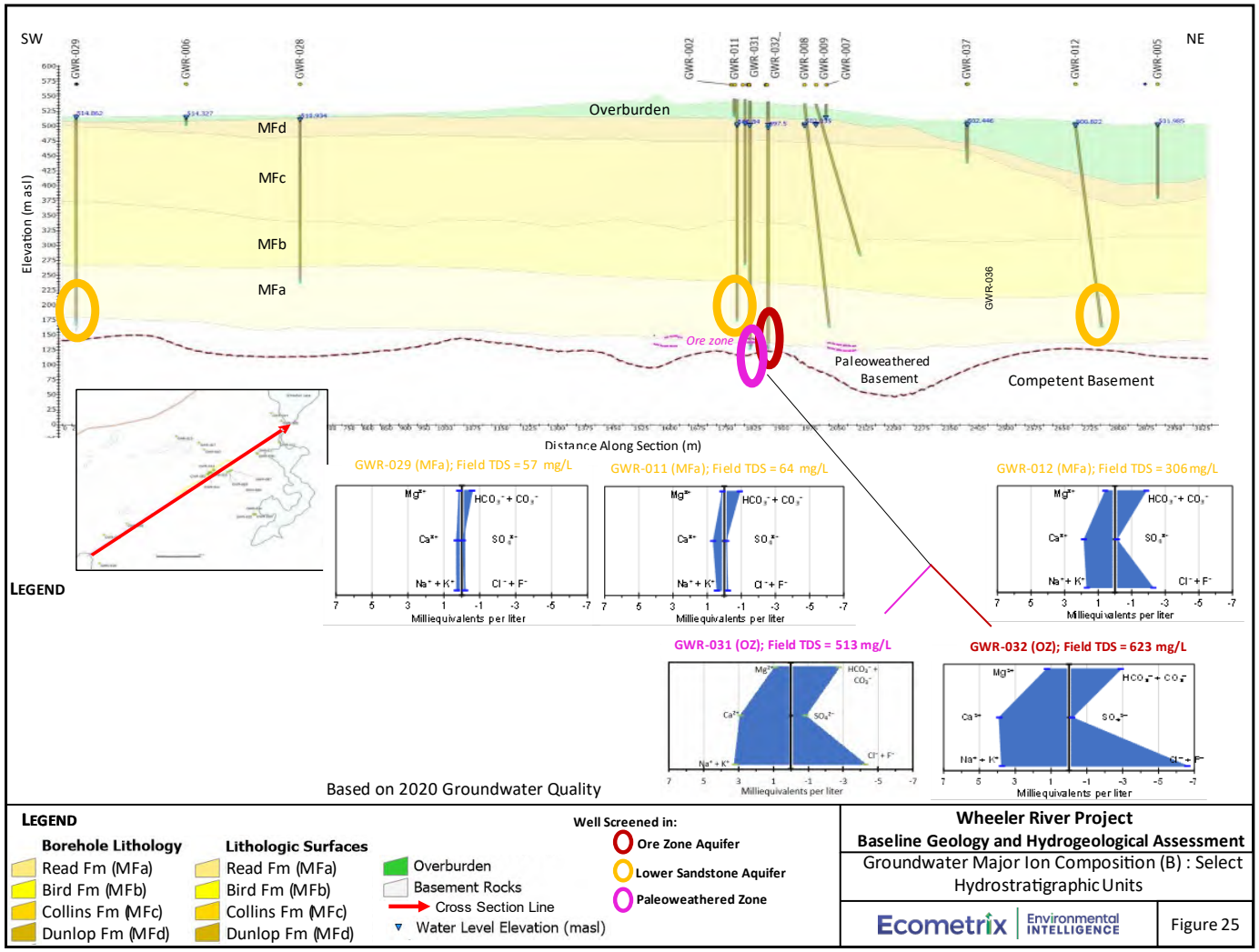
Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Specific Conductance in Groundwater with Elevation of Well Screened Interval

Ecometrix Environmental INTELLIGENCE

Figure 23


GWR-006 (OB), Field TDS = 52 mg/L
GWR-009 (MFb), Field TDS = 157 mg/L
LA-5 (Whitefish Lake); Lab TDS = 22 mg/L
Milliequivalents per liter
SW
NE
Elevation (m asl)
Overburden
MFd
MFc
MFb
MFa
Ore zone
Paleoweathered Basement
Competent Basement
Whitefish Lake
Distance Along Section (m)
Based on 2020 Groundwater Quality
LEGEND
Borehole Lithology
Read Fm (MFa)
Bird Fm (MFb)
Collins Fm (MFc)
Dunlop Fm (MFd)
Lithologic Surfaces
Read Fm (MFa)
Bird Fm (MFb)
Collins Fm (MFc)
Dunlop Fm (MFd)
Overburden
Basement Rocks
Cross Section Line
Water Level Elevation (masl)
Well Screened in:
Intermediate Sandstone Aquitard
Overburden of Upper Sandstone Aquifers
Surface Water Sample:
Wheeler River Project
Baseline Geology and Hydrogeological Assessment
Groundwater Major Ion Composition (A) : Select Hydrostratigaphic Units
Ecometrix Environmental INTELLIGENCE
Figure 24



LEGEND

Borehole Lithology
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Cross Section Line
- Water Level Elevation (masl)

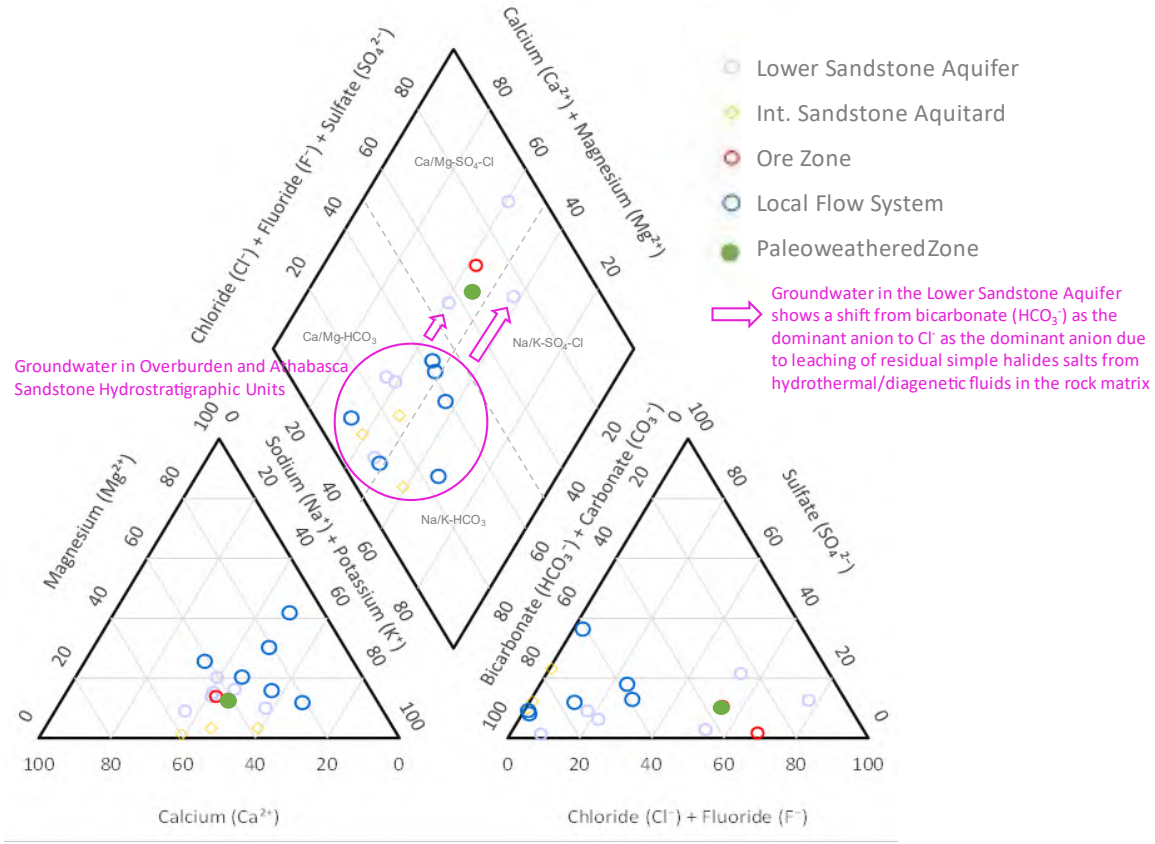
Well Screened in:
- **Ore Zone Aquifer**
- **Lower Sandstone Aquifer**
- **Paleoweathered Zone**

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

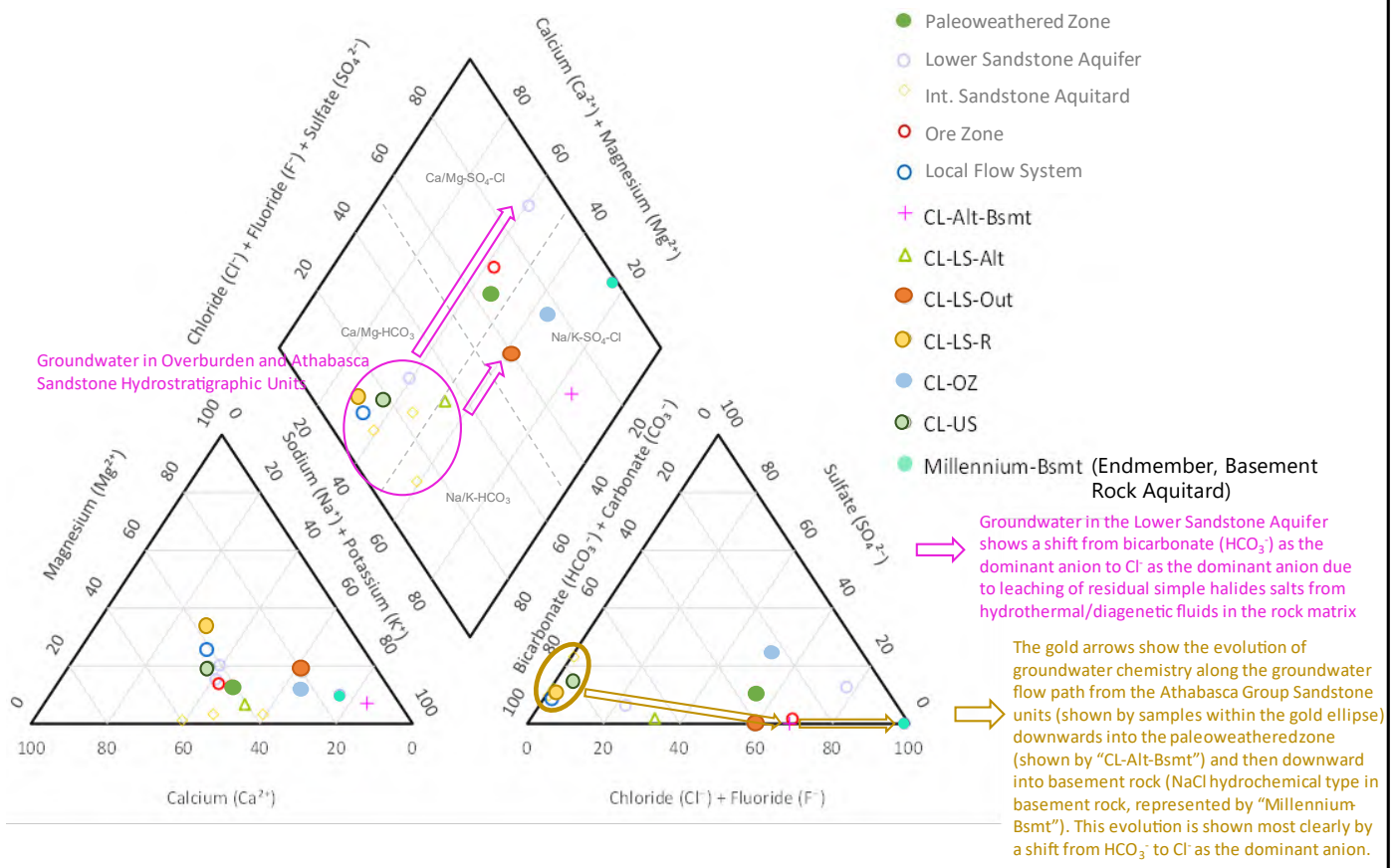
Groundwater Major Ion Composition (B) : Select Hydrostratigraphic Units

Ecometrix | Environmental INTELLIGENCE

Figure 25



	Wheeler River Project **Baseline Geology and Hydrogeological Assessment**
	Hydrochemical Type: Groundwaters for the Wheeler River Project
Based on (Project) 2020 Groundwater Quality	Ecometrix Environmental INTELLIGENCE — Figure 26



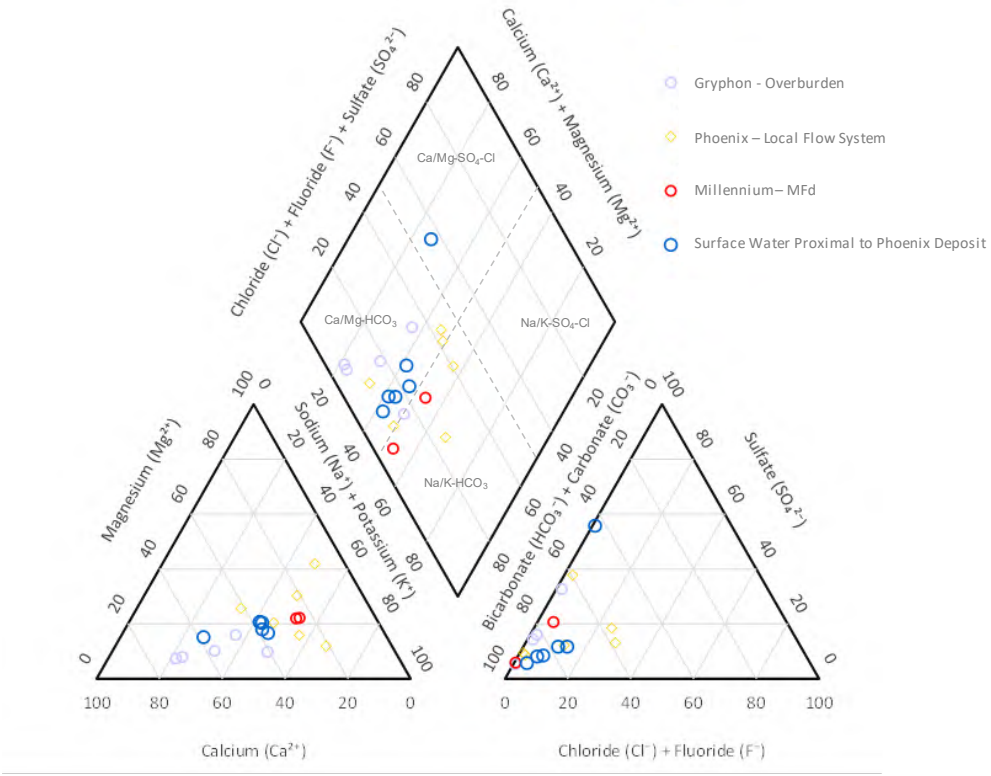
Groundwater in the Lower Sandstone Aquifer shows a shift from bicarbonate (HCO_3^-) as the dominant anion to Cl^- as the dominant anion due to leaching of residual simple halides salts from hydrothermal/diagenetic fluids in the rock matrix

The gold arrows show the evolution of groundwater chemistry along the groundwater flow path from the Athabasca Group Sandstone units (shown by samples within the gold ellipse) downwards into the paleoweatheredzone (shown by "CL-Alt-Bsmt") and then downward into basement rock (NaCl hydrochemical type in basement rock, represented by "Millennium-Bsmt"). This evolution is shown most clearly by a shift from HCO_3^- to Cl^- as the dominant anion.

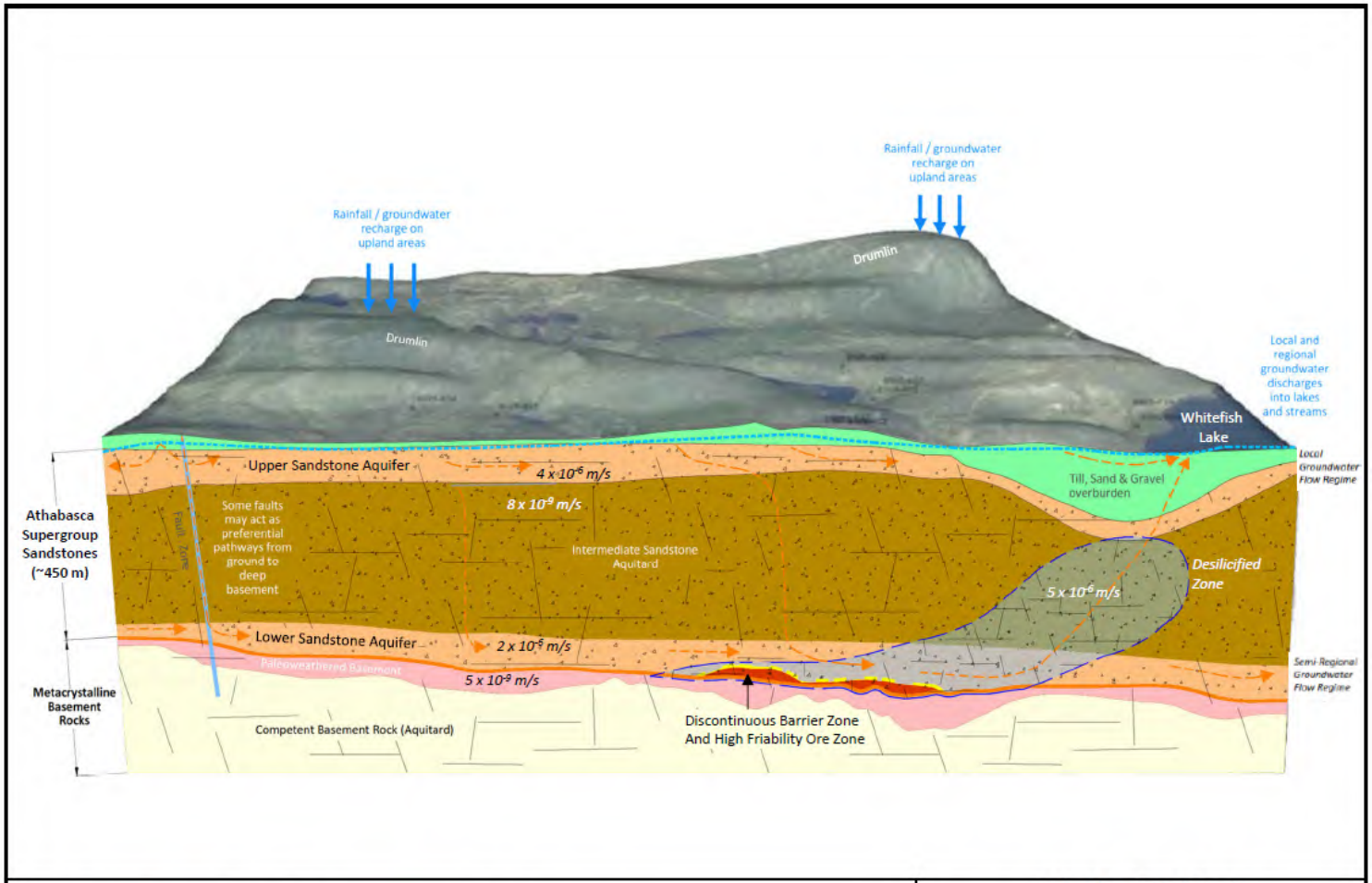
Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Hydrochemical Type: Groundwaters for the Wheeler River, Cigar Lake and Millennium Projects

Ecometrix Environmental INTELLIGENCE | Figure 27



	Wheeler River Project **Baseline Geology and Hydrogeological Assessment**	
	Hydrochemical Type: Select Local Flow System Samples and Surface Water Samples	
Based on (Project) 2020 Groundwater Quality	Ecometrix Environmental INTELLIGENCE	Figure 28



LEGEND			
Groundwater Flow		Clay Cap	
Fractures		High Friability Ore Zone	
Fault		Water Table	
Unconformity	2×10^{-7} m/s	Geomean of Field Based Hydraulic Conductivity Values	

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

Summary Conceptual Site Model for the Phoenix Area

Ecometrix Environmental INTELLIGENCE

Figure 29

Appendix A Borehole Logs

STRIPLOGS LEGEND:

Structure Interval Codes

STRUCTURE TYPE CODE	Description	STRUCTURE TYPE CODE	Description
BC	Broken core	**UC**	Unconformity Contact
BED	Bedding	**OF**	Open fracturing
BK	Blocky core	**RB**	
BN	Banded	**RF**	Reticulate
BP	Brittle overprint	**S#**	Strong brittle overprint
BX	Breccia	**SGG**	Sandy Gouge
CABX	Cataclastic Breccia	**SH**	Shear
CON	Contact	**SK**	Slickenside
CY	Clay	**SZ**	Shear Zone
FA	Fold Axis	**LC**	Lost core
FCTZ	Fracture Zone	**LN**	Lineation
FLT	Fault	**MY**	Mylonite
FLTZ	Fault Zone	**UC**	Unconformity Contact
FOL	Foliation	**UN**	Unconsolidated
FRAC	Fracture	**VN**	Veining is common
FRC	Fracture	**VUG**	Vuggy
FRIA	Friable Zone	**WX**	Weak breccia
FT	Brittle fault zone	**XB**	Cross Bedding
FTDU	Ductile shear zone	**XC**	Cross Cutting Fracture
FTSBR	Semi-brittle fault zone	**XH**	Healed breccia
GG	Gouge	**HF**	Healed fracturing
GN	Gneissosity		

Lithology

ROCK TYPE CODE	Description	ROCK TYPE CODE	Description
CDPL	Cordierite pelite	MFC	Manitou falls c form
CY	Clay?	MFD	Manitou falls d form
GTCD	Garnet cord. Pelite	PEGM	Pegmatite
GTPL	Garnitiferous pelite	PELT	Pelite
FLTGG	Fault gouge	QZIT	Quartzite
FLZN	Fault zone	QZSP	Quartz semipelite
GFPL	Graphitic pelite	QZVN	Vein quartz
GTPL	Garnitiferous pelite	SDST	Sandstone
LC	Lost core	UC	Unconformity
LOST	Lost core	UX	Uranium intersection
MFA	Manitou falls a form		
MFB	Manitou falls b form		

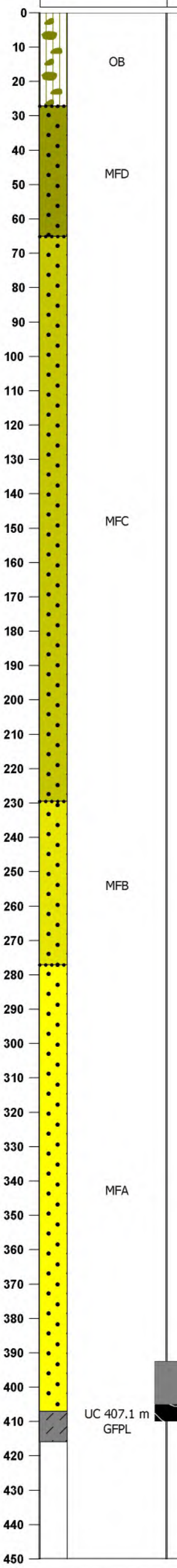
Hydrogeology Units

HYDRO UNIT	Description	HYDRO UNIT	Description
1a	Overlying Sandstone	**2d**	Sulphide or Hematite Cemented U Zone
1b	Sulphide Cemented Sandstone	**2e**	Lower Clay Zone
2a	Upper Clay Zone	**3a**	Paleoweathered Basement
2b	Black or Brown Friable or High-Density U	**3b**	Underlying Basement
2c	Mineralized Brown Redox U Zone		

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-001
Project:	Phoenix	Drilling method:	DDH
Drilling End Date:	2019	Total depth:	415.9 m
		Hole Type:	PQ

Coordinates: 477,077.48 m E ; 6,374,175.3 m N
Elevation: 542.03 m.



Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB						
MFD						
MFC						
MFB						
MFA	PVC Casing	PVC Casing	0	403.62	403.62	2.5" SCH-80 PVC
	Cement	Cement	392.4	405.4	13	
UC 407.1 m GFPL	Packer	Packer	403.62	405.67	2.05	PQ Inflatable Packer
	Ore Zone	Ore Zone	405	409.99	4.01	
	Screen	Screen	405.67	409.99	4.32	2.5" SCH-80 Slotted Screen
	PVC Casing	PVC Casing	409.99	415.9	5.91	2.5" SCH-80 PVC
	Cap	Cap	415.88	415.9	0.02	

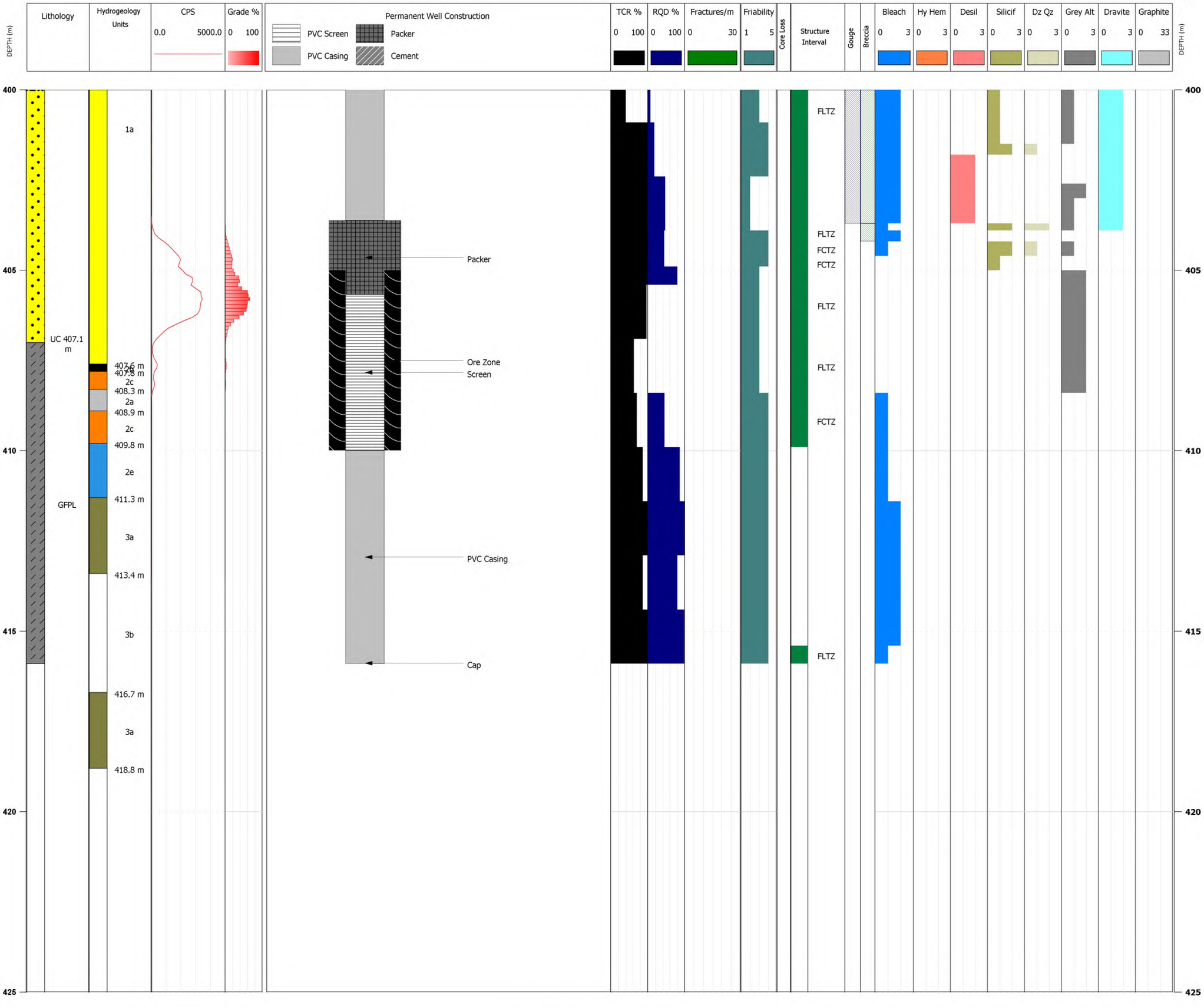
Comments: Depth below surface.

Denison Mines

Title:	Basement Geochemistry	Drillhole #	GWR-001
Project:	Wheeler River	Drilling method:	DDH
Geologist:		Total depth:	415.9 m
Date:	2019		

Coordinates E; N:477,077.48 ; 6,374,175.29 Elevation:542.03

Comments: Basement Geochemistry



Denison Mines

Title:	Well Schematic	Drillhole #	GWR-002
Project:	Phoenix	Drilling method:	DDH
Drilling End Date:	2019	Total depth:	28.5 m
		Hole Type:	HQ

Coordinates: 477,046.95 m E ; 6,374,160.5 m N
Elevation: 545.23 m.

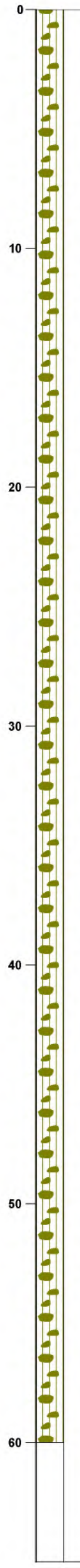
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	22.5	22.5	2" SCH-40
	Packer	Shale Packer	22.5	22.5	0	
	Screen	PVC Screen	24.3	28.5	6	2" SCH-40
	Cap	Cap	28.5	28.52	0.2	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-003
Project:	Phoenix	Drilling method:	
Drilling End Date:	2019	Total depth:	60 m
		Hole Type:	HQ

Coordinates: 477,009.95 m E ; 6,374,510.2 m N
Elevation: 525.58 m.



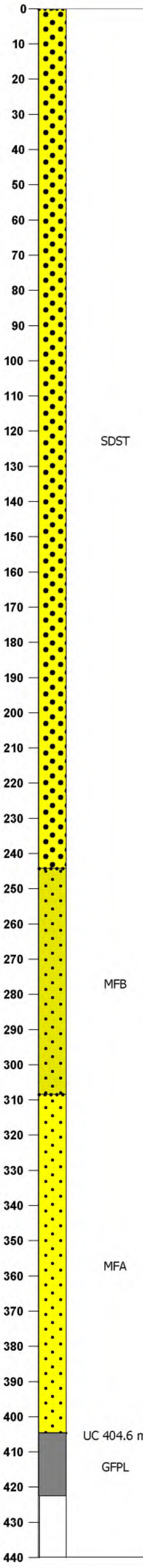
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	54.06	54.6	2" SCH-40
	Packer	Shale Packer	54.06	54.06	0	
	Screen	PVC Screen	54.06	60	5.94	2" SCH-40
	Cap	Cap	60	60.2	0.2	

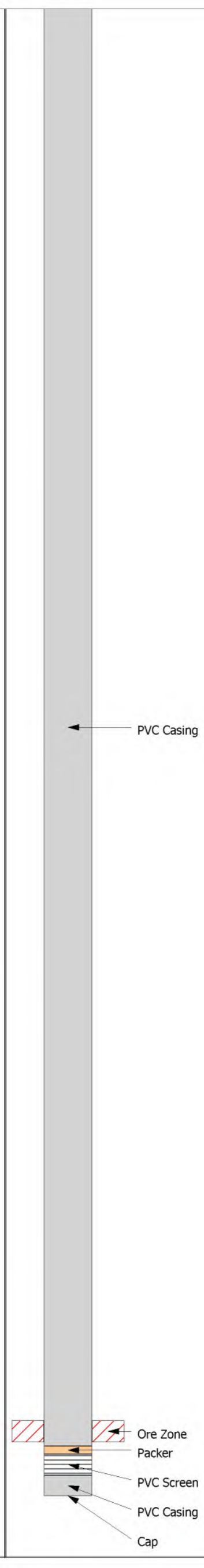
Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-004
Project:	Phoenix	Drilling method:	DDH
Logged by	XX	Total depth:	422.5 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,061.65 m E ; 6,374,146.8 m N
Elevation: 541.87 m.





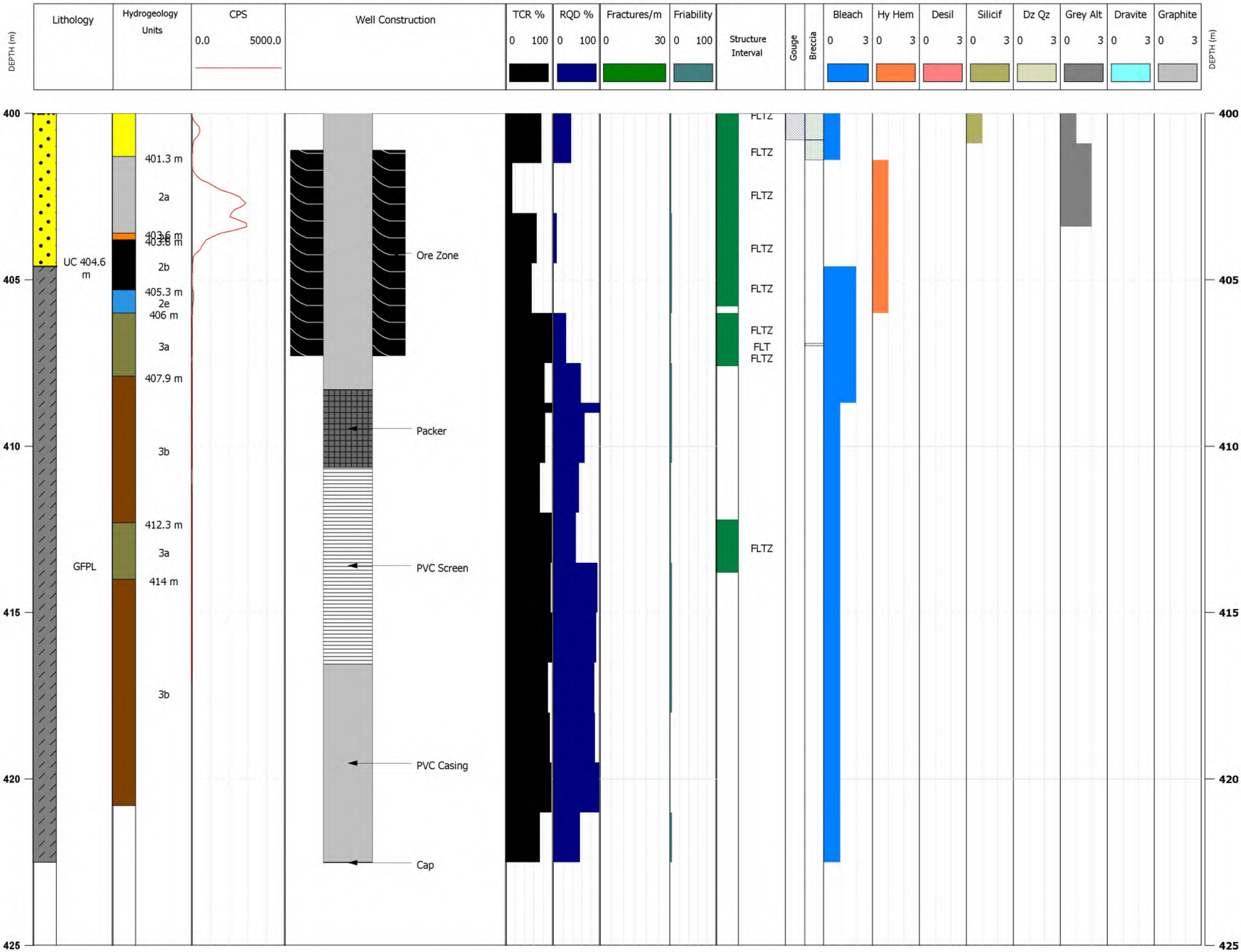
Lithology	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
PVC Casing	PVC Casing	0	408.3	408.3	1.5" SCH-80 PVC
Ore Zone	Ore Zone	401.1	407.3	6.2	
Packer	Packer	408.3	410.63	2.3	HQ Inflatable Packer
PVC Screen	PVC Screen	410.63	416.55	5.92	1.5" SCH-80 Slotted Screen
PVC Casing	PVC Casing	416.55	422.5	5.95	1.5" SCH-80 PVC
Cap	Cap	422.5	422.52	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-004
Project:	Phoenix	Drilling method:	DDH
Logged by	BDB	Total depth:	422.5 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,061.65 m E ; 6,374,146.8 m N
Elevation: 541.87 m.
Comments: Edit-Text



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-005
Project:	Phoenix	Drilling method:	
Drilling End Date:	2019	Total depth:	123 m
		Hole Type:	HQ

Coordinates: 477,887.75 m E ; 6,374,920.95 m N
Elevation: 503.39 m.

Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	PVC Casing	PVC Casing	0	117.06	117.06	2" SCH-40
	Packer	Shale Packer	117.06	117.06	0	
	Screen	PVC Screen	117.06	123	5.94	2" SCH-40
	Cap	Cap	123	123.02	0.2	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-006
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	15 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 475,867.96 m E ; 6,373,287.58 m N
Elevation: 517.32 m.

Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	PVC Casing	PVC Casing	0	9.06	9.06	2" SCH-40
	Packer	Shale Packer	9.06	9.06	0	
	Screen	PVC Screen	9.06	15	5.94	2" SCH-40
	Cap	Cap	15	15.2	0.2	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-007
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	24 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,320.96 m E ; 6,374,213.5 m N
Elevation: 536.18 m.

DEPTH (m)

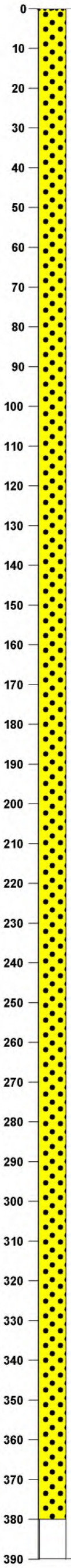
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	Bentonite	Bentonite	0	18.06	18.06	Bentonite chips
	PVC Casing	PVC Casing	0	18.06	18.06	2" SCH-40
	Shale Packer	Shale Packer	18.06	18.06	0	
	Screen	PVC Screen	18.06	24	5.94	2" SCH-40
24 m	Cap	Cap	24	24.2	0.2	

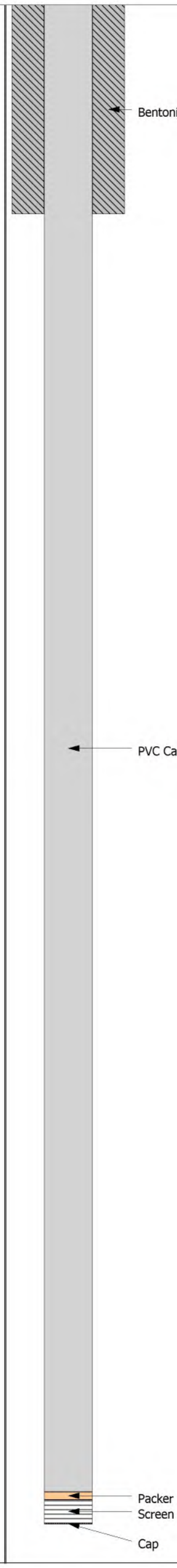
Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-008
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	380 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,269.89 m E ; 6,374,185.3 m N
Elevation: 537.5 m.





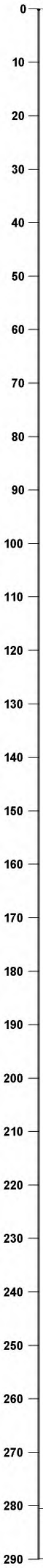
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Bentonite	Bentonite	0	52.4	52.4	Bentonite chips
SDST	PVC Casing	PVC Casing	0	372.16	372.16	1.5" SCH-80
	Packer	HQ Inflatable Packer	372.16	374.06	1.9	
	Screen	PVC Screen	380	380	5.94	1.5" SCH-80
	Cap	Cap	24	380.2	0.2	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-009
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	280.55 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,298.66 m E ; 6,374,198.4 m N
Elevation: 536.7 m.



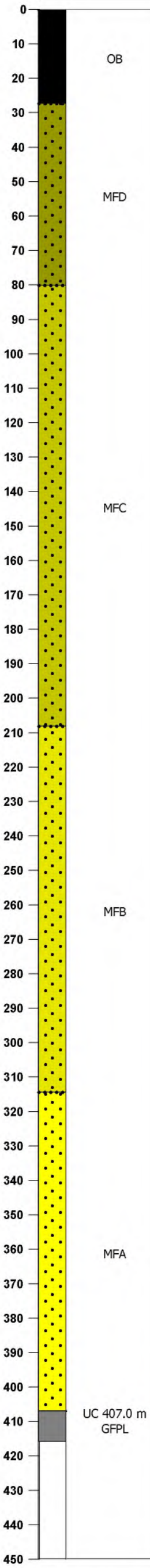
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Bentonite	Bentonite	0	42	42	Bentonite Chips
	PVC Casing	PVC Casing	0	272.16	272.16	1.5" SCH-80
SDST						
	Cement	Cement	256	274	18	
	Packer	HQ Inflatable Packer	272.16	274.06	1.9	
	Screen	PVC Screen	274.06	280.55	5.94	1.5" SCH-80
	Cap	Cap	280.57	280.57	0.2	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-010
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	415.8 m
Drilling End Date:	2019	Hole Type:	PQ

Coordinates: 477,084.28 m E ; 6,374,182.2 m N
Elevation: 543.31 m.



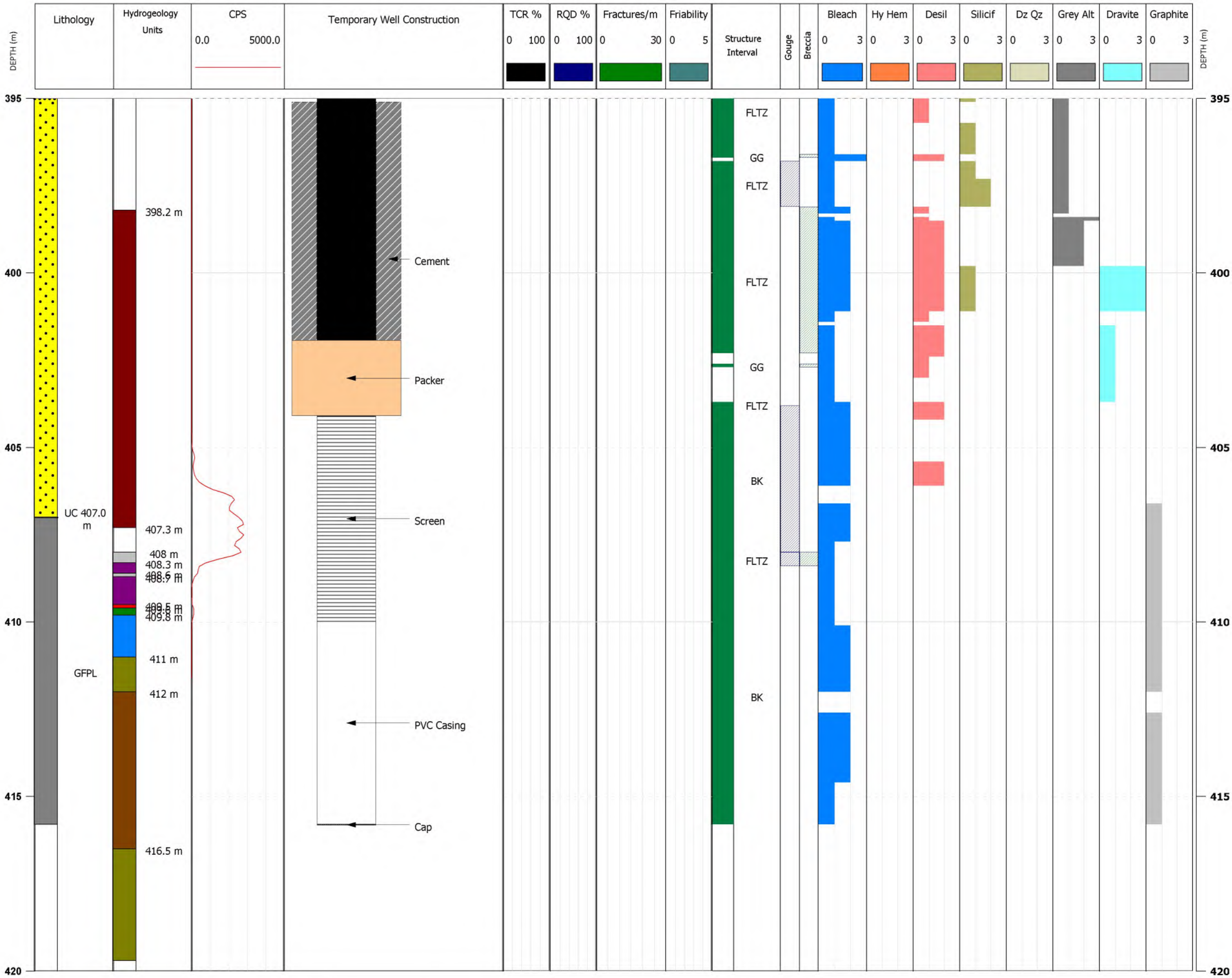
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	401.93	401.93	2.5" SCH-80
	Cement	Cement	395.1	404.1	9	
	Packer	HQ Inflatable Packer	401.93	404.1	2.17	
	Ore Zone	Ore zone	403.5	407.6	4.1	
	Screen	PVC Screen	404.1	409.98	5.88	2.5" SCH-80
	PVC Casing	PVC Casing	409.98	415.8	5.82	
	Cap	Cap	415.8	415.82	0.2	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematic	Drillhole #	GWR-010
Project:	Phoenix	Drilling method:	DDH
Logged by	BDB	Total depth:	415.8 m
Drilling End Date:	2019	Hole Type:	PQ

Coordinates: 477,084.28 m E ; 6,374,182.2 m N
Elevation: 543.31 m.
Comments: Edit-Text



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

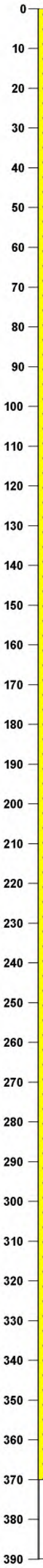
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-011
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	370 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,055.63 m E ; 6,374,162.4 m N
Elevation: 544.2 m.



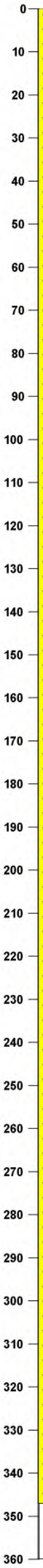
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
SDST	PVC Casing	PVC Casing	0	362.1	362.1	1.5" PVC Sch 80
370 m	Cement	Cement	354	364	10	
	Packer	Packer	362.1	364	1.9	Inflatable Packer
	PVC Screen	PVC Screen	364	370	6	1.5" PVC Well Screen Sch 80
	Cap	Cap	369.98	370	0.02	Sch 80

Comments: Depth below surface. No logs available.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-012
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	347 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,856.61 m E ; 6,374,611.0 m N
Elevation: 503.24 m.



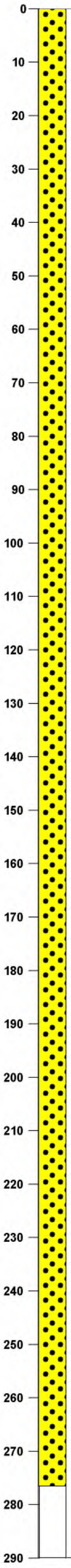
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
SDST	PVC Casing	PVC Casing	0	339.1	339.1	1.5" PVC Sch 80
347 m	Cement	Cement	331	341	10	
	Packer	Packer	339.1	341	1.9	Inflatable Packer
	PVC Screen	PVC Screen	341	347	6	1.5" PVC Well Screen Sch 80
	Cap	Cap	346.98	347	0.02	Sch 80

Comments: Depth below surface. No logs available.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-013
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	276.5 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,068.72 m E ; 6,374,179.9 m N
Elevation: 544.18 m.



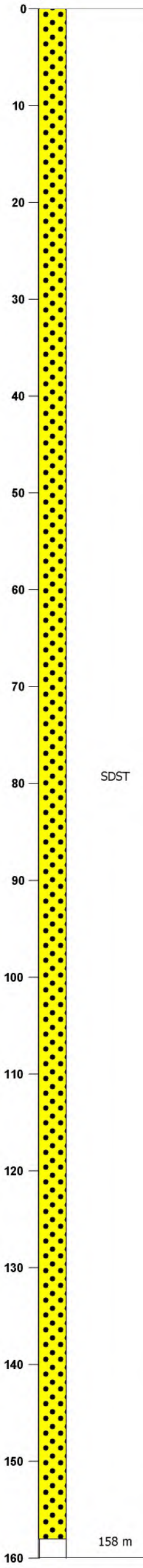
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
SDST	PVC Casing	PVC Casing	0	268.7	268.7	1.5" PVC Sch 80
276.5 m	Cement	Cement	262	272	10	
	Packer	Packer	268.7	270.6	1.9	Inflatable Packer
	PVC Screen	PVC Screen	270.6	276.5	5.9	1.5" PVC Well Screen Sch 80
	Cap	Cap	276.48	276.5	0.02	Sch 80

Comments: Depth below surface. No logs available.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-014
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	158 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,770.65 m E ; 6,375,029.8 m N
Elevation: 502.9 m.



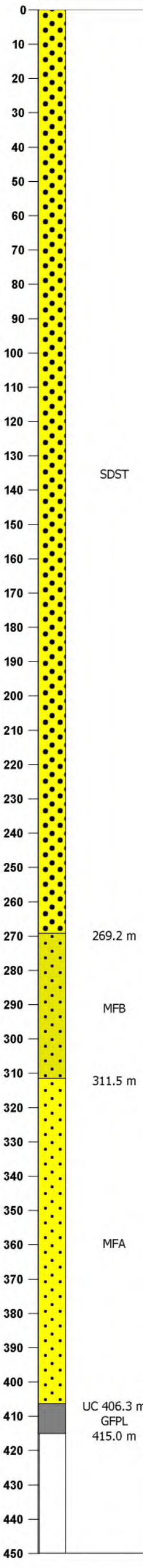
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Bentonite	Bentonite	0	50	50	Bentonite Chips
	PVC Casing	PVC Casing	0	150.2	150.2	1.5" PVC Sch 80
	Cement	Cement	142	152	10	
	Packer	Packer	150.2	152.1	1.9	Inflatable Packer
	PVC Screen	PVC Screen	152.1	158	5.9	1.5" PVC Well Screen Sch 80
	Cap	Cap	157.98	158	0.02	Sch 80

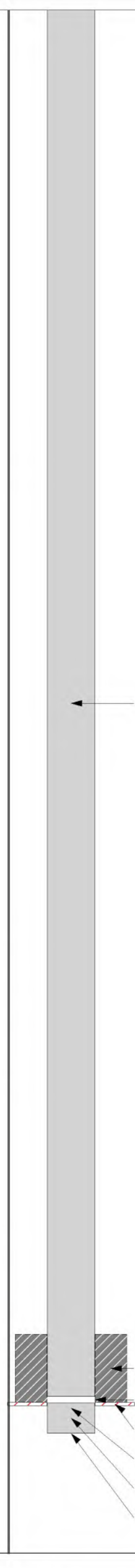
Comments: Depth below surface. No logs available.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-015
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	415.0 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,077.03 m E ; 6,374,164.7 m N
Elevation: 542.4 m.





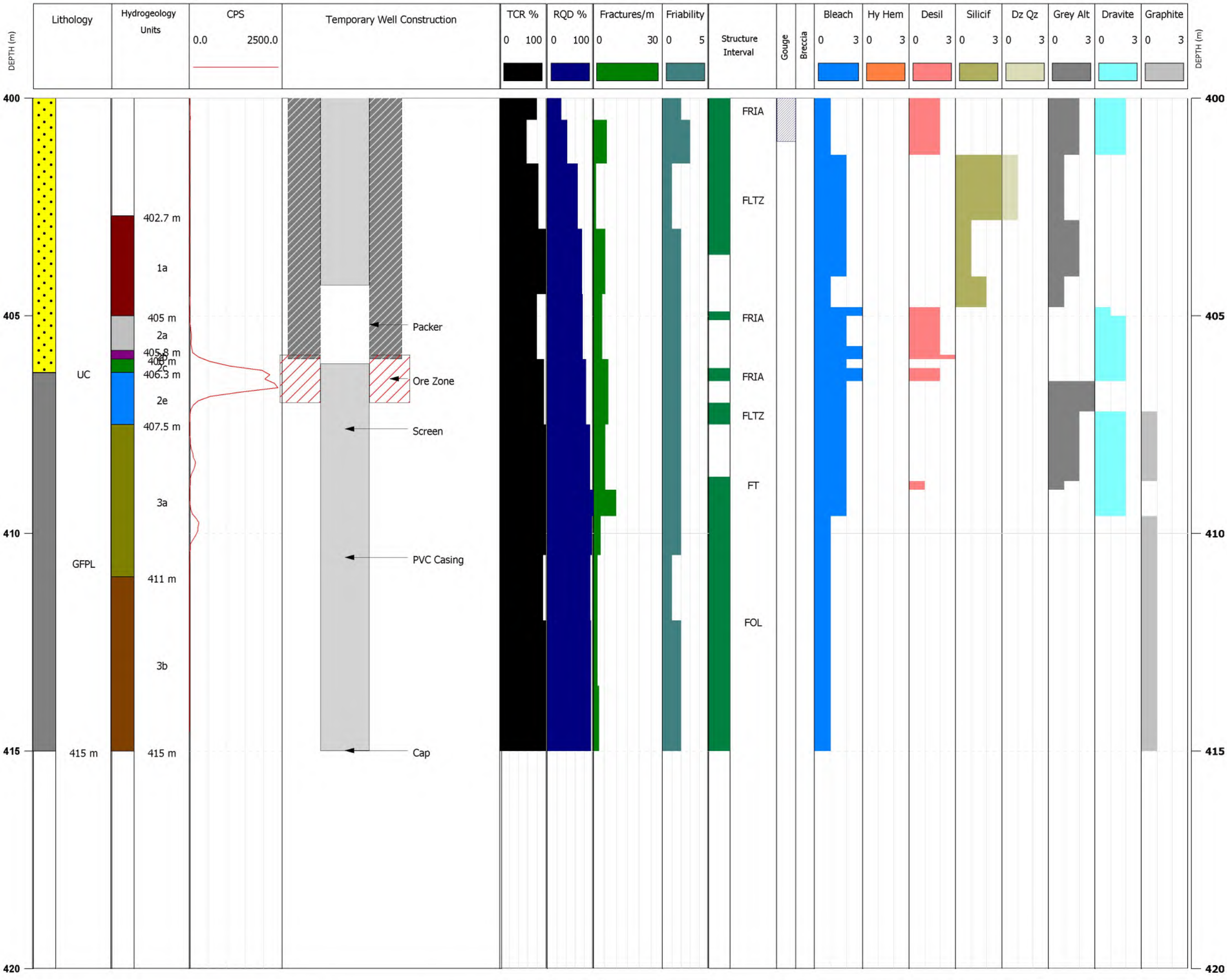
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	404.3	404.3	1.5" SCH-80 PVC
	Cement	Cement	386	406	20	
	Packer	Packer	404.3	406.1	1.8	HQ Inflatable Packer
	Ore Zone	Ore Zone	405.9	407	1.1	
	Screen	Screen	406.1	409.1	3	1.5" SCH-80 Slotted Well screen
	PVC Casing	PVC Casing	406.1	415	8.9	1.5" SCH-80 PVC
	Cap	Cap	414.98	415	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-015
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	415 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,077.03 m E ; 6,374,164.7 m N
Elevation: 542.4 m.
Comments: Hydrogeology units logged from photos.



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

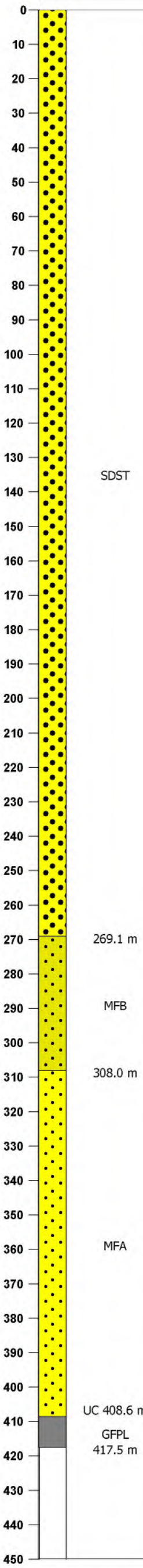
Alterations

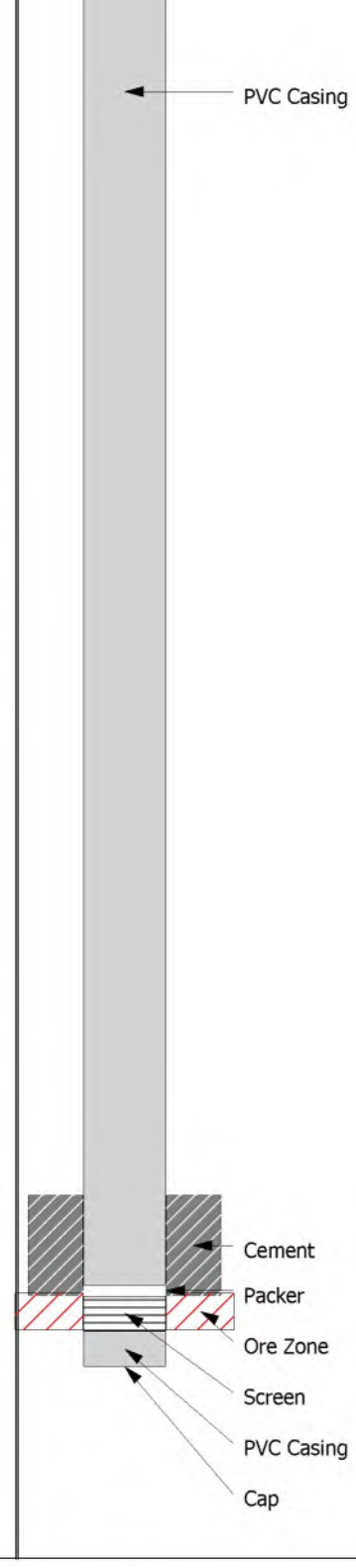
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-016
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	417.5 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,096.72 m E ; 6,374,185.0 m N
Elevation: 542.73 m.



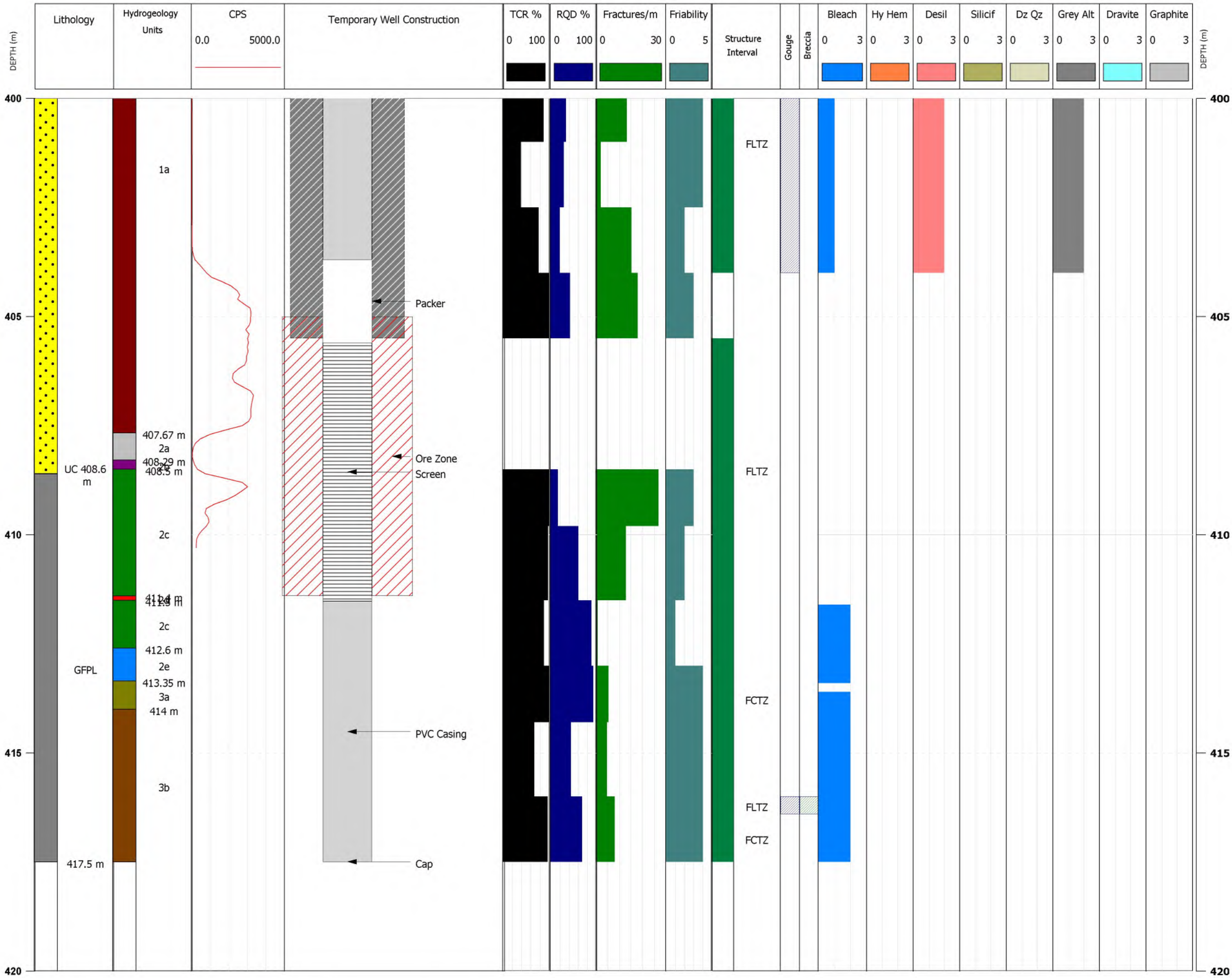


Lithology	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
PVC Casing	PVC Casing	0	403.7	403.7	1.5" SCH-80 PVC
Cement	Cement	388.5	405.5	17	
Packer	Packer	403.7	405.6	1.9	HQ Inflatable Packer
Ore Zone	Ore Zone	405	411.4	6.4	
Screen	Screen	405.6	411.52	5.92	1.5" SCH-80 Slotted Well screen
PVC Casing	PVC Casing	411.52	417.5	5.98	1.5" SCH-80 PVC
Cap	Cap	417.48	417.5	0.02	

Comments: Depth below surface.

Title:	Well Schematics	Drillhole #	GWR-016
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	417.5 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,096.72 m E ; 6,374,185.0 m N
Elevation: 542.73 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

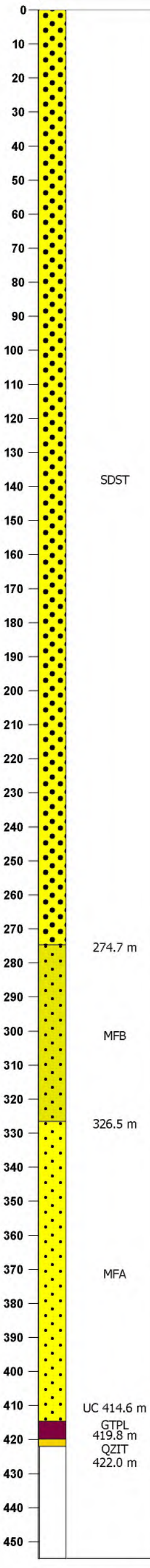
Alterations

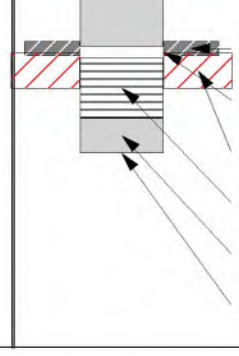
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-017
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	422.0 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,076.95 m E ; 6,374,187.4 m N
Elevation: 543.08 m.





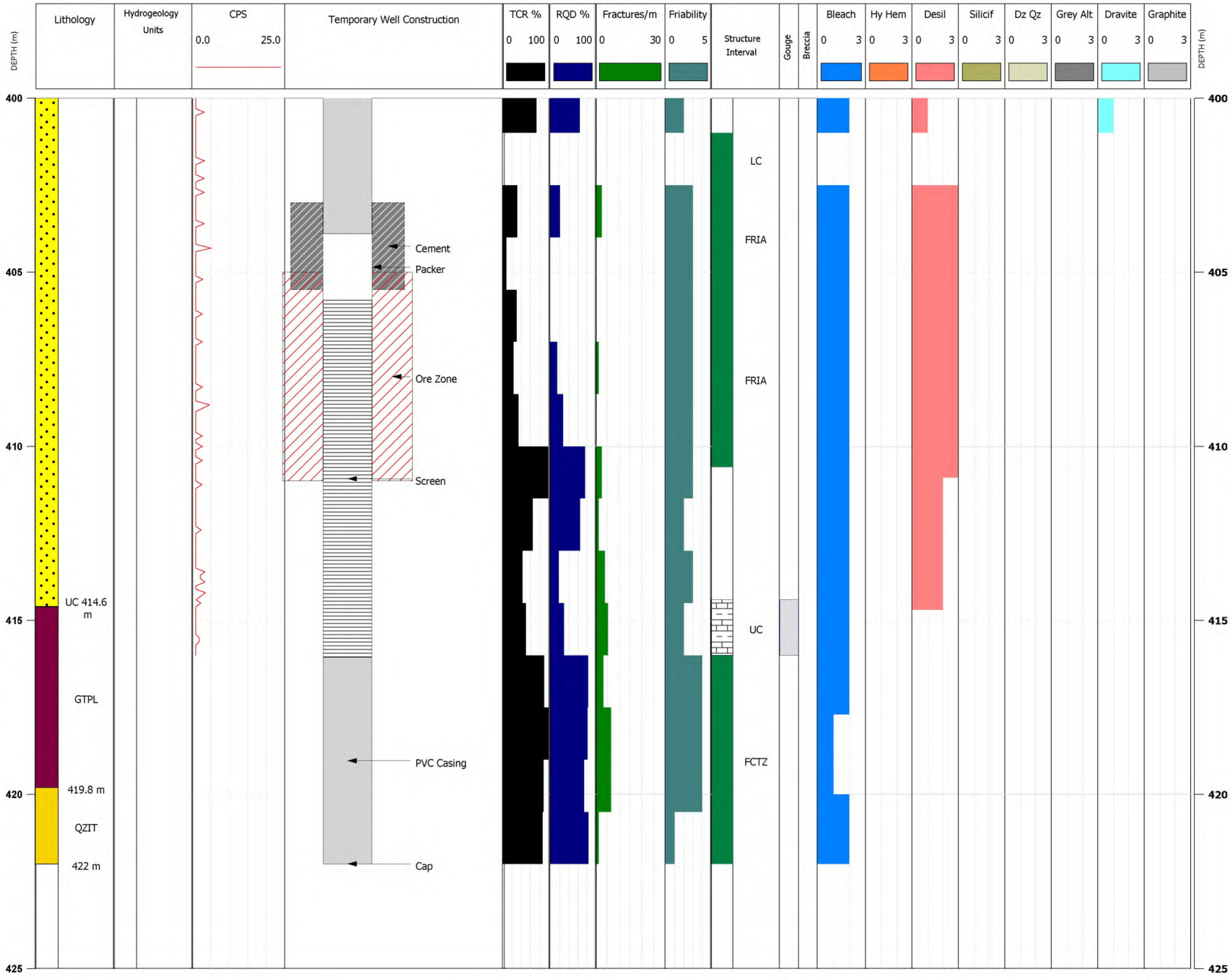
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	403.9	403.9	1.5" SCH-80 PVC
	Cement	Cement	403	405.5	2.5	HQ Inflatable Packer
	Packer	Packer	403.9	405.8	1.9	1.5" SCH-80 Slotted Well screen
	Ore Zone	Ore Zone	405	411	6	1.5" SCH-80 PVC
	Screen	Screen	405.8	416.06	10.26	
	PVC Casing	PVC Casing	416.06	422	5.94	
	Cap	Cap	421.98	422	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-017
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	422 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,076.95 m E ; 6,374,187.4 m N
Elevation: 543.08 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

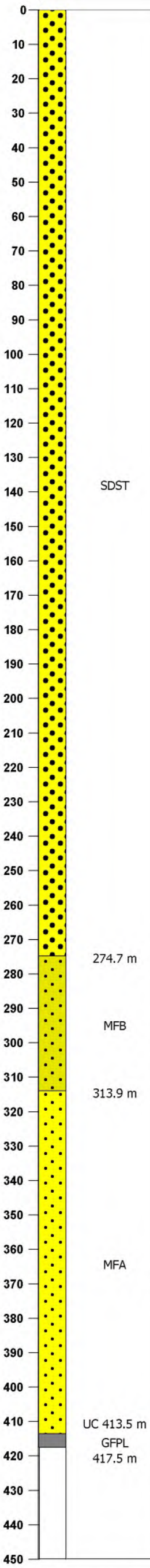
Alterations

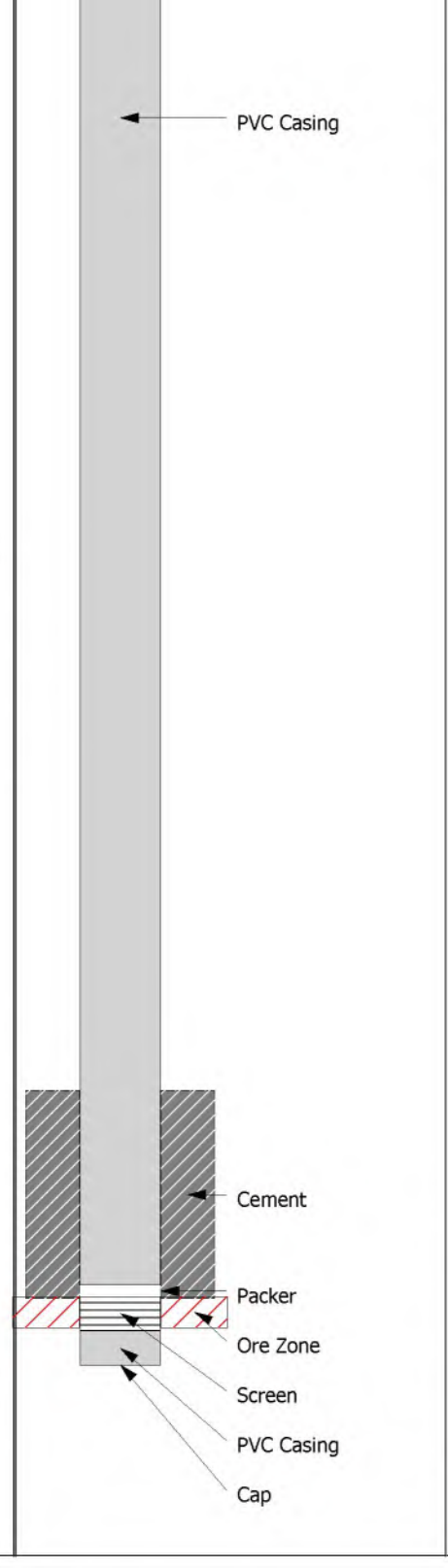
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-018
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	417.5 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,106.84 m E ; 6,374,207.4 m N
Elevation: 541.36 m.





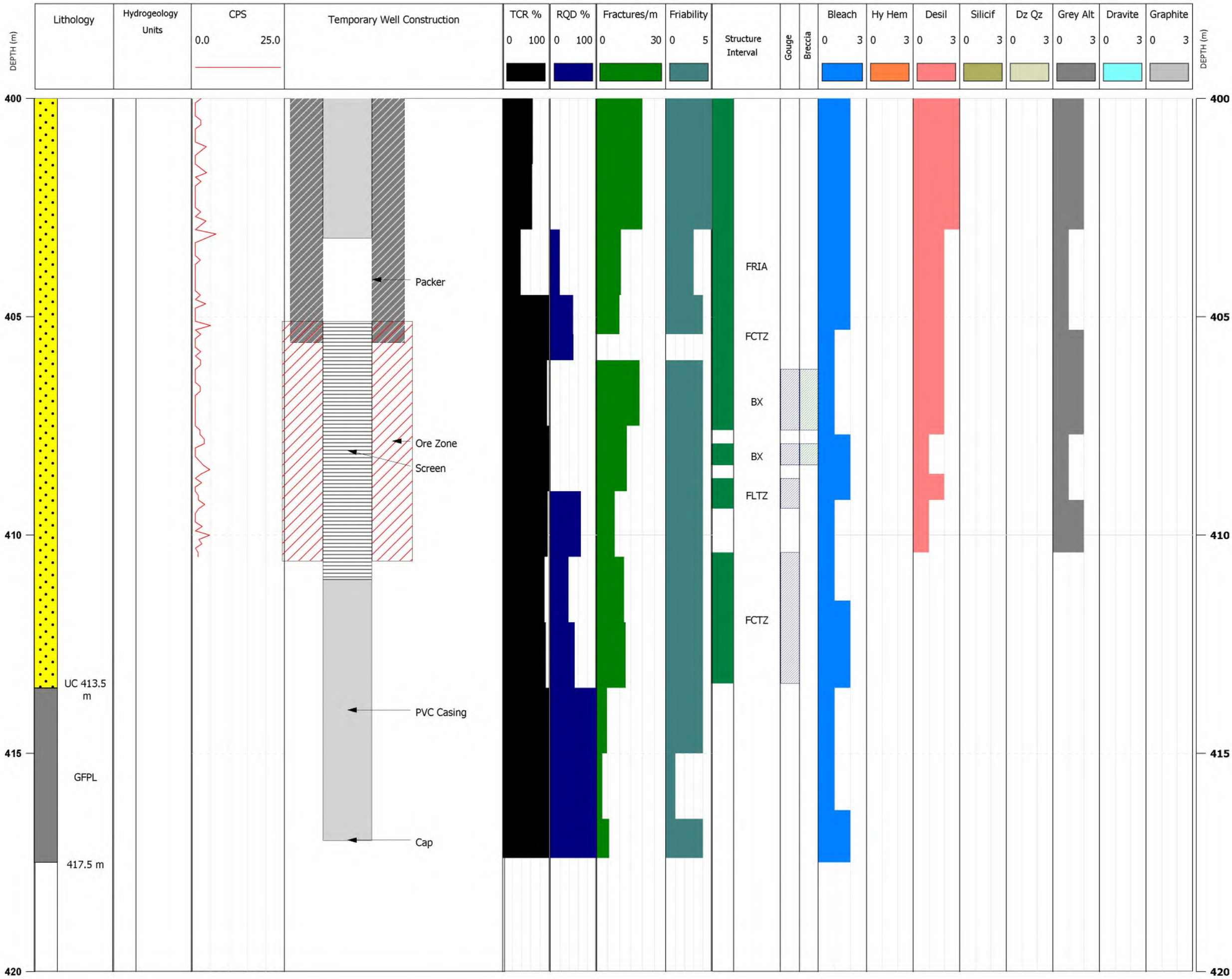
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	403.2	403.2	1.5" SCH-80 PVC
	Cement	Cement	369.5	405.6	36.1	
	Packer	Packer	403.2	405.1	1.9	HQ Inflatable Packer
	Ore Zone	Ore Zone	405.1	410.6	5.5	
	Screen	Screen	405.1	411.02	5.92	1.5" SCH-80 Slotted Well screen
	PVC Casing	PVC Casing	411.02	417	5.98	1.5" SCH-80 PVC
	Cap	Cap	416.98	417	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-018
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	417.5 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,106.84 m E ; 6,374,207.4 m N
Elevation: 541.36 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

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2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

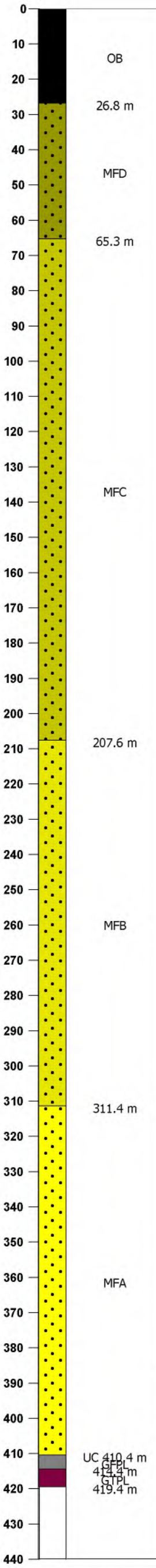
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-019
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419.4 m
Drilling End Date:	2019	Hole Type:	PQ

Coordinates: 477,121.3 m E ; 6,374,221.0 m N
Elevation: 540.93 m.



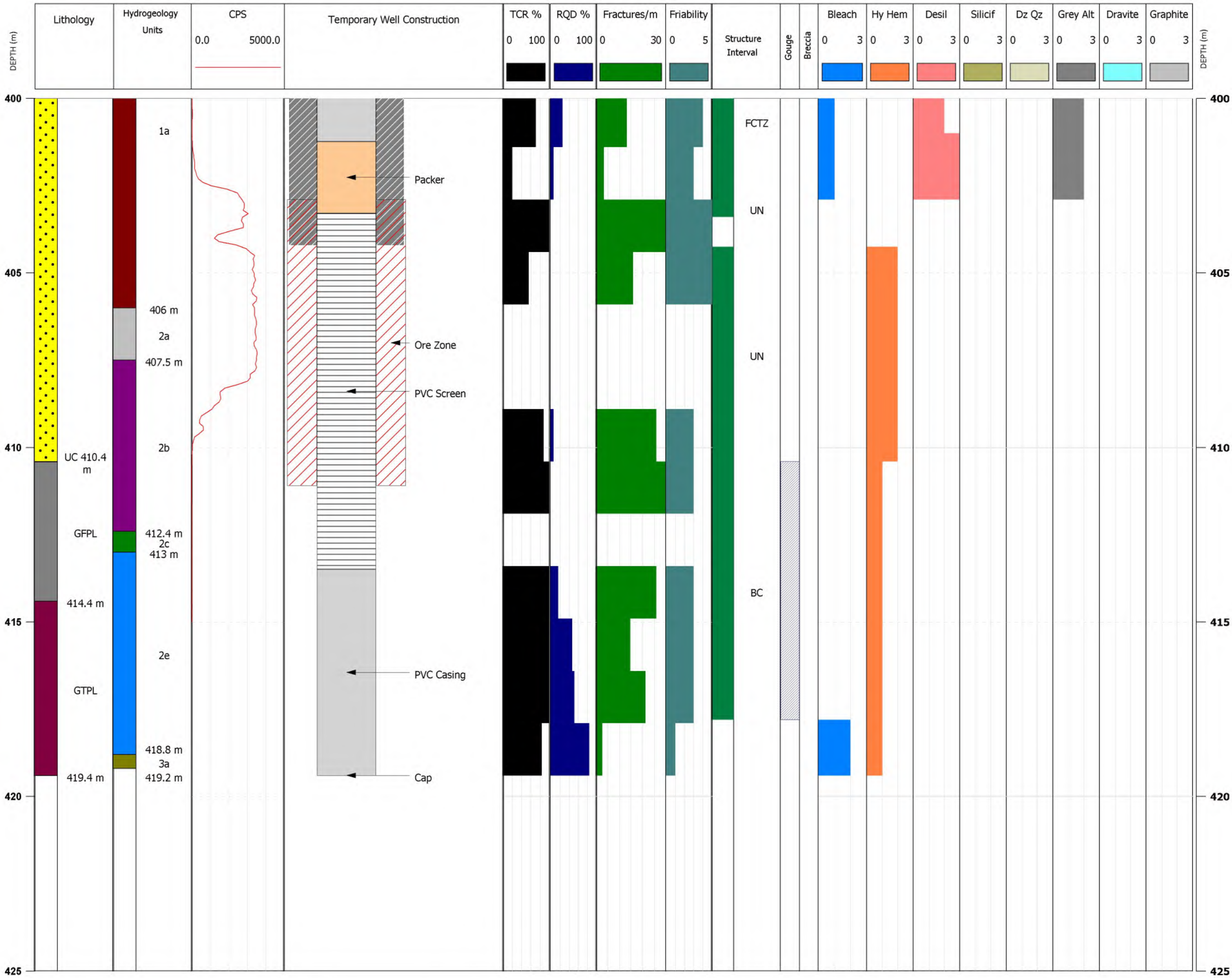
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	401.24	401.24	2.5" PVC sch 80
	Cement	Cement	386.2	404.2	18	
	Packer	Packer	401.24	403.29	2.05	PQ Inflatable packer
	Ore Zone	Ore Zone	402.9	411.1	10.2	
	PVC Screen	PVC Screen	403.29	413.49	10.2	2.5" slotted PVC sch 80
	PVC Casing	PVC Casing	413.49	419.4	5.91	2.5" PVC sch 80
	Cap	Cap	419.38	419.4	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-019
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419.4 m
Drilling End Date:	2019	Hole Type:	PQ

Coordinates: 477,121.3 m E ; 6,374,221.0 m N
Elevation: 540.93 m.
Comments:



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

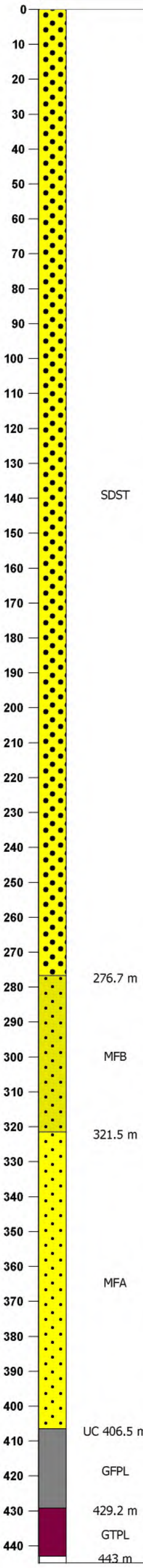
Alterations

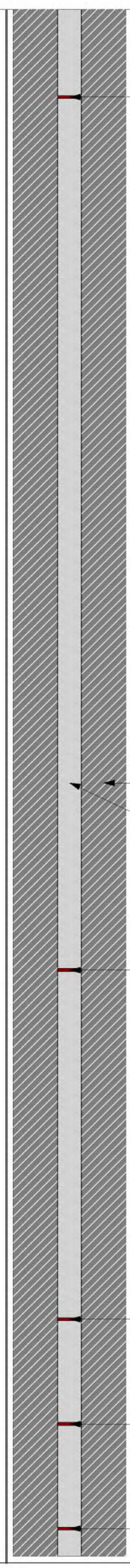
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-020
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	443 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,092.05 m E ; 6,374,189.4 m N
Elevation: 541.09 m.





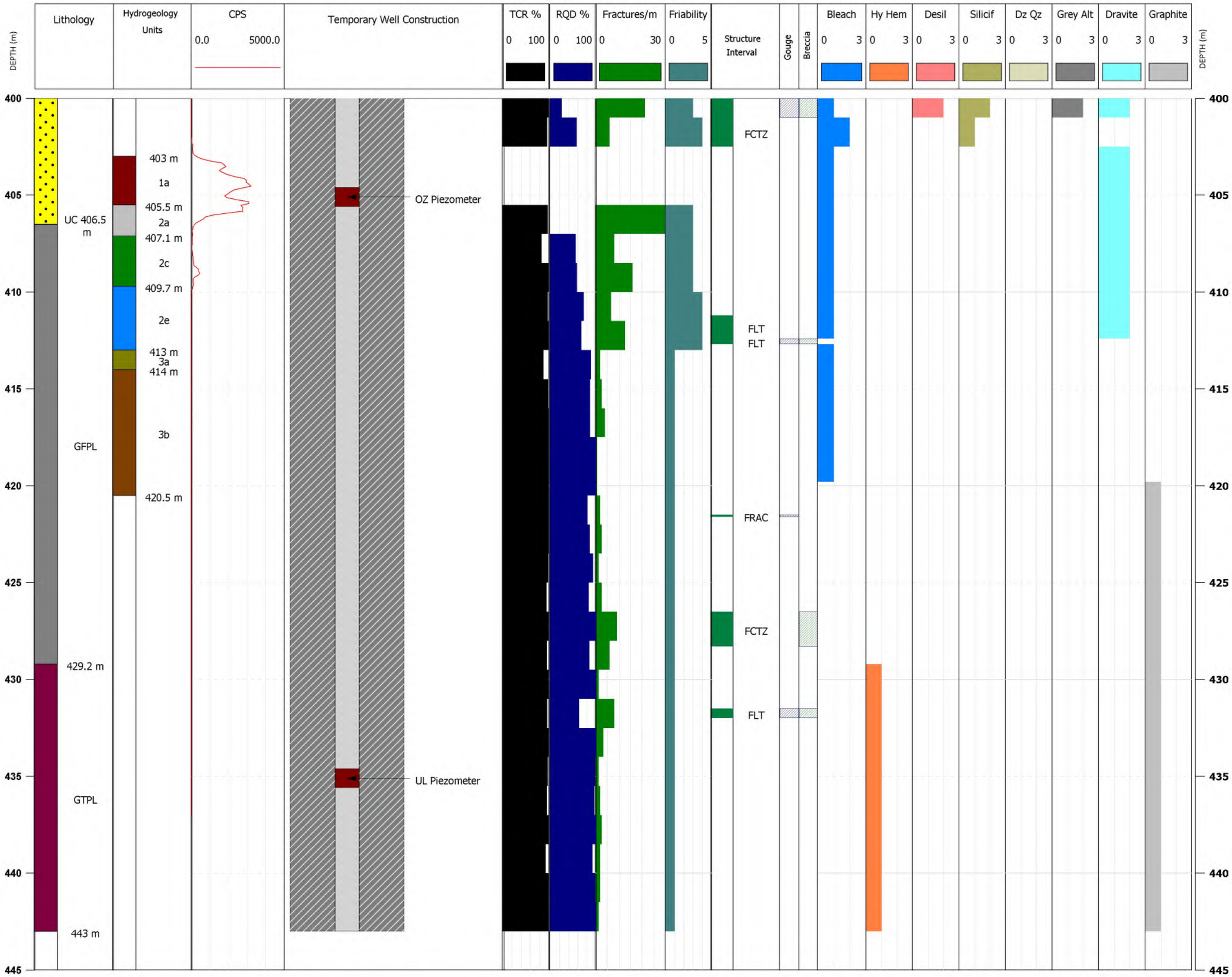
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	OB Piezometer	VWP		25.6		Serial # VW57872
	Cement	Cement	0	436.9	443	
	PVC Casing	PVC Casing	0	436.9	443	3/4" PVC pipe Sch 40
	OL-A Piezometer	VWP		275.6		Serial # VW57873
	OL-B Piezometer	VWP		375.6		Serial # VW57874
	OZ Piezometer	VWP		405.6		Serial # VW57875
	UL Piezometer	VWP		435.6		Serial # VW57876

Comments: Depth below surface. First piezometer is 7.4 m above bottom.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-020
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	443 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,092.05 m E ; 6,374,189.4 m N
Elevation: 541.09 m.
Comments:



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

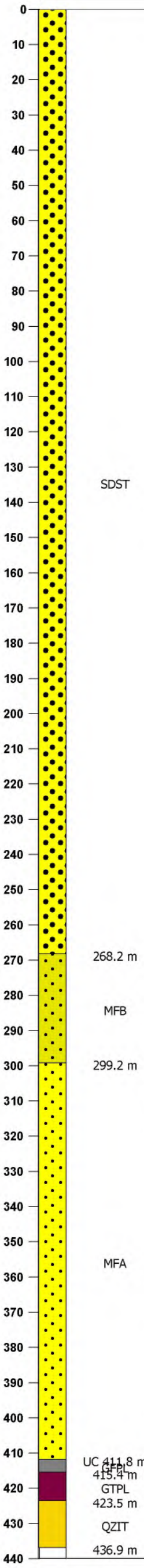
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-021
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	436.9 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,134.33 m E ; 6,374,231.0 m N
Elevation: 540.29 m.



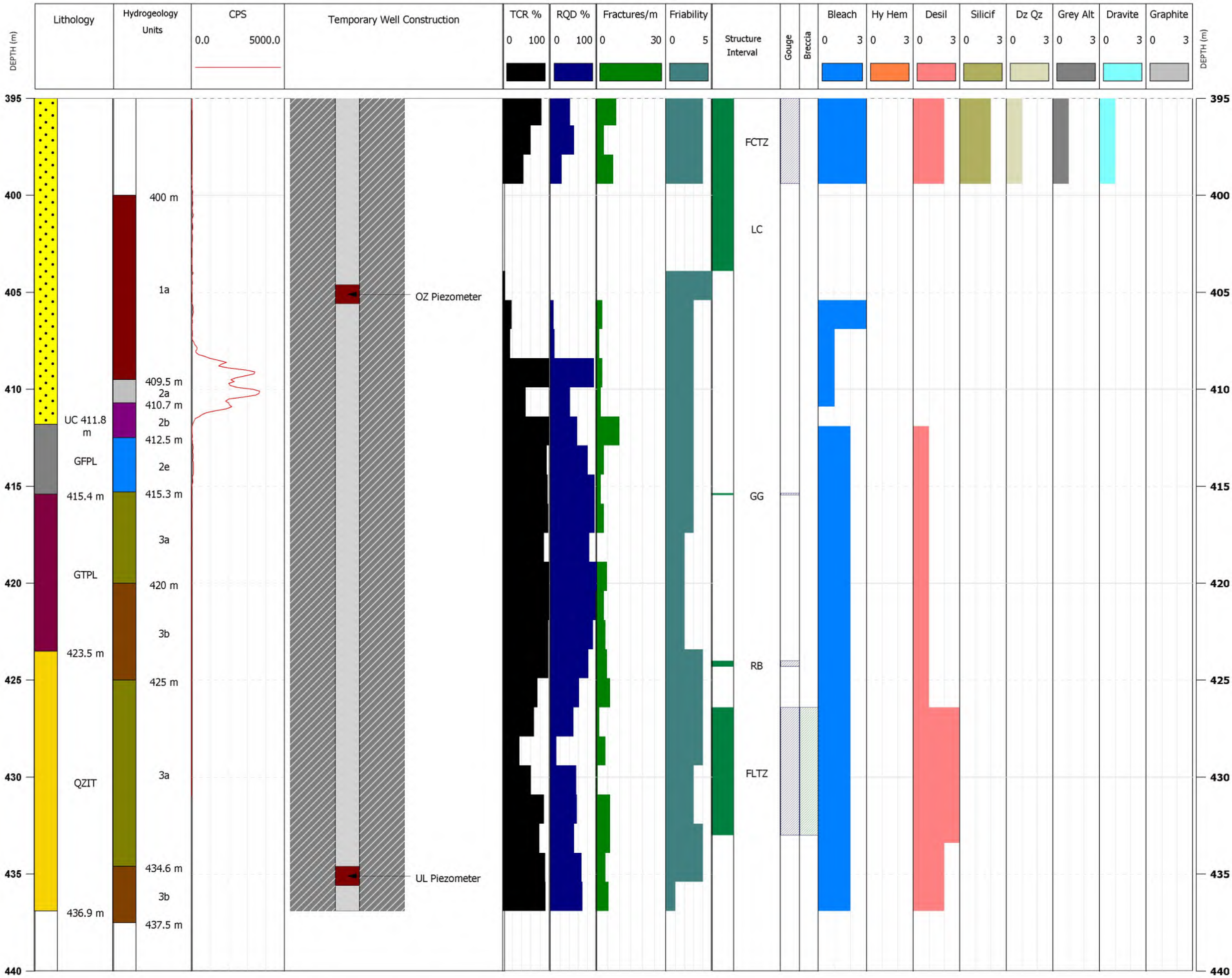
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	OB Piezometer	VWP		25.6		Serial # VW57877
	Cement	Cement	0	436.9	436.9	
	PVC Casing	PVC Casing	0	436.9	436.9	3/4" PVC pipe Sch 40
	OL-A Piezometer	VWP		275.6		Serial # VW57878
	OL-B Piezometer	VWP		375.6		Serial # VW57879
	OZ Piezometer	VWP		405.6		Serial # VW57880
	UL Piezometer	VWP		435.6		Serial # VW578781

Comments: Depth below surface. First piezometer is 1.3 m above bottom.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-021
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	436.9 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 477,134.33 m E ; 6,374,231.0 m N
Elevation: 540.29 m.
Comments:



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

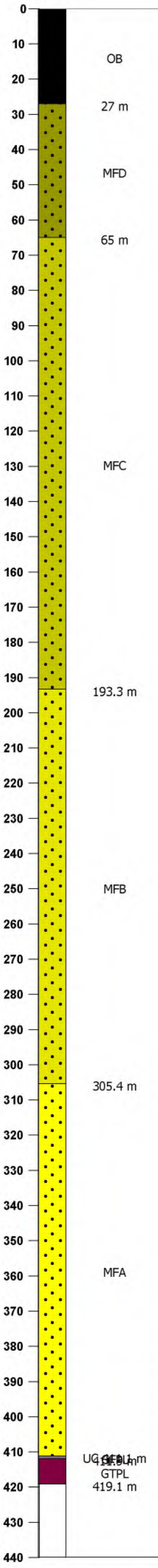
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-022
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419.1 m
Drilling End Date:	2019	Hole Type:	PQ

Coordinates: 477,114.87 m E ; 6,374,208.8 m N
Elevation: 541.39 m.

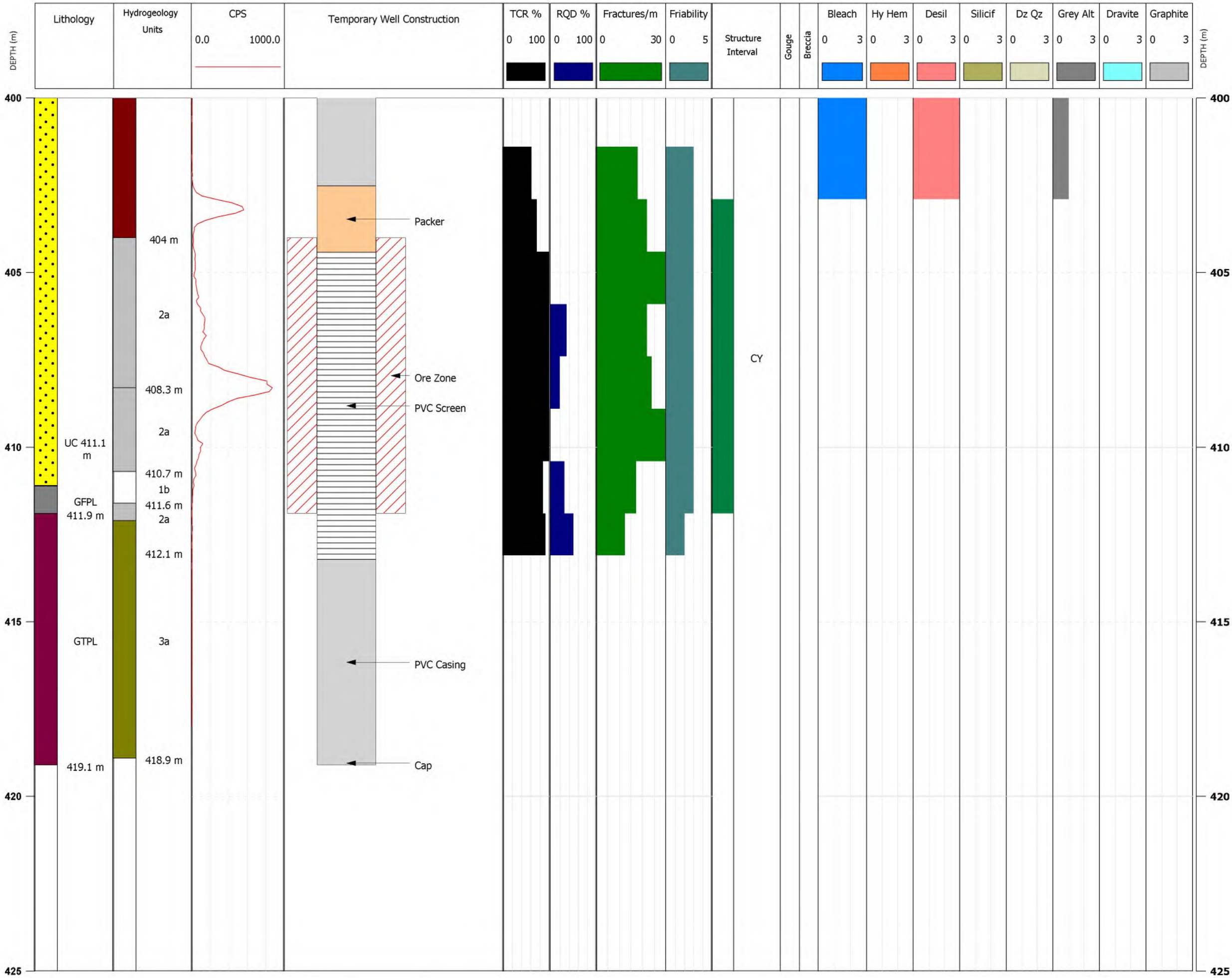


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	402.52	402.52	2.5" PVC sch 80
	Cement	Cement	385	398	13	
	Packer	Packer	402.52	404.42	1.9	PQ Inflatable packer
	Ore Zone	Ore Zone	404	411.9	7.9	2.5" slotted PVC sch 80
	PVC Screen	PVC Screen	404.42	413.21	8.79	
	PVC Casing	PVC Casing	413.21	419.1	5.89	2.5" PVC sch 80
	Cap	Cap	419.08	419.1	0.02	

Comments: Depth below surface.

Title:	Well Schematics	Drillhole #	GWR-022
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419.1 m
Drilling End Date:	2019	Hole Type:	PQ

Coordinates: 477,114.87 m E ; 6,374,208.8 m N
Elevation: 541.39 m.
Comments:



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

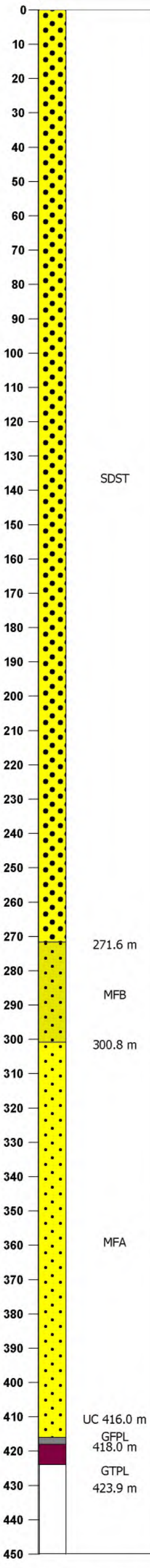
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-023
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	423.9 m
Drilling End Date:		Hole Type:	OZ/HQ

Coordinates: 477,114.74 m E ; 6,374,229.0 m N
Elevation: 542.59 m.



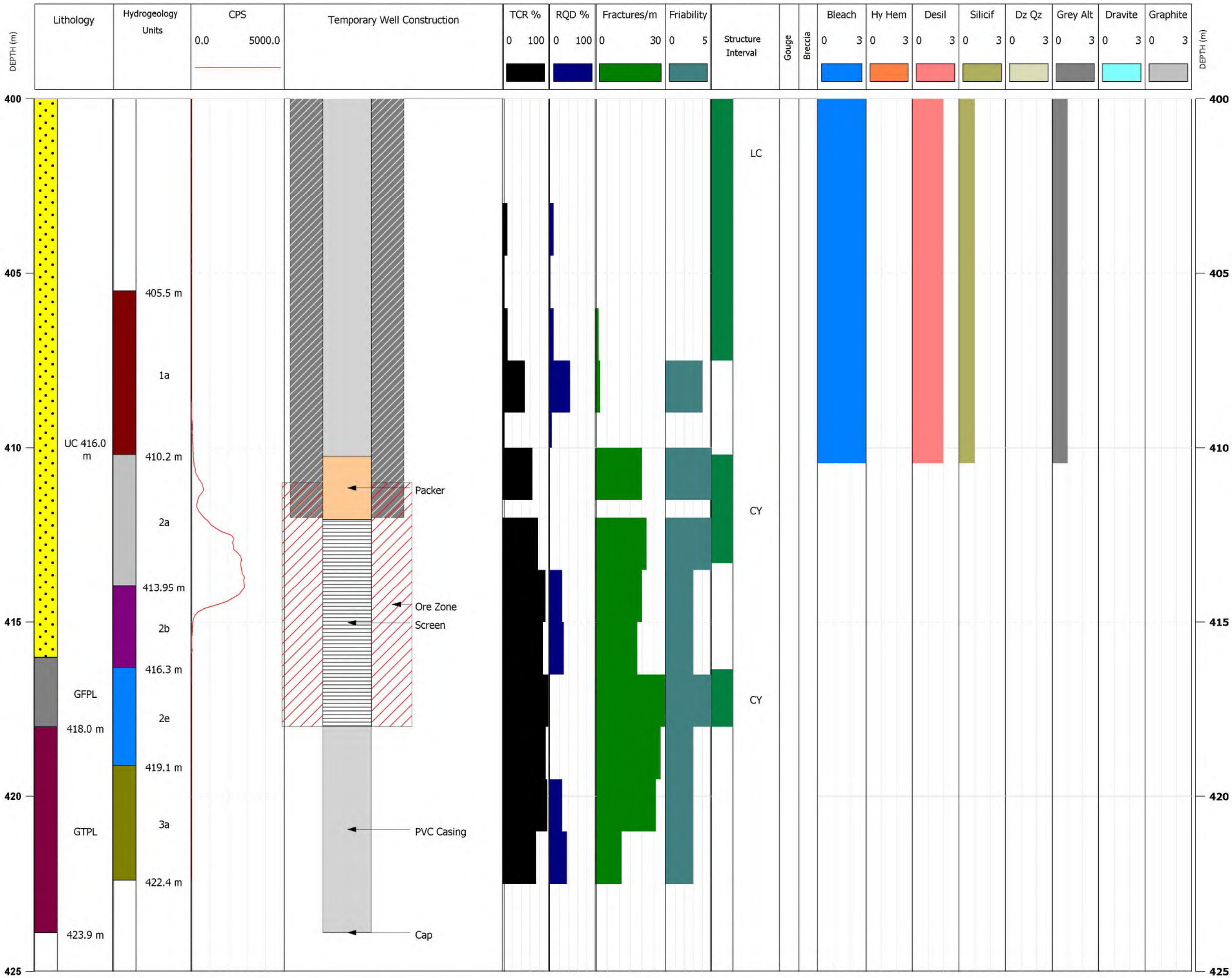
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	410.24	410.24	1.5" PVC
	Cement	Cement	347	412	65	
	Packer	Packer	410.24	412.06	1.82	HQ Inflatable Packer
	Ore Zone	Ore Zone	411	418		
	Screen	Screen	412.06	417.98	5.92	1.5" Well screen
	PVC Casing	PVC Casing	417.98	423.9	5.92	1.5" PVC
	Cap	Cap	423.	423.9	0	

Comments: Depth below surface. Had to cement twice. Cement recovered to 403 m. From 403.0 to 412 m no cement recovered however good water circulation and pressure so cement might have coated the wall of the hole.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-023
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	423.9 m
Drilling End Date:		Hole Type:	OZ/HQ

Coordinates: 477,114.74 m E ; 6,374,229.0 m N
Elevation: 542.59 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

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1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

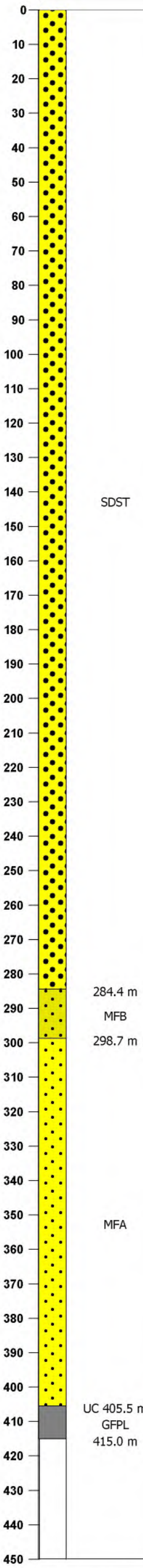
Alterations

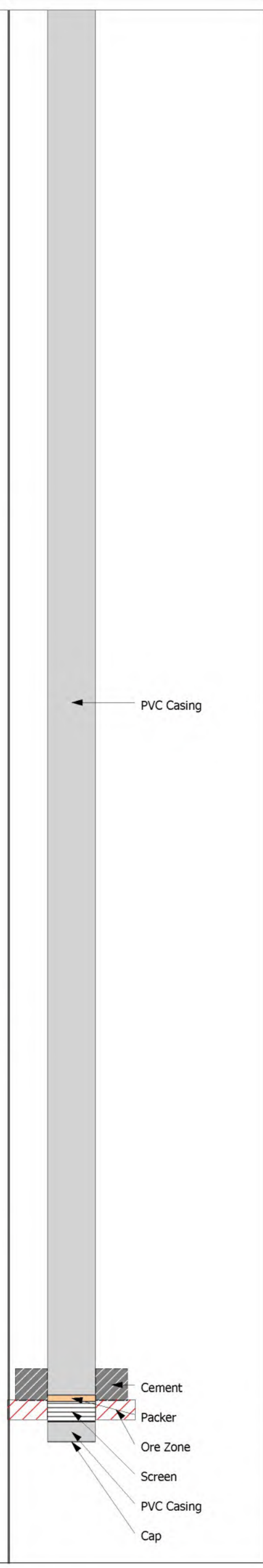
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-024
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	414.9 m
Drilling End Date:		Hole Type:	HQ

Coordinates: 477,066.43 m E ; 6,374,166.9 m N
Elevation: 542.6 m.





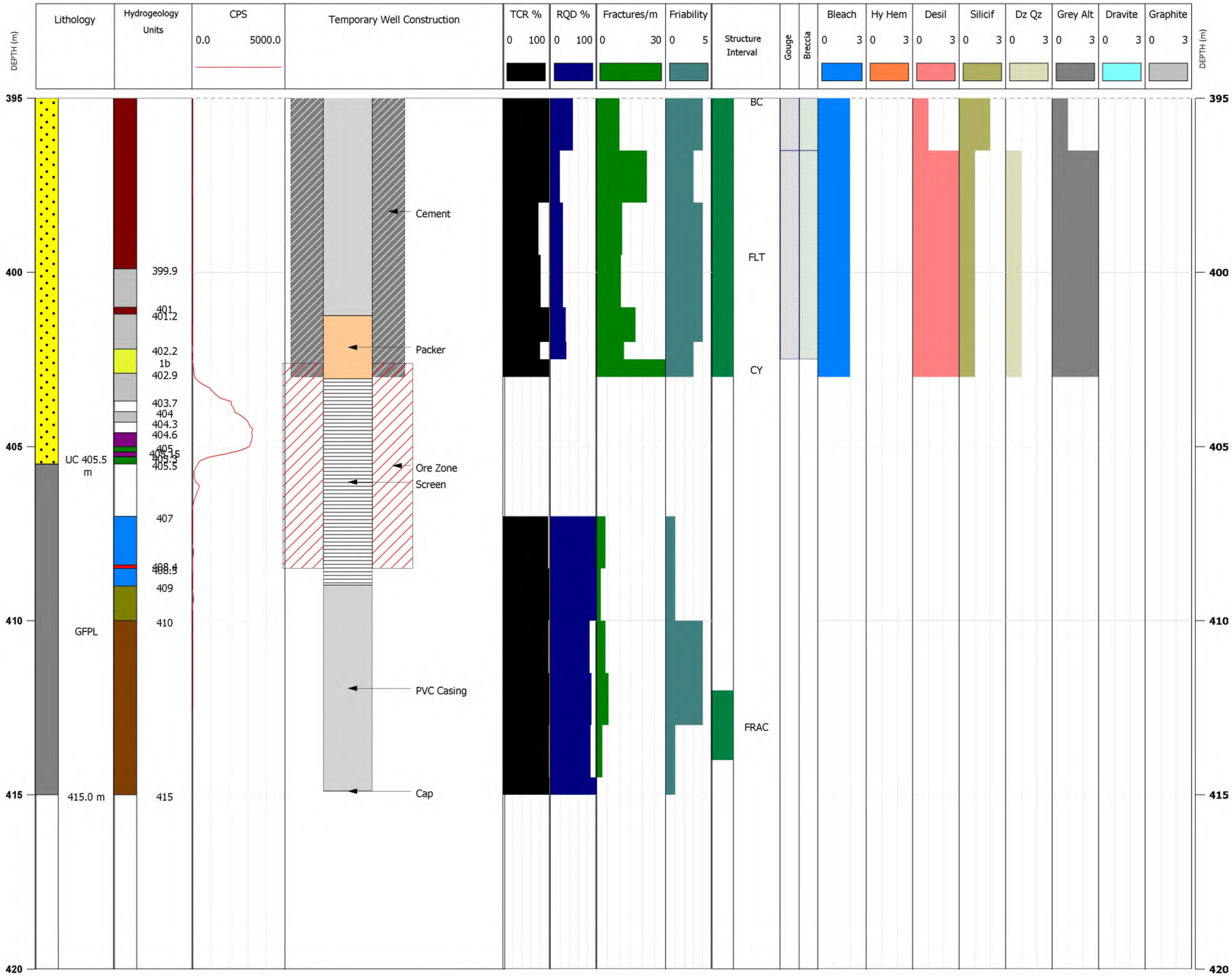
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	401.24	401.24	1.5" PVC
	Cement	Cement	393.5	403	9.5	
	Packer	Packer	401.24	403.06	1.82	HQ Inflatable Packer
	Ore Zone	Ore Zone	402.6	408.5	5.9	
	Screen	Screen	403.06	408.98	5.92	1.5" Well screen
	PVC Casing	PVC Casing	408.98	414.9	5.92	1.5" PVC
	Cap	Cap	414.7	414.9	0.2	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-024
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	414.9 m
Drilling End Date:		Hole Type:	OZ/HQ

Coordinates: 477,066.43 m E ; 6,374,166.9 m N
Elevation: 542.6 m.
Comments: Hydro Units logged from metallurgical samples and photos.



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

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2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

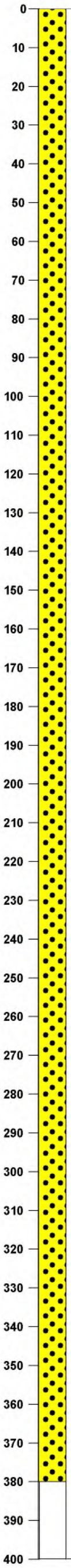
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-025
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	380 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 476,689.87 m E ; 6,374,700.2 m N
Elevation: 523.81 m.



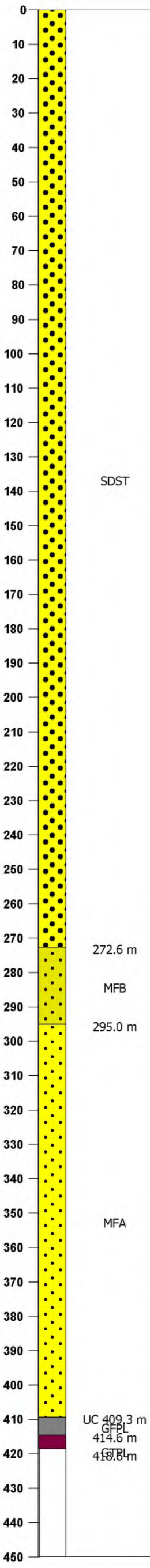
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Bentonite	Bentonite	0	55.9	55.9	
SDST	PVC Casing	PVC Casing	0	372.2	372.2	1.5" PVC casing Sch 80
380 m	Packer	Packer	372.2	374	1.8	HQ Inflatable Packer
	PVC Screen	PVC Screen	374	380	6	1.5" PVC 0.04" slotted screen Sch 80
	Cap	Cap	379.98	380	0.02	Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-026
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	418.62 m
Drilling End Date:		Hole Type:	OZ/HQ

Coordinates: 477,122.58 m E ; 6,374,209.6 m N
Elevation: 540.43 m.



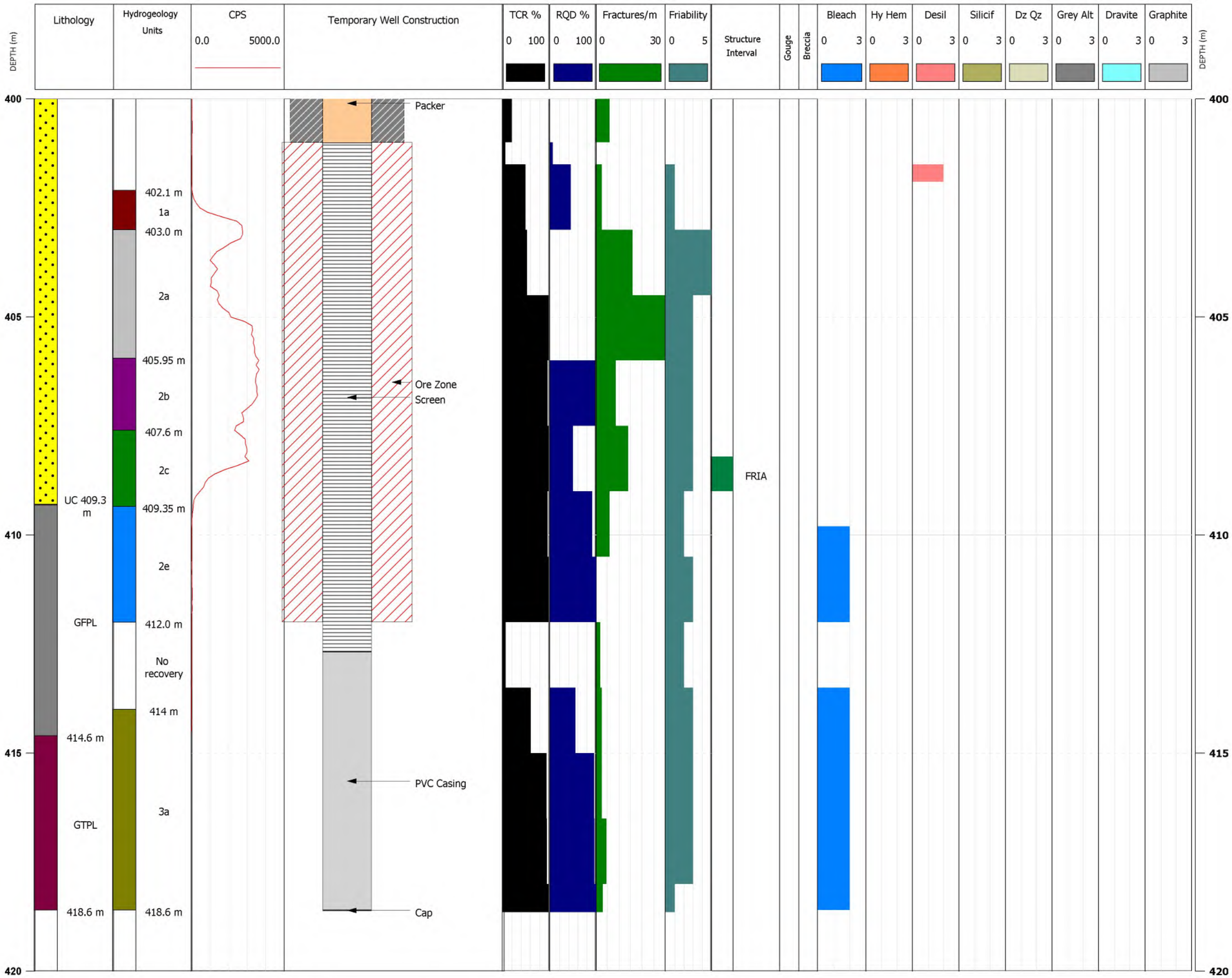
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	399.19	399.19	1.5" PVC
	Cement	Cement	376	401	25	
	Packer	Packer	399.19	401.01	1.82	HQ Inflatable Packer
	Ore Zone	Ore Zone	401	412	11	
	Screen	Screen	401.01	412.68	11.67	1.5" Well screen
	PVC Casing	PVC Casing	412.68	418.6	5.92	1.5" PVC
	Cap	Cap	418.6	418.62	0	

Comments: Depth below surface. Lots of core loss

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-026
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	418.62 m
Drilling End Date:		Hole Type:	OZ/HQ

Coordinates: 477,122.58 m E ; 6,374,209.6 m N
Elevation: 540.43 m.
Comments: Hydrogeology Unit 3a added from photo.



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

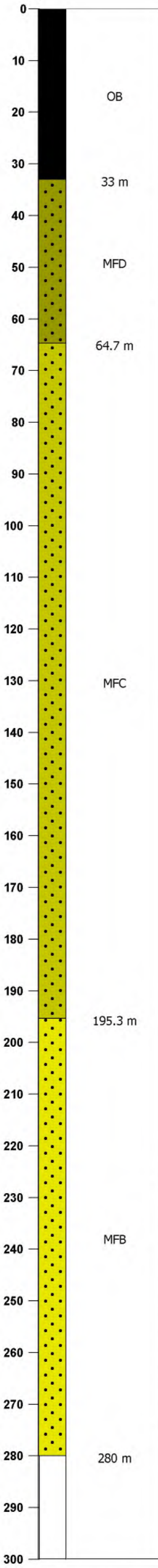
Alterations

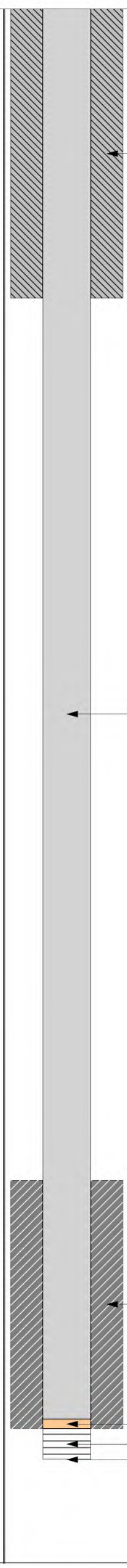
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-027
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	280 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 476,951.28 m E ; 6,374,608.29 m N
Elevation: 523.5 m.





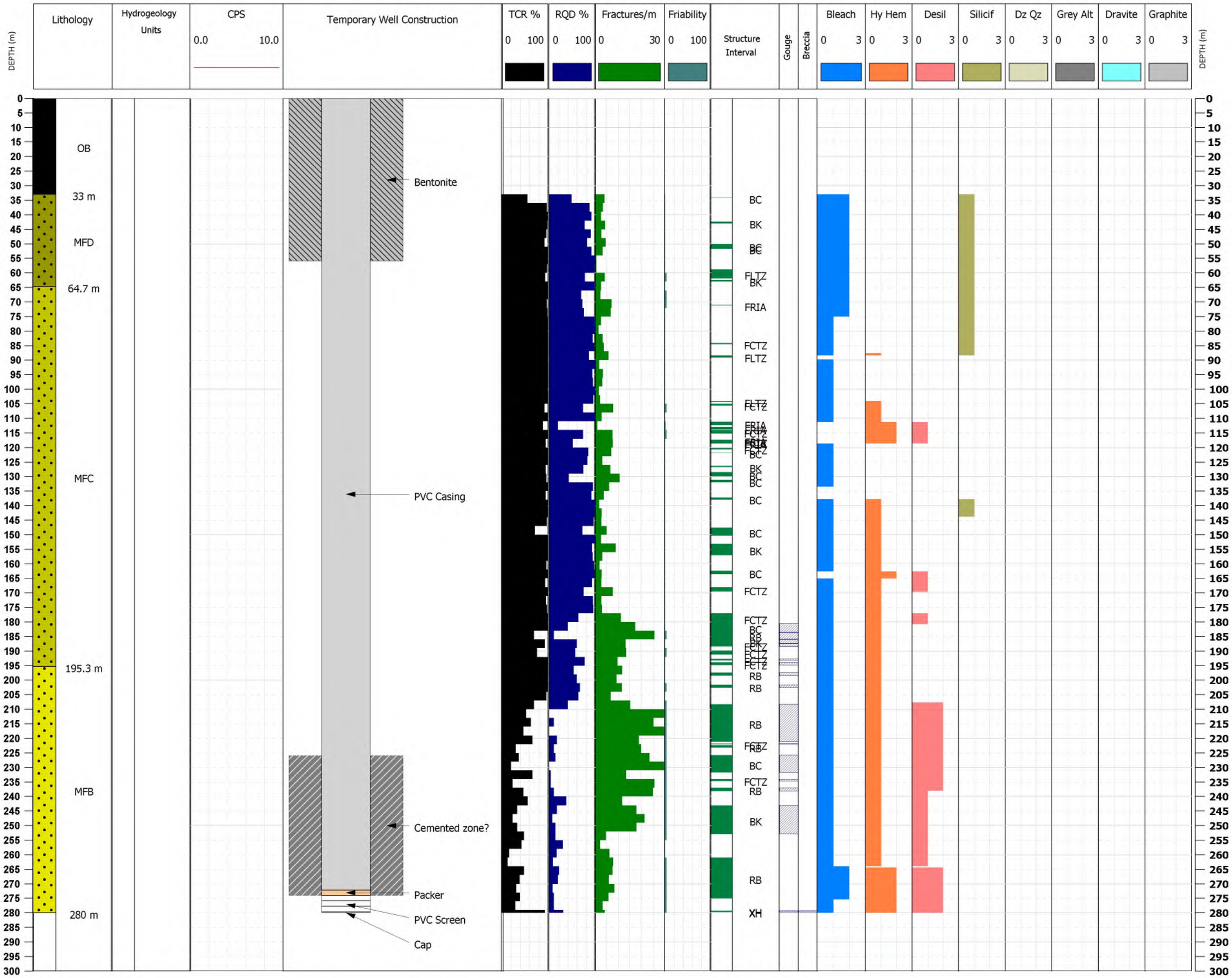
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB, 33 m, MFD, 64.7 m, MFC, 195.3 m, MFB, 280 m	Bentonite	Bentonite	0	55.9	55.9	
	PVC Casing	PVC Casing	0	272.2	272.2	1.5" PVC casing Sch 80
	Cemented zone?	Cemented zone?	226	274	48	
	Packer	Packer	272.2	274	1.8	HQ Inflatable Packer
	PVC Screen	PVC Screen	274	280	6	1.5" PVC 0.04" slotted screen Sch 80
	Cap	Cap	279.98	280	0.02	Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-027
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	280 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 476,951.28 m E ; 6,374,608.29 m N
Elevation: 523.5 m.
Comments:



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability
0 = Unknwn
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2 = Moderately friable
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5 = Unconsolidaded

Structure Interval

BC = Breccia	FLT = Fault	FLTZ = Fault Zone
SZ = Shear Zone	FCT = Fault	FCTZ = Fracture Zone

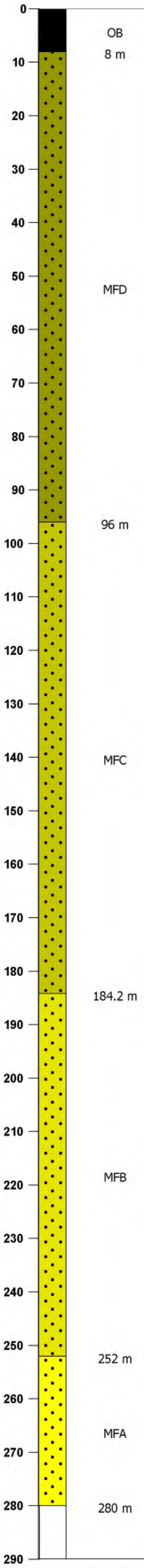
*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

Alterations
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-028
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	280 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 476,125.82 m E ; 6,373,453.54 m N
Elevation: 518.52 m.



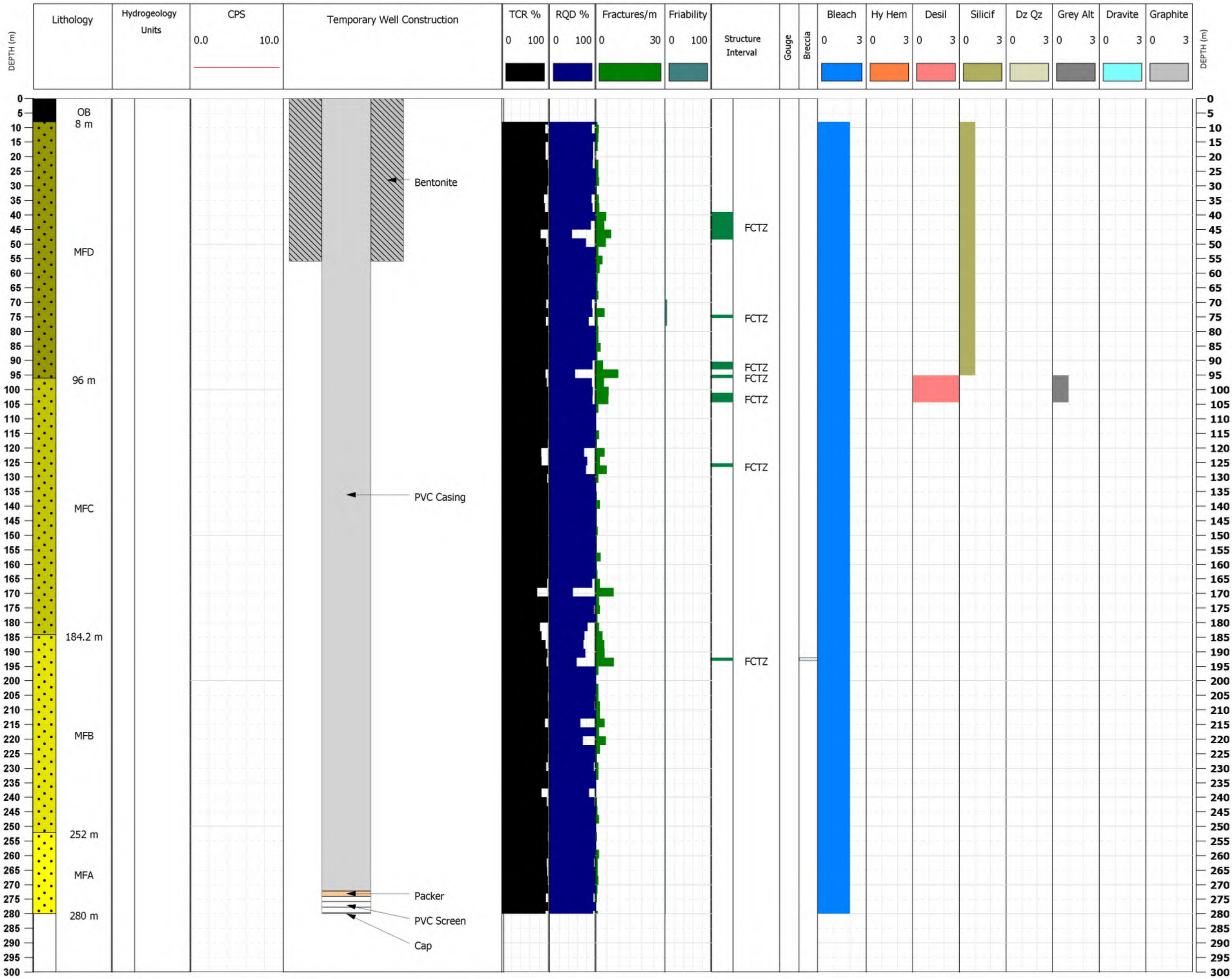
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Bentonite	Bentonite	0	55.9	55.9	
	PVC Casing	PVC Casing	0	272.2	272.2	1.5" PVC casing Sch 80
	Packer	Packer	272.2	274	1.8	HQ Inflatable Packer
	PVC Screen	PVC Screen	274	280	6	1.5" PVC 0.04" slotted screen Sch 80
	Cap	Cap	279.98	280	0.02	Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-028
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	280 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 476,125.82 m E ; 6,373,453.54 m N
Elevation: 518.52 m.
Comments:



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability
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3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

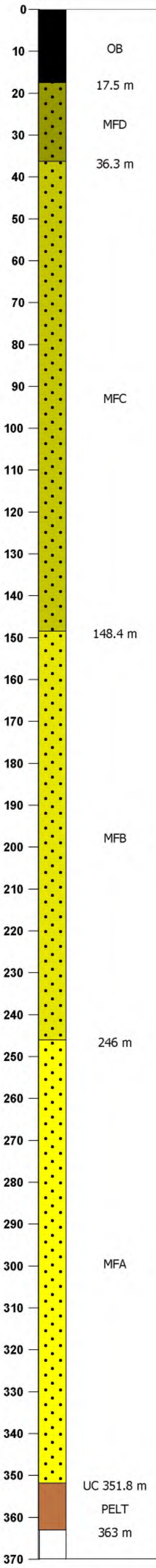
*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

Alterations
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-029
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	363 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 475,819.83 m E ; 6,372,881.05 m N
Elevation: 519.12 m.



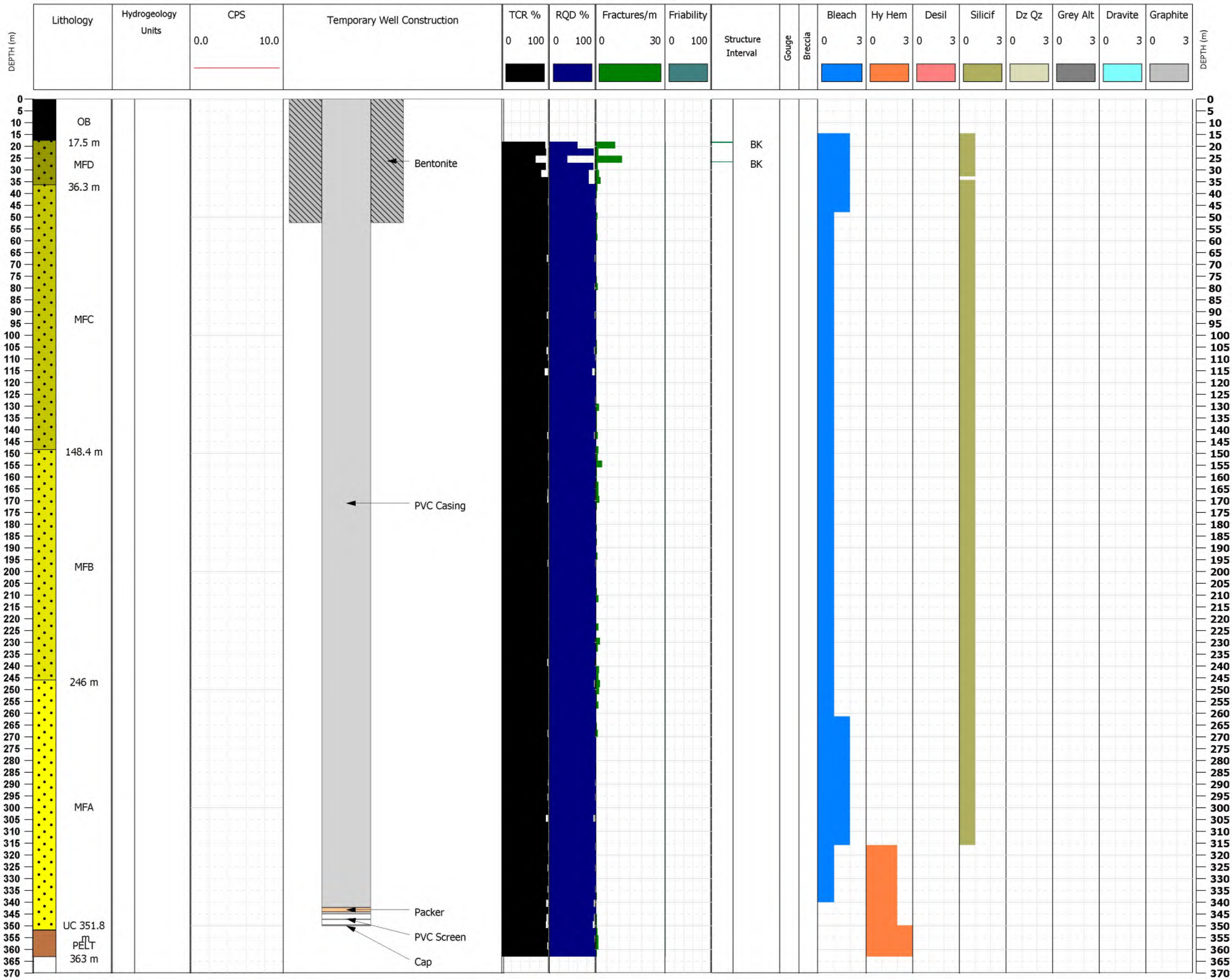
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	Bentonite	Bentonite	0	52.4	52.4	
MFD	PVC Casing	PVC Casing	0	342.26	342.26	1.5" PVC casing Sch 80
MFC	Packer	Packer	342.26	344.08	1.82	HQ Inflatable Packer
MFB	PVC Screen	PVC Screen	344.08	350	5.92	1.5" PVC 0.04" slotted screen Sch 80
MFA	Cap	Cap	349.98	350	0.02	Sch 80
UC 351.8 m						
PELT						
363 m						

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-029
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	363 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 475,819.83 m E ; 6,372,881.05 m N
Elevation: 519.12 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

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Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-030
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	369.5 m
Drilling End Date:	2019	Hole Type:	HQ

Coordinates: 476,859.27 m E ; 6,373,964.51 m N
Elevation: 544.03 m.

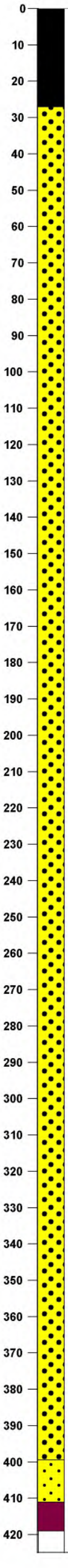
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
SDST	PVC Casing	PVC Casing	0	363.2	363.2	1.5" PVC casing Sch 80
371 m	Packer	Packer	363.2	365	1.8	HQ Inflatable Packer
	PVC Screen	PVC Screen	365	371	6	1.5" PVC 0.04" slotted screen Sch 80
	Cap	Cap	369.48	369.5	0.02	
	Historic Cement	Historic Cement	363.5	413.5	50	

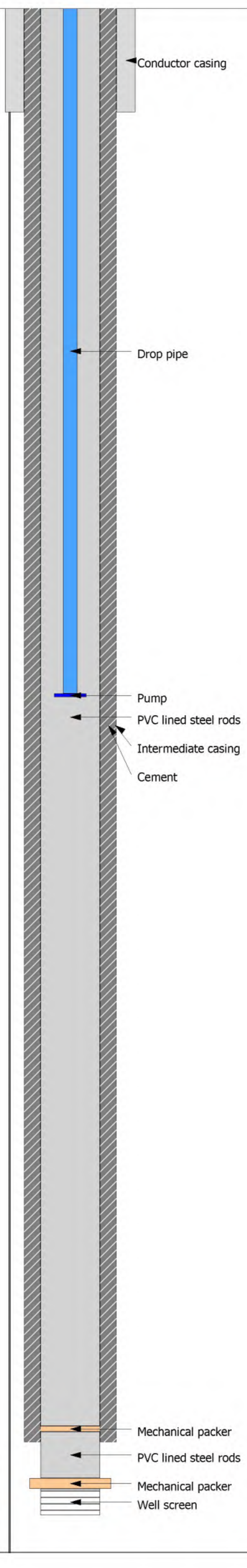
Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-031
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	416.5 m
Drilling End Date:	2019	Hole Type:	CSW

Coordinates: 477,086.15 m E ; 6,374,179.7 m N
Elevation: 541.82 m.
Comments:



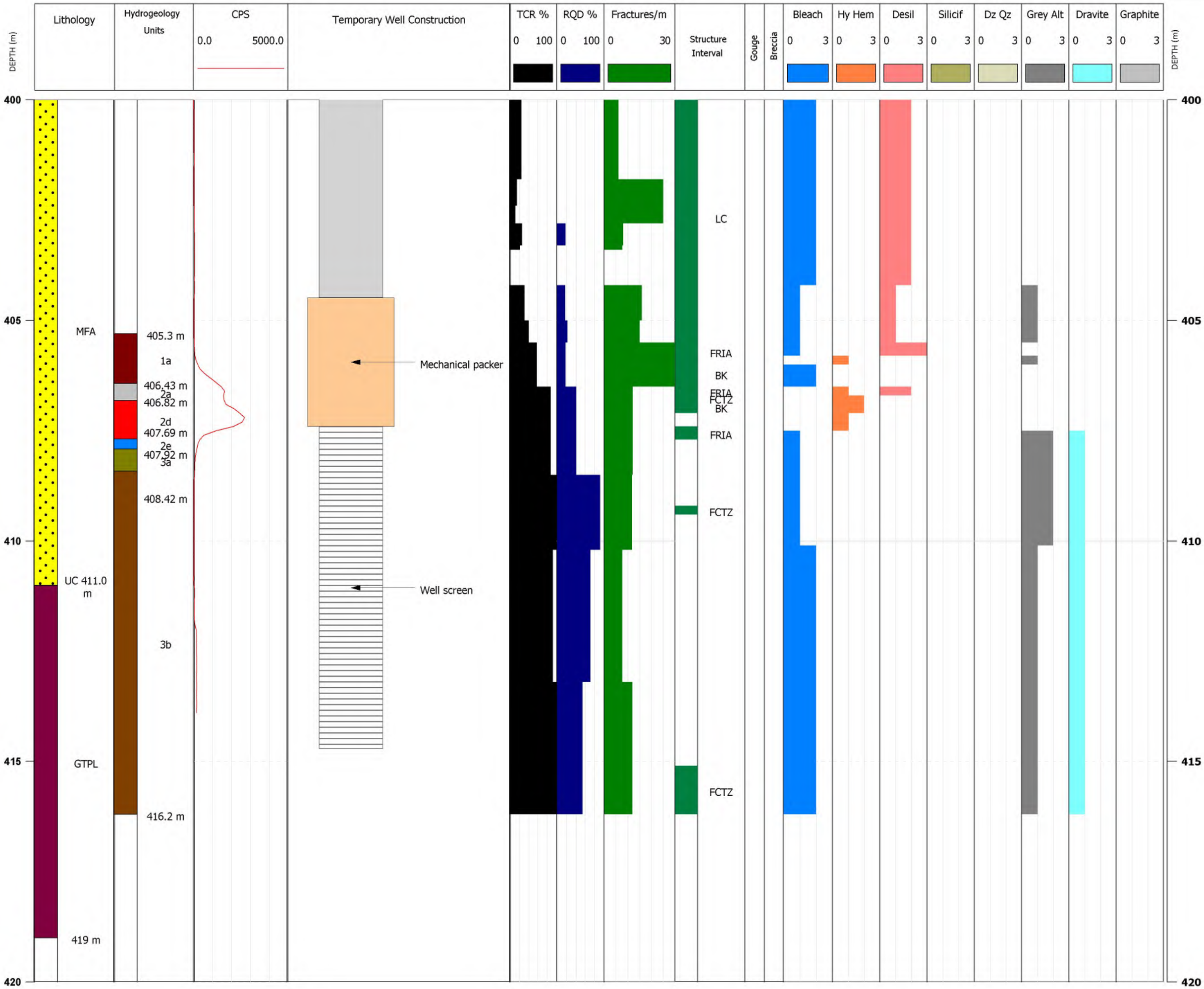


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	Conductor casing	Conductor casing	0	28.5	28.5	
	Drop pipe	Drop pipe	0	188.55	188.55	PVC pipe Sch 40
	Pump	Pump	188.55	189.54	0.99	
	PVC lined steel rods	PVC lined steel rods	0	390.14	390.14	5" PVC lined steel rods
	Intermediate casing	Intermediate casing	0	394.5	394.5	8 5/8" casing
	Mechanical packer	Mechanical packer	390.14	391.63	1.49	
	PVC lined steel rods	PVC lined steel rods	391.63	404.49	12.86	5" PVC lined steel rods
	Mechanical packer	Mechanical packer	404.49	407.41	2.92	
	Well screen	Well screen	407.41	414.71	7.3	300M InnoGuard

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-031
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	416.2 m
Drilling End Date:	2019	Hole Type:	CSW

Coordinates: 477,086.15 m E ; 6,374,179.7 m N
Elevation: 541.82 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
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5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

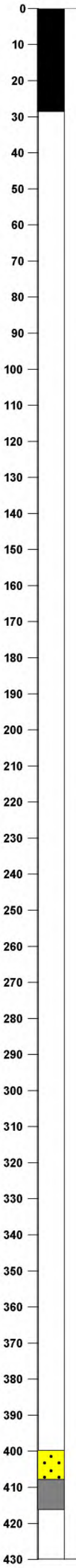
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-032
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419 m
Drilling End Date:	2019	Hole Type:	CSW

Coordinates: 477,119.56 m E ; 6,374,214.92 m N
Elevation: 540.86 m.
Comments:

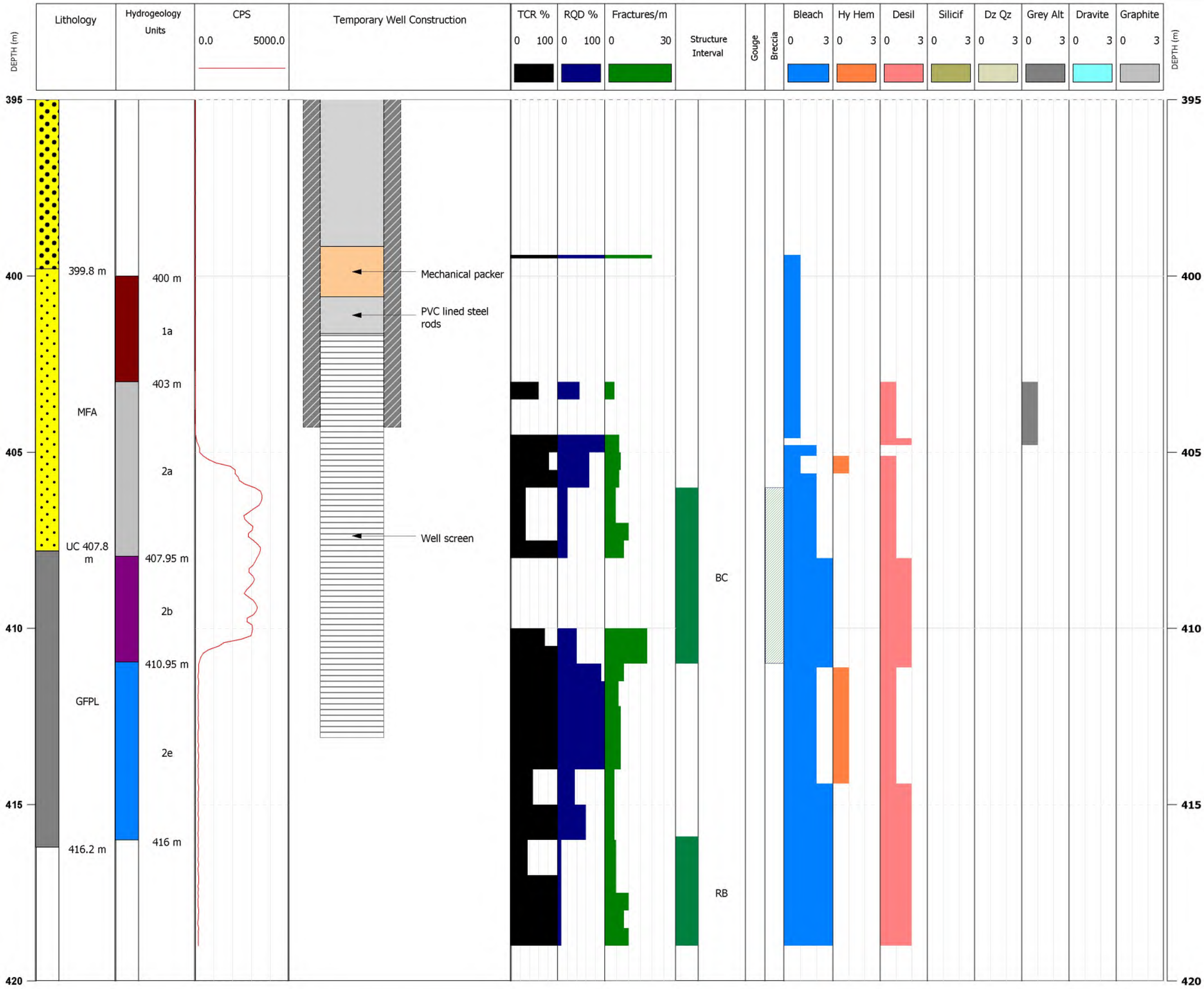


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	Conductor casing	Conductor casing	0	27	27	
28.5 m						
	Drop pipe	Drop pipe	0	224.4	224.4	PVC pipe Sch 40
	PVC lined steel rods	PVC lined steel rods	0	399.16	399.16	5" PVC lined steel rods
SDST	Cement					
	Pump	Pump	224.4	225.39	0.99	
399.8 m MFA	Mechanical packer	Mechanical packer	399.16	400.59	1.43	
UC 407.8 m GFPL	PVC lined steel rods	PVC lined steel rods	400.59	401.64	1.05	5" PVC lined steel rods
416.2 m	Well screen	Well screen	401.64	413.1	11.46	300M InnoGuard

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-032
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419 m
Drilling End Date:	2019	Hole Type:	CSW

Coordinates: 477,119.56 m E ; 6,374,214.9 m N
Elevation: 540.86 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

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Fractures/m = Natural fractures per meter

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Structure Interval

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FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia columns indicate the presence of these structures in the interval, not the accurate length.

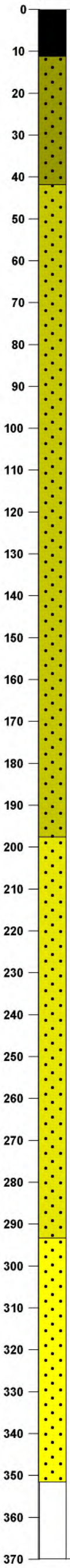
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-033
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	351.6 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,593.45 m E ; 6,373,583.0 m N
Elevation: 504.6 m.



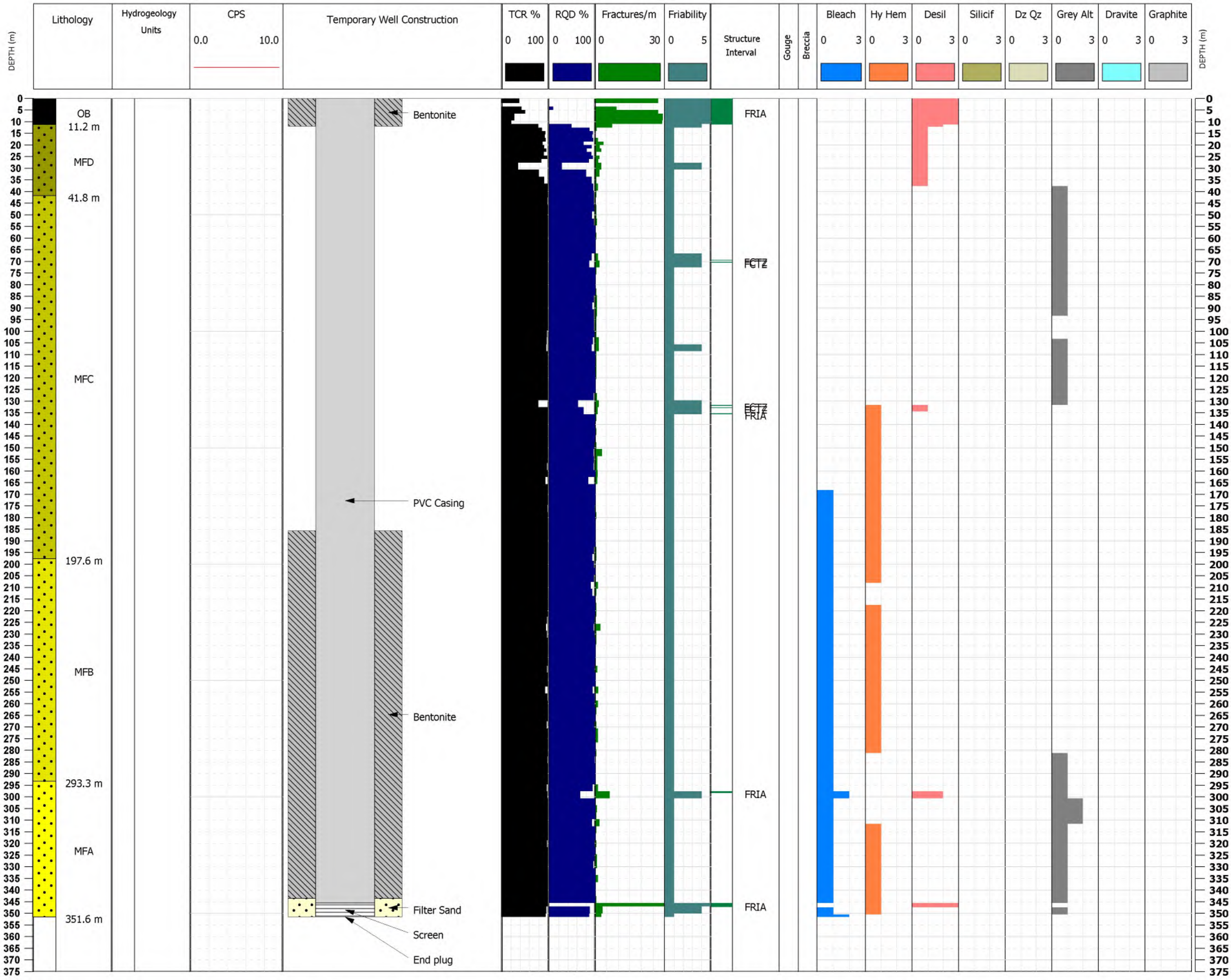
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	Bentonite	Bentonite	0	12	12	3/8" coated bentonite tablets
MFC	PVC Casing	PVC Casing	0	345.6	345.6	2.5" PVC casing sch 80
MFB	Bentonite	Bentonite	185.6	343.6	158	3/8" coated bentonite tablets
MFA	Filter Sand	Filter Sand	343.6	351.6	8	
	Screen	Screen	345.6	351.6	6	2.5" PVC screen sch 80 with filter sock 3s.s. hose clamps
	End plug	End plug	351.58	351.6	0	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-033
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	351.6 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,593.45 m E ; 6,373,583.0 m N
Elevation: 504.6 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

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Structure Interval

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FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

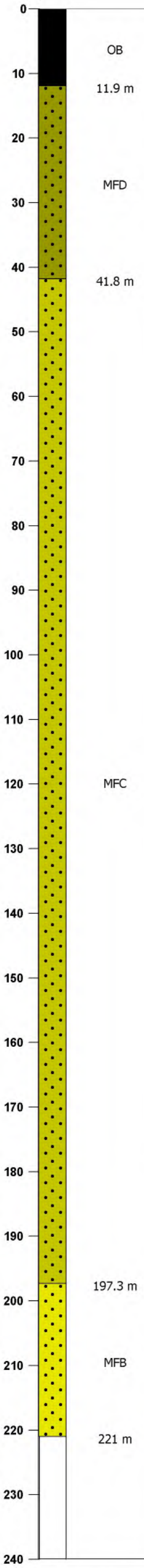
Alterations

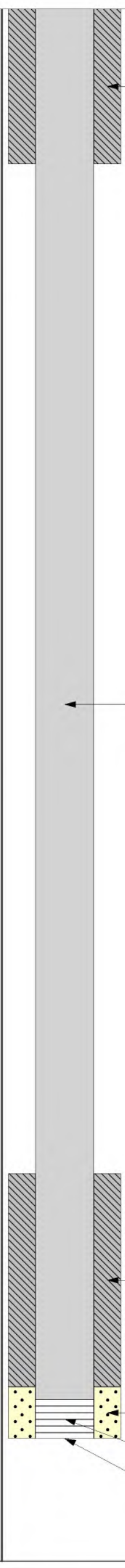
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-034
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	221 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,580.8 m E ; 6,373,581.3 m N
Elevation: 504.36 m.





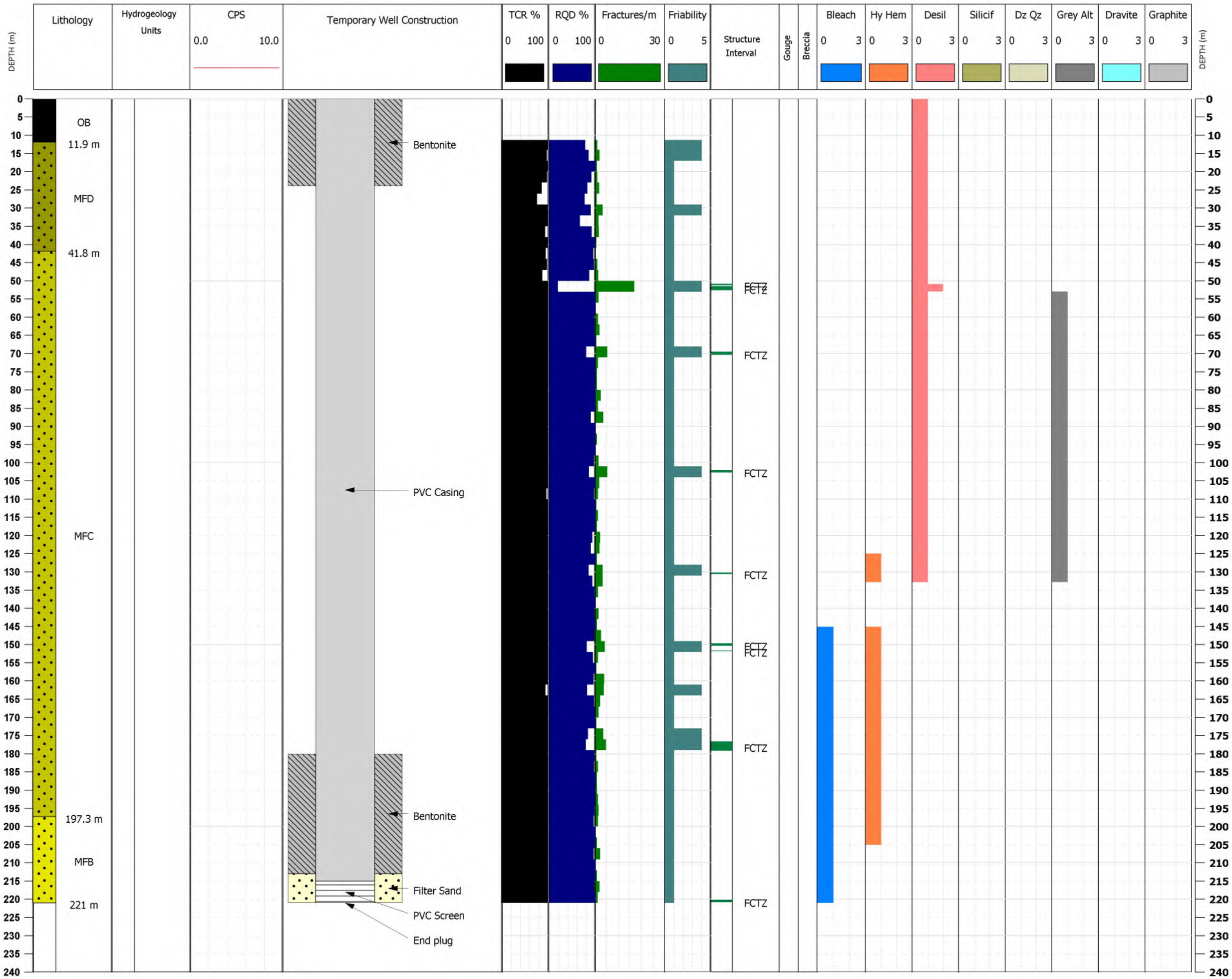
Lithology	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
Bentonite	Bentonite	0	24	24	3/8" coated bentonite tablets
PVC Casing	PVC Casing	0	215	215	2.5" PVC casing sch 80
Bentonite	Bentonite	180	213	33	3/8" coated bentonite tablets
Filter Sand	Filter Sand	213	221	8	
PVC Screen	PVC Screen	215	221	6	2.5" PVC screen sch 80 with filter sock 3s.s. hose clamps
End plug	End plug	220.98	221	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-034
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	221 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,580.8 m E ; 6,373,581.3 m N
Elevation: 504.36 m.
Comments:



Hydrogeology Units

1a 2a 2b 2c
2d 2e 3a 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

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Structure Interval

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SZ = Shear Zone FCT = Fault FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

Alterations

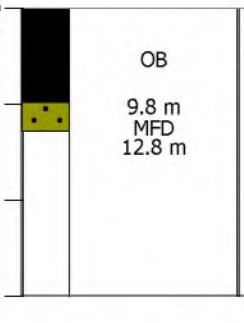
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

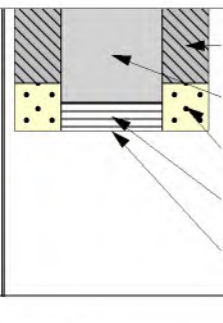
Title:	Well Schematics	Drillhole #	GWR-035
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	12.8 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,571.06 m E ; 6,373,579.9 m N
Elevation: 504.51 m.

DEPTH (m)



Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	Bentonite	Bentonite	0	7.8	7.8	3/8" coated bentonite tablets
9.8 m MFD 12.8 m	PVC Casing	PVC Casing	0	9.8	9.8	2.5" PVC casing sch 80
	Filter Sand	Filter Sand	7.8	12.8	5	
	Screen	Screen	9.8	12.8	3	2.5" PVC screen sch 80 with filter sock 3s.s. hose clamps
	End plug	End plug	12.78	12.8	0.02	

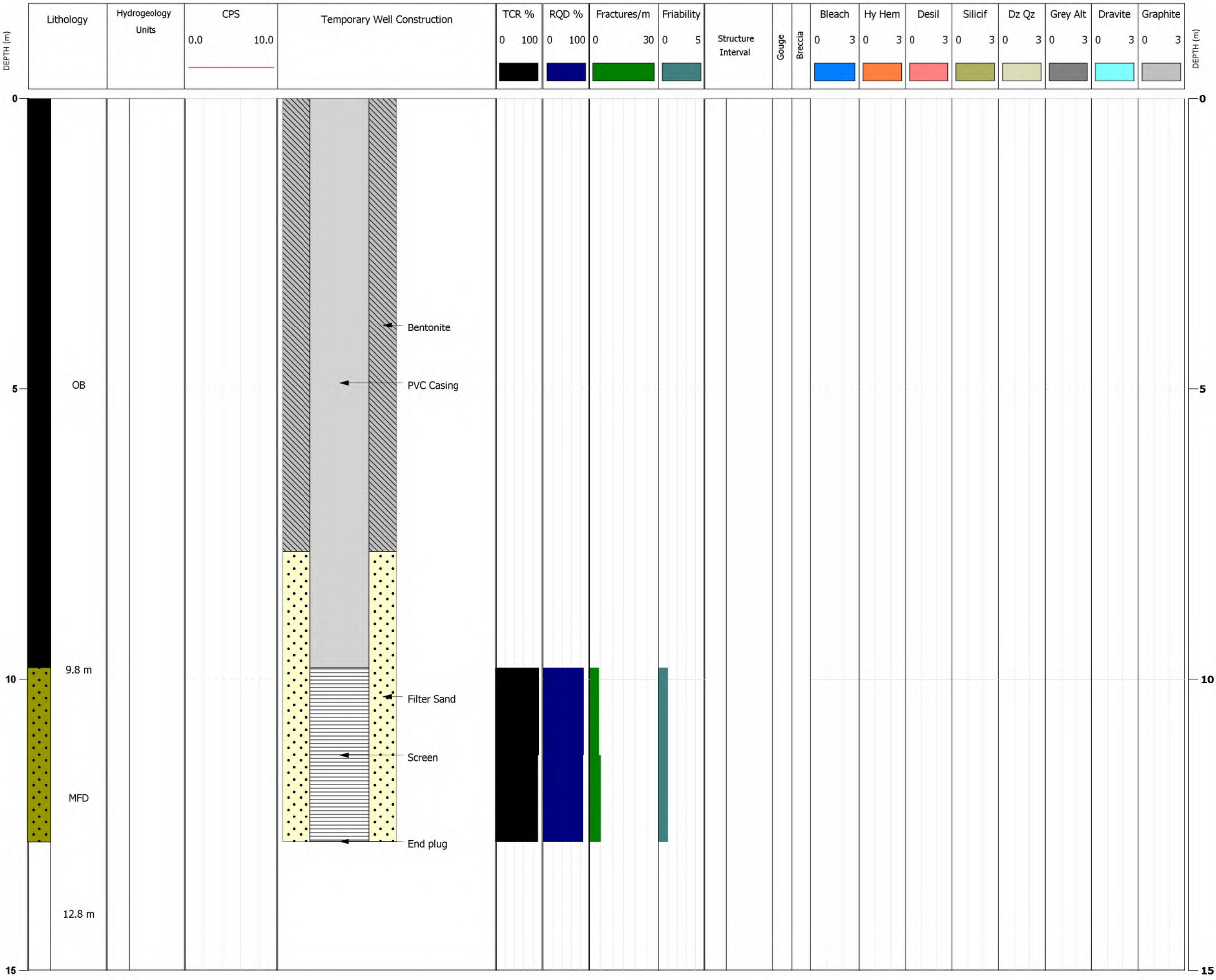


Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-035
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	12.8 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,571.06 m E ; 6,373,579.9 m N
Elevation: 504.51 m.
Comments: Edit-Text



Hydrogeology Units

1a 2a 2b 2c
2d 2e 3a 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

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5 = Unconsolidaded

Structure Interval

BC = Breccia FLT = Fault FLTZ = Fault Zone
SZ = Shear Zone FCT = Fault FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

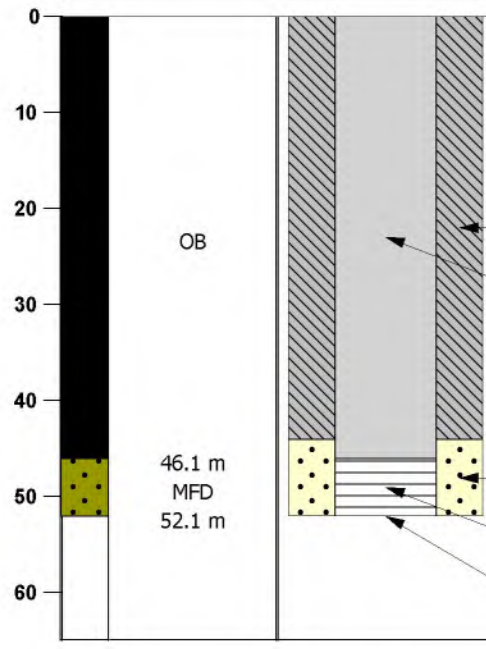
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-036
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	52.1 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,617.22 m E ; 6,374,449.1 m N
Elevation: 506.91 m.



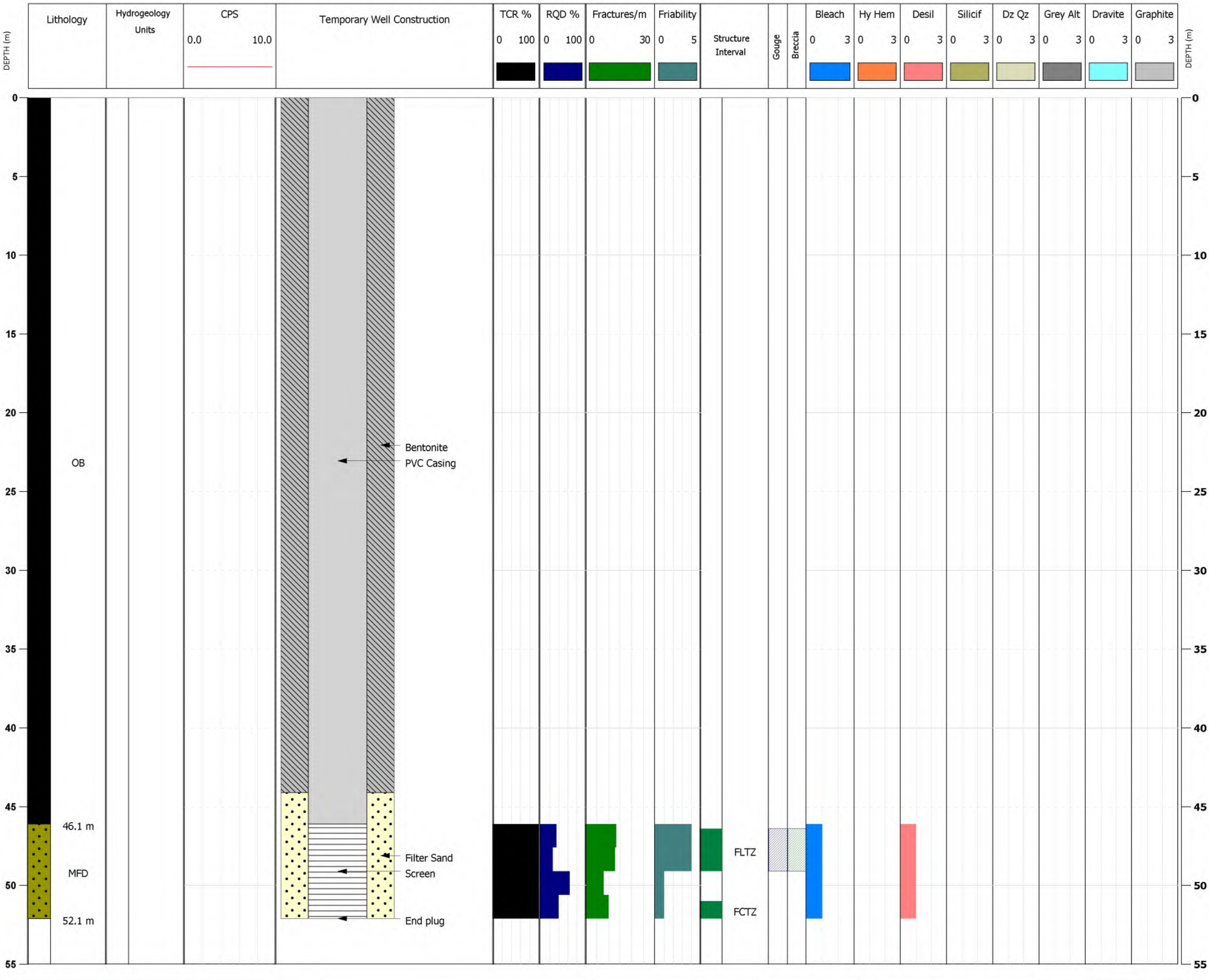
Lithology	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
OB	Bentonite	0	44.1	44.1	3/8" coated bentonite tablets
	PVC Casing	0	46.1	46.1	2.5" PVC casing Sch 80
46.1 m MFD 52.1 m	Filter Sand	44.1	46.1	2	
	Screen	46.1	52.1	6	2.5" PVC screen Sch 80 with filter sock 3 s.s. hose clamps
	End plug	52.08	52.1	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-036
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	52.1 m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,617.22 m E ; 6,374,449.1 m N
Elevation: 506.91 m.
Comments:



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

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Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

Alterations

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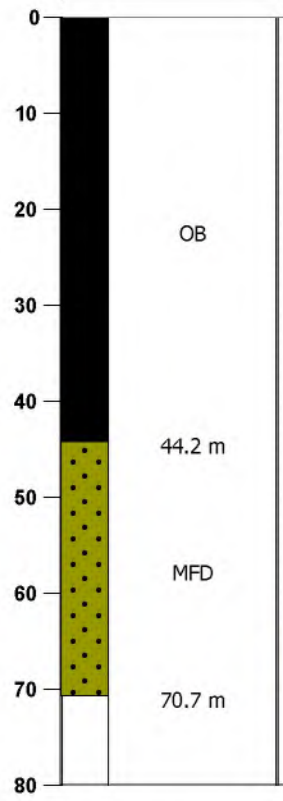
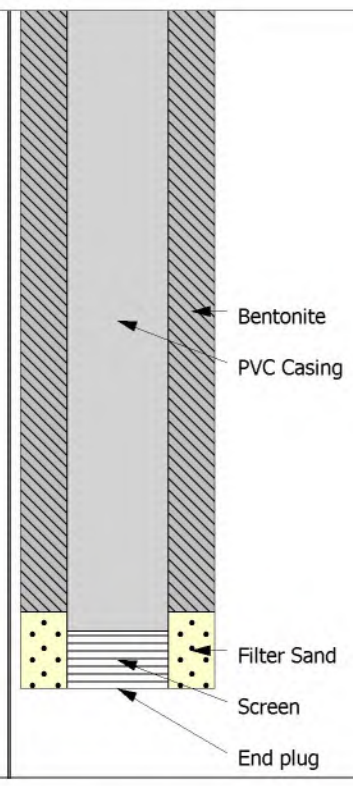
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-037
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	70.7m
Drilling End Date:	2020	Hole Type:	PQ

Coordinates: 477,607.69 m E ; 6,374,457.3 m N
Elevation: 506.92 m.





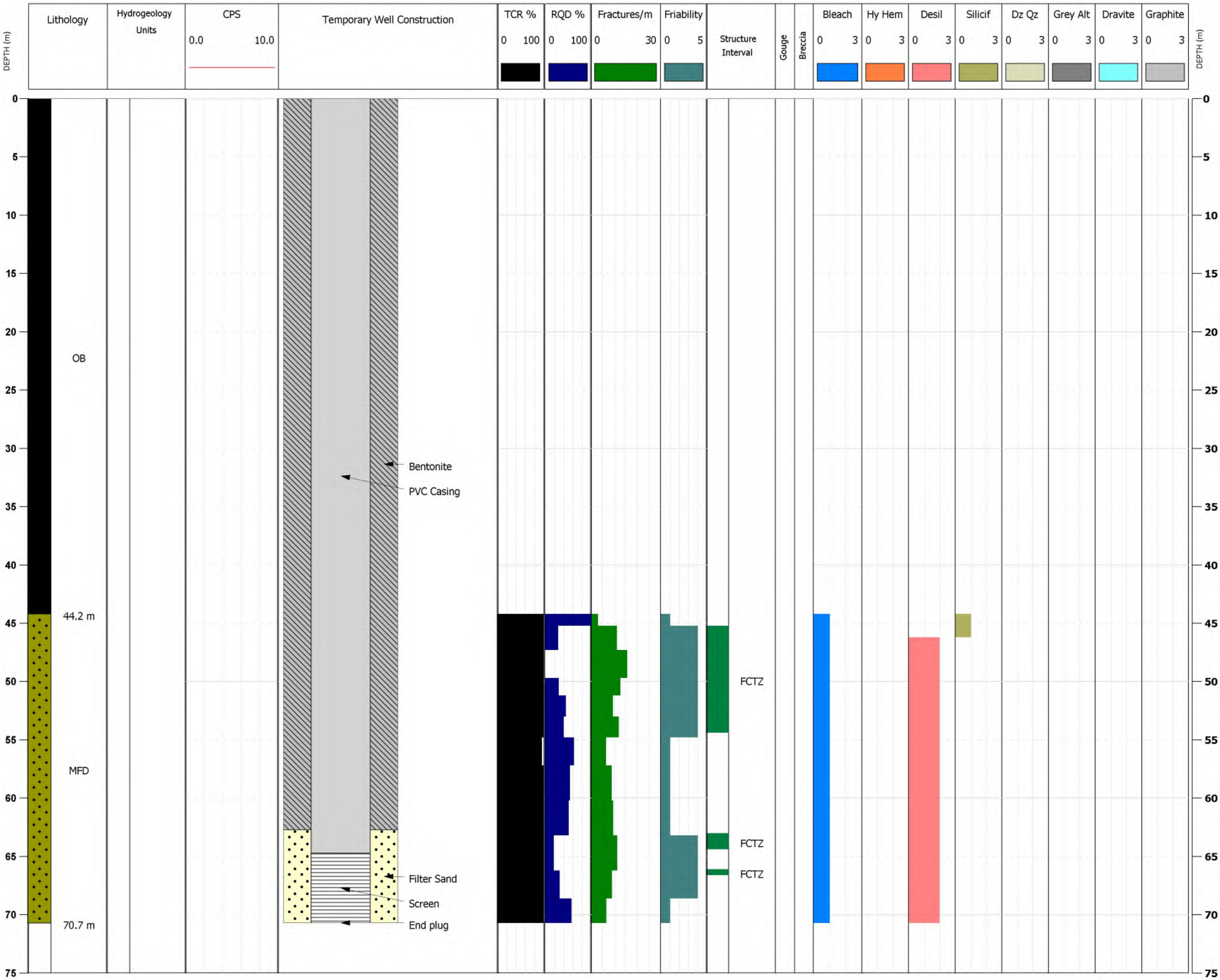
Lithology	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
Bentonite	Bentonite	0	62.7	62.7	3/8" coated bentonite tablets
PVC Casing	PVC Casing	0	64.7	64.7	2.5" PVC casing sch 80
Filter Sand	Filter Sand	62.7	70.7	8	
Screen	Screen	64.7	70.7	6	2.5" PVC screen sch 80 with filter sock 3s.s. hose clamps
End plug	End plug	70.68	70.7	0.02	

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-037
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	70.7 m
Drilling End Date:	2020	Hole Type:	CSW

Coordinates: 477,607.69 m E ; 6,374,457.3 m N
Elevation: 506.92 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

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FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

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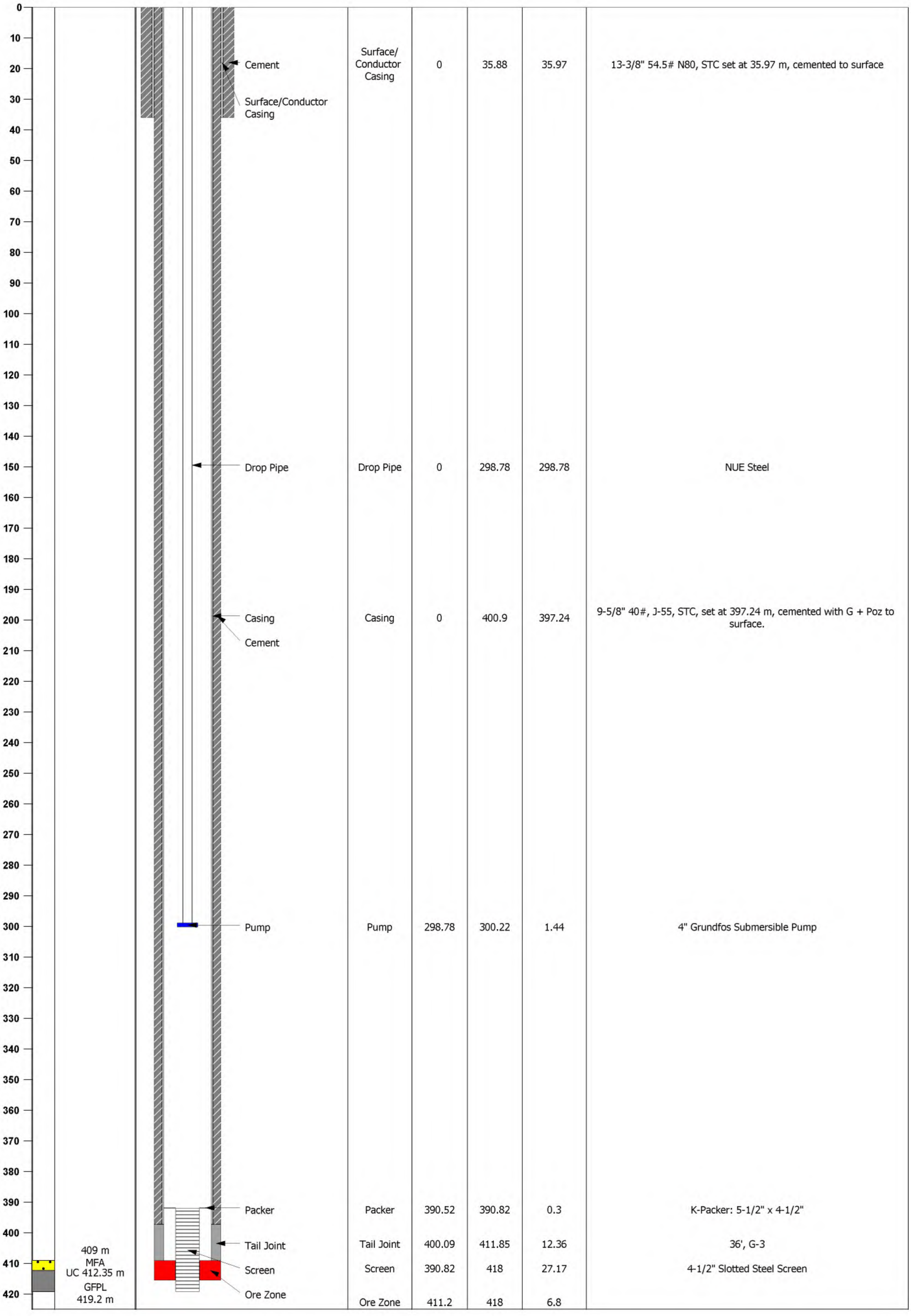
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics - Full Plot	Drillhole #	GWR-038
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419.2 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,138.88 m E ; 6,374,236.7 m N
Elevation: 541.49 m.
Comments: Depth from Tubing Hanger Flage.

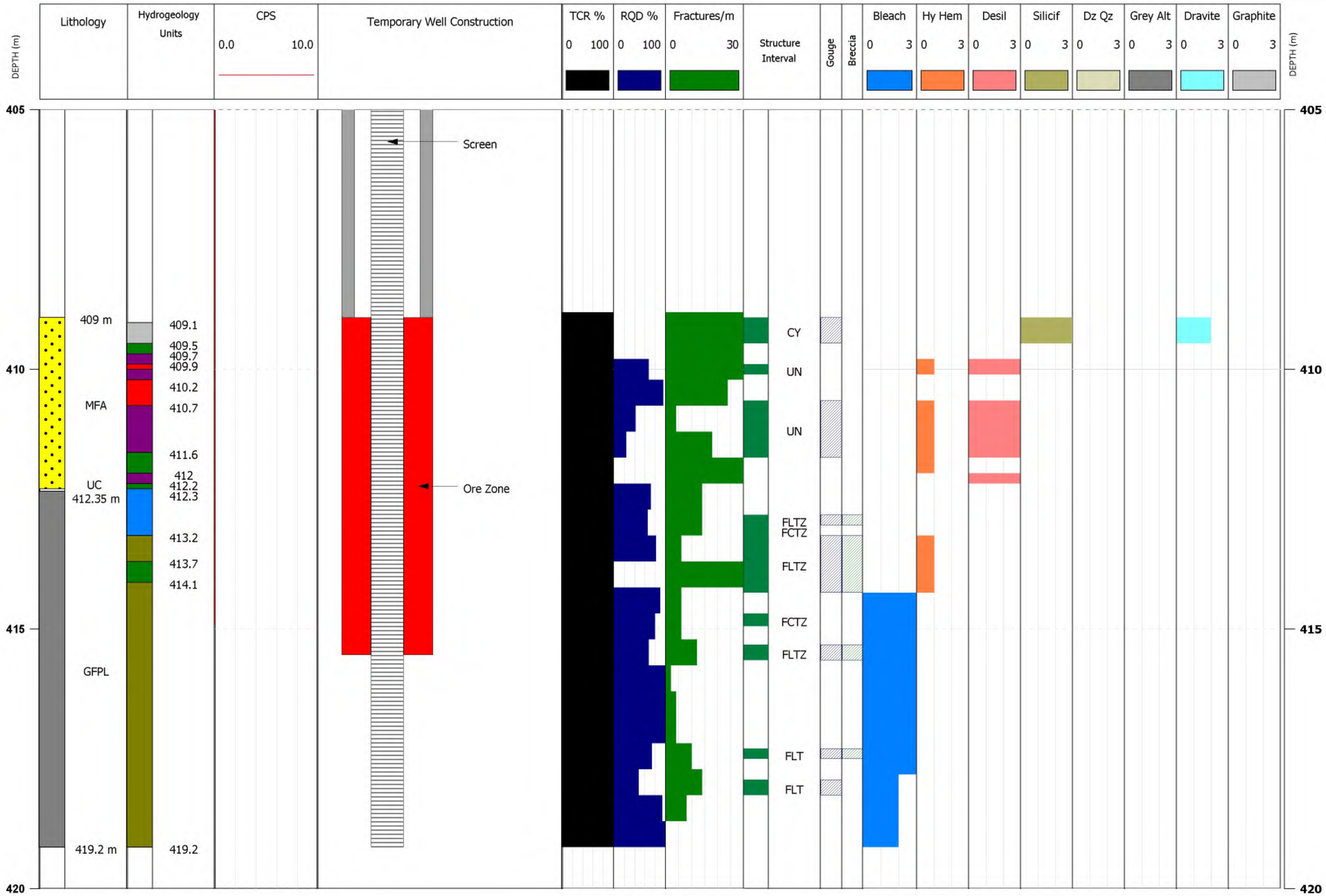


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Cement / Surface/Conductor Casing	Surface/ Conductor Casing	0	35.88	35.97	13-3/8" 54.5# N80, STC set at 35.97 m, cemented to surface
	Drop Pipe	Drop Pipe	0	298.78	298.78	NUE Steel
	Casing / Cement	Casing	0	400.9	397.24	9-5/8" 40#, J-55, STC, set at 397.24 m, cemented with G + Poz to surface.
	Pump	Pump	298.78	300.22	1.44	4" Grundfos Submersible Pump
	Packer	Packer	390.52	390.82	0.3	K-Packer: 5-1/2" x 4-1/2"
	Tail Joint	Tail Joint	400.09	411.85	12.36	36', G-3
	Screen	Screen	390.82	418	27.17	4-1/2" Slotted Steel Screen
	Ore Zone	Ore Zone	411.2	418	6.8	

Denison Mines

Title:	Well Schematics - Mineralization	Drillhole #	GWR-038
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419.2 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,138.88 m E ; 6,374,236.7 m N
Elevation: 541.49 m.
Comments: Depth from Tubing Hanger Flage.



Legend

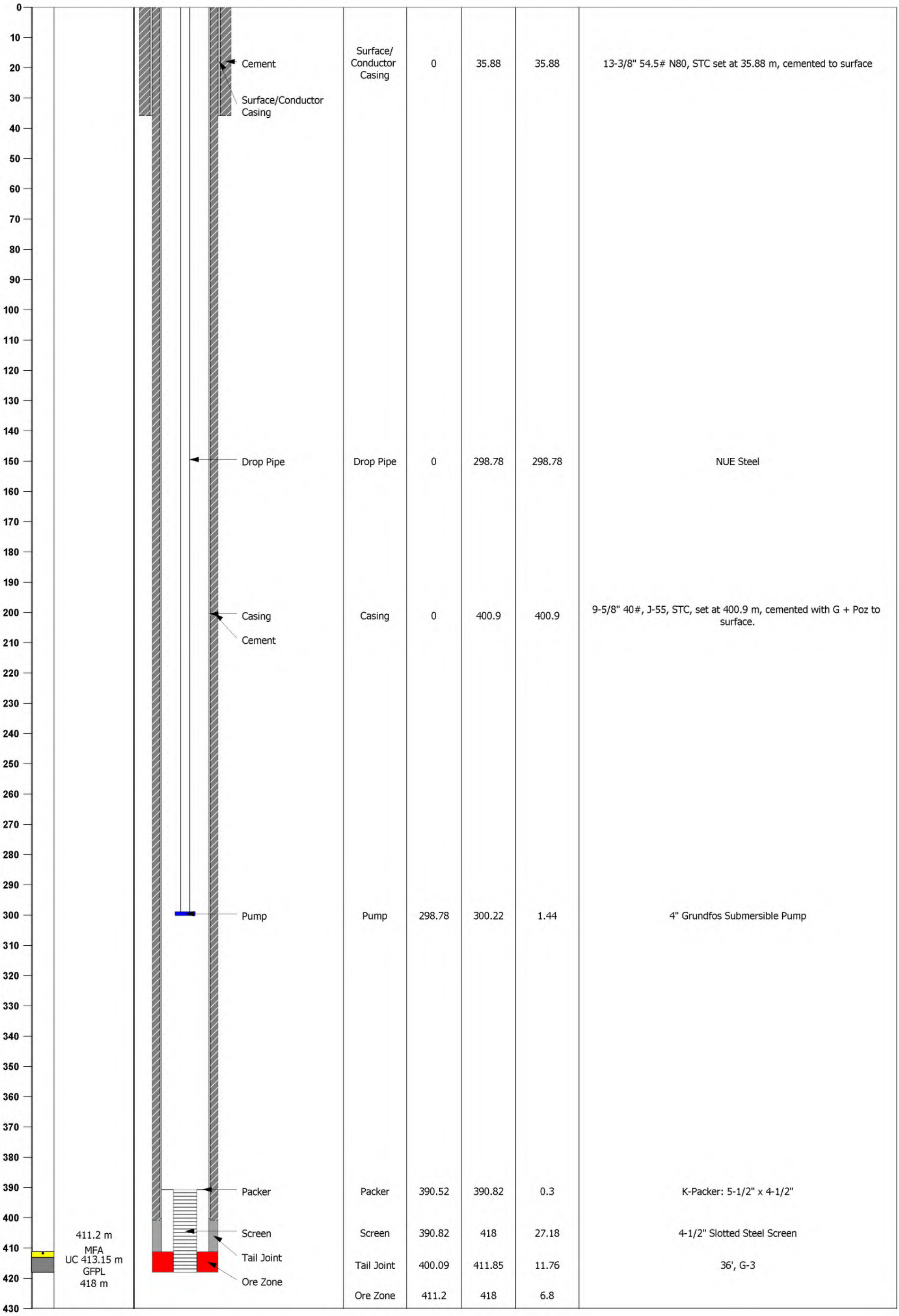
Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Denison Mines

Title:	Well Schematics - Full Plot	Drillhole #	GWR-039
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	418.0 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,128.32 m E ; 6,374,233.1 m N
Elevation: 542.02 m.
Comments: Depth from Tubing Hanger Flage.

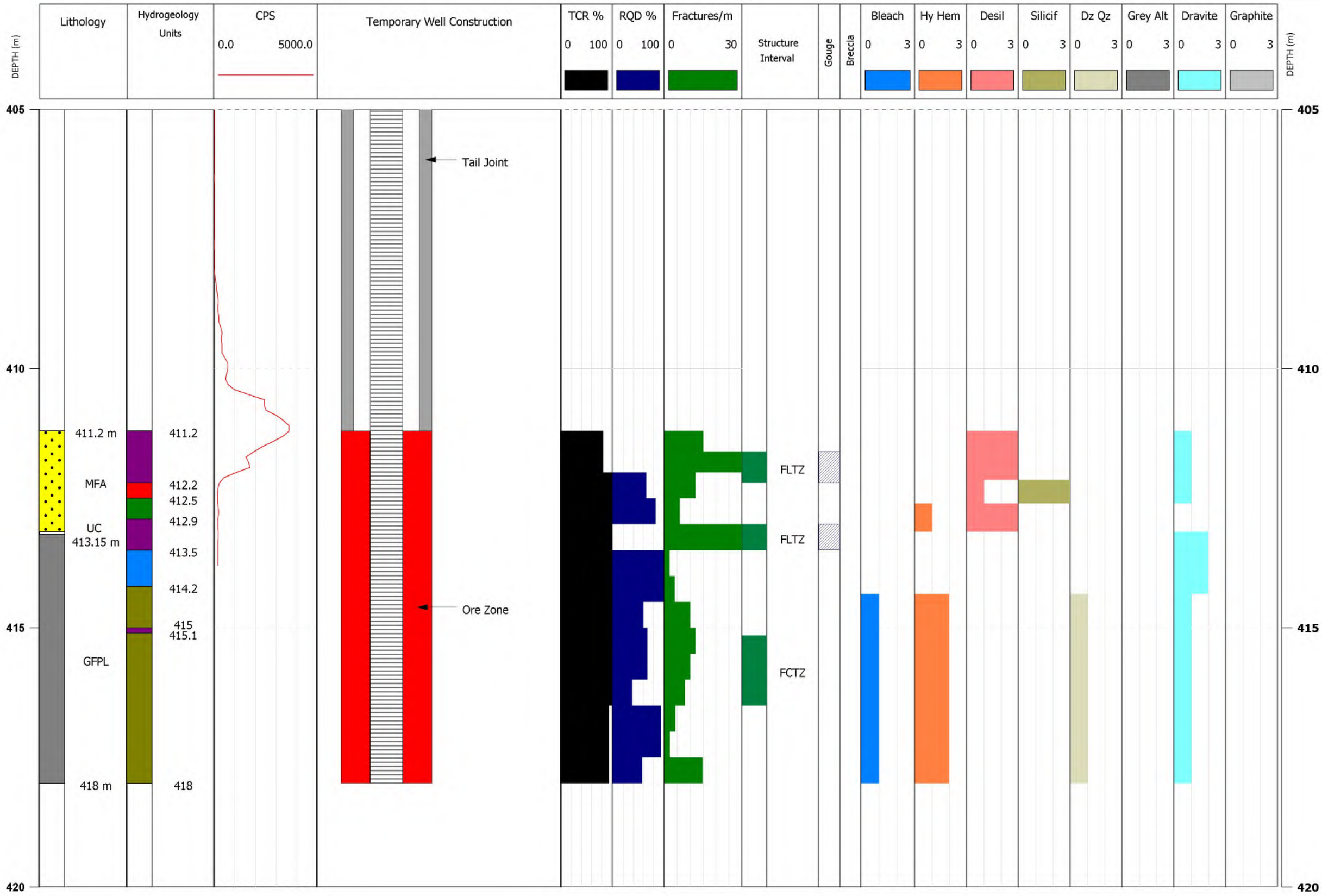


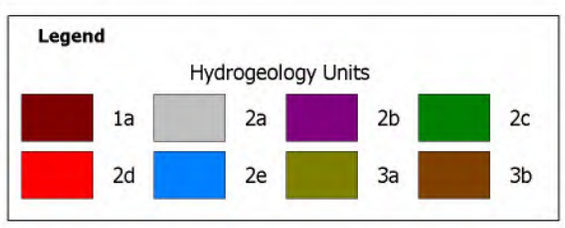
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Cement / Surface/Conductor Casing	Surface/ Conductor Casing	0	35.88	35.88	13-3/8" 54.5# N80, STC set at 35.88 m, cemented to surface
	Drop Pipe	Drop Pipe	0	298.78	298.78	NUE Steel
	Casing / Cement	Casing	0	400.9	400.9	9-5/8" 40#, J-55, STC, set at 400.9 m, cemented with G + Poz to surface.
	Pump	Pump	298.78	300.22	1.44	4" Grundfos Submersible Pump
	Packer	Packer	390.52	390.82	0.3	K-Packer: 5-1/2" x 4-1/2"
	Screen	Screen	390.82	418	27.18	4-1/2" Slotted Steel Screen
	Tail Joint	Tail Joint	400.09	411.85	11.76	36', G-3
	Ore Zone	Ore Zone	411.2	418	6.8	

Denison Mines

Title:	Well Schematics - Mineralization	Drillhole #	GWR-039
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	418.0 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,128.32 m E ; 6,374,233.1 m N
Elevation: 542.02 m.
Comments: Depth from Tubing Hanger Flage.

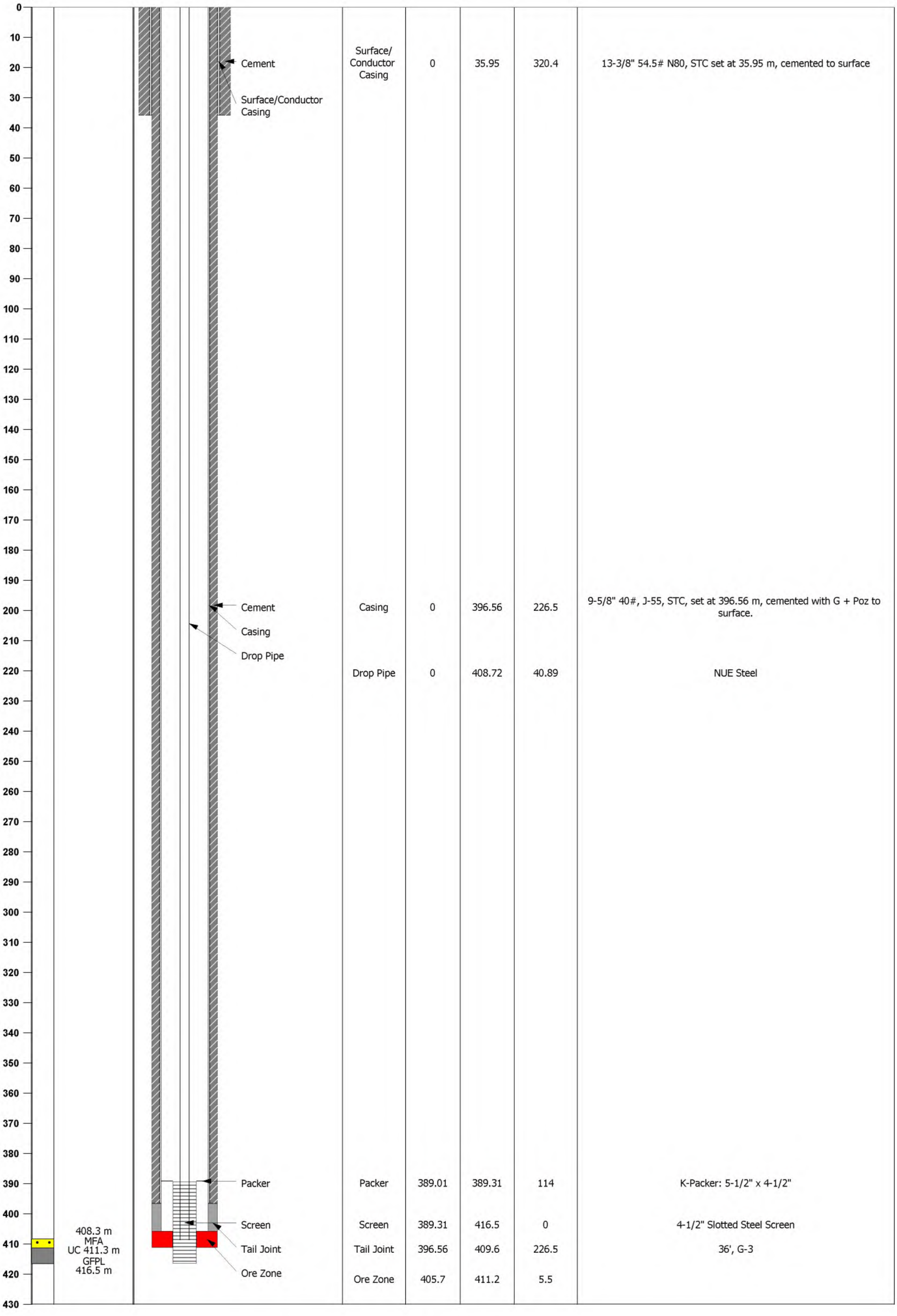




Denison Mines

Title:	Well Schematics - Full Plot	Drillhole #	GWR-040
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	416.5 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,131.81 m E ; 6,374,229.6 m N
Elevation: 541.42 m.
Comments: Depth from Tubing Hanger Flage.

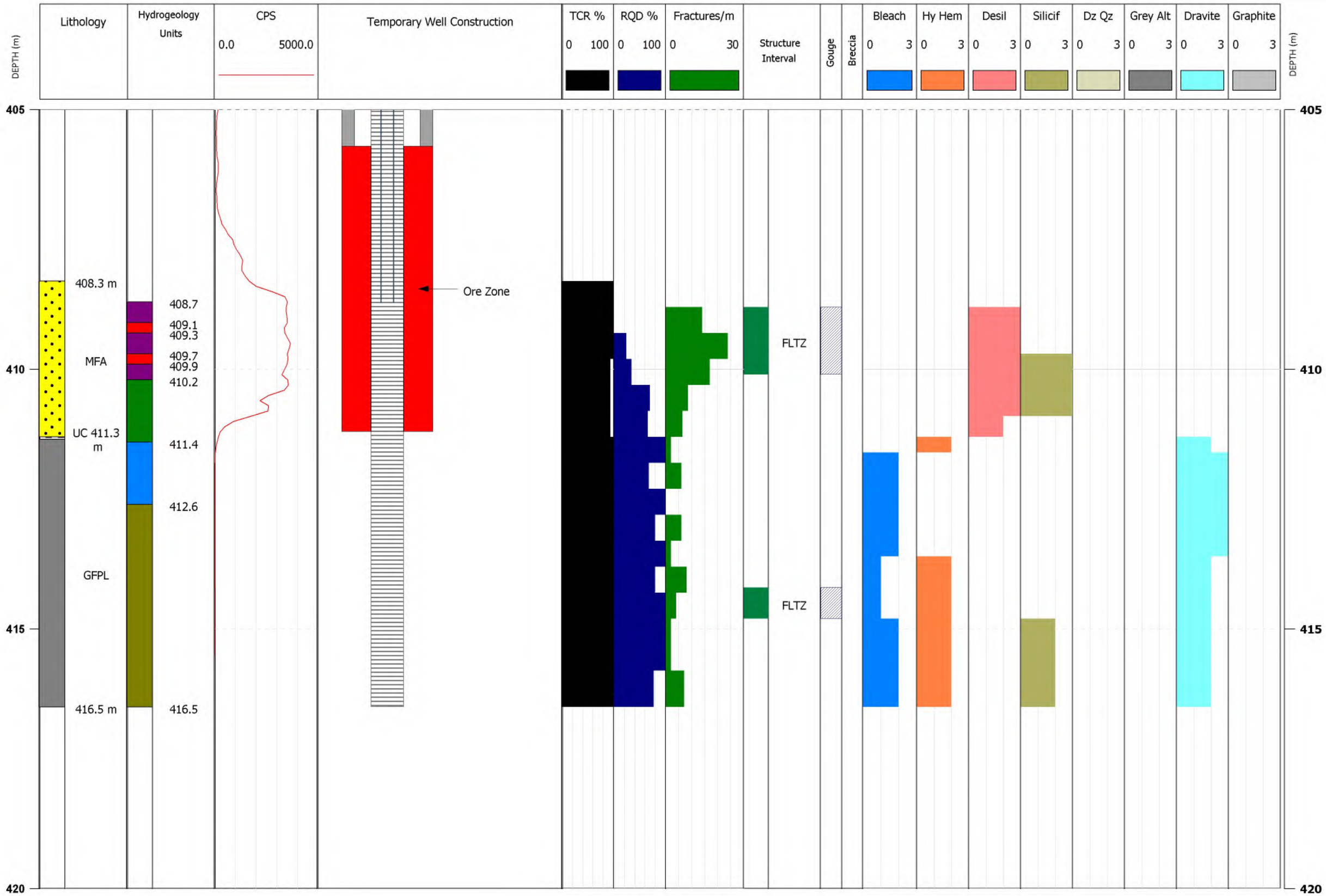


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Cement; Surface/Conductor Casing	Surface/ Conductor Casing	0	35.95	320.4	13-3/8" 54.5# N80, STC set at 35.95 m, cemented to surface
	Cement; Casing	Casing	0	396.56	226.5	9-5/8" 40#, J-55, STC, set at 396.56 m, cemented with G + Poz to surface.
	Drop Pipe	Drop Pipe	0	408.72	40.89	NUE Steel
	Packer	Packer	389.01	389.31	114	K-Packer: 5-1/2" x 4-1/2"
	Screen	Screen	389.31	416.5	0	4-1/2" Slotted Steel Screen
	Tail Joint	Tail Joint	396.56	409.6	226.5	36', G-3
	Ore Zone	Ore Zone	405.7	411.2	5.5	

Denison Mines

Title:	Well Schematics - Mineralization	Drillhole #	GWR-040
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	416.5 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,131.81 m E ; 6,374,229.6 m N
Elevation: 541.42 m.
Comments: Depth from Tubing Hanger Flage.



Legend

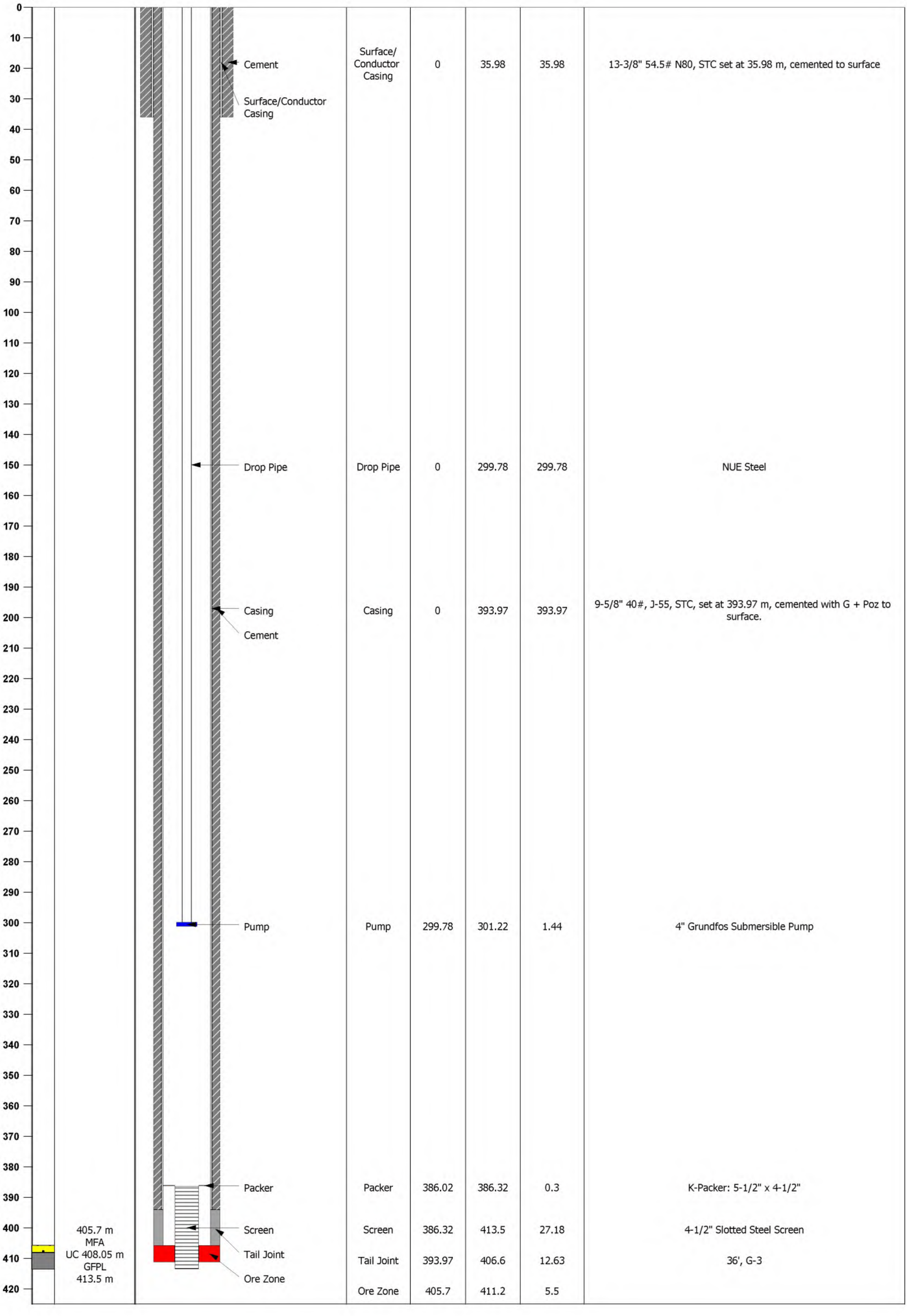
Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Denison Mines

Title:	Well Scematics - Full plot	Drillhole #	GWR-041
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	413.5 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,135.39 m E ; 6,374,226.2 m N
Elevation: 541.47 m.
Comments: Depth from Tubing Hanger Flage.

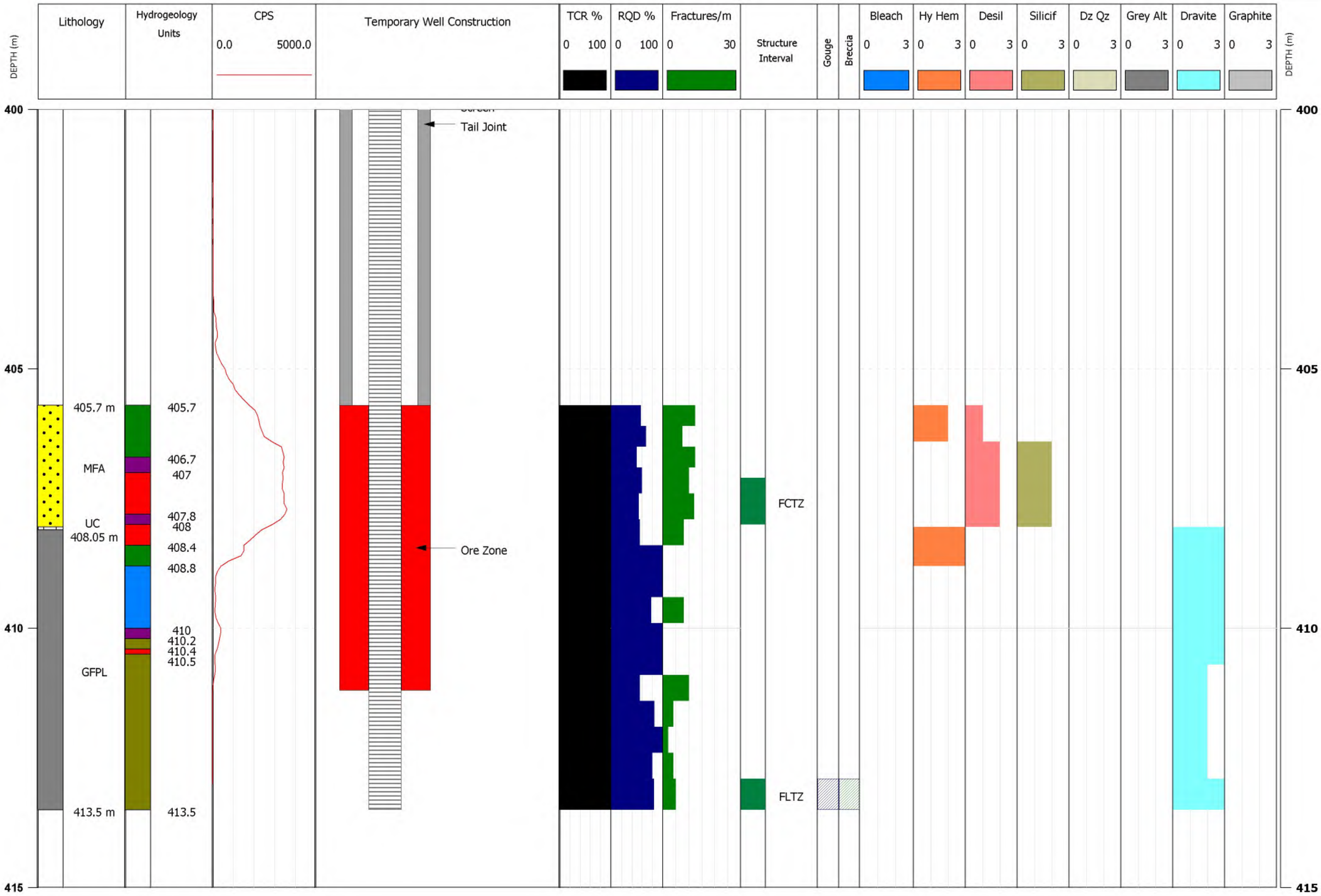


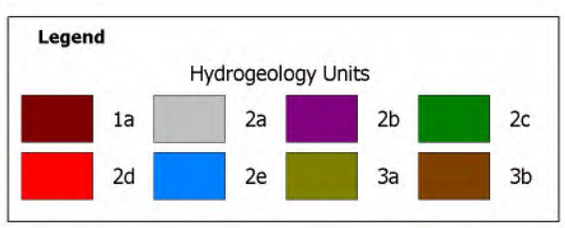
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Cement / Surface/Conductor Casing	Surface/ Conductor Casing	0	35.98	35.98	13-3/8" 54.5# N80, STC set at 35.98 m, cemented to surface
	Drop Pipe	Drop Pipe	0	299.78	299.78	NUE Steel
	Casing / Cement	Casing	0	393.97	393.97	9-5/8" 40#, J-55, STC, set at 393.97 m, cemented with G + Poz to surface.
	Pump	Pump	299.78	301.22	1.44	4" Grundfos Submersible Pump
	Packer	Packer	386.02	386.32	0.3	K-Packer: 5-1/2" x 4-1/2"
	Screen	Screen	386.32	413.5	27.18	4-1/2" Slotted Steel Screen
	Tail Joint	Tail Joint	393.97	406.6	12.63	36', G-3
	Ore Zone	Ore Zone	405.7	411.2	5.5	

Denison Mines

Title:	Well Schematics - Mineralization	Drillhole #	GWR-041
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	413.5 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,135.39 m E ; 6,374,226.2 m N
Elevation: 541.47 m.
Comments: Depth from Tubing Hanger Flage.

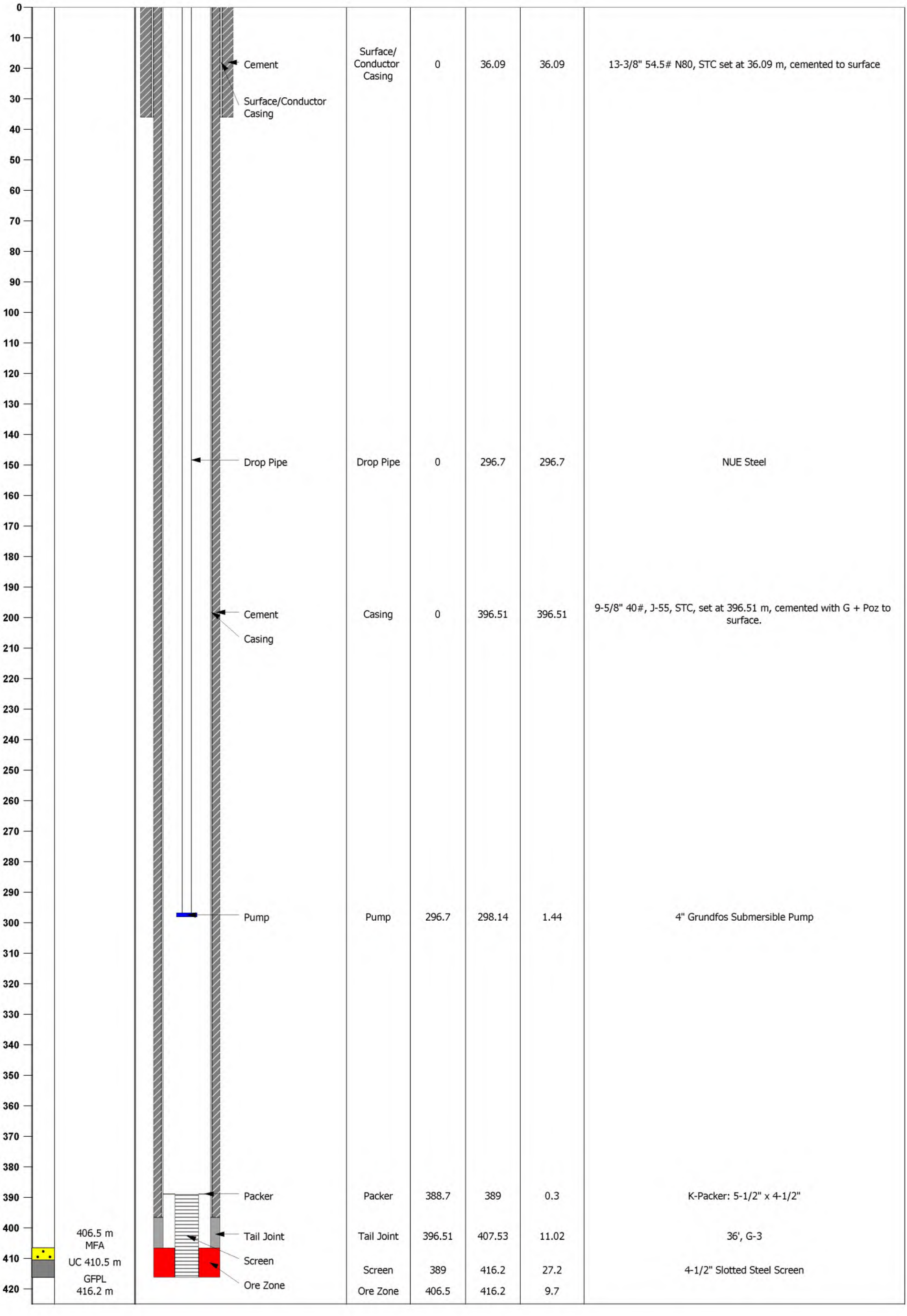




Denison Mines

Title:		Drillhole #	GWR-042
Project:	Wheeler River	Drilling method:	DDH
Logged by		Total depth:	416.2 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,124.43 m E ; 6,374,222.6 m N
Elevation: 542.22 m.
Comments: Depth from Tubing Hanger Flage

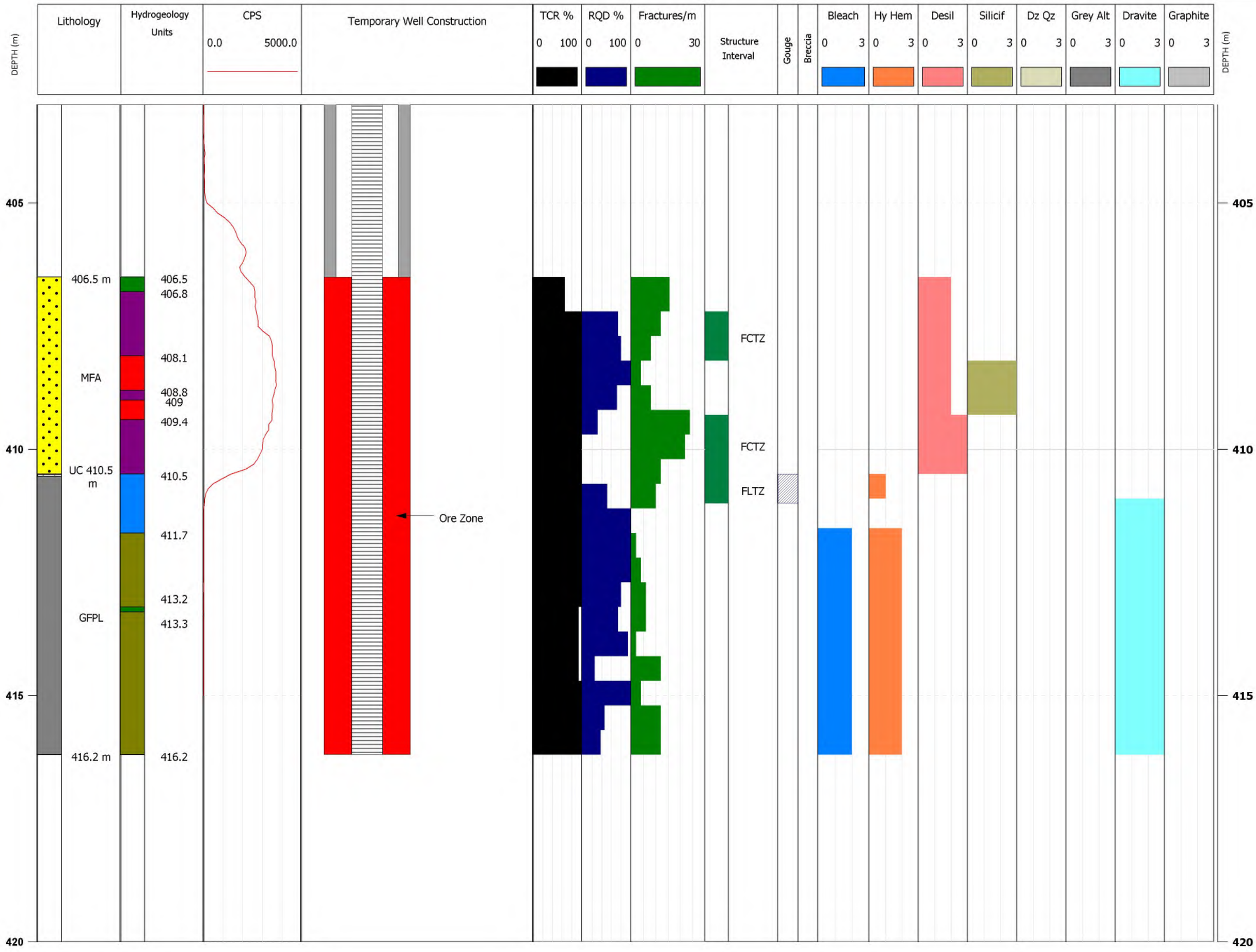


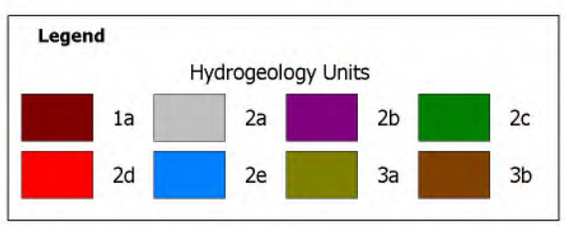
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Cement / Surface/Conductor Casing	Surface/ Conductor Casing	0	36.09	36.09	13-3/8" 54.5# N80, STC set at 36.09 m, cemented to surface
	Drop Pipe	Drop Pipe	0	296.7	296.7	NUE Steel
	Cement / Casing	Casing	0	396.51	396.51	9-5/8" 40#, J-55, STC, set at 396.51 m, cemented with G + Poz to surface.
	Pump	Pump	296.7	298.14	1.44	4" Grundfos Submersible Pump
	Packer	Packer	388.7	389	0.3	K-Packer: 5-1/2" x 4-1/2"
	Tail Joint	Tail Joint	396.51	407.53	11.02	36', G-3
	Screen	Screen	389	416.2	27.2	4-1/2" Slotted Steel Screen
	Ore Zone	Ore Zone	406.5	416.2	9.7	

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-042
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	416.2 m
Drilling End Date:		Hole Type:	CSW

Coordinates: 477,124.43 m E ; 6,374,222.6 m N
Elevation: 542.22 m.
Comments: Depth from Tubing Hanger Flage





Denison Mines

Title:	Well Schematics	Drillhole #	GWR-043
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	389 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 477,369.93 m E ; 6,374,353.3 m N
Elevation: 519.15 m.

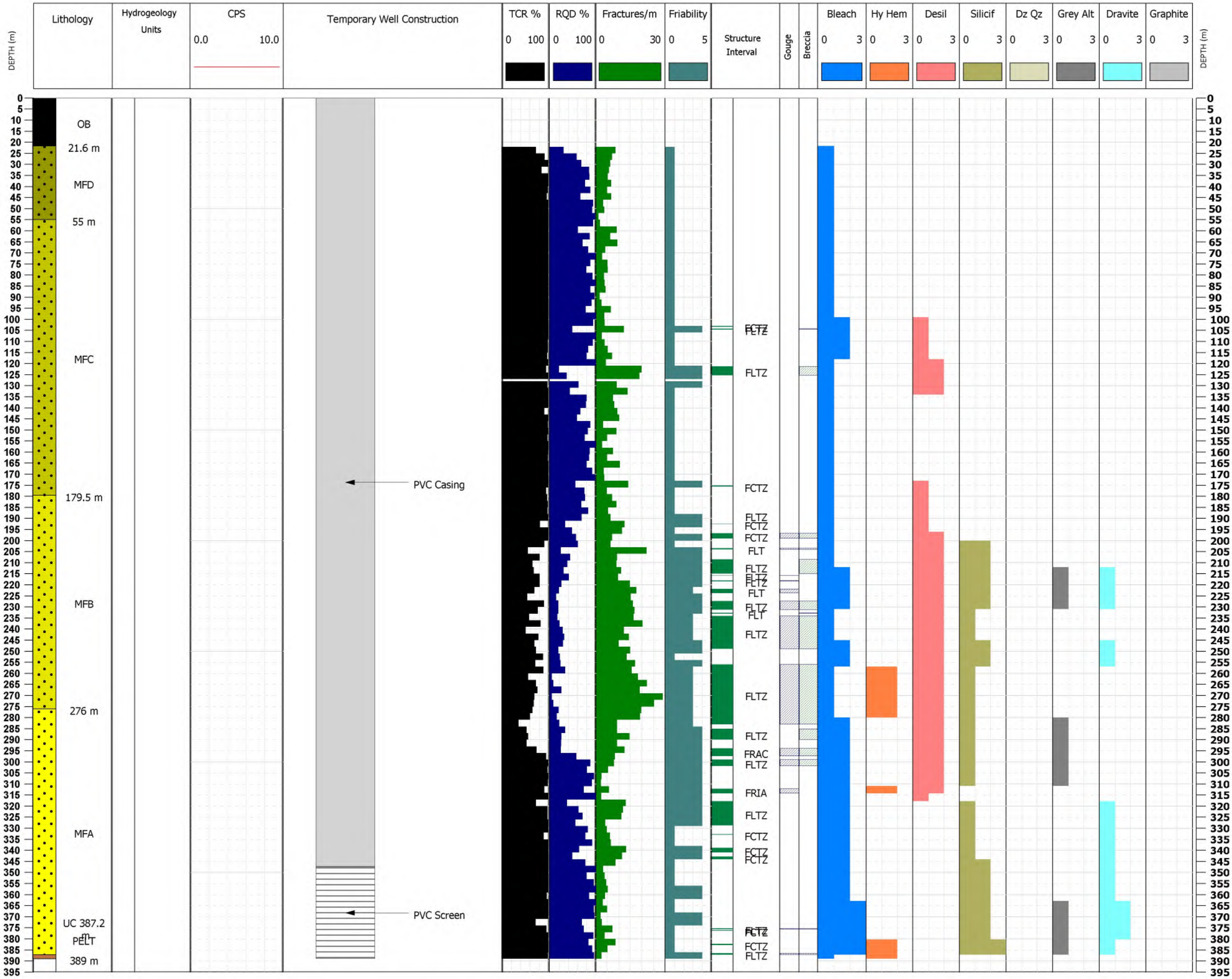
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	PVC Casing	0	347.4	347.4	2.5" PVC casing Sch 80
	PVC Screen	PVC Screen	347.4	389	41.6	2.5" slotted PVC Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-043
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	389 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 477,369.93 m E ; 6,374,353.3 m N
Elevation: 519.15 m.
Comments: No Hydro units logged.



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

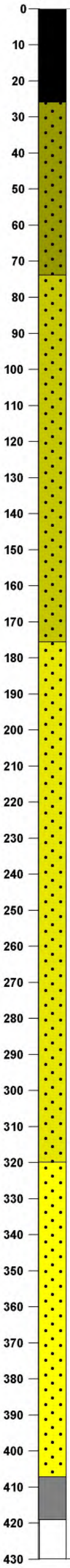
Alterations

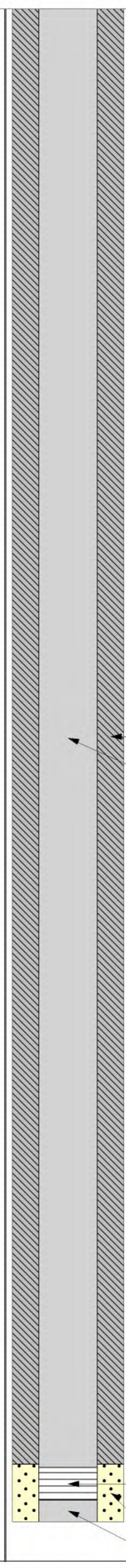
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-044
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 477,153.78 m E ; 6,374,241.2 m N
Elevation: 538.91 m.





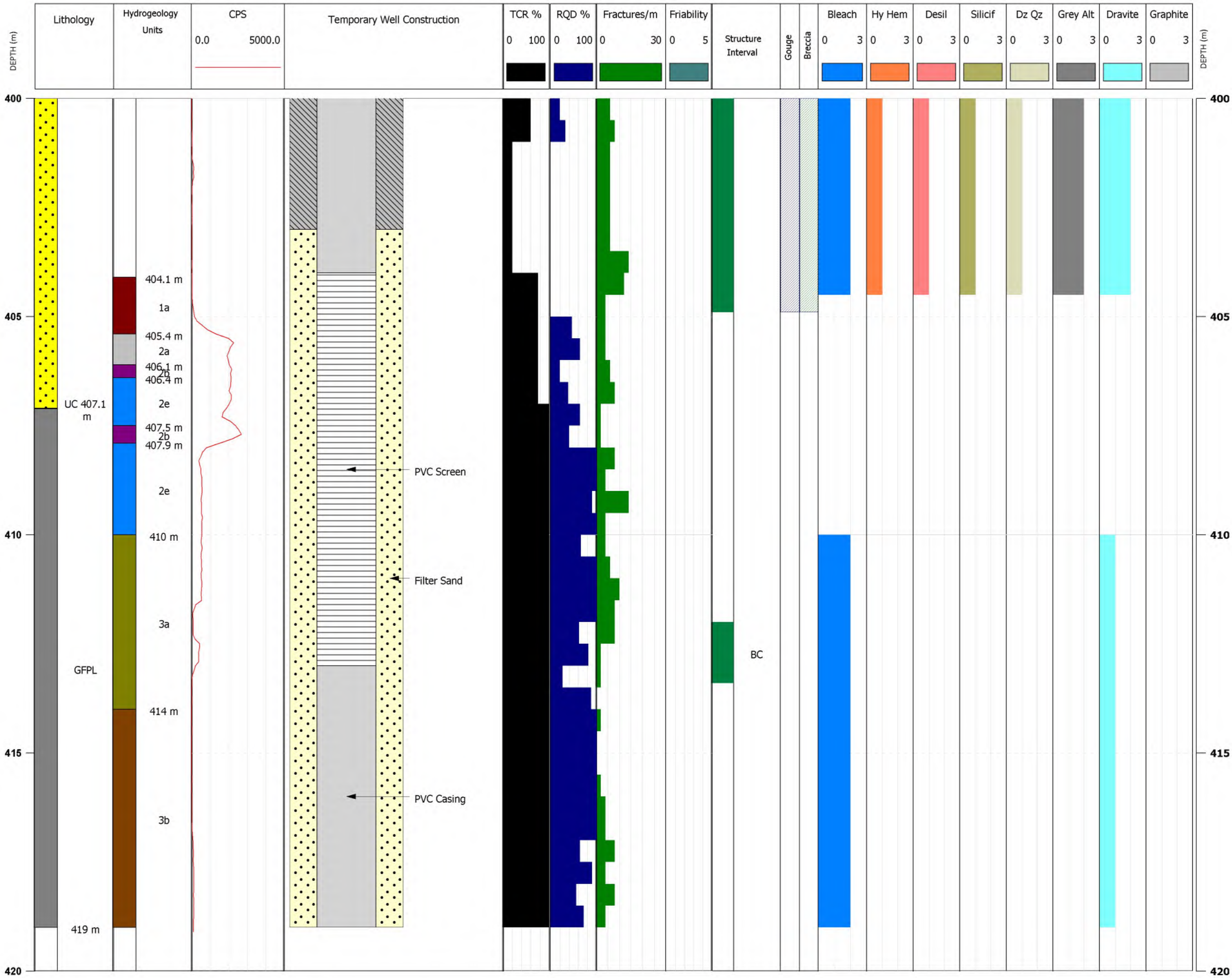
Lithology	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
Bentonite	Bentonite	0	403	403	1/4" coated tablets
PVC Casing	PVC Casing	0	404	404	2.5" PVC casing Sch 80
PVC Screen	PVC Screen	404	413	9	2.5" slotted PVC Sch 80
Filter Sand	Filter Sand	403	419	16	
PVC Casing	PVC Casing	413	419	6	2.5" PVC casing Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-044
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	419 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 477,153.78 m E ; 6,374,241.2 m N
Elevation: 538.91 m.
Comments: Hydro units logged from photos. No friability below 392 m.



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability
0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia	FLT = Fault	FLTZ = Fault Zone
SZ = Shear Zone	FCT = Fault	FCTZ = Fracture Zone

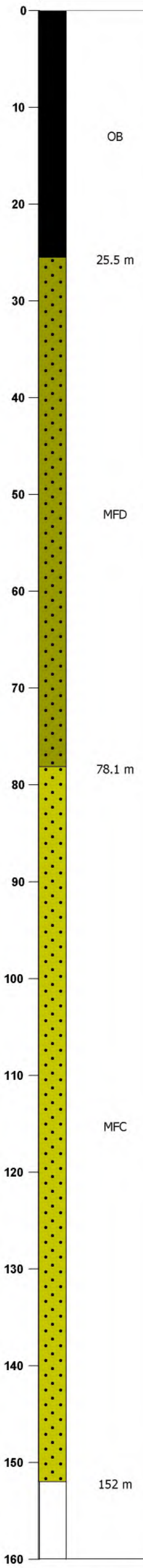
*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

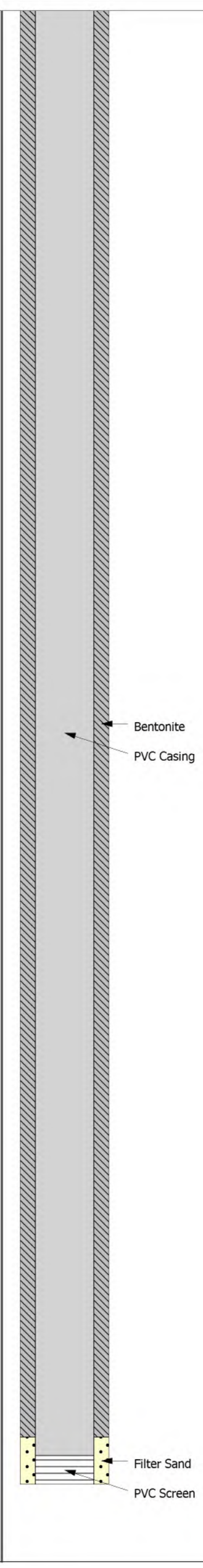
Alterations
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-046
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	152 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 477,135.58 m E ; 6,374,233.2 m N
Elevation: 540.5 m.





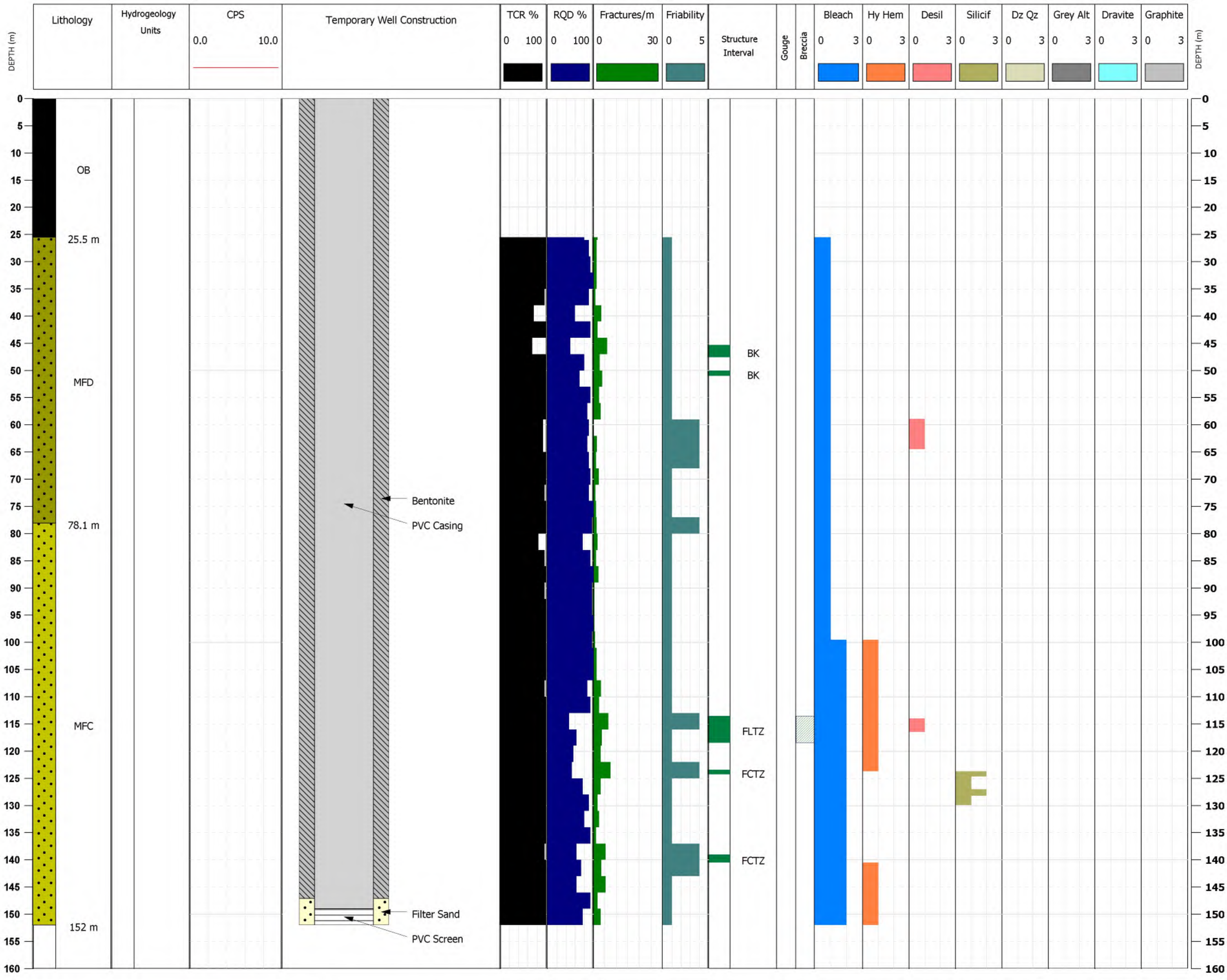
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	Bentonite	Bentonite	0	147.1	147.1	3/8" coaed bentonite with canola oil
	PVC Casing	PVC Casing	0	149	149	2.5" PVC casing Sch 80
	Filter Sand	Filter Sand	147.1	152	4.9	
	PVC Screen	PVC Screen	149	152	3	2.5" slotted PVC screen Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-046
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	152 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 477,135.58 m E ; 6,374,233.2 m N
Elevation: 540.5 m.
Comments: No Hydro units logged.



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

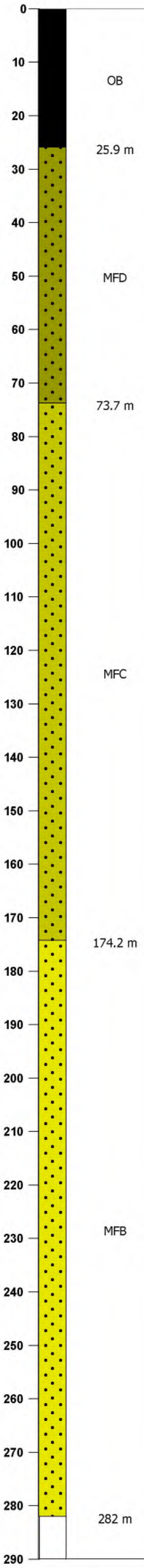
Alterations

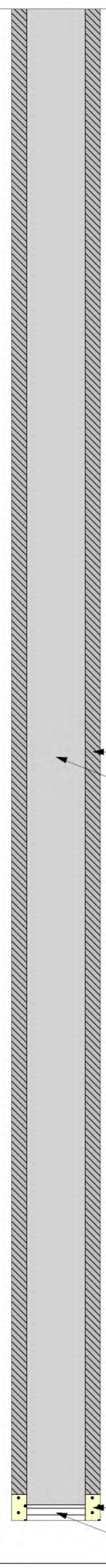
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-047
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	282 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 0.0 m E ; 0.0 m N
Elevation: 0.0 m.





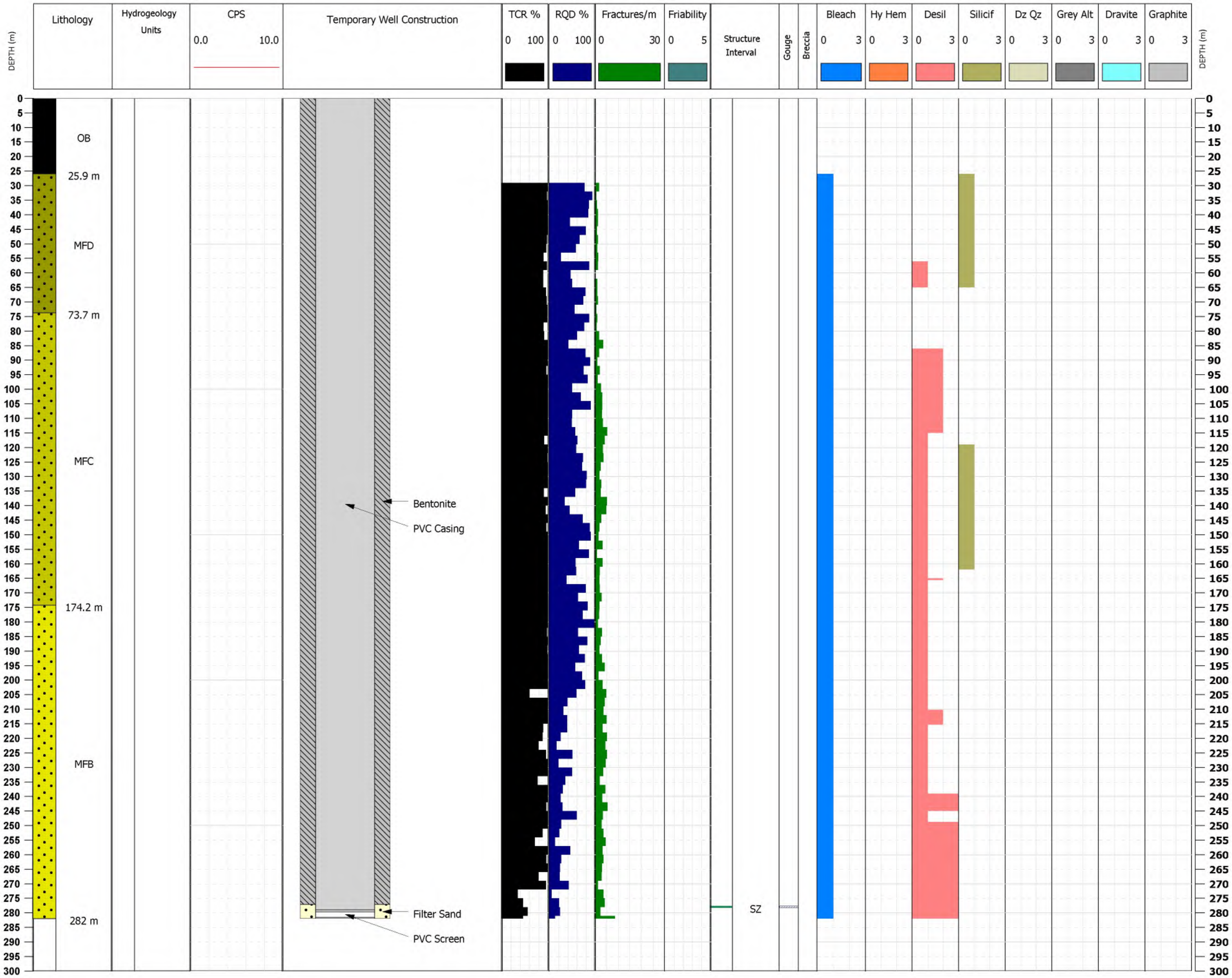
Lithology	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
Bentonite	Bentonite	0	277.1	277.1	3/8" coaed bentonite with canola oil
PVC Casing	PVC Casing	0	279	279	2.5" PVC casing Sch 80
Filter Sand	Filter Sand	277.1	282	4.9	
PVC Screen	PVC Screen	279	282	3	2.5" slotted PVC screen Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-047
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	282 m
Drilling End Date:	2021	Hole Type:	PQ

Coordinates: 477,132.04 m E ; 6,374,232.2 m N
Elevation: 540.5 m.
Comments: No Hydro units or friability logged.



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

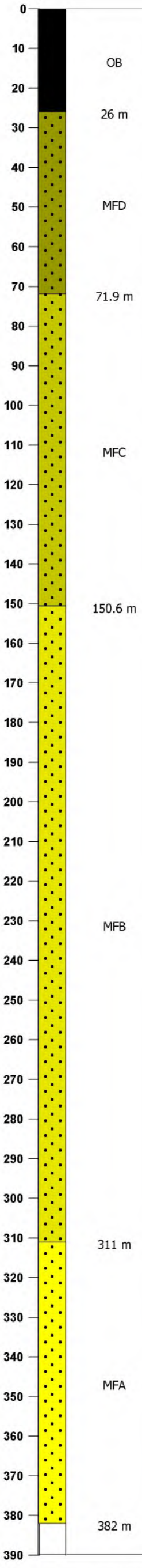
Alterations

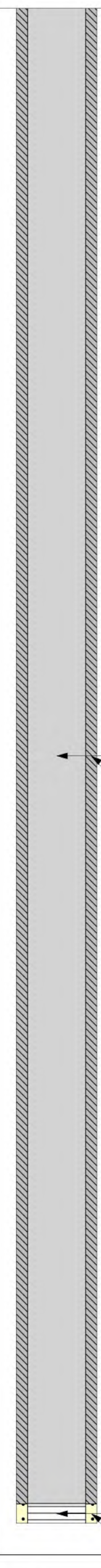
0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-048
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	382 m
Drilling End Date:	2021	Hole Type:	

Coordinates: 477,127.99 m E ; 6,374,225.93 m N
Elevation: 540.57 m.





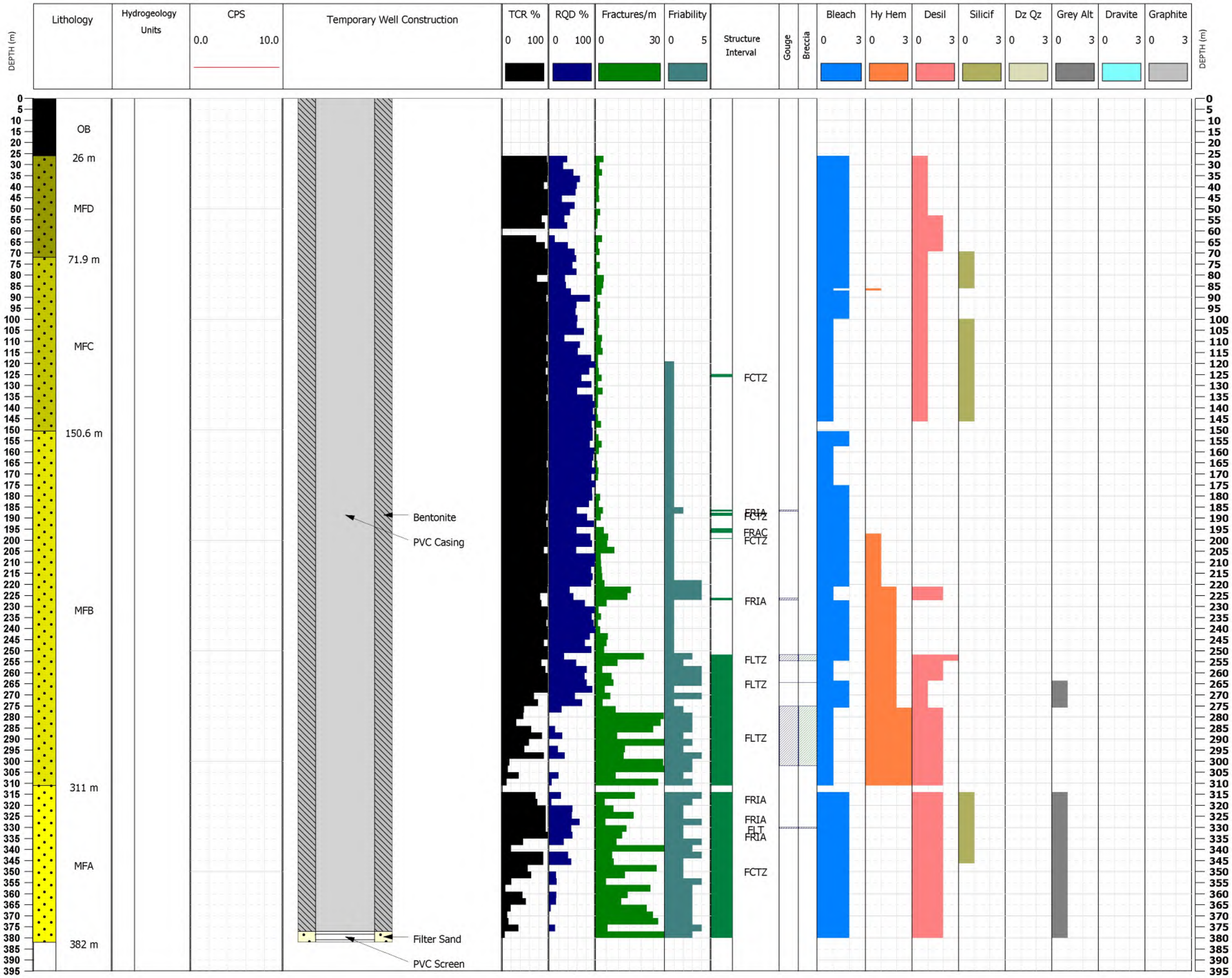
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	PVC Casing	Bentonite	0	377.1	377.1	3/8" coated tablets
	Bentonite	PVC Casing	0	377	377	2.5" PVC casing Sch 80
	PVC Screen	Filter Sand	377.1	382	4.9	
	Filter Sand	PVC Screen	377	382	3	2.5" slotted VC screen Sch 80

Comments: Depth below surface.

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-048
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	382 m
Drilling End Date:	2021	Hole Type:	

Coordinates: 477,127.99 m E ; 6,374,225.93 m N
Elevation: 540.57 m.
Comments:



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

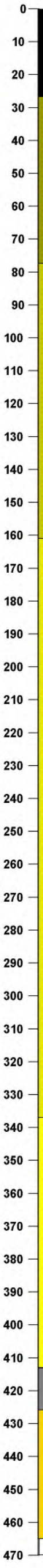
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-049
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	465 m
Drilling End Date:	2021	Hole Type:	HQ/NQ

Coordinates: 477,123.01 m E ; 6,374,234.73 m N
Elevation: 541.26 m.

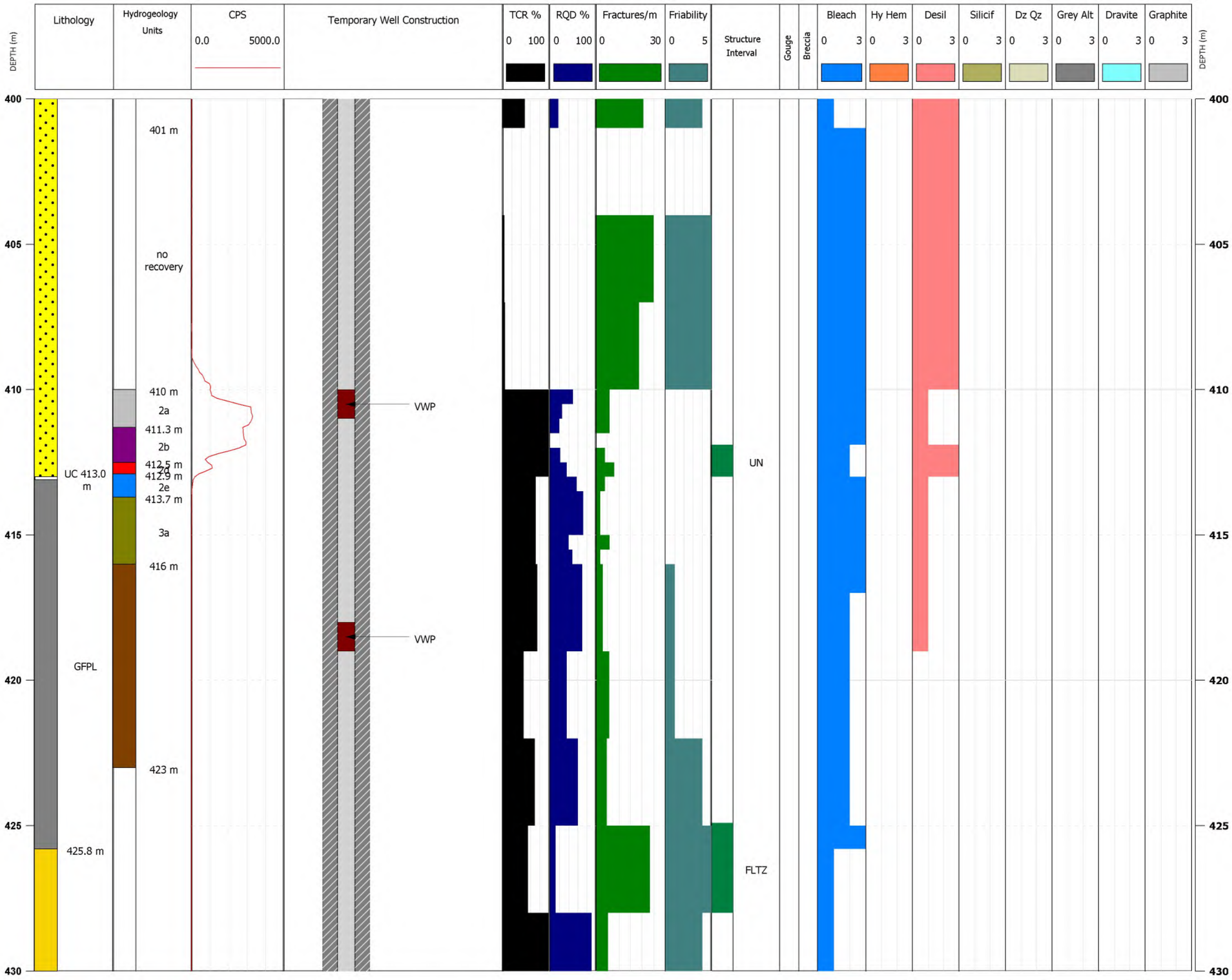


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	VWP	VWP		147		
	Cement	Cement	0	452	452	
	PVC Casing	PVC Casing	0	465	465	3/4" PVC pipe Sch 40
	VWP	VWP		277		
	VWP	VWP		377		
	VWP	VWP		411		
	VWP	VWP		419		
	VWP	VWP		452		

Comments: Depth below surface.

Title:	Well Schematics	Drillhole #	GWR-049
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	465 m
Drilling End Date:	2021	Hole Type:	HQ/NQ

Coordinates: 477,123.01 m E ; 6,374,234.7 m N
Elevation: 541.26 m.
Comments: Hydrogeology units logged from photos.



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

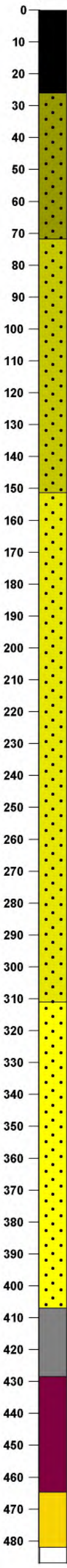
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-050
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	482 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,132.27 m E ; 6,374,216.86 m N
Elevation: 539.93 m.

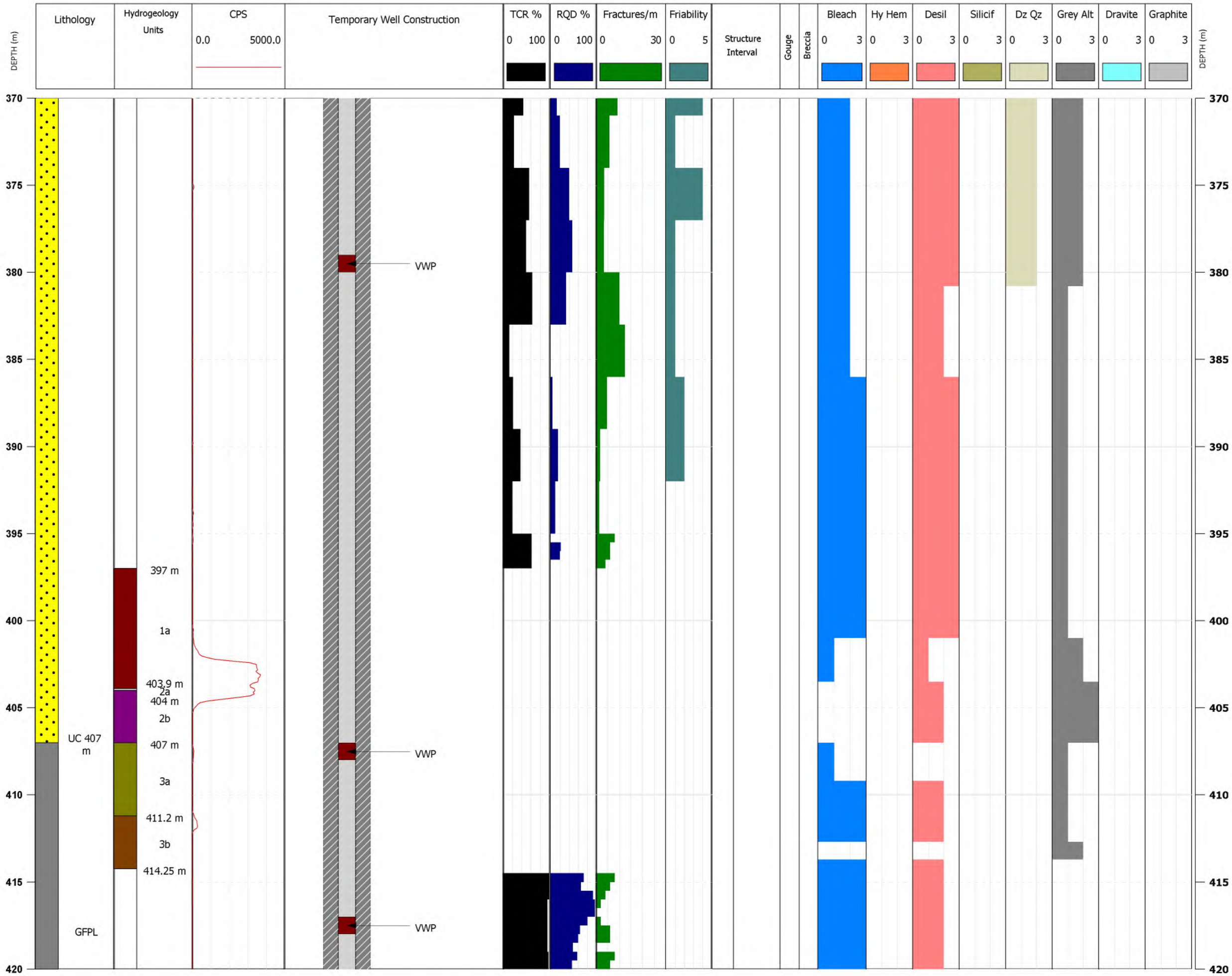


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	VWP	VWP		150		
	Cement	Cement	0	480	480	
	PVC Casing	PVC Casing	0	482	482	3/4" PVC pipe Sch 40
	VWP	VWP		280		
	VWP	VWP		380		
	VWP	VWP		408		
	VWP	VWP		418		
	VWP	VWP		480		

Comments: Depth below surface.

Title:	Well Schematics	Drillhole #	GWR-050
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	482 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,132.27 m E ; 6,374,216.9 m N
Elevation: 539.93 m.
Comments: Hydrogeology Units logged from photos.



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

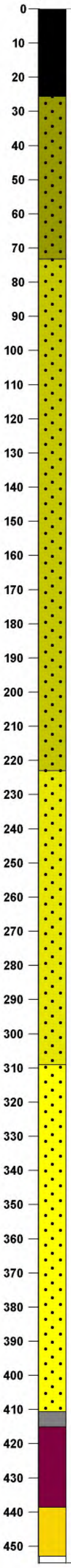
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-051
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	450 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,148.28 m E ; 6,374,228.8 m N
Elevation: 538.98 m.



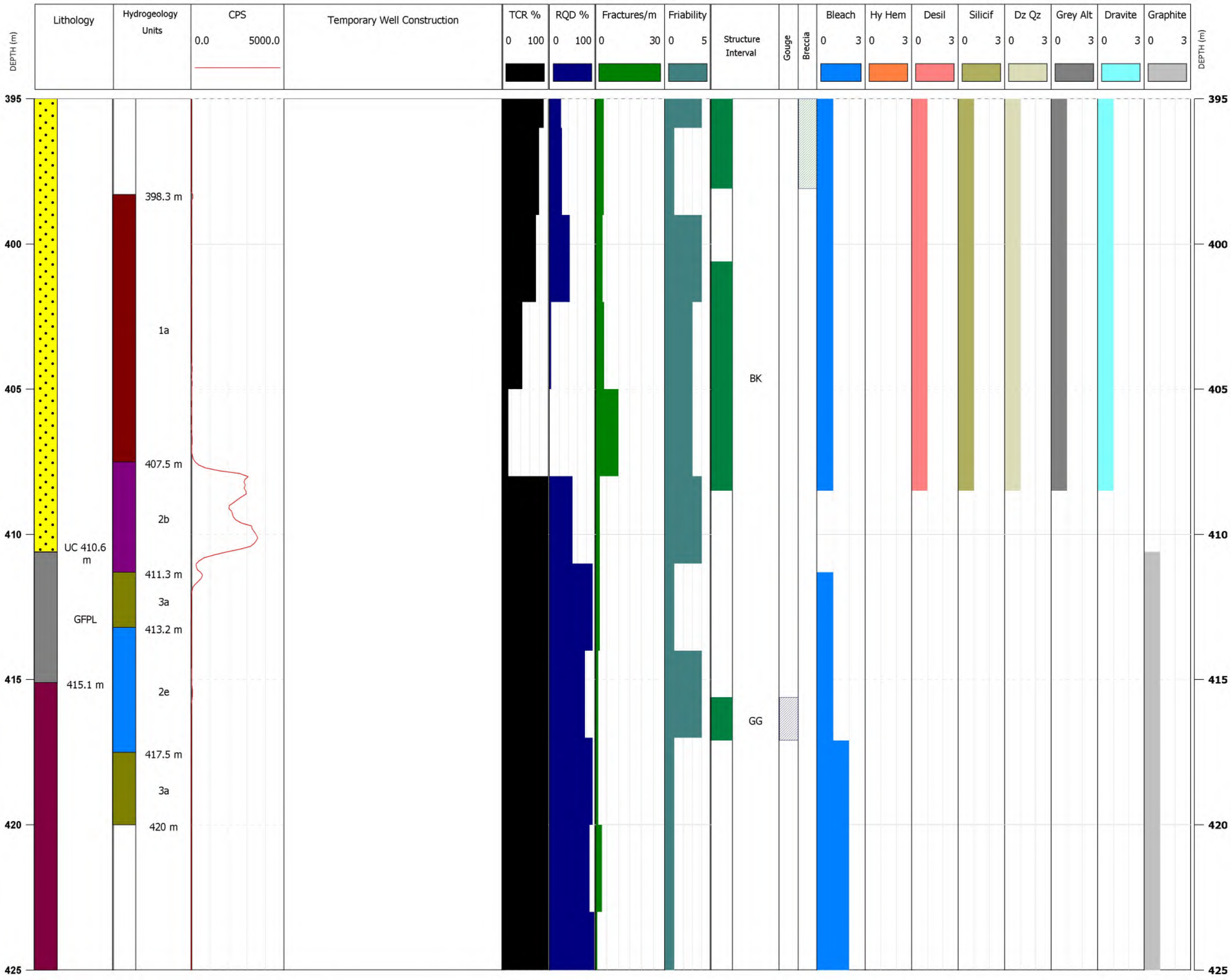
Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	VWP	VWP	150			
	Cement	Cement	449.4	0	449.4	
	PVC Casing	PVC Casing	451.4	0	451.4	3/4" PVC pipe Sch 40
	VWP	VWP	280			
	VWP	VWP	380			
	VWP	VWP	408			
	VWP	VWP	415			
	VWP	VWP	449.4			

Comments: Depth below surface. WR-342 reentry

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-051
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	450 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,148.28 m E ; 6,374,228.8 m N
Elevation: 538.98 m.
Comments: WR-342 reentry.



Hydrogeology Units

1a	2a	2b	2c
2d	2e	3a	3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
SZ = Shear Zone
FLT = Fault
FCT = Fault
FLTZ = Fault Zone
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

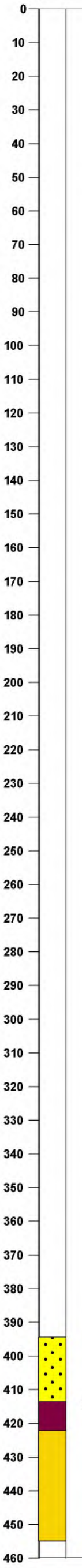
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-052
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	455 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,143.35 m E ; 6,374,252.35 m N
Elevation: 538.4 m.

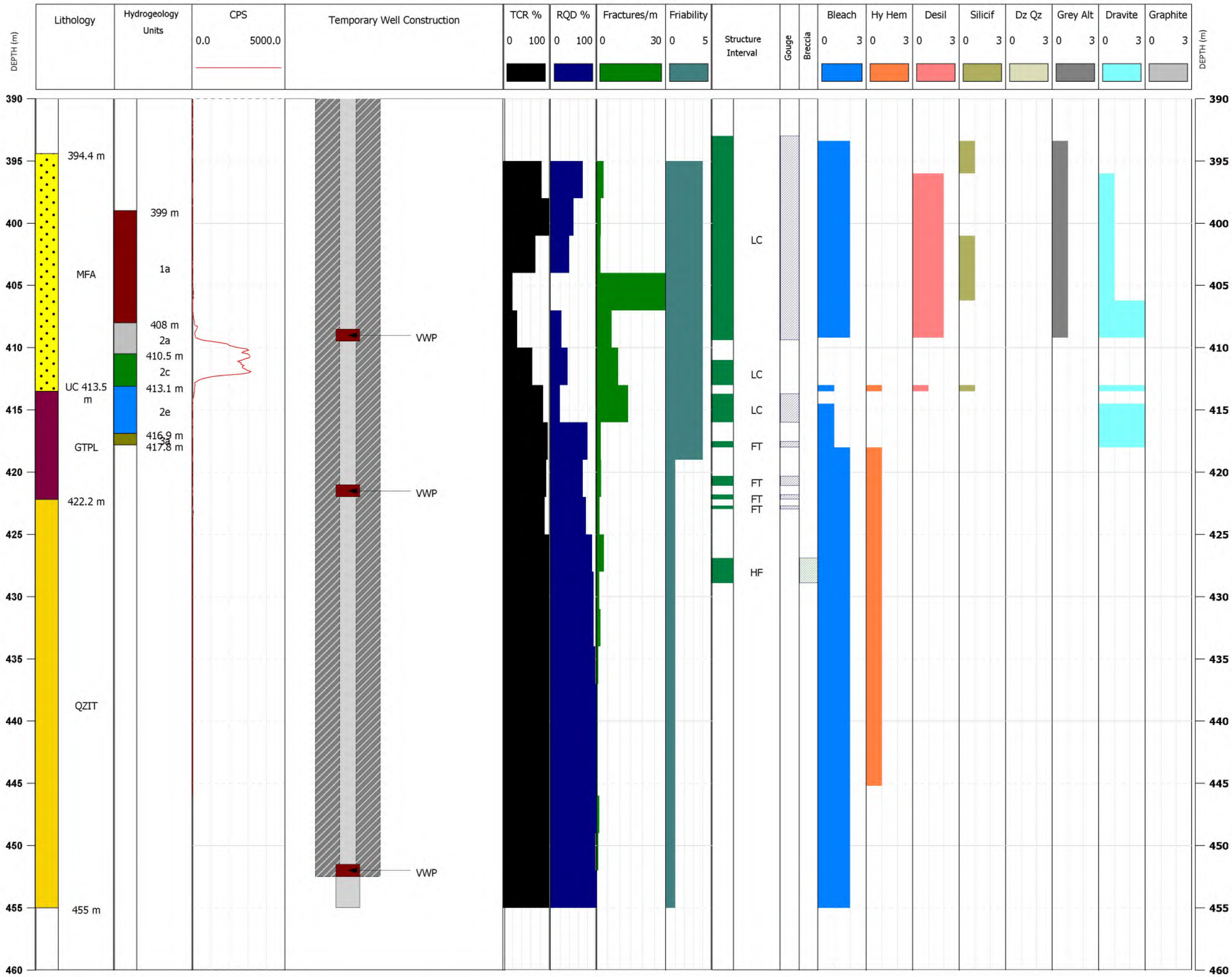


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	VWP	VWP		150		
	Cement	Cement	0	452.5	452.5	
	PVC Casing	PVC Casing	0	455	455	3/4" PVC pipe Sch 40
	VWP	VWP		280		
	VWP	VWP		380		
	VWP	VWP		409.5		
	VWP	VWP		422		
	VWP	VWP		452.5		

Comments: Depth below surface.

Title:	Well Schematics	Drillhole #	GWR-052
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	455 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,143.35 m E ; 6,374,252.4 m N
Elevation: 538.4 m.
Comments: Probe data and hydrogeology units from WR-437 (reentry)



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

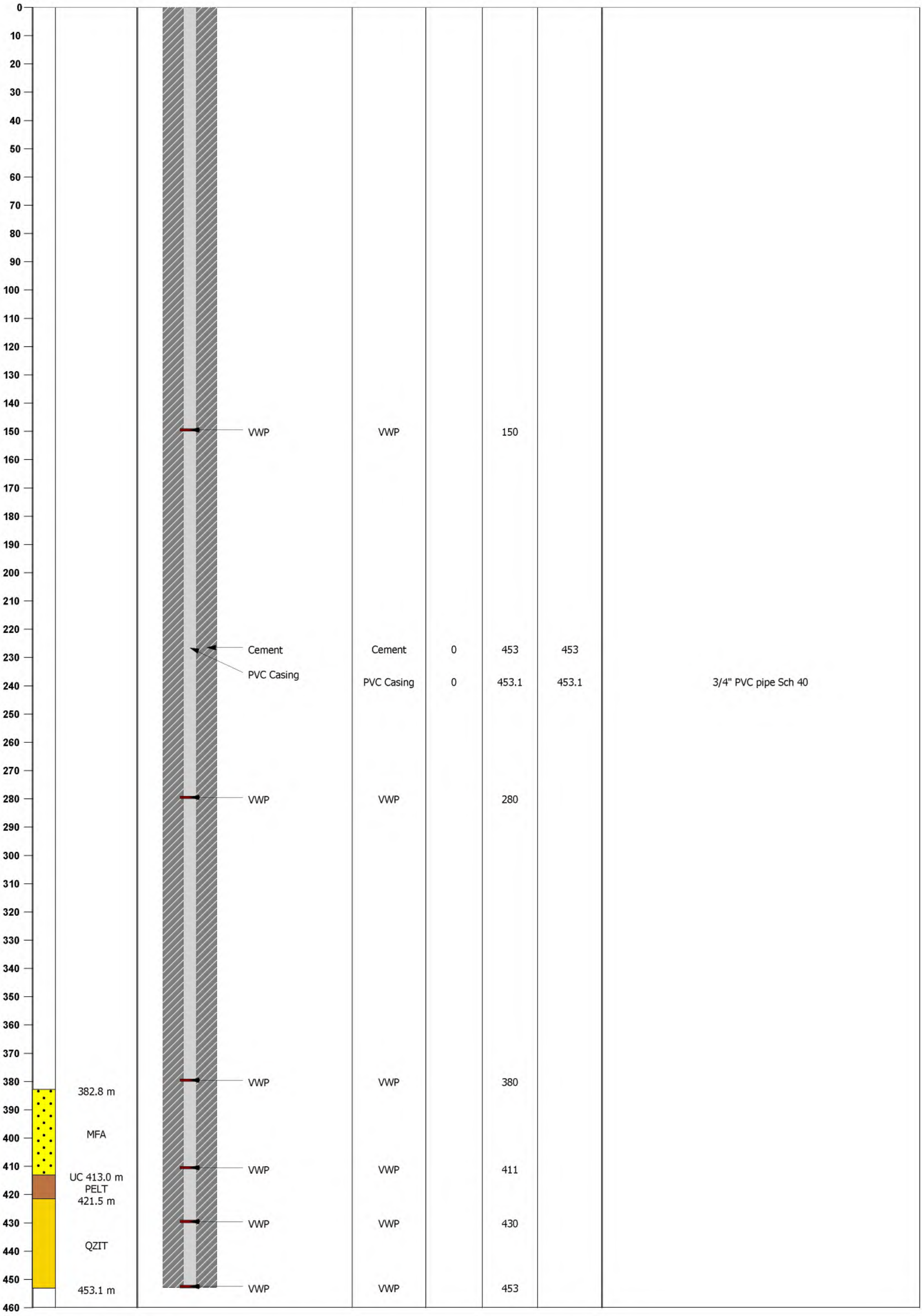
Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Denison Mines

Title:	Well Schematics	Drillhole #	GWR-053
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	453.1 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,131.49 m E ; 6,374,242.0 m N
Elevation: 540.67 m.

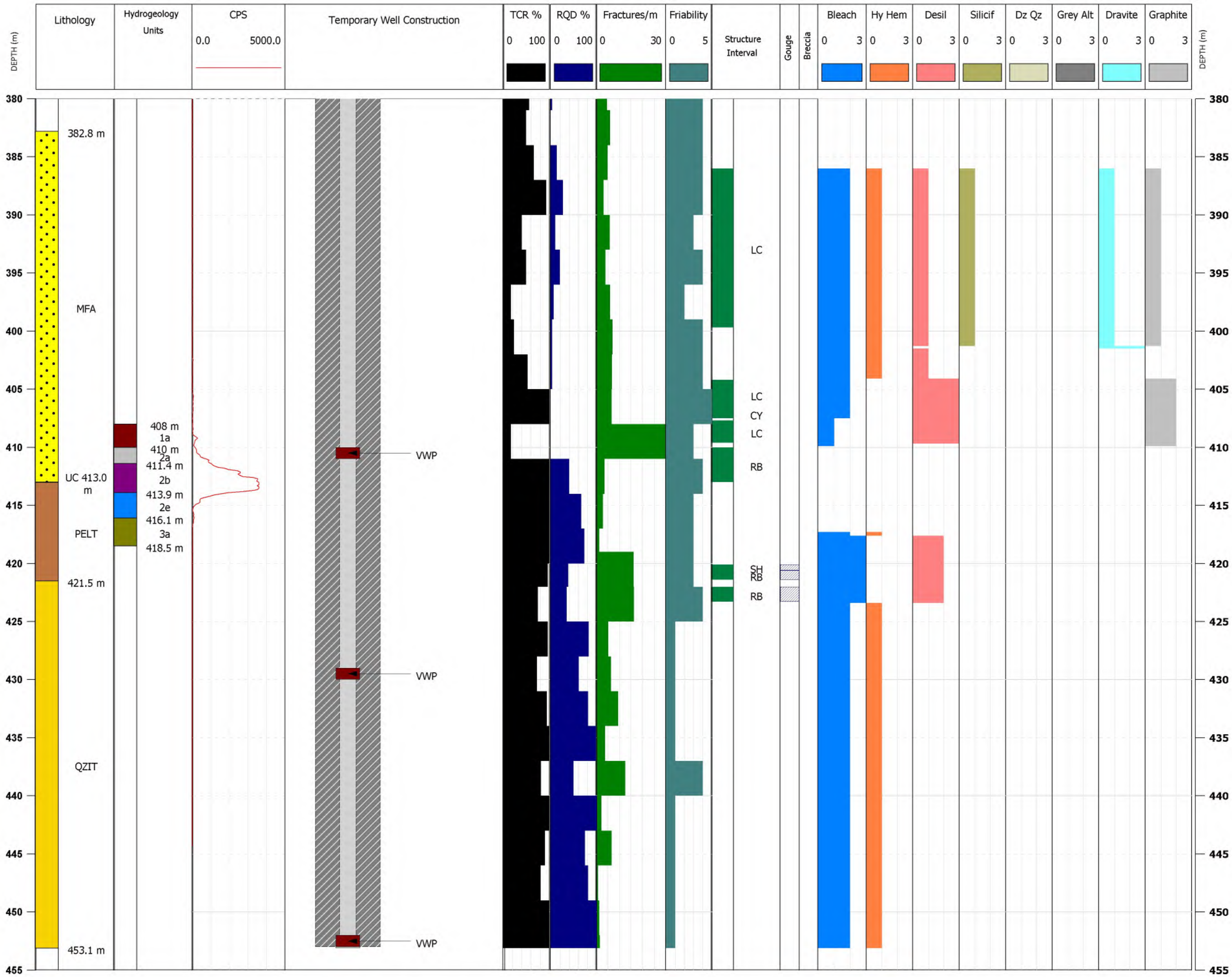


Lithology	Well Construction	Material	Depth From (m)	Depth To (m)	Length (m)	Specifications
	VWP	VWP		150		
	Cement	Cement	0	453	453	
	PVC Casing	PVC Casing	0	453.1	453.1	3/4" PVC pipe Sch 40
	VWP	VWP		280		
	VWP	VWP		380		
	VWP	VWP		411		
	VWP	VWP		430		
	VWP	VWP		453		

Comments: Depth below surface.

Title:	Well Schematics	Drillhole #	GWR-053
Project:	Phoenix	Drilling method:	DDH
Logged by		Total depth:	453.1 m
Drilling End Date:	2021	Hole Type:	HQ

Coordinates: 477,131.49 m E ; 6,374,242.0 m N
Elevation: 0.0 m.
Comments: Probe data and hydrogeology units from WR-435 (reentry).



Hydrogeology Units

1a, 2a, 2b, 2c, 2d, 2e, 3a, 3b

Geotechnical

RQD % = Rock Quality Designation (sum of competent core lenght greater than 10 cm.

Fractures/m = Natural fractures per meter

Friability

0 = Unknwn
1 = Competent (very hard)
2 = Moderately friable
3 = Friable (crumbles in hand)
4 = Locally friable over interval
5 = Unconsolidaded

Structure Interval

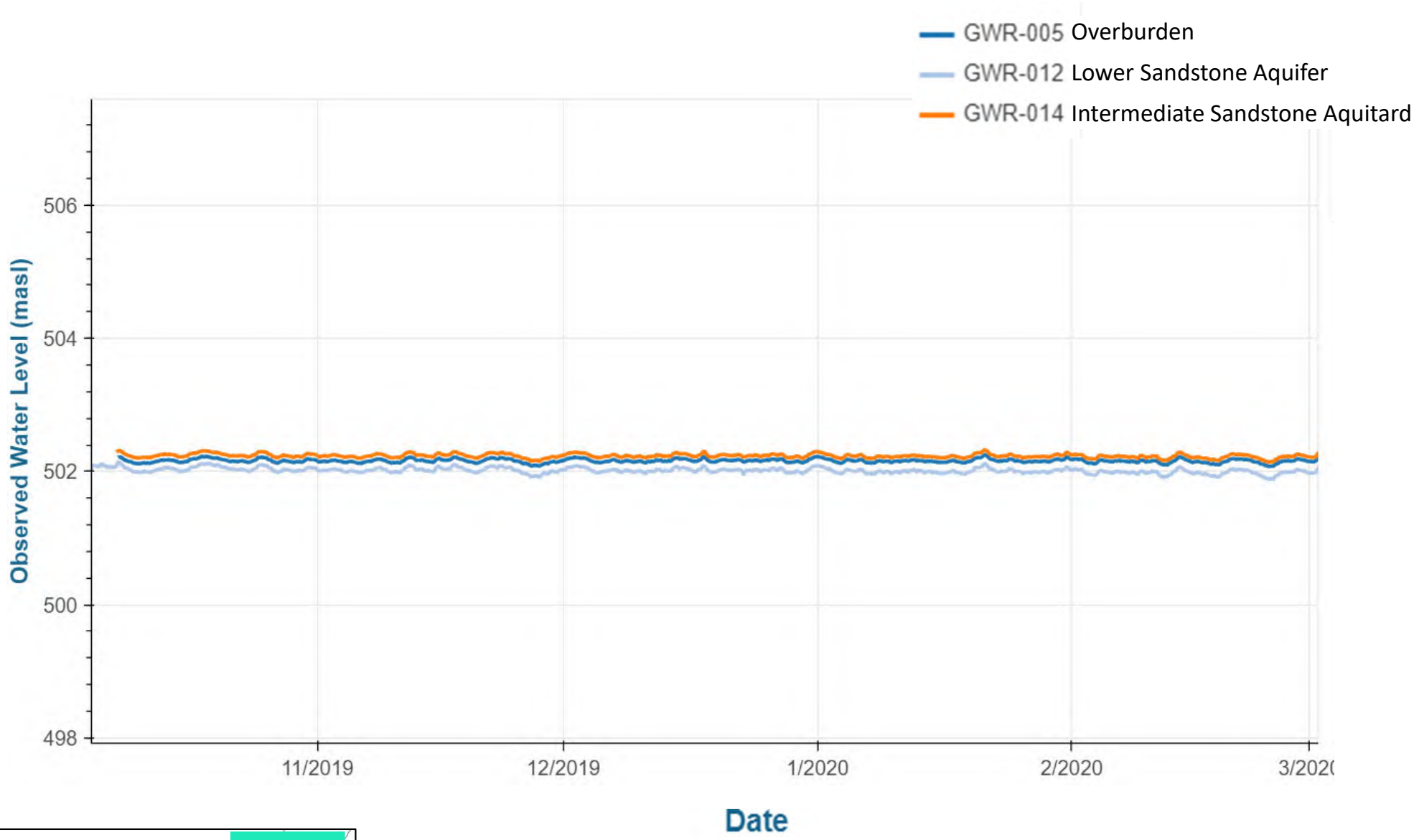
BC = Breccia
FLT = Fault
FLTZ = Fault Zone
SZ = Shear Zone
FCT = Fault
FCTZ = Fracture Zone

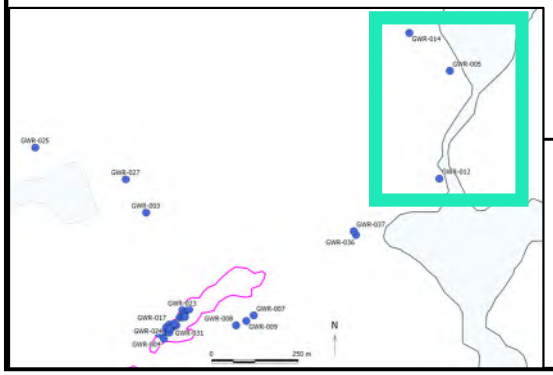
*Gouge and Breccia collumns indicate the presence of these structures in the interval, not the accurate length.

Alterations

0 = Not present
1 = Weak
2 = Moderate
3 = Strong

Appendix B Monitoring Well Hydrographs





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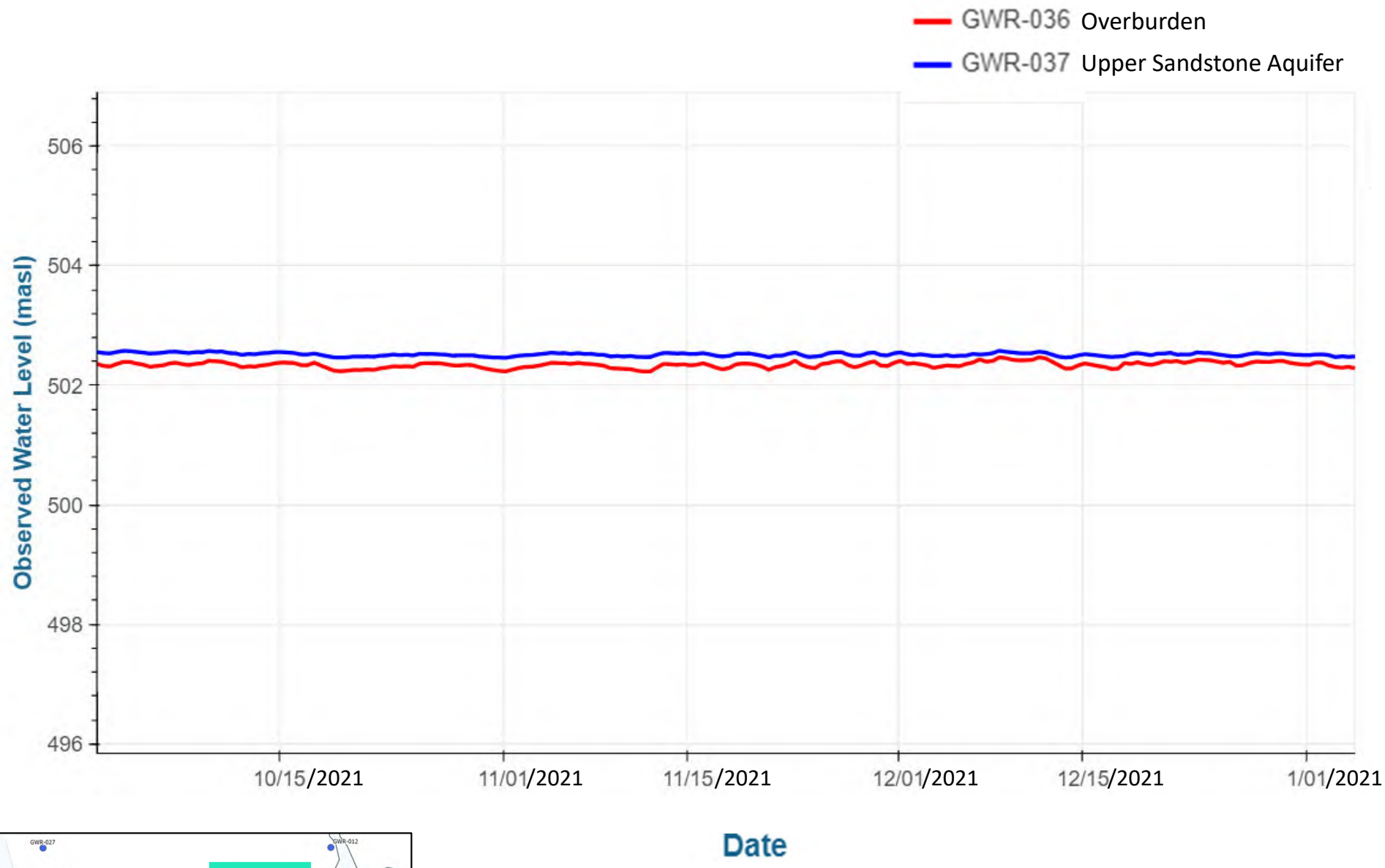
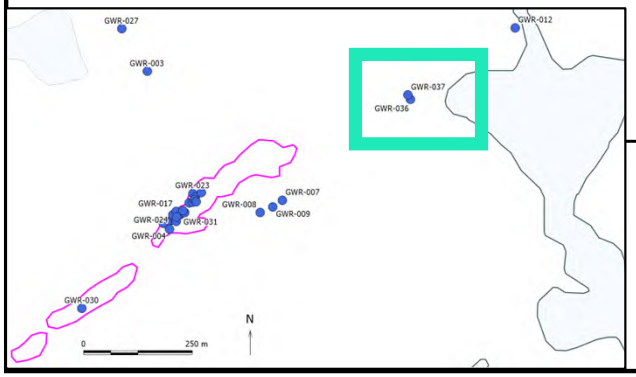
B1





GWR-037 contains a vented transducer that does not require barometric correction.

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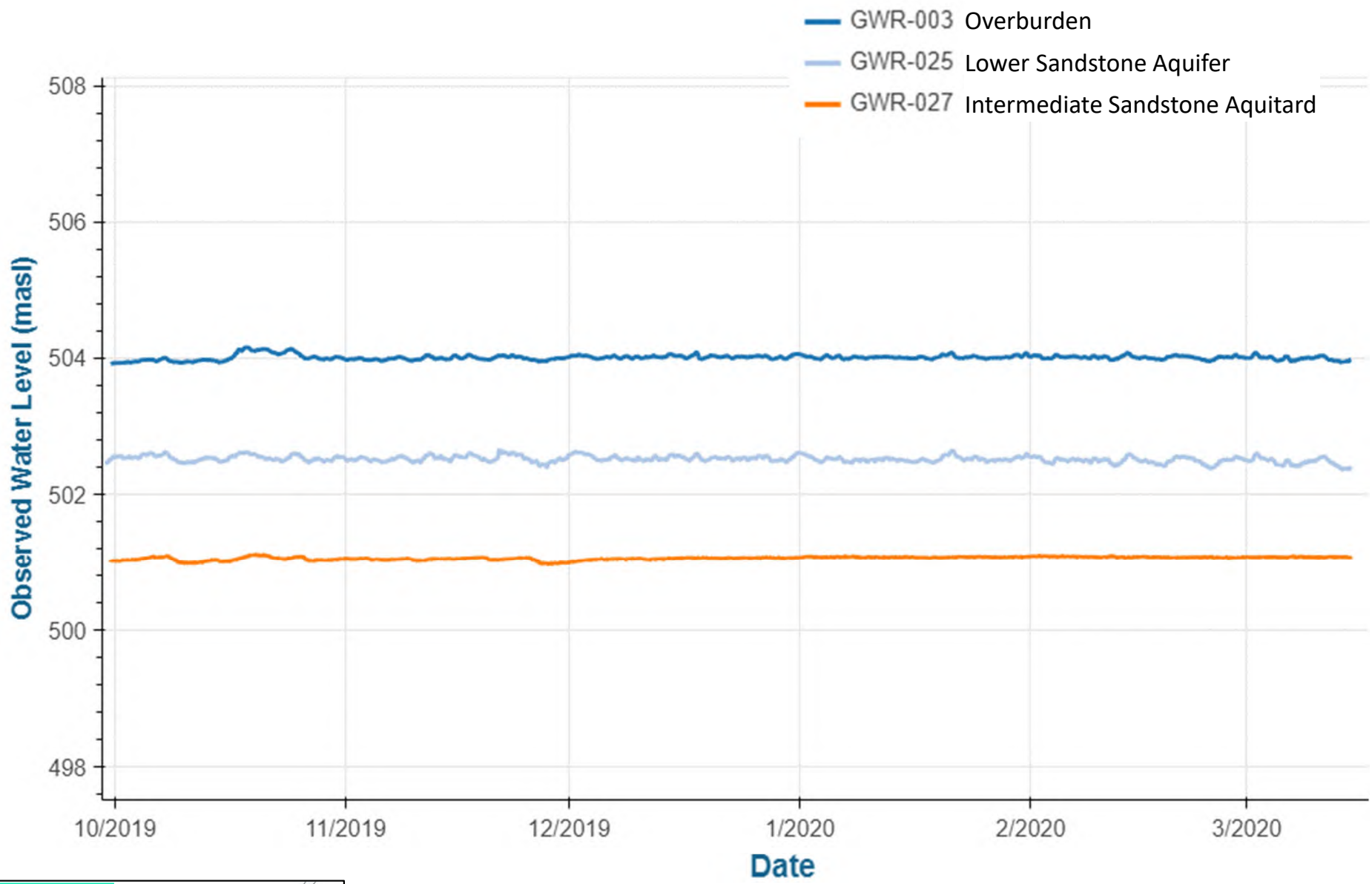
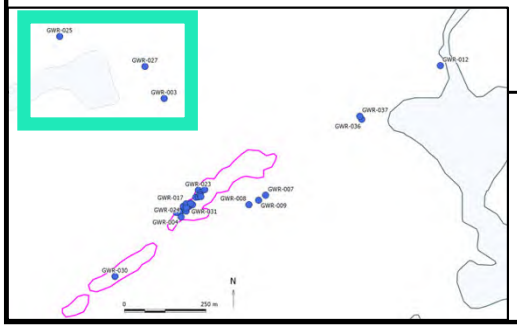
B2





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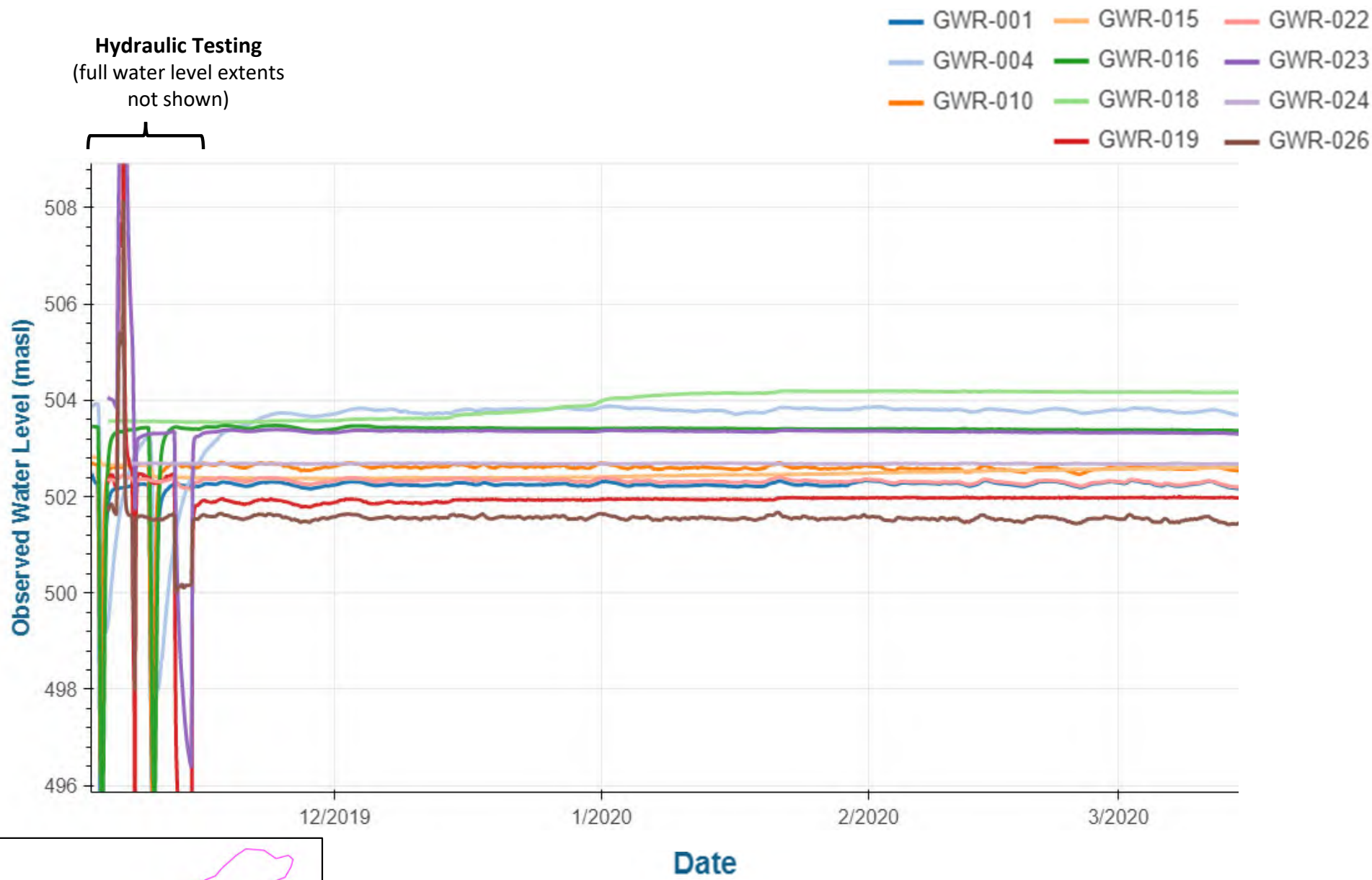
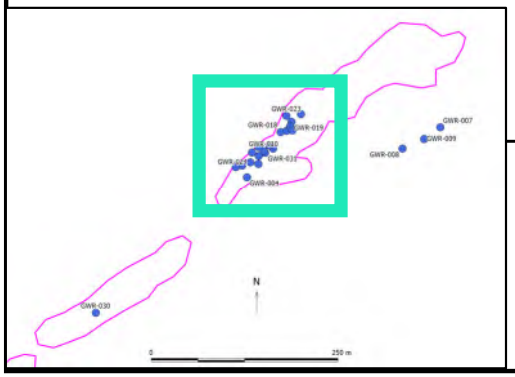
B3





Wells screened across the Ore Zone and Barrier Zones; some wells also screened across the Lower Sandstone Aquifer and Basement Aquifers. Well screens vary from 5 to 11 m in length.

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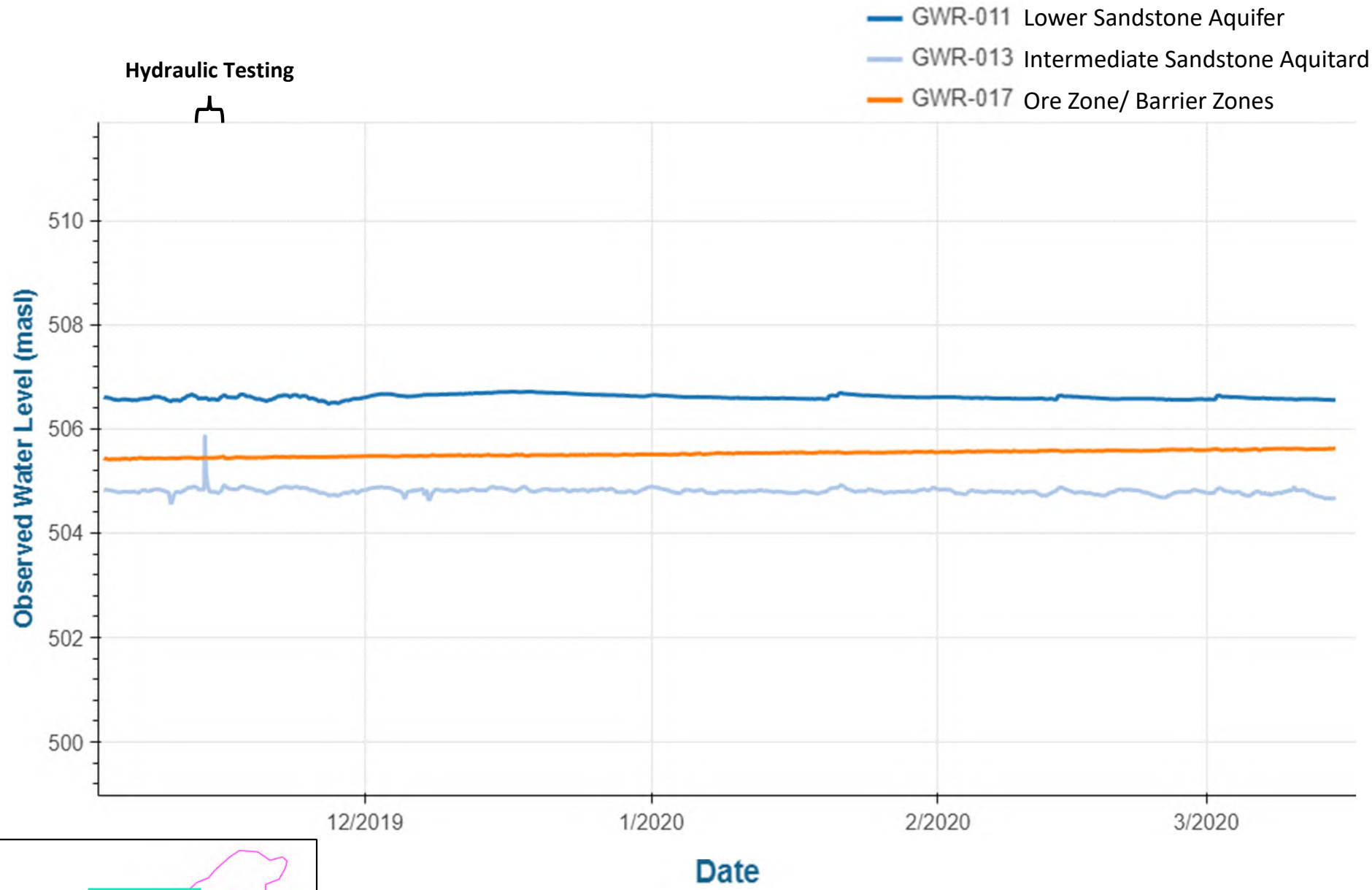
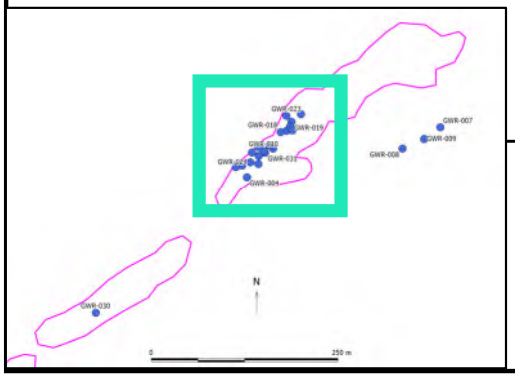
B4





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Baseline Geology and Hydrogeological Assessment

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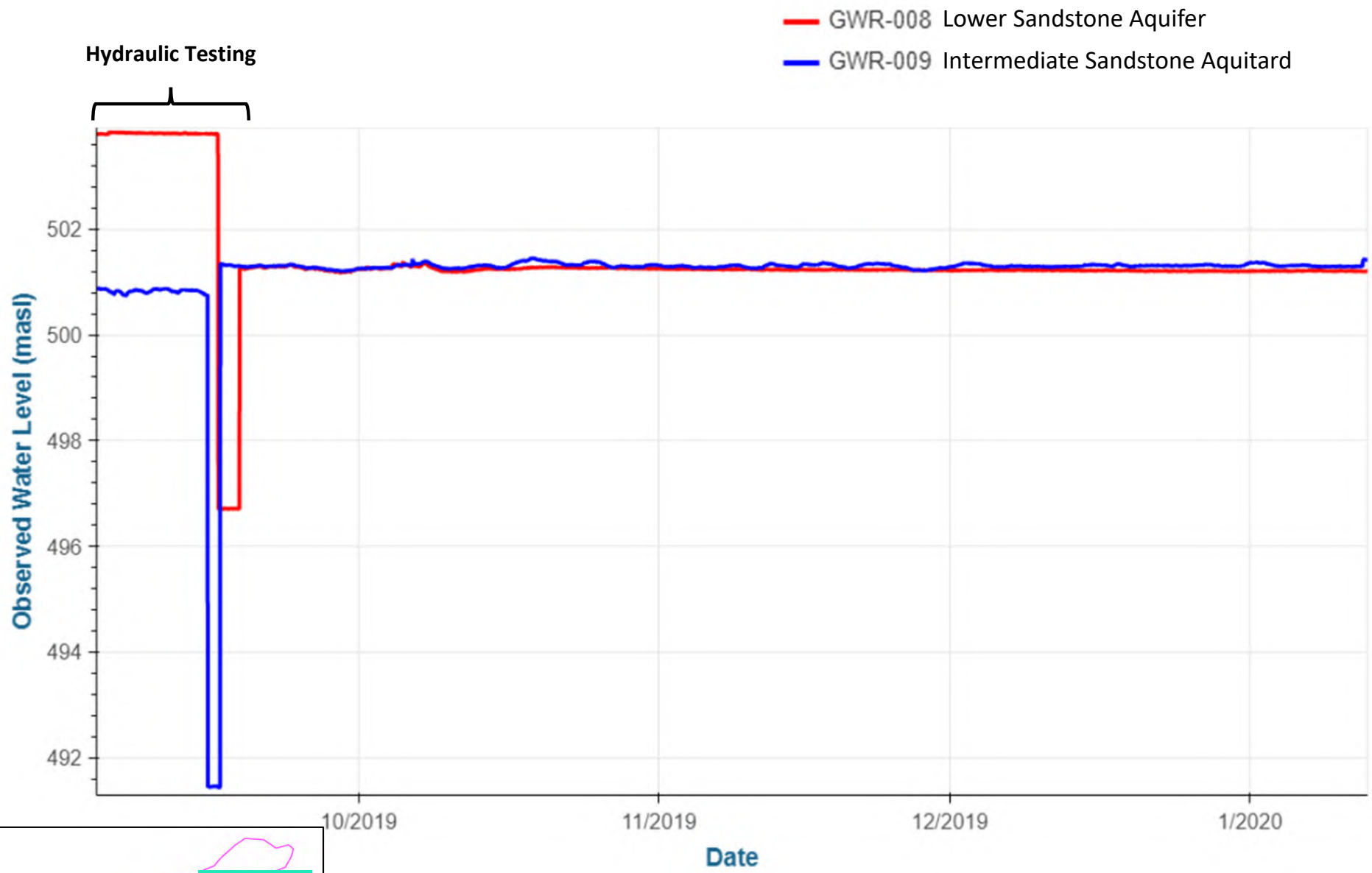
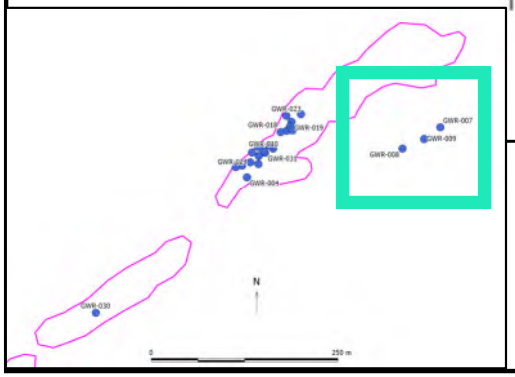
B5





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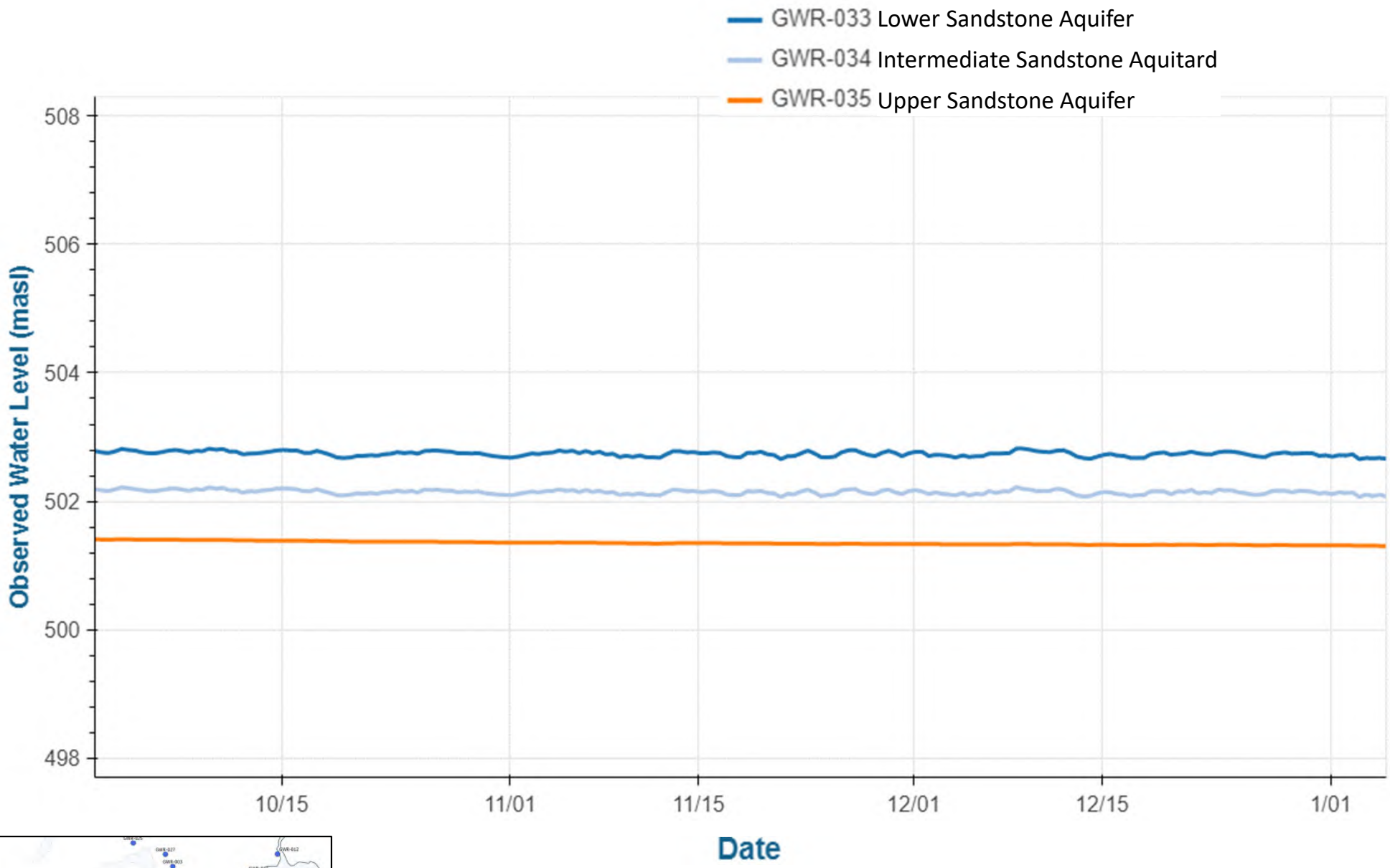
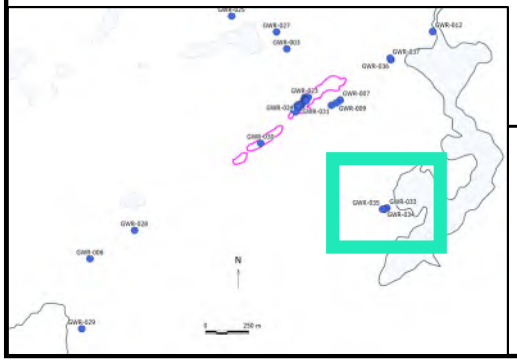
B6





GWR-033 to –035 contain vented transducers that do not require barometric correction.

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Baseline Geology and Hydrogeological Assessment

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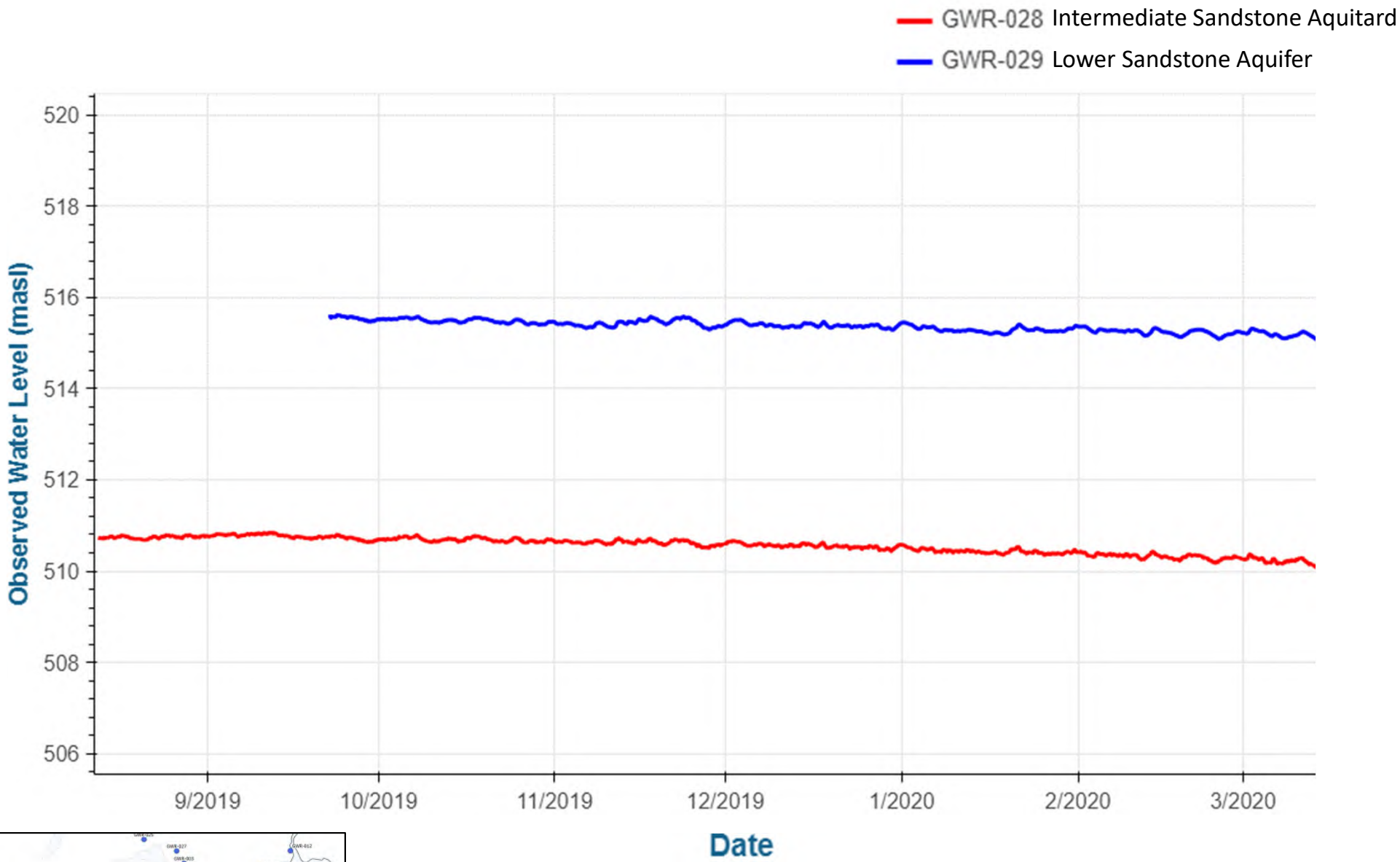
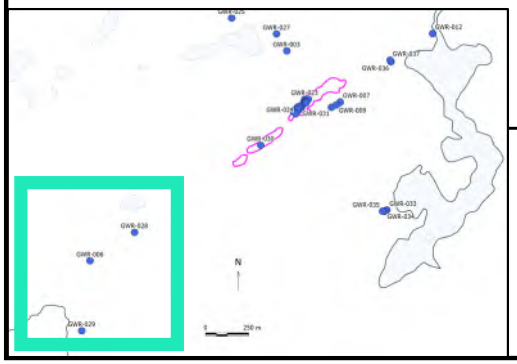
B7





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Baseline Geology and Hydrogeological Assessment

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B8

Appendix C Summary of Hydraulic Testing Data and Conductivity Values

Table C-1 Summary of Hydraulic Testing Data and Conductivity Values

Well Name	Hydrostrat-igraphic Unit	Lithologic Unit	Estimated K (m/s)	Comment	Type of Hydraulic Test	Reference	Direction	Depth to Screen/ Packer (m)	
								Top	Bottom
GWR-036	Overburden Aquifer	Overburden	3.00E-06	Pumping well	Pseudo Pump Test	Appendix D	Vertical	43.0	49.0
GWR-035		Mfd / Overburden	2.00E-04	Pumping well	Pseudo Pump Test	Appendix D	Vertical	0.0	0.0
GWR-037	Upper Sandstone Aquifer	MFd	1.00E-04	Pumping well	Pseudo Pump Test	Appendix D	Vertical	0.0	0.0
WR-555		MFd	6.00E-06		Packer test	Golder, 2014	Vertical	38.4	46.5
WR-555		MFd/ MFc contact	3.00E-06		Packer test	Golder, 2014	Vertical	44.4	88.5
WR-555		MFc	4.00E-07		Packer test	Golder, 2014	Vertical	86.4	130.5
WR-555		MFc	1.00E-06		Packer test	Golder, 2014	Vertical	129.4	172.5
GWR-009	Intermediate Sandstone Aquitard	MFb	8.40E-07		Packer test	Scibek, 2019	Oriented	272.0	280.0
GWR-027		MFb	3.80E-06	Used early-time flow rate 13 l/min	Packer test	Scibek, 2019	Vertical	274.0	280.0
GWR-034		MFb	< 1e-7	Pumping well	Pseudo Pump Test	Appendix D	Vertical	215.0	221.0
WR-555		MFc/ MFb contact	7.00E-07		Packer test	Golder, 2014	Vertical	171.9	214.5
WR-606		MFa	4.30E-09		Packer test	SRK, 2015	Oriented	394.2	429.0
WR-695		MFc	6.02E-08		Packer test	SRK, 2018b	Vertical	100.2	201.0
WR-695		MFc	<3.0E-7	<3.0E-7	Packer test	SRK, 2018b	Vertical	202.2	210.0
WR-695		MFc	<3.0E-7	<3.0E-7	Packer test	SRK, 2018b	Vertical	202.2	210.0
WR-695		MFc	<2.0E-7	<2.0E-7	Packer test	SRK, 2018b	Vertical	211.2	225.0
WR-695		MFc	1.00E-10		Packer test	SRK, 2018b	Vertical	223.2	246.0
WR-695		MFc/ MFb	1.00E-10		Packer test	SRK, 2018b	Vertical	247.2	270.0
WR-695		MFb	1.00E-10		Packer test	SRK, 2018b	Vertical	271.2	294.0
WR-695		MFb	9.68E-10		Packer test	SRK, 2018b	Vertical	295.2	318.0
WR-695		MFb	5.39E-10		Packer test	SRK, 2018b	Vertical	319.2	342.0
WR-695		MFb/MFa	1.34E-09		Packer test	SRK, 2018b	Vertical	343.2	366.0
WR-695		MFa	2.05E-09		Packer test	SRK, 2018b	Vertical	367.2	390.0
WR-695		MFa	1.34E-08		Packer test	SRK, 2018b	Vertical	391.2	414.0
GWR-046		MFc	7.60E-07		Pumping test	Petrotek, 2021	Vertical	149.0	152.0
WR-555	Desilicified Zone	MFb	1.00E-06		Packer test	Golder, 2014	Vertical	213.7	256.5
WR-555		MFb	1.00E-05	Did packer seal?	Packer test	Golder, 2014	Vertical	255.9	298.5
GWR-014		MFc	8.70E-06		Packer test	Scibek, 2019	Vertical	149.0	158.0
WR-555		MFa	2.00E-05		Packer test	Golder, 2014	Vertical	281.7	363.3
GWR-047		MFb	2.70E-06		Pumping test	Petrotek, 2021	Vertical	279.0	282.2
GWR-048		MFa	2.70E-06		Pumping test	Petrotek, 2021	Vertical	379.0	382.0
WR-405	Lower Sandstone Aquifer	MFa	3.00E-05		Packer test	SRK, 2017	Vertical	356.4	379.6
GWR-008		MFa	1.30E-05		Packer test	Scibek, 2019	Oriented	369.0	380.0
GWR-025		MFa	6.60E-06	Packer stayed inflated	Packer test	Scibek, 2019	Vertical	374.0	380.0
GWR-033		MFa	4.00E-06	Pumping well	Pseudo Pump Test	Appendix D	Vertical	345.6	351.6
GWR-048		MFa	2.70E-06		Pumping test	Petrotek, 2021	Vertical	379.0	382.0
WR-555		MFa, Barrier Zones, Ore zone	2.00E-06		Packer test	Golder, 2014	Vertical	365.5	409.5
WR-594		MFa	2.50E-07		Open Hole	SRK, 2015	Oriented	451.2	489.0
WR-601		MFa and Basement	1.30E-06		Packer test	SRK, 2015	Oriented	376.2	822.0

Well Name	Hydrostrat-igraphic Unit	Lithologic Unit	Estimated K (m/s)	Comment	Type of Hydraulic Test	Reference	Direction	Depth to Screen/ Packer (m)	
								Top	Bottom
WR-602		MFa and Basement	1.60E-05	fault at 463 m; open fracture at 466 m deep - drive high K	Packer test	SRK, 2015	Oriented	451.2	490.0
WR-603A		MFa	1.20E-06		Packer test	SRK, 2015	Oriented	361.2	380.0
WR-604		MFa	7.80E-08		Packer test	SRK, 2015	Oriented	418.2	450.0
WR-695		MFa	1.81E-07		Packer test	SRK, 2018b	Vertical	415.2	438.0
WR-695		MFa	8.59E-07		Packer test	SRK, 2018b	Vertical	415.2	438.0
WR-695		MFa	5.73E-07		Packer test	SRK, 2018b	Vertical	415.2	438.0
WR-695		MFa	2.92E-06		Packer test	SRK, 2018b	Vertical	439.2	462.0
WR-695		MFa	3.25E-06		Packer test	SRK, 2018b	Vertical	439.2	462.0
WR-695		MFa	5.11E-06		Packer test	SRK, 2018b	Vertical	457.2	465.0
GWR-012		MFa	1.30E-05		Packer test	Scibek, 2019	Oriented	339.0	347.0
GWR-001	Lower Sandstone Aquifer, Barrier Zones, Ore Zone Aquifer, Basement Aquitard	MFa, Upper and Lower Barrier Aquitard, Ore Zone, Paleoweathered Basement	1.70E-08	Observation well	GWR-010 Development	Petrotek, 2020	Vertical	405.7	410.0
GWR-001			1.00E-08	Observation well	GWR-010 Development	Petrotek, 2020	Vertical	405.7	410.0
GWR-001			6.00E-08	Observation well	GWR-010 Injection Test	Petrotek, 2020	Vertical	405.7	410.0
GWR-001			6.00E-08	Observation well	GWR-031 Pump Test	Petrotek, 2020	Vertical	405.7	410.0
GWR-010			1.70E-08	Pumping well	GWR-010 Development	Petrotek, 2020	Vertical	404.2	410.0
GWR-010			2.80E-07	Observation well	GWR-001 Injection Test	Petrotek, 2020	Vertical	404.2	410.0
GWR-010			7.40E-09	Observation well	GWR-031 Pump Test	Petrotek, 2020	Vertical	404.2	410.0
GWR-015			2.20E-07	Observation well	GWR-001 Injection Test	Petrotek, 2020	Vertical	406.1	409.0
GWR-016			6.30E-07		Packer test	Scibek, 2019	Vertical	408.5	417.5
GWR-016			2.50E-09	Observation well	GWR-010 Development	Petrotek, 2020	Vertical	405.6	411.6
GWR-016			2.50E-09	Observation well	GWR-010 Development	Petrotek, 2020	Vertical	405.6	411.6
GWR-016			1.80E-09	Observation well	GWR-010 Injection Test	Petrotek, 2020	Vertical	405.6	411.6
GWR-016			1.10E-07	Observation well	GWR-001 Development	Petrotek, 2020	Vertical	405.6	411.6
GWR-016			5.40E-09	Observation well	GWR-001 Injection Test	Petrotek, 2020	Vertical	405.6	411.6
GWR-017			2.60E-06		Packer test	Scibek, 2019	Vertical	405.5	411.5
GWR-019			6.40E-09	Observation well	GWR-032 Pre-MP Injection Test	Petrotek, 2020	Vertical	403.3	413.4
GWR-019			2.90E-07	Observation well	GWR-032 Post-MP Injection Test	Petrotek, 2020	Vertical	403.3	413.4
WR-287	Lower Sandstone Aquifer, Barrier Zones, Ore Zone Aquifer, Basement Aquitard	MFa, Upper and Lower Barrier Aquitard, Ore Zone, Paleoweathered Basement	1.50E-07		Packer test	SRK, 2017	Vertical	364.2	408.0
GWR-026			1.60E-06	Good test; packer inflation confirmed	Packer test	Scibek, 2019	Vertical	401.0	412.0
GWR-026			4.60E-07	Observation well	GWR-019 Injection Test	Petrotek, 2020	Vertical	401.0	412.7
GWR-026			2.50E-07	Observation well	GWR-032 Pre-MP Injection Test	Petrotek, 2020	Vertical	401.0	412.7
GWR-026			1.20E-07	Observation well	GWR-032 Post-MP Injection Test	Petrotek, 2020	Vertical	401.0	412.7
GWR-026			3.70E-07	Observation well	GWR-032 Pump Test	Petrotek, 2020	Vertical	401.0	412.7
GWR-038			3.60E-07	Pumping well	Pumping test	Petrotek, 2021	Vertical	405.0	419.2
GWR-039			5.50E-07	Pumping well	Pumping test	Petrotek, 2021	Vertical	390.8	418
GWR-040			2.70E-07	Pumping well	Pumping test	Petrotek, 2021	Vertical	389.3	416.5
GWR-041			2.30E-07	Pumping well	Pumping test	Petrotek, 2021	Vertical	386.3	413.5
GWR-042			1.70E-07	Pumping well	Pumping test	Petrotek, 2021	Vertical	389.0	416.2
GWR-004			3.00E-07		Packer test	Scibek, 2019	Vertical	401.0	409.0

Well Name	Hydrostrat-igraphic Unit	Lithologic Unit	Estimated K (m/s)	Comment	Type of Hydraulic Test	Reference	Direction	Depth to Screen/ Packer (m)	
								Top	Bottom
GWR-020	Barrier Zones, Ore Zone Aquifer, Basement Aquitard	Upper and Lower Barrier Aquitard, Ore Zone, Paleoweathered Basement	5.60E-06	Not cemented above the U mineralization. Fault zone cuts this area.	Packer test	Scibek, 2019	Vertical	403.5	413.0
GWR-024			3.60E-06	Used 1st minute of flow because packer deflated	Packer test	Scibek, 2019	Vertical	403.0	410.0
GWR-024			9.10E-09	Observation well	GWR-010 Development	Petrotek, 2020	Vertical	403.0	408.9
GWR-024			9.10E-08	Observation well	GWR-001 Development	Petrotek, 2020	Vertical	403.0	408.9
GWR-032			5.60E-08	Injection	GWR-032 Pre-MP Injection Test	Petrotek, 2020	Vertical	401.6	413.1
GWR-032			5.60E-08	Injection	GWR-032 Post-MP Injection Test	Petrotek, 2020	Vertical	401.6	413.1
GWR-032			9.60E-07	Pumping well	GWR-032 Pump Test	Petrotek, 2020	Vertical	401.6	413.1
GWR-023			1.10E-07	No fractures or permeable features	Packer test	Scibek, 2019	Vertical	418.0	423.9
GWR-023	Ore Zone and Barrier Zones	Ore Zone and Barrier Zones	1.00E-07	High flow was likely storage effect into clay zone (enlarging the hole)	Packer test	Scibek, 2019	Vertical	413.0	418.0
GWR-023			5.30E-07	Observation well	GWR-019 Injection Test	Petrotek, 2020	Vertical	412.0	417.9
GWR-023			1.10E-07	Observation well	GWR-032 Post-MP Injection Test	Petrotek, 2020	Vertical	412.0	417.9
GWR-023			4.90E-07	Observation well	GWR-032 Pump Test	Petrotek, 2020	Vertical	412.0	417.9
GWR-016	Ore Zone and Barrier Zones	Upper Barrier Zone, Ore Zone	1.30E-08		Packer test	Scibek, 2019	Vertical	405.5	408.5
GWR-016	Ore Zone and Barrier Zones	Upper and Lower Barrier Zone, Ore Zone	3.60E-10	Observation well	GWR-031 Pump Test	Petrotek, 2020	Vertical	405.6	411.6
GWR-021	Lower Barrier Zone, Basement Rock	Lower Barrier Zone and Basement Aquitard	9.00E-06		Packer test	Scibek, 2019	Vertical	412.4	426.4
GWR-031	Basement Aquitard	Upper and Lower Barrier Zone, Ore Zone, Paleoweathered Basement	1.60E-09	Pumping well	GWR-031 Pump Test	Petrotek, 2020	Vertical	407.4	414.7
WR-582	Basement Aquitard	Basement	4.30E-08		Packer test	SRK, 2015	Oriented	451.2	495.0
WR-594			1.60E-07		Packer test	SRK, 2015	Oriented	490.2	517.0
WR-594			1.60E-08		Packer test	SRK, 2015	Oriented	517.2	564.0
WR-594			2.10E-07		Open Hole	SRK, 2015	Oriented	517.2	564.0
WR-605			3.40E-07		Open Hole	SRK, 2015	Oriented	451.2	510.0
GWR-018			3.50E-08		Packer test	Scibek, 2019	Vertical	405.4	412.0
GWR-021			1.10E-05		Packer test	Scibek, 2019	Vertical	427.4	443.0
GWR-024			7.30E-09	Observation well	GWR-010 Development	Petrotek, 2020	Vertical	403.0	408.9
WR-287			2.10E-08		Packer test	SRK, 2017	Vertical	409.2	465.0
WR-525			5.60E-08		Packer test	SRK, 2017	Vertical	372.2	425.7
WR-555			9.00E-09		Packer test	Golder, 2014	Vertical	433.6	481.5
WR-555			4.00E-06		Packer test	Golder, 2014	Vertical	410.8	451.5

Well Name	Hydrostrat-igraphic Unit	Lithologic Unit	Estimated K (m/s)	Comment	Type of Hydraulic Test	Reference	Direction	Depth to Screen/ Packer (m)	
								Top	Bottom
WR-582			1.50E-09		Packer test	SRK, 2015	Oriented	501.2	606.0
WR-582			2.60E-10		Packer test	SRK, 2015	Oriented	607.2	726.0
WR-594			8.90E-09		Packer test	SRK, 2015	Oriented	565.2	642.0
WR-594			3.70E-10		Packer test	SRK, 2015	Oriented	643.2	720.0
WR-594			1.10E-06		Open Hole	SRK, 2015	Oriented	643.2	720.0
WR-602			2.00E-09		Packer test	SRK, 2015	Oriented	491.2	569.0
WR-602			1.40E-10		Packer test	SRK, 2015	Oriented	570.2	639.0
WR-602	Basement Aquitard	Basement	1.10E-11		Packer test	SRK, 2015	Oriented	641.2	753.0
WR-603A			1.40E-10		Packer test	SRK, 2015	Oriented	381.2	420.0
WR-603A			4.40E-10		Packer test	SRK, 2015	Oriented	421.2	510.0
WR-603A			8.10E-11		Packer test	SRK, 2015	Oriented	511.2	615.0
WR-604			1.50E-06		Packer test	SRK, 2015	Oriented	451.2	480.0
WR-604			1.80E-10		Packer test	SRK, 2015	Oriented	517.2	576.0
WR-605			8.90E-11		Packer test	SRK, 2015	Oriented	511.2	615.0
WR-605			2.70E-07		Packer test	SRK, 2015	Oriented	511.2	615.0
WR-605			3.00E-09		Packer test	SRK, 2015	Oriented	616.2	699.0
WR-695			3.37E-09		Packer test	SRK, 2018b	Vertical	459.2	462.0
WR-695			1.00E-10		Packer test	SRK, 2018b	Vertical	460.2	465.0
WR-695			2.07E-09		Packer test	SRK, 2018b	Vertical	466.2	495.0
WR-695			2.26E-09		Packer test	SRK, 2018b	Vertical	496.2	525.0
WR-695			5.87E-10		Packer test	SRK, 2018b	Vertical	526.2	564.0
WR-695			1.00E-10		Packer test	SRK, 2018b	Vertical	565.2	599.5
WR-695			8.00E-10		Packer test	SRK, 2018b	Vertical	466.2	599.5
WR-695			1.00E-10		Packer test	SRK, 2018b	Vertical	466.2	599.5

Appendix D 2020 Hydraulic Testing Analysis; Wells GWR-033 to GWR-037

Aquifer Test Analyses: GWR-037 and GWR-036

Two-hour pumping tests were sequentially performed in monitoring wells GWR-036 and GWR-037 (see Figure D1 for location) in 2020 and monitoring of water levels were conducted in the adjacent well. These monitoring wells are screened in an overburden trough that the borehole logs indicate is infilled with fine- to coarse-grained sand and gravel with cobbles and boulders, and sandy till, without any evidence of a competent fine-grained aquitard unit.

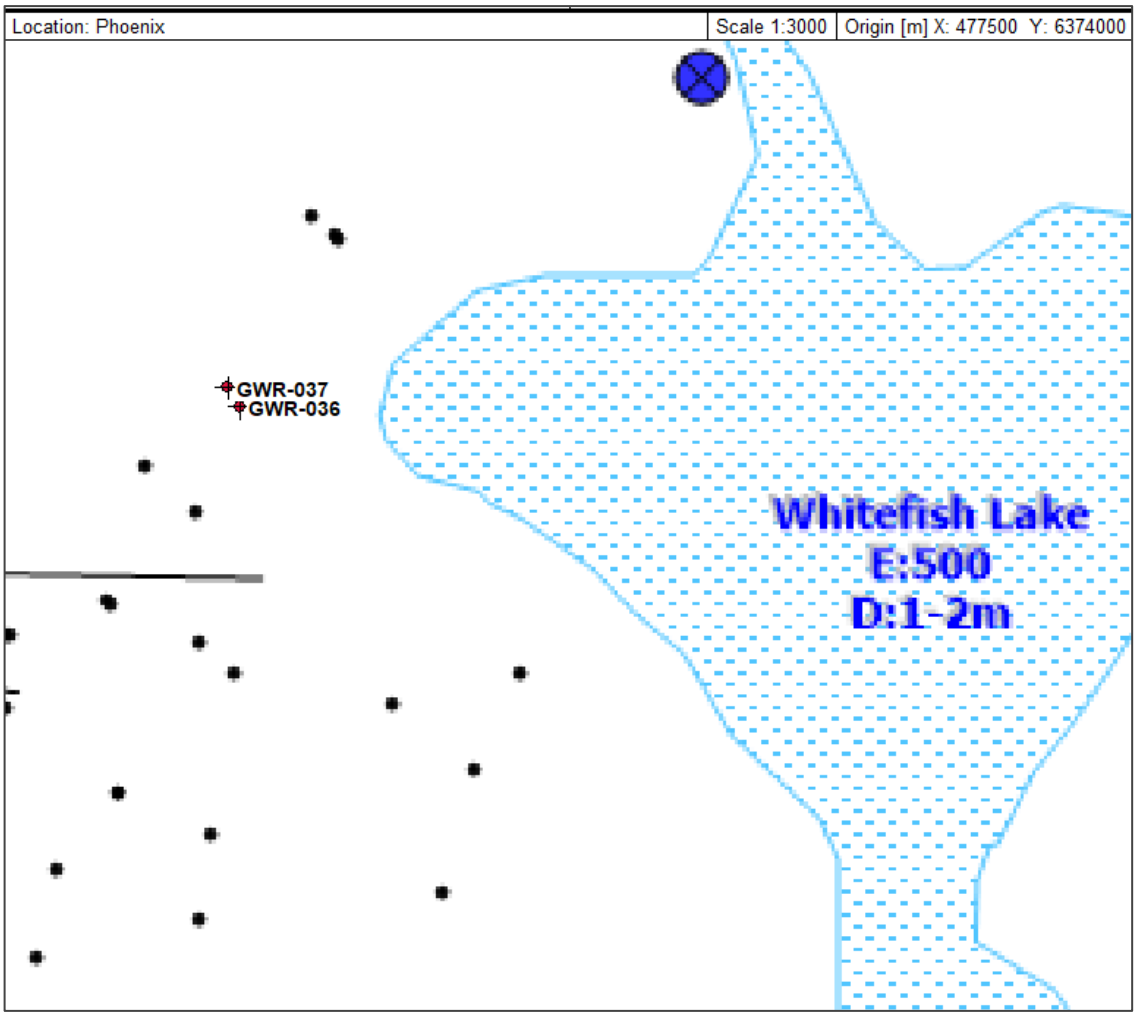


Figure D1: Well Locations

The pumped interval in both cases was 40 to 60 m below the water table, and the water level stayed more than 25 m below the water table throughout the pumping test. As the overburden consists of sandy till, sand to silty sand with cobbles and boulders, the entire saturated thickness to the drilled depth is considered to form one aquifer. The monitoring wells are considered partially penetrating as they are screened within the lower portion of the aquifer (see Table D1 for details).

Table D1: Monitoring Well Details

Feature	GWR-036	GWR-037
Ground Surface / Top of Casing (m asl)	509	509
Screened Unit	Overburden / Bedrock Interface	Upper Bedrock (MFD)
Screened Interval (depth in m btoc)	43.1-49.1 (6 m)	64.7-70.7 (6 m)
Top of Bedrock (depth in m btoc)	46.1	44.2
Coarse Gravel (depth in m btoc)	40 – 42m	41.2 – 44 m (estimate)
Overburden above Bedrock	Sand with cobbles	Sand with cobbles
Upper Bedrock	Weathered sandstone, lots of fractures	Weathered, oxidized sandstone, lots of fractures
Approximate depth (m) to water	4.82	4.77
Maximum Drawdown (m) – Pumped well	11.15	5.64
Maximum Drawdown (m) – Obs well	0.51	0.1

Considering the positioning of the wells within the setting (Table D1), as well as the limited (i.e., 2 hour) pumping test timeline, responses to pumping are expected to reflect a confined aquifer (i.e., radial flow without contribution from pore drainage), with the potential for leakage from the overlying sediments to off-set the requirement for radial flow in response to pumping.

Analysis of drawdown versus time derivatives for the pumping and observation wells suggest that the response to pumping does not purely represent that of a confined aquifer, or a leaky confined aquifer. Leakage within the overburden aquifer (GWR-036) is most evident. A review of the core photos shows a section of angular gravel at a depth of approximately 41 m below ground surface, (just above the screened interval of GWR-036), which may provide leakage within the overburden unit.

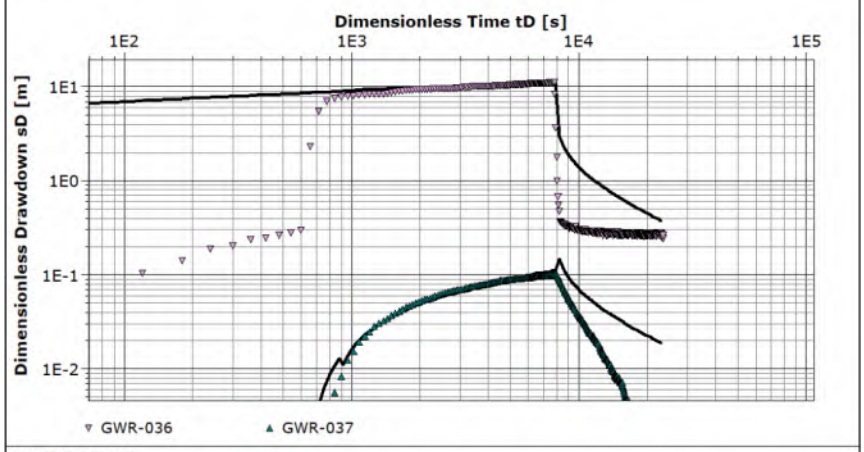
Pumping Test

The pumping of well GWR-037 was performed for 2 hours and 15 minutes (8100 s), and the rate was initially variable for the first 23 minutes. As a result, the primary analysis was focused on later-time pumping data (i.e., data after the first 25 minutes or 1500s).

The analysis is illustrated on Figure D2. The match includes analysis of both the pumping and recovery period, but the match illustrated focused on the pumping period. The analysis indicated a higher hydraulic conductivity value exists within the upper weathered bedrock than the screened portion of the lower overburden.

Leaky aquifer conditions were also evaluated (Hantush type curves) as presented on Figures D3 and D4. Similar curve matching was achieved with comparable transmissivity values.

Location: Phoenix	Pumping Test: Pumping Test GWR-036	Pumping Well: GWR-036
Test Conducted by:		Test Date: 2020-11-05
Analysis Performed by: PJM	Theis	Analysis Date: 2020-11-10
Aquifer Thickness: 73.10 m	Discharge: variable, average rate 4.9651 [U.S. gal/min]	

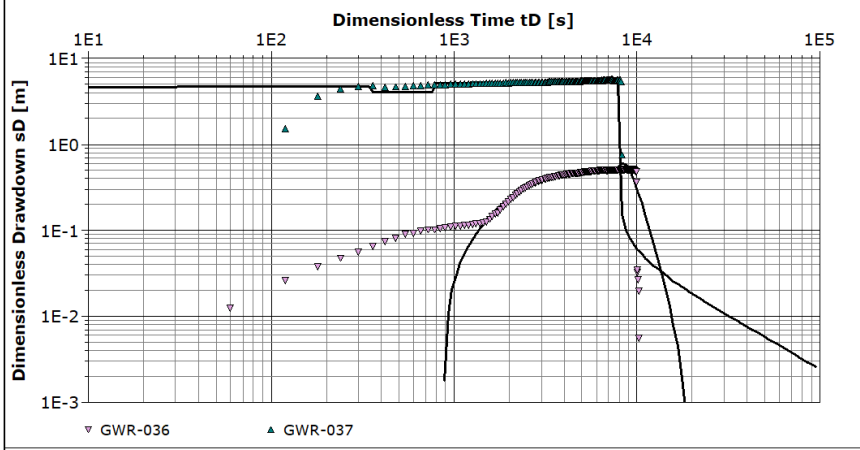


Calculation using Theis

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Ratio K(v)/K(h)	Radial Distance to PW [m]
GWR-036	2.40×10^{0}	3.28×10^{-2}		1.00×10^{-1}	0.03
GWR-037	4.80×10^{1}	6.57×10^{-1}	3.11×10^{-4}	1.40×10^{-2}	11.66
Average	2.52×10^{1}	3.45×10^{-1}	3.11×10^{-4}	5.70×10^{-2}	

Figure D2: Theis Curve Match

Location: Phoenix	Pumping Test: Pumping Test GW037	Pumping Well: GWR-037
Test Conducted by:		Test Date: 2020-10-24
Analysis Performed by: PJM	Hantush	Analysis Date: 2020-11-10
Aquifer Thickness: 73.10 m	Discharge: variable, average rate 4.8283 [U.S. gal/min]	

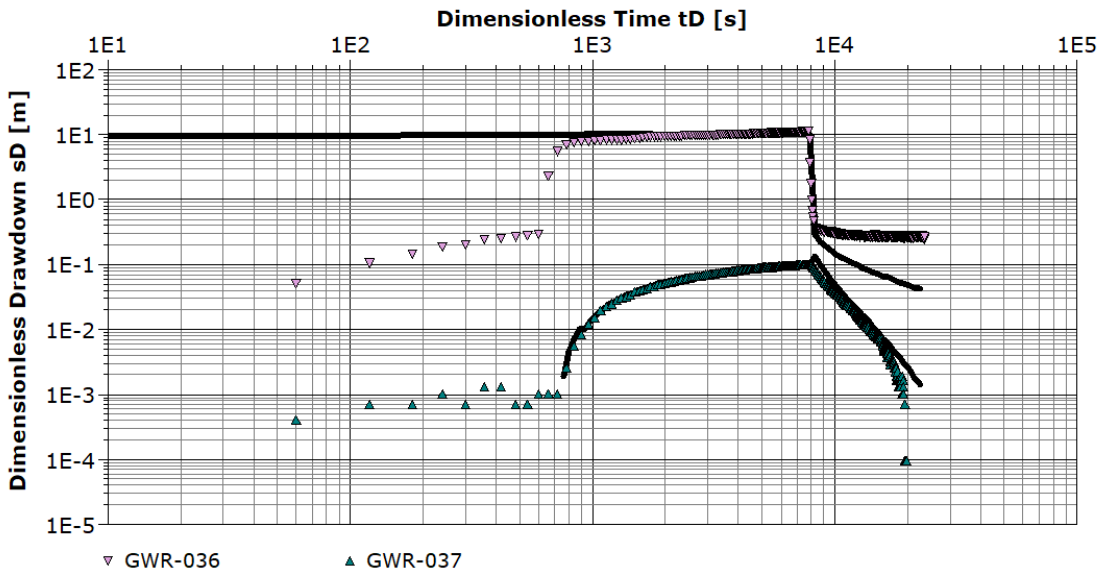


Calculation using Hantush

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Ratio K(v)/K(h)	Hydr. resistance [s]	Leakage factor [m]	Radial Distance to PW [m]
GWR-036	8.00×10^{-1}	1.09×10^{-2}	5.10×10^{-4}	3.93×10^{-1}	3.67×10^{6}	5.83×10^{0}	11.66
GWR-037	5.75×10^{1}	7.86×10^{-1}		1.13×10^{-1}	1.81×10^{8}	3.47×10^{2}	0.03
Average	2.91×10^{1}	3.99×10^{-1}	5.10×10^{-4}	2.53×10^{-1}	9.22×10^{7}	1.76×10^{2}	

Figure D3: Hantush Leaky Aquifer Analysis - Pumping GWR-037

Location: Phoenix	Pumping Test: Pumping Test GWR-036	Pumping Well: GWR-036
Test Conducted by:		Test Date: 2020-11-05
Analysis Performed by: PJM	Hantush - PW	Analysis Date: 2020-11-10
Aquifer Thickness: 73.10 m	Discharge: variable, average rate 4.9651 [U.S. gal/min]	



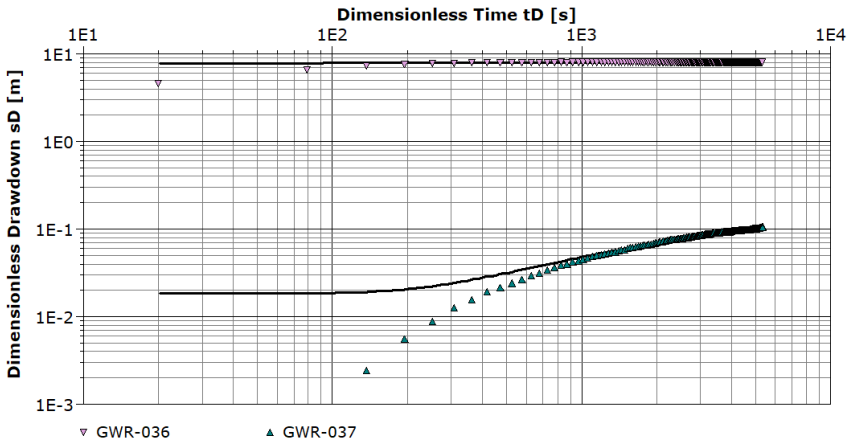
Calculation using Hantush with Storage

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Ratio K(v)/K(h)	Hydr. resistance [s]	Storage coefficient of the aquitard	Leakage factor [m]	Radial Distance to PW [m]
GWR-036	2.21×10^{1}	3.02×10^{-1}		1.00×10^{0}	2.43×10^{6}	1.23×10^{-11}	2.49×10^{1}	0.03
GWR-037	2.80×10^{1}	3.83×10^{-1}	1.40×10^{-3}	9.67×10^{-2}	4.00×10^{6}	1.73×10^{-7}	3.60×10^{1}	11.66
Average	2.51×10^{1}	3.43×10^{-1}	1.40×10^{-3}	5.48×10^{-1}	3.22×10^{6}	8.67×10^{-8}	3.05×10^{1}	

Figure D4: Hantush Leaky Aquifer Analysis - Pumping GWR-036

Analysis of recovery data alone was also performed (Figures D5 and D6).

Location: Phoenix	Pumping Test: Pumping Test GWR-036	Pumping Well: GWR-036
Test Conducted by:		Test Date: 2020-11-05
Analysis Performed by: PJM	Hantush - Recovery	Analysis Date: 2020-11-13
Aquifer Thickness: 73.10 m	Discharge: variable, average rate 4.9651 [U.S. gal/min]	

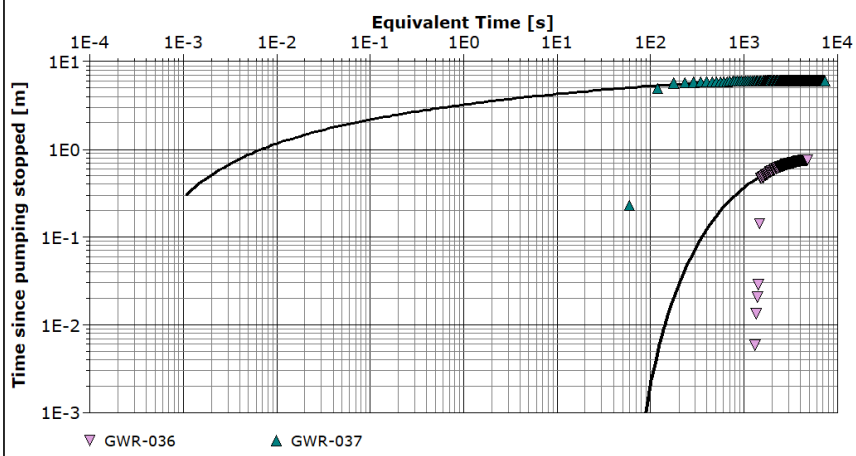


Calculation using AGARWAL + Hantush

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Hydr. resistance [s]	Leakage factor [m]	Radial Distance to PW [m]
GWR-036	3.05×10^{1}	4.17×10^{-1}		8.33×10^{8}	5.42×10^{2}	0.03
GWR-037	5.19×10^{1}	7.10×10^{-1}	7.02×10^{-3}	8.91×10^{7}	2.31×10^{2}	11.66
Average	4.12×10^{1}	5.64×10^{-1}	7.02×10^{-3}	4.61×10^{8}	3.87×10^{2}	

Figure D5: Recovery Analysis - Pumping GWR-036

Location: Phoenix	Pumping Test: Pumping Test GW037	Pumping Well: GWR-037
Test Conducted by:		Test Date: 2020-10-24
Analysis Performed by:	Hantush - Recovery	Analysis Date: 2020-11-16
Aquifer Thickness: 73.10 m	Discharge: variable, average rate 4.8283 [U.S. gal/min]	



Calculation using AGARWAL + Hantush

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Hydr. resistance [s]	Leakage factor [m]	Radial Distance to PW [m]
GWR-036	3.75×10^{0}	5.13×10^{-2}	5.00×10^{-4}	1.00×10^{7}	2.08×10^{1}	11.66
GWR-037	4.70×10^{0}	6.43×10^{-2}		1.00×10^{7}	2.33×10^{1}	0.03
Average	4.22×10^{0}	5.78×10^{-2}	5.00×10^{-4}	1.00×10^{7}	2.21×10^{1}	

Figure D6: Recovery Analysis - Pumping GRW-037

Summary of Analysis and Values:

As noted in Table D2, the hydraulic conductivity of the upper bedrock (MFd) near Wells GRW-036 and GWR-037 is estimated to be approximately $1x10^{-4}$ m/s, which is considered high for a weathered sandstone. The hydraulic conductivity value for the deep overburden was estimated to be $2x10^{-6}$ m/s to $8x10^{-6}$ m/s, with higher local values interpreted in discrete beds of coarse-grained material. Specific storage values were consistently in the range of $5x10^{-5}$ 1/m to $5x10^{-4}$ 1/m. The hydraulic conductivity and storage values will be useful in constraining the hydraulic conductivity input parameters within the regional numerical groundwater model.

Table D2: Summary of Hydraulic Parameters at GWR-036 and GWR-037

Well	Method	T (m^2/d)	K (m/s)	S	Ss (1/m)	Fit Comment
GWR-037 (MFD)	Theis - Pumping	5	9.6E-06	5.00E-03	8E-04	Good
	Hantush- Pumping	57	1.1E-04	5.00E-03	8E-04	Very Good
	Hantush - Recovery	5	9.6E-06	1.00E-04	2E-05	Excellent
	Theis – Obs Well	48	9.3E-05	3.00E-04	5E-05	Very Good
	Hantush – Obs Well	28	5.4E-05	1.40E-03	2E-04	Very Good
	Hantush Recovery - Obs	50	9.6E-05	7.00E-03	1E-03	Very Good
GWR-036 (OVB)	Theis – Obs Well	7	1.4E-05	3.00E-03	5E-04	Good
	Hantush – Obs Well	1	1.9E-06	5.00E-04	8E-05	Very Good
	Hantush - Recovery	4	7.7E-06	5.00E-04	8E-05	Excellent
	Theis - Pumping	2	3.9E-06	2.00E-03	3E-04	Very Good
	Hantush- Pumping	23	4.4E-05	1.00E-04	2E-05	Good
	Hantush Recovery - Obs	30	5.8E-05	1.00E-04	2E-05	Good

Aquifer Test Analyses: GWR-033, GWR-034 and GWR-035

Pumping tests were performed in monitoring wells GWR-033 to -035 (Figure D7) with monitoring in the adjacent wells. These monitoring wells are located 600 m southeast of the Phoenix deposit and were drilled to provide insight into the regional hydrogeologic conditions at a greater distance from the ore deposit.

The three monitoring wells are located near WR-607 (known geology) and a southern embayment of Whitefish Lake. The wells were screened at different depths to create a well nest or cluster that provides insights on the changes in water level elevations from shallow bedrock (i.e., less than 10 m below surface) to the deep sandstone (i.e., 350 m below surface; Table D3).

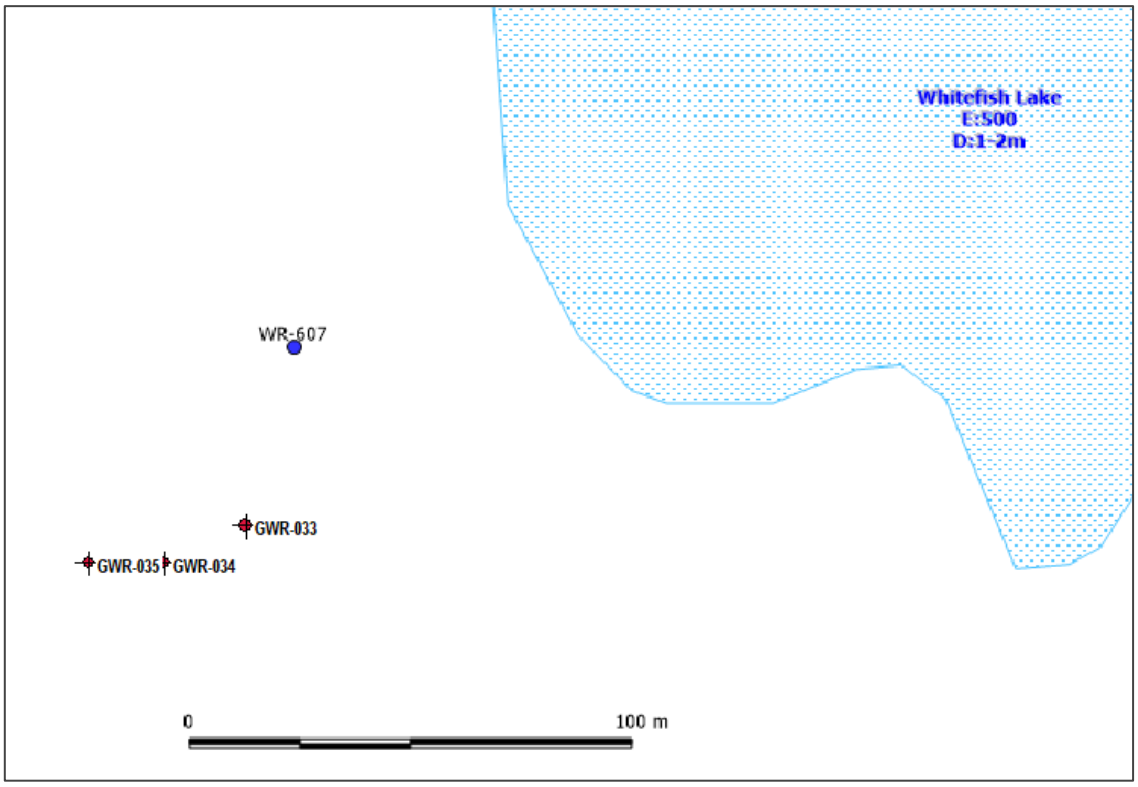


Figure D7: Well Locations

Hydrogeologic Setting

In all cases, the screened interval was well below the water table throughout the test, even though significant drawdown was experienced when pumping GWR-033 and GWR-034 (Table D3); it is noted that the depth of the submersible pump was not recorded. As such, the entire saturated thickness to the drilled depth is considered to form one multi-layered aquifer system, and the wells are partially penetrating.

Considering the positioning of the wells within the setting, as well as the limited pumping test timeline (i.e., 2 hours of pumping), responses to pumping were interpreted to reflect a confined aquifer (i.e., radial flow without contribution from pore drainage), with the potential for leakage from the overlying sediments to off-set the requirement for radial flow in response to pumping.

Table D3: Well Details at GWR-033 to GWR-035

Feature	GWR-033	GWR-034	GWR-035
Ground Surface / Top of Casing (m asl)	504	504	504
Screened Unit	MFa, above unconformity (Friable Sandstone)	MFb (fractured and friable zone)	MFd (weathered bedrock)
Screened Interval (depth in m btoc)	345.6-351.6 (6 m)	215-221 (6 m)	9.9-12.8 (3 m)
Top of Bedrock (depth in m btoc)	11.2	11.9	8
Coarse Gravel (depth in m btoc)	5 – 9 m	No core photo	4 - 8 m
Overburden above Bedrock	Sand with cobbles	No core photo	Sand with cobbles
Upper Bedrock	Weathered sandstone, friable portions	No core photo	Weathered sandstone, oxidized
Approximate depth (m) to water	2.3 m	2.6 m	3.1 m
Maximum Drawdown (m) – Pumped well	21 m	36 m	0.75 m
Maximum Drawdown (m) – Obs well	0 m	0.08 m ? (GWR-034)	< 1cm (GWR-033) ? (GWR-034)

Analysis of drawdown versus time derivatives for the pumping and observation wells suggest that the response to pumping ranges from a confined aquifer to a leaky confined aquifer (although responses were not ideal for either case). Leakage within the deep bedrock (i.e., GWR-034 and GWR-033) is most evident.

Pumping Test

The pumping of each was performed for approximately 2 hours, with a target rate of 5 USGPM. Target rates were not able to be maintained however within wells GWR-033 and GWR-034 (deep bedrock wells). As a result, variable pumping rates were calculated based on the total volume of discharge recorded throughout the test (as opposed to using instantaneous pumping rates).

In all cases, monitoring was completed within the pumped as well as the adjacent observation wells. Barometric pressure variability was available for the period from July 2020 to the end of October 2020. Late time water level fluctuations from well GRW-036 were

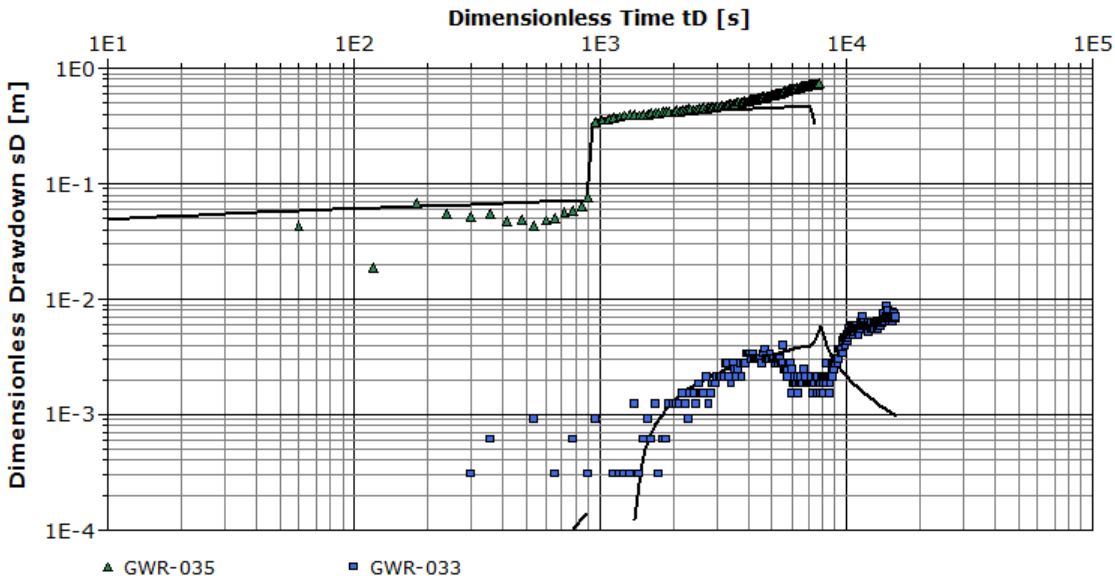
used to evaluate the barometric efficiency, which was found to be 0.5. Barometric corrections to drawdown were performed within the software program AquiferTest™.

Results

Theis analyses for wells GWR-035 and GWR-033 are illustrated on Figures D8 and D9, respectively. The match focuses on analysis of the pumping period and indicates a higher hydraulic conductivity value in the upper weathered bedrock than the deeper bedrock. Additionally, the response within GWR-033 suggests there is a higher hydraulic conductivity values in the deep sandstone unit (Read Fm; MFa) than the intermediate sandstone bedrock unit (MFb).

Leaky aquifer conditions (Hantush type curves) were also evaluated, but they were not found to provide enhanced fit to observation data at any well. Fit of recovery data was also attempted but was not well replicated with the data collected through these tests.

Location:	Pumping Test: Pumping Test GWR-035	Pumping Well: GWR-035
Test Conducted by:		Test Date: 2020-11-03
Analysis Performed by: PJM	Theis	Analysis Date: 2020-11-10
Aquifer Thickness: 360.00 m	Discharge: variable, average rate 4.3983 [U.S. gal/min]	

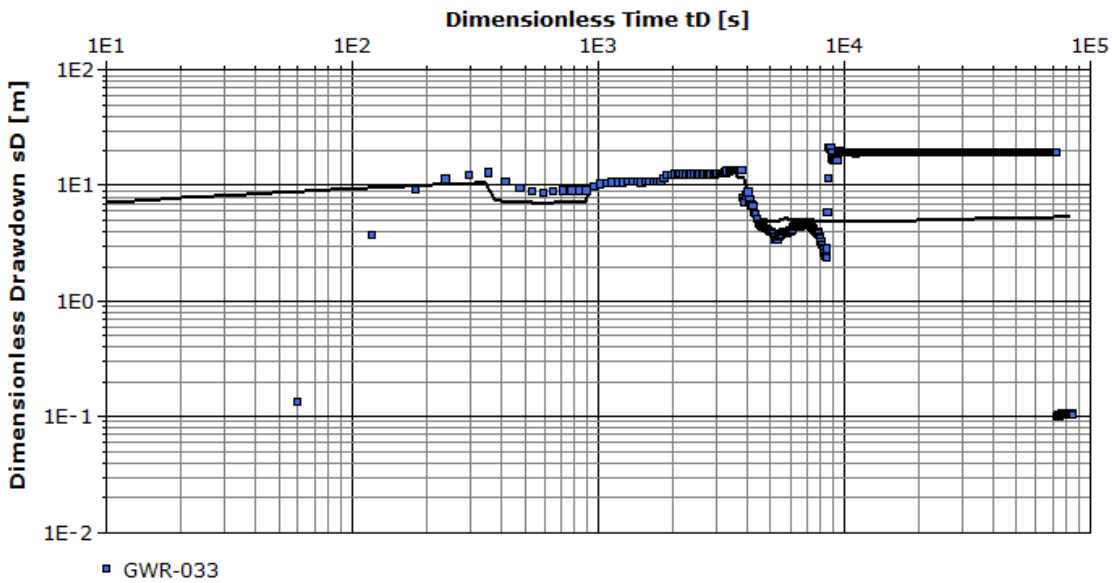


Calculation using Theis

Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Ratio K(v)/K(h)	Radial Distance to PW [m]
GWR-035	7.80×10^{1}	2.17×10^{-1}		5.59×10^{-2}	0.03
GWR-033	1.36×10^{3}	3.78×10^{0}	5.08×10^{-5}	1.00×10^{-1}	25.71

Figure D8: Theis Analysis for GWR-035

Location: Phoenix	Pumping Test: Pumping Test GWR-033	Pumping Well: GWR-033
Test Conducted by:		Test Date: 2020-11-03
Analysis Performed by: PJM	Theis	Analysis Date: 2020-11-10
Aquifer Thickness: 352.00 m	Discharge: variable, average rate 3.0464 [U.S. gal/min]	



Calculation using Theis

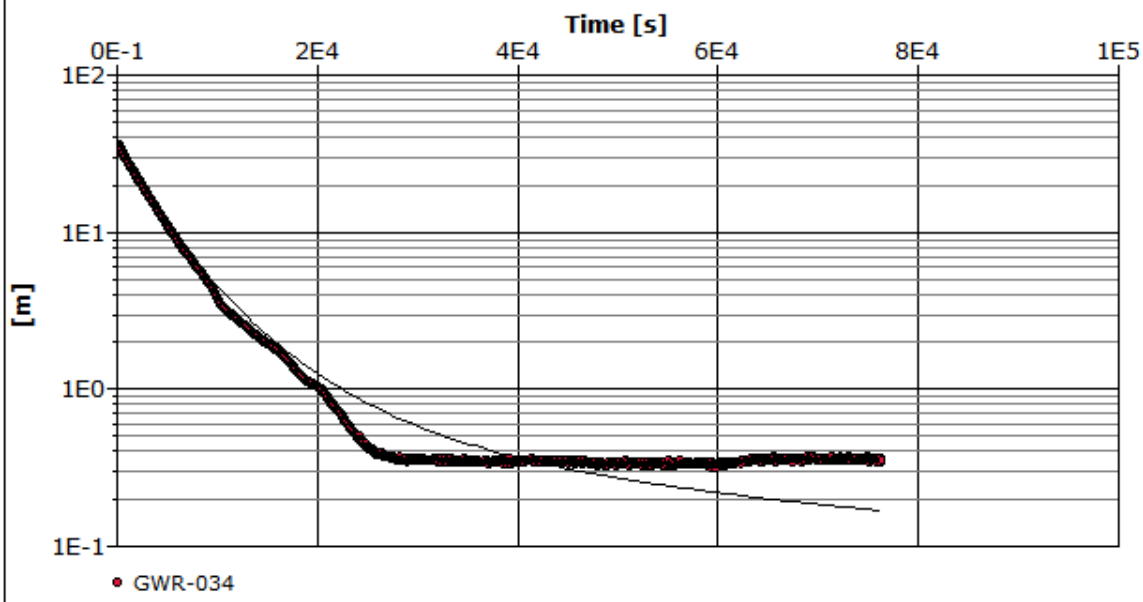
Observation Well	Transmissivity [m²/d]	Hydraulic Conductivity [m/d]	Storage coefficient	Ratio K(v)/K(h)	Radial Distance to PW [m]
GWR-033	1.88×10^{0}	5.34×10^{-3}		9.00×10^{-2}	0.03

Figure D9: Theis Analysis for GWR-033

For GWR-034, the observed response to pumping of the neighbouring wells was negligible, while the well was dewatered when it was pumped. Both of those cases resulted in poor data for analysis of hydraulic conductivity. However, when the pump and associated hoses were removed (estimated as 27 L of water) from the well, the result was an inadvertent slug test. Since the transducer was still recording, the recorded water level vs. time, which resulted in a significant water level change, was used to estimate the hydraulic conductivity as a slug test analysis.

The water level recovery vs time was analyzed using three curve-fitting approaches: Hvorslev, Bouwer and Rice, and Cooper-Bredeheoft-Papadopulos. All analyses resulted in hydraulic conductivity of 5 to 8×10^{-8} m/s; an example is presented in Figure D10.

Location: Phoenix	Slug Test: Slug Test 1	Test Well: GWR-034
Test Conducted by: PJM		Test Date: 2021-02-26
Analysis Performed by: PJM	Cooper Bred - Papa	Analysis Date: 2021-02-26
Aquifer Thickness: 10.00 m		



Calculation using Cooper-Bredehoeft-Papadopulos				
Observation Well	Transmissivity [m²/s]	Hydraulic Conductivity [m/s]	Well-bore storage coefficient	
GWR-034	8.00×10^{-7}	8.00×10^{-8}	1.00×10^{-5}	

Figure D10: GWR-034 Response to Removal of Pumping Equipment

Summary of Analysis and Values:

As noted in the table below, the hydraulic conductivity of the upper bedrock (MFd) at this location is estimated to have a transmissivity on the order of 50 to 100 m^2/d, and a hydraulic conductivity value of $1x10^{-4}$ m/s to $4x10^{-4}$ m/s, which is considered high for a weathered sandstone. Specific storage estimates were inconsistent, but are estimated to be approximately 10^{-6} 1/m.

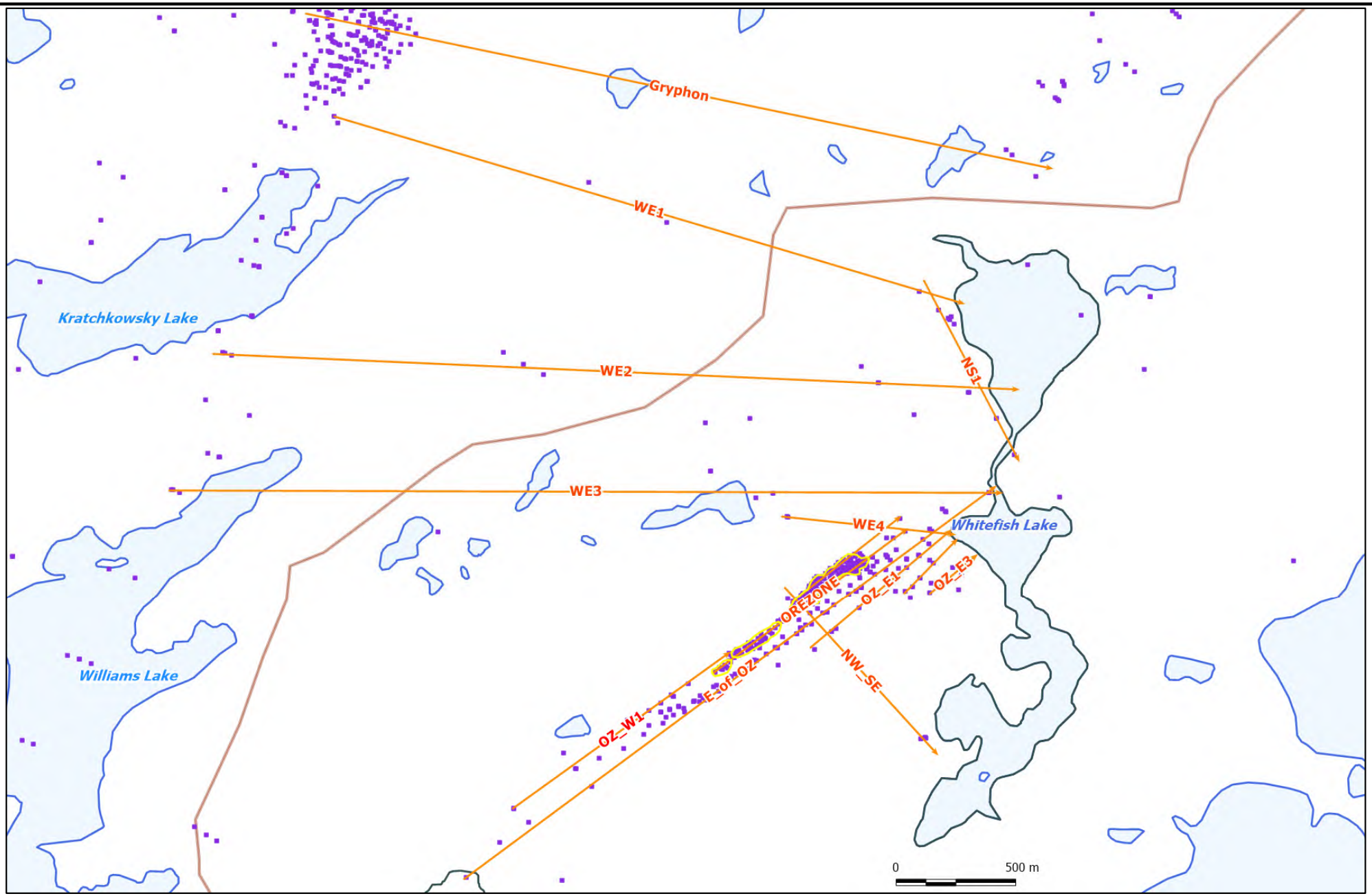
Hydraulic conductivity values for the deep bedrock (Read Fm; MFa) were estimated to range from $4x10^{-6}$ m/s to $4x10^{-5}$ m/s (Table D4). Specific storage values were consistently in the range of 10^{-6} 1/m to 10^{-5} 1/m. The overlying sandstone bedrock (MFb) was estimated to have the lowest hydraulic conductivity (less than 10^{-7} m/s), and a specific storage value comparable to other bedrock zones (10^{-5} 1/m).

Table D4: Summary of Hydraulic Parameters at GWR-033 to GWR-035

Well	Method	Pumped Well	T (m^2/d)	K (m/s)	S	Ss (1/m)
GWR-035 (Weathered MFd)	Theis – Pumping	GWR-035	50	1.9E-04	8.20E-04	3E-04
	Dougherty -Babu	GWR-035	113	4.4E-04	9.50E-02	3E-02
	Theis - Recovery	GWR-035	35	1.4E-04	2.60E-06	9E-07
	Theis - Obs Well	GWR-034	68	1.3E-04	2.00E-05	3E-06
GWR-034 (MFb)	Theis – Pumping	GWR-034	0.1	1.9E-07	1.80E-04	3E-05
	Hantush	GWR-034	2	3.9E-06	1.26E-03	2E-04
	Slug Test Analyses	GWR-034		8.0E-08	1.00E-05	1E-06
GWR-033 (Read Fm; MFa)	Theis	GWR-035	1360	4.4E-05	5.10E-05	1E-07
	Theis	GWR-034	7.3	6.0E-07	2.00E-04	1E-06
	Hantush	GWR-034	46	3.8E-06	2.00E-04	1E-06
	Theis – Pumping	GWR-033	2	3.9E-06	1.00E-04	2E-05
	Hantush-Pumping	GWR-033	70	1.4E-04	1.00E-04	2E-05
	Double Porosity – Pumping	GWR-033	2	3.9E-06	1.00E-04	2E-05

Appendix E Cross-Sections Generated in the Phoenix Area

Figure E1	Cross-Section Locations and Names
Figure E2	Gryphon Cross-Section
Figure E3	WE1 Cross-Section
Figure E4	WE2 Cross-Section
Figure E5	WE3 Cross-Section
Figure E6	WE4 Cross-Section
Figure E7	NW-SE Cross-Section
Figure E8	OZ-WE1 Cross-Section
Figure E9	Ore Zone Cross-Section
Figure E10	E of Ore Zone Cross-Section
Figure E11	OZ E1 Cross-Section
Figure E12	OZ E2 Cross-Section
Figure E13	OZ E3 Cross-Section



LEGEND

- Lakes
- Rivers/ Streams
- Road/ Highway
- Phoenix Ore Zone
- Core Holes
- NS1 Cross-Section Name
- Cross Section Line

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

Cross-Section Locations and Names

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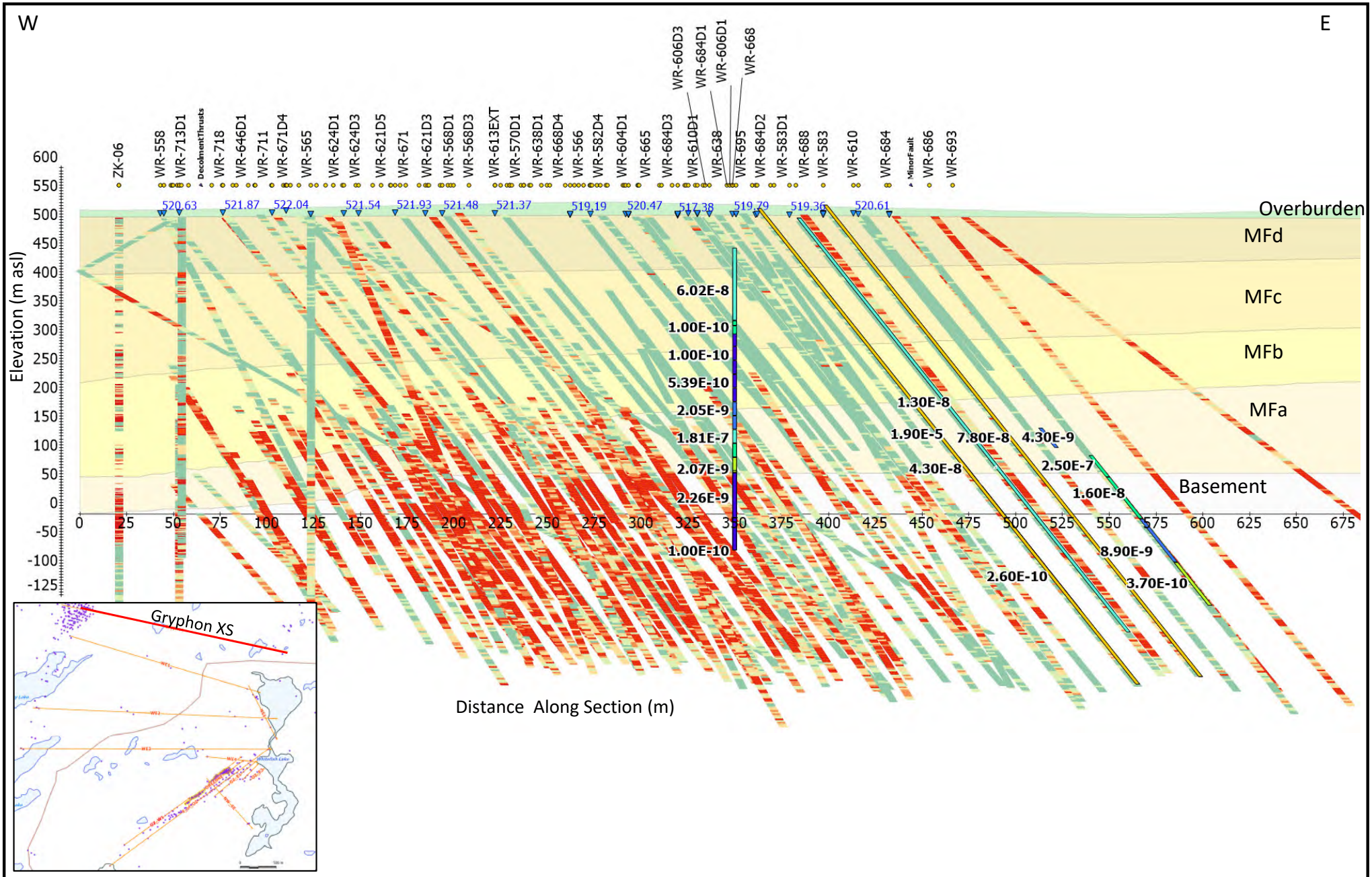
E1



LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Source: Denison DH Logger Database

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

Gryphon Cross-Section

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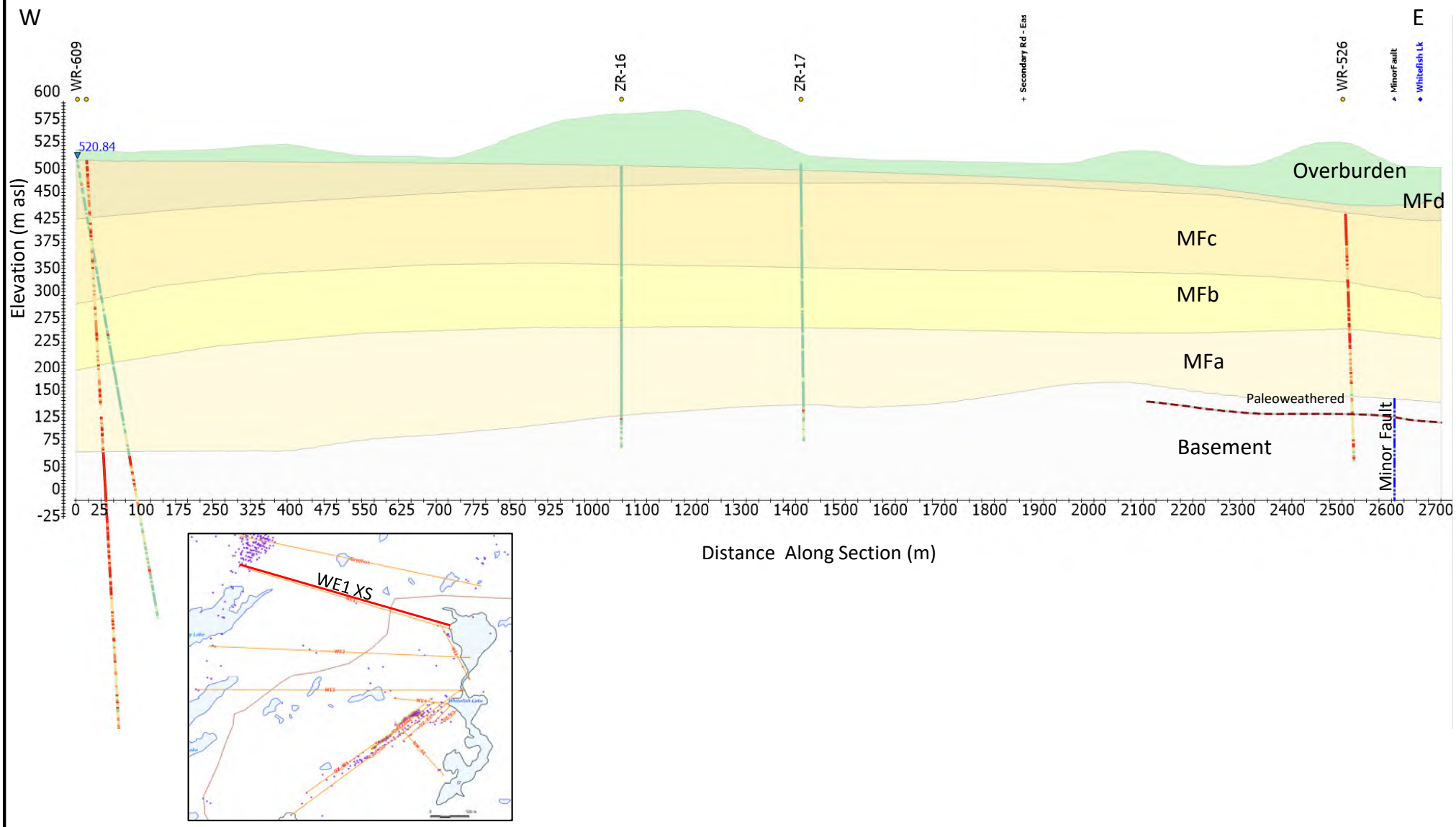
E2



LEGEND

Fracture Frequency

- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces

- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)
- Overburden
- Basement Rocks
- Water Level Elevation (masl)

Source: Denison DH Logger Database. Fracture frequency calculated as number of fractures per metre

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

WE1 Cross-Section

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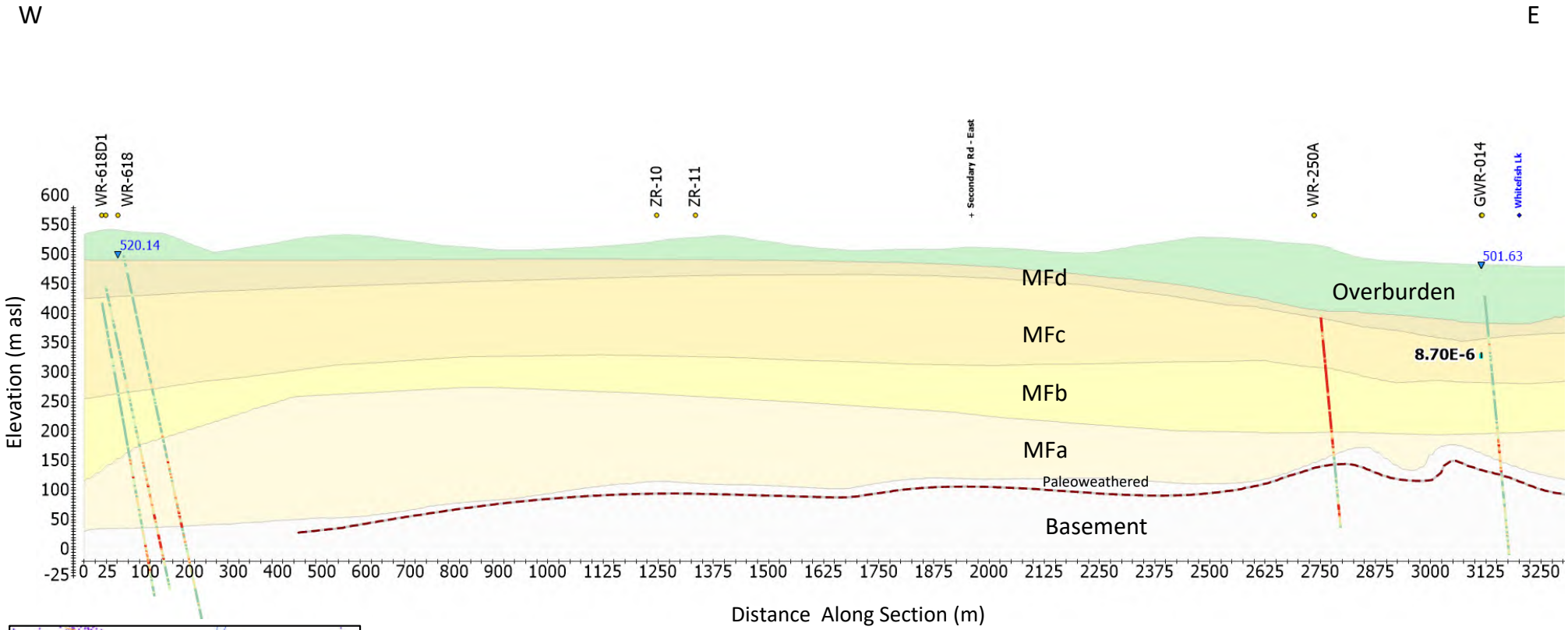
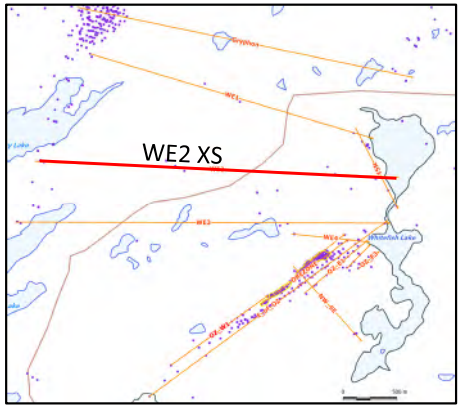
E3





LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

WE2 Cross-Section

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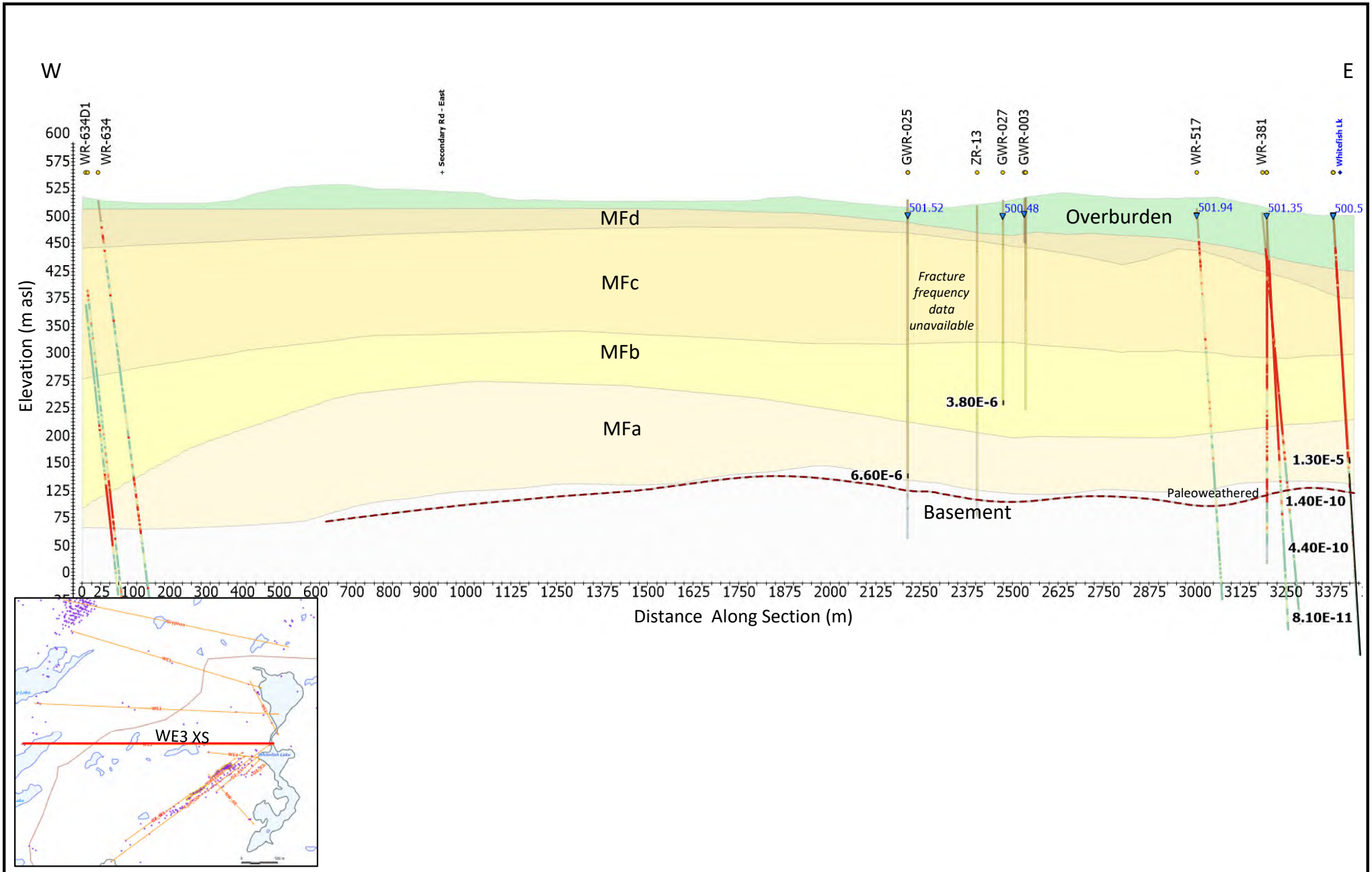
E4



LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

WE3 Cross-Section

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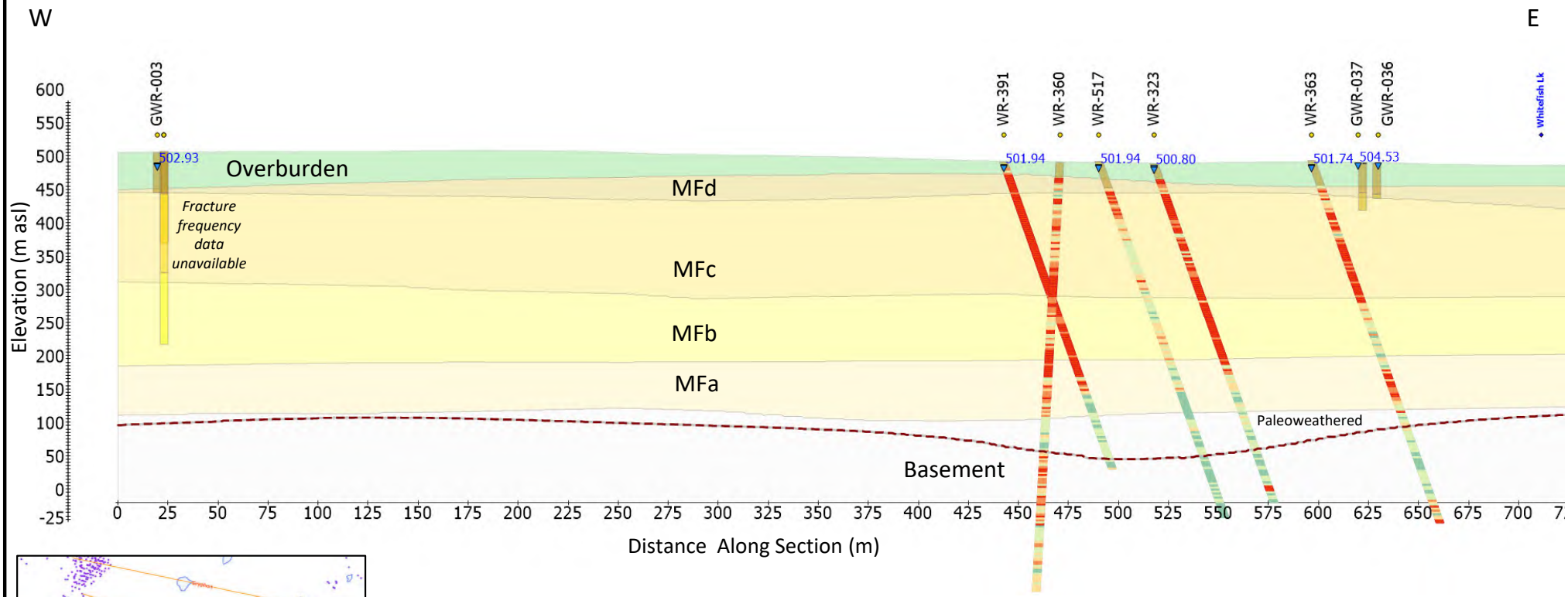
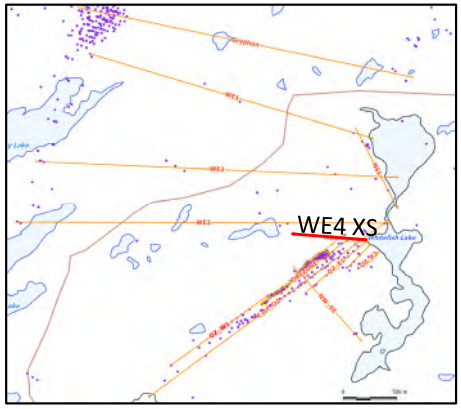
E5





LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

WE4 Cross-Section

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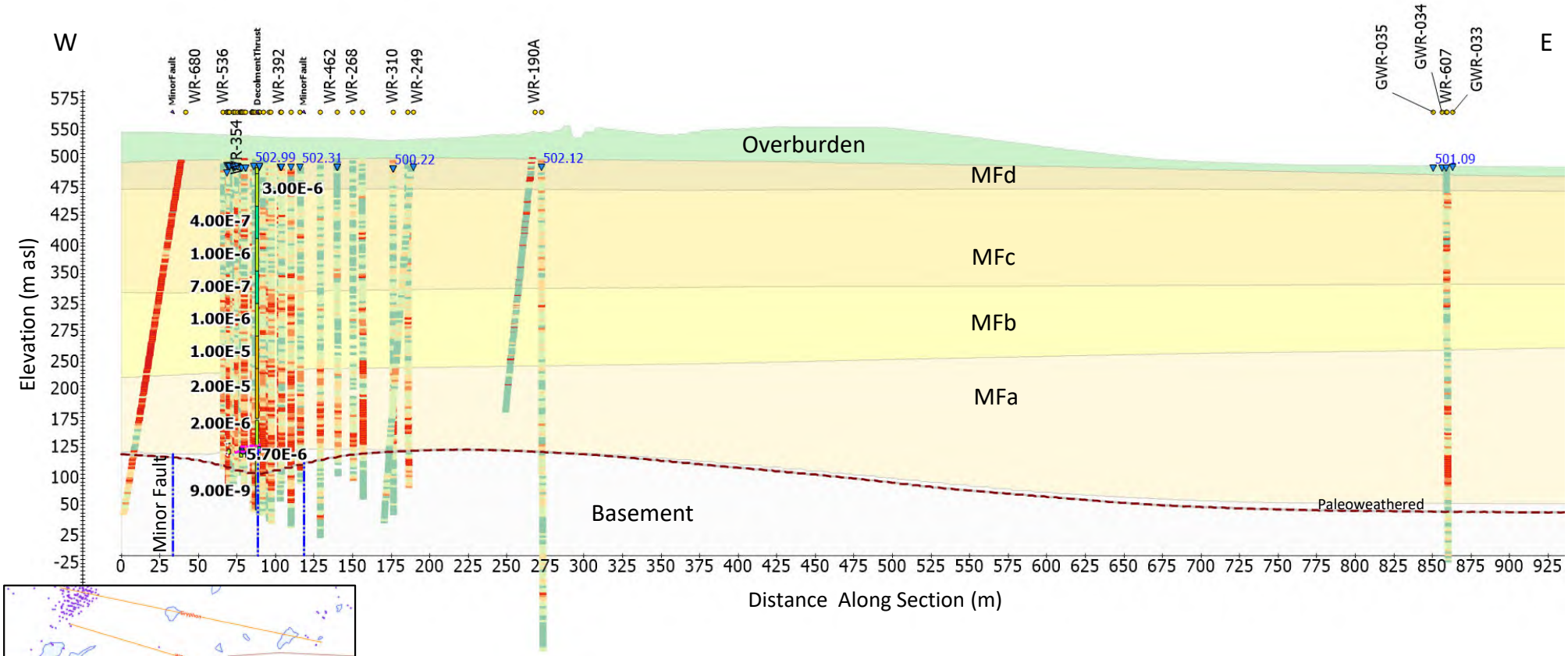
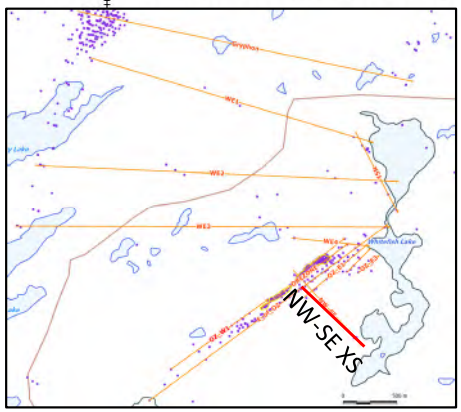
E6





Note: Recent interpretations of the Top of Read Fm and Paleoweathered surface at wells GWR-033 to -035 are not reflected on this cross-section

LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project
Baseline Geology and Hydrogeological Assessment

NW-SE Cross-Section

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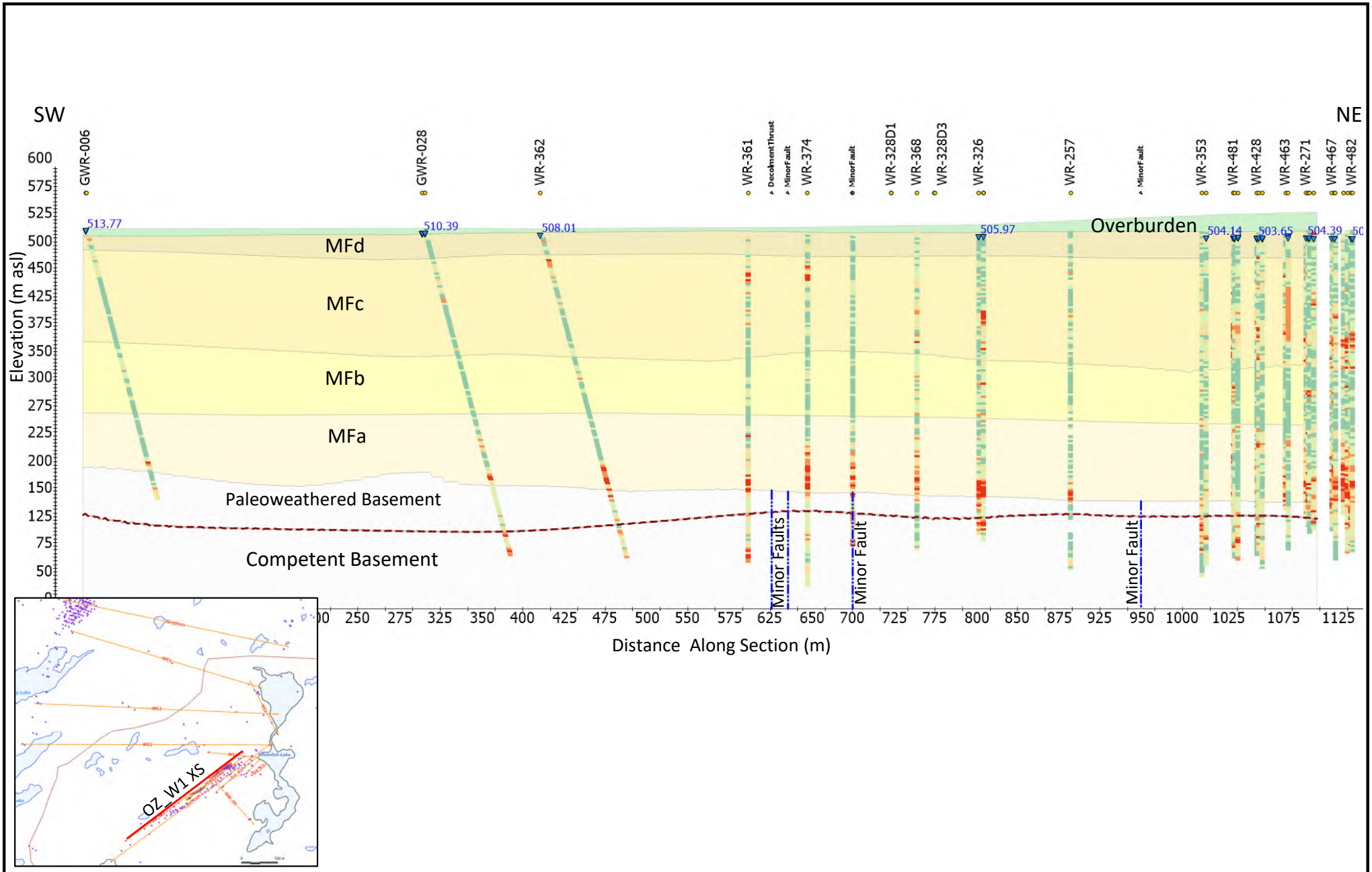
E7



LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

OZ-WE1 Cross-Section

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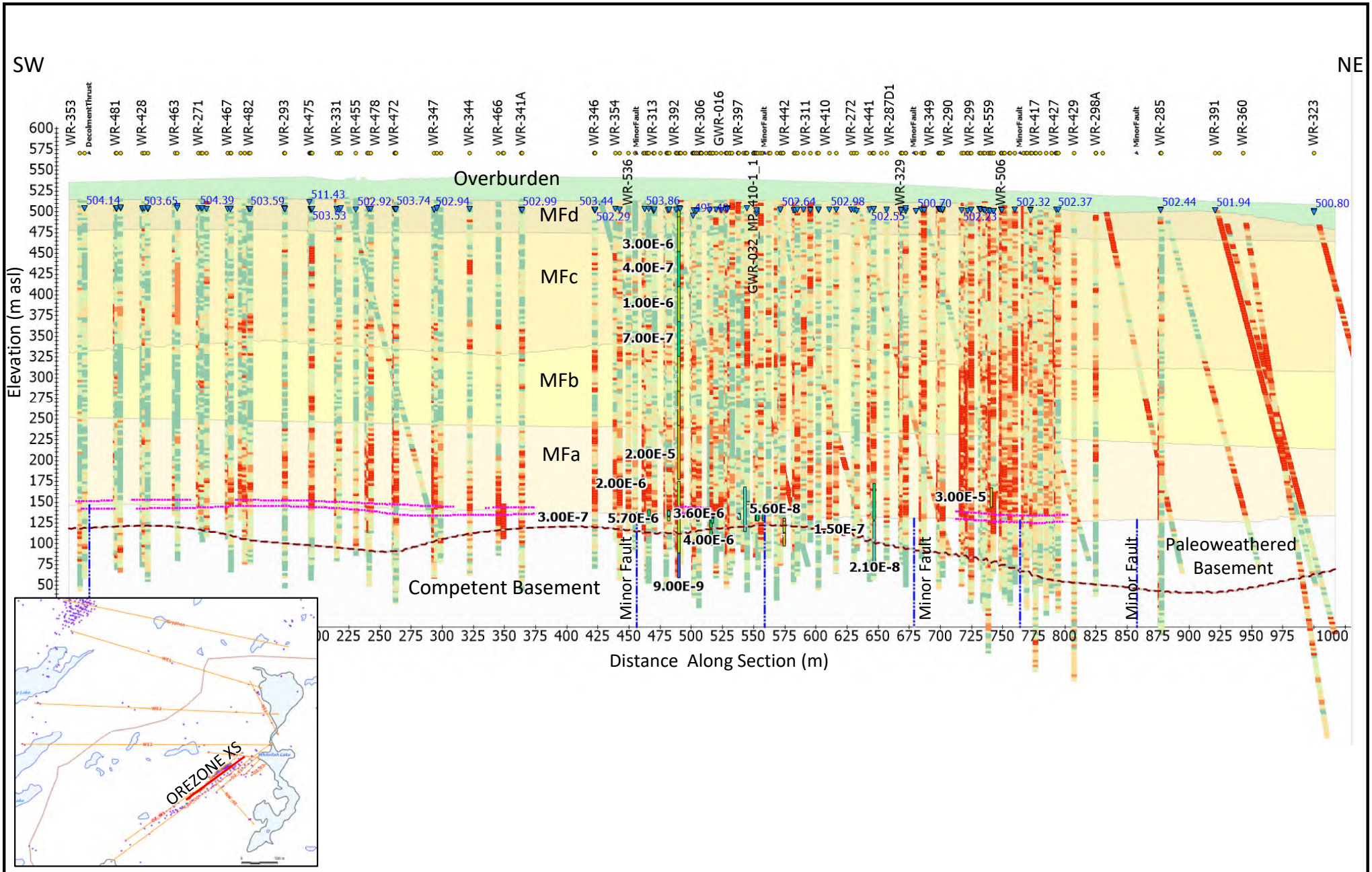
E8



LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)
- Ore Zone
- Paleoweathered Surface

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

Ore Zone Cross-Section

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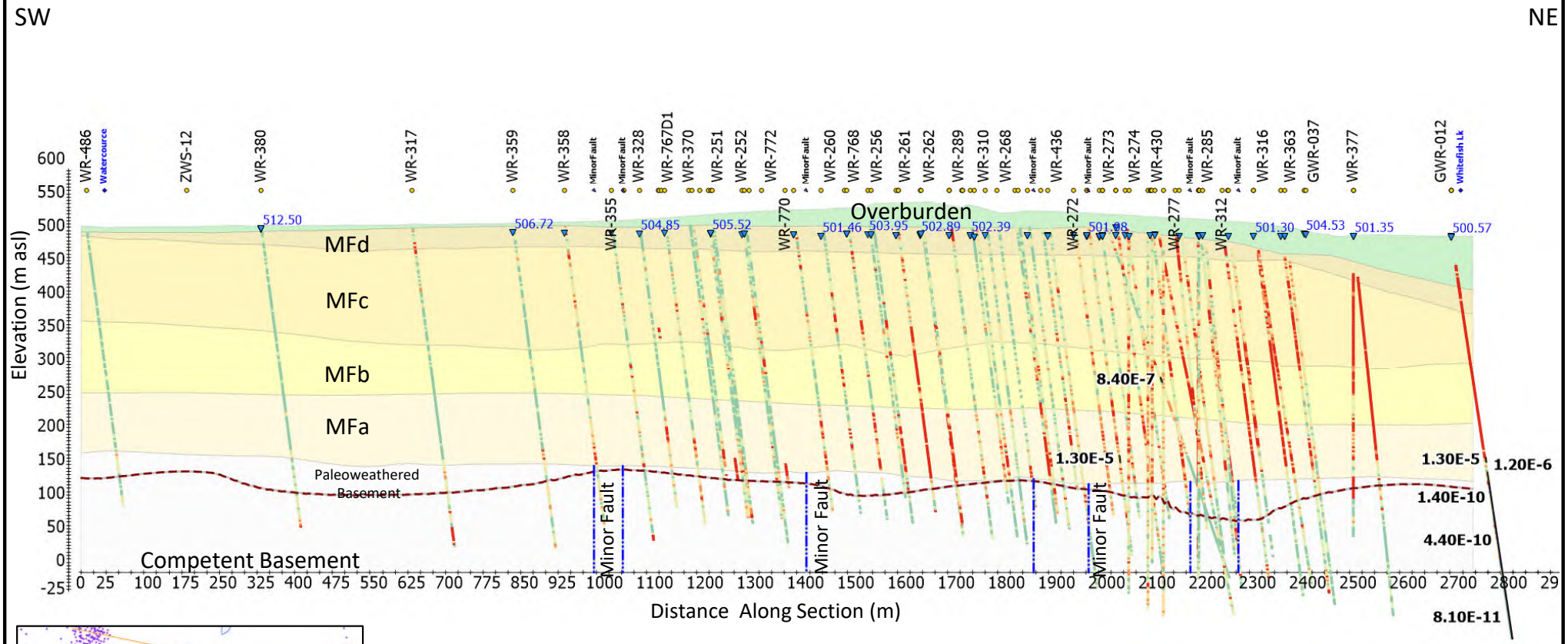
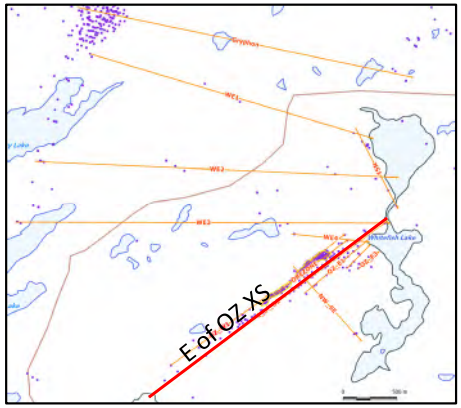
E9





LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)
- Paleoweathered Surface

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

E of Ore Zone Cross-Section

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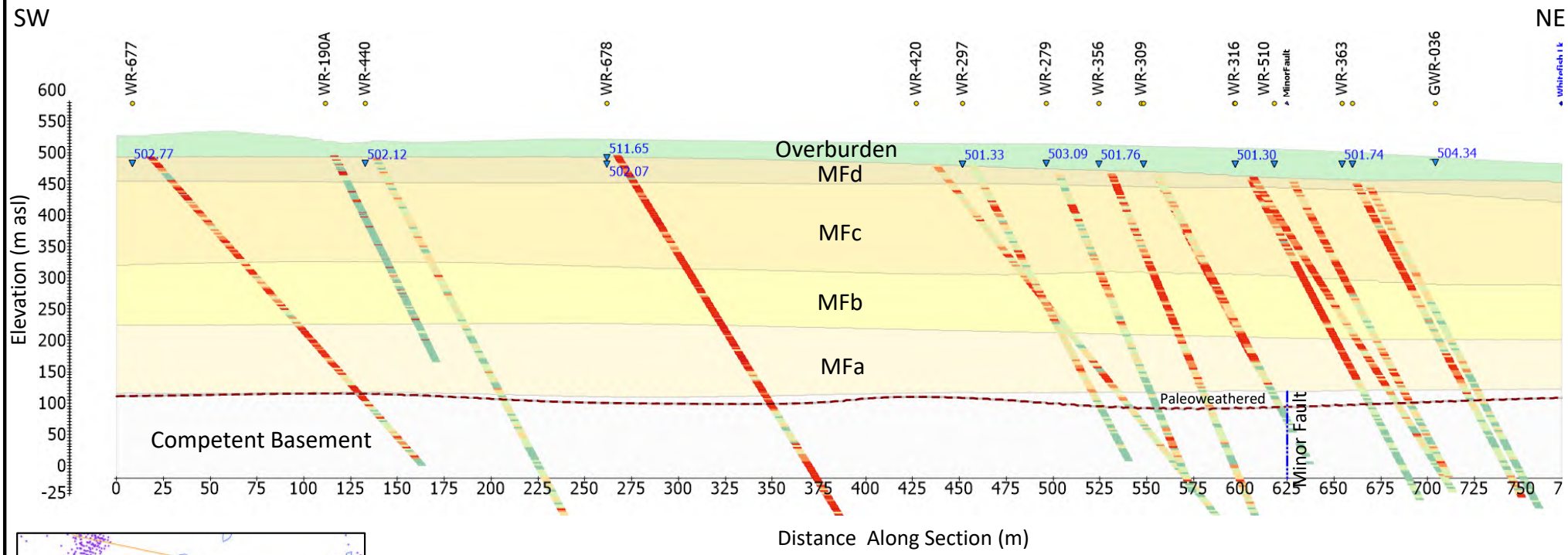
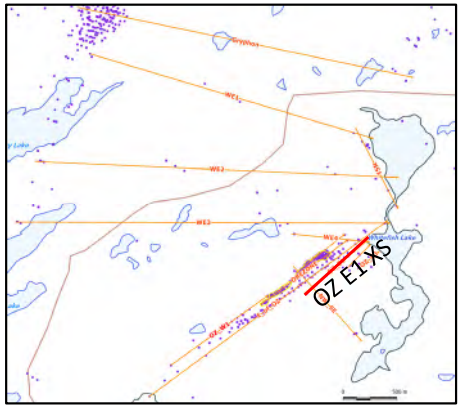
E10





LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)
- Paleoweathered Surface

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

OZ E1 Cross-Section

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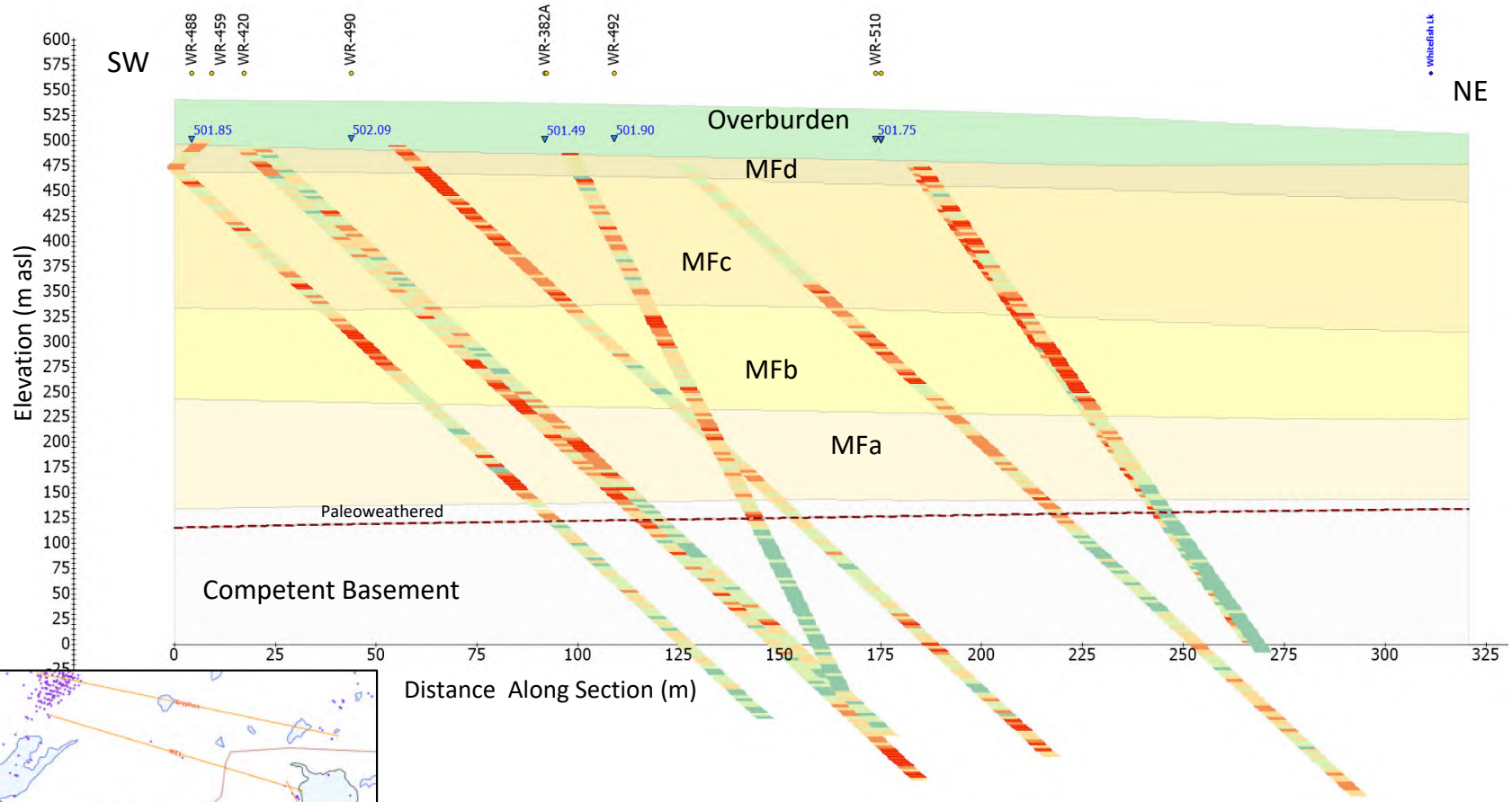
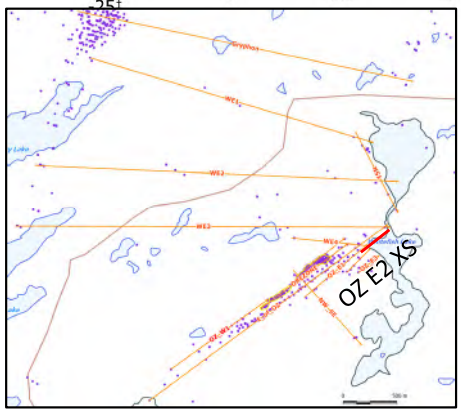
E11





LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)
- Paleoweathered Surface

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

OZ E2 Cross-Section

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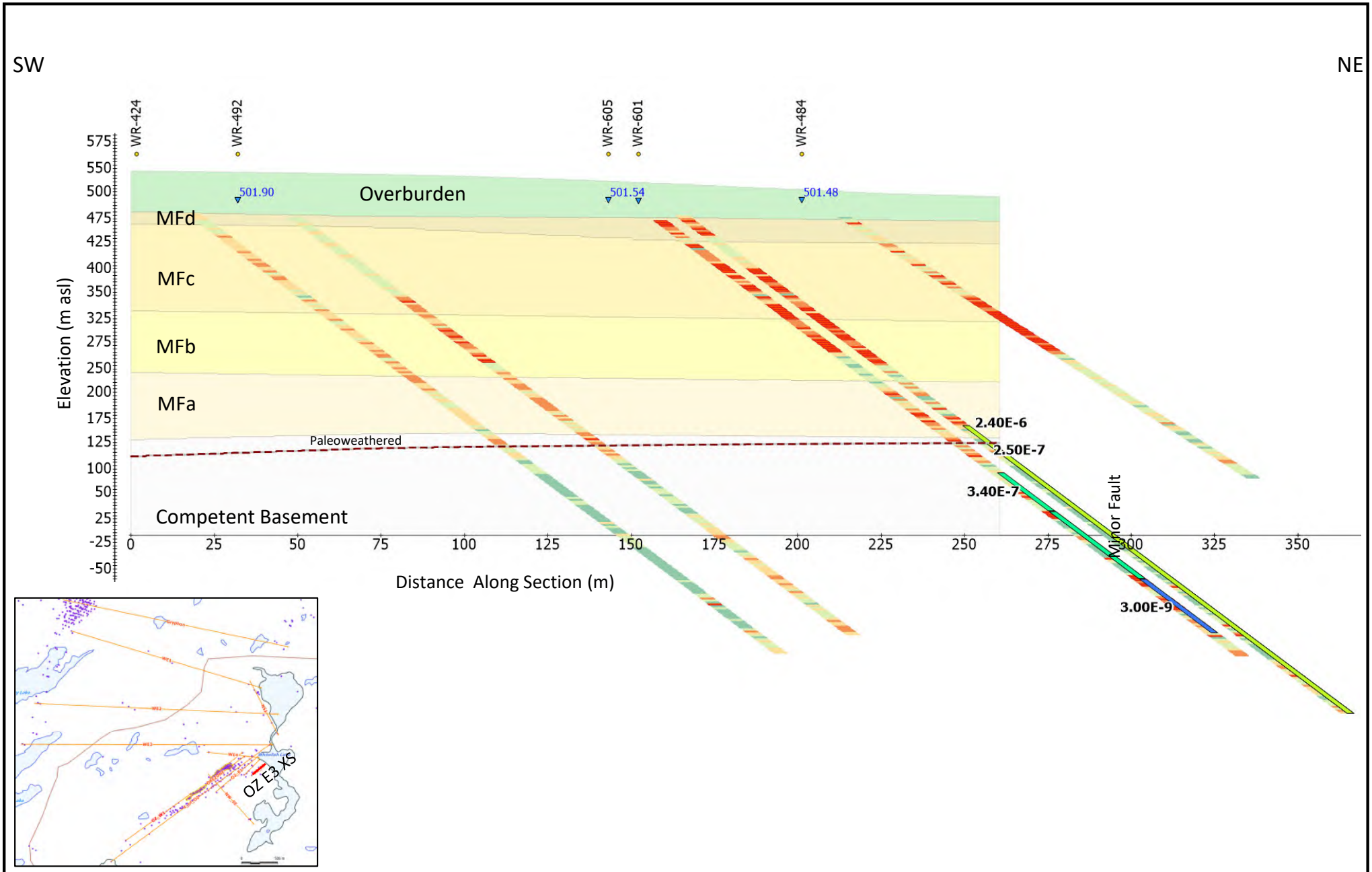
E12



LEGEND

Fracture Frequency
- 0 to 1
- 1 to 2
- 2 to 3
- 3 to 4
- >4

Lithologic Surfaces
- Read Fm (MFa)
- Bird Fm (MFb)
- Collins Fm (MFc)
- Dunlop Fm (MFd)

- Overburden
- Basement Rocks
- Water Level Elevation (masl)
- 1E-5 K Estimate (m/s)
- Paleoweathered Surface

Hydraulic Conductivity (m/s)
- <1E-10
- 1E-10 to 1E-9
- 1E-9 to 1E-8
- 1E-8 to 1E-7
- 1E-7 to 1E-6

Wheeler River Project

Baseline Geology and Hydrogeological Assessment

OZ E3 Cross-Section

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E13

Appendix F Groundwater Sampling Methodology

Denison Mines Corp.
200 – 230 22nd St. East
Saskatoon, SK S7K 0E9
T: 306-652-8200
F: 306-652-8202

www.denisonmines.com

Work Instruction

Wheeler River Evaluation Groundwater Sampling

WRE-WI-006

Revision	Date yy-mm-dd	Summary of Changes	Authorized by:
0	20-06-04	Original	David Bronkhorst, VP Operations

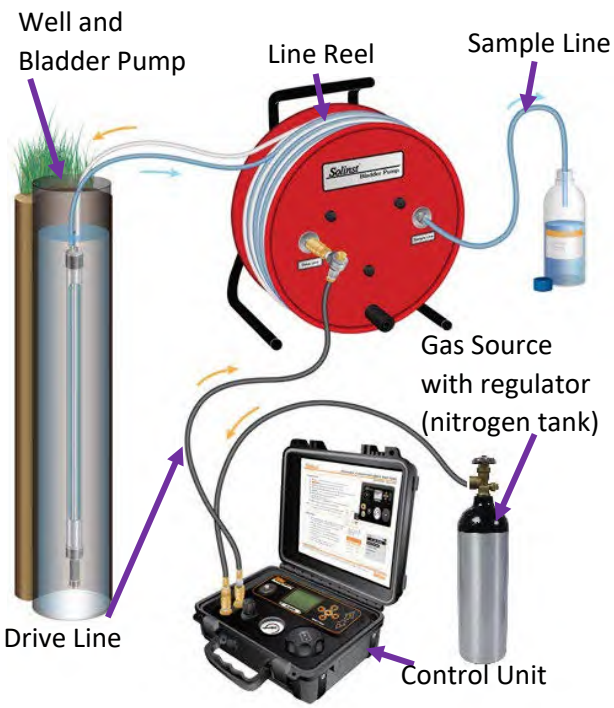
Related Documents
Wheeler River Covid-19 Procedure Document WR-PRO-01 Radiation Protection Program Air Lift Well Development – WRE-WI-004 WRE_FRM_AirLiftChecklist Injection And Pump Tests – WRE-WI-005 Solinst Model 407 Bladder Pump and control unit operator's manual

Objective and Scope	Tools and materials
The purpose of groundwater sampling is to create baseline water quality data for environmental modelling, future test work, and mining activities. Samples will also be taken from the ore zone to aid in geochemical modelling for ISR mining. The primary objective of this work instruction is to ensure the collection of the best possible representative samples from the screened interval depths This procedure is for groundwater sampling and does not cover purging by air lift which is covered by (Air Lift Well Development WRE HYD 01) To be conducted by Denison field staff	• Truck with hitch • 20kw Generator on trailer • Nitrogen tank with regulator • Crescent wrenches • Redi-Flo pump (if applicable) • Bladder pump setup (Solinst Model 407) • Sample containers, preservatives, and filters • Coolers and ice packs • YSI water quality meter (calibrate before use) • Field notebook pencils and markers • Water level tape • Deionized water • Phosphate-free soap • Field test kits (Fe, H_2S)

Covid-19 Mitigation Procedures	PPE Required
• Practice social distancing (>2m) while undertaking work • After initial setup the work can be done alone • If social distancing is not possible for a task a cloth mask must be worn • Work involves shared contact with equipment and materials so hand sanitizer must be used before and after doing the work • Bladder pump controls must be wiped down with disinfectant wipes before and after work	• Hand-held radio to check in every 2 hours when working alone • Safety glasses • Coveralls or designated work clothes (long sleeve and pants) • Rubberized work gloves • Disposable rubber gloves • TLD Badge • Polimaster Direct Reading Dosimeter

Record(s) Required	Duration of Record(s) Storage	Responsibility for Record Mgmt.
• Field Notes • WRE_FRM_ GroundwaterPurgeAndSample • Chain of custody and submission forms • Shipping labels (SRC and U of O)	Indefinitely	Technical Services Coordinator/ Environmental Services Coordinator

Step	Instructions	Illustration of Step
1. Ensure that well is developed and purged before sampling	Sampling will done on screened well installations that have been initially developed by air lift (confirm checklist for well; right) and have been purged by airlift or other methods for at least 1 casing volume; Record field parameters and take field tests every 1/2 casing volume during purging until parameters stabilize. 3 casing volumes maximum and record in GroundwaterPurgeAndSample form. (see Air Lift Well Development - WRE HYD 01). Development and purging are necessary to collect a sample that is representative of the natural formation water. Samples should be taken between 2 days and a week after well purging via air lift to allow suspended solids to settle. A bladder pump (with N_2 gas) should be used to collect the sample because it has the lowest impact on sample quality, does not cause sample aeration, and provides the most consistent sampling method. Some well installations are large enough to accommodate a Redi-Flo pump (2”), Bennet pump (2.5”), or Grundfos pump (4”) for well purging (see 20200601_WRE_WI_HYD-04-InjectionAndPumpTests) but sampling should still be done with bladder pump.	**<u>Air Lift Checklist Form</u>** **Air Lift Well Development Checklist** **Well ID: Test Supervisor: _____** **Date: start time:_____ end time:_____** **1. Airlift monitoring well development planning:** ❑ estimate depth of submergenceft ❑ estimate minimum air pressurepsi 2. **Pre-air-lifting checks** ❑ compressor/generator (turn on/off, check fuel) ❑ airline system check (all components present): compressor valve —> injection hose & connections (measure length required and mark) ❑ water discharge system check: —> sump pump —> discharge hose & connections —> discharge measuring bucket ❑ measuring equipment: —> water level meter —> watch, tape measure, notepad, pencil ❑ YSI water quality meter (calibrated before use) **3. Measure static water level _____ft** **4. Install air system** ❑ insert air pipe or hose down hole ❑ secure hose in air inlet on well head with In Situ cap **5. Install water discharge system** ❑ discharge hose attached to port on well head and secured with rope. Alternatively, discharge to overpack drum and use sump pump **6. Airlift monitoring well development** ❑ start compressor and open air valve to begin air injection (may need to partially open valve to achieve steady-state flow; if so note how much): **AIR ON_____** time of day ❑ measure water discharge rate vs. time until steady state has been achieved. If steady state not possible record the length of air cycle, number of cycles, and volume purged per cycle.
2. Prepare sampling materials	Assemble all the materials required for the sample to be taken. Refer to Appendix A for the number/size of bottles, types and amount of preservatives, field test kits, and filters required for the sample.	

3. Install bladder pump in well and calculate pumping pressure	Before installing, measure the depth to water (see Injection And Pump Tests – WRE HYD 04). When installing pump, make sure that the safety line is securely attached to the bladder pump (add field picture) and set it at least 3 m below water level. Connect the supply line from the N_2 cylinder with a regulator to the control unit. Get someone experienced with compressed gas cylinders to show you how if you are not familiar with using them. The drive line connects from the control unit to the reel (make sure it is the line with the quick exhaust fitting). Attach a 1 m length of 1/4" OD sample line to the sample connector on the reel. Determine the pressure required to sample. 1 psi of pressure can raise a 0.7 m column of water in the line. Add 10 psi for line loss. Pressure must not exceed 250 psi. See below for formula and an example for a pump installed at 30 m below ground surface. $$psi = \frac{Depth(m)}{0.7(psi/m)} + 10$$ $$\mathbf{53psi} = \frac{30\ m}{0.7(psi/m)} + 10$$	
4. Turn on bladder pump and determine drive time	Turn the control unit regulator to the calculated pressure from Step 3. To help protect the control unit from damage due to moisture, always position it physically higher than the sample discharge and wellhead. Before use, refer to the Solinst Model 407 Bladder Pump and control unit manual for detailed instructions, troubleshooting, and operating principles.	

	To initially set the pump drive and vent time, submerge the sample discharge line into a clear container of water, push the manual control valve on the pump controller, and count the number of seconds until you stop seeing air bubbles in the container of water. When the air bubbles stop, the bladder is fully compressed and that is the end of the drive time. When the intake of the pump is shallower than 30 m, set the vent time to twice as long as the drive time. For example, if it took 8 seconds of drive time to compress the bladder, allow 16 seconds for the vent time to refill the bladder. When the pump intake is deeper than 30 m, the vent time will be closer to 3 to 4 times the drive time. Adjust the vent time as needed to achieve the best flow rate.	
5. Purge sample line and record field parameters	Using the pressure and drive/vent times determined in Steps 3 and 4, begin pumping. The sample line will need to be purged at least one line volume (32 mL per metre of sample line) to remove any water that was already in the line. Once the line is purged, begin regularly recording water quality measurements with the YSI meter (refer to the operating instructions in the meter case and ensure it has been calibrated prior to sampling). These readings should be taken in a manner that minimizes interaction between the sample and the atmosphere. Record pH, conductivity, dissolved O_2, and temperature measurements in FRM_ GroundwaterPurgeAndSample. In addition to the purge and sample form, documentation of observations	

	and data acquired in the field will provide information on the acquisition of samples. Information recorded in field notes must include: o Weather conditions o Drill hole number/ID o Initial water level depth o Volume of water purged before sampling o Calibration information for field instruments o Field parameters recorded o Number of water samples taken o Water sample identification numbers o Date and time of sample collection o Water color and odour if notable o Any deviations from the procedures o Note any possible contaminants introduced during sampling Ensure that you have enough nitrogen available to complete the purging and sampling. Generally, you should allow for 10 L of nitrogen to push 1 L of water. Once the field water quality parameters have stabilized, a sample may be collected.	
6. Collect samples and measure using field kits	A total required sampling volume of approximately 6.0 L is required. Before opening and filling sample containers, check the sampling area for potential sources contamination. Make sure the surface area is clean and that contaminated equipment is kept clear from the sampling location. Protect the samples from airborne contaminants such as engine exhaust, wind borne dust and organic fumes (e.g. gas cans); sample upwind of these contaminants or remove them before sampling. Nitrile gloves should	Add Photos

	be worn at all times while filling sample bottles. For samples listed in Appendix A that do not require filtering or preservation, fill sample bottle as full as possible to limit headspace. Take care not to touch the inside of the lid or sample bottle and to limit dust or other particulate entry into the bottle. Tightly seal the bottle. For samples listed in Appendix A that require filtering and/or preservation, use a new syringe and slowly and gently force sample water through a new 0.45 µm filter into the sample bottle. When sample bottle is ¾ full, add any needed preservatives, then continue to fill the sample bottle with filtered water until no or minimal headspace remains. Take care not to touch the inside of the lid or sample bottle, and to limit dust or other particulate entry into the bottle. Tightly seal the bottle. Quality control samples are also required and should include the collection of field duplicate, field blank, and equipment rinse blank (see Step 7). Field Duplicate Samples: One out of every 20, or a minimum of 1 per month, groundwater sample sets should be duplicated. For these, an extra sample is collected for all parameters except tritium. Field Blank Samples: For every 20, or a minimum of 1 per month, groundwater samples, a blank sample should be taken. The field blank will use DI water instead of sample water and will done for all parameters	

	except tritium, following normal procedures for each (e.g., for dissolved metals, the sample will be filtered and preserved as is done with a normal sample). The DOC field blank will be RO or de-ionized water. Label all sample bottles in accordance with Appendix A. Check sample bottles to ensure labels are correctly, and fully filled in with all required details. Ensure the well ID is on the label. Date and time, as well as sampler initials, are required. Time recorded should be when the sample is transferred to sample bottle(s). Along with the sample taken for lab analysis, field tests will be done with a HACH kit to measure ferrous iron and H_2S gas (only for ore zone samples).	
7. Decontaminate sample equipment	Between wells, sampling equipment should be thoroughly decontaminated to ensure that cross contamination does not affect results. Triple rinse field monitoring equipment using clean distilled (DI) water. The bladder pump's interior can be cleaned by disassembling (refer to manual) and washing with phosphate free soap, then rinsing with deionized water. One set of equipment rinse blanks should be collected from the decontaminated equipment during the season to ensure proper decontamination is taking place. Sampling procedure should match the field blank sample collection from Step 6. Equipment rinse blank should be labelled based on last well sampled.	

8. Ship samples	Shipping of samples will need to be coordinated to minimize hold time exceedances for time sensitive samples (Appendix A). Due to the remote location, it is not possible to have samples analyzed within 48 hours for nitrite (Bottle #7), so priority will be given to reduce hold time for overburden well samples which are most likely to have detectable levels. Sample sets will be shipped to SRC as soon as possible after sample collection (maximum 4 days). Many of the requested analytes listed (Appendix B) need to be specifically requested on the COC and/or in communications with SRC. Bismuth and lithium are not included in the standard SRC metals package and need to be specifically requested on the COC.	Saskatchewan Research Council 125 - 15 Innovation Boulevard Saskatoon, SK S7N 2X8 Phone: 306-933-5400

Appendix A Volumes, Preservatives and Filtering Requirements for Analytes

Bottle #	Parameter	Preferred Volume	Minimum Volume	Preserved	Filtered 0.45 um	Hold Time
1	General Chemical: Chloride, Fluoride, Specific Conductivity, Ca, Mg, Na, K, P, SO4 General Chemical Alkalinity, bicarbonate, carbonate, hydroxide, pH, TDS TSS	1.0 L plastic Fill bottle with sample. Keep cool.	250 mL	no	no	14days 4 days for pH (not critical) 7 days for TDS
2	Ammonia, Nitrate + Nitrite, N	250 ml plastic Fill bottle with sample. Keep cool.	50 mL	2 mL 20% sulfuric acid	no	28 days
3	Nitrite	100 mL plastic No preservative. No headspace. Keep cool.	5 mL	no	no	48 hours (only critical for overburden samples)
4	Dissolved Metals (including Bi and Li)	100 mL plastic Pour vial of acid into bottle and fill with sample.	10 mL	**1.5 mL** 17.5% HNO_3	**0.45 micron**	28 days
5	Dissolved Metals (including Bi and Li)	10 mL plastic Pour vial of acid into bottle and fill with sample.	10 mL	**0.2 mL** 17.5% HNO_3	**0.01 micron**	28 days (only on select samples; 1 per OB OL-A OL-B)
6	Bromine	100 mL plastic. Fill bottle with sample	10 mL	no	no	28 days
7	Radionuclides (including Pb-210, Po-210, Ra-226, Th-230)	4.0 L plastic Fill bottle with sample	4.0 L	**40 mL** 17.5% HNO3	no	28 days
8	Radon-222	2 x 40 mL glass vials Date and time sampled is required.	10 mL	no	no	8 days
9	Tritium (3H)	100 mL plastic Fill bottle with sample	25 mL	no	no	28 days
10	Dissolved organic carbon	100 mL plastic. Leave unpreserved and mark bottle for lab to filter	50 mL	no	no	28 days

Appendix B Field Measurements

Parameter	Method	Comments
Temperature	YSI ProDSS Meter	Measured while purging until stable
Dissolved Oxygen	YSI ProDSS Meter	Measured while purging until stable
Conductivity	YSI ProDSS Meter	Measured while purging until stable
pH	YSI ProDSS Meter	Measured while purging until stable
Iron Speciation	HACH field kit	Measured while purging until stable
H2S	HACH field kit	Measure while purging until stable; Ore zone only

Appendix C Detailed Analyte List

Analyte	Units	Detection Limit	Method
Bicarbonate	mg/L	0.01	Alkalinity
Calcium	mg/L	0.1	ICP
Carbonate	mg/L	0.01	Alkalinity
Chloride	mg/L	0.1	Colorimetric
Fluoride	mg/L	0.01	Ion Selective Electrode
Hydroxide	mg/L	0.01	Alkalinity
Magnesium	mg/L	0.1	ICP
pH	pH Units	N/A	Ion Selective Electrode
Potassium	mg/L	0.1	ICP
Sodium	mg/L	0.1	ICP
Specific Conductivity	µS/cm	1	Conductivity cell
Sulphate	mg/L	0.2	ICP
Sums of Ions	mg/L	N/A	Calculation
Total Alkalinity	mg/L	1	Titration
Total Hardness	mg/L	1	Calculation
Total Dissolved Solids	mg/L	1	Gravimetric
Total Suspended Solids	mg/L	1	Gravimetric
Nitrate+Nitrite - N	mg/L	0.04	Colorimetric
Phosphorous	**TBD**	**TBD**	**TBD**
Ammonia - N	mg/L	0.01	Colorimetric
Aluminum	mg/L	0.0005	ICP-MS
Antimony	mg/L	0.0002	ICP-MS
Arsenic	mg/L	0.0001	ICP-MS
Barium	mg/L	0.0005	ICP-MS
Beryllium	mg/L	0.0001	ICP-MS
Bismuth	µg/L	0.2	ICP-MS
Boron	mg/L	0.01	ICP-MS
Cadmium	mg/L	0.00001	ICP-MS
Chromium	mg/L	0.0005	ICP-MS
Cobalt	mg/L	0.0001	ICP-MS
Copper	mg/L	0.0002	ICP-MS
Iron	mg/L	0.0005	ICP-MS
Lead	mg/L	0.0001	ICP-MS
Lithium	µg/L	0.1	ICP-MS
Manganese	mg/L	0.0005	ICP-MS

Molybdenum	mg/L	0.0001	ICP-MS
Nickel	mg/L	0.0001	ICP-MS
Selenium	mg/L	0.0001	ICP-MS
Silver	mg/L	0.00005	ICP-MS
Strontium	mg/L	0.0005	ICP-MS
Thallium	mg/L	0.0002	ICP-MS
Tin	mg/L	0.0001	ICP-MS
Titanium	mg/L	0.0002	ICP-MS
Uranium	mg/L	0.0001	ICP-MS
Vanadium	mg/L	0.0001	ICP-MS
Zinc	mg/L	0.0005	ICP-MS
Lead-210	Bq/L	Variable	Extraction/beta counting
Polonium-210	Bq/L	Variable	Alpha spectrometry
Radium-226	Bq/L	Variable	Alpha spectrometry
Thorium-230	Bq/L	Variable	Alpha spectrometry
Tritium (3H)	TU	0.7	Liquid scintillation counting
Bromine	mg/L		
Organic carbon, Dissolved	mg/L		
Radon-222	Bq/L		
Silica, soluble	Mg/L		
Sulfur	mg/L		
Uranium-234	Bq/L		
Uranium-238	Bq/L		

Appendix G Groundwater Sampling Field Sheets

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-003
Dip: -90 Sampler: YX / JC / BB
Project: WR-EVAL
Date: 16-Aug-20
Temperature/Weather: 18 *C

Depth of well (ft): 198
Screen interval (ft):
Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump
Purging equip. (circle): Redi-flow Bailer [Air Lift] Grundfos 5SQE5-450

A) Bottom of well depth (ft): 198
B) Depth to water level (ft): 68.24
C) Water column (A-B)(ft): 129.76

D) Well diameter (ID) (ft): 0.16666667
E) Casing Volume (gal): 21.16457774
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
11:00	5.5		6.9	9.7	41.3	57.2	37	9.85	0.00	0.0	Relatively Clear
11:10	11	0.5	7.27	8.5	27	39.4	26	11.37	0.25	0.0	Muddy, Rusty brown sediment
11:20	16.5		7.34	8.6	25.5	36.9	24	11.19	0.00	0.0	Trace of Rusty brown sediment
11:30	22	1.0	7.36	7.7	22.6	33.6	22	11.43	0.00	0.0	Trace of Rusty brown sediment
11:40	27.5		7.19	7.8	21.5	32	21	11.57	0.00	0.0	Clear, Rusty brown tinge
11:50	33	1.5	7.14	7.3	20.6	31.1	20	11.87	0.00	0.0	Clear, Rusty brown tinge

Sample Collection Time: 10:00 **Ship Date:** 17-Aug-20

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	General Chemical	250	N/A	No	
2	Ammonia Nitrite	50	2 mL 20% Sulfuric Acid	No	
3	Nitrite	5	N/A	No	
4	Dissolved Metals	10	1.5 mL 17.5% HNO3	0.45 Micron	
6	Bromine	10	N/A	No	
7	Radionuclides	4000	40 mL 17.5% HN03	No	
8	Radon-222	10	N/A	No	
9	Tritium	25	N/A	No	
10	Dissolved Organic Carbon	50	N/A	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0
H_2S (mg/L) : 0.0
Diss. O_2 (mg/L) : 9.05
TDS (mg/L) : 23

SPC (µS/cm) : 35.3
C (µS/cm) : 28.2
pH : 6.35
Temp. (˚C) : 14.6

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-005

Dip: -90 Sampler: ME/BB Depth of well (ft): 403.5

Project: Wheeler Screen interval (ft): 384.0 - 403.0

Date: 2020-08-29 Depth of Static Water Level (corrected for angle)(ft): N/A

Temperature/Weather: Mix of sun and cloud, 10˚C

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer [Air Lift] Grundfos 5SQE5-450

A) Bottom of well depth (ft): 403.5 D) Well diameter (ID) (ft): 0.125

B) Depth to water level (ft): 2.42 E) Casing Volume (gal): 36.8

C) Water column (A-B)(ft): 401.08 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
2:02	5		6.82	8.6	91.4	132.9	86	10.27			Light grey, cloudy; min seds
2:14	10		7.19	7.9	81.6	121	79	11.23			Light grey, cloudy; min seds
2:30	15	0.5	7.13	8.0	74.8	110.7	72	11.42	1.50		Milky grey
2:39	20		7.03	7.7	68.7	102.5	67	11.34			Milky grey
2:53	25		6.94	8.6	67.9	98.7	64	11.18			Light grey
3:00	30	1.0	6.96	8.1	68.1	100.5	65	11.27	1.50		Light grey
3:10	35		6.94	8.2	65.2	95.8	62	11.28			Light grey, clear
3:19	40		6.89	7.9	64.0	95	62	11.38			Light grey, clear
3:27	45	1.5	6.89	7.9	63.9	94.3	61	11.36	2.00		Light grey, clear

Sample Collection Time: 2020-08-29 **Ship Date:** 2020-08-31

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-005-01	1000	No	No	
2	GWR-005-02	250	2 mL Sulfuric Acid	No	
3	GWR-005-03	100	No	No	
4	GWR-005-04	100	1.5 mL HNO_3	0.45 micron	
6	GWR-005-06	100	No	No	
7	GWR-005-07	4000	40 mL HNO_3	No	
8	GWR-005-08	80	No	No	
9	GWR-005-09	100	No	No	
10	GWR-005-10	100	No	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 2.0 SPC (µS/cm) : 93.4

H_2S (mg/L) : N/A C (µS/cm) : 68.2

Diss. O_2 (mg/L) : 2.33 pH : 7.49

TDS (mg/L) : 61 Temp. (˚C) : 10.4

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID GWR-006

Dip: -90 Sampler JC / BB

Project: WR-EVAL

Date: 22-Aug-20

Temperature/Weath 10 C

Depth of well (ft): 29.5

Screen interval (ft): 10.0-29.0

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Redi-flow

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 29.5

B) Depth to water level (ft): 7.19

C) Water column (A-B)(ft): 22.31

D) Well diameter (ID) (ft): 0.16666667

E) Casing Volume (gal): 3.63888509

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
14:30	5	1.0	6.4	7.6	108.7	162.9	106	2.62			viscous light greywater, susp
14:40	15	3.0	6.98	4.9	56.4	91.4	59	3.08	0.50		viscous light greywater, susp
14:50	25	6.0	6.65	4.9	49.6	80.5	52	4.52	1.00		light grey water, suspended s
14:55	35	8.0	6.71	4.7	49.3	80.6	52	3.13			cloudy water
15:)5	45	11.0	6.73	5.2	50.2	80.6	52	3.6	1.00		cloudy water

Sample Collection Time: 15:30 **Ship Date:** 24-Aug-20

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-006-01	250	N/A	no	
2	GWR-006-02	50	2 mL 20% Sulfuric Acid	no	
3	GWR-006-03	5	N/A	no	
4	GWR-006-04	10	1.5 mL 17.5% HNO3	0.45 micron	
6	GWR-006-06	10	N/A	no	
7	GWR-006-07	4	40 mL 17.5% HN03	no	
8	GWR-006-08	10	N/A	no	
9	GWR-006-09	25	N/A	no	
10	GWR-006-010	50	N/A	no	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.0

H_2S (mg/L) : 0.0

Diss. O_2 (mg/L) : 3.76

TDS (mg/L) : 52

SPC (µS/cm) : 80.4

C (µS/cm) : 53.1

pH : 6.75

Temp. (˚C) : 6.7

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-008
Dip: -80 Sampler: ME/DG
Project: Wheeler
Date: 2020-09-06
Temperature/Weather: Cloudy, 8˚C

Depth of well (ft): 1246.7
Screen interval (ft): 1227.2 - 1246.6
Depth of Static Water Level (corrected for angle)(ft): 115.12

Sampling equip.: Bladder Pump
Purging equip. (circle): Redi-flow Bailer [Air Lift] Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1246.7
B) Depth to water level (ft): 116.9
C) Water column (A-B)(ft): 1129.8

D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): 103.7
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:24	10		6.62	5.7	79.3	125.4	81	12.02			Dark grey, cloudy
10:34	20		6.72	4.8	76.8	124.9	81	12.14			Slightly lighter dark grey
10:47	40		6.74	4.7	79.0	128.9	84	12.17			Grey, cloudy
10:55	50	0.5	6.73	4.8	76.7	124.9	81	12.08	2.00		Grey, cloudy
11:00	60		6.74	4.7	76.6	124.6	81	12.16			Light grey clear
11:17	80		6.81	5.2	76.5	122.8	80	11.93			Light grey clear
11:35	100	1.0	6.84	5.3	70.7	113.3	74	12.07	2.50		Light grey clear
11:43	110		6.85	5.1	69.2	111.5	72	12.11			Light grey clear
11:52	120		6.86	4.9	66.8	108.3	70	12.17			Light grey clear

Sample Collection Time: **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-008-01	1000	No	No	
2	GWR-008-02	250	2 mL Sulfuric Acid	No	
3	GWR-008-03	100	No	No	
4	GWR-008-04	100	1.5 mL HNO_3	0.45 micron	
6	GWR-008-06	100	No	No	
7	GWR-008-07	4000	40 mL HNO_3	No	
8	GWR-008-08	80	No	No	
9	GWR-008-09	100	No	No	
10	GWR-008-10	100	No	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 2.5
H_2S (mg/L) : N/A
Diss. O_2 (mg/L) : 7.53
TDS (mg/L) : 66

SPC (µS/cm) : 102
C (µS/cm) : 71.9
pH : 6.92
Temp. (˚C) : 9.1

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID:GWR-009

Dip: 65 Sampler ME / BB

Project: WR-EVAL

Date:

Temperature/Weathe 6C, Clo

Depth of well (ft): 918.6

Screen interval (ft): 899.1-918.5

Depth of Static Water Level (corrected for angle)(ft): 114.01

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 918.6

B) Depth to water level (ft): 125.8

C) Water column (A-B)(ft): 792.8

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 72.77

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
14:33	19		12.33	7.4	2641	3980	2587	11.06			Milky grey water, floating ch
15:45	20		12.2	8.2	2259	3319	2157	11.7			Milky grey water
16:05	35	0.5	12.44	5.5	2314	3687	2397	11.69	0.00		Milky grey water
16:30	50		12.33	10	2572	3602	2341	10.76			Milky grey, polymer
11:18	90		12.12	8.5	1593	2312	1501	10.88			Cloudy white water
11:42	100		12.11	7.8	1191	1772	1152	11.06			Cloudy white water
13:06	145	2.0	11.88	8.7	1003	1455	945	11.07	0.00		Cloudy white water, white fla
13:40	160		11.91	8.3	881	1293	840	11.07			Milky white water
14:06	170		11.72	8	601	890	579	11.06			Milky white water
14:20	175	2.5	11.63	7.8	547	813	529	11.11	0.00		Milky white water
14:59	190		11.43	8	464	682	443	11.07			Light grey cloudy water
15:25	200		11.16	7.8	368	548	356	11.18			Light grey cloudy water
15:53	210	3.0	10.74	7.7	310	463	301	11.13	0.00		Cloudy white water
16:20	220		10.55	7.3	292	441	287	11.34			Cloudy white water
16:34	225		10.48	7.1	284	430	279	11.4			Cloudy white water
16:48	230	3.5	10.36	6.9	276	421	274	11.4			Cloudy white water
15:05	235		11.54	9.7	625	884	574	6.51			Cloudy, foamy, viscous brow
15:40	255	4.0	11.89	7.1	748	1137	739	9.86	0.00		Cloudy, foamy, viscous brow
4:00	275		11.46	6.2	604	943	613	11.46			Cloudy, foamy, viscous brow
10:00	285	4.5	11.76	6	632	985	638	10.78	0.00		Cloudy white water, foamy
10:30	305		11.89	6.3	701	1088	708	11.58			Cloudy white water, foamy
11:00	325	5.0	12.08	6.3	919	1427	927	11.6	0.00		Cloudy white water, foamy
11:30	345		12.06	6.2	880	1373	892	11.59			Cloudy white water, foamy
12:00	365	5.5	12	6.3	848	1222	853	11.46	0.00		Cloudy white water, foamy
13:30	425	6.0	11.51	7.7	386	577	375	11.36	0.00		Cloudy white water
14:00	445		11.43	6.5	320	493	321	11.54			Cloudy white water
14:30	465	6.5	11.28	6.1	271	425	277	11.78	0.00		Cloudy white water
15:00	485		11.21	6	248	390	253	11.81			Cloudy white water
15:30	505	7.0	11.13	6.1	235	367	239	11.77	0.00		Cloudy white water
16:00	525		11.04	6.4	229	354	230	11.68			Cloudy white water
9:00	1205	16.0	9.97	4.8	139	226	147	11.97	0.00		Clear, yellow tinge
9:30	1230		9.86	4.3	139	228	149	12.01			Clear, yellow tinge

Sample Collection Time: 14/9/2020 3:30:00 PM **Ship Date:** 15-Sep-20

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-009-01	1000	N/A	N/A	
2	GWR-009-02	250	2 mL 20% Sulfuric Acid	N/A	
3	GWR-009-03	100	N/A	N/A	
4	GWR-009-04	100	1.5 mL 17.5% HNO3	0.45 micron	
6	GWR-009-06	100	N/A	N/A	
7	GWR-009-07	4000	40 mL 17.5% HN03	N/A	
8	GWR-009-08	80	N/A	N/A	
9	GWR-009-09	100	N/A	N/A	
10	GWR-009-10	100	N/A	N/A	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0

H_2S (mg/L) :

Diss. O_2 (mg/L) : 3.00

TDS (mg/L) : 157

SPC (µS/cm) : 241

C (µS/cm) : 153

pH : 10.87

Temp. (˚C) : 5.9

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-011
Dip: -90 Sampler: YX / MT / ME / JC Depth of well (ft): ~1213
Project: Wheeler Screen interval (ft): ~1194 - 1213
Date: 2020-08-08 Depth of Static Water Level (corrected for angle)(ft): N/A
Temperature/Weather: Sunny, 27˚C

Sampling equip.: Bladder Pump
Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): ~1213
B) Depth to water level (ft): ~130
C) Water column (A-B)(ft): ~1083
D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): ~99.41
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
1:53	20		7.9	7.8	24	33.9	22	-		-	Clear, with air bubbles
2:06	35		7.54	8.2	23	32.3	22	-		-	Clear, with air bubbles
2:21	50	0.5	7.32	8.2	23	32.7	21	-	0.00	-	Clear, with air bubbles
2:40	70		7.39	8.2	23	33.1	22	-		-	Clear, with air bubbles
2:52	85		7.35	8.3	23	33.6	22	-		-	Clear, with air bubbles
3:06	100	1.0	7.48	7.8	51	76	49	-	0.00	-	Milky grey, bubbles, seds.
3:24	120		8.93	8.4	83	118.7	78	-		-	Muddy grey, lots of seds
3:36	135		8.4	7.9	84	124	81	-		-	Muddy grey, lots of seds
3:49	150	1.5	8.21	7.9	83	122.7	80	-	0.25	-	Light grey, lots of seds
4:06	170		8.2	8.6	86	125.8	82	-		-	Light grey, relatively clean
4:18	185		8.02	8	83	121.3	79	-		-	Light grey, relatively clean
4:30	200	2.0	7.97	7.8	81	120.7	78	-	0.00	-	Light grey, relatively clean

Sample Collection Time: Daytime : 2020-08-08 **Ship Date:** 2020-08-10

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-011-01	800	No	No	
2	GWR-011-02	250	2 mL Sulfuric Acid	No	
3	GWR-011-03	100	No	No	
4	GWR-011-04	100	1.5 mL HNO_3	0.45 micron	
6	GWR-011-06	100	No	No	
7	GWR-011-07	4000	40 mL HNO_3	No	
8	GWR-011-08	80	No	No	
9	GWR-011-09	100	No	No	
10	GWR-011-10	100	No	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0
H_2S (mg/L) : N/A
Diss. O_2 (mg/L) : 4.64
TDS (mg/L) : 74
SPC (µS/cm) : 114
C (µS/cm) : 98.5
pH : 8.70
Temp. (˚C) : 17.5

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID GWR-012
Dip: -78 Sampler ME/BB
Project: WR-EVAL
Date: 29-Aug-20
Temperature/Weath Cloudy,

Depth of well (ft): 1138.5
Screen interval (ft): 1119-1138.4
Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump
Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1138.5
B) Depth to water level (ft): 3.31
C) Water column (A-B)(ft): 1135.19

D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): 104.2
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
2:25	5		8.13	11.8	343	462	300	8.76			Dark grey cloudy water, lots
2:32	20		7.69	7.4	335	482	313	11.08			Cloudy, dark grey water
2:42	40		7.49	7.9	340	484	314	10.99			Cloudy, dark grey water
2:47	50	0.5	7.42	7.6	322	479	311	11.44	1.00		Cloudy, dark grey water
2:53	60		7.39	7.9	325	481	313	11.3			Cloudy, dark grey water
3:02	80		7.44	7.9	327	479	311	11.38			Cloudy, dark grey water
3:15	100	1.0	10.85	8.4	393	573	372	10.9	0.00		Light grey, milky water
3:25	120		9.06	7.6	373	552	359	11.26			Light grey, clear water
3:35	140		7.91	7	342	512	333	11.19			Light grey, milky water
3:42	150	1.5	7.35	7	337	499	325	11.17	1.50		Light grey, clear water
3:46	160		7.22	7.4	324	489	318	11.21			Light grey, clear water
3:51	180		7.13	7	319	484	315	11.33			Light grey, clear water

Sample Collection Time: 2020-08-29 **Ship Date:** 2020-08-31

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-005-01	1000	N/A	N/A	
2	GWR-005-02	250	2 mL 20% Sulfuric Acid	N/A	
3	GWR-005-03	100	N/A	N/A	
4	GWR-005-04	100	1.5 mL 17.5% HNO3	0.45 micron	
6	GWR-005-06	100	N/A	N/A	
7	GWR-005-07	4000	40 mL 17.5% HN03	N/A	
8	GWR-005-08	80	N/A	N/A	
9	GWR-005-09	100	N/A	N/A	
10	GWR-005-010	100	N/A	N/A	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 2.0
H_2S (mg/L) :
Diss. O_2 (mg/L) : 1.63
TDS (mg/L) : 306

SPC (µS/cm) : 470.5
C (µS/cm) : 351.8
pH : 6.94
Temp. (˚C) : 11.5

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-013
Dip: -90 Sampler: MT / YX / ME / JC Depth of well (ft): ~907
Project: Wheeler Screen interval (ft): ~887-907
Date: 2020-08-09 Depth of Static Water Level (corrected for angle)(ft): N/A
Temperature/Weather: Rainy, 10˚C

Sampling equip.: Bladder Pump
Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 907
B) Depth to water level (ft): 130
C) Water column (A-B)(ft): 777
D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): ~71
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
9:26	27		7.65	8.9	33	47.2	30	-		-	Clear with air bubbles
9:41	35	0.5	7.58	7.7	24	35.4	23	-	0.00	-	Clear with air bubbles
9:51	45		7.52	9.5	29	41.8	27	-		-	Clear with air bubbles
10:05	60		9.19	7.8	80	119.2	78	-		-	Grey-green, susp. solids
10:13	70	1.0	9.54	7.4	132	192.8	125	-	1.75	-	Darker greyish-green
10:28	80		9.58	8.3	184	267.5	173	-		-	Darker greyish-green
10:38	90		9.53	7.9	181	266.8	173	-		-	Darker greyish-green
10:52	105	1.5	9.26	7.9	175	258.5	168	-	1.25	-	Lighter greyish-green
11:06	120		9.19	7.8	176	258.5	168	-		-	Lighter greyish-green
11:15	130		9.18	7.7	174	260	169	-		-	Lighter greyish-green
11:24	140	2.0	9.18	7.5	174	261.1	170	-	0.75	-	Lighter greyish-green

Sample Collection Time: Daytime : 2020-08-09 **Ship Date:** 2020-08-10

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-013-01	1000	No	No	
2	GWR-013-02	250	2 mL Sulfuric Acid	No	
3	GWR-013-03	100	No	No	
4	GWR-013-04	100	1.5 mL HNO_3	0.45 micron	
6	GWR-013-06	100	No	No	
7	GWR-013-07	4000	40 mL HNO_3	No	
8	GWR-013-08	80	No	No	
9	GWR-013-09	100	No	No	
10	GWR-013-10	100	No	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0
H_2S (mg/L) : N/A
Diss. O_2 (mg/L) : 3.60
TDS (mg/L) : 155
SPC (µS/cm) : 238.4
C (µS/cm) : 174.8
pH : 9.68
Temp. (˚C) : 10.5

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-014
Dip: Sampler: ME / BB
Project: WR-EVAL
Date: 29-Aug-20
Temperature/Weathe Cloudy, 10C

Depth of well (ft): 518.4
Screen interval (ft): 498.89-518.3
Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump
Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 518.4
B) Depth to water level (ft): 3.62
C) Water column (A-B)(ft): 514.78

D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): 47.22945631
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
4:34	5		9.73	7.7	104.8	156.5	102	10.09			Brown water, moderate sedir
4:41	10		9.98	6.2	106.3	165.4	107	11.67			Milky yellow, foamy water
4:49	15		10.03	5.9	107.8	169.3	110	11.9			Milky yellow, foamywater
4:55	20		10.03	5.7	107.7	169.8	110	11.84			Milky yellow, foamy water
5:02	25	0.5	10.15	5.8	114.8	178.8	116	11.96	0.00		Light hazy yellow water
5:11	30		11.27	5.8	321.5	506	329	12.07			Milky yellow water
8:42	35		12.01	6.6	1164	1794	1166	11.54			Light hazy yellow water
8:47	40		11.8	6.4	1064	1653	1075	11.63			Light hazy yellow water
8:52	45		11.87	6.1	1214	1894	1231	11.77			Light hazy yellow water
8:57	50	1.0	12.01	6.4	1275	1979	1286	11.74	0.50		Light hazy yellow water
9:02	55		12.08	6.2	1314	2047	1330	11.76			Light hazy yellow water
9:06	60		12.12	6.2	863	1347	876	11.75			Light hazy yellow water
9:10	65		12.12	6.3	1221	1902	1236	11.73			Light hazy yellow water
9:14	70		12.11	6.5	1124	1749	1137	11.72			Light hazy yellow water
9:19	75	1.5	12.06	6.8	961	1476	959	11.7	0.00		Light hazy yellow water
9:24	80		12.02	6.3	769	1195	777	11.73			Light hazy yellow water
9:29	85		11.93	6.6	673	1041	677	11.69			Light yellow water, clear
9:35	90		11.87	7.1	603	917	596	11.62			Light yellow water, clear
9:39	95		11.84	6.9	552	844	549	11.63			Light yellow water, clear
9:44	100	2.0	11.77	6.8	510	781	507	11.6	0.00		Light yellow water, clear
9:50	105		11.72	6.8	458	703	457	11.69			Light yellow water, clear
9:55	110		11.63	6.8	415	635	412	11.67			Light yellow water, clear
10:00	115		11.58	7	385	588	382	11.63			Light yellow water, clear
10:05	120		11.52	7.1	351	533	347	11.6			Light yellow water, clear
10:13	125	2.5	11.45	7.1	324	493	323	11.73	0.00		Light yellow water, clear

Sample Collection Time: 2020-08-29 **Ship Date:** 2020-08-31

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-005-01	1000	N/A	n/a	
2	GWR-005-02	250	2 mL 20% Sulfuric Acid	n/a	
3	GWR-005-03	100	N/A	n/a	
4	GWR-005-04	100	1.5 mL 17.5% HNO3	0.45 micron	
6	GWR-005-06	100	N/A	n/a	
7	GWR-005-07	4000	40 mL 17.5% HN03	n/a	
8	GWR-005-08	80	N/A	n/a	
9	GWR-005-09	100	N/A	n/a	
10	GWR-005-010	100	N/A	n/a	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0
H_2S (mg/L) :
Diss. O_2 (mg/L) : 1.07
TDS (mg/L) : 259

SPC (µS/cm) : 397.2
C (µS/cm) : 275.6
pH : 11.38
Temp. (˚C) : 8.4

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC I GWR-025

Dip: -90 Sampler: MT / JC /BB Depth of well (ft): 1246.7

Project: WR-EVAL Screen interval (ft): 1227.2-1246

Date: 22-Aug-20 Depth of Static Water Level (corrected for angle)(ft): N/A

Temperature/Weather: 10 C

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft 1246.7

B) Depth to water level (ft) 68.59

C) Water column (A-B)(ft) 1178.11

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 108.8

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10;40	5		6.46	8	331.5	491	319	6.97			black water
11:02	20		7.04	6.5	304.4	469.6	305	11.66			grey water
11:10	40		7.1	6.5	297.5	456	297	11.56			light grey water
11:22	60	0.5	7.02	6.7	325.6	501	326	11.52	1.50		black water
11:30	80		7.08	6.9	376.6	574	373	11.54			light grey water
11:40	100	1.0	7.08	6.6	381.3	585	381	11.33	1.50		relatively clear, brown tinge
2:30	120		6.96	8.4	695	1018	662	11.41			clear, light grey tinge
2:40	140		7.03	6.9	605	926	602	11.67			clear, clean water
2:49	160	1.5	7	7.8	601	894	581	11.43	1.50		clear, clean water
2:59	180		7	6.8	584	895	581	11.7			clear, clean water
3:09	200	2.0	7	7.7	626	930	604	11.53	2.00		clear, clean water

Sample Collection Time: 10:15 **Ship Date:** 24-Aug-20

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-025-01	250	N/A		
2	GWR-025-02	50	2 mL 20% Sulfuric Acid		
3	GWR-025-03	5	N/A		
4	GWR-025-04	10	1.5 mL 17.5% HNO3	0.45 micron	
6	GWR-025-06	10	N/A		
7	GWR-025-07	4000	40 mL 17.5% HN03		
8	GWR-025-08	10	N/A		
9	GWR-025-09	25	N/A		
10	GWR-025-10	50	N/A		

Final Sample Field Parameters

Ferrous Fe (mg/L) : 2.0

H_2S (mg/L) : 0.0

Diss. O_2 (mg/L) : 3.15

TDS (mg/L) : 615

SPC (µS/cm) : 946

C (µS/cm) : 668

pH : 6.49

Temp. (˚C) : 9.6

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID GWR-029

Dip: -90 Sampler ME / BB

Project: WR-EVAL

Date: 30-Aug-20

Temperature/Weath Mix of s

Depth of well (ft): 1148.3

Screen interval (ft): 1128.8-1148.2

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1148.3

B) Depth to water level (ft): 13.59

C) Water column (A-B)(ft): 1134.71

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 104.15

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:11	5		6.74	9.2	75	108	70	9.26			Dark grey water, Moderate s
10:29	20		6.81	7	64	98	64	11.5			Dark grey water, Moderate s
10:47	40		6.88	8.1	65	85	62	11.39			Dark grey water, clear
10:57	50	0.5	6.86	7.9	66	97	63	11.33	2.00		Dark grey water, clear
11:12	60		6.86	8	68	96	63	10.99			Dark grey water, clear
11:30	80		6.85	8.7	60	88	58	11.32			Clear light grey water
11:49	100	1.0	6.8	7.7	61	89	58	11.41	1.50		Clear water

Sample Collection Time: 2020-08-30 9:00 **Ship Date:** 31-Aug-20

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-029-01	1000	N/A	n/a	
2	GWR-029-02	250	2 mL 20% Sulfuric Acid	n/a	
3	GWR-029-03	100	N/A	n/a	
4	GWR-029-04	100	1.5 mL 17.5% HNO3	0.45 micron	
6	GWR-029-06	100	N/A	n/a	
7	GWR-029-07	4000	40 mL 17.5% HN03	n/a	
8	GWR-029-08	80	N/A	n/a	
9	GWR-029-09	100	N/A	n/a	
10	GWR-029-010	100	N/A	n/a	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 2.0

H_2S (mg/L) :

Diss. O_2 (mg/L) : 2.48

TDS (mg/L) : 57

SPC (µS/cm) : 87.6

C (µS/cm) : 56.7

pH : 6.46

Temp. (˚C) : 6.5

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-031

Dip: -90 Sampler: ME / MT / JC Depth of well (ft): 1361

Project: Wheeler Screen interval (ft): ~20

Date: 2020-08-09 Depth of Static Water Level (corrected for angle)(ft): ~130

Temperature/Weather: Rainy, 10˚C

Sampling equip.: Grundfos 5SQE5-450

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1361 D) Well diameter (ID) (ft): 0.417

B) Depth to water level (ft): ~130 E) Casing Volume (gal): ~1250

C) Water column (A-B)(ft): ~1231 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

****Started pumping @ 8:40 am with an initial rate of 5gpm****

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:50	55		7.27	6.5	520	799	519	1.82			Clear, not radioactive
9:25	175		7.58	7.2	534	808	525	1.94			Clear, not radioactive
10:30	419		7.66	9.9	500	703	457	2.03			Clear, not radioactive
11:30	521		7.5	9.2	566	799	520	3.54			Clear, ~5µSv/h
1:20	647	~0.5	7.3	11.4	598	797	518	3.59	0.5	0	Clear, radioactive
2:10	700		7.1	10.8	590	794	516	3.42			Clear, radioactive
2:40	733		7.05	10.9	293	391.4	254	4.07			Clear, radioactive
3:05	760		7.04	11.6	591	788	513	4			Clear, radioactive
4:01	818		7.03	11.3	588	789	513	4.62	0.5	0	Clear, radioactive

Sample Collection Time: Daytime : 2020-08-09 **Ship Date:** 2020-08-10

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-031-01	1000	No	No	
2	GWR-031-02	250	2 mL Sulfuric Acid	No	
3	GWR-031-03	100	No	No	
4	GWR-031-04	100	1.5 mL HNO_3	0.45 micron	
6	GWR-031-06	100	No	No	
7	GWR-031-07	4000	40 mL HNO_3	No	
8	GWR-031-08	80	No	No	
9	GWR-031-09	100	No	No	
10	GWR-031-10	100	No	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.5 SPC (µS/cm) : 789

H_2S (mg/L) : 0.0 C (µS/cm) : 588

Diss. O_2 (mg/L) : 4.62 pH : 7.03

TDS (mg/L) : 513 Temp. (˚C) : 11.3

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-031

Dip: -90 Sampler: ME / MT / JC Depth of well (ft): 1361

Project: Wheeler Screen interval (ft): ~20

Date: 2020-08-09 Depth of Static Water Level (corrected for angle)(ft): ~130

Temperature/Weather: Rainy, 10˚C

Sampling equip.: Grundfos 5SQE5-450

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1361 D) Well diameter (ID) (ft): 0.417

B) Depth to water level (ft): ~130 E) Casing Volume (gal): ~1250

C) Water column (A-B)(ft): ~1231 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

****Started pumping @ 8:40 am with an initial rate of 5gpm****

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:50	55		7.27	6.5	520	799	519	1.82			Clear, not radioactive
9:25	175		7.58	7.2	534	808	525	1.94			Clear, not radioactive
10:30	419		7.66	9.9	500	703	457	2.03			Clear, not radioactive
11:30	521		7.5	9.2	566	799	520	3.54			Clear, ~5µSv/h
1:20	647	~0.5	7.3	11.4	598	797	518	3.59	0.5	0	Clear, radioactive
2:10	700		7.1	10.8	590	794	516	3.42			Clear, radioactive
2:40	733		7.05	10.9	293	391.4	254	4.07			Clear, radioactive
3:05	760		7.04	11.6	591	788	513	4			Clear, radioactive
4:01	818		7.03	11.3	588	789	513	4.62	0.5	0	Clear, radioactive

Sample Collection Time: Daytime : 2020-08-09 **Ship Date:** 2020-08-10

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-031-DUP-01	1000	No	No	
2	GWR-031-DUP-02	250	2 mL Sulfuric Acid	No	
3	GWR-031-DUP-03	100	No	No	
4	GWR-031-DUP-04	100	1.5 mL HNO_3	0.45 micron	
6	GWR-031-DUP-06	100	No	No	
7	GWR-031-DUP-07	4000	40 mL HNO_3	No	
8	GWR-031-DUP-08	80	No	No	
9	GWR-031-DUP-09	100	No	No	
10	GWR-031-DUP-10	100	No	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0 SPC (µS/cm) : 789

H_2S (mg/L) : 0.0 C (µS/cm) : 613

Diss. O_2 (mg/L) : 8.61 pH : 7.18

TDS (mg/L) : 513 Temp. (˚C) : 13.0

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-032

Dip: -90 Sampler: MT / JC / ME Depth of well (ft): 1361.5

Project: Wheeler Screen interval (ft): ~20

Date: 2020-08-08 Depth of Static Water Level (corrected for angle)(ft): N/A

Temperature/Weather: Rainy then cloudy, 16˚C

Sampling equip.: Grundfos 5SQE5-450

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1361.5

B) Depth to water level (ft): 422.15

C) Water column (A-B)(ft): 939

D) Well diameter (ID) (ft): 0.417

E) Casing Volume (gal): 959.24

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

**** Samples taken at the end of 24 hr pump test. Purging field parmeters unavailable****

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments

Sample Collection Time: **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-032-01	1000	No	No	
2	GWR-032-02	250	2 mL Sulfuric Acid	No	
3	GWR-032-03	100	No	No	
4	GWR-032-04	100	1.5 mL HNO_3	0.45 micron	
6	GWR-032-06	100	No	No	
7	GWR-032-07	4000	40 mL HNO_3	No	
8	GWR-032-08	80	No	No	
9	GWR-032-09	100	No	No	
10	GWR-032-10	100	No	No	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.5

H_2S (mg/L) : 0.0

Diss. O_2 (mg/L) : 1.16

TDS (mg/L) : 623

SPC (µS/cm) : 958

C (µS/cm) : 737

pH : 6.79

Temp. (˚C) : 8.0

Note: Sample taken at 9:10 am on November 14, 2019 at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.
This well was sampled again in 2020 and 2021

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-033

Dip: -90 Sampler: ME/CS

Project: Wheeler

Date: 2020-11-03

Temperature/Weather: Overcast/cloudy, 0˚C

Depth of well (ft): 1153.5

Screen interval (ft): 1133.9 - 1153.4

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump | Redi-flow | Grundfos 5SQE5-450

Purging equip. (circle): Redi-flow | Bailer | Air Lift | Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1153.5

B) Depth to water level (ft): 7.5

C) Water column (A-B)(ft): 1146

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 291.27

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
14:51	74		7.56	5.3	30.1	48.2	31	9.67			Clear
15:08	145	0.5	8.66	5.0	29.8	48.2	31	9.36	0.00		Clear
15:22	207		8.87	5.2	31.3	50.5	33	9.72			Clear
15:43	260		8.37	5.2	354.2	570	371	2.87			Clear, slightly cloudy
15:35	291	1.0	7.8	5.3	165.6	265.9	173	6.06	0.00		Clear, slightly cloudy
16:02	319		7.33	6.5	249.8	386.5	251	3.08			Clear, slightly cloudy
16:11	331		7.17	6.7	247.2	379.1	246	3.17			Clear, slightly cloudy
16:22	345		7.07	6.5	237.3	360.5	238	3.55			Clear
16:31	358		7.04	6.5	232.2	358.7	233	3.19			Clear

Sample Collection Time: 4:30 PM **Ship Date:** 2020-11-06

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-033-01	1000	No	No	4
2	GWR-033-02	250	2 mL Sulfuric Acid	No	4
3	GWR-033-03	100	No	No	4
4	GWR-033-04	100	1.5 mL HNO_3	0.45 micron	4
5	GWR-033-05	10	1.5 mL HNO_3	0.22 micron	4
6	GWR-033-06	100	No	No	4
7	GWR-033-07	4000	40 mL HNO_3	No	4
8	GWR-033-08	80	No	No	4
9	GWR-033-09	100	No	No	4
10	GWR-033-10	100	No	No	4

Final Sample Field Parameters

Ferrous Fe (mg/L) : 2.0

H_2S (mg/L) : N/A

Diss. O_2 (mg/L) : 3.22

TDS (mg/L) : 231

SPC (µS/cm) : 351.4

C (µS/cm) : 229.9

pH : 7.02

Temp. (˚C) : 6.5

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-034

Dip: -90 Sampler: BB/ME

Project: WR-EA

Date: 31-Oct-20

Temperature/Weath Flurries, -15 Celsius

Depth of well (ft): 725.1

Screen interval (ft): 705.567-725.017

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 725.1

B) Depth to water level (ft): 8.6

C) Water column (A-B)(ft): 716.5

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 182

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
15:50	27.74	0.14	8.53	3.3	304.3	520	338	9.35	0.00		Clear water, minor sediments
16:30	39.51	0.25	8.77	2.8	303.3	527	343	9.52	0.00		Clear water

Sample Collection Time: 2020-10-31 15:00:00 PM **Ship Date:** 03-Nov-20

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-029-01	1000	N/A	n/a	
2	GWR-029-02	250	2 mL 20% Sulfuric Acid	n/a	
3	GWR-029-03	100	N/A	n/a	
4	GWR-029-04	100	1.5 mL 17.5% HNO3	0.45 micron	
5	GWR-029-05	100	0.2 mL 17.5% HNO3	0.1 micron	
6	GWR-029-06	100	N/A	n/a	
7	GWR-029-07	4000	40 mL 17.5% HN03	n/a	
8	GWR-029-08	80	N/A	n/a	
9	GWR-029-09	100	N/A	n/a	
10	GWR-029-010	100	N/A	n/a	

Final Sample Field Parameters

Ferrous Fe (mg/L) :	0.0	SPC (µS/cm) :	520
H_2S (mg/L) :		C (µS/cm) :	303.3
Diss. O_2 (mg/L) :	9.52	pH :	8.77
TDS (mg/L) :	343	Temp. (˚C) :	2.8

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-035

Dip: -90 Sampler: ME/CS

Project: Wheeler

Date: 2020-11-03

Temperature/Weather: Cloudy, -1˚C

Depth of well (ft): 42

Screen interval (ft): 32.4 - 41.9

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump | Redi-flow | Grundfos 5SQE5-450

Purging equip. (circle): Redi-flow | Bailer | Air Lift | Grundfos 5SQE5-450

A) Bottom of well depth (ft): 42

B) Depth to water level (ft): 10

C) Water column (A-B)(ft): 32

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 8.13

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
9:38	4	0.5	7.73	5.3	50.4	80.8	53	2.65	0.50		Clear
9:48	32	4.0	6.97	4.4	38.7	63.8	41	4.12	0.50		Clear
10:02	96	12.0	6.72	4.2	38.3	63.4	41	4.37	0.50		Clear
10:08	128	16.0	6.61	4.4	38.3	63.1	41	4.06	0.50		Clear
10:16	168	21.0	6.53	4.4	38.3	63.1	41	4.08	0.50		Clear
10:32	248	31.0	6.47	4.4	38.4	63.4	41	3.72	0.50		Clear
10:47	320	40.0	6.45	4.2	38.6	64	42	3.78	0.50		Clear
11:00	400	50.0	6.47	4.3	39.5	65.4	42	3.58	0.50		Clear
11:17	472	59.0	6.47	4.1	39.6	65.8	43	4.16	0.50		Clear

Sample Collection Time: 11:30 AM **Ship Date:** 2020-11-06

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-035-01	1000	No	No	4
2	GWR-035-02	250	2 mL Sulfuric Acid	No	4
3	GWR-035-03	100	No	No	4
4	GWR-035-04	100	1.5 mL HNO_3	0.45 micron	4
5	GWR-035-05	10	1.5 mL HNO_3	0.22 micron	4
6	GWR-035-06	100	No	No	4
7	GWR-035-07	4000	40 mL HNO_3	No	4
8	GWR-035-08	80	No	No	4
9	GWR-035-09	100	No	No	4
10	GWR-035-10	100	No	No	4

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.5

H_2S (mg/L) : N/A

Diss. O_2 (mg/L) : 3.87

TDS (mg/L) : 43

SPC (µS/cm) : 66.7

C (µS/cm) : 40.3

pH : 6.48

Temp. (˚C) : 4.3

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-036

Dip: -90 Sampler: ME/CS

Project: Wheeler

Date: 2020-11-05

Temperature/Weather: Cloudy, -16˚C

Depth of well (ft): 161.1

Screen interval (ft): 141.5 - 161.0

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump | Redi-flow | Grundfos 5SQE5-450

Purging equip. (circle): Redi-flow | Bailer | Air Lift | Grundfos 5SQE5-450

A) Bottom of well depth (ft): 161.1

B) Depth to water level (ft): 15.6

C) Water column (A-B)(ft): 145.5

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 36.98

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:04	18.5	0.5	7.85	4.5	61.0	100.8	66	4.71	0.00		Light yellow, cloudy
10:12	55.5	1.5	7.56	2.6	26.8	46.9	30	7.88	0.00		Light brown, milky
10:23	111	3.0	7.1	3.1	23.6	40.5	26	8.92	0.00		Light brown, milky
10:31	148	4.0	6.88	3.8	22.4	37.7	24	9.05	0.00		Light brown, cloudy
10:53	259	7.0	6.71	4.9	22.4	36.4	24	9.12	0.00		Light brown, cloudy
11:08	333	9.0	6.65	5.1	10.6	17.2	11	9.09	0.00		Light brown/yellow, cloudy
11:24	407	11.0	6.55	5.0	20.5	33.2	22	9.44	0.00		Light yellow, milky
11:38	481	13.0	6.56	4.1	19.1	31.8	21	9.44	0.00		Light brown/yellow, cloudy
11:53	555	15.0	6.48	4.3	18.6	30.1	20	9.52	0.00		Light brown/yellow, cloudy

Sample Collection Time: 12:00 PM **Ship Date:** 2020-11-06

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-036-01	1000	No	No	4
2	GWR-036-02	250	2 mL Sulfuric Acid	No	4
3	GWR-036-03	100	No	No	4
4	GWR-036-04	100	1.5 mL HNO_3	0.45 micron	4
5	GWR-036-05	10	1.5 mL HNO_3	0.02 micron	4
6	GWR-036-06	100	No	No	4
7	GWR-036-07	4000	40 mL HNO_3	No	4
8	GWR-036-08	80	No	No	4
9	GWR-036-09	100	No	No	4
10	GWR-036-10	100	No	No	4

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0

H_2S (mg/L) : N/A

Diss. O_2 (mg/L) : 9.80

TDS (mg/L) : 20

SPC (µS/cm) : 30.5

C (µS/cm) : 18.3

pH : 6.45

Temp. (˚C) : 4.4

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-037

Dip: -90 Sampler: BB

Project: WR-ENV

Date: 30-Aug-20

Temperature/Weathe Flurries, -13 Celsius

Depth of well (ft): 232.0

Screen interval (ft): 212.46 - 231.917

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 232.0

B) Depth to water level (ft): 16.65

C) Water column (A-B)(ft): 216.35

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 54.96

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
14:37	27	0.5	7.54	3.8	28.4	47.1	31	3.18	0.00		Cloudy water
14:44	54	1.0	7.25	3.9	52.5	87.8	57	3.85	0.50		Cloudy water, Trace of sedin
14:54	108	2.0	6.42	3.7	28.2	47.5	31	3.24	0.00		Clear water
15:05	162	3.0	6.29	4	26	43.5	28	3.50	0.50		Clear water
15:16	216	4.0	6.25	3.7	26.5	44.5	29	3.50	0.50		Clear water
15:25	270	5.0	6.18	4.3	26.3	43.5	28	3.50	0.50		Clear water
15:36	324	6.0	6.16	4.2	27.1	44.4	29	3.18	0.00		Clear water
15:46	378	7.0	6.14	4.6	27.8	45.6	30	3.43	0.50		Clear water
15:47	432	8.0	6.13	4.7	26.5	43.4	28	3.91	0.50		Clear water
16:08	486	9.0	6.13	4.6	26.4	43.2	28	3.92	0.00		Clear water
16:19	540	10.0	6.13	4.8	26.4	43.1	28	3.90	0.00		Clear water
16:31	594	11.0	6.13	4.8	26.4	43.2	28	4.00	0.50		Clear water

Sample Collection Time: 2020-10-30 16:40:00 PM **Ship Date:** 27-Oct-20

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-029-01	1000	N/A	n/a	
2	GWR-029-02	250	2 mL 20% Sulfuric Acid	n/a	
3	GWR-029-03	100	N/A	n/a	
4	GWR-029-04	100	1.5 mL 17.5% HNO3	0.45 micron	
6	GWR-029-06	100	N/A	n/a	
7	GWR-029-07	4000	40 mL 17.5% HN03	n/a	
8	GWR-029-08	80	N/A	n/a	
9	GWR-029-09	100	N/A	n/a	
10	GWR-029-010	100	N/A	n/a	

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.5

H_2S (mg/L) :

Diss. O_2 (mg/L) : 4.01

TDS (mg/L) : 57

SPC (µS/cm) : 43.1

C (µS/cm) : 26.4

pH : 6.13

Temp. (˚C) : 4.8

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-003

Dip: -90 Sampler: PB + EB Depth of well (ft): 198

Project: Screen interval (ft): N/A

Date: Depth of Static Water Level (corrected for angle)(ft): N/A

Temperature/Weather: minus 12 degrees, clear sunny skies

Sampling equip.: sampled immediately after redi-flow purging

Purging equip. (circle): **Redi-flow** Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 198 D) Well diameter (ID) (ft): 0.1667

B) Depth to water level (ft): 66.79 E) Casing Volume (gal): 21.41

C) Water column (A-B)(ft): 131.21 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Started purging water @ 9:01am

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
9:26	10	0.5	5.74	3.6	35.9	60.5	39	4.84	0.00	N/A	light yellow
9:41	25	1.0	5.76	4.6	36	59	38	4.78	0.00	N/A	light yellow
10:05	45	2.0	5.84	4.7	35.4	57.8	38	4.01	0.00	N/A	clear
10:24	60	2.8	5.72	4.4	35	57.7	37	4.72	0.25	N/A	clear
10:41	75	3.5	5.8	4.9	35.1	56.8	37	4.02	0.25	N/A	clear
10:45	78.85	FINAL							0.00	N/A	clear
											Average flow rate of 0.85
											gallons per minute @
											200 Hz
											* 80 ft of hose down well
											one 50 ft blue hose at
											bottom plus 30 ft of the
											black hose on top

Sample Collection Time: 10:45am **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters 10:45am

Ferrous Fe (mg/L) : 0.0 SPC (µS/cm) : 27.8

H_2S (mg/L) : N/A C (µS/cm) : 17.2

Diss. O_2 (mg/L) : 3.82 pH : 5.86

TDS (mg/L) : 18 Temp. (˚C) : 5.1

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-005

Dip: -90 Sampler: PB + EB

Project: WR-EVAL

Date: Saturday, May 22 2021

Temperature/Weather: 5, clear

Depth of well (ft): 403.5

Screen interval (ft): 384-403

Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging

Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 403.5

B) Depth to water level (ft): 2

C) Water column (A-B)(ft): 401.5

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 37 (~40gal/8 buckets)

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Start time: 7:30am

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:00	20	0.50	6.87	5.6	52.9	82	53	11.74	1.50	n/a	milky grey with seds
8:25	40	1.00	6.87	6	102.6	160.9	105	11.97	1.50	n/a	milky grey
8:48	60	1.50	6.86	6.4	48.7	75	49	11.79	1.75	n/a	light milky grey
9:10	80	2.00	6.85	6.8	100.6	154.7	100	11.93	1.50	n/a	light milky grey
9:32	100	2.50	6.86	6.4	99.4	152.7	99	11.77	1.75	n/a	clear
9:54	120	3.00	6.86	6.4	100.8	154.3	100	11.72	1.50	n/a	clear

Sample Collection Time: 10:03am **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-005_1	1000	no	no	stored in fridge
2	GWR-005_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-005_3	100	no	no	stored in fridge
4	GWR-005_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
5	GWR-005_5	250	20ml 9% HCl	no	stored in fridge
6	GWR-005_6	100	no	no	stored in fridge
7	GWR-005_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-005_8	2 x 40	no	no	stored in fridge
9	GWR-005_9	500	no	no	stored in fridge
10	GWR-005_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.5

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 11.82

TDS (mg/L) : 98

SPC (µS/cm) : 150.5

C (µS/cm) : 97.5

pH : 6.80

Temp. (˚C) : 6.3

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-006

Dip: -90 Sampler: PB +EB

Project: WR Eval

Date: April 14 2021

Temperature/Weather: 2 degrees, sunny cool

Depth of well (ft): 29.5

Screen interval (ft): 10.0 - 29.0

Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: Bladder Pump

Purging equip. (circle): **Redi-flow** Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 29.5

B) Depth to water level (ft): 8.33

C) Water column (A-B)(ft): 21.17

D) Well diameter (ID) (ft): 0.166667

E) Casing Volume (gal): 3.45

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
3:48pm	10.5	3	6.95	6.3	163.4	254.1	165	3.7	0.50	n/a	milky grey cloudy
3:59	14	4	6.88	5.4	121.4	194	126	2.8	1.25	n/a	milky grey cloudy
4:06	17.5	5	6.86	5.1	102.4	165.5	108	3.5	1.25	n/a	milky grey cloudy
4:12	21	6	6.87	4.9	97.8	158.6	103	3.22	1.00	n/a	milky grey cloudy
4:20	24.5	7	6.86	4.7	94.1	153.5	100	5.36	1.25	n/a	milky grey cloudy
											pumping started around
											3:19pm
											use ~ 98.6 Hz
											average pumping rate was
											0.4 to 0.5 gallons per
											minute

Sample Collection Time: 4:25pm to 4:31pm - 2 gallons **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters collected gallons 25.5 to 27.5 from 4:25pm to 4:31pm

Ferrous Fe (mg/L) : 1.3

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 4.70

TDS (mg/L) : 98

SPC (µS/cm) : 150.9

C (µS/cm) : 92.8

pH : 6.90

Temp. (˚C) : 4.8

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-008

Dip: -80 Sampler: PB/EB

Project: Wheeler

Date: April 9 2021

Temperature/Weather: 2 degrees, cloudy

Depth of well (ft): 1246.7

Screen interval (ft): 1227.2-1246.6

Depth of Static Water Level (corrected for angle)(ft): 115.12

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1246.7

B) Depth to water level (ft): 116.9

C) Water column (A-B)(ft): 1129.8

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 103.7

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
16:42	50	0.5	7.22	4.1	106.9	177.5	115	12.44	2.50	n/a	Clear
17:00	80	-	7.38	3.9	102.0	170.2	111	12.53	-	n/a	Clear
17:17	100	1	7.42	3.9	98.0	164.5	107	12.40	2.00	n/a	Clear
17:31	120	-	7.42	4.1	98.9	165.0	107	12.50	-	n/a	Clear
17:50	150	1.5	7.40	4.0	98.2	164.6	107	12.62	1.00	n/a	Clear

Sample Collection Time: **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.5

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 12.56

TDS (mg/L) : 108

SPC (µS/cm) : 165.7

C (µS/cm) : 98.9

pH : 7.42

Temp. (˚C) : 3.9

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-009

Dip: -65 Sampler: PB/EB/JLS Depth of well (ft): 918.6

Project: Wheeler Screen interval (ft): 899.1-918.5

Date: April 10 2021 Depth of Static Water Level (corrected for angle)(ft): 114.01

Temperature/Weather: sunny, snowing, -5

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 918.6 D) Well diameter (ID) (ft): 0.125

B) Depth to water level (ft): 125.8 E) Casing Volume (gal): 72.77

C) Water column (A-B)(ft): 729.8 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
9:26	55	-	2.36	4.8	21.18	3489	2267	12.21	2.00		frothy, cloudy, white
9:43	75	1.0	2.67	3.4	14.2	2400	1559	12.23	-		frothy, cloudy, white
10:18	105	1.5	3.14	4.1	15.5	2566	1665	11.85	-		cloudy, grey
10:56	150	2.0	4.36	4.1	4.7	7.8	5	12.19	0.50		cloudy, grey
11:35	190	2.5	7.20	4.4	172.1	279.3	182	11.08	-		cloudy, grey
12:06	225	3.0	7.62	4.7	386.4	612	402	11.72	1.00		cloudy, yellow
12:41	265	3.5	7.67	5.3	398.8	633	411	11.79	-		cloudy, yellow
13:18	300	4.0	7.74	5.3	427.0	677	440	11.84	1.00		cloudy, yellow
13:58	340	4.5	7.71	4.8	444.8	718	467	12.03	-		cloudy, yellow
14:33	375	5.0	7.65	4.7	232.2	347	225	11.02	2.00		cloudy, yellow
15:16	415	5.5	7.63	4.6	443.6	712	463	11.8	-		cloudy, yellow
15:50	450	6.0	7.64	4.1	419.2	692	450	12.14	1.50		cloudy, yellow
16:32	490	6.5	7.61	4.5	210.0	342	222	11.89	-		cloudy, yellow
17:15	525	7.0	7.64	3.5	384.6	644	419	12.25	1.00		cloudy, yellow
18:02	565	7.5	7.71	3.6	373.7	629	409	12.36	-		clear, yellow
18:37	600	8.0	7.67	3.3	362.1	618	402	12.47	1.50		clear, yellow

Sample Collection Time: **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.5 SPC (µS/cm) : 618

H_2S (mg/L) : C (µS/cm) : 362.1

Diss. O_2 (mg/L) : 12.47 pH : 7.67

TDS (mg/L) : 402 Temp. (˚C) : 3.3

Approx 400 gal of mud enzymes pumped down well 24 hrs prior to purging - for this reason we took first parameters at

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-011

Dip: -90 Sampler: PB + EB

Project: WR-EVAL

Date: Tuesday, June 1 2021

Temperature/Weather: plus 20, clear skies

Depth of well (ft): 1213

Screen interval (ft): 1194-1213

Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging

Purging equip. (circle): Geotech Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1213

B) Depth to water level (ft): 133.85

C) Water column (A-B)(ft): 1079.15

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 99.5

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Start time: 9:45am

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:18	25	0.25	6.96	9.2	166.8	235.5	153	11.25	N/A	N/A	slightly milky
10:53	50	0.50	7.53	9.6	174.9	241.5	157	10.99	N/A	N/A	slightly milky
11:37	75	0.75	8.18	9.4	202.7	277.1	180	11.01	N/A	N/A	milky grey
1:27	100	1.00	7.92	11.1	196.3	261.4	170	10.6	0.00	N/A	slightly milky grey
2:46	125	1.25	7.49	13.7	195.2	250.1	163	10.04	0.75	N/A	slightly milky grey
3:21	150	1.50	7.39	8.5	167.6	244.1	159	11.53	N/A	N/A	milky grey
3:42	175	1.75	7.11	8.2	165.9	245	159	11.69	N/A	N/A	milky grey
4:03	200	2.00	6.96	7.8	149.6	222.8	145	11.73	1.50	N/A	slightly milky grey
4:26	225	2.25	6.91	8.2	151.5	220.2	143	11.49	N/A	N/A	slightly milky grey
4:58	250	2.50	7.04	8.6	154.1	223.7	146	11.54	N/A	N/A	slightly cloudy
5:20	275	2.75	7.07	7.9	150.9	234.4	145	11.63	N/A	N/A	slightly cloudy
5:40	300	3.00	7.08	7.5	147.7	220.6	143	11.69	0.75	N/A	slightly cloudy

Sample Collection Time: 5:47 PM **Ship Date:** June 6 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-011_1	1000	no	no	stored in fridge
2	GWR-011_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-011_3	100	no	no	stored in fridge
4	GWR-011_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
6	GWR-011_6	100	no	no	stored in fridge
7	GWR-011_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-011_8	2 x 40	no	no	stored in fridge
9	GWR-011_9	500	no	no	stored in fridge
10	GWR-011_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.0

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 11.91

TDS (mg/L) : 142

SPC (µS/cm) : 219.2

C (µS/cm) : 144.8

pH : 6.82

Temp. (˚C) : 7.2

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-012
Dip: -78 Sampler: PB + EB
Project: WR-EVAL
Date: Sunday, May 23 2021
Temperature/Weather: 10, clear

Depth of well (ft): 1138.5
Screen interval (ft): 1119-1138.5
Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging
Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1138.5
B) Depth to water level (ft): 2
C) Water column (A-B)(ft): 1136.5
Start time: 7:24am

D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): 104.33 (~105gal/21 buckets)
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:11	25	0.25	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	not sampled, too murky
9:05	55	0.50	7.03	9.6	670	934	607	11.11	1.50	n/a	clear
9:47	80	0.75	9.14	9.5	701	974	633	10.92	0.25	n/a	slightly milky
10:16	105	1.00	8.6	7.8	688	1022	664	11.75	0.00	n/a	light milky grey
10:32	130	1.25	8.19	7.4	671	1004	653	11.91	0.00	n/a	slightly milky
10:48	155	1.50	7.56	7.6	651	980	637	11.69	2.00	n/a	milky
11:08	185	1.75	7.35	7.6	639	950	617	11.48	1.50	n/a	milky grey
11:25	210	2.00	7.23	7.8	337.9	502	326	11.49	1.75	n/a	slightly milky
11:42	235	2.25	7.21	7.8	630	939	611	11.59	1.75	n/a	clear
12:00	260	2.50	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	clear
12:18	285	2.75	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
12:35	315	3.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
12:52	340	3.25	7.13	8.7	618	899	619	11.42	2.00	n/a	
1:09	365	3.50	7.16	8	607	896	582	11.53	1.50	n/a	clear
1:44	375										Final sample collected

Sample Collection Time: 1:44pm **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-012_1	1000	no	no	stored in fridge
2	GWR-012_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-012_3	100	no	no	stored in fridge
4	GWR-012_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
5	GWR-012_5	250	20ml 9% HCl	no	stored in fridge
6	GWR-012_6	100	no	no	stored in fridge
7	GWR-012_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-012_8	2 x 40	no	no	stored in fridge
9	GWR-012_9	500	no	no	stored in fridge
10	GWR-012_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.5
H_2S (mg/L) : n/a
Diss. O_2 (mg/L) : 11.61
TDS (mg/L) : 582

SPC (µS/cm) : 896
C (µS/cm) : 602
pH : 7.17
Temp. (˚C) : 7.9

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-013
Dip: -90 Sampler: PB + EB
Project: WR-EVAL
Date: Wednesday, June 2 2021
Temperature/Weather: plus 20, clear skies

Depth of well (ft): 907
Screen interval (ft): 887-907
Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging
Purging equip. (circle): Geotech Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 907
B) Depth to water level (ft): 140
C) Water column (A-B)(ft): 767
Start time: 7:45am

D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): ~71
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:10	35	0.50	8.79	9.9	359.3	503	327	11.4	0.00	N/A	grey water
8;38	70	1.00	9.07	8.1	123.6	182.6	119	11.63	0.25	N/A	murky grey
9:04	105	1.50	8.32	8.6	209.1	304.7	198	11.65	0.50	N/A	murky grey
9:28	140	2.00	7.69	8.6	199	281.6	183	11.43	1.25	N/A	murky grey
9:54	175	2.50	7.49	7.9	184.9	276.4	180	11.77	1.25	N/A	murky grey
10:22	210	3.00	7.44	8.5	188.8	274	178	11.51	0.75	N/A	murky grey
10:45	245	2.50	7.45	8.3	93.4	136.2	89	11.66	N/A	N/A	cloudy
11:11	280	4.00	7.49	8.6	189.2	274.3	179	11.6	N/A	N/A	cloudy
11:38	315	4.50	7.46	8.3	189	275.8	179	11.74	N/A	N/A	cloudy

Sample Collection Time: 11:43 AM **Ship Date:** June 6 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-013_1	1000	no	no	stored in fridge
2	GWR-013_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-013_3	100	no	no	stored in fridge
4	GWR-013_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
6	GWR-013_6	100	no	no	stored in fridge
7	GWR-013_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-013_8	2 x 40	no	no	stored in fridge
9	GWR-013_9	500	no	no	stored in fridge
10	GWR-013_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.0
H_2S (mg/L) : n/a
Diss. O_2 (mg/L) : 11.83
TDS (mg/L) : 176

SPC (µS/cm) : 271.5
C (µS/cm) : 182.7
pH : 7.35
Temp. (˚C) : 7.8

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-014
Dip: -90 Sampler: PB + EB
Project: WR-EVAL
Date: Friday, May 21 2021
Temperature/Weather:

Depth of well (ft): 518.4
Screen interval (ft): 498.89-518.3
Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging
Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 518.4
B) Depth to water level (ft): 3.62
C) Water column (A-B)(ft): 514.78
Start time: 7:34am

D) Well diameter (ID) (ft): 0.125
E) Casing Volume (gal): 47.22 (~50gal/10 buckets)
Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:07	25	0.5	11.15	5.1	368.4	595	387	12.57	0.00	n/a	clear
9:01	50	1.0	10.83	4.2	328.4	542	352	12.68	0.00	n/a	lightly milky yellow
9:58	75	1.5	10.05	5.9	268.2	418.2	272	12.18	0.00	n/a	lightly milky yellow
10:30	100	2.0	9.87	6.2	172.2	264.2	169	12.38	0.00	n/a	lightly milky yellow
10:51	125	2.5	10.04	6.4	290.9	439.3	286	12.17	0.00	n/a	lightly milky yellow
11:23	150	3.0	9.79	6.9	277.9	423.4	275	12.19	0.00	n/a	lightly milky yellow

Sample Collection Time: 11:27am **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-014_1	1000	no	no	stored in fridge
2	GWR-014_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-014_3	100	no	no	stored in fridge
4	GWR-014_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
5	GWR-014_5	250	20ml 9% HCl	no	stored in fridge
6	GWR-014_6	100	no	no	stored in fridge
7	GWR-014_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-014_8	2 x 40	no	no	stored in fridge
9	GWR-014_9	500	no	no	stored in fridge
10	GWR-014_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0
H_2S (mg/L) : n/a
Diss. O_2 (mg/L) : 12.20
TDS (mg/L) : 274

SPC (µS/cm) : 421.5
C (µS/cm) : 270.3
pH : 9.77
Temp. (˚C) : 6.2

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-025

-90 Sampler: PB + EB

Depth of well (ft): 1246.7

Project: WR EVAL

Screen interval (ft): 1227.2-1246

Date: April 17 2021

Depth of Static Water Level (corrected for angle)(ft): n/a

Temperature/Weather: minus 5, overcast

Sampling equip.: sampled directly after purging

Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1246.7

B) Depth to water level (ft): 67.24

C) Water column (A-B)(ft): 1179.46

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 108.26

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (ft^3 *per gal)*

Purging start time : 9:35am

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:27	55	0.5	6.72	3.7	1063	1792	1165	12.98	2.00	N/A	dark grey milky
11:39	110	1.0	6.99	3.8	1347	2263	1471	12.43	1.25	N/A	dark grey milky
12:45	165	1.5	7.03	3.9	1355	2273	1477	12.48	2.00	N/A	clear
1:55	220	2.0	7.07	3.9	1356	2268	1474	12.38	1.00	N/A	clear
2:58	275	2.5	7.06	4.1	662	1101	715	12.42	1.50	N/A	clear
4:01	330	3.0	7.03	4.4	1404	2314	1504	12.25	0.75	N/A	clear
4:18	345	3.1	SEE FINAL SAMPLE FIELD PARAMETERS								
											We had 100 ft of hose down the well, 1 blue 50ft hose and 1 black 50ft hose. We purged 69 five gallon pails worth of water between 9:35 am and 4:18pm. Average pumping rate of 1.13 gallons per minute.

Sample Collection Time: 4:18 pm April 17 2021 **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.0

H_2S (mg/L) : N/A

Diss. O_2 (mg/L) : 12.35

TDS (mg/L) : 1505

SPC (µS/cm) : 2315

C (µS/cm) : 1392

pH : 7.06

Temp. (˚C) : 4.1

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-029

Dip: -90 Sampler: PB+EB

Project: WR-Eval

Date: April 12 2021

Temperature/Weather: sunny, cold

Depth of well (ft): 1148.3

Screen interval (ft): 1128.8-1148.2

Depth of Static Water Level (corrected for angle)(ft): N/A

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer **Air Lift** Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1148.3

B) Depth to water level (ft): 14.99

C) Water column (A-B)(ft): 1133.51

D) Well diameter (ID) (ft): 0.125

E) Casing Volume (gal): 103.97

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
9:51	50	0.5	6.86	2.6	46.4	82.6	54	13.46	N/A	N/A	clear
11:05	100	1.0	7.19	3.7	101.3	170.8	111	12.71	N/A	N/A	clear
12:15	150	1.5	7.29	4.7	108	177.8	115	12.64	N/A	N/A	clear
13:21	200	2.0	7.17	5	54.6	88.5	58	12.37	N/A	N/A	clear
14:32	250	2.5	7.33	3.8	52.5	87.6	57	12.67	N/A	N/A	clear
15:54	300	3.0	7.27	4.1	97.6	171.5	111	12.74	N/A	N/A	clear
16:08	315	FINAL									see final parameters

Sample Collection Time: **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters sample taken from 315 gallons purged at 16:08pm, April 12 2021

Ferrous Fe (mg/L) : N/A

H_2S (mg/L) : N/A

Diss. O_2 (mg/L) : 12.83

TDS (mg/L) : 119

SPC (µS/cm) : 183.1

C (µS/cm) : 108

pH : 7.30

Temp. (˚C) : 3.6

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-031

Dip: -90 Sampler: PB + EB Depth of well (ft): 1361

Project: WR-EVAL Screen interval (ft): ~20

Date: Thursday, June 3 2021 Depth of Static Water Level (corrected for angle)(ft): ~135

Temperature/Weather: plus 20 to 35, clear skies

Sampling equip.: sample taken immediate upon completion of purging

Purging equip. (circle): Geotech Bailer Air Lift **Grundfos 5SQE5-450**

A) Bottom of well depth (ft): 1361 D) Well diameter (ID) (ft): 0.417

B) Depth to water level (ft): ~135 E) Casing Volume (gal): ~1250

C) Water column (A-B)(ft): 1226 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Start time: 2:04pm

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
2:20	100	N/A	8.98	26.8	1589	1505	979	1.38	N/A	N/A	clear; 6 gpm flow rate
3:00	300	N/A	7.12	30.4	1834	1655	1076	1.58	N/A	N/A	clear; 4 gpm flow rate
3:30	400	0.25	7.06	28.7	1833	1704	1107	1.31	N/A	N/A	clear; 3 gpm flow rate
4:14	500	N/A	6.99	26.6	1738	1694	1101	1.28	1.00	N/A	clear; 1 gpm flow rate
5:50	600	0.5	6.94	22.5	1596	1674	1088	2.08	1.00	N/A	clear; 1 gpm flow rate
7:45	715	N/A	7.02	15.6	1387	1690	1099	3.29	1.00	N/A	clear; 0.97 gpm flow rate
absent from 7:45pm June 3 to 7:00am June 4											
7:14	1400	1.1	7.12	16.8	1421	1681	1093	3.75	0.00	N/A	clear; 0.97 gpm flow rate
8:16	1460	N/A	6.99	17.6	1286	1496	973	4	0.00	N/A	clear; 0.97 gpm flow rate
											Started purging 2:04pm June 3, ended purging at 8:23am June 4, 2021

Sample Collection Time: 8:23pm - 1467 gallons **Ship Date:** June 6 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-031_1	1000	no	no	stored in fridge
2	GWR-031_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-031_3	100	no	no	stored in fridge
4	GWR-031_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
5	GWR-031_5	250	20ml 9% HCl	no	stored in fridge
6	GWR-031_6	100	no	no	stored in fridge
7	GWR-031_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-031_8	2 x 40	no	no	stored in fridge
9	GWR-031_9	500	no	no	stored in fridge
10	GWR-031_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0 SPC (µS/cm) : 1374

H_2S (mg/L) : n/a C (µS/cm) : 1162

Diss. O_2 (mg/L) : 3.65 pH : 7.21

TDS (mg/L) : 893 Temp. (˚C) : 16.8

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-032

Dip: -90 Sampler: PB + EB Depth of well (ft): 1361.5

Project: WR-EVAL Screen interval (ft): ~20

Date: Friday, June 4 2021 Depth of Static Water Level (corrected for angle)(ft): ~135

Temperature/Weather: plus 20 to 35, clear skies

Sampling equip.: sample taken immediate upon completion of purging

Purging equip. (circle): Geotech Bailer Air Lift **Grundfos 5SQE5-450**

A) Bottom of well depth (ft): 1361.5 D) Well diameter (ID) (ft): 0.417

B) Depth to water level (ft): ~135 E) Casing Volume (gal): ~1250

C) Water column (A-B)(ft): 1226.5 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Start time: 1:34pm with a flow rate of 6.6 gpm

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
1:55	150	0.120	7.37	33.6	1616	1385	900	3.97	0.00	N/A	clear; 6.8 gpm flow rate
2:23	340	0.272	7.08	29.4	757	697	453	4.31	N/A	N/A	clear; 6.75 gpm flow rate
3:04	610	0.488	6.97	28.7	947	884	574	2.82	0.50	N/A	clear; 6.40 gpm flow rate
4:47	1270	1.016	6.98	25.2	1943	1933	1257	2.5	0.50	N/A	clear; 6.5 gpm flow rate
7:42	2400	1.960	6.85	21.5	1641	1764	1147	2.25	0.50	N/A	clear; 6.47 gpm flow rate

Sample Collection Time: 7:53pm - 2485 gallons **Ship Date:** June 6 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-032_1	1000	no	no	stored in fridge
2	GWR-032_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-032_3	100	no	no	stored in fridge
4	GWR-032_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
5	GWR-032_5	250	20ml 9% HCl	no	stored in fridge
6	GWR-032_6	100	no	no	stored in fridge
7	GWR-032_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-032_8	2 x 40	no	no	stored in fridge
9	GWR-032_9	500	no	no	stored in fridge
10	GWR-032_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.5 SPC (µS/cm) : 1683

H_2S (mg/L) : n/a C (µS/cm) : 1486

Diss. O_2 (mg/L) : 2.26 pH : 6.83

TDS (mg/L) : 1094 Temp. (˚C) : 18.5

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-033

Dip: -90 Sampler: PB + EB

Project: WR-EVAL

Date: Tuesday, May 25 2021

Temperature/Weather: minus 6, overcast

Depth of well (ft): 1153.5

Screen interval (ft): 1133.9 - 1153.4

Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging

Purging equip. (circle): **Geotech** Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 1153.5

B) Depth to water level (ft): 7.18

C) Water column (A-B)(ft): 1146.32

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 291.3

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Start time: 8:20am

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:54	10		7.29	3.3	412.8	705	458	5.77	1.00	n/a	clear
9:28	20		7.1	3.6	408.3	690	449	5.81	1.00	n/a	clear
9:47	30		7.26	5.8	440.5	696	452	5.89	1.00	n/a	clear
10:26	40		7.31	6.8	454.6	696	452	5.98	1.00	n/a	clear
11:13	50		7.33	7.3	461.5	696	452	6.07	1.00	n/a	clear

No # 5 sample collected for this well or the #2 Field Blank collected today. Out of bottles.

Sample Collection Time: 11:22am **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-033_1	1000	no	no	stored in fridge
2	GWR-033_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-033_3	100	no	no	stored in fridge
4	GWR-033_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
6	GWR-033_6	100	no	no	stored in fridge
7	GWR-033_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-033_8	2 x 40	no	no	stored in fridge
9	GWR-033_9	500	no	no	stored in fridge
10	GWR-033_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.0

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 6.09

TDS (mg/L) : 451

SPC (µS/cm) : 694

C (µS/cm) : 461.9

pH : 7.32

Temp. (˚C) : 7.5

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-034

Dip: -90 Sampler: PB + EB

Project: WR-EVAL

Date: Monday, May 24 2021

Temperature/Weather: 10, clear

Depth of well (ft): 725.1

Screen interval (ft): 705.57-725.02

Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging

Purging equip. (circle): **Geotech** Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 725.1

B) Depth to water level (ft): 9.3

C) Water column (A-B)(ft): 715.8

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 182

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Start time: 2:35pm

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
3:55	45	0.25	7.59	7.3	666	1010	656	5.65	0.00	n/a	clear
4:09	50		7.57	7.2	666	1007	654	5.16	0.00	n/a	clear
											Duplicate # 2 was collected from GWR-034. **No #5 sample.**

Sample Collection Time: 4:23pm **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-034_1	1000	no	no	stored in fridge
2	GWR-034_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-034_3	100	no	no	stored in fridge
4	GWR-034_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
5	GWR-034_5	250	20ml 9% HCl	no	stored in fridge
6	GWR-034_6	100	no	no	stored in fridge
7	GWR-034_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-034_8	2 x 40	no	no	stored in fridge
9	GWR-034_9	500	no	no	stored in fridge
10	GWR-034_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 5.16

TDS (mg/L) : 654

SPC (µS/cm) : 1007

C (µS/cm) : 666

pH : 7.57

Temp. (˚C) : 7.2

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-035

Dip: -90 Sampler: PB + EB

Project: WR-EVAL

Date: Monday, May 24 2021

Temperature/Weather: 10, clear

Depth of well (ft): 42

Screen interval (ft): 32.4-41.9

Depth of Static Water Level (corrected for angle)(ft): n/a

Sampling equip.: sample taken immediate upon completion of purging

Purging equip. (circle): **Geotech** Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 42

B) Depth to water level (ft): 10

C) Water column (A-B)(ft): 32

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 8.13

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Start time: 10:23am

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:37	10	1.00	6.6	8.2	75.9	111.6	73	7.67	0.25	n/a	light grey
11:40	20	2.00	6.75	10.3	98.1	136.1	88	8.46	0.50	n/a	light grey
1:38	30	3.00	6.64	7.1	42.1	78.1	63.7	8.03	0.50	n/a	light grey
1:53	40	4.00	6.31	5.7	74.3	115.4	117.4	8.12	0.00	n/a	clear
2:03	50	5.00	6.32	5.7	72.7	114.8	75	8.07	0.00	n/a	clear
2:15	60	6.00	6.31	6	73.9	116.2	74	7.74	0.00	n/a	clear

Sample Collection Time: 1:44pm **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-035_1	1000	no	no	stored in fridge
2	GWR-035_2	250	2ml 20% sulfuric acid	no	stored in fridge
3	GWR-035_3	100	no	no	stored in fridge
4	GWR-035_4	100	1.5ml 17.5% HNO3	yes	stored in fridge
5	GWR-035_5	250	20ml 9% HCl	no	stored in fridge
6	GWR-035_6	100	no	no	stored in fridge
7	GWR-035_7	4000	40ml 17.5% HNO3	no	stored in fridge
8	GWR-035_8	2 x 40	no	no	stored in fridge
9	GWR-035_9	500	no	no	stored in fridge
10	GWR-035_10	100	no	no	stored in fridge

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 8.01

TDS (mg/L) : 74

SPC (µS/cm) : 113.6

C (µS/cm) : 71

pH : 6.30

Temp. (˚C) : 5.4

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-036

Dip: -90 Sampler: PB/JLS Depth of well (ft): 161.1

Project: Wheeler Screen interval (ft): 141.5-161.0

Date: 8-Apr-21 Depth of Static Water Level (corrected for angle)(ft):

Temperature/Weather: Snowing, overcast, -2

Sampling equip.: Bladder Pump

Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 161.1

B) Depth to water level (ft): 15.55

C) Water column (A-B)(ft): 145.5

D) Well diameter (ID) (ft): 0.208

E) Casing Volume (gal): 36.98

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
14:50	19	0.5	7.14	3.9	139.4	232.8	157	3.28	0.00		Clear, yellow
14:54	37	1.0	7.12	3.7	114.1	192.5	125	4.22	0.00		Clear, yellow
15:02	55	1.5	6.81	3.5	62.8	106.5	69	6.79	0.00		Clear, yellow
15:11	74	2.0	6.71	3.4	52.7	90.3	59	7.46	0.00		Clear, yellow
15:18	92	1.5	6.71	3.5	51.1	87.1	57	7.77	0.00		Clear, yellow
15:27	111	3.0	6.65	3.3	45.3	77.8	51	8.35	0.00		Clear, yellow
15:34	129	3.5	6.63	3.5	44.7	76.2	50	8.35	0.00		Clear, yellow

Sample Collection Time: **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : 0.0

H_2S (mg/L) :

Diss. O_2 (mg/L) : 8.36

TDS (mg/L) : 48

SPC (µS/cm) : 73.1

C (µS/cm) : 42.8

pH : 6.62

Temp. (˚C) : 3.4

*Duplicate #1 sampled

SAMPLING AND PURGING DATA SHEET

Drill Hole ID or QA/QC ID: GWR-037
Dip: -90 Sampler: PB/JLS/EB Depth of well (ft): 232.0
Project: Wheeler Screen interval (ft): 212.46-231.917
Date: 9-Apr-21 Depth of Static Water Level (corrected for angle)(ft):
Temperature/Weather: Sunny, -6

Sampling equip.: Bladder Pump
Purging equip. (circle): Redi-flow Bailer Air Lift Grundfos 5SQE5-450

A) Bottom of well depth (ft): 232.0 D) Well diameter (ID) (ft): 0.208
B) Depth to water level (ft): 15.61 E) Casing Volume (gal): 55
C) Water column (A-B)(ft): 216.31 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:10	27	0.5	7.29	4.6	216.0	352	231	2.42	0.00		Clear
10:20	55	1.0	6.37	3.9	94.0	158.5	103	2.42	1.00		Clear
10:30	82	1.5	6.13	3.7	29.3	50.1	33	2.46	1.50		Clear, sulfur smell
10:39	110	2.0	6.04	3.9	50.2	84.7	55	2.85	1.00		Clear, sulfur smell
10:49	137	1.5	6.01	4.0	48.5	81.8	53	2.83	1.50		Clear, sulfur smell
10:59	165	3.0	6.00	4.0	48.2	81.0	53	3.02	1.00		Clear, sulfur smell

Sample Collection Time: **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : 1.0 SPC (µS/cm) : 81.1
H_2S (mg/L) : C (µS/cm) : 49.1
Diss. O_2 (mg/L) : 3.00 pH : 6.02
TDS (mg/L) : 53 Temp. (˚C) : 4.1

GWR-038 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler: BB/JC

Project: Wheeler ENG

Date: Sept 4/21

Temperature/Weather: Cloudy 15C

Depth of well (ft):

Screen interval (ft): n/a

Depth of Static Water Level (corrected for angle)(ft): 147.6

Sampling equip.: Bladder Pump

Purging equip. (circle): 1.9" Redi-flo2 Bailer Air Lift **Grundfos 4" 2HP** Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 1354

B) Depth to water level (ft): 147.6

C) Water column (A-B)(ft): 1206.4

D) Well diameter (ID) (ft): 0.7434

E) Casing Volume (gal): **3875**

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (ft^3 *per gal)*

Time	Volume (gal)	Casing Volumes	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
10:00	272.1	0.07	7.08	6.3	26100	40270	26274	4.22			Bubbly, clear water
11:00	630.88	0.16	7.07	6.9	19388	29620	19253	4.96			White water
12:00	981.89	0.25	6.79	9.5	13352	18966	12328	3.13			White water
13:00	1337.29	0.35	8.19	8.2	10288	15159	9853	4.25			White water
14:00	1690.22	0.44	8.15	9.1	7769	11155	7251	4.63			Murky grey water, trace of sediment
15:00	2052.22	0.53	7.65	7.7	8531	12755	8291	5.5			Murky grey water, trace of sediment
16:00	2407.6	0.62	7.54	7.7	7233	10811	7027	5.57			Murkky grey water, trace of sediment

Sample Collection Time: 16:00:00 PM Sept 4th, 2021 **Ship Date:** Sept 4th 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-038	1000	-	-	10
2					
3					
4	GWR-038	100	1.5 mL 17.5% nitric acid	0.45 micron	10
5					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 5.57

TDS (mg/L) : 7027

SPC (µS/cm) : 10811

C (µS/cm) : 7233

pH : 7.54

Temp. (˚C) : 7.7

GWR-039 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler BB/MC/JC

Project: Wheeler ENG

Date: Sept 5/21

Temperature/Weather: Cloudy 15C

Depth of well (ft):

Screen interval (ft): n/a

Depth of Static Water Level (corrected for angle)(ft): 144

Sampling equip.: Bladder Pump

Purging equip. (circle): 1.9" Redi-flo2 Bailer Air Lift **Grundfos 4" 2HP** Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 1364

B) Depth to water level (ft): 144

C) Water column (A-B)(ft): 1220

D) Well diameter (ID) (ft): 0.7434

E) Casing Volume (gal): **3961**

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
9:00	173.01	0.04	6.16	6.8	40283	61789	40163	2.47			Light grey water
10:00	423.81	0.11	5.96	8.6	42877	62471	40606	1.85			Light yellow water
11:00	665.32	0.17	5.94	8.2	42106	61958	40272	1.48			Light yellow water
12:00	907.56	0.23	6.01	10.6	43872	60557	39362	0.83			Light yellow water
13:00	1146.97	0.29	6.01	10.0	41754	58533	38046	2.20			Light yellow water
14:00	1382	0.35	6.25	8.4	33738	49397	32108	2.44			Light yellow water. Radioactive
15:00	1630.95	0.41	6.51	8.9	27546	39793	25866	3.01			Light grey water Radioactive
16:15	1942.02	0.49	6.74	8.9	23173	33458	21748	4.59			Clear water Radioactive

Sample Collection Time: 16:15:00 PM Sept 5th, 2021 **Ship Date:** Sept 4th 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-039	1000	-	-	10
2	GWR-039	250	2 mL 20% sulfuric acid	-	10
3	GWR-039	100	-	-	10
4	GWR-039	100	1.5 mL 17.5% nitric acid	0.45 micron	10
5	GWR-039	100	None (no HCl available)	-	10
6	GWR-039	100	-	-	10
7	GWR-039	4000	40 mL 17.5% nitric acid	-	10
8	GWR-039	80	-	-	10
9	GWR-039	100	-	-	10
10	GWR-039	100	-	-	10

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 4.59

TDS (mg/L) : 21748

SPC (µS/cm) : 33458

C (µS/cm) : 23173

pH : 6.74

Temp. (˚C) : 8.9

GWR-040 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler: M.T.

Project: Wheeler ENG

Date: Sept 1/21

Temperature/Weather: Partly Cloudy 18C

Depth of well (ft): 1364

Screen interval (ft): n/a

Depth of Static Water Level (corrected for angle)(ft): 152

Sampling equip.: Bladder Pump

Purging equip. (circle): 1.9" Redi-flo2 Bailer Air Lift **Grundfos 4" 2HP** Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 1364

B) Depth to water level (ft): 152

C) Water column (A-B)(ft): 1212

D) Well diameter (ID) (ft): 0.7434

E) Casing Volume (gal): **3935**

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
Active Pumping Test. No field parameter monitoring. Sample taken at end of test prior to shutting in. Total pumping of 4,285 gallons (1.09 casing volumes) before sampling.											Refer to pump test form

Sample Collection Time: 14:00 **Ship Date:** Sept 4th 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-040	1000	-	-	10
2	GWR-040	250	2 mL 20% sulfuric acid	-	10
3	GWR-040	100	-	-	10
4	GWR-040	100	1.5 mL 17.5% nitric acid	0.45 micron	10
5	Not Taken (no HCl on site)	n/a	n/a	n/a	10
6	GWR-040	100	-	-	10
7	GWR-040	4000	40 mL 17.5% nitric acid	-	10
8	GWR-040	80	-	-	10
9	GWR-040	100	-	-	10
10	GWR-040	100	-	-	10

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 2.57

TDS (mg/L) : 9947

SPC (µS/cm) : 15302

C (µS/cm) : 11290

pH : 6.84

Temp. (˚C) : 11.3

GWR-040 SAMPLING DATA SHEET (Duplicate)

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler: M.T. Depth of well (ft): 1364

Project: Wheeler ENG Screen interval (ft): n/a

Date: Sept 1/21 Depth of Static Water Level (corrected for angle)(ft): 152

Temperature/Weather: Partly Cloudy 18C

Sampling equip.: Bladder Pump

Purging equip. (circle): 1.9" Redi-flo2 Bailer Air Lift **Grundfos 4" 2HP** Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 1364 D) Well diameter (ID) (ft): 0.7434

B) Depth to water level (ft): 152 E) Casing Volume (gal): **3935**

C) Water column (A-B)(ft): 1212 Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
Active Pumping Test. No field parameter monitoring. Sample taken at end of test prior to shutting in. Total pumping of 4,285 gallons (1.09 casing volumes) before sampling.											Refer to pump test form

Sample Collection Time: 14:00 **Ship Date:** Sept 4th 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-040	1000	-	-	10
2	GWR-040	250	2 mL 20% sulfuric acid	-	10
3	GWR-040	100	-	-	10
4	GWR-040	100	1.5 mL 17.5% nitric acid	0.45 micron	10
5	Not Taken (no HCl on site)	n/a	n/a	n/a	10
6	GWR-040	100	-	-	10
7	GWR-040	4000	40 mL 17.5% nitric acid	-	10
8	GWR-040	80	-	-	10
9	GWR-040	100	-	-	10
10	GWR-040	100	-	-	10

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a SPC (µS/cm) : 15302

H_2S (mg/L) : n/a C (µS/cm) : 11290

Diss. O_2 (mg/L) : 2.57 pH : 6.84

TDS (mg/L) : 9947 Temp. (˚C) : 11.3

GWR-041 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler BB/MC/JC

Project: Wheeler ENG

Date: Sept 6/21

Temperature/Weather: Cloudy 15C

Depth of well (ft):

Screen interval (ft): n/a

Depth of Static Water Level (corrected for angle)(ft): 152

Sampling equip.: Bladder Pump

Purging equip. (circle): 1.9" Redi-flo2 Bailer Air Lift **Grundfos 4" 2HP** Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 1364

B) Depth to water level (ft): 152

C) Water column (A-B)(ft): 1212

D) Well diameter (ID) (ft): 0.7434

E) Casing Volume (gal): **3935**

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
08:00	178.129	0.05	7.16	6.5	33265	51400	33410	6.46			Light grey water
09:00	531.718	0.14	6.99	10.2	31360	43744	28434	6.37			Light grey water
09:30	704.845	0.18	7.05	10.9	27634	37774	24553	5.98			Light grey water
10:00	874.598	0.22	6.81	13.0	26058	33826	21987	6.07			Light grey water
10:30	1045.93	0.27	6.99	11.5	22527	30354	19730	5.97			Light grey water
11:00	1217.6	0.31	6.89	12.4	20805	27373	17792	5.36			Light grey water
11:30	1389.53	0.35	6.77	12.8	18648	24337	15819	5.79			Light grey water
12:00	1556.14	0.40	6.80	10.0	16869	23653	15374	5.99			Light grey water 180 uSv/hr
12:30	1727.67	0.44	6.85	9.5	14996	21308	13854	5.24			Light grey water radioactive
13:00	1903.07	0.48	6.88	8.5	14015	20455	13296	5.09			Light grey water 180 uSv/hr
13:30	2066.22	0.53	6.86	7.8	12926	19227	12497	6.24			Light grey water 180 uSv/hr
14:00	2232.70	0.57	6.83	8.2	12442	18333	11917	7.05			Light grey water radioactive
14:30	2405.96	0.61	6.88	8.0	11584	17143	11143	6.51			Light grey water radioactive
15:00	2576.57	0.65	6.88	8.1	11289	16664	10832	6.93			Light grey water radioactive
15:30	2727.17	0.69	6.88	8.0	9996	14820	9633	6.69			Light grey water radioactive

Sample Collection Time: 15:30:00 PM Sept 6th, 2021 **Ship Date:** Sept 8th 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-041	1000	-	-	10
2	GWR-041	250	2 mL 20% sulfuric acid	-	10
3	GWR-041	100	-	-	10
4	GWR-041	100	1.5 mL 17.5% nitric acid	0.45 micron	10
5	GWR-041	100	None (no HCl available)	-	10
6	GWR-041	100	-	-	10
7	GWR-041	4000	40 mL 17.5% nitric acid	-	10
8	GWR-041	80	-	-	10
9	GWR-041	100	-	-	10
10	GWR-041	100	-	-	10

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) :

TDS (mg/L) :

SPC (µS/cm) :

C (µS/cm) :

pH :

Temp. (˚C) :

GWR-042 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler BB/MC/JC

Project: Wheeler ENG

Date: Sept 7/21

Temperature/Weather: Cloudy 15C

Depth of well (ft):

Screen interval (ft): n/a

Depth of Static Water Level (corrected for angle)(ft):

Sampling equip.: Bladder Pump

Purging equip. (circle): 1.9" Redi-flo2 Bailer Air Lift **Grundfos 4" 2HP** Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft):

B) Depth to water level (ft): 164.9

C) Water column (A-B)(ft):

D) Well diameter (ID) (ft): 0.7434

E) Casing Volume (gal): **0**

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volume (gal)	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	Ferrous Fe (mg/L)	H_2S (mg/L)	Comments
8:30	107.536		6.82	7.4	49976	74270	48926	5.15			Light grey
9:00	272.484		6.58	8.4	51174	75006	48754	5.70			Light grey
9:30	445.568		6.53	9.1	48122	69076	44899	5.84			Light grey
10:00	624		6.46	10.1	46107	64451	41893	5.9			Light yellow
10:30	806		6.44	9.7	42665	60335	39218	6.42			Light yellow
11:00	972.995		6.55	10.9	40965	56073	36447	5.81			Light yellow
11:30	1155.81		6.56	11.5	37733	50796	33017	5.47			Light yellow
12:00	1330.68		6.69	10.0	33872	47492	30870	5.97			Light yellow
12:30	1500.1		6.66	9.8	29149	40992	26376	5.0			Light yellow
13:00	1671.4		6.73	8.5	25271	36723	23890	5.0			Light yellow
13:30	1842.7		6.75	8.2	24034	35233	22860	5.4			Light yellow
14:00	2024.14		6.72	8.3	21541	31671	20586	6.00			Light yellow
14:30	2199.92		6.75	8.3	19830	29156	18951	6.71			Light yellow
15:00	2370.67		6.71	8.3	19150	28139	18290	6.77			Light yellow
15:30	2549.62		6.63	8.4	17865	26140	16991	7.23			Light yellow
16:00	2714.74		6.71	8.6	16567	24146	15695	6.28			light yellow

Sample Collection Time: 16:00:00 PM Sept 7th, 2021 **Ship Date:** Sept 8th 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1	GWR-041	1000	-	-	10
2					
3					
4	GWR-041	100	1.5 mL 17.5% nitric acid	0.45 micron	10
5					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) :

TDS (mg/L) :

SPC (µS/cm) :

C (µS/cm) :

pH :

Temp. (˚C) :

GWR-044 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler: Andrew/Cameron — Depth of well (ft): 1374

Project: Wheeler ENG — Screen interval (ft): 1328.4 - 1354.64

Date: Sept 10/21 — Depth of Static Water Level (corrected for angle)(ft):

Temperature/Weather: Mix Sun and Cloud/Windy 15C

Sampling equip.: 1.9" Redi-flo2 on 3/4" Line

Purging equip. (circle): ' **Redi-flo2 on 3/4" I** Bailer Air Lift Grundfos 4" 2HP Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 1374 — D) Well diameter (ID) (ft): 0.2083

B) Depth to water level (ft): 120 — E) Casing Volume (gal): **316**

C) Water column (A-B)(ft): 1254 — Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (*ft^3 per gal)*

Time	Volume (gal)	Casing Volumes	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	ORP	H_2S (mg/L)	Comments
10:15	9.91	0.03	5.45	8.94	495	712	0.465	3.57	-54.4		
10:30	19.04	0.06	5.44	8.56	357	520	0.339	1.79	-53.5		
11:00	38.55	0.12	5.45	9.54	289	411	0.267	1.8	-47.2		
11:30	57.59	0.18	5.41	9.88	466	656	0.426	1.32	-44.1		
12:00	68.07	0.22	5.37	8.98	475	684	0.445	1.18	-42		
12:30	94.44	0.30	5.45	10.11	136	191	0.124	1.26	-96.6		
13:00	125.15	0.40	5.39	10.02	487	682	0.443	1.3	-94.4		
13:30	156.75	0.50	5.29	8.59	472	686	0.448	1.89	-71.9		
14:00	188.59	0.60	5.38	9.04	534	768	0.498	1.79	-76.2		
14:30	220.23	0.70	5.49	9.82	718	1011	0.657	1.06	-76.8		
15:00	252.34	0.80	5.58	9.77	702	989	0.643	1	-75.7		
15:30	284.55	0.90	5.59	10.29	656	912	0.593	0.84	-71.7		
16:00	316.37	1.00	5.64	9.59	568	805	0.523	0.92	-70.5		
16:30	347.43	1.10	5.68	9.94	571	801	0.521	0.86	-68.4		
17:00	378.63	1.20	5.72	9.9	443	623	0.404	0.94	-69		
17:30	410.08	1.30	5.73	9.65	514	727	0.472	0.71	-90.1		
18:00	441.53	1.40	5.69	7.5	354	531	0.345	0.45	-76		sample collected here

Sample Collection Time: 16:00:00 PM Sept 11th, 2021 **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a — SPC (µS/cm) : 682

H_2S (mg/L) : n/a — C (µS/cm) : 487

Diss. O_2 (mg/L) : 1.3 — pH : 5.39

TDS (mg/L) : 0.443 — Temp. (˚C) : 10.02

ORP -76

GWR-046 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler Andrew/Cameron

Project: Wheeler ENG

Date: Sept 8/21

Temperature/Weather: Sunny 18C

Depth of well (ft): 498.6

Screen interval (ft): 488.76 - 498.6

Depth of Static Water Level (corrected for angle)(ft): 119.8

Sampling equip.: Bladder Pump

Purging equip. (circle): ' **Redi-flo2 on 3/4" l** Bailer Air Lift Grundfos 4" 2HP Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 498.6

B) Depth to water level (ft): 119.8

C) Water column (A-B)(ft): 378.8

D) Well diameter (ID) (ft): 0.2083

E) Casing Volume (gal): **96**

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (ft^3 *per gal)*

Time	Volume (gal)	Casing Volumes	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	ORP	H_2S (mg/L)	Comments
13:45	0										began pump test at 1 gpm but quickly decreased as water level continued to drop
14:00	6.2		6.05	19.66	607	680	0.436	5.95	-46.5		pumping at about 0.25 gpm before stopping test. Sampled water was clear without sediment.
18:20	12.2		6.37	10.24	136	192	0.123	12.2	51.1		air lifted about 6 gallons from well and took a sample at the end.

Sample Collection Time: 16:00:00 PM Sept 4th, 2021 **Ship Date:** Sept 4th 2021

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 0

TDS (mg/L) : 0

SPC (µS/cm) : 0

C (µS/cm) : 0

pH : 0

Temp. (˚C) : 0

GWR-047 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler Andrew/Cameron

Project: Wheeler ENG

Date: Sept 9/21

Temperature/Weather: Cloudy 15C

Depth of well (ft): 925

Screen interval (ft): 915.16 - 925

Depth of Static Water Level (corrected for angle)(ft): 123.05

Sampling equip.: 1.9" Redi-flo2 on 3/4" Line

Purging equip. (circle): ' **Redi-flo2 on 3/4"**] Bailer Air Lift Grundfos 4" 2HP Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 925

B) Depth to water level (ft): 123.05

C) Water column (A-B)(ft): 801.95

D) Well diameter (ID) (ft): 0.2083

E) Casing Volume (gal): **202**

Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (ft^3 *per gal)*

Time	Volume (gal)	Casing Volumes	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	ORP	H_2S (mg/L)	Comments
11:15	13		6.21	9.57	322	459	0.295	2.88	-90		
11:30	25.4		6.17	9.73	76	107	0.07	1.71	-82.3		
11:45	36.8		6.44	9.61	88	124	0.081	2.32	-89.8		
12:00	49.1		6.56	9.93	92	129	0.084	2.91	-90.3		
12:30	70.5		6.45	10.88	99	136	0.088	1.82	-86.5		
13:00	93		6.58	10.31	95	133	0.086	1.38	-86.7		
13:30	114.6		6.47	9.51	97	138	0.09	3.14	-84.5		
14:00	136.5		6.5	10.09	118	164	0.107	3.8	-81.7		
14:30	157		6.58	10.94	151	206	0.134	1.82	-86.1		
15:00	178.7		6.68	10.75	156	214	0.139	0.98	-87.4		
15:30	200.1		6.54	11.39	153	207	0.135	1.04	-82.2		
16:00	223.6		6.46	10.92	146	199	0.130	1.34	-79.5		
16:30	246.2		6.48	10.4	141	195	0.127	1.89	-82.8		
17:00	269		6.49	10.37	136	189	0.123	1.32	-79		
17:30	291		6.5	10.61	134	184	0.120	1.53	-84.7		
18:00	298.6		6.47	9.35	125	179	0.116	0.7	-75.9		
18:30	326.4		6.33	10.09	122	171	0.111	8.44	-77.6		high DO readings from conditioning bottles with sample water and then putting in bucket for YSI test
19:00	344.9		6.38	10.44	123	171	0.111	1.5	-80.9		

Sample Collection Time: 18:30:00 Sept 9th, 2021 **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a

H_2S (mg/L) : n/a

Diss. O_2 (mg/L) : 3.14

TDS (mg/L) : 0.09

SPC (µS/cm) : 138

C (µS/cm) : 97

pH : 6.47

Temp. (˚C) : 9.51

ORP -84.5

GWR-048 SAMPLING DATA SHEET

Drill Hole ID or QA/QC ID:

Dip: -90 Sampler: Andrew/Cameron — Depth of well (ft): 1246.4

Project: Wheeler ENG — Screen interval (ft): 1236.56 - 1246.4

Date: Sept 10/21 — Depth of Static Water Level (corrected for angle)(ft): 124.05

Temperature/Weather: Mix Sun and Cloud/Windy 15C

Sampling equip.: 1.9" Redi-flo2 on 3/4" Line

Purging equip. (circle): ' **Redi-flo2 on 3/4" l** Bailer Air Lift Grundfos 4" 2HP Grundfos 3" 5SQE5-450

A) Bottom of well depth (ft): 1246.4 — D) Well diameter (ID) (ft): 0.2083

B) Depth to water level (ft): 124.05 — E) Casing Volume (gal): **283**

C) Water column (A-B)(ft): 1122.35 — Casing Volume = $\pi * (D/2)^2 * C * 7.48$ (ft^3 *per gal)*

Time	Volume (gal)	Casing Volumes	pH	Temp. (˚C)	Cond. (µS/cm)	SPC (µS/cm)	Total Dissolved Solids (TDS)	Diss. O_2 (mg/L)	ORP	H_2S (mg/L)	Comments
11:30	18.61		5.77	7.19	70	106	0.069	2.16	-64.7		
12:00	61.42		5.91	8.38	73	108	0.070	1.53	-69.5		
12:30	103.65		5.77	9.18	75	107	0.070	1.15	-63.3		
13:00	149.23		5.8	8.83	74	107	0.070	1.25	-62.3		
13:30	189.57		6.13	10.42	103	143	0.093	1.45	-68.5		upped pump speed after this sample from 1.45gpm to 1.85gpm
14:00	245.38		6.12	9.69	121	171	0.111	1.42	-61.9		
14:30	303.53		6.08	8.44	111	163	0.106	1.74	-57.5		
15:00	363.60		6.32	10.55	116	160	0.104	1.39	-70.2		
15:30	419.27		6.1	9.21	108	155	0.101	0.99	-57.6		
16:00	472.43		6.07	8.19	99	145	0.095	1.71	-56.9		
16:30											
17:00											
17:30											
18:00											
18:30											
19:00											
19:30											
20:00											

Sample Collection Time: 16:00:00 PM Sept 10th, 2021 **Ship Date:**

Bottle	Sample ID	Vol. (mL)	Preservatives	Filtered?	Storage Temp. (˚C)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Final Sample Field Parameters

Ferrous Fe (mg/L) : n/a — SPC (µS/cm) : 163

H_2S (mg/L) : n/a — C (µS/cm) : 111

Diss. O_2 (mg/L) : 1.74 — pH : 6.08

TDS (mg/L) : 0.106 — Temp. (˚C) : 8.44

ORP -57.5

Appendix H Analytical Reports and QA/QC

EcoMetrix INCORPORATED

2020 Data Quality Verification

Project Name: Denison Groundwater Sampling Results	**Project Number:** 19-2642
Report Title: N/A	**Revision Number:** 001
Author's Name: Neera Sundaralingam	**Review Type:** Analytical Data Review

Section 1: Data Verification

Sample Media: ☐Soil ☐Sediment ☐Rock/Core ☐Ballast ☒Groundwater ☐Surface Water ☐Other: Click here to enter text.	Number of Samples: **202009126**: 7 (incl 1 dup, 1 FB, 1 Equipment Rinse), GWR-032, GWR-031, GWR-011, GWR-013 **202009522**: 1, GWR-003 **202009866**: 2, GWR-025, GWR-006 **202010201**: 4, GWR-014, GWR-005, GWR-012, GWR-029 **202010517**: 1, GWR-008 **202010932**: 1, GWR-009 **202013266**: 1, GWR-037 **202013483**: 1, GWR-034 **202013732**: 6 (3 samples that were submitted twice, filtered and unfiltered) GWR-033, GWR-036, GWR-035 and the same samples filtered to 0.2 um. Filtered samples were only analyzed for dissolved metals **201910289**: 7 (incl 1 FB and 1 TB) DH17-3, MW17-2, DH17-5, MW17-3, DH17-6 **201810_WRE_RPT_GWResults**: 7, (incl 1 TB) DH17-3, MW17-1, DH17-5, MW17-3, DH17-6, O-37 **201807466:** 6, (incl 1 TB) DH17-3, MW17-1, DH17-5, MW17-3, DH17-6 **201906039:** 7 (incl FB and TB) DH17-3, MW17-1, DH17-5, MW17-3, DH17-6
All samples are accounted for in field sheets, Chain of Custody Forms and Laboratory Certificates of Analysis? If not, explain. 202009126, 202009522, 202009866, 202010201, 202010517, 202010932, 202013266, 202013483, 202013732: Yes for Excel and COA, no COC provided	

<table>
<tr><td colspan="2">202010289, 2018_WRE_RPT_GWResults, 201807466, 201906039: Excel file only available</td></tr>
<tr><td>Duplicate Samples Collected/Analysed?
☒ Yes
☐ No

If Yes:
Duplicate Sample ID: 202009126: 8/9/2020 16:10 GWR-031 DUPLICATE
Primary Sample ID: 202009126: 8/9/2020 16:10 GWR-031</td><td>Relative percent difference (RPD) for primary and duplicate sample

All less than 30% with the exception of arsenic (66%) (1 to 2 ug/L)

Primary and duplicate sample results satisfy the data quality criteria?

Yes</td></tr>
<tr><td>Quality Control Samples Collected?

☒ Field Blank
Sample ID: 202009126:8/9/2020 15:30 BLANK 202010289: 7/22/2019 11:15 FIELD BLANK (L-42) 201906039: 5/14/2019 12:00 BLANK (FIELD BLANK L-42)
☒ Trip Blank
Sample ID: 201910289: 7/23/2019 TRAVEL BLANK (L-42)
2018_WRE_RPT_GWResults: TRAVEL BLANK
201817466: TRIP BLANK O-37
201906039: 5/14/2019 12:00 BLANK (FIELD BLANK L-42)
☒ Equipment Rinse
Sample ID 202009126: 8/9/2020 15:45 EQUIPMENT RINSE
☐ Other:Click here to enter text.
Sample ID Click here to enter text.</td><td>Quality control sample results meet data quality objectives?

Yes blanks remained below detection limits, equipment rinse remained generally below detection or within same order of magnitude of detection limit.

Field blank from 201906039 reported a zinc concentration slightly above the detection limit (0.0018 mg/L, detection limit: 0.0005 mg/L)</td></tr>
<tr><td colspan="2">Laboratory deviations from requested analyses?
202009126:
8/8/2020 08:25 GWR-032: Air was bubbled through the sample before the gamma spectroscopy analysis to reduced the interferences caused by high activity of Radon.Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.
202009522:
8/16/2020 15:00 GWR-003 Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. This sample was reanalyzed</td></tr>
</table>

for Fluoride. Reanalysis confirms original results are within the expected measurement uncertainty.

202009866:

Holding time for Organic carbon, dissolved between sampling and receipt in lab exceeds the recommended 24 hours.

8/22/2020 10:30 GWR-025 Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

8/22/2020 15:00 GWR-006 This sample was reanalyzed for Total suspended solids. Reanalysis confirms original results are within the expected measurement uncertainty.

202010201:

8/29/2020 09:00 GWR-014 Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

8/29/2020 10:30 GWR-005 Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. This sample was reanalyzed for Ortho-phosphate as P. Reanalysis confirms original results are within the expected measurement uncertainty.

202010517:

9/6/2020 09:00 GWR-008 This sample was reanalyzed for Ortho-phosphate as P. Reanalysis confirms original results are within the expected measurement uncertainty. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

202010932:

9/14/2020 15:30 GWR-009 Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. Radon result is corrected for decay to the time of sample collection.

202013266:

10/24/2020 16:40 GWR-037 An external instrument, that is outside of SRC's direct control, was used for the analysis of Radon-222. Additional quality control measures were put in place to mitigate any associated risks. This sample was reanalyzed for Total dissolved solids. Reanalysis confirms original results are within the expected measurement uncertainty. Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

202013483:

10/30/2020 17:00 GWR-034 Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Radon result is corrected for decay to the time of sample collection. An external instrument, that is outside of SRC's direct control, was used for the analysis of Radon-222 and Tritium. Additional quality control measures were put in place to mitigate any associated risks.

202013732:

Radon results are corrected for decay to the time of sample collection. An external instrument, that is outside of SRC's direct control, was used for the analysis of Radon-

222. Additional quality control measures were put in place to mitigate any associated risks. 11/3/2020 16:30 GWR-033 Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. 11/5/2020 12:00 GWR-036 Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. 11/3/2020 11:30 GWR-035 Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. **201810_WRE_RPT_GWResults**: 10/4/2018 09:50 O-37 The sample for radionuclides was acidified in the lab. Due to the time lapse from sampling to acidification, we can not guarantee that the results accurately reflect the concentration at the time of sampling. Comments within Laboratory Certificates of Analysis regarding data quality 202009126, 202009522, 202009866, 202010201, 202010517, 202010932, 202013266, 202013483, 202013732 – All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Plan Chapter, for the purposes of certifying laboratory analysis. Test methods and data are validated by the laboratory's QA program 201910289, 201906039, 201807466: Excel only available, the reported results indicated no concerns with the reported results. 201810_WRE_RPT_GWResults: Cannot guarantee the results accurately reflect concentration at time of sampling for radionuclides due to time lapse from sampling to acidifcation for O-37
Overall, does the dataset satisfy the data quality objectives and meet the project requirements? 202009126, 202009522, 202009866, 202010201, 202010517, 202010932, 202013266, 202013483, 202013732– Yes 201910289, 201807466, 201906039– Missing Lab CoA, need to verify in order to ensure data meets requirements *Radionuclides from O-37 (201810_WRE_RPT_GWResults) may not meet requirements, also missing CoA, need to verify in order to ensure data meets requirements*

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Section 3: Review Completion

Reviewer's Name & Signature:	**Date:**	**Author's Name & Signature:**	**Date:**
Click here to enter text.	Click here to enter a date	Neera Sundaralingam	3 March 2021

202009126 RPD Calculation

Group #		2020-9126	2020-9126	Percent Difference (%)
Sample #		38101	38104	([Primary-Duplicate]/(Primary + Duplicate)) x 100
Description		8/9/2020 16:10 GWR-031	8/9/2020 16:10 GWR-031 DUPLICATE	
Sample Type		WATER	WATER	
Parameter	**Unit**			
Bicarbonate	mg/L	167	168	0.6
Carbonate	mg/L	<1	<1	-
Chloride	mg/L	151	150	0.7
Hydroxide	mg/L	<1	<1	-
P. alkalinity	mg/L	<1	<1	-
pH	pH units	7.36	7.34	0.3
Specific conductivity	uS/cm	810	810	0.0
Sum of ions	mg/L	504	504	0.0
Total alkalinity	mg/L	137	138	0.7
Total hardness	mg/L	190	190	0.0
Ammonia as nitrogen	mg/L	0.05	0.05	0.0
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	<0.04	-
Nitrite	mg/L	<0.03	<0.03	-
Nitrite+Nitrate as nitrogen	mg/L	<0.01	<0.01	-
Ortho-phosphate as P	mg/L	<0.01	<0.01	-
Organic carbon, dissolved	mg/L	68	69	1.5
Fluoride	mg/L	0.32	0.33	3.1
Total dissolved solids	mg/L	536	528	1.5
Total suspended solids	mg/L	5	6	18.2
Lead-210	Bq/L	1100	1100	0.0
Polonium-210	Bq/L	460	410	11.5
Radium-226	Bq/L	120	120	0.0
Radon-222	Bq/L	5900	6400	8.1
Thorium-230	Bq/L	1.1	0.9	20.0
Tritium	Bq/L	<15	<15	-
Calcium	mg/L	58	58	0.0
Magnesium	mg/L	11	11	0.0
Potassium	mg/L	5.5	5.5	0.0

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202009126 RPD Calculation

Group #		2020-9126	2020-9126	Percent Difference (%)
Sample #		38101	38104	([Primary-Duplicate]/(Primary + Duplicate)) x 100
Description		8/9/2020 16:10 GWR-031	8/9/2020 16:10 GWR-031 DUPLICATE	
Sample Type		WATER	WATER	
Parameter	Unit			
Sodium	mg/L	71	71	0.0
Sulfate	mg/L	40	40	0.0
Aluminum, dissolved	mg/L	<0.005	0.006	-
Antimony, dissolved	mg/L	<0.002	<0.002	-
Arsenic, dissolved	ug/L	1	2	66.7
Barium, dissolved	mg/L	0.052	0.052	0.0
Beryllium, dissolved	mg/L	<0.001	<0.001	-
Bismuth, dissolved	mg/L	<0.002	<0.002	-
Boron, dissolved	mg/L	0.5	0.5	0.0
Bromine	ug/L	1100	1100	0.0
Cadmium, dissolved	mg/L	<0.0001	<0.0001	-
Chromium, dissolved	mg/L	0.009	0.009	0.0
Cobalt, dissolved	mg/L	0.002	0.002	0.0
Copper, dissolved	mg/L	<0.002	<0.002	-
Iron, dissolved	mg/L	3.6	3.6	0.0
Lead, dissolved	mg/L	0.001	0.001	0.0
Lithium, dissolved	ug/L	89	88	1.1
Manganese, dissolved	mg/L	0.22	0.22	0.0
Molybdenum, dissolved	mg/L	0.062	0.062	0.0
Nickel, dissolved	mg/L	0.040	0.039	2.5
Selenium, dissolved	mg/L	<0.001	<0.001	-
Silica, soluble, dissolved	mg/L	10.0	10.0	0.0
Silver, dissolved	mg/L	<0.0005	<0.0005	-
Strontium, dissolved	mg/L	1.4	1.4	0.0
Sulfur	mg/L	13	13	0.0
Thallium, dissolved	mg/L	<0.002	<0.002	-
Tin, dissolved	mg/L	<0.001	<0.001	-
Titanium, dissolved	mg/L	<0.002	<0.002	-
Uranium, dissolved	ug/L	17	16	6.1
Vanadium, dissolved	mg/L	<0.001	<0.001	-
Zinc, dissolved	mg/L	18.4	18.4	0.0
Phosphorus, dissolved	mg/L	<0.1	<0.1	-
Uranium-234 calculated	Bq/L	0.46	0.45	2.2
Uranium-238 calculated	Bq/L	0.46	0.45	2.2

"-" RPD calculation not possible as primary and/or duplicate sample reported concentration as less than the laboratory detection limit

EcoMetrix INCORPORATED

Environmental Analytical Laboratories
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Saskatoon, SK S7N 3R2
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	Group #				2019-10289			
	Sample #	40996	40997	40998	40999	41000	41001	41002
	Description	7/22/2019 12:00 DH17-3	7/22/2019 11:15 MW17-1	7/22/2019 13:10 DH17-5	7/22/2019 14:11 MW17-3	7/22/2019 13:10 DH17-6	7/22/2019 11:15 FIELD BLANK (L-42)	7/23/2019 TRAVEL BLANK (L-42)
	Sample Type	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Analyte	**Units**							
Bicarbonate	mg/L	56	27	48	51	46	2	2
Carbonate	mg/L	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	0.7	0.3	0.1	0.3	0.1	<0.1	<0.1
Hydroxide	mg/L	<1	<1	<1	<1	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1	<1	<1	<1	<1
pH	pH units	7.10	6.98	7.06	7.61	7.17	5.74	5.62
Specific conductivity	uS/cm	102	62	70	90	70	<1	<1
Sum of ions	mg/L	87	51	65	80	64	2	2
Total alkalinity	mg/L	46	22	39	42	38	2	2
Total hardness	mg/L	35	20	28	25	30	<1	<1
Nitrate	mg/L	0.04	<0.04	0.21	0.30	0.22	<0.04	<0.04
Fluoride	mg/L	0.08	0.07	0.03	0.17	0.03	<0.01	<0.01
Lead-210	Bq/L						<0.02	<0.02
Lead-210, dissolved	Bq/L	<0.02	<0.02	<0.02	<0.02	<0.02		
Polonium-210	Bq/L						<0.005	<0.005
Polonium-210, dissolved	Bq/L	0.005	<0.005	<0.005	<0.005	0.009		
Radium-226	Bq/L						<0.005	<0.005
Radium-226, dissolved	Bq/L	<0.005	<0.005	<0.005	0.009	0.01		
Thorium-228	Bq/L						<0.01	<0.01
Thorium-228, dissolved	Bq/L	<0.01	<0.01	<0.01	<0.01	0.02		
Thorium-230	Bq/L						<0.01	<0.01
Thorium-230, dissolved	Bq/L	<0.01	<0.01	<0.01	<0.01	<0.01		
Thorium-232	Bq/L						<0.01	<0.01
Thorium-232, dissolved	Bq/L	<0.01	<0.01	<0.01	<0.01	<0.01		
Calcium	mg/L	12	5.9	10	8.2	11	<0.1	<0.1
Magnesium	mg/L	1.3	1.2	0.7	1.2	0.7	<0.1	<0.1
Potassium	mg/L	1.0	1.3	0.5	0.8	0.4	<0.1	<0.1
Sodium	mg/L	7.2	4.4	3.6	11	3.6	0.1	0.1
Sulfate	mg/L	8.8	11	2.2	7.0	2.2	<0.2	<0.2

Aluminum	mg/L	0.37	0.11	2.0	0.88	2.4	0.0008	0.0009
Aluminum, dissolved	mg/L	0.0031	0.0080	0.023	0.0050	0.023		
Antimony	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
Arsenic	ug/L	2.6	0.5	2.0	3.4	1.8	<0.1	<0.1
Arsenic, dissolved	ug/L	0.9	0.3	0.3	0.8	0.3		
Barium	mg/L	0.031	0.0089	0.037	0.040	0.034	<0.0005	<0.0005
Barium, dissolved	mg/L	0.029	0.0061	0.017	0.010	0.017		
Beryllium	mg/L	<0.0001	<0.0001	0.0001	0.0002	0.0001	<0.0001	<0.0001
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Boron	mg/L	<0.01	<0.01	0.02	0.17	0.11	<0.01	<0.01
Boron, dissolved	mg/L	<0.01	<0.01	<0.01	0.10	<0.01		
Cadmium	mg/L	0.00004	0.00002	0.00007	0.00020	0.00006	<0.00001	<0.00001
Cadmium, dissolved	mg/L	<0.00001	<0.00001	0.00001	<0.00001	0.00002		
Chromium	mg/L	0.0070	0.0015	0.028	0.019	0.020	<0.0005	<0.0005
Chromium, dissolved	mg/L	<0.0005	<0.0005	0.0006	0.0005	0.0006		
Cobalt	mg/L	0.014	0.0003	0.0013	0.0020	0.0011	<0.0001	<0.0001
Cobalt, dissolved	mg/L	0.0082	0.0002	0.0003	0.0001	0.0004		
Copper	mg/L	0.0076	<0.0002	0.011	0.020	0.007	<0.0002	<0.0002
Copper, dissolved	mg/L	0.0025	0.0006	0.0015	0.0003	0.0005		
Iron	mg/L	2.89	0.30	5.1	2.3	4.0	<0.0005	<0.0005
Iron, dissolved	mg/L	1.57	0.14	0.33	0.019	0.32		
Lead	mg/L	0.0007	0.0001	0.0027	0.0025	0.0016	<0.0001	<0.0001
Lead, dissolved	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Manganese	mg/L	0.40	0.20	0.13	0.19	0.12	<0.0005	<0.0005
Manganese, dissolved	mg/L	0.44	0.20	0.11	0.036	0.12		
Molybdenum	mg/L	0.0060	0.0031	0.0096	0.026	0.0076	<0.0001	<0.0001
Molybdenum, dissolved	mg/L	0.0055	0.0028	0.0025	0.026	0.0027		
Nickel	mg/L	0.0032	0.0017	0.0056	0.014	0.0039	0.0002	<0.0001
Nickel, dissolved	mg/L	0.0007	0.0005	0.0010	0.0009	0.0010		
Selenium	mg/L	<0.0001	<0.0001	0.0002	0.0002	0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	0.0002	<0.0001		
Silver	mg/L	<0.00005	<0.00005	0.0014	0.00047	0.00074	<0.00005	<0.00005
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005		

Strontium	mg/L	0.035	0.027	0.029	0.052	0.033	<0.0005	<0.0005
Strontium, dissolved	mg/L	0.044	0.026	0.018	0.030	0.018		
Thallium	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
Tin	mg/L	<0.0001	<0.0001	0.0005	0.0003	0.0003	<0.0001	<0.0001
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
Titanium	mg/L	0.016	0.0059	0.085	0.030	0.13	<0.0002	<0.0002
Titanium, dissolved	mg/L	<0.0002	<0.0002	0.0002	<0.0002	0.0004		
Uranium	ug/L	0.3	0.1	0.6	1.5	0.7	<0.1	<0.1
Uranium, dissolved	ug/L	<0.1	<0.1	0.2	0.3	0.2		
Vanadium	mg/L	0.0009	0.0002	0.0056	0.0019	0.0048	<0.0001	<0.0001
Vanadium, dissolved	mg/L	<0.0001	<0.0001	0.0002	0.0002	0.0002		
Zinc	mg/L	0.013	0.0039	0.019	0.018	0.008	0.0022	<0.0005
Zinc, dissolved	mg/L	0.0035	0.0027	0.0040	0.0020	0.0028		

Note for 41001: This sample was reanalyzed for Zinc. Reanalysis confirms original results are within the expected measurement uncertainty.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Aug-10-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Aug-10-2020 Client P.O.: E0220015

38100	**08/08/2020 08:25 GWR-032**	***WATER***
38101	**08/09/2020 16:10 GWR-031**	***WATER***
38102	**08/08/2020 16:30 GWR-011**	***WATER***

Analyte	Units	38100	38101	38102
Lab Section 1				
Bicarbonate	mg/L	174	167	54
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	234	151	Not Requested
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
Chloride	mg/L	Not Requested	Not Requested	7.4
pH	pH units	7.33	7.36	7.83
Specific conductivity	uS/cm	1000	810	115
Sum of ions	mg/L	598	504	92
Total alkalinity	mg/L	143	137	44
Total hardness	mg/L	256	190	38
Ammonia as nitrogen	mg/L	0.31	0.05	0.26
Nitrate (calc. from NO2+NO3-N)	mg/L	0.04	<0.04	<0.04
Nitrite	mg/L	<0.03	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.01	<0.01	<0.01
Ortho-phosphate as P	mg/L	<0.01	<0.01	0.11
Organic carbon, dissolved	mg/L	36	68	3.6
Fluoride	mg/L	0.19	0.32	0.20
Total dissolved solids	mg/L	628	536	101
Total suspended solids	mg/L	11	5	171
Lab Section 2				
Calcium	mg/L	78	58	13
Magnesium	mg/L	15	11	1.3
Potassium	mg/L	5.4	5.5	2.4
Sodium	mg/L	83	71	8.4
Sulfate	mg/L	8.0	40	5.5
Aluminum, dissolved	mg/L	0.0057	<0.005	0.0082
Antimony, dissolved	mg/L	<0.0002	<0.002	0.0014
Arsenic, dissolved	ug/L	0.3	1	4.1
Barium, dissolved	mg/L	0.083	0.052	0.21
Beryllium, dissolved	mg/L	<0.0001	<0.001	<0.0001

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

38100	**08/08/2020 08:25**	**GWR-032**	***WATER***
38101	**08/09/2020 16:10**	**GWR-031**	***WATER***
38102	**08/08/2020 16:30**	**GWR-011**	***WATER***

Analyte	Units	38100	38101	38102
Lab Section 2				
Bismuth, dissolved	mg/L	<0.0002	<0.002	<0.0002
Boron, dissolved	mg/L	0.59	0.5	0.04
Bromine	ug/L	2300	1100	100
Cadmium, dissolved	mg/L	<0.00001	<0.0001	<0.00001
Chromium, dissolved	mg/L	0.0011	0.009	<0.0005
Cobalt, dissolved	mg/L	<0.0001	0.002	<0.0001
Copper, dissolved	mg/L	<0.0002	<0.002	0.0006
Iron, dissolved	mg/L	6.4	3.6	0.012
Lead, dissolved	mg/L	0.0005	0.001	<0.0001
Lithium, dissolved	ug/L	75	89	10
Manganese, dissolved	mg/L	0.24	0.22	0.085
Molybdenum, dissolved	mg/L	0.0059	0.062	0.028
Nickel, dissolved	mg/L	0.0014	0.040	0.0003
Selenium, dissolved	mg/L	<0.0001	<0.001	0.0001
Silica, soluble, dissolved	mg/L	13.5	10.0	22.5
Silver, dissolved	mg/L	<0.00005	<0.0005	<0.00005
Strontium, dissolved	mg/L	2.51	1.4	0.13
Sulfur	mg/L	2.7	13	1.8
Thallium, dissolved	mg/L	<0.0002	<0.002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.001	<0.0001
Titanium, dissolved	mg/L	<0.0002	<0.002	<0.0002
Uranium, dissolved	ug/L	5.7	17	9.0
Vanadium, dissolved	mg/L	0.0004	<0.001	0.0005
Zinc, dissolved	mg/L	5.0	18.4	0.0018
Phosphorus, dissolved	mg/L	<0.01	<0.1	0.15
Uranium-234 calculated	Bq/L	0.21	0.46	0.36
Uranium-238 calculated	Bq/L	0.21	0.46	0.36
Lab Section 4				
Polonium-210	Bq/L	260	460	0.4
Radon-222	Bq/L	2700000	5900	90
Thorium-230	Bq/L	2	1.1	0.3
Tritium	Bq/L	950	<15	<15
Radium-226	Bq/L	400	120	Not Requested
Lead-210	Bq/L	Not Requested	Not Requested	0.6
Radium-226	Bq/L	Not Requested	Not Requested	1.0
Lead-210	Bq/L	3300	1100	Not Requested

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 38100
Air was bubbled through the sample before the gamma spectroscopy analysis to reduced the interferences caused by high activity of Radon.

Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.

Radon results are corrected for decay to the time of sample collection.

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

38103 08/09/2020 10:45 GWR-013 *WATER*
38104 08/09/2020 16:10 GWR-031 DUPLICATE *WATER*

Analyte	Units	38103	38104
Lab Section 1			
Bicarbonate	mg/L	105	168
Carbonate	mg/L	24	<1
Chloride	mg/L	0.6	Not Requested
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	20	<1
Chloride	mg/L	Not Requested	150
pH	pH units	9.30	7.34
Specific conductivity	uS/cm	248	810
Sum of ions	mg/L	210	504
Total alkalinity	mg/L	126	138
Total hardness	mg/L	57	190
Ammonia as nitrogen	mg/L	0.68	0.05
Nitrate (calc. from NO2+NO3-N)	mg/L	0.04	<0.04
Nitrite	mg/L	0.05	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.01	<0.01
Ortho-phosphate as P	mg/L	0.03	<0.01
Organic carbon, dissolved	mg/L	7.9	69
Fluoride	mg/L	0.13	0.33
Total dissolved solids	mg/L	182	528
Total suspended solids	mg/L	28	6
Lab Section 2			
Calcium	mg/L	21	58
Magnesium	mg/L	1.1	11
Potassium	mg/L	6.7	5.5
Sodium	mg/L	34	71
Sulfate	mg/L	17	40
Aluminum, dissolved	mg/L	0.025	0.006
Antimony, dissolved	mg/L	0.0008	<0.002
Arsenic, dissolved	ug/L	3.1	2
Barium, dissolved	mg/L	0.041	0.052
Beryllium, dissolved	mg/L	<0.0001	<0.001
Bismuth, dissolved	mg/L	<0.0002	<0.002
Boron, dissolved	mg/L	0.02	0.5
Bromine	ug/L	8	1100
Cadmium, dissolved	mg/L	<0.00001	<0.0001
Chromium, dissolved	mg/L	<0.0005	0.009

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

38103 08/09/2020 10:45 GWR-013 *WATER*
38104 08/09/2020 16:10 GWR-031 DUPLICATE *WATER*

Analyte	Units	38103	38104
Lab Section 2			
Cobalt, dissolved	mg/L	<0.0001	0.002
Copper, dissolved	mg/L	0.0006	<0.002
Iron, dissolved	mg/L	0.086	3.6
Lead, dissolved	mg/L	<0.0001	0.001
Lithium, dissolved	ug/L	8.8	88
Manganese, dissolved	mg/L	0.026	0.22
Molybdenum, dissolved	mg/L	0.018	0.062
Nickel, dissolved	mg/L	0.0024	0.039
Selenium, dissolved	mg/L	0.0001	<0.001
Silica, soluble, dissolved	mg/L	19.2	10.0
Silver, dissolved	mg/L	<0.00005	<0.0005
Strontium, dissolved	mg/L	0.16	1.4
Sulfur	mg/L	5.7	13
Thallium, dissolved	mg/L	<0.0002	<0.002
Tin, dissolved	mg/L	0.0001	<0.001
Titanium, dissolved	mg/L	<0.0002	<0.002
Uranium, dissolved	ug/L	14	16
Vanadium, dissolved	mg/L	0.0019	<0.001
Zinc, dissolved	mg/L	0.0010	18.4
Phosphorus, dissolved	mg/L	0.10	<0.1
Uranium-234 calculated	Bq/L	0.29	0.45
Uranium-238 calculated	Bq/L	0.29	0.45
Lab Section 4			
Lead-210	Bq/L	0.4	Not Requested
Polonium-210	Bq/L	0.4	410
Radium-226	Bq/L	0.5	Not Requested
Radon-222	Bq/L	34	6400
Thorium-230	Bq/L	0.2	0.9
Radium-226	Bq/L	Not Requested	120
Tritium	Bq/L	<15	<15
Lead-210	Bq/L	Not Requested	1100

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Radon results are corrected for decay to the time of sample collection.

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

38105 08/09/2020 15:30 BLANK *WATER*
38106 08/09/2020 15:45 EQUIPMENT RINSE *WATER*

Analyte	Units	38105	38106
Lab Section 1			
Bicarbonate	mg/L	<1	<1
Carbonate	mg/L	<1	<1
Chloride	mg/L	<0.1	<0.1
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	5.79	5.88
Specific conductivity	uS/cm	<1	<1
Sum of ions	mg/L	<1	<1
Total alkalinity	mg/L	<1	<1
Total hardness	mg/L	<1	<1
Ammonia as nitrogen	mg/L	0.02	0.02
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	0.09
Nitrite	mg/L	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	0.02
Ortho-phosphate as P	mg/L	<0.01	<0.01
Organic carbon, dissolved	mg/L	<0.2	<0.2
Fluoride	mg/L	<0.01	<0.01
Total dissolved solids	mg/L	<5	6
Total suspended solids	mg/L	<1	2
Lab Section 2			
Calcium	mg/L	<0.1	<0.1
Magnesium	mg/L	<0.1	<0.1
Potassium	mg/L	<0.1	<0.1
Sodium	mg/L	<0.1	0.2
Sulfate	mg/L	<0.2	<0.2
Aluminum, dissolved	mg/L	0.0006	0.0012
Antimony, dissolved	mg/L	<0.0002	<0.0002
Arsenic, dissolved	ug/L	<0.1	<0.1
Barium, dissolved	mg/L	<0.0005	<0.0005
Beryllium, dissolved	mg/L	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002
Boron, dissolved	mg/L	<0.01	<0.01
Bromine	ug/L	5	<5
Cadmium, dissolved	mg/L	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005
Cobalt, dissolved	mg/L	<0.0001	<0.0001

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

38105 08/09/2020 15:30 BLANK *WATER*
38106 08/09/2020 15:45 EQUIPMENT RINSE *WATER*

Analyte	Units	38105	38106
Lab Section 2			
Copper, dissolved	mg/L	<0.0002	0.0004
Iron, dissolved	mg/L	<0.0005	0.0024
Lead, dissolved	mg/L	<0.0001	<0.0001
Lithium, dissolved	ug/L	<0.1	<0.1
Manganese, dissolved	mg/L	<0.0005	<0.0005
Molybdenum, dissolved	mg/L	<0.0001	0.0002
Nickel, dissolved	mg/L	<0.0001	<0.0001
Selenium, dissolved	mg/L	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	<0.02	1.8
Silver, dissolved	mg/L	<0.00005	<0.00005
Strontium, dissolved	mg/L	<0.0005	<0.0005
Sulfur	mg/L	<0.05	<0.05
Thallium, dissolved	mg/L	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	<0.0002
Uranium, dissolved	ug/L	<0.1	<0.1
Vanadium, dissolved	mg/L	<0.0001	<0.0001
Zinc, dissolved	mg/L	<0.0005	0.0020
Phosphorus, dissolved	mg/L	<0.01	0.01
Uranium-234 calculated	Bq/L	0.001	0.005
Uranium-238 calculated	Bq/L	0.001	0.005
Lab Section 4			
Lead-210	Bq/L	<0.02	<0.02
Polonium-210	Bq/L	<0.005	<0.005
Radium-226	Bq/L	<0.005	0.005
Radon-222	Bq/L	<3	<3
Thorium-230	Bq/L	<0.01	0.02

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Radon results are corrected for decay to the time of sample collection.

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2020-9126

Sep 24, 2020

Denison Mines Inc.

Name	Units	Method
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-300
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radium-226	Bq/L	Rad-300
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-9522

Sep 10, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Aug-17-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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www.src.sk.ca/analytical

SRC Group # 2020-9522

Sep 10, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Aug-17-2020 Client P.O.: E0220015

39606 08/16/2020 15:00 GWR-003 *WATER*

Analyte	Units	39606
Lab Section 1		
Bicarbonate	mg/L	12
Carbonate	mg/L	<1
Chloride	mg/L	0.1
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	6.76
Specific conductivity	uS/cm	27
Sum of ions	mg/L	20
Total alkalinity	mg/L	10
Total hardness	mg/L	12
Ammonia as nitrogen	mg/L	0.09
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01
Ortho-phosphate as P	mg/L	0.05
Organic carbon, dissolved	mg/L	1.4
Fluoride	mg/L	0.04
Total dissolved solids	mg/L	64
Total suspended solids	mg/L	133
Lab Section 2		
Calcium	mg/L	2.9
Magnesium	mg/L	1.1
Potassium	mg/L	1.0
Sodium	mg/L	2.1
Sulfate	mg/L	1.0
Aluminum, dissolved	mg/L	0.0065
Antimony, dissolved	mg/L	<0.0002
Arsenic, dissolved	ug/L	0.2
Barium, dissolved	mg/L	0.0082
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002

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SRC Group # 2020-9522

Sep 10, 2020

Denison Mines Inc.

39606 08/16/2020 15:00 GWR-003 *WATER*

Analyte	Units	39606
Lab Section 2		
Boron, dissolved	mg/L	<0.01
Bromine	ug/L	<5
Cadmium, dissolved	mg/L	0.00001
Chromium, dissolved	mg/L	<0.0005
Cobalt, dissolved	mg/L	0.0009
Copper, dissolved	mg/L	0.0017
Iron, dissolved	mg/L	0.039
Lead, dissolved	mg/L	0.0001
Lithium, dissolved	ug/L	0.8
Manganese, dissolved	mg/L	0.14
Molybdenum, dissolved	mg/L	0.0012
Nickel, dissolved	mg/L	0.0021
Selenium, dissolved	mg/L	<0.0001
Silica, soluble, dissolved	mg/L	16.5
Silver, dissolved	mg/L	<0.00005
Strontium, dissolved	mg/L	0.020
Sulfur	mg/L	0.33
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	<0.0001
Titanium, dissolved	mg/L	<0.0002
Uranium, dissolved	ug/L	0.5
Vanadium, dissolved	mg/L	0.0001
Zinc, dissolved	mg/L	0.010
Phosphorus, dissolved	mg/L	<0.01
Uranium-234 calculated	Bq/L	0.10
Uranium-238 calculated	Bq/L	0.10
Lab Section 4		
Lead-210	Bq/L	0.60
Polonium-210	Bq/L	0.20
Radium-226	Bq/L	0.27
Radon-222	Bq/L	86
Thorium-230	Bq/L	0.08
Tritium	Bq/L	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 39606
Time between sampling and receipt in lab exceeds the recommended 24

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SRC Group # 2020-9522

Sep 10, 2020

Denison Mines Inc.

hours for Organic carbon, dissolved.
This sample was reanalyzed for Fluoride. Reanalysis confirms original results are within the expected measurement uncertainty.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-9522

Sep 10, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2020-9522

Sep 10, 2020

Denison Mines Inc.

Name	Units	Method
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-9866

Sep 16, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Janna Switzer

Date Samples Received: Aug-24-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-9866

Sep 16, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Janna Switzer

Date Samples Received: Aug-24-2020 Client P.O.: E0220015

40769 08/22/2020 10:30 GWR-025 *WATER*
40770 08/22/2020 15:00 GWR-006 *WATER*

Analyte	Units	40769	40770
Lab Section 1			
Bicarbonate	mg/L	51	35
Carbonate	mg/L	<1	<1
Chloride	mg/L	233	10
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	6.90	7.04
Specific conductivity	uS/cm	918	71
Sum of ions	mg/L	488	75
Total alkalinity	mg/L	42	29
Total hardness	mg/L	222	30
Ammonia as nitrogen	mg/L	0.08	0.15
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	0.09
Nitrite	mg/L	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	0.02
Ortho-phosphate as P	mg/L	0.08	0.13
Organic carbon, dissolved	mg/L	2.2	2.4
Fluoride	mg/L	0.21	0.14
Total dissolved solids	mg/L	566	199
Total suspended solids	mg/L	7	838
Lab Section 2			
Calcium	mg/L	66	4.9
Magnesium	mg/L	14	4.3
Potassium	mg/L	3.5	1.8
Sodium	mg/L	68	12
Sulfate	mg/L	52	6.4
Aluminum, dissolved	mg/L	0.0024	0.0096
Antimony, dissolved	mg/L	0.0003	<0.0002
Arsenic, dissolved	ug/L	<0.1	1.3
Barium, dissolved	mg/L	0.12	0.0081
Beryllium, dissolved	mg/L	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002

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SRC Group # 2020-9866

Sep 16, 2020

Denison Mines Inc.

40769 08/22/2020 10:30 GWR-025 *WATER*
40770 08/22/2020 15:00 GWR-006 *WATER*

Analyte	Units	40769	40770
Lab Section 2			
Boron, dissolved	mg/L	0.32	0.01
Bromine	ug/L	2900	22
Cadmium, dissolved	mg/L	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005
Cobalt, dissolved	mg/L	<0.0001	0.0002
Copper, dissolved	mg/L	<0.0002	0.0008
Iron, dissolved	mg/L	16.0	0.49
Lead, dissolved	mg/L	<0.0001	<0.0001
Lithium, dissolved	ug/L	32	8.5
Manganese, dissolved	mg/L	0.97	0.14
Molybdenum, dissolved	mg/L	0.0005	0.0012
Nickel, dissolved	mg/L	0.0002	0.0004
Selenium, dissolved	mg/L	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	17.8	23
Silver, dissolved	mg/L	<0.00005	<0.00005
Strontium, dissolved	mg/L	1.88	0.034
Sulfur	mg/L	17	2.1
Thallium, dissolved	mg/L	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	<0.0002
Uranium, dissolved	ug/L	0.8	1.4
Vanadium, dissolved	mg/L	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.0030	0.0009
Phosphorus, dissolved	mg/L	0.09	0.06
Uranium-234 calculated	Bq/L	0.024	0.043
Uranium-238 calculated	Bq/L	0.024	0.043
Lab Section 4			
Lead-210	Bq/L	0.08	0.09
Polonium-210	Bq/L	0.02	0.13
Radium-226	Bq/L	0.26	0.36
Radon-222	Bq/L	7	32
Thorium-230	Bq/L	<0.01	0.12
Tritium	Bq/L	<15	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 40769
Time between sampling and receipt in lab exceeds the recommended 48

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SRC Group # 2020-9866

Sep 16, 2020

Denison Mines Inc.

hours for Nitrite and Ortho-phosphate as P.

Note for Sample # 40770
This sample was reanalyzed for Total suspended solids. Reanalysis confirms original results are within the expected measurement uncertainty.

The temperature of the cooler was 15.5 °C upon receipt.

Holding time for Organic carbon, dissolved between sampling and receipt in lab exceeds the recommended 24 hours.

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SRC Group # 2020-9866

Sep 16, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522

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Sep 16, 2020

Denison Mines Inc.

Name	Units	Method
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-10201

Sep 16, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Aug-31-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-10201

Sep 16, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Aug-31-2020 Client P.O.: E0220015

41915	**08/29/2020 09:00 GWR-014**	***WATER***
41916	**08/29/2020 10:30 GWR-005**	***WATER***
41917	**08/29/2020 14:40 GWR-012**	***WATER***

Analyte	Units	41915	41916	41917
Lab Section 1				
Bicarbonate	mg/L	115	34	112
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	0.4	3.3	Not Requested
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
Chloride	mg/L	Not Requested	Not Requested	81
pH	pH units	7.68	6.99	7.62
Specific conductivity	uS/cm	190	70	452
Sum of ions	mg/L	190	57	284
Total alkalinity	mg/L	94	28	92
Total hardness	mg/L	84	11	121
Ammonia as nitrogen	mg/L	3.4	<0.01	0.35
Nitrate (calc. from NO2+NO3-N)	mg/L	0.09	<0.04	<0.04
Nitrite	mg/L	0.23	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.02	<0.01	<0.01
Ortho-phosphate as P	mg/L	<0.01	0.05	0.08
Organic carbon, dissolved	mg/L	18	0.5	4.1
Fluoride	mg/L	0.08	0.09	0.01
Total dissolved solids	mg/L	160	75	274
Total suspended solids	mg/L	13	18	10
Lab Section 2				
Calcium	mg/L	33	2.9	37
Magnesium	mg/L	0.4	1.0	7.0
Potassium	mg/L	6.3	1.1	4.4
Sodium	mg/L	21	10	36
Sulfate	mg/L	10	4.5	5.9
Aluminum, dissolved	mg/L	0.020	0.0022	0.0038
Antimony, dissolved	mg/L	0.0020	<0.0002	<0.0002
Arsenic, dissolved	ug/L	0.6	1.1	0.2
Barium, dissolved	mg/L	0.15	0.024	0.25
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001

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Sep 16, 2020

Denison Mines Inc.

41915 08/29/2020 09:00 GWR-014 *WATER*
41916 08/29/2020 10:30 GWR-005 *WATER*
41917 08/29/2020 14:40 GWR-012 *WATER*

Analyte	Units	41915	41916	41917
Lab Section 2				
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	0.02	0.03	0.15
Bromine	ug/L	5	46	1000
Cadmium, dissolved	mg/L	<0.00001	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Copper, dissolved	mg/L	0.0004	<0.0002	<0.0002
Iron, dissolved	mg/L	0.055	3.71	5.6
Lead, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Lithium, dissolved	ug/L	12	11	26
Manganese, dissolved	mg/L	0.0018	0.17	0.57
Molybdenum, dissolved	mg/L	0.0024	0.0023	0.0023
Nickel, dissolved	mg/L	0.0027	0.0003	0.0006
Selenium, dissolved	mg/L	<0.0001	<0.0001	0.0002
Silica, soluble, dissolved	mg/L	15.5	19.9	24.4
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.26	0.057	0.61
Sulfur	mg/L	3.3	1.5	2.0
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Uranium, dissolved	ug/L	0.3	0.5	0.5
Vanadium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.0007	0.0064	0.0007
Phosphorus, dissolved	mg/L	0.03	<0.01	0.10
Uranium-234 calculated	Bq/L	0.037	0.037	0.011
Uranium-238 calculated	Bq/L	0.037	0.037	0.011
Lab Section 4				
Lead-210	Bq/L	0.08	0.28	0.15
Polonium-210	Bq/L	0.03	0.11	0.03
Radium-226	Bq/L	0.08	0.16	0.17
Radon-222	Bq/L	11	15	23
Thorium-230	Bq/L	0.01	0.04	<0.01
Tritium	Bq/L	19	<15	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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SRC Group # 2020-10201

Sep 16, 2020

Denison Mines Inc.

Note for Sample # 41915
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

Note for Sample # 41916
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
This sample was reanalyzed for Ortho-phosphate as P. Reanalysis confirms original results are within the expected measurement uncertainty.

The temperature of the cooler was 11.4 °C upon receipt.

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SRC Group # 2020-10201

Sep 16, 2020

Denison Mines Inc.

41918 08/30/2020 09:00 GWR-029 *WATER*

Analyte	Units	41918
Lab Section 1		
Bicarbonate	mg/L	33
Carbonate	mg/L	<1
Chloride	mg/L	6.1
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	7.14
Specific conductivity	uS/cm	72
Sum of ions	mg/L	56
Total alkalinity	mg/L	27
Total hardness	mg/L	21
Ammonia as nitrogen	mg/L	0.03
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01
Ortho-phosphate as P	mg/L	0.08
Organic carbon, dissolved	mg/L	1.6
Fluoride	mg/L	0.09
Total dissolved solids	mg/L	71
Total suspended solids	mg/L	<1
Lab Section 2		
Calcium	mg/L	5.6
Magnesium	mg/L	1.7
Potassium	mg/L	1.6
Sodium	mg/L	5.3
Sulfate	mg/L	2.4
Aluminum, dissolved	mg/L	0.014
Antimony, dissolved	mg/L	<0.0002
Arsenic, dissolved	ug/L	0.3
Barium, dissolved	mg/L	0.0082
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002
Boron, dissolved	mg/L	0.04
Bromine	ug/L	85
Cadmium, dissolved	mg/L	<0.00001
Chromium, dissolved	mg/L	<0.0005
Cobalt, dissolved	mg/L	<0.0001

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SRC Group # 2020-10201

Sep 16, 2020

Denison Mines Inc.

41918 08/30/2020 09:00 GWR-029 *WATER*

Analyte	Units	41918
Lab Section 2		
Copper, dissolved	mg/L	<0.0002
Iron, dissolved	mg/L	4.86
Lead, dissolved	mg/L	<0.0001
Lithium, dissolved	ug/L	11
Manganese, dissolved	mg/L	0.23
Molybdenum, dissolved	mg/L	0.0001
Nickel, dissolved	mg/L	0.0002
Selenium, dissolved	mg/L	0.0011
Silica, soluble, dissolved	mg/L	17.4
Silver, dissolved	mg/L	<0.00005
Strontium, dissolved	mg/L	0.12
Sulfur	mg/L	0.8
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	0.0002
Titanium, dissolved	mg/L	<0.0002
Uranium, dissolved	ug/L	0.2
Vanadium, dissolved	mg/L	<0.0001
Zinc, dissolved	mg/L	0.0010
Phosphorus, dissolved	mg/L	0.06
Uranium-234 calculated	Bq/L	0.004
Uranium-238 calculated	Bq/L	0.004
Lab Section 4		
Lead-210	Bq/L	0.10
Polonium-210	Bq/L	0.02
Radium-226	Bq/L	0.07
Radon-222	Bq/L	35
Thorium-230	Bq/L	<0.01
Tritium	Bq/L	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 11.4 °C upon receipt.

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SRC Group # 2020-10201

Sep 16, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522

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Sep 16, 2020

Denison Mines Inc.

Name	Units	Method
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-10517

Sep 22, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Janna Switzer

Date Samples Received: Sep-08-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
143-111 Research Drive, Saskatoon, SK Canada S7N 3R2

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Toll-free: 1-800-240-8808
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SRC Group # 2020-10517

Sep 22, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Janna Switzer

Date Samples Received: Sep-08-2020 Client P.O.: E0220015

42973 09/06/2020 09:00 GWR-008 *WATER*

Analyte	Units	42973
Lab Section 1		
Bicarbonate	mg/L	55
Carbonate	mg/L	<1
Chloride	mg/L	3.0
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	7.44
Specific conductivity	uS/cm	86
Sum of ions	mg/L	78
Total alkalinity	mg/L	45
Total hardness	mg/L	24
Ammonia as nitrogen	mg/L	0.05
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01
Ortho-phosphate as P	mg/L	0.12
Organic carbon, dissolved	mg/L	7.0
Fluoride	mg/L	0.07
Total dissolved solids	mg/L	72
Total suspended solids	mg/L	3
Lab Section 2		
Calcium	mg/L	6.8
Magnesium	mg/L	1.8
Potassium	mg/L	1.7
Sodium	mg/L	8.6
Sulfate	mg/L	0.7
Aluminum, dissolved	mg/L	0.0081
Antimony, dissolved	mg/L	0.0005
Arsenic, dissolved	ug/L	0.1
Barium, dissolved	mg/L	0.10
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002

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SRC Group # 2020-10517

Sep 22, 2020

Denison Mines Inc.

42973 09/06/2020 09:00 GWR-008 *WATER*

Analyte	Units	42973
Lab Section 2		
Boron, dissolved	mg/L	0.03
Bromine	ug/L	40
Cadmium, dissolved	mg/L	<0.00001
Chromium, dissolved	mg/L	<0.0005
Cobalt, dissolved	mg/L	<0.0001
Copper, dissolved	mg/L	<0.0002
Iron, dissolved	mg/L	3.55
Lead, dissolved	mg/L	<0.0001
Lithium, dissolved	ug/L	12
Manganese, dissolved	mg/L	0.40
Molybdenum, dissolved	mg/L	0.0003
Nickel, dissolved	mg/L	0.0004
Selenium, dissolved	mg/L	<0.0001
Silica, soluble, dissolved	mg/L	25.8
Silver, dissolved	mg/L	<0.00005
Strontium, dissolved	mg/L	0.12
Sulfur	mg/L	0.23
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	<0.0001
Titanium, dissolved	mg/L	<0.0002
Uranium, dissolved	ug/L	2.4
Vanadium, dissolved	mg/L	<0.0001
Zinc, dissolved	mg/L	0.0029
Phosphorus, dissolved	mg/L	0.06
Uranium-234 calculated	Bq/L	0.043
Uranium-238 calculated	Bq/L	0.043
Lab Section 4		
Lead-210	Bq/L	<0.02
Polonium-210	Bq/L	0.05
Radium-226	Bq/L	0.81
Radon-222	Bq/L	38
Thorium-230	Bq/L	0.01
Tritium	Bq/L	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 42973
This sample was reanalyzed for Ortho-phosphate as P. Reanalysis confirms

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SRC Group # 2020-10517

Sep 22, 2020

Denison Mines Inc.

original results are within the expected measurement uncertainty.

The temperature of the cooler was 17.1 °C upon receipt.

Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

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SRC Group # 2020-10517

Sep 22, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2020-10517

Sep 22, 2020

Denison Mines Inc.

Name	Units	Method
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-10932

Sep 30, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Sep-15-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

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SRC Group # 2020-10932

Sep 30, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Sep-15-2020 Client P.O.: E0220015

44254 09/14/2020 15:30 GWR-009 *WATER*

Analyte	Units	44254
Lab Section 1		
Bicarbonate	mg/L	<1
Carbonate	mg/L	49
Chloride	mg/L	0.3
Hydroxide	mg/L	2
P. alkalinity	mg/L	46
pH	pH units	10.06
Specific conductivity	uS/cm	215
Sum of ions	mg/L	127
Total alkalinity	mg/L	87
Total hardness	mg/L	53
Ammonia as nitrogen	mg/L	0.96
Nitrate (calc. from NO2+NO3-N)	mg/L	0.04
Nitrite	mg/L	0.11
Nitrite+Nitrate as nitrogen	mg/L	0.01
Ortho-phosphate as P	mg/L	0.04
Organic carbon, dissolved	mg/L	10
Fluoride	mg/L	0.08
Total dissolved solids	mg/L	139
Total suspended solids	mg/L	9
Lab Section 2		
Calcium	mg/L	20
Magnesium	mg/L	0.8
Potassium	mg/L	8.6
Sodium	mg/L	21
Sulfate	mg/L	24
Aluminum, dissolved	mg/L	0.012
Antimony, dissolved	mg/L	0.0055
Arsenic, dissolved	ug/L	3.3
Barium, dissolved	mg/L	0.059
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002

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SRC Group # 2020-10932

Sep 30, 2020

Denison Mines Inc.

44254 09/14/2020 15:30 GWR-009 *WATER*

Analyte	Units	44254
Lab Section 2		
Boron, dissolved	mg/L	<0.01
Bromine	ug/L	<5
Cadmium, dissolved	mg/L	0.00001
Chromium, dissolved	mg/L	<0.0005
Cobalt, dissolved	mg/L	<0.0001
Copper, dissolved	mg/L	0.0008
Iron, dissolved	mg/L	0.21
Lead, dissolved	mg/L	<0.0001
Lithium, dissolved	ug/L	9.0
Manganese, dissolved	mg/L	0.021
Molybdenum, dissolved	mg/L	0.0087
Nickel, dissolved	mg/L	0.0012
Selenium, dissolved	mg/L	<0.0001
Silica, soluble, dissolved	mg/L	19.5
Silver, dissolved	mg/L	<0.00005
Strontium, dissolved	mg/L	0.24
Sulfur	mg/L	8
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	<0.0001
Titanium, dissolved	mg/L	<0.0002
Uranium, dissolved	ug/L	5.3
Vanadium, dissolved	mg/L	<0.0001
Zinc, dissolved	mg/L	0.0014
Phosphorus, dissolved	mg/L	0.05
Uranium-234 calculated	Bq/L	0.13
Uranium-238 calculated	Bq/L	0.13
Lab Section 4		
Lead-210	Bq/L	0.30
Polonium-210	Bq/L	0.07
Radium-226	Bq/L	0.33
Radon-222	Bq/L	<3
Thorium-230	Bq/L	0.03
Tritium	Bq/L	16

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 15.7 °C upon receipt.

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SRC Group # 2020-10932

Sep 30, 2020

Denison Mines Inc.

Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
Radon result is corrected for decay to the time of sample collection.

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SRC Group # 2020-10932

Sep 30, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2020-10932

Sep 30, 2020

Denison Mines Inc.

Name	Units	Method
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-13266

Nov 06, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Oct-28-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

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SRC Group # 2020-13266

Nov 06, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Oct-28-2020 Client P.O.: E0220015

57400 10/24/2020 16:40 GWR-037 *WATER*

Analyte	Units	57400
Lab Section 1		
Bicarbonate	mg/L	15
Carbonate	mg/L	<1
Chloride	mg/L	0.4
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	6.57
Specific conductivity	uS/cm	32
Sum of ions	mg/L	32
Total alkalinity	mg/L	12
Total hardness	mg/L	8
Ammonia as nitrogen	mg/L	0.04
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01
Ortho-phosphate as P	mg/L	0.02
Organic carbon, dissolved	mg/L	3.9
Fluoride	mg/L	<0.01
Total dissolved solids	mg/L	90
Total suspended solids	mg/L	<1
Lab Section 2		
Calcium	mg/L	2.0
Magnesium	mg/L	0.7
Potassium	mg/L	1.9
Sodium	mg/L	3.6
Sulfate	mg/L	8.0
Aluminum, dissolved	mg/L	0.48
Antimony, dissolved	mg/L	<0.0002
Arsenic, dissolved	ug/L	0.4
Barium, dissolved	mg/L	0.0073
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002

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SRC Group # 2020-13266

Nov 06, 2020

Denison Mines Inc.

57400 10/24/2020 16:40 GWR-037 *WATER*

Analyte	Units	57400
Lab Section 2		
Boron, dissolved	mg/L	<0.01
Bromine	ug/L	<5
Cadmium, dissolved	mg/L	0.00002
Chromium, dissolved	mg/L	<0.0005
Cobalt, dissolved	mg/L	0.0005
Copper, dissolved	mg/L	0.0013
Iron, dissolved	mg/L	1.64
Lead, dissolved	mg/L	0.0002
Lithium, dissolved	ug/L	9.2
Manganese, dissolved	mg/L	0.12
Molybdenum, dissolved	mg/L	<0.0001
Nickel, dissolved	mg/L	0.0037
Selenium, dissolved	mg/L	0.0001
Silica, soluble, dissolved	mg/L	33.4
Silver, dissolved	mg/L	0.00010
Strontium, dissolved	mg/L	0.014
Sulfur	mg/L	2.7
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	<0.0001
Titanium, dissolved	mg/L	0.0048
Uranium, dissolved	ug/L	5.8
Vanadium, dissolved	mg/L	<0.0001
Zinc, dissolved	mg/L	0.0067
Phosphorus, dissolved	mg/L	0.01
Uranium-234 calculated	Bq/L	0.080
Uranium-238 calculated	Bq/L	0.080
Lab Section 4		
Lead-210	Bq/L	0.08
Polonium-210	Bq/L	0.14
Radium-226	Bq/L	0.19
Radon-222	Bq/L	64
Thorium-230	Bq/L	<0.01
Tritium	Bq/L	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 57400
An external instrument, that is outside of SRC's direct control, was used

SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
143-111 Research Drive, Saskatoon, SK Canada S7N 3R2

T: 306-933-6932 **F:** 306-933-7922
Toll-free: 1-800-240-8808
E: analytical@src.sk.ca

www.src.sk.ca/analytical

SRC Group # 2020-13266

Nov 06, 2020

Denison Mines Inc.

for the analysis of Radon-222. Additional quality control measures were put in place to mitigate any associated risks.

This sample was reanalyzed for Total dissolved solids. Reanalysis confirms original results are within the expected measurement uncertainty.

The temperature of the cooler was 21.3 °C upon receipt.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2020-13266

Nov 06, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2020-13266

Nov 06, 2020

Denison Mines Inc.

Name	Units	Method
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-13483

Nov 24, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Nov-03-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-13483

Nov 24, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Nov-03-2020 Client P.O.: E0220015

58245 10/30/2020 17:00 GWR-034 *WATER*

Analyte	Units	58245
Lab Section 1		
Bicarbonate	mg/L	166
Carbonate	mg/L	<1
Chloride	mg/L	<1
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	8.07
Specific conductivity	uS/cm	481
Sum of ions	mg/L	329
Total alkalinity	mg/L	136
Total hardness	mg/L	21
Ammonia as nitrogen	mg/L	0.08
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01
Ortho-phosphate as P	mg/L	26
Organic carbon, dissolved	mg/L	8.7
Fluoride	mg/L	0.02
Total dissolved solids	mg/L	375
Total suspended solids	mg/L	3
Lab Section 2		
Calcium	mg/L	7.7
Magnesium	mg/L	0.5
Potassium	mg/L	149
Sodium	mg/L	3.7
Sulfate	mg/L	1.8
Aluminum, dissolved	mg/L	0.035
Antimony, dissolved	mg/L	0.0003
Arsenic, dissolved	ug/L	0.2
Barium, dissolved	mg/L	0.011
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002

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SRC Group # 2020-13483

Nov 24, 2020

Denison Mines Inc.

58245 10/30/2020 17:00 GWR-034 *WATER*

Analyte	Units	58245
Lab Section 2		
Boron, dissolved	mg/L	<0.01
Bromine	ug/L	12
Cadmium, dissolved	mg/L	0.00003
Chromium, dissolved	mg/L	0.0048
Cobalt, dissolved	mg/L	0.0003
Copper, dissolved	mg/L	0.016
Iron, dissolved	mg/L	0.61
Lead, dissolved	mg/L	0.011
Lithium, dissolved	ug/L	0.4
Manganese, dissolved	mg/L	0.019
Molybdenum, dissolved	mg/L	0.0007
Nickel, dissolved	mg/L	0.0035
Selenium, dissolved	mg/L	0.0001
Silica, soluble, dissolved	mg/L	5.2
Silver, dissolved	mg/L	<0.00005
Strontium, dissolved	mg/L	0.021
Sulfur	mg/L	0.6
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	0.0017
Titanium, dissolved	mg/L	0.0011
Uranium, dissolved	ug/L	136
Vanadium, dissolved	mg/L	<0.0001
Zinc, dissolved	mg/L	0.14
Phosphorus, dissolved	mg/L	58.4
Uranium-234 calculated	Bq/L	2.4
Uranium-238 calculated	Bq/L	2.4
Lab Section 4		
Lead-210	Bq/L	22
Polonium-210	Bq/L	6.3
Radium-226	Bq/L	3.6
Radon-222	Bq/L	25
Thorium-230	Bq/L	2.6
Tritium	Bq/L	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 13.8 °C upon receipt.

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SRC Group # 2020-13483

Nov 24, 2020

Denison Mines Inc.

Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

Radon result is corrected for decay to the time of sample collection.

An external instrument, that is outside of SRC's direct control, was used for the analysis of Radon-222 and Tritium. Additional quality control measures were put in place to mitigate any associated risks.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-13483

Nov 24, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2020-13483

Nov 24, 2020

Denison Mines Inc.

Name	Units	Method
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2020-13732

Nov 24, 2020

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Nov-06-2020 Client P.O.: E0220015

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1, Lab Section 2 authorized by Keith Gipman, Supervisor
Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

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SRC Group # 2020-13732

Nov 24, 2020

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Nov-06-2020 Client P.O.: E0220015

59586 11/03/2020 16:30 GWR-033 *WATER*
59587 11/05/2020 12:00 GWR-036 *WATER*
59588 11/03/2020 11:30 GWR-035 *WATER*

Analyte	Units	59586	59587	59588
Lab Section 1				
Bicarbonate	mg/L	43	30	22
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	57	Not Requested	Not Requested
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
Chloride	mg/L	Not Requested	0.2	5.8
pH	pH units	7.48	6.96	7.04
Specific conductivity	uS/cm	331	21	54
Sum of ions	mg/L	191	47	44
Total alkalinity	mg/L	35	25	18
Total hardness	mg/L	59	16	14
Ammonia as nitrogen	mg/L	0.12	<0.01	<0.01
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	0.49	<0.04
Nitrite	mg/L	<0.03	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	0.11	<0.01
Ortho-phosphate as P	mg/L	<0.01	0.09	<0.01
Organic carbon, dissolved	mg/L	3.4	1.1	2.1
Fluoride	mg/L	0.09	0.01	<0.01
Total dissolved solids	mg/L	132	112	50
Total suspended solids	mg/L	10	180	3
Lab Section 2				
Calcium	mg/L	18	1.2	3.5
Magnesium	mg/L	3.4	3.2	1.3
Potassium	mg/L	2.1	5.3	1.1
Sodium	mg/L	36	3.9	4.9
Sulfate	mg/L	31	2.6	5.9
Aluminum, dissolved	mg/L	0.025	0.15	0.013
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Arsenic, dissolved	ug/L	2.2	0.2	0.2
Barium, dissolved	mg/L	0.059	0.0095	0.015
Beryllium, dissolved	mg/L	<0.0001	0.0001	<0.0001

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SRC Group # 2020-13732

Nov 24, 2020

Denison Mines Inc.

59586 11/03/2020 16:30 GWR-033 *WATER*
59587 11/05/2020 12:00 GWR-036 *WATER*
59588 11/03/2020 11:30 GWR-035 *WATER*

Analyte	Units	59586	59587	59588
Lab Section 2				
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	0.04	<0.01	<0.01
Bromine	ug/L	750	<5	76
Cadmium, dissolved	mg/L	0.00001	0.00001	0.00002
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	0.0005	0.0004	0.0010
Copper, dissolved	mg/L	0.0003	0.0020	0.0005
Iron, dissolved	mg/L	0.47	0.12	0.32
Lead, dissolved	mg/L	0.0002	0.0001	<0.0001
Lithium, dissolved	ug/L	14	3.0	4.0
Manganese, dissolved	mg/L	0.21	0.048	0.14
Molybdenum, dissolved	mg/L	0.0030	0.0003	0.0008
Nickel, dissolved	mg/L	0.0011	0.0023	0.0050
Selenium, dissolved	mg/L	0.0001	0.0007	<0.0001
Silica, soluble, dissolved	mg/L	10.9	25.5	20.3
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.30	0.012	0.033
Sulfur	mg/L	10.3	0.87	1.97
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	0.0009	<0.0002
Uranium, dissolved	ug/L	3.6	0.9	0.2
Vanadium, dissolved	mg/L	<0.0001	0.0001	<0.0001
Zinc, dissolved	mg/L	0.015	0.0061	0.0025
Phosphorus, dissolved	mg/L	<0.01	0.04	<0.01
Uranium-234 calculated	Bq/L	0.047	0.042	0.002
Uranium-238 calculated	Bq/L	0.047	0.042	0.002
Lab Section 4				
Lead-210	Bq/L	0.14	0.14	0.03
Polonium-210	Bq/L	0.16	0.08	0.06
Radium-226	Bq/L	1.6	0.22	0.14
Radon-222	Bq/L	20	17	30
Thorium-230	Bq/L	0.03	<0.01	<0.01
Tritium	Bq/L	<15	<15	<15

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

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SRC Group # 2020-13732

Nov 24, 2020

Denison Mines Inc.

Note for Sample # 59586
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

Note for Sample # 59587
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

Note for Sample # 59588
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

The temperature of the cooler was 12.6 °C upon receipt.

Radon results are corrected for decay to the time of sample collection.

An external instrument, that is outside of SRC's direct control, was used for the analysis of Radon-222. Additional quality control measures were put in place to mitigate any associated risks.

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SRC Group # 2020-13732

Nov 24, 2020

Denison Mines Inc.

59589 11/03/2020 16:30 GWR-033 FILTERED TO .2UM *WATER*
59590 11/05/2020 12:00 GWR-036 FILTERED TO .02UM *WATER*
59591 11/03/2020 11:30 GWR-035 FILTERED TO .2UM *WATER*

Analyte	Units	59589	59590	59591
Lab Section 2				
Aluminum, dissolved	mg/L	0.025	0.013	0.025
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Arsenic, dissolved	ug/L	2.1	0.1	0.2
Barium, dissolved	mg/L	0.052	0.0022	0.014
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	0.04	<0.01	0.01
Cadmium, dissolved	mg/L	0.00002	0.00001	0.00002
Chromium, dissolved	mg/L	<0.0005	<0.0005	0.0014
Cobalt, dissolved	mg/L	0.0006	0.0003	0.0011
Copper, dissolved	mg/L	0.0028	0.0006	0.0039
Iron, dissolved	mg/L	0.25	0.0072	0.31
Lead, dissolved	mg/L	0.0002	<0.0001	0.0014
Lithium, dissolved	ug/L	13	2.7	4.1
Manganese, dissolved	mg/L	0.20	0.034	0.14
Molybdenum, dissolved	mg/L	0.0030	0.0003	0.0007
Nickel, dissolved	mg/L	0.0034	0.0017	0.0055
Selenium, dissolved	mg/L	0.0001	0.0007	<0.0001
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.28	0.0074	0.036
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	0.0003	<0.0002	0.0002
Uranium, dissolved	ug/L	1.8	<0.1	0.6
Vanadium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.019	0.0062	0.13

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 12.6 °C upon receipt.

Radon results are corrected for decay to the time of sample collection.

An external instrument, that is outside of SRC's direct control, was used for the analysis of Radon-222. Additional quality control measures were put in place to mitigate any associated risks.

SASKATCHEWAN RESEARCH COUNCIL

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143-111 Research Drive, Saskatoon, SK Canada S7N 3R2

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SRC Group # 2020-13732

Nov 24, 2020

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2020-13732

Nov 24, 2020

Denison Mines Inc.

Name	Units	Method
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

2021 Data Quality Verification

Project Name: Hydrogeology for Wheeler River EIA	**Project Number:** 19-2642
Report Title: Wheeler River Project Baseline Hydrogeology	**Revision Number:** 1
Author's Name: Langping Wu	**Review Type:** Internal Draft

Section 1: Data Verification

Sample Media: ☐Soil ☐Sediment ☐Rock/Core ☐Ballast ☒Groundwater ☐Surface Water ☐Other: Click here to enter text.	Number of Samples: Total of 33 samples, including • 3 Duplicate Sample • 2 Field Blank • 2 Tracer Tank. **SRC Group # 2021-4265**: 6 (incl 1 duplicate, 1 field blank), GWR-008, GWR-009, GWR-036, GWR-037 **SRC Group # 2021-4672**: 4, GWR-003, GWR-006, GWR-025, GWR-029 **SRC Group # 2021-6345**: 8 (incl 1 duplicate, 1 field blank), GWR-005, GWR-012, GWR-014, GWR-033, GWR-034, GWR-035 **SRC Group # 2021-7066**: 2 (only tritium), GWR-031, GWR-032 **SRC Group # 2021-6894**: 4, GWR-011, GWR-013, GWR-031, GWR-032 **SRC Group # 2021-11729**: 6 (incl 1 tracer tank), GWR-038, GWR-039, GWR-040, GWR-041, GWR-042 **SRC Group # 2021-11730**: 7 (incl 1 duplicate, 1 tracer tank), GWR-038 (only uranium), GWR-039, GWR-040, GWR-041, GWR-042 (only uranium) **SRC Group # 2021-12063**: 3, GWR-046, GWR-047, GWR-048 **SK2103820**: 4 (incl 1 tracer tank), GWR-046, GWR-047, GWR-048 **21062021-Tritium**: 8, GWR-003, GWR-006, GWR-008, GWR-009, GWR-025, GWR-029, GWR-036, GWR-037

	30082021-Tritium: 6, GWR-005, GWR-012, GWR-014, GWR-033, GWR-034, GWR-035 **09092021-Tritium**: 2, GWR-011, GWR-013
All samples are accounted for in field sheets, Chain of Custody Forms and Laboratory Certificates of Analysis? *No* If not, explain. All samples are accounted for in field sheets and Laboratory Certificates of Analysis; No Quality Control Reports provided for SRC Group # 2021-11729, # 2021-11730 and # 2021-12063; No Laboratory Certificates of Analysis for 21062021-Tritium, 30082021-Tritium and 09092021-Tritium, only excel files are available. No Chain of Custody Forms provided except for SK2103820	
Duplicate Samples Collected/Analysed? ☒ Yes ☐ No If Yes: Duplicate Sample ID: 04/08/2021 GRW-036 DUPLICATE #1; 05/24/2021 GRW-034 DUPLICATE #2; 09/01/2021 GWR-040 DUPLICATE Primary Sample ID: 04/08/2021 GWR-036; 05/24/2021 GWR-034 09/01/2021 GWR-040	Relative percent difference (RPD) for primary and duplicate sample: Less than 50% for all measured parameters, with the exception of uranium (66.7%) (0.1 to 0.2 ug/L) in GRW-036 DUPLICATE #1. Calculations of RPD are not possible for values that are below detection limit. Primary and duplicate sample results satisfy the data quality criteria? Yes
Quality Control Samples Collected? ☒ Field Blank Sample ID: **SRC Group # 2021-4265:** 04/08/2021 FIELD BLANK **SRC Group # 2021-6345**: 05/25/2021 FIELD BLANK #2 ☐ Trip Blank Sample ID: Click here to enter text. ☐ Equipment Rinse Sample ID Click here to enter text. ☐ Other:Click here to enter text.	Quality control sample results meet data quality objectives? Yes Field blank from SRC Group # 2021-4265 reported a aluminium, copper and zinc concentrations slightly above the detection limit. Field blank from SRC Group # 2021-6345 reported an organic carbon and nitrate concentrations slightly above the detection limit. Overall, blanks remained below

Sample ID Click here to enter text.	detection or within the same order of magnitude of detection limit. There were no other indications of problems with the analysis and the results were considered.

Laboratory deviations from requested analyses?

GWR-038 and GWR-042 were measured only for dissolved uranium, as they are very close to GWR-039/040/041 which have full suite analysis.

No analytical results were provided for GWR-044.

Comments within Laboratory Certificates of Analysis regarding data quality.

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis.

SRC Group # 2021-4265:

The temperature of the cooler was 9.6 ºC upon receipt.
Radon results are corrected for decay to the time of sample collection.
GWR-008, GWR-037 and FIELD BLANK: Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

SRC Group # 2021-4672

The temperature of the cooler was 9.2 ºC upon receipt.
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved and Iron(II).

SRC Group # 2021-6345

The temperature of the cooler was 11.2 ºC upon receipt.
GWR-014: Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved and Iron(II).
GWR-012 and GWR-035: Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
GWR-034and FIELD BLANK#2: Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

SRC Group # 2021-7066

SRC Group # 2021-6894

The temperature of the cooler was 9.9 ºC upon receipt.
GRW-031 and GRW-032: Time between sampling and receipt in lab exceeds the recommended 24 hours for Iron (II) and Organic carbon, dissolved. Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon. Analysis of radon exceeded the recommended 8 days as the radon had to
decay to a level in our calibration range before analysis.
GRW-011 and GRW-013: Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
SRC Group # 2021-11730
The temperature of the cooler was 16.3 ºC upon receipt.
GRW-040 and GRW-040 Dup: Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved. Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Radon results are corrected for decay to the time of sample collection. Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon. Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.
GRW-039 and GRW-041: Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved and Iron (II). Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P. Radon results are corrected for decay to the time of sample collection. Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon. Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.
SRC Group # 2021-12063
The temperature of the cooler was 10.4 ºC upon receipt.
Radon results are corrected for decay to the time of sample collection.
SK2103820
General Comments: The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.
Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.
Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Overall, does the dataset satisfy the data quality objectives and meet the project requirements?

Yes, except that:
No quality control reports provided for SRC Group # 2021-11729, # 2021-11730 and # 2021-12063;
No chain of custody forms provided except for SK2103820.

Section 2: Review Completion

Reviewer's Name & Signature:	**Date:**	**Author's Name & Signature:**	**Date:**
Click here to enter text.	Click here to enter a date	Langping Wu Langping Wu	20 May 2022

2021-4265 RPD Calculation

SRC Group #		2021-4265	2021-4265	
Sample #		16479	16480	
Descreption		4/8/2021 15:45 GWR-036	4/8/2021 15:45 GWR-036 DUPLICATE #1	Relative Percentage Difference (RPD)
Sample Type		WATER	WATER	%
Parameter	**Unit**			
Bicarbonate	mg/L	16	16	0.0
Carbonate	mg/L	<1	<1	-
Chloride	mg/L	<0.1	0.1	-
Hydroxide	mg/L	<1	<1	-
P. alkalinity	mg/L	<1	<1	-
pH	pH units	6.91	6.9	0.1
Specific conductivity	uS/cm	35	34	2.9
Sum of ions	mg/L	28	29	-3.5
Total alkalinity	mg/L	13	13	0.0
Total hardness	mg/L	14	15	-6.9
Ammonia as nitrogen	mg/L	<0.01	0.02	-
Nitrate (calc. from NO2+NO3-N)	mg/L	0.49	0.49	0.0
Nitrite	mg/L	<0.03	<0.03	-
Nitrite+Nitrate as nitrogen	mg/L	0.11	0.11	0.0
Ortho-phosphate as P	mg/L	0.08	0.08	0.0
Organic carbon, dissolved	mg/L	0.5	0.5	0.0
Iron (II)	mg/L			-
Fluoride	mg/L	0.06	0.06	0.0
Total dissolved solids	mg/L	66	66	0.0
Total suspended solids	mg/L	71	63	11.9
Lead-210	Bq/L	0.07	0.08	-13.3
Polonium-210	Bq/L	0.05	0.06	-18.2
Radium-226	Bq/L	0.06	0.06	0.0
Radon-222	Bq/L	20	20	0.0
Thorium-230	Bq/L	0.02	0.02	0.0
Calcium	mg/L	2.7	3.1	-13.8
Magnesium	mg/L	1.8	1.7	5.7
Potassium	mg/L	2.8	2.9	-3.5
Sodium	mg/L	2.9	2.9	0.0
Sulfate	mg/L	1.9	1.9	0.0
Aluminum, dissolved	mg/L	0.037	0.053	-35.6
Antimony, dissolved	mg/L	<0.0002	<0.0002	-
Arsenic, dissolved	ug/L	0.3	0.3	0.0
Barium, dissolved	mg/L	0.0057	0.0061	-6.8

Beryllium, dissolved	mg/L	<0.0001	<0.0001	-
Bismuth, dissolved	mg/L	<0.0002	<0.0002	-
Boron, dissolved	mg/L	<0.01	<0.01	-
Bromine	ug/L	<5	<5	-
Cadmium, dissolved	mg/L	<0.00001	<0.00001	-
Chromium, dissolved	mg/L	<0.0005	<0.0005	-
Cobalt, dissolved	mg/L	0.0002	0.0002	0.0
Copper, dissolved	mg/L	0.0006	0.0008	-28.6
Iron, dissolved	mg/L	0.014	0.019	-30.3
Lead, dissolved	mg/L	<0.0001	0.0003	-
Lithium, dissolved	ug/L	2.8	2.6	7.4
Manganese, dissolved	mg/L	0.039	0.038	2.6
Molybdenum, dissolved	mg/L	0.0007	0.0007	0.0
Nickel, dissolved	mg/L	0.0018	0.0018	0.0
Selenium, dissolved	mg/L	0.0008	0.0007	13.3
Silica, soluble, dissolved	mg/L	26.2	25.7	1.9
Silver, dissolved	mg/L	<0.00005	<0.00005	-
Strontium, dissolved	mg/L	0.012	0.013	-8.0
Sulfur	mg/L	0.6	0.6	0.0
Thallium, dissolved	mg/L	<0.0002	<0.0002	-
Tin, dissolved	mg/L	<0.0001	<0.0001	-
Titanium, dissolved	mg/L	0.0004	0.0006	-40.0
Uranium, dissolved	ug/L	0.1	0.2	-66.7
Vanadium, dissolved	mg/L	0.0004	0.0003	28.6
Zinc, dissolved	mg/L	0.0044	0.0046	-4.4
Phosphorus, dissolved	mg/L	0.04	0.04	0.0

Note:

RPD (%) = 100 x (D1-D2) / ((D1+D2) / 2)

where: D1 = primary sample analysis; D2 = duplicate sample analysis.

"-" indicate RPG calculation not possibile as primary and/or duplicate sample reported concentrations are less than the laboratory detection limit.

2021-6345 RPD Calculation

SRC Group #		2021-6345	2021-6345	
Sample #		23096	23097	
Descreption		5/24/2021 16:23 GWR-034	5/24/2021 16:23 GWR-034 DUPLICATE #2	Relative Percentage Difference (RPD)
Sample Type		WATER	WATER	%
Parameter	**Unit**			
Bicarbonate	mg/L	156	156	0.0
Carbonate	mg/L	<1	<1	-
Chloride	mg/L	<1	<1	-
Hydroxide	mg/L	<1	<1	-
P. alkalinity	mg/L	<1	<1	-
pH	pH units	7.63	7.62	0.1
Specific conductivity	uS/cm	480	481	-0.2
Sum of ions	mg/L	318	316	0.6
Total alkalinity	mg/L	128	128	0.0
Total hardness	mg/L	19	19	0.0
Ammonia as nitrogen	mg/L	0.19	0.18	5.4
Nitrate (calc. from NO2+NO3-N)	mg/L	0.09	0.09	0.0
Nitrite	mg/L	0.25	0.25	0.0
Nitrite+Nitrate as nitrogen	mg/L	0.02	0.02	0.0
Ortho-phosphate as P	mg/L	62	52	17.5
Organic carbon, dissolved	mg/L	7.9	8.2	-3.7
Iron (II)	mg/L			-
Fluoride	mg/L	0.02	0.02	0.0
Total dissolved solids	mg/L	402	452	-11.7
Total suspended solids	mg/L	6	5	18.2
Lead-210	Bq/L	5.7	6.3	-10.0
Polonium-210	Bq/L	4.4	4.6	-4.4
Radium-226	Bq/L	0.90	0.86	4.5
Radon-222	Bq/L	8	9	-11.8
Thorium-230	Bq/L	0.44	0.43	2.3
Calcium	mg/L	6.7	6.8	-1.5
Magnesium	mg/L	0.5	0.5	0.0
Potassium	mg/L	148	147	0.7
Sodium	mg/L	3.9	3.9	0.0
Sulfate	mg/L	2.2	2.0	9.5
Aluminum, dissolved	mg/L	0.20	0.21	-4.9
Antimony, dissolved	mg/L	0.0007	0.0007	0.0
Arsenic, dissolved	ug/L	0.4	0.4	0.0
Barium, dissolved	mg/L	0.018	0.018	0.0

Beryllium, dissolved	mg/L	<0.0001	<0.0001	-
Bismuth, dissolved	mg/L	<0.0002	<0.0002	-
Boron, dissolved	mg/L	<0.01	<0.01	-
Bromine	ug/L	12	14	-15.4
Cadmium, dissolved	mg/L	0.00006	0.00005	18.2
Chromium, dissolved	mg/L	0.0019	0.0019	0.0
Cobalt, dissolved	mg/L	0.0003	0.0003	0.0
Copper, dissolved	mg/L	0.025	0.025	0.0
Iron, dissolved	mg/L	0.75	0.74	1.3
Lead, dissolved	mg/L	0.0054	0.0054	0.0
Lithium, dissolved	ug/L	0.7	0.7	0.0
Manganese, dissolved	mg/L	0.037	0.038	-2.7
Molybdenum, dissolved	mg/L	0.0004	0.0003	28.6
Nickel, dissolved	mg/L	0.0020	0.0022	-9.5
Selenium, dissolved	mg/L	<0.0001	<0.0001	-
Silica, soluble, dissolved	mg/L	6.9	6.9	0.0
Silver, dissolved	mg/L	<0.00005	<0.00005	-
Strontium, dissolved	mg/L	0.022	0.022	0.0
Sulfur	mg/L	0.7	0.7	0.0
Thallium, dissolved	mg/L	<0.0002	<0.0002	-
Tin, dissolved	mg/L	0.0032	0.0033	-3.1
Titanium, dissolved	mg/L	0.0051	0.0045	12.5
Uranium, dissolved	ug/L	87	88	-1.1
Vanadium, dissolved	mg/L	0.0004	0.0004	0.0
Zinc, dissolved	mg/L	0.12	0.12	0.0
Phosphorus, dissolved	mg/L	61	60	1.7

Note:

RPD (%) = 100 x (D1-D2) / ((D1+D2) / 2)

where: D1 = primary sample analysis; D2 = duplicate sample analysis.

"-" indicate RPG calculation not possibile as primary and/or duplicate sample reported concentrations are less than the laboratory detection limit.

2021-11730 RPD Calculation

SRC Group #		2021-11729 2021-11730	2021-11730	
Sample #		44627 44638	44639	
Descreption		9/1/2021 14:00 GWR-040	9/1/2021 14:00 GWR-040 DUPLICATE #3	Relative Percentage Difference (RPD)
Sample Type		WATER	WATER	%
Parameter	**Unit**			
Bicarbonate	mg/L	76	76	0.0
Carbonate	mg/L	<1	<1	-
Chloride	mg/L	2560	2580	-0.8
Hydroxide	mg/L	<1	<1	-
P. alkalinity	mg/L	<1	<1	-
pH	pH units	6.98	7.39	-5.7
Specific conductivity	uS/cm	7530	7530	0.0
Sum of ions	mg/L	4360	4350	0.2
Total alkalinity	mg/L	62	62	0.0
Total hardness	mg/L	1830	1830	0.0
Ammonia as nitrogen	mg/L	12	12	0.0
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	<0.04	-
Nitrite	mg/L	<0.03	<0.03	-
Nitrite+Nitrate as nitrogen	mg/L	<0.01	<0.01	-
Ortho-phosphate as P	mg/L	0.02	<0.01	-
Organic carbon, dissolved	mg/L	19	19	0.0
Iron (II)	mg/L			-
Fluoride	mg/L	0.21	0.21	0.0
Total dissolved solids	mg/L	4640	4080	12.8
Total suspended solids	mg/L	28	26	7.4
Lead-210	Bq/L	5000	5000	0.0
Polonium-210	Bq/L	700	600	15.4
Radium-226	Bq/L	1500	1100	30.8
Radon-222	Bq/L	6000000	6000000	0.0
Thorium-230	Bq/L	6	10	-50.0
Calcium	mg/L	590	590	0.0
Magnesium	mg/L	88	88	0.0
Potassium	mg/L	767	732	4.7
Sodium	mg/L	203	205	-1.0
Sulfate	mg/L	71	67	5.8
Aluminum, dissolved	mg/L	<0.005	<0.005	-
Antimony, dissolved	mg/L	<0.002	<0.002	-
Arsenic, dissolved	ug/L	<1	<1	-
Barium, dissolved	mg/L	0.52	0.52	0.0

Beryllium, dissolved	mg/L	<0.001	<0.001	-
Bismuth, dissolved	mg/L	<0.002	<0.002	-
Boron, dissolved	mg/L	0.5	0.5	0.0
Bromine	ug/L	9800	9800	0.0
Cadmium, dissolved	mg/L	<0.0001	<0.0001	-
Chromium, dissolved	mg/L	<0.005	<0.005	-
Cobalt, dissolved	mg/L	0.001	0.001	0.0
Copper, dissolved	mg/L	<0.002	<0.002	-
Iron, dissolved	mg/L	8.2	7.7	6.3
Lead, dissolved	mg/L	<0.001	<0.001	-
Lithium, dissolved	ug/L	250	250	0.0
Manganese, dissolved	mg/L	0.85	0.83	2.4
Molybdenum, dissolved	mg/L	0.011	0.011	0.0
Nickel, dissolved	mg/L	0.019	0.020	-5.1
Selenium, dissolved	mg/L	0.002	0.002	0.0
Silica, soluble, dissolved	mg/L	50.5	51.2	-1.4
Silver, dissolved	mg/L	<0.0005	<0.0005	-
Strontium, dissolved	mg/L	16.1	16.1	0.0
Sulfur	mg/L	24	22	8.7
Thallium, dissolved	mg/L	<0.002	<0.002	-
Tin, dissolved	mg/L	<0.001	<0.001	-
Titanium, dissolved	mg/L	<0.002	<0.002	-
Uranium, dissolved	ug/L	10	10	0.0
Vanadium, dissolved	mg/L	<0.001	<0.001	-
Zinc, dissolved	mg/L	0.010	0.011	-9.5
Phosphorus, dissolved	mg/L	<0.1	<0.1	-

Note:

RPD (%) = 100 x (D1-D2) / ((D1+D2) / 2)

where: D1 = primary sample analysis; D2 = duplicate sample analysis.

"-" indicate RPG calculation not possibile as primary and/or duplicate sample reported concentrations are less than the laboratory detection limit.

SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
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Toll-free: 1-800-240-8808
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www.src.sk.ca/analytical

SRC Group # 2021-4265

Apr 29, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Apr-12-2021 Client P.O.: WRE_E0220083

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1 approved by Hamilton, Ashley
Results from Lab Section 4 approved by Smith-Windsor, Jenna
Results from Lab Section 2 approved by Britton, Stephanie

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

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Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Apr-12-2021 Client P.O.: WRE_E0220083

16479 04/08/2021 15:45 GWR-036 *WATER*
16480 04/08/2021 15:45 DUPLICATE #1 *WATER*
16481 04/08/2021 17:30 FIELD BLANK *WATER*

Analyte	Units	16479	16480	16481
Lab Section 1				
Bicarbonate	mg/L	16	16	2
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	<0.1	0.1	<0.1
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.91	6.90	5.70
Specific conductivity	uS/cm	35	34	<1
Sum of ions	mg/L	28	29	2
Total alkalinity	mg/L	13	13	2
Total hardness	mg/L	14	15	<1
Ammonia as nitrogen	mg/L	<0.01	0.02	<0.01
Nitrate (calc. from NO2+NO3-N)	mg/L	0.49	0.49	<0.04
Nitrite	mg/L	<0.03	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.11	0.11	<0.01
Ortho-phosphate as P	mg/L	0.08	0.08	<0.01
Organic carbon, dissolved	mg/L	0.5	0.5	<0.2
Fluoride	mg/L	0.06	0.06	<0.01
Total dissolved solids	mg/L	66	66	<5
Total suspended solids	mg/L	71	63	<1
Lab Section 2				
Calcium	mg/L	2.7	3.1	<0.1
Magnesium	mg/L	1.8	1.7	<0.1
Potassium	mg/L	2.8	2.9	<0.1
Sodium	mg/L	2.9	2.9	<0.1
Sulfate	mg/L	1.9	1.9	<0.2
Aluminum, dissolved	mg/L	0.037	0.053	0.0006
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Arsenic, dissolved	ug/L	0.3	0.3	<0.1
Barium, dissolved	mg/L	0.0057	0.0061	<0.0005
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002

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Denison Mines Inc.

16479 04/08/2021 15:45 GWR-036 *WATER*
16480 04/08/2021 15:45 DUPLICATE #1 *WATER*
16481 04/08/2021 17:30 FIELD BLANK *WATER*

Analyte	Units	16479	16480	16481
Lab Section 2				
Boron, dissolved	mg/L	<0.01	<0.01	<0.01
Bromine	ug/L	<5	<5	<5
Cadmium, dissolved	mg/L	<0.00001	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	0.0002	0.0002	<0.0001
Copper, dissolved	mg/L	0.0006	0.0008	0.0003
Iron, dissolved	mg/L	0.014	0.019	<0.0005
Lead, dissolved	mg/L	<0.0001	0.0003	<0.0001
Lithium, dissolved	ug/L	2.8	2.6	<0.1
Manganese, dissolved	mg/L	0.039	0.038	<0.0005
Molybdenum, dissolved	mg/L	0.0007	0.0007	<0.0001
Nickel, dissolved	mg/L	0.0018	0.0018	<0.0001
Selenium, dissolved	mg/L	0.0008	0.0007	<0.0001
Silica, soluble, dissolved	mg/L	26.2	25.7	<0.02
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.012	0.013	<0.0005
Sulfur	mg/L	0.6	0.6	<0.05
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	0.0004	0.0006	<0.0002
Uranium, dissolved	ug/L	0.1	0.2	<0.1
Vanadium, dissolved	mg/L	0.0004	0.0003	<0.0001
Zinc, dissolved	mg/L	0.0044	0.0046	0.0021
Phosphorus, dissolved	mg/L	0.04	0.04	<0.01
Uranium-234 calculated	Bq/L	0.002	0.003	<0.001
Uranium-238 calculated	Bq/L	0.002	0.003	<0.001
Lab Section 4				
Lead-210	Bq/L	0.07	0.08	<0.02
Polonium-210	Bq/L	0.05	0.06	<0.005
Radium-226	Bq/L	0.06	0.06	<0.005
Radon-222	Bq/L	20	20	<5
Thorium-230	Bq/L	0.02	0.02	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

Time between sampling and receipt in lab exceeds the recommended 24

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Denison Mines Inc.

hours for Organic carbon, dissolved.

The temperature of the cooler was 9.6 °C upon receipt.

Radon results are corrected for decay to the time of sample collection.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2021-4265

Apr 29, 2021

Denison Mines Inc.

16482 04/09/2021 18:30 GWR-008 *WATER*

Analyte	Units	16482
Lab Section 1		
Bicarbonate	mg/L	39
Carbonate	mg/L	<1
Chloride	mg/L	2.7
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	7.16
Specific conductivity	uS/cm	69
Sum of ions	mg/L	56
Total alkalinity	mg/L	32
Total hardness	mg/L	17
Ammonia as nitrogen	mg/L	0.08
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01
Ortho-phosphate as P	mg/L	0.16
Organic carbon, dissolved	mg/L	1.0
Fluoride	mg/L	0.17
Total dissolved solids	mg/L	59
Total suspended solids	mg/L	4
Lab Section 2		
Calcium	mg/L	4.7
Magnesium	mg/L	1.2
Potassium	mg/L	1.5
Sodium	mg/L	5.4
Sulfate	mg/L	0.9
Aluminum, dissolved	mg/L	0.0023
Antimony, dissolved	mg/L	<0.0002
Arsenic, dissolved	ug/L	0.1
Barium, dissolved	mg/L	0.042
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002
Boron, dissolved	mg/L	0.03
Bromine	ug/L	34
Cadmium, dissolved	mg/L	<0.00001
Chromium, dissolved	mg/L	<0.0005
Cobalt, dissolved	mg/L	<0.0001

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SRC Group # 2021-4265

Apr 29, 2021

Denison Mines Inc.

16482 04/09/2021 18:30 GWR-008 *WATER*

Analyte	Units	16482
Lab Section 2		
Copper, dissolved	mg/L	0.0007
Iron, dissolved	mg/L	2.81
Lead, dissolved	mg/L	<0.0001
Lithium, dissolved	ug/L	9.9
Manganese, dissolved	mg/L	0.33
Molybdenum, dissolved	mg/L	0.0002
Nickel, dissolved	mg/L	0.0002
Selenium, dissolved	mg/L	<0.0001
Silica, soluble, dissolved	mg/L	23.9
Silver, dissolved	mg/L	<0.00005
Strontium, dissolved	mg/L	0.10
Sulfur	mg/L	0.3
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	<0.0001
Titanium, dissolved	mg/L	<0.0002
Uranium, dissolved	ug/L	0.7
Vanadium, dissolved	mg/L	<0.0001
Zinc, dissolved	mg/L	0.0016
Phosphorus, dissolved	mg/L	0.10
Uranium-234 calculated	Bq/L	0.009
Uranium-238 calculated	Bq/L	0.009
Lab Section 4		
Lead-210	Bq/L	0.66
Polonium-210	Bq/L	0.67
Radium-226	Bq/L	0.32
Radon-222	Bq/L	<4
Thorium-230	Bq/L	0.02

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

The temperature of the cooler was 9.6 °C upon receipt.

Radon results are corrected for decay to the time of sample collection.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2021-4265

Apr 29, 2021

Denison Mines Inc.

16483 04/10/2021 18:45 GWR-009 *WATER*
16484 04/09/2021 11:30 GWR-037 *WATER*

Analyte	Units	16483	16484
Lab Section 1			
Bicarbonate	mg/L	188	16
Carbonate	mg/L	<1	<1
Chloride	mg/L	0.4	0.1
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	7.59	6.38
Specific conductivity	uS/cm	289	39
Sum of ions	mg/L	252	29
Total alkalinity	mg/L	154	13
Total hardness	mg/L	104	6
Ammonia as nitrogen	mg/L	0.07	0.02
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	<0.04
Nitrite	mg/L	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	<0.01
Ortho-phosphate as P	mg/L	0.20	0.04
Organic carbon, dissolved	mg/L	33	2.0
Iron (II)	mg/L	<0.02	<0.02
Fluoride	mg/L	0.10	0.01
Total dissolved solids	mg/L	264	55
Total suspended solids	mg/L	13	<1
Lab Section 2			
Calcium	mg/L	29	1.8
Magnesium	mg/L	7.6	0.4
Potassium	mg/L	1.2	1.8
Sodium	mg/L	23	2.8
Sulfate	mg/L	2.5	6.5
Aluminum, dissolved	mg/L	0.21	0.060
Antimony, dissolved	mg/L	<0.0002	<0.0002
Arsenic, dissolved	ug/L	11	1.0
Barium, dissolved	mg/L	0.22	0.0087
Beryllium, dissolved	mg/L	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002
Boron, dissolved	mg/L	<0.01	<0.01
Bromine	ug/L	5	<5
Cadmium, dissolved	mg/L	0.00001	<0.00001
Chromium, dissolved	mg/L	0.0058	<0.0005

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Apr 29, 2021

Denison Mines Inc.

16483 04/10/2021 18:45 GWR-009 *WATER*
16484 04/09/2021 11:30 GWR-037 *WATER*

Analyte	Units	16483	16484
Lab Section 2			
Cobalt, dissolved	mg/L	0.0047	0.0004
Copper, dissolved	mg/L	0.0011	0.0009
Iron, dissolved	mg/L	15.3	1.38
Lead, dissolved	mg/L	0.0003	<0.0001
Lithium, dissolved	ug/L	6.3	9.0
Manganese, dissolved	mg/L	2.75	0.16
Molybdenum, dissolved	mg/L	0.0038	0.0028
Nickel, dissolved	mg/L	0.0053	0.0023
Selenium, dissolved	mg/L	<0.0001	0.0004
Silica, soluble, dissolved	mg/L	30.3	35.3
Silver, dissolved	mg/L	<0.00005	0.00011
Strontium, dissolved	mg/L	0.21	0.012
Sulfur	mg/L	0.8	2.1
Thallium, dissolved	mg/L	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001
Titanium, dissolved	mg/L	0.0034	0.0006
Uranium, dissolved	ug/L	22	0.8
Vanadium, dissolved	mg/L	0.0018	<0.0001
Zinc, dissolved	mg/L	0.017	0.0041
Phosphorus, dissolved	mg/L	0.19	0.03
Uranium-234 calculated	Bq/L	0.27	0.010
Uranium-238 calculated	Bq/L	0.27	0.010
Lab Section 4			
Lead-210	Bq/L	1.1	0.05
Polonium-210	Bq/L	0.73	0.11
Radium-226	Bq/L	0.30	0.03
Radon-222	Bq/L	<4	57
Thorium-230	Bq/L	0.22	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 16484
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

The temperature of the cooler was 9.6 °C upon receipt.

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SRC Group # 2021-4265

Apr 29, 2021

Denison Mines Inc.

Radon results are corrected for decay to the time of sample collection.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2021-4265

Apr 29, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Iron (II)	mg/L	Chm-225
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2021-4265

Apr 29, 2021

Denison Mines Inc.

Name	Units	Method
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106

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SRC Group # 2021-4672

May 05, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Apr-20-2021 Client P.O.: WRE_E0221082

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1 approved by Hamilton, Ashley
Results from Lab Section 4 approved by Smith-Windsor, Jenna
Results from Lab Section 2 approved by Britton, Stephanie

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2021-4672

May 05, 2021

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Apr-20-2021 Client P.O.: WRE_E0221082

17599 04/12/2021 16:08 GWR-029 *WATER*
17600 04/14/2021 16:31 GWR-006 *WATER*
17601 04/17/2021 16:18 GWR-025 *WATER*

Analyte	Units	17599	17600	17601
Lab Section 1				
Bicarbonate	mg/L	29	35	35
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	6.1	1.4	Not Requested
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
Chloride	mg/L	Not Requested	Not Requested	319
pH	pH units	7.36	7.32	6.96
Specific conductivity	uS/cm	68	61	1110
Sum of ions	mg/L	54	64	610
Total alkalinity	mg/L	24	29	29
Total hardness	mg/L	21	32	283
Ammonia as nitrogen	mg/L	0.05	0.17	0.14
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	0.09	<0.04
Nitrite	mg/L	<0.03	0.05	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	0.02	<0.01
Ortho-phosphate as P	mg/L	0.02	0.14	<0.01
Organic carbon, dissolved	mg/L	1.2	1.3	1.1
Iron (II)	mg/L	0.02	0.04	0.09
Fluoride	mg/L	0.10	0.14	0.21
Total dissolved solids	mg/L	82	178	653
Total suspended solids	mg/L	6	413	17
Lab Section 2				
Calcium	mg/L	5.3	5.2	84
Magnesium	mg/L	1.9	4.7	18
Potassium	mg/L	1.5	1.5	4.1
Sodium	mg/L	5.5	9.0	83
Sulfate	mg/L	4.2	7.0	67
Aluminum, dissolved	mg/L	<0.0005	0.016	<0.0005
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Arsenic, dissolved	ug/L	<0.1	0.8	<0.1
Barium, dissolved	mg/L	0.0053	0.0095	0.11
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001

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SRC Group # 2021-4672

May 05, 2021

Denison Mines Inc.

17599 04/12/2021 16:08 GWR-029 *WATER*
17600 04/14/2021 16:31 GWR-006 *WATER*
17601 04/17/2021 16:18 GWR-025 *WATER*

Analyte	Units	17599	17600	17601
Lab Section 2				
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	0.04	0.01	0.40
Bromine	ug/L	79	18	3600
Cadmium, dissolved	mg/L	<0.00001	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	<0.0001	0.0002	<0.0001
Copper, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Iron, dissolved	mg/L	2.16	0.53	9.7
Lead, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Lithium, dissolved	ug/L	13	9.1	40
Manganese, dissolved	mg/L	0.24	0.16	1.14
Molybdenum, dissolved	mg/L	<0.0001	0.0007	0.0002
Nickel, dissolved	mg/L	<0.0001	0.0004	<0.0001
Selenium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	17.2	24.2	16.8
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.12	0.029	2.19
Sulfur	mg/L	1.4	2.3	22
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	0.0003	0.0004
Uranium, dissolved	ug/L	0.2	0.2	<0.1
Vanadium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.0016	0.0041	0.0026
Phosphorus, dissolved	mg/L	<0.01	0.02	<0.01
Uranium-234 calculated	Bq/L	0.002	0.002	0.001
Uranium-238 calculated	Bq/L	0.002	0.002	0.001
Lab Section 4				
Lead-210	Bq/L	0.07	0.08	0.08
Polonium-210	Bq/L	0.34	0.22	0.18
Radium-226	Bq/L	0.09	0.06	0.29
Radon-222	Bq/L	<10	20	<4
Thorium-230	Bq/L	0.04	<0.02	0.03

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 9.2 °C upon receipt.

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SRC Group # 2021-4672

May 05, 2021

Denison Mines Inc.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved and Iron (II).

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SRC Group # 2021-4672

May 05, 2021

Denison Mines Inc.

17602 04/18/2021 10:45 GWR-003 *WATER*

Analyte	Units	17602
Lab Section 1		
Bicarbonate	mg/L	17
Carbonate	mg/L	<1
Chloride	mg/L	<0.1
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	6.88
Specific conductivity	uS/cm	19
Sum of ions	mg/L	23
Total alkalinity	mg/L	14
Total hardness	mg/L	8
Ammonia as nitrogen	mg/L	<0.01
Nitrate (calc. from NO2+NO3-N)	mg/L	0.13
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.03
Ortho-phosphate as P	mg/L	0.01
Organic carbon, dissolved	mg/L	0.8
Iron (II)	mg/L	<0.02
Fluoride	mg/L	0.03
Total dissolved solids	mg/L	63
Total suspended solids	mg/L	<1
Lab Section 2		
Calcium	mg/L	2.4
Magnesium	mg/L	0.5
Potassium	mg/L	0.3
Sodium	mg/L	1.7
Sulfate	mg/L	0.9
Aluminum, dissolved	mg/L	0.0055
Antimony, dissolved	mg/L	<0.0002
Arsenic, dissolved	ug/L	0.1
Barium, dissolved	mg/L	0.0056
Beryllium, dissolved	mg/L	<0.0001
Bismuth, dissolved	mg/L	<0.0002
Boron, dissolved	mg/L	<0.01
Bromine	ug/L	<5
Cadmium, dissolved	mg/L	0.00001
Chromium, dissolved	mg/L	<0.0005

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SRC Group # 2021-4672

May 05, 2021

Denison Mines Inc.

17602 04/18/2021 10:45 GWR-003 *WATER*

Analyte	Units	17602
Lab Section 2		
Cobalt, dissolved	mg/L	0.0003
Copper, dissolved	mg/L	0.0007
Iron, dissolved	mg/L	0.16
Lead, dissolved	mg/L	<0.0001
Lithium, dissolved	ug/L	0.8
Manganese, dissolved	mg/L	0.073
Molybdenum, dissolved	mg/L	<0.0001
Nickel, dissolved	mg/L	0.0017
Selenium, dissolved	mg/L	<0.0001
Silica, soluble, dissolved	mg/L	17.6
Silver, dissolved	mg/L	<0.00005
Strontium, dissolved	mg/L	0.020
Sulfur	mg/L	0.3
Thallium, dissolved	mg/L	<0.0002
Tin, dissolved	mg/L	<0.0001
Titanium, dissolved	mg/L	<0.0002
Uranium, dissolved	ug/L	<0.1
Vanadium, dissolved	mg/L	<0.0001
Zinc, dissolved	mg/L	0.0090
Phosphorus, dissolved	mg/L	<0.01
Uranium-234 calculated	Bq/L	0.001
Uranium-238 calculated	Bq/L	0.001
Lab Section 4		
Lead-210	Bq/L	0.03
Polonium-210	Bq/L	0.05
Radium-226	Bq/L	0.02
Radon-222	Bq/L	18
Thorium-230	Bq/L	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 9.2 °C upon receipt.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved and Iron (II).

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May 05, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Iron (II)	mg/L	Chm-225
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508

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SRC Group # 2021-4672

May 05, 2021

Denison Mines Inc.

Name	Units	Method
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: May-26-2021 Client P.O.: WRE_E0221082

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1 approved by Hamilton, Ashley
Results from Lab Section 4 approved by Smith-Windsor, Jenna
Results from Lab Section 2 approved by Britton, Stephanie

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: May-26-2021 Client P.O.: WRE_E0221082

23092 05/21/2021 11:27 GWR-014 *WATER*
23093 05/22/2021 10:03 GWR-005 *WATER*

Analyte	Units	23092	23093
Lab Section 1			
Bicarbonate	mg/L	76	26
Carbonate	mg/L	18	<1
Chloride	mg/L	0.4	3.3
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	15	<1
pH	pH units	9.05	6.80
Specific conductivity	uS/cm	175	49
Sum of ions	mg/L	138	43
Total alkalinity	mg/L	92	21
Total hardness	mg/L	45	9
Ammonia as nitrogen	mg/L	1.9	0.01
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	<0.04
Nitrite	mg/L	0.11	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	<0.01
Ortho-phosphate as P	mg/L	0.06	0.02
Organic carbon, dissolved	mg/L	8.3	0.7
Iron (II)	mg/L	<0.02	0.07
Fluoride	mg/L	0.18	0.11
Total dissolved solids	mg/L	142	51
Total suspended solids	mg/L	24	20
Lab Section 2			
Calcium	mg/L	17	2.3
Magnesium	mg/L	0.7	0.8
Potassium	mg/L	4.4	1.2
Sodium	mg/L	15	6.1
Sulfate	mg/L	4.2	3.0
Aluminum, dissolved	mg/L	0.0030	<0.0005
Antimony, dissolved	mg/L	<0.0002	<0.0002
Arsenic, dissolved	ug/L	0.5	1.4
Barium, dissolved	mg/L	0.11	0.015
Beryllium, dissolved	mg/L	<0.0001	<0.0001

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

23092 05/21/2021 11:27 GWR-014 *WATER*
23093 05/22/2021 10:03 GWR-005 *WATER*

Analyte	Units	23092	23093
Lab Section 2			
Bismuth, dissolved	mg/L	<0.0002	<0.0002
Boron, dissolved	mg/L	0.02	0.03
Bromine	ug/L	7	47
Cadmium, dissolved	mg/L	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005
Cobalt, dissolved	mg/L	<0.0001	<0.0001
Copper, dissolved	mg/L	0.0009	<0.0002
Iron, dissolved	mg/L	0.064	4.84
Lead, dissolved	mg/L	<0.0001	<0.0001
Lithium, dissolved	ug/L	14	11
Manganese, dissolved	mg/L	0.0037	0.20
Molybdenum, dissolved	mg/L	0.0034	0.0007
Nickel, dissolved	mg/L	0.0015	<0.0001
Selenium, dissolved	mg/L	0.0001	<0.0001
Silica, soluble, dissolved	mg/L	16.3	20.4
Silver, dissolved	mg/L	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.15	0.059
Sulfur	mg/L	1.4	1.0
Thallium, dissolved	mg/L	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	<0.0002
Uranium, dissolved	ug/L	1.2	0.5
Vanadium, dissolved	mg/L	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.0008	0.0014
Phosphorus, dissolved	mg/L	0.07	<0.01
Uranium-234 calculated	Bq/L	0.017	0.010
Uranium-238 calculated	Bq/L	0.017	0.010
Lab Section 4			
Lead-210	Bq/L	0.30	<0.02
Polonium-210	Bq/L	0.52	0.02
Radium-226	Bq/L	0.06	0.03
Radon-222	Bq/L	<6	<5
Thorium-230	Bq/L	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Time between sampling and receipt in lab exceeds the recommended 24 hours for Iron (II) and Organic carbon, dissolved.

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

The temperature of the cooler was 11.2 °C upon receipt.

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

23094 05/23/2021 13:14 GWR-012 *WATER*
23095 05/24/2021 14:23 GWR-035 *WATER*
23096 05/24/2021 16:23 GWR-034 *WATER*

Analyte	Units	23094	23095	23096
Lab Section 1				
Bicarbonate	mg/L	77	27	156
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	86	Not Requested	<1
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
Chloride	mg/L	Not Requested	5.7	Not Requested
pH	pH units	7.24	6.79	7.63
Specific conductivity	uS/cm	416	46	480
Sum of ions	mg/L	245	44	318
Total alkalinity	mg/L	63	22	128
Total hardness	mg/L	106	12	19
Ammonia as nitrogen	mg/L	0.33	0.03	0.19
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	0.04	0.09
Nitrite	mg/L	<0.03	<0.03	0.25
Nitrite+Nitrate as nitrogen	mg/L	<0.01	0.01	0.02
Ortho-phosphate as P	mg/L	0.04	0.01	62
Organic carbon, dissolved	mg/L	1.9	0.4	7.9
Fluoride	mg/L	0.24	0.02	0.02
Total dissolved solids	mg/L	250	45	402
Total suspended solids	mg/L	26	<1	6
Lab Section 2				
Calcium	mg/L	31	3.0	6.7
Magnesium	mg/L	6.9	1.0	0.5
Potassium	mg/L	3.7	0.7	148
Sodium	mg/L	32	3.9	3.9
Sulfate	mg/L	8.1	3.0	2.2
Aluminum, dissolved	mg/L	<0.0005	0.0058	0.20
Antimony, dissolved	mg/L	<0.0002	<0.0002	0.0007
Arsenic, dissolved	ug/L	<0.1	0.2	0.4
Barium, dissolved	mg/L	0.15	0.016	0.018
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	0.15	<0.01	<0.01
Bromine	ug/L	1100	79	12
Cadmium, dissolved	mg/L	<0.00001	0.00001	0.00006
Chromium, dissolved	mg/L	<0.0005	<0.0005	0.0019

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

23094 05/23/2021 13:14 GWR-012 *WATER*
23095 05/24/2021 14:23 GWR-035 *WATER*
23096 05/24/2021 16:23 GWR-034 *WATER*

Analyte	Units	23094	23095	23096
Lab Section 2				
Cobalt, dissolved	mg/L	<0.0001	0.0012	0.0003
Copper, dissolved	mg/L	<0.0002	0.0003	0.025
Iron, dissolved	mg/L	1.32	0.16	0.75
Lead, dissolved	mg/L	<0.0001	<0.0001	0.0054
Lithium, dissolved	ug/L	28	3.1	0.7
Manganese, dissolved	mg/L	0.59	0.23	0.037
Molybdenum, dissolved	mg/L	0.0007	0.0009	0.0004
Nickel, dissolved	mg/L	0.0002	0.010	0.0020
Selenium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	21.2	19.1	6.9
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.59	0.031	0.022
Sulfur	mg/L	2.7	1.0	0.7
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	0.0032
Titanium, dissolved	mg/L	<0.0002	<0.0002	0.0051
Uranium, dissolved	ug/L	<0.1	<0.1	87
Vanadium, dissolved	mg/L	<0.0001	<0.0001	0.0004
Zinc, dissolved	mg/L	0.0020	0.0045	0.12
Phosphorus, dissolved	mg/L	<0.01	<0.01	61
Uranium-234 calculated	Bq/L	0.002	0.003	1.2
Uranium-238 calculated	Bq/L	0.002	0.003	1.2
Lab Section 4				
Lead-210	Bq/L	0.10	<0.02	5.7
Polonium-210	Bq/L	0.26	0.03	4.4
Radium-226	Bq/L	0.12	0.04	0.90
Radon-222	Bq/L	<4	20	8
Thorium-230	Bq/L	<0.01	<0.01	0.44

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 23094
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

Note for Sample # 23095
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

Time between sampling and receipt in lab exceeds the recommended 24
for Organic carbon, dissolved

The temperature of the cooler was 11.2 °C upon receipt.

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

23097 05/24/2021 16:23 DUPLICATE #2 *WATER*
23098 05/25/2021 11:22 GWR-033 *WATER*
23099 05/25/2021 14:00 FIELD BLANK #2 *WATER*

Analyte	Units	23097	23098	23099
Lab Section 1				
Bicarbonate	mg/L	156	51	1
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	<1	67	Not Requested
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
Chloride	mg/L	Not Requested	Not Requested	<0.1
pH	pH units	7.62	7.43	5.85
Specific conductivity	uS/cm	481	334	<1
Sum of ions	mg/L	316	194	1
Total alkalinity	mg/L	128	42	1
Total hardness	mg/L	19	73	<1
Ammonia as nitrogen	mg/L	0.18	0.27	<0.01
Nitrate (calc. from NO2+NO3-N)	mg/L	0.09	<0.04	0.09
Nitrite	mg/L	0.25	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.02	<0.01	0.02
Ortho-phosphate as P	mg/L	52	0.01	0.01
Organic carbon, dissolved	mg/L	8.2	2.0	0.3
Fluoride	mg/L	0.02	0.12	<0.01
Total dissolved solids	mg/L	452	209	<5
Total suspended solids	mg/L	5	8	<1
Lab Section 2				
Calcium	mg/L	6.8	23	<0.1
Magnesium	mg/L	0.5	3.8	<0.1
Potassium	mg/L	147	2.1	<0.1
Sodium	mg/L	3.9	30	<0.1
Sulfate	mg/L	2.0	17	<0.2
Aluminum, dissolved	mg/L	0.21	0.0013	<0.0005
Antimony, dissolved	mg/L	0.0007	<0.0002	<0.0002
Arsenic, dissolved	ug/L	0.4	1.8	<0.1
Barium, dissolved	mg/L	0.018	0.059	<0.0005
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	<0.01	0.05	<0.01
Bromine	ug/L	14	860	<5
Cadmium, dissolved	mg/L	0.00005	<0.00001	<0.00001
Chromium, dissolved	mg/L	0.0019	<0.0005	<0.0005

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

23097 05/24/2021 16:23 DUPLICATE #2 *WATER*
23098 05/25/2021 11:22 GWR-033 *WATER*
23099 05/25/2021 14:00 FIELD BLANK #2 *WATER*

Analyte	Units	23097	23098	23099
Lab Section 2				
Cobalt, dissolved	mg/L	0.0003	0.0005	<0.0001
Copper, dissolved	mg/L	0.025	<0.0002	<0.0002
Iron, dissolved	mg/L	0.74	0.66	<0.0005
Lead, dissolved	mg/L	0.0054	<0.0001	<0.0001
Lithium, dissolved	ug/L	0.7	15	<0.1
Manganese, dissolved	mg/L	0.038	0.27	<0.0005
Molybdenum, dissolved	mg/L	0.0003	0.0026	<0.0001
Nickel, dissolved	mg/L	0.0022	0.0008	<0.0001
Selenium, dissolved	mg/L	<0.0001	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	6.9	12.2	<0.02
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.022	0.36	<0.0005
Sulfur	mg/L	0.7	5.7	<0.05
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	0.0033	<0.0001	<0.0001
Titanium, dissolved	mg/L	0.0045	<0.0002	<0.0002
Uranium, dissolved	ug/L	88	0.8	<0.1
Vanadium, dissolved	mg/L	0.0004	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.12	0.0040	<0.0005
Phosphorus, dissolved	mg/L	60	0.01	<0.01
Uranium-234 calculated	Bq/L	1.2	0.011	<0.001
Uranium-238 calculated	Bq/L	1.2	0.011	<0.001
Lab Section 4				
Lead-210	Bq/L	6.3	0.04	<0.02
Polonium-210	Bq/L	4.6	0.12	<0.005
Radium-226	Bq/L	0.86	0.13	<0.005
Radon-222	Bq/L	9	<3	<3
Thorium-230	Bq/L	0.43	<0.01	<0.01

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Time between sampling and receipt in lab exceeds the recommended 24
for Organic carbon, dissolved

The temperature of the cooler was 11.2 °C upon receipt.

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SRC Group # 2021-6345

Jun 08, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Iron (II)	mg/L	Chm-225
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508

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Jun 08, 2021

Denison Mines Inc.

Name	Units	Method
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Jun-07-2021 Client P.O.: WRE_E0221082

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1 approved by Hamilton, Ashley
Results from Lab Section 4 approved by Smith-Windsor, Jenna
Results from Lab Section 2 approved by Britton, Stephanie

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Jun-07-2021 Client P.O.: WRE_E0221082

25066 06/01/2021 17:47 GWR-011 *WATER*
25067 06/02/2021 11:43 GWR-013 *WATER*

Analyte	Units	25066	25067
Lab Section 1			
Bicarbonate	mg/L	41	85
Carbonate	mg/L	<1	<1
Chloride	mg/L	7.2	1.3
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	7.34	7.76
Specific conductivity	uS/cm	99	141
Sum of ions	mg/L	71	126
Total alkalinity	mg/L	34	70
Total hardness	mg/L	26	48
Ammonia as nitrogen	mg/L	0.13	0.02
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	0.13
Nitrite	mg/L	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	0.03
Ortho-phosphate as P	mg/L	0.12	0.06
Organic carbon, dissolved	mg/L	1.0	2.0
Fluoride	mg/L	0.18	0.08
Total dissolved solids	mg/L	98	177
Total suspended solids	mg/L	34	208
Lab Section 2			
Calcium	mg/L	7.9	14
Magnesium	mg/L	1.6	3.1
Potassium	mg/L	2.0	1.8
Sodium	mg/L	6.1	15
Sulfate	mg/L	4.7	5.2
Aluminum, dissolved	mg/L	0.052	0.011
Antimony, dissolved	mg/L	<0.0002	<0.0002
Arsenic, dissolved	ug/L	1.3	0.9
Barium, dissolved	mg/L	0.054	0.11
Beryllium, dissolved	mg/L	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

25066 06/01/2021 17:47 GWR-011 *WATER*
25067 06/02/2021 11:43 GWR-013 *WATER*

Analyte	Units	25066	25067
Lab Section 2			
Boron, dissolved	mg/L	0.04	<0.01
Bromine	ug/L	100	<5
Cadmium, dissolved	mg/L	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005
Cobalt, dissolved	mg/L	<0.0001	0.0001
Copper, dissolved	mg/L	0.0018	0.0008
Iron, dissolved	mg/L	0.86	0.014
Lead, dissolved	mg/L	0.0001	<0.0001
Lithium, dissolved	ug/L	13	6.2
Manganese, dissolved	mg/L	0.36	0.22
Molybdenum, dissolved	mg/L	0.0042	0.0054
Nickel, dissolved	mg/L	0.0001	0.0018
Selenium, dissolved	mg/L	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	24.1	22.7
Silver, dissolved	mg/L	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.12	0.080
Sulfur	mg/L	1.6	1.7
Thallium, dissolved	mg/L	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	<0.0002
Uranium, dissolved	ug/L	0.7	55
Vanadium, dissolved	mg/L	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.012	0.0016
Phosphorus, dissolved	mg/L	0.01	0.01
Uranium-234 calculated	Bq/L	0.008	10.5
Uranium-238 calculated	Bq/L	0.008	10.5
Lab Section 4			
Lead-210	Bq/L	0.3	8
Polonium-210	Bq/L	0.3	13
Radium-226	Bq/L	0.5	17
Radon-222	Bq/L	<8	41
Thorium-230	Bq/L	<0.1	4.7

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 9.9 °C upon receipt.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

25068 06/03/2021 08:23 GWR-031 *WATER*
25069 06/04/2021 19:53 GWR-032 *WATER*

Analyte	Units	25068	25069
Lab Section 1			
Bicarbonate	mg/L	160	118
Carbonate	mg/L	<1	<1
Chloride	mg/L	145	220
Hydroxide	mg/L	<1	<1
P. alkalinity	mg/L	<1	<1
pH	pH units	7.83	7.40
Specific conductivity	uS/cm	686	860
Sum of ions	mg/L	439	504
Total alkalinity	mg/L	131	97
Total hardness	mg/L	148	182
Ammonia as nitrogen	mg/L	0.35	0.73
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	<0.04
Nitrite	mg/L	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01	<0.01
Ortho-phosphate as P	mg/L	0.01	0.01
Organic carbon, dissolved	mg/L	6.2	5.8
Iron (II)	mg/L	<0.02	0.04
Fluoride	mg/L	0.42	0.23
Total dissolved solids	mg/L	393	599
Total suspended solids	mg/L	41	17
Lab Section 2			
Calcium	mg/L	43	55
Magnesium	mg/L	9.9	11
Potassium	mg/L	5.3	4.6
Sodium	mg/L	69	81
Sulfate	mg/L	6.6	13
Aluminum, dissolved	mg/L	<0.0005	0.0006
Antimony, dissolved	mg/L	0.0003	<0.0002
Arsenic, dissolved	ug/L	1.2	0.2
Barium, dissolved	mg/L	0.035	0.063
Beryllium, dissolved	mg/L	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002
Boron, dissolved	mg/L	0.55	0.43
Bromine	ug/L	1500	2000
Cadmium, dissolved	mg/L	<0.00001	<0.00001
Chromium, dissolved	mg/L	0.0008	<0.0005

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

25068 06/03/2021 08:23 GWR-031 *WATER*
25069 06/04/2021 19:53 GWR-032 *WATER*

Analyte	Units	25068	25069
Lab Section 2			
Cobalt, dissolved	mg/L	0.0002	<0.0001
Copper, dissolved	mg/L	<0.0002	<0.0002
Iron, dissolved	mg/L	0.090	4.20
Lead, dissolved	mg/L	<0.0001	<0.0001
Lithium, dissolved	ug/L	90	65
Manganese, dissolved	mg/L	0.13	0.22
Molybdenum, dissolved	mg/L	0.012	0.0038
Nickel, dissolved	mg/L	0.0019	0.0010
Selenium, dissolved	mg/L	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	9.1	13.3
Silver, dissolved	mg/L	<0.00005	<0.00005
Strontium, dissolved	mg/L	1.17	1.66
Sulfur	mg/L	2.2	4.3
Thallium, dissolved	mg/L	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	<0.0002
Uranium, dissolved	ug/L	50	11
Vanadium, dissolved	mg/L	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.69	2.62
Phosphorus, dissolved	mg/L	<0.01	<0.01
Uranium-234 calculated	Bq/L	10.7	1.69
Uranium-238 calculated	Bq/L	10.7	1.69
Lab Section 4			
Polonium-210	Bq/L	650	110
Radium-226	Bq/L	76	180
Radon-222	Bq/L	12000000	3800000
Thorium-230	Bq/L	30	7
Lead-210	Bq/L	7300	2200

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 25068
Time between sampling and receipt in lab exceeds the recommended 24 hours for Iron (II).
Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon.
Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

Note for Sample # 25069
Time between sampling and receipt in lab exceeds the recommended 24 hours for Iron (II).
Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon.
Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.

The temperature of the cooler was 9.9 °C upon receipt.

Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Chloride	mg/L	Chm-133 / Chm-134
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Iron (II)	mg/L	Chm-225
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508

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SRC Group # 2021-6894

Jul 23, 2021

Denison Mines Inc.

Name	Units	Method
Manganese, dissolved	mg/L	Chm-501 / Chm-522
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-300
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106

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SRC Group # 2021-7066

Jun 18, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Jun-09-2021 Client P.O.: WRE_E0221082

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 4 approved by Smith-Windsor, Jenna

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2021-7066

Jun 18, 2021

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Jennifer Skilnick

Date Samples Received: Jun-09-2021 Client P.O.: WRE_E0221082

25735 06/04/2021 08:30 GWR-031 *WATER*
25736 06/04/2021 19:30 GWR-032 *WATER*

Analyte	Units	25735	25736
Lab Section 4			
Tritium	Bq/L	910	1800

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SRC Group # 2021-7066

Jun 18, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
Tritium	Bq/L	Rad-122

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RUSH

SRC Group # 2021-11729

Sep 10, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Sep-08-2021 Client P.O.: WRE_T0421210

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 1 approved by Gipman, Keith
Results from Lab Section 2 approved by Britton, Stephanie

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

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RUSH

SRC Group # 2021-11729

Sep 10, 2021

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

IR-205: The 'Tracer Tank' label refers to the predetermined KCl tracer concentration of 15% (75,000 to 85,000 ppm Cl and K) utilized for injection as part of the 2021 Tracer Test. This sample is not discussed further in the Wheeler River Project Baseline Geology and Hydrogeology report.

Date Samples Received: Sep-08-2021

Client P.O.: WRE_T0421210

44624 09/02/2021 14:00 TRACER TANK *WATER*
44625 09/04/2021 14:00 GWR-038 *WATER*
44626 09/05/2021 14:00 GWR-039 *WATER*

Analyte	Units	44624	44625	44626
Lab Section 1				
Bicarbonate	mg/L	12	104	40
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	3180	1600	4760
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.94	7.56	6.49
Specific conductivity	uS/cm	11120	5380	16100
Sum of ions	mg/L	6370	3130	9220
Total alkalinity	mg/L	10	85	33
Total hardness	mg/L	46	614	2470
Nitrate (calc. from NO2+NO3-N)	mg/L	0.04	0.04	<0.04
Nitrite+Nitrate as nitrogen	mg/L	0.01	0.01	<0.01
Fluoride	mg/L	0.02	0.27	0.14
Total dissolved solids	mg/L	6220	3280	10400
Lab Section 2				
Calcium	mg/L	17	190	843
Magnesium	mg/L	1.0	34	90
Potassium	mg/L	3120	955	3000
Sodium	mg/L	31	137	189
Sulfate	mg/L	11	110	300

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 16.3 °C upon receipt.

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RUSH

SRC Group # 2021-11729

Sep 10, 2021

Denison Mines Inc.

44627 09/01/2021 14:00 GWR-040 *WATER*
44628 09/06/2021 14:00 GWR-041 *WATER*
44629 09/07/2021 14:00 GWR-042 *WATER*

Analyte	Units	44627	44628	44629
Lab Section 1				
Bicarbonate	mg/L	76	80	61
Carbonate	mg/L	<1	<1	<1
Chloride	mg/L	2560	2270	3590
Hydroxide	mg/L	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1
pH	pH units	6.98	6.91	6.51
Specific conductivity	uS/cm	7530	7050	11530
Sum of ions	mg/L	4360	4130	6760
Total alkalinity	mg/L	62	66	50
Total hardness	mg/L	1830	1340	1900
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04	<0.04	<0.04
Nitrite+Nitrate as nitrogen	mg/L	<0.01	<0.01	<0.01
Fluoride	mg/L	0.21	0.21	0.18
Total dissolved solids	mg/L	4640	4510	7830
Lab Section 2				
Calcium	mg/L	590	431	665
Magnesium	mg/L	88	64	58
Potassium	mg/L	767	975	2000
Sodium	mg/L	203	154	152
Sulfate	mg/L	71	160	230

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 16.3 °C upon receipt.

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RUSH

SRC Group # 2021-11729

Sep 10, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Chloride	mg/L	Chm-115
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Bicarbonate	mg/L	Chm-211
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Total dissolved solids	mg/L	Chm-203
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Calcium	mg/L	Chm-508
Potassium	mg/L	Chm-508
Magnesium	mg/L	Chm-508
Sodium	mg/L	Chm-508
Sulfate	mg/L	Chm-508

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SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Sep-08-2021 Client P.O.: WRE_T0421210

These results are preliminary and are subject to revision.

The final authorized report will be provided when all tests have been completed.

SASKATCHEWAN RESEARCH COUNCIL

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Sep-08-2021 Client P.O.: WRE_T0421210

44633 09/02/2021 14:00 TRACER TANK *WATER*
44634 09/04/2021 14:00 GWR-038 *WATER*
44635 09/07/2021 14:00 GWR-042 *WATER*

Analyte	Units	44633	44634	44635
Lab Section 2				
Uranium, dissolved	ug/L	26	504	564

The temperature of the cooler was 16.3 °C upon receipt.

This is a preliminary report. Results are subject to revision. The final authorized report will be provided when all tests have been completed.

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SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

44636 09/05/2021 14:00 GWR-039 *WATER*
44637 09/06/2021 14:00 GWR-041 *WATER*

Analyte	Units	44636	44637
Lab Section 1			
Ammonia as nitrogen	mg/L	44	18
Nitrite	mg/L	<0.03	0.04
Ortho-phosphate as P	mg/L	0.04	0.02
Organic carbon, dissolved	mg/L	40	21
Iron (II)	mg/L	0.07	0.05
Total suspended solids	mg/L	68	31
Lab Section 2			
Aluminum, dissolved	mg/L	0.005	0.010
Antimony, dissolved	mg/L	<0.002	<0.002
Arsenic, dissolved	ug/L	<1	<1
Barium, dissolved	mg/L	0.96	0.35
Beryllium, dissolved	mg/L	<0.001	<0.001
Bismuth, dissolved	mg/L	<0.002	<0.002
Boron, dissolved	mg/L	0.4	0.5
Bromine	ug/L	15800	6800
Cadmium, dissolved	mg/L	<0.0001	<0.0001
Chromium, dissolved	mg/L	<0.005	<0.005
Cobalt, dissolved	mg/L	0.003	0.002
Copper, dissolved	mg/L	<0.002	<0.002
Iron, dissolved	mg/L	23.0	18.2
Lead, dissolved	mg/L	<0.001	<0.001
Lithium, dissolved	ug/L	470	210
Manganese, dissolved	mg/L	1.8	0.87
Molybdenum, dissolved	mg/L	0.008	0.045
Nickel, dissolved	mg/L	0.056	0.024
Selenium, dissolved	mg/L	0.003	0.002
Silica, soluble, dissolved	mg/L	55.7	70.2
Silver, dissolved	mg/L	<0.0005	<0.0005
Strontium, dissolved	mg/L	23.5	11.2
Sulfur	mg/L	100	53.3
Thallium, dissolved	mg/L	<0.002	<0.002
Tin, dissolved	mg/L	<0.001	<0.001
Titanium, dissolved	mg/L	<0.002	<0.002
Uranium, dissolved	ug/L	38	10
Vanadium, dissolved	mg/L	<0.001	<0.001
Zinc, dissolved	mg/L	0.090	0.065

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

44636 09/05/2021 14:00 GWR-039 *WATER*
44637 09/06/2021 14:00 GWR-041 *WATER*

Analyte	Units	44636	44637
Lab Section 2			
Phosphorus, dissolved	mg/L	<0.1	<0.1
Uranium-234 calculated	Bq/L	15.9	1.0
Uranium-238 calculated	Bq/L	15.9	1.0
Lab Section 4			
Polonium-210	Bq/L	460	420
Radon-222	Bq/L	6000000	4000000
Thorium-230	Bq/L	21	6
Tritium	Bq/L	RTR	RTR
Radium-226	Bq/L	6200	10000
Lead-210	Bq/L	2700	2300

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 44636
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved and Iron (II).
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Radon results are corrected for decay to the time of sample collection.
Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon.
Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.

Note for Sample # 44637
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved and Iron (II).
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Radon results are corrected for decay to the time of sample collection.
Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon.
Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.

The temperature of the cooler was 16.3 °C upon receipt.

This is a preliminary report. Results are subject to revision. The final authorized report will be provided when all tests have been completed.

SASKATCHEWAN RESEARCH COUNCIL

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

44638 09/01/2021 14:00 GWR-040 *WATER*

Analyte	Units	44638
Lab Section 1		
Ammonia as nitrogen	mg/L	12
Nitrite	mg/L	<0.03
Ortho-phosphate as P	mg/L	0.02
Organic carbon, dissolved	mg/L	19
Total suspended solids	mg/L	28
Lab Section 2		
Aluminum, dissolved	mg/L	<0.005
Antimony, dissolved	mg/L	<0.002
Arsenic, dissolved	ug/L	<1
Barium, dissolved	mg/L	0.52
Beryllium, dissolved	mg/L	<0.001
Bismuth, dissolved	mg/L	<0.002
Boron, dissolved	mg/L	0.5
Bromine	ug/L	9800
Cadmium, dissolved	mg/L	<0.0001
Chromium, dissolved	mg/L	<0.005
Cobalt, dissolved	mg/L	0.001
Copper, dissolved	mg/L	<0.002
Iron, dissolved	mg/L	8.2
Lead, dissolved	mg/L	<0.001
Lithium, dissolved	ug/L	250
Manganese, dissolved	mg/L	0.85
Molybdenum, dissolved	mg/L	0.011
Nickel, dissolved	mg/L	0.019
Selenium, dissolved	mg/L	0.002
Silica, soluble, dissolved	mg/L	50.5
Silver, dissolved	mg/L	<0.0005
Strontium, dissolved	mg/L	16.1
Sulfur	mg/L	24
Thallium, dissolved	mg/L	<0.002
Tin, dissolved	mg/L	<0.001
Titanium, dissolved	mg/L	<0.002
Uranium, dissolved	ug/L	10
Vanadium, dissolved	mg/L	<0.001
Zinc, dissolved	mg/L	0.010
Phosphorus, dissolved	mg/L	<0.1

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

44638 09/01/2021 14:00 GWR-040 *WATER*

Analyte	Units	44638
Lab Section 2		
Uranium-234 calculated	Bq/L	0.24
Uranium-238 calculated	Bq/L	0.24
Lab Section 4		
Polonium-210	Bq/L	700
Radon-222	Bq/L	6000000
Thorium-230	Bq/L	6
Tritium	Bq/L	<15
Radium-226	Bq/L	1500
Lead-210	Bq/L	5000

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 44638
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Radon results are corrected for decay to the time of sample collection.
Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon.
Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.

The temperature of the cooler was 16.3 °C upon receipt.

This is a preliminary report. Results are subject to revision. The final authorized report will be provided when all tests have been completed.

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

44639 09/01/2021 14:00 GWR-040 DUPLICATE *WATER*

Analyte	Units	44639
Lab Section 1		
Bicarbonate	mg/L	76
Carbonate	mg/L	<1
Chloride	mg/L	2580
Hydroxide	mg/L	<1
P. alkalinity	mg/L	<1
pH	pH units	7.39
Specific conductivity	uS/cm	7530
Sum of ions	mg/L	4350
Total alkalinity	mg/L	62
Total hardness	mg/L	1830
Ammonia as nitrogen	mg/L	12
Nitrate (calc. from NO2+NO3-N)	mg/L	<0.04
Nitrite	mg/L	<0.03
Nitrite+Nitrate as nitrogen	mg/L	<0.01
Ortho-phosphate as P	mg/L	<0.01
Organic carbon, dissolved	mg/L	19
Fluoride	mg/L	0.21
Total dissolved solids	mg/L	4080
Total suspended solids	mg/L	26
Lab Section 2		
Calcium	mg/L	590
Magnesium	mg/L	88
Potassium	mg/L	732
Sodium	mg/L	205
Sulfate	mg/L	67
Aluminum, dissolved	mg/L	<0.005
Antimony, dissolved	mg/L	<0.002
Arsenic, dissolved	ug/L	<1
Barium, dissolved	mg/L	0.52
Beryllium, dissolved	mg/L	<0.001
Bismuth, dissolved	mg/L	<0.002
Boron, dissolved	mg/L	0.5
Bromine	ug/L	9800
Cadmium, dissolved	mg/L	<0.0001
Chromium, dissolved	mg/L	<0.005
Cobalt, dissolved	mg/L	0.001

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

44639 09/01/2021 14:00 GWR-040 DUPLICATE *WATER*

Analyte	Units	44639
Lab Section 2		
Copper, dissolved	mg/L	<0.002
Iron, dissolved	mg/L	7.7
Lead, dissolved	mg/L	<0.001
Lithium, dissolved	ug/L	250
Manganese, dissolved	mg/L	0.83
Molybdenum, dissolved	mg/L	0.011
Nickel, dissolved	mg/L	0.020
Selenium, dissolved	mg/L	0.002
Silica, soluble, dissolved	mg/L	51.2
Silver, dissolved	mg/L	<0.0005
Strontium, dissolved	mg/L	16.1
Sulfur	mg/L	22
Thallium, dissolved	mg/L	<0.002
Tin, dissolved	mg/L	<0.001
Titanium, dissolved	mg/L	<0.002
Uranium, dissolved	ug/L	10
Vanadium, dissolved	mg/L	<0.001
Zinc, dissolved	mg/L	0.011
Phosphorus, dissolved	mg/L	<0.1
Uranium-234 calculated	Bq/L	0.56
Uranium-238 calculated	Bq/L	0.56
Lab Section 4		
Polonium-210	Bq/L	600
Radon-222	Bq/L	6000000
Thorium-230	Bq/L	10
Tritium	Bq/L	<15
Radium-226	Bq/L	1100
Lead-210	Bq/L	5000

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 44639
Time between sampling and receipt in lab exceeds the recommended 24 hours for Organic carbon, dissolved.
Time between sampling and receipt in lab exceeds the recommended 48 hours for Nitrite and Ortho-phosphate as P.
Radon results are corrected for decay to the time of sample collection.
Air was bubbled through the sample before the gamma spectroscopy analysis to reduce the interferences caused by high activity of Radon.

SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
143-111 Research Drive, Saskatoon, SK Canada S7N 3R2

T: 306-933-6932 **F:** 306-933-7922
Toll-free: 1-800-240-8808
E: analytical@src.sk.ca

www.src.sk.ca/analytical

Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

Analysis of radon exceeded the recommended 8 days as the radon had to decay to a level in our calibration range before analysis.

The temperature of the cooler was 16.3 °C upon receipt.

This is a preliminary report. Results are subject to revision. The final authorized report will be provided when all tests have been completed.

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Iron (II)	mg/L	Chm-225
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate (calc. from NO2+NO3-N)	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Ortho-phosphate as P	mg/L	Chm-116
Total dissolved solids	mg/L	Chm-203
Total suspended solids	mg/L	Chm-206
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522

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Preliminary

SRC Group # 2021-11730

Nov 02, 2021

Denison Mines Inc.

Name	Units	Method
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Phosphorus, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Sulfur	mg/L	Chm-508
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Silica, soluble, dissolved	mg/L	Chm-501 / Calculation
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Uranium-234 calculated	Bq/L	Chm-522
Uranium-238 calculated	Bq/L	Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-300
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-300
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

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SRC Group # 2021-12063

Nov 16, 2021

Denison Mines Inc.
200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Sep-16-2021 Client P.O.: WRE-T0421210

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 4 approved by Snook, Vicky
Results from Lab Section 1 approved by Hamilton, Ashley
Results from Lab Section 2 approved by Britton, Stephanie

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2021-12063

Nov 16, 2021

Denison Mines Inc.

200-230 22nd Street East
Saskatoon, SK S7K 0E9
Attn: Mikkel Tetland

Date Samples Received: Sep-16-2021 Client P.O.: WRE-T0421210

45769 09/14/2021 GWR-046 *WATER*
45770 09/10/2021 GWR-047 *WATER*
45771 09/11/2021 GWR-048 *WATER*

Analyte	Units	45769	45770	45771
Lab Section 1				
Bicarbonate	mg/L	See attached	See attached	See attached
Carbonate	mg/L	See attached	See attached	See attached
Chloride	mg/L	See attached	See attached	See attached
Hydroxide	mg/L	See attached	See attached	See attached
P. alkalinity	mg/L	See attached	See attached	See attached
pH	pH units	See attached	See attached	See attached
Specific conductivity	uS/cm	See attached	See attached	See attached
Sum of ions	mg/L	See attached	See attached	See attached
Total alkalinity	mg/L	See attached	See attached	See attached
Total hardness	mg/L	See attached	See attached	See attached
Ammonia as nitrogen	mg/L	See attached	See attached	See attached
Nitrate	mg/L	See attached	See attached	See attached
Nitrite	mg/L	See attached	See attached	See attached
Nitrite+Nitrate as nitrogen	mg/L	See attached	See attached	See attached
Organic carbon, dissolved	mg/L	See attached	See attached	See attached
Iron (II)	mg/L	See attached	See attached	See attached
Iron (III), calculated	mg/L	See attached	See attached	See attached
Fluoride	mg/L	See attached	See attached	See attached
Total dissolved solids	mg/L	See attached	See attached	See attached
Lab Section 2				
Calcium	mg/L	See attached	See attached	See attached
Magnesium	mg/L	See attached	See attached	See attached
Potassium	mg/L	See attached	See attached	See attached
Sodium	mg/L	See attached	See attached	See attached
Sulfate	mg/L	See attached	See attached	See attached
Aluminum, dissolved	mg/L	See attached	See attached	See attached
Antimony, dissolved	mg/L	See attached	See attached	See attached
Arsenic, dissolved	ug/L	See attached	See attached	See attached
Barium, dissolved	mg/L	See attached	See attached	See attached
Beryllium, dissolved	mg/L	See attached	See attached	See attached
Bismuth, dissolved	mg/L	See attached	See attached	See attached

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SRC Group # 2021-12063

Nov 16, 2021

Denison Mines Inc.

45769 09/14/2021 GWR-046 *WATER*
45770 09/10/2021 GWR-047 *WATER*
45771 09/11/2021 GWR-048 *WATER*

Analyte	Units	45769	45770	45771
Lab Section 2				
Boron, dissolved	mg/L	See attached	See attached	See attached
Bromine	ug/L	11	34	57
Cadmium, dissolved	mg/L	See attached	See attached	See attached
Chromium, dissolved	mg/L	See attached	See attached	See attached
Cobalt, dissolved	mg/L	See attached	See attached	See attached
Copper, dissolved	mg/L	See attached	See attached	See attached
Iron	mg/L	See attached	See attached	See attached
Iron, dissolved	mg/L	See attached	See attached	See attached
Lead, dissolved	mg/L	See attached	See attached	See attached
Lithium, dissolved	ug/L	See attached	See attached	See attached
Manganese, dissolved	mg/L	See attached	See attached	See attached
Molybdenum, dissolved	mg/L	See attached	See attached	See attached
Nickel, dissolved	mg/L	See attached	See attached	See attached
Selenium, dissolved	mg/L	See attached	See attached	See attached
Silver, dissolved	mg/L	See attached	See attached	See attached
Strontium, dissolved	mg/L	See attached	See attached	See attached
Thallium, dissolved	mg/L	See attached	See attached	See attached
Tin, dissolved	mg/L	See attached	See attached	See attached
Titanium, dissolved	mg/L	See attached	See attached	See attached
Uranium, dissolved	ug/L	See attached	See attached	See attached
Vanadium, dissolved	mg/L	See attached	See attached	See attached
Zinc, dissolved	mg/L	See attached	See attached	See attached
Lab Section 4				
Lead-210	Bq/L	0.9	1.1	0.46
Polonium-210	Bq/L	0.65	0.14	1.3
Radium-226	Bq/L	0.93	0.24	0.75
Radon-222	Bq/L	11	1800	620
Thorium-230	Bq/L	0.20	<0.01	0.01
Tritium	Bq/L	<40	<40	<40

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 10.4 °C upon receipt.

Radon results are corrected for decay to the time of sample collection.

SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2021-12063

Nov 16, 2021

Denison Mines Inc.

Analyte Methods

Name	Units	Method
P. alkalinity	mg/L	Chm-211
Organic carbon, dissolved	mg/L	Chm-399
Chloride	mg/L	Chm-115
Carbonate	mg/L	Chm-211
Fluoride	mg/L	Chm-211
Iron (III), calculated	mg/L	Calculation
Iron (II)	mg/L	Chm-225
Bicarbonate	mg/L	Chm-211
Ammonia as nitrogen	mg/L	Chm-123
Nitrite+Nitrate as nitrogen	mg/L	Chm-124
Nitrite	mg/L	Chm-124
Nitrate	mg/L	Chm-124
Hydroxide	mg/L	Chm-211
pH	pH units	Chm-211
Total dissolved solids	mg/L	Chm-203
Specific conductivity	uS/cm	Chm-211
Sum of ions	mg/L	Calculation
Total hardness	mg/L	Calculation
Total alkalinity	mg/L	Chm-211
Silver, dissolved	mg/L	Chm-501 / Chm-522
Aluminum, dissolved	mg/L	Chm-501 / Chm-522
Arsenic, dissolved	ug/L	Chm-501 / Chm-522
Boron, dissolved	mg/L	Chm-501 / Chm-522
Barium, dissolved	mg/L	Chm-501 / Chm-522
Beryllium, dissolved	mg/L	Chm-501 / Chm-522
Bismuth, dissolved	mg/L	Chm-501 / Chm-522
Bromine	ug/L	Chm-522
Calcium	mg/L	Chm-508
Cadmium, dissolved	mg/L	Chm-501 / Chm-522
Cobalt, dissolved	mg/L	Chm-501 / Chm-522
Chromium, dissolved	mg/L	Chm-501 / Chm-522
Copper, dissolved	mg/L	Chm-501 / Chm-522
Iron	mg/L	Chm-522
Iron, dissolved	mg/L	Chm-501 / Chm-522
Potassium	mg/L	Chm-508
Lithium, dissolved	ug/L	Chm-501 / Chm-522
Magnesium	mg/L	Chm-508
Manganese, dissolved	mg/L	Chm-501 / Chm-522

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SRC Group # 2021-12063

Nov 16, 2021

Denison Mines Inc.

Name	Units	Method
Molybdenum, dissolved	mg/L	Chm-501 / Chm-522
Sodium	mg/L	Chm-508
Nickel, dissolved	mg/L	Chm-501 / Chm-522
Lead, dissolved	mg/L	Chm-501 / Chm-522
Antimony, dissolved	mg/L	Chm-501 / Chm-522
Selenium, dissolved	mg/L	Chm-501 / Chm-522
Tin, dissolved	mg/L	Chm-501 / Chm-522
Sulfate	mg/L	Chm-508
Strontium, dissolved	mg/L	Chm-501 / Chm-522
Titanium, dissolved	mg/L	Chm-501 / Chm-522
Thallium, dissolved	mg/L	Chm-501 / Chm-522
Uranium, dissolved	ug/L	Chm-501 / Chm-522
Vanadium, dissolved	mg/L	Chm-501 / Chm-522
Zinc, dissolved	mg/L	Chm-501 / Chm-522
Lead-210	Bq/L	Rad-101
Polonium-210	Bq/L	Rad-103
Radium-226	Bq/L	Rad-105
Radon-222	Bq/L	Rad-116
Thorium-230	Bq/L	Rad-106
Tritium	Bq/L	Rad-122

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **SK2103820**	Page	: 1 of 5
Client	: **Saskatchewan Research Council**	Laboratory	: Saskatoon - Environmental
Contact	: Mikkel Tetland	Account Manager	: Brian Morgan
Address	: 143- 111 RESEARCH DRIVE Saskatoon SK Canada S7N 3R2	Address	: 819 58 Street East Saskatoon SK Canada S7K 6X5
Telephone	: ----	Telephone	: 1 306 221 7147
Project	: ----	Date Samples Received	: 21-Sep-2021 16:00
PO	: ----	Date Analysis Commenced	: 22-Sep-2021
C-O-C number	: ----	Issue Date	: 05-Oct-2021 10:17
Sampler	: ----		
Site	: denison Mines		
Quote number	: standard rates		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Colby Bingham	Quality Systems Coordinator	Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Quality Systems Coordinator	Metals, Saskatoon, Saskatchewan
Elke Tabora		Inorganics, Calgary, Alberta
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Lian Nesbitt	Laboratory Analyst	Metals, Saskatoon, Saskatchewan
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Melissa Houseman	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Melissa Houseman	Team Leader - Inorganics	Metals, Saskatoon, Saskatchewan
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
IB:INT	*Ion Balance Reviewed: Imbalance is due to interference or non-measured component.*
SFP	*Sample was filtered and preserved at the laboratory.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

				Client sample ID	Tracer Tank	GWR-046	GWR-047	GWR-048	----
				Client sampling date / time	14-Sep-2021 12:00	14-Sep-2021 12:00	10-Sep-2021 12:00	10-Sep-2021 12:00	----
Analyte	CAS Number	Method	LOR	Unit	SK2103820-001	SK2103820-002	SK2103820-003	SK2103820-004	--------
					Result	Result	Result	Result	----
Sample Preparation									
dissolved Fe2 filtration location	----	EP541	-	-	----	Field	Field	Field	----
Physical Tests									
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	112	89.5	29.4	43.4	----
conductivity	----	E100	2.0	µS/cm	230000	277	160	139	----
pH	----	E108	0.10	pH units	3.15	7.06	7.37	7.08	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	<1.0	86.3	75.2	57.0	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, total (as CaCO3)	----	E290	2.0	mg/L	<2.0	70.7	61.6	46.7	----
solids, total dissolved [TDS], calculated	----	EC103	1.0	mg/L	170000	188	132	122	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	----	0.0260	<0.0050	<0.0050	----
bromide	24959-67-9	E235.Br	0.10	mg/L	----	<0.10	<0.10	<0.10	----
nitrogen, total	7727-37-9	EC368	0.050	mg/L	----	2.65	0.287	0.669	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.200	mg/L	----	2.65	0.287	0.669	----
chloride	16887-00-6	E235.Cl	0.50	mg/L	84800	8.63	6.13	4.14	----
fluoride	16984-48-8	E235.F	0.020	mg/L	<20.0 DLDS	0.059	0.074	0.142	----
nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L	<20.0 DLDS	<0.020	<0.020	<0.020	----
nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L	<10.0 DLDS	<0.010	<0.010	<0.010	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	421	10.1	2.28	6.26	----
nitrate + nitrite (as N)	----	EC235.N+N	0.0500	mg/L	<22.4	<0.0500	<0.0500	<0.0500	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	----	34.6	8.95	15.6	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	2400	1.87	1.46	1.19	----
cation sum	----	EC101	0.10	meq/L	2190	2.70	1.97	1.67	----
ion balance (cation-anion difference)	----	EC101	0.010	%	4.58	18.2 IB:INT	14.9 IB:INT	16.8 IB:INT	----
ion balance (cations/anions ratio)	----	EC101	0.010	%	91.2	144 IB:INT	135 IB:INT	140 IB:INT	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	----	0.800	0.0065	0.0010	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	Tracer Tank	GWR-046	GWR-047	GWR-048	----
				Client sampling date / time	14-Sep-2021 12:00	14-Sep-2021 12:00	10-Sep-2021 12:00	10-Sep-2021 12:00	----
Analyte	CAS Number	Method	LOR	Unit	SK2103820-001	SK2103820-002	SK2103820-003	SK2103820-004	--------
					Result	Result	Result	Result	----
Dissolved Metals									
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	----	0.00024	<0.00010	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	----	0.00475	0.00371	0.00085	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	----	0.241	0.0626	0.0577	----
beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	----	0.000167	<0.000020	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	----	<0.000050	<0.000050	<0.000050	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	----	0.023	0.018	0.041	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	----	0.0000336	<0.0000050	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	37.2	29.4	8.24	13.1	----
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	----	0.000042	<0.000010	0.000019	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	----	0.00169	<0.00050	0.00068	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	----	0.00584	0.00025	0.00036	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	----	0.00629	<0.00020	<0.00020	----
iron, dissolved	7439-89-6	E421	0.030	mg/L	10.7	6.03	11.9	9.62	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	----	0.00157	<0.000050	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	----	0.0083	0.0096	0.0155	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	4.58	3.91	2.14	2.60	----
manganese, dissolved	7439-96-5	E421	0.00500	mg/L	<1.00 DLDS	1.08	0.844	0.715	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	----	0.00389	0.00374	0.00298	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	----	0.0487	0.00062	0.00066	----
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	----	<0.050	0.130	0.289	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	84200	6.77	4.46	1.89	----
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	----	0.00159	0.00212	0.00125	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	----	0.000359	<0.000050	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	----	13.1	11.8	11.6	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	----	0.000046	<0.000010	<0.000010	----
sodium, dissolved	17341-25-2	E421	0.050	mg/L	707	8.96	18.6	8.87	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	----	0.115	0.0796	0.169	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	----	8.69	1.34	3.58	----
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	----	<0.00020	<0.00020	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	----	<0.000010	<0.000010	<0.000010	----
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	----	0.00201	<0.00010	<0.00010	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	Tracer Tank	GWR-046	GWR-047	GWR-048	----
				Client sampling date / time	14-Sep-2021 12:00	14-Sep-2021 12:00	10-Sep-2021 12:00	10-Sep-2021 12:00	----
Analyte	CAS Number	Method	LOR	Unit	SK2103820-001	SK2103820-002	SK2103820-003	SK2103820-004	--------
					Result	Result	Result	Result	----
Dissolved Metals									
tin, dissolved	7440-31-5	E421	0.00010	mg/L	----	0.00033	<0.00010	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	----	0.00897	<0.00030	<0.00030	----
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	----	0.00138	0.00507	0.00330	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	----	0.0226	0.000752	0.000488	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.100 DLDS	0.00120	<0.00050	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	----	0.0125	0.0011	0.0031	----
zirconium, dissolved	7440-67-7	E421	0.00030	mg/L	----	0.0137	0.00032	<0.00030	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Field	----
Speciated Metals									
iron, ferrous [Fe II], dissolved	15438-31-0	E541	0.020	mg/L	----	7.77 SFP	<0.020 SFP	2.30 SFP	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **SK2103820**	Page	: 1 of 13
Client	: **Saskatchewan Research Council**	Laboratory	: Saskatoon - Environmental
Contact	: Mikkel Tetland	Account Manager	: Brian Morgan
Address	: 143- 111 RESEARCH DRIVE Saskatoon SK Canada S7N 3R2	Address	: 819 58 Street East Saskatoon, Saskatchewan Canada S7K 6X5
Telephone	: ----	Telephone	: 1 306 221 7147
Project	: ----	Date Samples Received	: 21-Sep-2021 16:00
PO	: ----	Issue Date	: 05-Oct-2021 10:17
C-O-C number	: ----		
Sampler	: ----		
Site	: denison Mines		
Quote number	: standard rates		
No. of samples received	: 4		
No. of samples analysed	: 4		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Physical Tests	Anonymous	Anonymous	conductivity	----	E100	4.5 % DUP-H	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) GWR-046	E298	14-Sep-2021	02-Oct-2021	----	----		02-Oct-2021	28 days	18 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) GWR-047	E298	10-Sep-2021	02-Oct-2021	----	----		02-Oct-2021	28 days	22 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) GWR-048	E298	10-Sep-2021	02-Oct-2021	----	----		02-Oct-2021	28 days	22 days	✓
Anions and Nutrients : Bromide in Water by IC										
HDPE GWR-046	E235.Br	14-Sep-2021	----	----	----		24-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Bromide in Water by IC										
HDPE GWR-047	E235.Br	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Bromide in Water by IC										
HDPE GWR-048	E235.Br	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE GWR-046	E235.Cl	14-Sep-2021	----	----	----		24-Sep-2021	28 days	10 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC										
HDPE										
Tracer Tank	E235.Cl	14-Sep-2021	----	----	----		24-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
GWR-047	E235.Cl	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE										
GWR-048	E235.Cl	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
GWR-046	E235.F	14-Sep-2021	----	----	----		24-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
Tracer Tank	E235.F	14-Sep-2021	----	----	----		24-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
GWR-047	E235.F	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE										
GWR-048	E235.F	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE										
GWR-046	E235.NO3	14-Sep-2021	----	----	----		24-Sep-2021	3 days	10 days	× EHTR
Anions and Nutrients : Nitrate in Water by IC										
HDPE										
Tracer Tank	E235.NO3	14-Sep-2021	----	----	----		24-Sep-2021	3 days	10 days	× EHTR

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Anions and Nutrients : Nitrate in Water by IC										
HDPE GWR-047	E235.NO3	10-Sep-2021	----	----	----		22-Sep-2021	3 days	12 days	× EHTR
Anions and Nutrients : Nitrate in Water by IC										
HDPE GWR-048	E235.NO3	10-Sep-2021	----	----	----		22-Sep-2021	3 days	12 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC										
HDPE GWR-046	E235.NO2	14-Sep-2021	----	----	----		24-Sep-2021	3 days	10 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC										
HDPE Tracer Tank	E235.NO2	14-Sep-2021	----	----	----		24-Sep-2021	3 days	10 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC										
HDPE GWR-047	E235.NO2	10-Sep-2021	----	----	----		22-Sep-2021	3 days	12 days	× EHTR
Anions and Nutrients : Nitrite in Water by IC										
HDPE GWR-048	E235.NO2	10-Sep-2021	----	----	----		22-Sep-2021	3 days	12 days	× EHTR
Anions and Nutrients : Sulfate in Water by IC										
HDPE GWR-046	E235.SO4	14-Sep-2021	----	----	----		24-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE Tracer Tank	E235.SO4	14-Sep-2021	----	----	----		24-Sep-2021	28 days	10 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE GWR-047	E235.SO4	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE GWR-048	E235.SO4	10-Sep-2021	----	----	----		22-Sep-2021	28 days	12 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) GWR-046	E318	14-Sep-2021	28-Sep-2021	----	----		28-Sep-2021	28 days	14 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) GWR-047	E318	10-Sep-2021	28-Sep-2021	----	----		28-Sep-2021	28 days	18 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) GWR-048	E318	10-Sep-2021	28-Sep-2021	----	----		28-Sep-2021	28 days	18 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) GWR-047	E421	10-Sep-2021	22-Sep-2021	----	----		23-Sep-2021	180 days	13 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) GWR-048	E421	10-Sep-2021	22-Sep-2021	----	----		23-Sep-2021	180 days	13 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) GWR-046	E421	14-Sep-2021	22-Sep-2021	----	----		23-Sep-2021	180 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) Tracer Tank	E421	14-Sep-2021	22-Sep-2021	----	----		23-Sep-2021	180 days	9 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) GWR-046	E358-L	14-Sep-2021	29-Sep-2021	----	----		02-Oct-2021	28 days	18 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) GWR-047	E358-L	10-Sep-2021	29-Sep-2021	----	----		02-Oct-2021	28 days	22 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) GWR-048	E358-L	10-Sep-2021	29-Sep-2021	----	----		02-Oct-2021	28 days	22 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE GWR-047	E290	10-Sep-2021	----	----	----		23-Sep-2021	14 days	13 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE GWR-048	E290	10-Sep-2021	----	----	----		23-Sep-2021	14 days	13 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE GWR-046	E290	14-Sep-2021	----	----	----		23-Sep-2021	14 days	9 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE Tracer Tank	E290	14-Sep-2021	----	----	----		23-Sep-2021	14 days	9 days	✓
Physical Tests : Conductivity in Water										
HDPE GWR-047	E100	10-Sep-2021	----	----	----		23-Sep-2021	28 days	13 days	✓
Physical Tests : Conductivity in Water										
HDPE GWR-048	E100	10-Sep-2021	----	----	----		23-Sep-2021	28 days	13 days	✓
Physical Tests : Conductivity in Water										
HDPE GWR-046	E100	14-Sep-2021	----	----	----		23-Sep-2021	28 days	9 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : Conductivity in Water										
HDPE										
Tracer Tank	E100	14-Sep-2021	----	----	----		23-Sep-2021	28 days	9 days	✓
Physical Tests : pH by Meter										
HDPE										
GWR-046	E108	14-Sep-2021	----	----	----		23-Sep-2021	0.25 hrs	216 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE										
Tracer Tank	E108	14-Sep-2021	----	----	----		23-Sep-2021	0.25 hrs	216 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE										
GWR-047	E108	10-Sep-2021	----	----	----		23-Sep-2021	0.25 hrs	312 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE										
GWR-048	E108	10-Sep-2021	----	----	----		23-Sep-2021	0.25 hrs	312 hrs	× EHTR-FM
Speciated Metals : Dissolved Ferrous Iron in Water by Colour										
HDPE dissolved (hydrochloric acid)										
GWR-047	E541	10-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	----	13 days	EHTR-FM
Speciated Metals : Dissolved Ferrous Iron in Water by Colour										
HDPE dissolved (hydrochloric acid)										
GWR-048	E541	10-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	----	13 days	EHTR-FM
Speciated Metals : Dissolved Ferrous Iron in Water by Colour										
HDPE dissolved (hydrochloric acid)										
GWR-046	E541	14-Sep-2021	23-Sep-2021	----	----		23-Sep-2021	----	9 days	EHTL

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	299780	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	309096	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	299527	2	3	66.6	5.0	✓
Chloride in Water by IC	E235.Cl	299532	2	40	5.0	5.0	✓
Conductivity in Water	E100	299779	1	19	5.2	5.0	✓
Dissolved Ferrous Iron in Water by Colour	E541	300953	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	299697	1	8	12.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	306497	2	25	8.0	5.0	✓
Fluoride in Water by IC	E235.F	299531	2	40	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	299528	2	40	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	299529	2	40	5.0	5.0	✓
pH by Meter	E108	299778	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	299530	2	40	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	303490	1	4	25.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	299780	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	309096	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	299527	2	3	66.6	5.0	✓
Chloride in Water by IC	E235.Cl	299532	2	40	5.0	5.0	✓
Conductivity in Water	E100	299779	1	19	5.2	5.0	✓
Dissolved Ferrous Iron in Water by Colour	E541	300953	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	299697	1	8	12.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	306497	2	25	8.0	5.0	✓
Fluoride in Water by IC	E235.F	299531	2	40	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	299528	2	40	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	299529	2	40	5.0	5.0	✓
pH by Meter	E108	299778	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	299530	2	40	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	303490	1	4	25.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	299780	1	19	5.2	5.0	✓
Ammonia by Fluorescence	E298	309096	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	299527	2	3	66.6	5.0	✓
Chloride in Water by IC	E235.Cl	299532	2	40	5.0	5.0	✓
Conductivity in Water	E100	299779	1	19	5.2	5.0	✓
Dissolved Ferrous Iron in Water by Colour	E541	300953	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	299697	1	8	12.5	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	306497	2	25	8.0	5.0	✓
Fluoride in Water by IC	E235.F	299531	2	40	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	299528	2	40	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	299529	2	40	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	299530	2	40	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	303490	1	4	25.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	309096	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	299527	2	3	66.6	5.0	✓
Chloride in Water by IC	E235.Cl	299532	2	40	5.0	5.0	✓
Dissolved Ferrous Iron in Water by Colour	E541	300953	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	299697	1	8	12.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	306497	2	25	8.0	5.0	✓
Fluoride in Water by IC	E235.F	299531	2	40	5.0	5.0	✓
Nitrate in Water by IC	E235.NO3	299528	2	40	5.0	5.0	✓
Nitrite in Water by IC	E235.NO2	299529	2	40	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	299530	2	40	5.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	303490	1	4	25.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Saskatoon - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Saskatoon - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Bromide in Water by IC	E235.Br Saskatoon - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC	E235.Cl Saskatoon - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Saskatoon - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC	E235.NO2 Saskatoon - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC	E235.NO3 Saskatoon - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Saskatoon - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 Saskatoon - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Total Kjeldahl Nitrogen is determined using block digestion followed by flow-injection analysis with fluorescence detection.
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Dissolved Metals in Water by CRC ICPMS	E421 Saskatoon - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Ferrous Iron in Water by Colour	E541 Vancouver - Environmental	Water	APHA 3500-Fe B/James Ball et al (1999)	This analysis is carried out using procedures adapted from APHA 3500-Fe B and Environ. Sci. Technol. 1999, 33, 5, 807–813. The procedure involves preliminary sample filtration, and ferrous iron is determined using the "FerroZine" colourimetric method. Holding time is 7 days for 0.45um filtration or 6 months if samples have been filtered using 0.1um filters.
Dissolved Hardness (Calculated)	EC100 Saskatoon - Environmental	Water	APHA 2340B	“Hardness (as CaCO3), dissolved” is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. “Total Hardness” refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Saskatoon - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).
TDS in Water (Calculation)	EC103 Saskatoon - Environmental	Water	APHA 1030E (mod)	Total Dissolved Solids is calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N Saskatoon - Environmental	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).
Total Nitrogen (calculation)	EC368 Saskatoon - Environmental	Water	BC MOE LABORATORY MANUAL (2005)	Total Nitrogen is a calculated parameter. Total Nitrogen = Total Kjeldahl Nitrogen + [Nitrate and Nitrite (as N)].

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested using block digestion with Copper Sulfate Digestion Reagent.
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Dissolved Metals Water Filtration	EP421 Saskatoon - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Ferrous Iron in Water by Colour	EP541 Vancouver - Environmental	Water	APHA 3500-Fe B/James Ball et al (1999)	This analysis is carried out using procedures adapted from APHA 3500-Fe B and "A New Method for the Direct Determination of Dissolved Iron Concentration in Acid Mine Waters" published by James W. Ball et al (1999). The procedure involves preliminary sample filtration, and ferrous iron is determined using the "FerroZine" colourimetric method.

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askatoon
Work Order Reference
SK2103820

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CHAIN OF CUSTODY/ANALYSIS FORM

SRC Environmental Analytical Laboratories
143-111 Research Dr. Saskatoon, SK S7N 3R2
Ph: (306) 933-6932

Turnaround Time: ☑ Regular ☐ Rush (100% surcharge + overtime charges authorized*) ☐ Rush (100% surcharge)
* Contact lab in advance to authorize

Lab Use Only:
Radioactivity: ☐ background ☐ ☐
SRC Group:
Client Code:
Date/Time received:
WSA Flag ☐
Bottles
Preservatives
In Sample #
Received by:

Invoice to:
Company Name: Denison Mines
Contact Name:
Address:
City/Prov:
Postal Code:
Email:
PO# [illegible] 10421210 Quote # 1500 [illegible]

Report Format: ☐ PDF ☐ Excel
Report Results to: ☐ Water Security Agency ☐ WaterTrax Database
Special Instructions/Notes:
#4 10.41

Report to: Same as Invoice to? ☑
Company Name:
Contact Name:
Address:
City/Prov:
Postal Code:
Phone:
Email:
Email:
Email:

Tests Required

Sample Site Description	# of Bottles per site	Sample Type (water, soil, etc)	Date/Time Sampled												
			Sept 14	X			X	X							
Travel Tank	2	Water	Sept 14	X	X	X	X		X	X				X	
GWR-046	11	Water	Sept 10	X	X	X	X		X	X		X	X	X	X
GWR-047	11	Water	Sept 10	X	X	X	X		X	X	X	X	X	X	X
GWR-048	11	Water	Sept 11												

I hereby relinquish the above listed samples to SRC Analytical and authorize the above listed analysis as per the Standard Terms and Conditions on the 15 day of September, (Printed Name) (Day) (Month) (Year)

Relinquished by Signature:

Form CSM-132A

André E. Lalonde AMS Laboratory

Tritium Laboratory

www.ams.uottawa.ca

Analysis Report

SUBMITTER SUMMARY			
Submitter Name:	Jennifer Skilnick	**Affiliation:**	Denison Mines Corp.
Submitter Email:	jskilnick@denisonmines.com	**Street Address:**	200 - 230 22nd Street East
Submitter Phone:	(306) 281-8305	**City, Province:**	Saskatoon, SK
Principal Investigator Name:	Elizabeth Haack	**Postal Code:**	S7K 0E9
Principal Investigator Email:	ehaack@ecometrix.ca	**Country:**	Canada
Principal Investigator Phone:		**Date Submitted:**	2021-04-19 and 2021-04-21

PROJECT INFORMATION	
Project Title:	Wheeler River Project
Country:	Canada
Site Name:	Phoenix
Collection Date:	April 8 2021 to April 10, 2021 and April 12, 2021 to April 18, 2021

SUBMISSION TIMELINE	
Date samples received (YYYY/MM/DD)	Report date (YYYY/MM/DD)
(2021/04/20) and (2021/04/22)	(2021/06/21)

ANALYTICAL NOTES

Please note: Unless otherwise specified in the submission form, any remaining sample material will be held for a period of six (6) months, after which time it will be discarded.

CONTACT INFORMATION	
Should you have any questions regarding your data or sample preparation please contact:	
Name:	Monika Wilk
Email:	mwilk@uottawa.ca
Phone:	613-562-5800 ext.6183

Researchers are asked to report any publications that include data generated at the AEL AMS facility. Publication notifications should be sent to ael-ams@uottawa.ca. Published data should include the unique UO identifier number provided in this analytical report.

Table 1. Tritium results for enriched water samples

UofO Number	Sample ID	^{3}H (TU)	± 1σ (TU)	^{3}H (Bq/L)
UOT-2638	GWR-008	4.2	0.8	0.5
UOT-2639	GWR-009	10.0	0.9	1.2
UOT-2640	GWR-036	6.4	0.8	0.8
UOT-2641	GWR-037	1.2	0.4	0.1
UOT-2642	GWR-029	0.8	0.6	0.1
UOT-2643	GWR-006	1.1	0.6	0.1
UOT-2644	GWR-025	3.5	0.7	0.4
UOT-2645	GWR-003	9.3	0.9	1.1

Remarks: TU is Tritium Units where 1TU=0.1191Bq/L

André E. Lalonde AMS Laboratory

Tritium Laboratory

www.ams.uottawa.ca

Analysis Report

SUBMITTER SUMMARY			
Submitter Name:	Jennifer Skilnick	**Affiliation:**	Denison Mines Corp.
Submitter Email:	jskilnick@denisonmines.com	**Street Address:**	200 - 230 22nd Street East
Submitter Phone:	(306) 281-8305	**City, Province:**	Saskatoon, SK
Principal Investigator Name:	Elizabeth Haack	**Postal Code:**	S7K 0E9
Principal Investigator Email:	ehaack@ecometrix.ca	**Country:**	Canada
Principal Investigator Phone:		**Date Submitted:**	26-May-21

PROJECT INFORMATION	
Project Title:	Wheeler River Project
Country:	Canada
Site Name:	Phoenix
Collection Date:	May 21, 2021 to May 25, 2021

SUBMISSION TIMELINE	
Date samples received (YYYY/MM/DD)	Report date (YYYY/MM/DD)
(2021/05/28)	(2021/08/30)

ANALYTICAL NOTES

Please note: Unless otherwise specified in the submission form, any remaining sample material will be held for a period of six (6) months, after which time it will be discarded.

CONTACT INFORMATION	
Should you have any questions regarding your data or sample preparation please contact:	
Name:	Monika Wilk
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Phone:	613-562-5800 ext.6183

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Table 1. Tritium results for enriched water samples

UofO Number	Sample ID	^{3}H (TU)	± 1σ (TU)	^{3}H (Bq/L)
UOT-2718	GWR-005	<0.8		0.10
UOT-2719	GWR-012	<0.8		0.10
UOT-2720	GWR-014	1.1	0.6	0.13
UOT-2721	GWR-033	4.3	0.7	0.51
UOT-2722	GWR-034	10.0	0.9	1.19
UOT-2723	GWR-035	6.7	0.8	0.80

Remarks: TU is Tritium Units where 1TU=0.1191Bq/L

André E. Lalonde AMS Laboratory

Tritium Laboratory

www.ams.uottawa.ca

Analysis Report

SUBMITTER SUMMARY			
Submitter Name:	Jennifer Skilnick	**Affiliation:**	Denison Mines Corp.
Submitter Email:	jskilnick@denisonmines.com	**Street Address:**	200 - 230 22nd Street East
Submitter Phone:	(306) 281-8305	**City, Province:**	Saskatoon, SK
Principal Investigator Name:	Elizabeth Haack	**Postal Code:**	S7K 0E9
Principal Investigator Email:	ehaack@ecometrix.ca	**Country:**	Canada
Principal Investigator Phone:		**Date Submitted:**	7-Jun-21

PROJECT INFORMATION	
Project Title:	Wheeler River Project
Country:	Canada
Site Name:	Phoenix
Collection Date:	June 1 and June 2

SUBMISSION TIMELINE	
Date samples received (YYYY/MM/DD)	Report date (YYYY/MM/DD)
(2021/06/15)	(2021/09/09)

ANALYTICAL NOTES

Please note: Unless otherwise specified in the submission form, any remaining sample material will be held for a period of six (6) months, after which time it will be discarded.

CONTACT INFORMATION	
Should you have any questions regarding your data or sample preparation please contact:	
Name:	Monika Wilk
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Researchers are asked to report any publications that include data generated at the AEL AMS facility. Publication notifications should be sent to ael-ams@uottawa.ca. Published data should include the unique UO identifier number provided in this analytical report.

Table 1. Tritium results for enriched water samples

UofO Number	Sample ID	^{3}H (TU)	± 1σ (TU)	^{3}H (Bq/L)
UOT-2759	GWR-011	1.1	0.7	0.13
UOT-2760	GWR-013	6.5	0.9	0.78

Remarks: TU is Tritium Units where 1TU=0.1191Bq/L

Appendix I Groundwater Quality and Drinking Water Guidelines

Regionally, groundwater is not relied upon for drinking water. This is understood from a search of water wells within a 100 km radius of the Project Area, provided below. A single domestic use well is listed in the Government of Saskatchewan, Water Security Agency, Water Well Information Database (WSA, 2022) within the search area. The one listed domestic well is a (shallow) well drilled by Cameco Corporation in 1969 to a depth of approximately 72 m bgs, installed in sand. There is also a shallow drinking water well at the existing Wheeler River Project camp, located over two kilometres southwest of the Phoenix deposit. There are no records in the database of groundwater wells for non-industrial use, meaning, there is no records of groundwater wells being used by residents in the area as a potable water source.

Groundwater quality collected as part of this baseline report is considered herein in the context of drinking water guidelines. The objective is to identify where exceedances of drinking water guidelines occur to understand the general suitability of raw groundwater in the study area as a potable water source. This is not an assessment of risk to human health from ingestion of groundwater as a potable water source.

Available drinking water guidelines for the groundwater constituents for the Project were compiled. Where guidelines for groundwater constituents were not available from Health Canada (2020), available guidelines from other sources were used. Shown in Table I1 is groundwater quality in GWR-series wells for groundwater constituents for which drinking water guidelines were available, and the source of the drinking water guidelines. Groundwater monitoring wells where uncertainty with well integrity (e.g., GWR-034) or water quality (e.g., ore zone wells with water quality affected by the KCl tracer) were not included in Table I1.

Exceedances of drinking water guidelines are shown in Table I2. Exceedances of health-based and aesthetic guidelines occur in all hydrostratigraphic at the Site. The frequency of exceedances is higher in the deeper hydrostratigraphic units and in the ore zone.

Table I1: Baseline Water Quality and Drinking Water Guidelines

Well Cluster	Units	Drinking Water Guideline		Upgradient Cluster[a]				NW Cluster[b]				SE Cluster[c]				WR-607 Cluster[d]				Downgradient Cluster					
Groundwater Monitoring Well				GWR-006		GWR-029		GWR-003		GWR-025		GWR-008		GWR-009		GWR-033		GWR-035		GWR-005		GWR-014		GWR-012	
Lithology				OB		Mfa		OB		MFa		MFa		MFb		MFa		OB / MFd		OB		MFc		MFa	
Hydrostratigraphic Unit		Value	Source	OB		LSA		OB		LSA		LSA/DSZ		ISA/DSZ		LSA		USA		OB		USA/DSZ		LSA/DSZ	
Sampling Date				2020-08-22	2021-04-14	2020-08-30	2021-04-12	2020-08-16	2021-04-18	2020-08-22	2021-04-17	2020-09-06	2021-04-09	2020-09-14	2021-04-10	2020-11-03	2021-05-25	2020-11-03	2021-05-24	2020-08-29	2021-05-22	2020-08-29	2021-05-21	2020-08-29	2021-05-23
Sampling Time				15:00	16:31	9:00	16:08	15:00	10:45	10:30	16:18	9:00	18:30	15:30	18:45	16:30	11:22	11:30	14:23	10:30	10:03	9:00	11:27	14:40	13:14
Field Parameters																									
Field pH	pH units	7-10.5	1	**6.75**	**6.90**	**6.46**	7.30	**6.35**	**5.86**	**6.49**	7.06	**6.92**	7.42	10.87	7.67	7.02	7.32	**6.48**	**6.30**	7.49	**6.8**	11.38*	9.77	**6.94**	7.17
Field TDS	mg/L	500	1	52	98	57	119	23	18	**615**	**1505**	66	108	157	402	231	451	43	74	61	98	259	274	306	**582**
Analytical Results																									
Nitrate (calc. from NO2+NO3-N)	mg/L	45	1	0.09	0.09	<0.04	<0.04	<0.04	0.13	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.04	0.09	<0.04	<0.04	<0.04
Nitrite	mg/L	3	1	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.11	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.23	0.11	<0.03	<0.03
Sulfate	mg/L	500	1	6.4	7	2.4	4.2	1	0.9	52	67	0.7	0.9	24	2.5	31	17	5.9	3	4.5	3	10	4.2	5.9	8.1
Aluminum, dissolved	mg/L	0.1	1	0.0096	0.016	0.014	<0.0005	0.0065	0.0055	0.0024	<0.0005	0.0081	0.0023	0.012	**0.21**	0.025	0.0013	0.013	0.0058	0.0022	<0.0005	0.02	0.003	0.0038	<0.0005
Arsenic, dissolved	ug/L	10	1	1.3	0.8	0.3	<0.1	0.2	0.1	<0.1	<0.1	0.1	0.1	3.3	**11**	2.2	1.8	0.2	0.2	1.1	1.4	0.6	0.5	0.2	<0.1
Barium, dissolved	mg/L	2	1	0.0081	0.0095	0.0082	0.0053	0.0082	0.0056	0.12	0.11	0.1	0.042	0.059	0.22	0.059	0.059	0.015	0.016	0.024	0.015	0.15	0.11	0.25	0.15
Boron, dissolved	mg/L	5	1	0.01	0.01	0.04	0.04	<0.01	<0.01	0.32	0.4	0.03	0.03	<0.01	<0.01	0.04	0.05	<0.01	<0.01	0.03	0.03	0.02	0.02	0.15	0.15
Cadmium, dissolved	mg/L	0.007	1	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	0.00001	0.00001	<0.00001	0.00002	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium, dissolved	mg/L	0.05	1	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0058	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	0.001	2	0.0002	0.0002	<0.0001	<0.0001	0.0009	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	**0.0047**	0.0005	0.0005	0.001	**0.0012**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper, dissolved	mg/L	2	1	0.0008	<0.0002	<0.0002	<0.0002	0.0017	0.0007	<0.0002	<0.0002	<0.0002	0.0007	0.0008	0.0011	0.0003	<0.0002	0.0005	0.0003	<0.0002	<0.0002	0.0004	0.0009	<0.0002	<0.0002
Iron, dissolved	mg/L	0.3	1	**0.49**	**0.53**	**4.86**	**2.16**	0.039	0.16	**16**	**9.7**	**3.55**	**2.81**	0.21	**15.3**	**0.47**	**0.66**	**0.32**	0.16	**3.71**	**4.84**	0.055	0.064	**5.6**	**1.32**
Lead, dissolved	mg/L	0.005	1	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese, dissolved	mg/L	0.12	1	**0.14**	**0.16**	**0.23**	**0.24**	**0.14**	0.073	**0.97**	**1.14**	**0.4**	**0.33**	0.021	**2.75**	**0.21**	**0.27**	**0.14**	**0.23**	**0.17**	**0.2**	0.0018	0.0037	**0.57**	**0.59**
Molybdenum, dissolved	mg/L	0.07	3	0.0012	0.0007	0.0001	<0.0001	0.0012	<0.0001	0.0005	0.0002	0.0003	0.0002	0.0087	0.0038	0.003	0.0026	0.0008	0.0009	0.0023	0.0007	0.0024	0.0034	0.0023	0.0007
Nickel, dissolved	mg/L	0.07	3	0.0004	0.0004	0.0002	<0.0001	0.0021	0.0017	0.0002	<0.0001	0.0004	0.0002	0.0012	0.0053	0.0011	0.0008	0.005	0.01	0.0003	<0.0001	0.0027	0.0015	0.0006	0.0002
Selenium, dissolved	mg/L	0.05	1	<0.0001	<0.0001	0.0011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0002	<0.0001
Strontium, dissolved	mg/L	7	1	0.034	0.029	0.12	0.12	0.02	0.02	1.88	2.19	0.12	0.1	0.24	0.21	0.3	0.36	0.033	0.031	0.057	0.059	0.26	0.15	0.61	0.59
Zinc, dissolved	mg/L	5	1	0.0009	0.0041	0.001	0.0016	0.01	0.009	0.003	0.0026	0.0029	0.0016	0.0014	0.017	0.015	0.004	0.0025	0.0045	0.0064	0.0014	0.0007	0.0008	0.0007	0.002
Radionuclides																									
Uranium, dissolved	ug/L	20	1	1.4	0.2	0.2	0.2	0.5	<0.1	0.8	<0.1	2.4	0.7	5.3	**22**	3.6	0.8	0.2	<0.1	0.5	0.5	0.3	1.2	0.5	<0.1
Lead-210	Bq/L	0.5	1	0.09	0.08	0.1	0.07	**0.6**	0.03	0.08	0.08	<0.02	**0.66**	**0.3**	**1.1**	0.14	0.04	0.03	<0.02	**0.28**	<0.02	0.08	**0.3**	0.15	0.1
Radium-226	Bq/L	0.2	1	0.36	0.06	0.07	0.09	0.27	0.02	0.26	0.29	**0.81**	0.32	0.33	0.3	**1.6**	0.13	0.14	0.04	0.16	0.03	0.08	0.06	0.17	0.12
Tritium	Bq/L	7000	1	<15	0.1	<15	0.1	<15	1.1	<15	0.4	<15	0.5	16	1.2	<15	0.5	<15	0.8	<15	<0.1	19	0.1	<15	<0.1

Notes

6.75 Bolded and Highlighted values exceed Drinking Water Guidelines

a Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.

b Sampling time reflects that recorded on Certificate of Analysis

Guideline Sources

1 Health Canada 2020. Guidelines for Canadian Drinking Water Quality Summary Table. September. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/summary-table-EN-2020-02-11.pdf

2 BC MECCS 2020. Source Drinking Water Quality Guidelines, Guideline Summary Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch .

3 WHO 2017. Guidelines for Drinking Water Quality. Fourth Edition Incorporating The First Addendum.

Table I1: Baseline Water Quality and Drinking Water Guidelines, continued

Well Cluster	Units	Drinking Water Guideline		LA-5 Cluster				Paloeweathered Zone		Phoenix Ore Zone[e]									
Groundwater Monitoring Well				GWR-036		GWR-037		GWR-031		GWR-011		GWR-013		GWR-032			GWR-046[b]	GWR-047[b]	GWR-048[b]
Lithology		Value	Source	OB		MFd		PWZ		MFa		MFb		OZ			MFc	MFb	Mfa
Hydrostratigraphic Unit				OB		USA/DSZ		PWZ		LSA/DSZ		ISA/DSZ		OZ			ISA	ISA/DSZ	LSA
Sampling Date				2020-11-05	2021-04-08	2020-10-24	2021-04-09	2020-08-09	2021-06-04	2020-08-08	2021-06-01	2020-08-09	2021-06-02	2019-11-14[a]	2020-08-08	2021-06-04	2021-09-14	2021-09-10	2021-09-10
Sampling Time				12:00	15:45	16:40	11:30	16:10	8:30	16:30	17:47	10:45	11:43	9:10	8:25	19:30	12:00	12:00	12:00
Field Parameters																			
Field pH	pH units	7-10.5	1	**6.45**	**6.62**	**6.13**	**6.02**	7.03	7.21	8.70	**6.82**	9.68	7.35	-	**6.79**	**6.83**	**6.37**	**6.47**	**6.08**
Field TDS	mg/L	500	1	20	48	57	53	**513**	**893**	74	142	155	176	-	**623**	**1094**	123	90	106
Analytical Results																			
Nitrate (calc. from NO2+NO3-N)	mg/L	45	1	0.49	0.49	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	0.13	<0.4	0.04	<0.04	<0.02	<0.02	<0.02
Nitrite	mg/L	3	1	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	-	<0.03	<0.03	<0.01	<0.01	<0.01
Sulfate	mg/L	500	1	2.6	1.9	8	6.5	40	6.6	5.5	4.7	17	5.2	30	8	13	10.1	2.28	6.26
Aluminum, dissolved	mg/L	0.1	1	**0.15**	0.037	**0.48**	0.06	<0.005	<0.0005	0.0082	0.052	0.025	0.011	**0.21**	0.0057	0.0006	**0.8**	0.0065	0.001
Arsenic, dissolved	ug/L	10	1	0.2	0.3	0.4	1	1	1.2	4.1	1.3	3.1	0.9	3.4	0.3	0.2	4.75	3.71	0.85
Barium, dissolved	mg/L	2	1	0.0095	0.0057	0.0073	0.0087	0.052	0.035	0.21	0.054	0.041	0.11	0.088	0.083	0.063	0.241	0.0626	0.0577
Boron, dissolved	mg/L	5	1	<0.01	<0.01	<0.01	<0.01	0.5	0.55	0.04	0.04	0.02	<0.01	0.58	0.59	0.43	0.023	0.018	0.041
Cadmium, dissolved	mg/L	0.007	1	0.00001	<0.00001	0.00002	<0.00001	<0.0001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	0.0000336	<0.000005	<0.000005
Chromium, dissolved	mg/L	0.05	1	<0.0005	<0.0005	<0.0005	<0.0005	0.009	0.0008	<0.0005	<0.0005	<0.0005	<0.0005	0.013	0.0011	<0.0005	0.00169	<0.0005	0.00068
Cobalt, dissolved	mg/L	0.001	2	0.0004	0.0002	0.0005	0.0004	**0.002**	0.0002	<0.0001	<0.0001	<0.0001	0.0001	0.0007	<0.0001	<0.0001	**0.00584**	0.00025	0.00036
Copper, dissolved	mg/L	2	1	0.002	0.0006	0.0013	0.0009	<0.002	<0.0002	0.0006	0.0018	0.0006	0.0008	<0.0002	<0.0002	<0.0002	0.00629	<0.0002	<0.0002
Iron, dissolved	mg/L	0.3	1	0.12	0.014	**1.64**	**1.38**	**3.6**	0.09	0.012	**0.86**	0.086	0.014	**3.83**	**6.4**	**4.2**	**6.03**	**11.9**	**9.62**
Lead, dissolved	mg/L	0.005	1	0.0001	<0.0001	0.0002	<0.0001	0.001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0003	0.0005	<0.0001	0.00157	<0.00005	<0.00005
Manganese, dissolved	mg/L	0.12	1	0.048	0.039	0.12	**0.16**	**0.22**	**0.13**	0.085	**0.36**	0.026	**0.22**	**0.2**	**0.24**	**0.22**	**3.91**	**2.14**	**2.6**
Molybdenum, dissolved	mg/L	0.07	3	0.0003	0.0007	<0.0001	0.0028	0.062	0.012	0.028	0.0042	0.018	0.0054	**0.078**	0.0059	0.0038	0.00389	0.00374	0.00298
Nickel, dissolved	mg/L	0.07	3	0.0023	0.0018	0.0037	0.0023	0.04	0.0019	0.0003	0.0001	0.0024	0.0018	0.012	0.0014	0.001	0.0487	0.00062	0.00066
Selenium, dissolved	mg/L	0.05	1	0.0007	0.0008	0.0001	0.0004	<0.001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.000359	<0.00005	<0.00005
Strontium, dissolved	mg/L	7	1	0.012	0.012	0.014	0.012	1.4	1.17	0.13	0.12	0.16	0.08	2.37	2.51	1.66	0.115	0.0796	0.169
Zinc, dissolved	mg/L	5	1	0.0061	0.0044	0.0067	0.0041	18.4	0.69	0.0018	0.012	0.001	0.0016	2.94	5	2.62	0.0125	0.0011	0.0031
Radionuclides																			
Uranium, dissolved	ug/L	20	1	0.9	0.1	5.8	0.8	17	**50**	9	0.7	14	**55**	**299**	5.7	11	**22.6**	0.752	0.488
Lead-210	Bq/L	0.5	1	0.14	0.07	0.08	0.05	**1100**	**7300**	**0.6**	**0.3**	**0.4**	**8**	**1200**	**3300**	**2200**	**0.9**	**1.1**	**0.46**
Radium-226	Bq/L	0.2	1	0.22	0.06	0.19	0.03	**120**	**76**	**1**	0.5	0.5	**17**	**300**	**400**	**180**	**0.93**	0.24	**0.75**
Tritium	Bq/L	7000	1	<15	0.8	<15	0.1	<15	910	<15	0.1	<15	0.8	-	950	1800	<40	<40	<40

Notes

6.75 Bolded and Highlighted values exceed Drinking Water Guidelines

a Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.

b Sampling time reflects that recorded on Certificate of Analysis

Guideline Sources

1 Health Canada 2020. Guidelines for Canadian Drinking Water Quality Summary Table. September. https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/summary-table-EN-2020-02-11.pdf

2 BC MECCS 2020. Source Drinking Water Quality Guidelines, Guideline Summary Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch .

3 WHO 2017. Guidelines for Drinking Water Quality. Fourth Edition Incorporating The First Addendum.

Table I2: Exceedances of Drinking Water Guidelines in Baseline Water Quality

Constituent Exceeding Guideline	Hydrostratigraphic Unit (HU) in which the exceedances of potable water quality guidelines occur[a]	Notes
pH < 7[b]	All HUs (most wells)	Aesthetic Objective, primarily to minimize corrosion and reduce leaching from distribution systems.
TDS[b]	LSA (GWR-012, GWR-025), PW (GWR-031) and OZ (GWR-032)	Aesthetic Objective; based on taste
Aluminum, dissolved[c]	OB and USA (GWR-036; GWR-037), ISA (GWR-046; GWR-009) and OZ (GWR-032)	All values are below the Maximum Acceptable Concentrations of 2.9 mg/L (Health Canada, 2020), which is to be applied as an annual running average. Concentrations exceeded the 0.1 mg/L operational guidance value (OG), only on the first sampling of the well. The OG value was set to minimize potential for metal accumulation and release in distribution systems.
Arsenic, dissolved	ISA (GWR-009)	ALARA value; recognized that that elevated values associated with some groundwaters (HC, 2020)
Cobalt, dissolved	OB/MFd (GWR-035), ISA (GWR-046; GWR-009) and GWR-031 (PW)	Health-based value
Iron, dissolved	All HUs (most wells)	Aesthetic Objective; based on taste and staining of laundry and plumbing fixtures
Manganese, dissolved	All HUs (most wells)	Maximum Acceptable Concentration
Molybdenum, dissolved	OZ (GWR-032)	Health-based value
Uranium, dissolved	ISA (GWR-009; GWR-046), PW (GWR-031) and OZ (GWR-032)	Maximum Acceptable Concentration
Lead-210	OB/USA (GWR-003, GWR-005, GWR-014), ISA (GWR-009, GWR-013, GWR-046, GWR-047), LSA (GWR-008, GWR-011, GWR-048), PW (GWR-031) and OZ (GWR-032)	Maximum Acceptable Concentration.
Radium-226	ISA (GWR-013, GWR-046), LSA (GWR-008, GWR-011, GWR-033, GWR-048), PW (GWR-031) and OZ (GWR-032)	Maximum Acceptable Concentration

Notes

[a] OB/USA = Overburden Aquifer and Upper Sandstone Aquifer; ISA = Intermediate Sandstone Aquitard; LSA = Lower Sandstone Aquifer, PW = Paleoweathered Zone; OZ = Ore Zone

[b] Field-measured values used for pH and TDS

[c] Exceedances generally during first sampling event only; suggesting exceedances related to well conditions and not Formation water

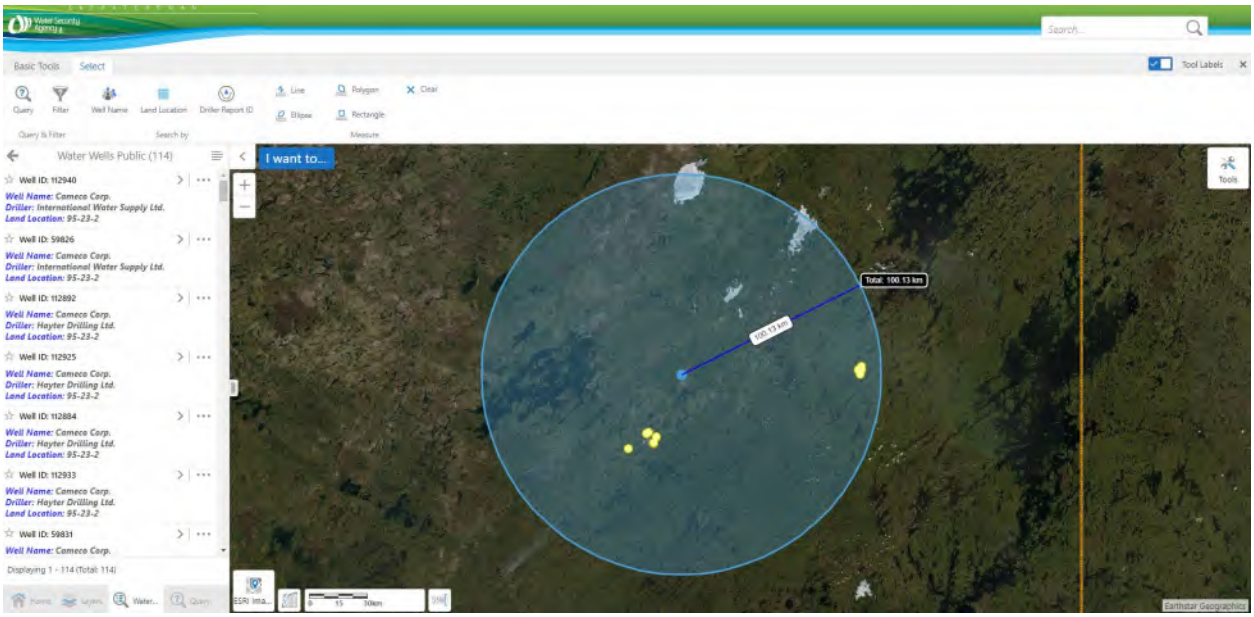
Water well Search

The WSA (Water Security Agency), Water Well Information Database. Government of Saskatchewan was last accessed on September 20, 2022. **https://www.wsask.ca/water-info/ground-water/online-driller-reports/**.

Search Details:

- A well radius search was conducted in areas within 100 km of the site (i.e. Denison Phoenix Deposit) using a center point as follows:
    - Easting 477119.560
    - Northing 6374214.920
    - Zone 13V

- There are 141 public well water records within a 100 km radius of the site. Below is a screenshot of the well locations:



Tables I3 and I4 provide well record details.

Table I3: Water Well Records Report within 100 km radius of the Project Area

geometry	GCX_OID	WWDR	LLD	Well Name	Driller	NTS Maps	Major Basin	Sub Basin	Elevation (ft)	RM	Hole Number	Completion Date	Install Method
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	0	112940	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	W28	1985.05.18	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	1	59826	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		3	1979.06.09	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	2	112892	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	019	1986.05.08	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	3	112925	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	006	1985.05.27	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	4	112884	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	22A	1986.04.29	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	5	112933	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	W21	1985.06.22	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	6	59831	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		L	1979.07.01	Drilled
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	7	93672	28-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1580		7	1988.01.26	Drilled
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	8	213500	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-5	2006.05.19	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	9	112928	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	009	1985.05.07	Drilled
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	10	83481	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	004	1986.04.18	Drilled
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	11	93678	34-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1573		3	1988.01.28	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	12	112904	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	006	1985.06.10	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	13	59829	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		Q	1979.06.12	Drilled
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	14	213463	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-8	2006.05.16	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	15	112901	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	003	1985.07.12	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	16	112922	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	003	1985.05.22	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	17	59823	95-23-2	Cameco Corp.	International Water Supply Ltd.	74H04		64	1800	921	0000000T	1979.06.22	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	18	59834	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		A	1979.07.29	Bored
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	19	112895	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	D18	1984.12.06	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	20	112887	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	D45	1986.05.02	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	21	112930	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	W17	1985.06.20	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	22	112907	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	009	1985.06.17	Drilled
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	23	83479	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	002	1986.05.14	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	24	112912	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	015	1984.11.01	Drilled
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	25	93675	34-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1571		1	1988.02.01	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	26	112898	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	D22	1984.10.23	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	27	112918	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	021	1984.10.04	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	28	112939	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	W27	1985.07.05	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	29	112923	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	004	1985.05.31	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	30	59824	95-23-2	Cameco Corp.	International Water Supply Ltd.	74H03		64	1800	921	0000000O	1979.06.15	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	31	112890	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	015	1986.04.22	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	32	112888	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	011	1986.04.16	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	33	112908	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	010	1985.07.05	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	34	59837	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		U	1979.09.19	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	35	60509	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		C46	1979.04.20	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	36	112902	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	004	1985.07.11	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	37	112915	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	018	1984.09.26	Drilled
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	38	93670	28-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1581		5	1988.01.27	Drilled
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	39	93676	34-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1571		2	1988.01.27	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	40	59827	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		C39	1979.06.16	Drilled
X: -11757633.3152682, Y: 7800610.44941267, Z: NaN	41	211217	95-23-2	Cameco Corp.	Binette/Bumford	74H04		64	1706	921	0000000A	1992.02.01	Drilled
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	42	93665	27-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1579		10	1988.01.30	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	43	112920	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	001	1985.06.13	Drilled
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	44	213461	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-6	2006.05.18	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	45	112936	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	W24	1985.07.08	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	46	112926	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	007	1985.06.02	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	47	112885	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	014	1986.04.27	Drilled
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	48	213497	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-2	2006.05.15	Drilled
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	49	93673	34-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1578		8	1988.02.01	Drilled
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	50	83484	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	007	1986.05.10	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	51	112929	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	010	1985.05.15	Drilled
X: -11781300.8677924, Y: 7795417.61173398, Z: NaN	52	234362	NE-20-94-24-2	Valard Construction LP	J R Drilling Central LP	74H04		64	1866	999	0TW13-02	2013.10.13	Drilled
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	53	93668	27-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1579	999	00000013	1988.02.01	
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	54	112905	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	007	1985.06.10	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	55	112896	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	D20	1984.10.06	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	56	112900	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	002	1985.07.23	Drilled
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	57	93666	27-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1579	999	00000011	1988.01.30	Drilled
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	58	213462	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-7	2006.05.17	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	59	112921	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	002	1985.05.20	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	60	59822	95-23-2	Cameco Corp.	International Water Supply Ltd.	74H04		64	1800	921	0000000C	1979.06.26	Bored
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	61	112937	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	W25	1985.07.20	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	62	59835	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		G	1979.08.13	Bored
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	63	213498	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-3	2006.05.21	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	64	112886	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	018	1986.05.10	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	65	112931	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	W18	1985.06.10	Drilled
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	66	83485	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	008	1986.05.10	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	67	59840	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		C75	1979.08.19	Bored
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	68	112913	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	016	1984.10.21	Drilled
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	69	93669	28-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1579	999	00000004	1988.01.27	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	70	112899	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	001	1985.07.02	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	71	112919	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	022	1984.10.09	Drilled
X: -11563468.9425606, Y: 7865235.30197006, Z: NaN	72	93663	98-12-2	Midwest Joint Venture	Groundation			35	0		1	1988.01.12	
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	73	112893	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	021	1986.05.12	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	74	112924	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	005	1985.05.27	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	75	59825	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		S	1979.06.16	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	76	112934	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	W22	1985.05.28	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	77	59832	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		K4	1979.05.24	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	78	59838	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		E	1979.07.08	Bored
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	79	83482	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	005	1986.05.08	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	80	112903	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	005	1985.06.27	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	81	112916	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	019	1985.05.15	Drilled
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	82	93671	28-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1582		6	1988.01.27	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	83	112910	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	013	1984.10.10	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	84	59828	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		C40	1979.07.01	Drilled
X: -11563468.9425606, Y: 7865235.30197006, Z: NaN	85	93664	98-12-2	Midwest Joint Venture	Groundation			35	0		2	1988.01.30	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	86	112935	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	W23	1985.07.11	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	87	59833	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		J	1979.09.07	Bored
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	88	112894	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	D19	1984.10.27	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	89	112927	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	008	1985.05.20	Drilled
X: -11757267.3876985, Y: 7800890.67598171, Z: NaN	90	211218	95-23-2	Cameco Corp.	Binette/Bumford	74H04		64	1706	921	00000008	1992.02.01	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	91	112889	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	013	1986.04.19	Drilled
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	92	213496	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-1	2006.05.13	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	93	59839	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		B8	1979.08.17	Drilled
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	94	83483	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	006	1986.05.08	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	95	60510	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		C45	1979.03.22	Drilled
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	96	83478	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	001	1986.04.22	Drilled
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	97	93667	27-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1579	999	00000012	1988.01.31	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	98	112906	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	008	1985.06.20	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	99	112911	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	014	1985.02.06	Drilled
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	100	93674	34-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1571		9	1988.02.01	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	101	112917	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	020	1984.09.20	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	102	112897	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	D21	1984.09.18	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	103	60508	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		C42	1979.04.17	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	104	112938	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	W26	1985.07.23	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	105	59836	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800		O	1979.07.20	Bored
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	106	112891	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	017	1986.05.15	Drilled
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	107	213499	16-95-23-2	Cameco Corp.	Elk Point Drilling Corp.	74H03		34	1673	921	00MTRW-4	2006.05.20	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	108	112932	95-23-2	Cameco Corp.	Hayter Drilling Ltd.			64	1800	921	W20	1985.06.18	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	109	59830	95-23-2	KLMC	International Water Supply Ltd.			64	1800		C43	1979.07.01	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	110	112909	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	012	1985.01.29	Drilled
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	111	83480	12-95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1710	921	003	1986.05.14	Drilled
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	112	112914	95-23-2	Cameco Corp.	International Water Supply Ltd.			64	1800	921	017	1984.09.20	Drilled
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	113	93677	34-98-12-2	Midwest Joint Venture	Mcneil Drilling			35	1591	999	0000002A	1988.02.02	Drilled

Table I3: Water Well Records Report within 100 km radius of the Project Area, continued.

geometry	Borehole Depth (ft)	Bit Dia (in)	Water Level	Flowing Head	Water Use	Well Use	Completion Method	ScreenDescription1	Screenslotsz1	ScreenDiameter1	ScreenLength1	ScreenBottom1	ScreenDescription2	Temperature	Draw Down	Duration	Pumping Rate	Recomended Pumping Rate
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	190	13.30000019	19	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	112	0		0	81.80000305	24	90	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	237	10	0	0	Domestic	Withdrawal		Stainless Steel	25	10	0	200	Stainless Steel	42	65	24	515	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	167	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	7.900000095	83	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	252	15.69999981	8	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	134	0		0	99	24	84	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	179	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	9.899999619	22	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	268	17.70000076	50	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	9.899999619	108	0		0	68.90000153	24	125	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	187	10	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	35	10	29	146	Stainless Steel	42	76	24	440	0
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	16	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	9		0	0	0	0	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	58	6.699999809	27	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	5	49		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	223	15.69999981	8	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	124	0		0	123.5999985	24	103	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	16	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	6	0	0		0	0	0	0	0
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	54	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	40	P.V.C.	0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	299	15.69999981	65	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	134	0		0	68.40000153	24	88	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	179	10	46	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	25	10	7	122	Stainless Steel	42	148	24	440	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	56	6.699999809	25	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	5	52		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	228	17.5	80	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	61	163	Unknown	0	48.29999924	24	130	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	233	12.30000019	16	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	5.900000095	132	0		0	111.6999969	24	40	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	96	10	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	25	10	35	96		42	92.69999695	24	480	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	96	10	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	25	8	20	72	Stainless Steel	42	91.80000305	24	150	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	217	15.69999981	85	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	9.899999619	71	207		0	43.70000076	24	145	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	290	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	5.900000095	124	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	278	15	32	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	173	0		0	58.09999847	24	84	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	249	12.5	27	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	4	133	0		0	9.199999809	24	66	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	20	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	6	81	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	338	15	43	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	142	0		0	99.59999847	24	59	0
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	48	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	33		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	173	19	15	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	9.899999619	142	167		0	21.10000038	24	867	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	197	17	31	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	91	0		0	121.4000015	24	132	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	205	15.69999981	74	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	9.899999619	91	196		0	31.79999924	24	251	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	262	15.69999981	14	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	5.900000095	123	0		0	65.80000305	24	24	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	139	9.600000381	0	0	Industrial	Withdrawal		Stainless Steel	25	10	25	129	Stainless Steel	42	23.20000076	24	560	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	246	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	5.900000095	113	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	286	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	5.900000095	113	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	280	12.5	33	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	4	73	0		0	17.39999962	24	68	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	230	10	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	25	8	10	43	Stainless Steel	0	76.59999847	24	30	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	161	7.800000191	0	0	Mineral Recovery	Water Test Hole	Sand Point	Stainless Steel	0	1.5	3	159		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	244	15.69999981	98	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	82	0		0	75.30000305	24	251	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	204	17	19	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	101	124	Unknown	0	82.09999847	24	66	0
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	20	5.400000095	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	17		0	0	0	0	0
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	25	0	0	0	Research	Soil Test Hole								0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	104	8	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	25	8	46	104		42	66	2	34	0
X: -11757633.3152682, Y: 7800610.44941267, Z: NaN	57	12	14	0	Municipal	Withdrawal	Perforated Casing	Steel Casing	0	8	45	57		0	18.5	8	295	0
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	4	0	0	0	Research	Soil Test Hole								0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	308	12.30000019	63	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	5.900000095	162	0		0	38.20000076	24	55	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	51	6.699999809	27	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	5	49		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	254	17.5	92	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	92	0		0	27.70000076	24	200	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	285	15.69999981	10	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	175	0		0	128.8000031	24	125	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	277	13.80000019	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	81	0		0	0	0	0	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	69	6.699999809	40	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	5	58		0	0	0	0	0
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	45	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	28		0	0	0	0	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	16	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	6	82	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	243	15.69999981	6	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	134	0		0	176	24	167	0
X: -11781300.8677924, Y: 7795417.61173398, Z: NaN	107	0	46	0	Municipal	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	60	5	4	100		0	0	0	0	16
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	17	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	17		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	246	17.70000076	35	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	9.899999619	144	0		0	44.70000076	24	167	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	149	17	22	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	40	138	Unknown	0	14.69999981	24	187	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	200	15.69999981	73	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	72	0		0	60.29999924	24	51	0
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	11	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	9		0	0	0	0	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	60	6.699999809	27	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	5	48		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	258	13.30000019	19	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	4	122	0		0	32.29999924	24	24	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	139	23	0	0	Industrial	Withdrawal		Stainless Steel	35	1	10	139	Stainless Steel	42	9.199999809	24	43	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	210	17	81	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	71	0		0	13.39999962	24	211	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	190	29	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	35	10	20	145	Stainless Steel	42	24.89999962	24	440	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	54	6.699999809	25	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	5	51		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	157	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	5.900000095	82	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	263	12.30000019	28	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	163	0		0	68.59999847	24	205	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	20	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	6	82	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	207	49	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Plastic	20	10	26	184	Plastic	42	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	300	15	21	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	71	0		0	88	24	31	0
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	16	6	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	16		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	220	15.69999981	77	0	Irrigation	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	62	0		0	30.60000038	24	312	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	177	15.69999981	19	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	5.900000095	132	167	P.V.C.	0	21.20000076	24	51	0
X: -11563468.9425606, Y: 7865235.30197006, Z: NaN	788	0	0	0	Research	Water Test Hole								0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	165	15.69999981	16	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	7.900000095	77	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	239	13.80000019	10	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	112	0		0	47.59999847	24	75	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	128	0	0	0	Industrial	Withdrawal		Stainless Steel	35	10	5	94	Stainless Steel	42	26.89999962	24	220	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	324	15.69999981	88	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	5.900000095	123	0		0	63.79999924	24	42	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	171	10	52	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	35	10	40	164		0	42	24	450	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	194	10	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	70	10	5	138	Stainless Steel	42	69	24	440	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	16	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	6	72	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	305	14.80000019	101	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	144	0		0	128.5	24	103	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	185	13.30000019	19	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	82	0		0	65.30000305	24	70	0
X: -11564976.2681523, Y: 7869770.7003821, Z: NaN	17	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	9		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	360	15.69999981	33	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	182	0		0	34.40000153	24	99	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	114	8	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	35	8	15	75	Stainless Steel	42	46.90000153	24	10	0
X: -11563468.9425606, Y: 7865235.30197006, Z: NaN	858	0	0	0	Research	Water Test Hole								0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	276	0	106	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	92	0		0	71.09999847	24	125	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	228	20	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	25	10	35	196	Stainless Steel	0	101.8000031	24	440	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	220	12	25	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	70	168	Unknown	0	66.09999847	24	73	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	280	12	8	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	124	0		0	41.40000153	24	24	0
X: -11757267.3876985, Y: 7800890.67598171, Z: NaN	94	12	39	0	Municipal	Withdrawal	Perforated Casing	Steel Casing	0	8	35	94		0	45.79999924	1	196	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	276	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	7.900000095	132	0		0	0	0	0	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	90	6.699999809	39	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	5	76		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	213	8	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	14	8	20	46	Stainless Steel	0	0	0	0	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	20	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	10	82	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	243	6	0	0	Mineral Recovery	Water Test Hole	Sand Point	Stainless Steel	0	4.5	3	226		0	0	0	0	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	15.80000019	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	8	0	267		0	0	0	0	0
X: -11561960.5492295, Y: 7869769.13621426, Z: NaN	2	0	0	0	Research	Soil Test Hole								0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	236	17	28	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	9.899999619	132	0		0	134.8999939	24	209	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	295	15	42	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	10	5.900000095	31	0	Unknown	0	20.10000038	24	73	0
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	38	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	23	P.V.C.	0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	187	15	25	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	5.900000095	81	0		0	20.60000038	24	20	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	170	19	16	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	9.899999619	20	60	Unknown	0	91.5	24	183	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	171	4.5	0	0	Mineral Recovery	Withdrawal	Well Screen	Stainless Steel	50	3	10	108	Stainless Steel	42	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	198	16	70	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	0	7.900000095	51	0		0	55.09999847	24	185	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	141	23	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	70	10	10	101	Stainless Steel	42	31	24	440	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	160	15.69999981	0	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	5.900000095	82	0		0	0	0	0	0
X: -11763991.0655179, Y: 7809705.59611178, Z: NaN	60	6.699999809	29	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	5	4	4	60		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	258	15.69999981	29	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	7.900000095	129	0		0	112.8000031	24	167	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	163	6	0	0	Industrial	Observation	Well Screen And Gravel Pack	Stainless Steel	15	0	3	162		0	181.3000031	24	50	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	324	11.80000019	25	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	6	213	295		0	66.09999847	24	73	0
X: -11754945.2298123, Y: 7806710.08550151, Z: NaN	290	16	0	0	Mineral Recovery	Withdrawal	Well Screen And Gravel Pack	Stainless Steel	30	6	72	0		0	0	0	0	0
X: -11762483.7631309, Y: 7811188.04883753, Z: NaN	224	17	13	0	Industrial	Withdrawal	Well Screen And Gravel Pack	Unknown	30	7.900000095	50	84	Unknown	0	25.20000076	24	121	0
X: -11561960.3345077, Y: 7872785.7498438, Z: NaN	12	0	0	0	Research	Soil Test Hole	Perforated Casing	P.V.C.	0	3.200000048	5	8		0	0	0	0	0

Table I4: Domestic water well lithology

GCX_OID	cWWDRId	cdescrip	ccolour	cmaterial	ndepth
1	59826	Fine-medium	Brown	Sand	223
1	59826	Unknown	Unknown	Boulders	237

Appendix J Supplemental Water Quality Data

Table J1: Supplemental Groundwater and Surface Water Quality

Well Cluster	Units	Overburden Wells - Gryphon Area					Surface Water Samples; Phoenix Project Area and Downstream						
Groundwater Monitoring Well		DH17-3	DH17-5	MW17-1	MW17-3	DH17-6	LA-5	LA-6	LA-1	LA-1-Bottom	LAB-1	SA-2	SA-6
Lithology		OB	OB	OB	OB	OB	SW	SW	SW	SW	SW	SW	SW
Sampling Date		7/22/2019	7/22/2019	7/22/2019	7/22/2019	7/22/2019	10-Sep-2016	12-Sep-2016	16-Mar-2018	16-Mar-2018	15-Sep-2016	05-Jul-2019	29-Aug-2019
Field Parameters													
Field pH	pH units	-	-	-	-	-	9	6.85	7.22	6.51	7.02	6.98	6.86
Field Temp.	˚C	-	-	-	-	-	12	8.61	18.62	11.7	12.6	14	13.8
Field Conductivity	µS/cm	-	-	-	-	-	13	12	15	16	30	13.7	13.7
Field SPC	µS/cm	-	-	-	-	-	18	17	17	20	39	17.4	17.5
Field TDS	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Diss. O2	mg/L	-	-	-	-	-	9	10.78	9.22	2.91	9.67	9.11	7.33
Fe2+	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Analytical Results													
Bicarbonate	mg/L	56	48	27	51	46	8	4	10	6	8	5	12
Carbonate	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	0.7	0.1	0.3	0.3	0.1	0.3	0.4	0.5	0.5	<0.1	0.4	0.3
Hydroxide	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
pH	pH units	7.1	7.06	6.98	7.61	7.17	6.95	6.71	6.82	6.8	6.96	7.04	6.93
Specific conductivity	µS/cm	102	70	62	90	70	19	18	15	14	47	9	11
Sum of ions	mg/L	87	65	51	80	64	12	8.0	15	12	23	9	16
Total alkalinity	mg/L	46	39	22	42	38	7.0	3.0	8	5	7.0	4	10
Total hardness	mg/L	35	28	20	25	30	5.0	5.0	5	5	12	4.0	5.0
Ammonia as nitrogen	mg/L			<0.04			0.07	0.04	0.03	0.02	<0.01	0.01	0.02
Nitrate (calc. from NO2+NO3-N)	mg/L	0.04	0.21		0.3	0.22	<0.04	<0.04	0.29	0.6	0.05	0.04	0.04
Nitrite	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite+Nitrate as nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Ortho-phosphate as P	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Organic carbon, dissolved	mg/L	-	-	-	-	-	2.1	2.2	2.2	2.2	2.4	2.7	2.6
Fluoride	mg/L	0.08	0.03	0.07	0.17	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.01
Total dissolved solids	mg/L	-	-	-	-	-	22	14	22	22	30	12	18
Total suspended solids	mg/L	-	-	-	-	-	4	4	<1	<1	1	<1	<5
Calcium	mg/L	12	10	5.9	8.2	11	1.2	1.2	1.4	1.4	3.8	1.1	1.2
Magnesium	mg/L	1.3	0.7	1.2	1.2	0.7	0.4	0.4	0.4	0.4	0.6	0.3	0.4
Potassium	mg/L	1	0.5	1.3	0.8	0.4	0.2	0.2	0.4	0.4	0.3	0.3	0.3
Sodium	mg/L	7.2	3.6	4.4	11	3.6	1.4	1.4	1.6	1.6	1.8	1.4	1.4
Sulfate	mg/L	8.8	2.2	11	7	2.2	0.6	0.5	0.8	0.8	8.1	0.6	0.6

Table J1: Supplemental Groundwater and Surface Water Quality, Continued

Well Cluster	Units	Overburden Wells - Gryphon Area					Surface Water Samples; Phoenix Project Area and Downstream						
Groundwater Monitoring Well		DH17-3	DH17-5	MW17-1	MW17-3	DH17-6	LA-5	LA-6	LA-1	LA-1-Bottom	LAB-1	SA-2	SA-6
Aluminum, dissolved	mg/L	0.0031	0.023	0.008	0.005	0.023	0.0078	0.0093	0.0046	0.0034	0.0025	0.0071	0.0072
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic, dissolved	µg/L	0.9	0.3	0.3	0.8	0.3	0.1	< 0.1	0.1	< 0.1	< 0.1	0.0001	0.1
Barium, dissolved	mg/L	0.029	0.017	0.0061	0.01	0.017	0.0027	0.0027	0.0032	0.0031	0.0035	0.002	0.0022
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth, dissolved	mg/L	-	-	-	-	-							
Boron, dissolved	mg/L	<0.01	<0.01	<0.01	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bromine	ug/L	-	-	-	-	-							
Cadmium, dissolved	mg/L	<0.00001	0.00001	<0.00001	<0.00001	0.00002	0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	0.00001
Chromium, dissolved	mg/L	<0.0005	0.0006	<0.0005	0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	0.0082	0.0003	0.0002	0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper, dissolved	mg/L	0.0025	0.0015	0.0006	0.0003	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Iron, dissolved	mg/L	1.57	0.33	0.14	0.019	0.32	0.19	0.21	0.037	0.036	0.076	0.066	0.1
Lead, dissolved	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium, dissolved	µg/L	-	-	-	-	-							
Manganese, dissolved	mg/L	0.44	0.11	0.2	0.036	0.12	0.020	0.017	0.0039	0.0053	0.041	0.0098	0.013
Molybdenum, dissolved	mg/L	0.0055	0.0025	0.0028	0.026	0.0027	<0.0001	<0.0001	<0.0001	<0.0001	0.0013	<0.0001	<0.0001
Nickel, dissolved	mg/L	0.0007	0.001	0.0005	0.0009	0.001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Selenium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Silica, soluble, dissolved	mg/L	-	-	-	-	-							
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.044	0.018	0.026	0.03	0.018	0.012	0.012	0.014	0.014	0.017	0.01	0.011
Sulfur	mg/L	-	-	-	-	-							
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Vanadium, dissolved	mg/L	<0.0001	0.0002	<0.0001	0.0002	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.0035	0.004	0.0027	0.002	0.0028	<0.0005	<0.0005	0.001	0.0016	<0.0005	<0.002	<0.0005
Phosphorus, dissolved	mg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Radionuclides													
Uranium, dissolved	µg/L	<0.1	0.2	<0.1	0.3	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.0001	< 0.1
Uranium-234 calculated	Bq/L	-	-	-	-	-			-	-	-	-	-
Uranium-238 calculated	Bq/L	-	-	-	-	-			-	-	-	-	-
Lead-210	Bq/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02
Polonium-210	Bq/L	0.005	<0.005	<0.005	<0.005	0.009	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Radium-226	Bq/L	<0.005	<0.005	<0.005	0.009	0.01	0.008	<0.005	<0.005	<0.005	0.006	<0.005	<0.005
Radon-222	Bq/L						-	-	-	-	-	-	<0.01
Thorium-230	Bq/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Tritium	Bq/L	-	-	-	-	-	-	-	-	-	-	-	-

Appendix K Geomechanical Report (External Report; RESPEC, 2024)

The information presented in Appendix K was based on the same geologic information as was used herein to develop the regional hydrogeology CSM for the Project. A clarification is provided, however, on differences in terminology for the desilicified zone used between the two reports.

Herein, the desilicified zone was delineated using rock core RQD, friability and fracture frequency (Section 3.4.4). Specifically, to delineate the desilicified zone in the hydrogeology CSM, core with a friability of 3 or greater was interpreted to be hydrothermally altered sandstone of high relative porosity and permeability in comparison to the unaltered Athabasca Supergroup sandstones, through substantive loss of matrix silica content (10% or more; Sorba and Tetland, Personal Communication).

In the RESPEC (2024) report, differentiation was made with respect to the level of desilicification of the altered sandstones using the terms "Altered Sandstone" and "Desilicified Sandstone". The "Altered Sandstone" was delineated using the same friability criteria as was used in the hydrogeology CSM to define the desilicified zone (i.e., a friability of 3 or more). The "Desilicified Sandstone" was delineated in RESPEC (2024) using a friability of 4 or greater, which represents extreme desilicification of the rock matrix (loss of matrix silica of up to 30% or more; Sorba and Tetland, Personal Communication). The zones of extreme desilicification were differentiated from the rest of the Altered Sandstone and ascribed very conservative average material properties presented in Table 1 of Appendix K. These average material properties included zero cohesion. As the objective of the geomechanical study was to evaluate the potential for bedrock collapse within the freeze wall above the ore zone, it was important to differentiate these zones of no cohesion for a worst-case scenario assessment.

Thus, the linkage between the two studies is as follows: the combined Altered Sandstone and Desilicified Sandstone shown in Figure 2a and 2b of Appendix K correspond to the "Desilicified Zone" shown in this report as Figures 9, 10. 12, and 29.

References

Sorba, C. and Tetland, M. Discussion of Project geology and minerals in once open fractures. Oral communication, Chad Sorba and Mikkel Tetland, Denison Mines to the Ecometrix team.

EXTERNAL MEMORANDUM

To: Xavier Lu Dac
Dana Harris
Denison Mines Corporation
230-22nd Street East
Suite 200
Saskatoon, SK S7K 0E9

cc: Project Central File 02924

From: Neel Gupta
Cody Vining
Brett Dueck
RESPEC
3824 Jet Drive
Rapid City, SD 57703

Date: January 25, 2024

Subject: Results of a Geomechanical Study Investigating the Stability of the Rock Mass in Response to In Situ Recovery of Uranium-Enriched Rock for the Wheeler River Uranium Project (Revision 1)

Denison Mines Corporation (Denison), a uranium exploration and development company, has a flagship Wheeler River Uranium project. This project is the largest undeveloped in situ recovery (ISR) uranium project in Northern Saskatchewan's eastern Athabasca Basin. The project site is located approximately 35 kilometers (km) north-northeast of the Cameco Corporation (Cameco) Key Lake operation and 35 km southwest of the Cameco McArthur River operation in the eastern Athabasca Basin. Denison proposes developing the Phoenix deposit in this region.

At the Phoenix deposit, Denison plans to drill the set of injection/recovery wells for ISR of uranium-enriched rock through leaching with a freeze wall isolating the operations from the surrounding rock mass. In response to the leaching process, the remnant ore zone may displace or fail and may no longer be able to support the overburden load while causing instability in the surrounding rock mass because of the stress redistribution. Denison, therefore, has requested a geomechanical study to analyze the geomechanical stability of the rock mass around the excavation and freeze wall from the leaching process. This memorandum documents the geomechanical study and briefly discusses the study objectives and approach, significant results, and conclusions.

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STUDY OBJECTIVES AND APPROACH

In a recent geomechanical study [Vining et al., 2023], RESPEC Company, LLC (RESPEC) developed a three-dimensional (3D) strip model of a specific geological section where maximum ore extraction is planned to investigate the stability of the mined cavity and estimate the surface disturbance. The boundary conditions of the strip numerical model assumed an infinite array of the modeled cross-section, where ore extraction is maximum, along the length of the Phoenix deposit. Considering the boundary conditions of the strip model and presuming the average material properties of key stratigraphic layers, the numerical model predicted surface displacement of approximately 7.5 centimeters (cm) and marginal stability of the rock mass limited to the extent of 16 meters (m) from the top extent of mined excavation.

The primary objectives of the current study are evaluating the geomechanical stability of the rock mass around the excavation and proposed freeze wall in response to the in situ leaching operations in Zone A of the Phoenix deposit. To achieve the desired objectives, RESPEC modified the previously developed 3D strip model [Vining et al., 2023] to create a full-scale 3D model using the structural finite difference program *FLAC3D* [Itasca Consulting Group, Inc., 2021] while presuming the similar, average material properties of key stratigraphic layers. Considering the computational time and analysis effort, creating a numerical model that extends across the entire extent of Zone A is impractical. Because the *FLAC3D* program imposes a plane of symmetry along its boundaries, RESPEC, in consultation with Denison, simulated the half-length of Zone A, and the modeling domain encompasses the Phoenix deposit's northeast extent, as shown in Figure 1. The vertical extent of the 3D model is assumed to be 1,000 m below ground surface (bgs), and the lateral boundary is approximately 135 m away from the extent of the low-grade ore zone. The model boundaries located far away from the excavation boundaries isolated the influence of model boundaries on the excavation response. The kinematic boundary conditions of the numerical model prevent normal (horizontal) displacements along the four vertical boundaries of the model and vertical displacements of the bottom boundary. These constraints allow the interior portion of the model to move freely. In situ stress data were not available for the Phoenix deposit. The vertical stress was assumed to be lithostatic (i.e., equal to the weight of the overburden) and determined as a function of depth from the weight of the overburden. In rock mass, the horizontal stress is considered isotropic (i.e., maximum and minimum horizontal stress equal to the vertical stress). For instance, at the depth of 400 m bgs, the average in situ vertical stress is approximately 10 megapascals (MPa).

Denison provided the AutoCAD drawings of key stratigraphic layers in the Phoenix deposit, which were used to develop the 3D structural model. Table 1 summarizes these stratigraphic layers. Figure 2(a) presents the elevation view of the 3D model, which illustrates the continually changing elevations and thicknesses of the rock layers, for example, upper and lower clay, sandstone with sulfide, and altered basement. Figure 2(b) illustrates the 3D extent of desilicified sandstone within altered sandstone. Based on the geological model of the Phoenix deposit developed by Denison, the total volume of the desilicified sandstone is approximately 4 percent of the total volume of altered sandstone. Except for the desilicified sandstone and sandstone with sulfide, the modeled stratigraphic units and their material properties are consistent with the 3D strip model in the previous geomechanical study [Vining et al., 2023]. In consultation with Denison, RESPEC assumed the Mohr-Coulomb property of sandstone with sulfide was similar to altered sandstone and the desilicified sandstone was similar to sand [Terzaghi and Peck, 1967].

Random rock removal was adopted to represent the in situ leaching process in the numerical model. Rock removal included the instantaneous excavation of 30 percent of rock by volume from the high-grade ore zone and 3 percent from the low-grade ore zone. According to Denison, high- and low-

grade ore zones are based on the uranium grade and encompass different stratigraphic layers (e.g., upper clay, lower clay, ore zone) within the Phoenix deposit. Denison plans to adopt the freeze wall design for ISR of uranium-enriched rock; therefore, RESPEC explicitly modeled the freeze wall, which was 20 m thick and located at a distance of 15 m from the extent of the low-grade ore zone. Figure 3 presents the vertical extent of the high- and low-grade ore zones on the vertical plane and surrounding freeze wall.

In the numerical simulation, the pressure at the excavation surface was maintained at a pressure equivalent to a wellhead pressure of 0 MPa with a freshwater gradient of 0.01 MPa/m. Considering that the overlying sandstone is fractured and permeable, and the elevation of the potentiometric surface is near the ground level, RESPEC also simulated the influence of porewater pressure on the predicted stresses and displacement, which is consistent with the previous study [Vining et al., 2023].

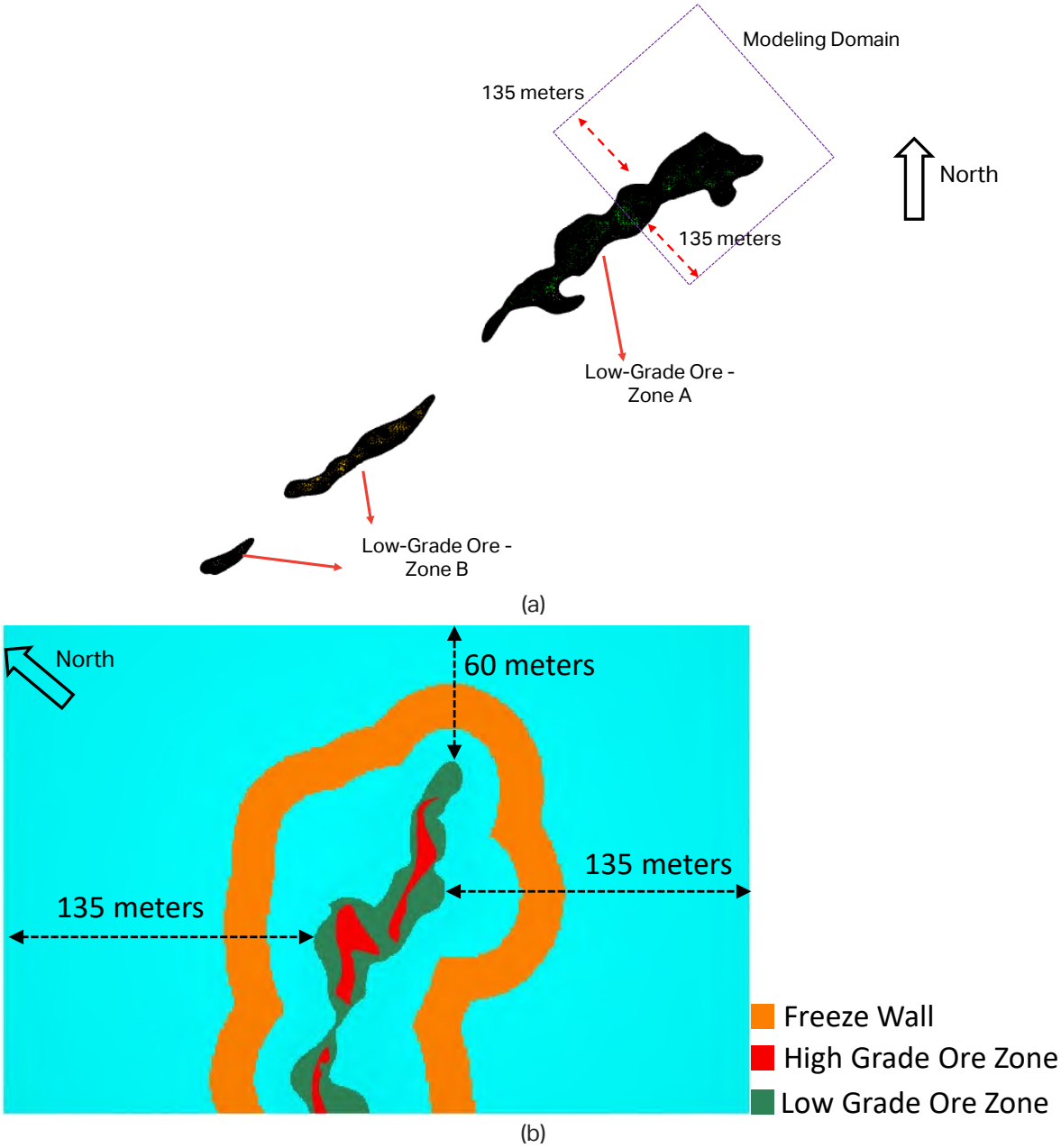

Figure 1. Plan View of the (a) Low-Grade Ore in Zone A and Zone B of the Phoenix Deposit and (b) Extent of Modeling Domain.

Table 1. Average Material Properties

Stratigraphy	Cohesion (MPa)	Friction Angle (degree)	Rock-Mass Compressive Strength (MPa)	Tensile Strength (MPa)	Rock-Mass Modulus (MPa)	Poisson's Ratio (—)	Density (g/cc)
Overburden	1.44	26.93	4.84	4.7	2,241.65	0.20	2.6
Stiff Sandstone	1.44	26.93	4.84	4.7	2,241.65	0.20	2.6
Altered Sandstone	1.07	22.54	3.39	1.0	1,363.76	0.25	2.1
Sandstone with Sulfide	1.07	22.54	3.39	1.0	1,363.76	0.25	2.1
Desilicified Sandstone	0.0	30.0	0.0	0.0	1,363.76	0.25	2.1
Upper Clay	0.03	16.6	0.12	0.20	55.17	0.28	1.7
Ore Zone	0.22	20.11	0.54	0.51	188.75	0.28	4.2
Lower Clay	0.15	18	0.48	0.20	206.43	0.28	1.7
Altered Basement	2.72	25.88	9.17	1.2	4,254.55	0.15	2.1
Stiff Basement	5.57	31.46	20.34	10.7	11,564.83	0.11	2.7

g/cc = grams per cubic centimeter

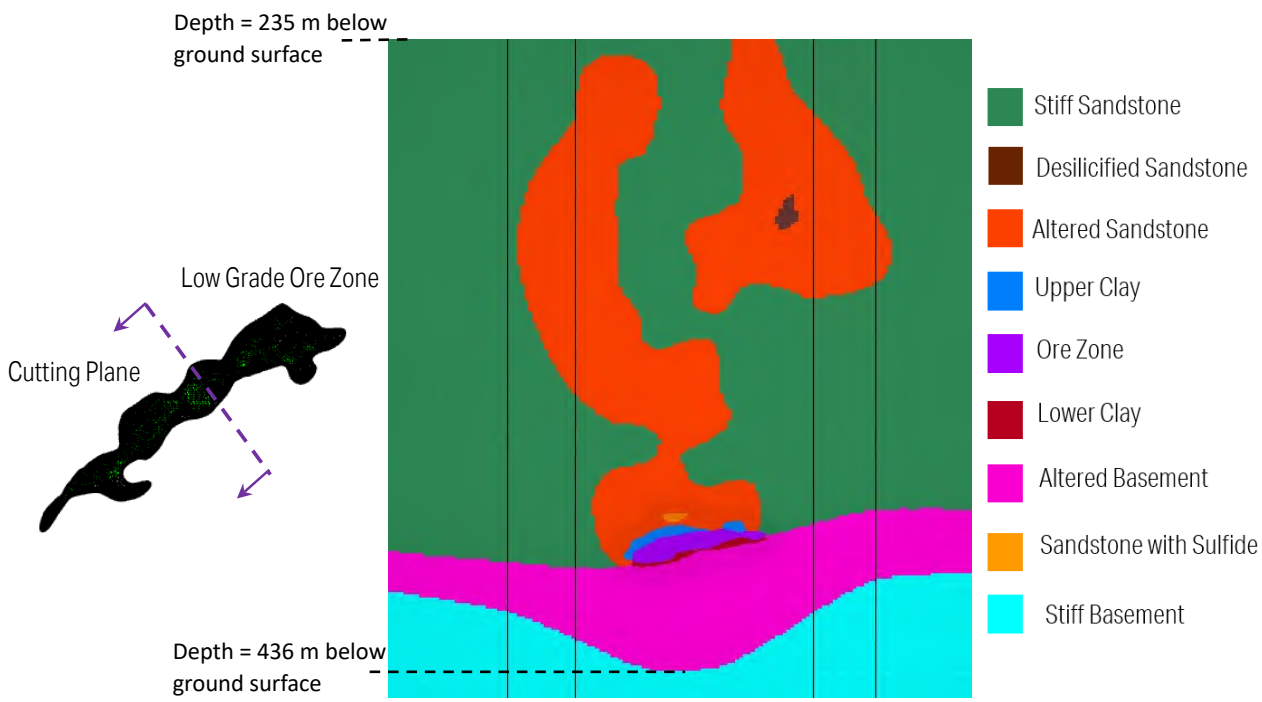

Figure 2(a). Elevation View of the Numerical Model Illustrating Changing Elevation of Different Stratigraphic Units Represented in the Structural Model.

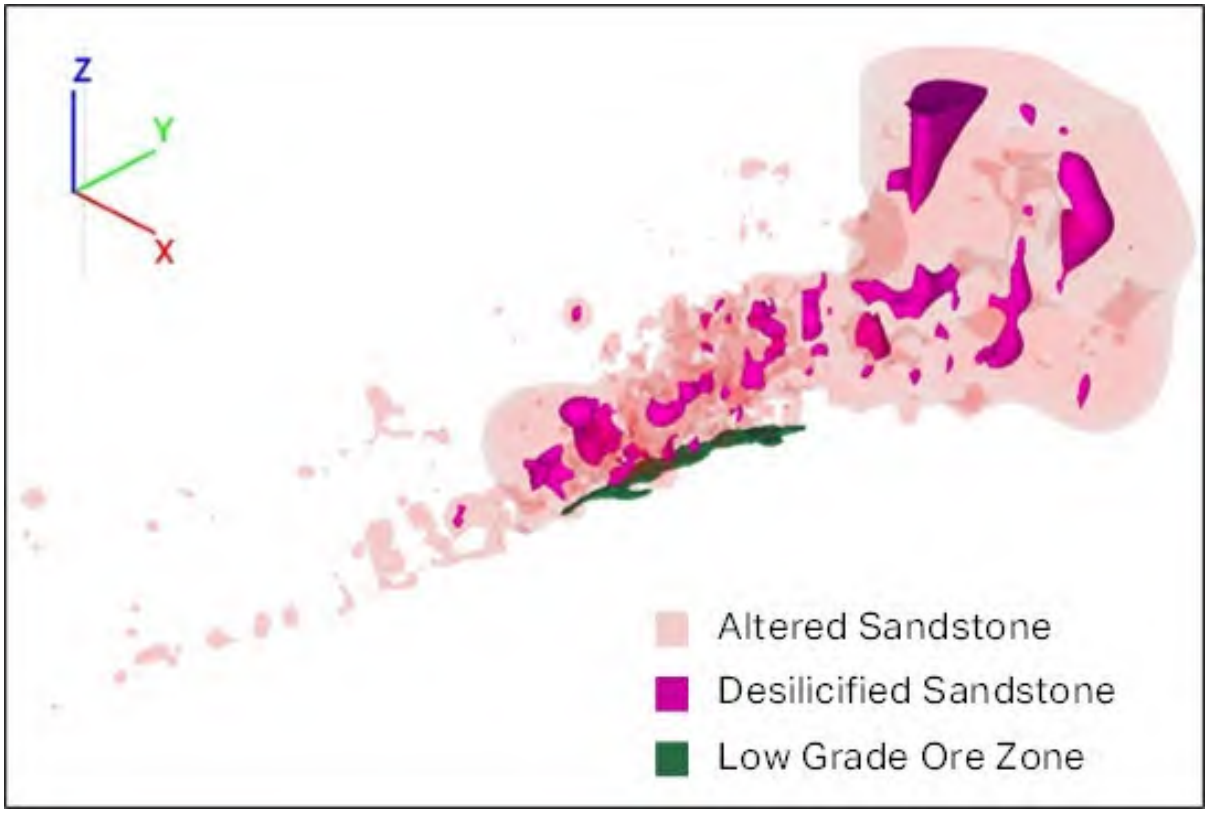

Figure 2(b). 3D Extent of Desilicified Sandstone Within Altered Sandstone at Phoenix Deposit.

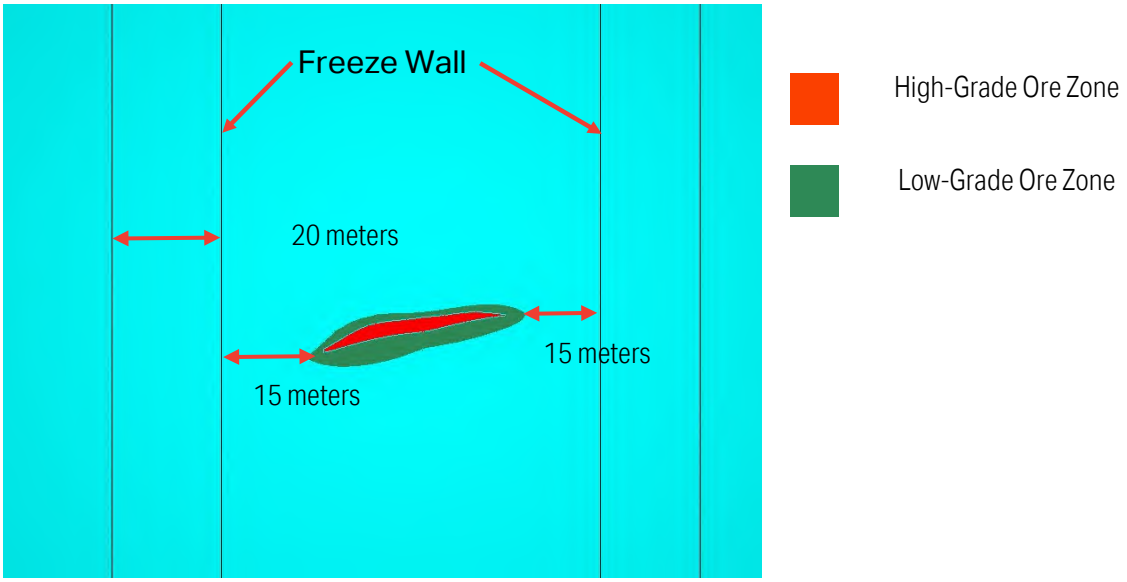

Figure 3. Elevation View of the Numerical Model Illustrating the Relative Location of the Freeze Wall to the High- and Low-Grade Ore Zones in Zone A of the Phoenix Deposit.

RESULTS

The numerical model-predicted stresses and displacements were scrutinized to assess the surface subsidence and the stability of the remaining ore zone, surrounding rock mass, and freeze wall. The outcomes of the numerical simulation are discussed in the following subsections.

ROCK STABILITY

RESPEC simulated the rheological behavior of rock presuming the Mohr-Coulomb constitutive model for each stratigraphic unit to analyze the stress redistribution in case of failure of the remnant rock around the excavation. In the post-simulation analysis, the Mohr-Coulomb Factor of Safety (MCFS) was determined to quantify the competency of the rock mass based on the predicted stress fields. The MCFS value greater than, equal to, or less than 1.0 quantifies the material as not failing, at failure, or failed, respectively. The potential for tensile fracturing in the rock mass was also analyzed using the least compressive principal stress (LCPS). The magnitude of LCPS will be positive at locations where a tensile stress component exists in any direction. Site-specific strength properties of the rock after freezing were unavailable at the time of the study; therefore, RESPEC took a conservative approach and assumed that the properties of the freeze wall were similar to the host rock.

Figures 4 and 5 present the MCFS contour and LCPS contour, respectively, on a horizontal plane passing through the depth of 390, 399, 406, and 413 m bgs. Figures 6 and 7 present the MCFS and LCPS contour on multiple vertical planes. MCFS contour (Figures 4 and 6) presents that the failure conditions (i.e., red contour) are limited within the close proximity (i.e., 5 to 8 m) of the low-grade ore zone, and its lateral extent varies with the depth of the ore zone below the ground surface. However, the MCFS is always greater than 2.50 within the modeled extent of the freeze wall. LCPS contour (Figures 5 and 7) presents that the marginally compressive stress conditions (i.e., yellow and red contours) are predicted within the extent of the low-grade ore zone, and compressive stresses greater than 5 MPa are predicted within the proposed extent of the freeze wall. Figure 8 quantifies the failure volume predicted within the different stratigraphic units. Within the modeled domain of Zone A, the predicted failure volume was approximately 8, 22, 41, and 26 percent of the modeled volume of sandstone with sulfide, upper clay, ore zone, and lower clay, respectively. However, the failure volume is less than 0.02 percent of the modeled volume of stiff or altered sandstone, desilicified sandstone, and altered and stiff basement rock. Additionally, 0 percent failure volume is predicted within the freeze wall.

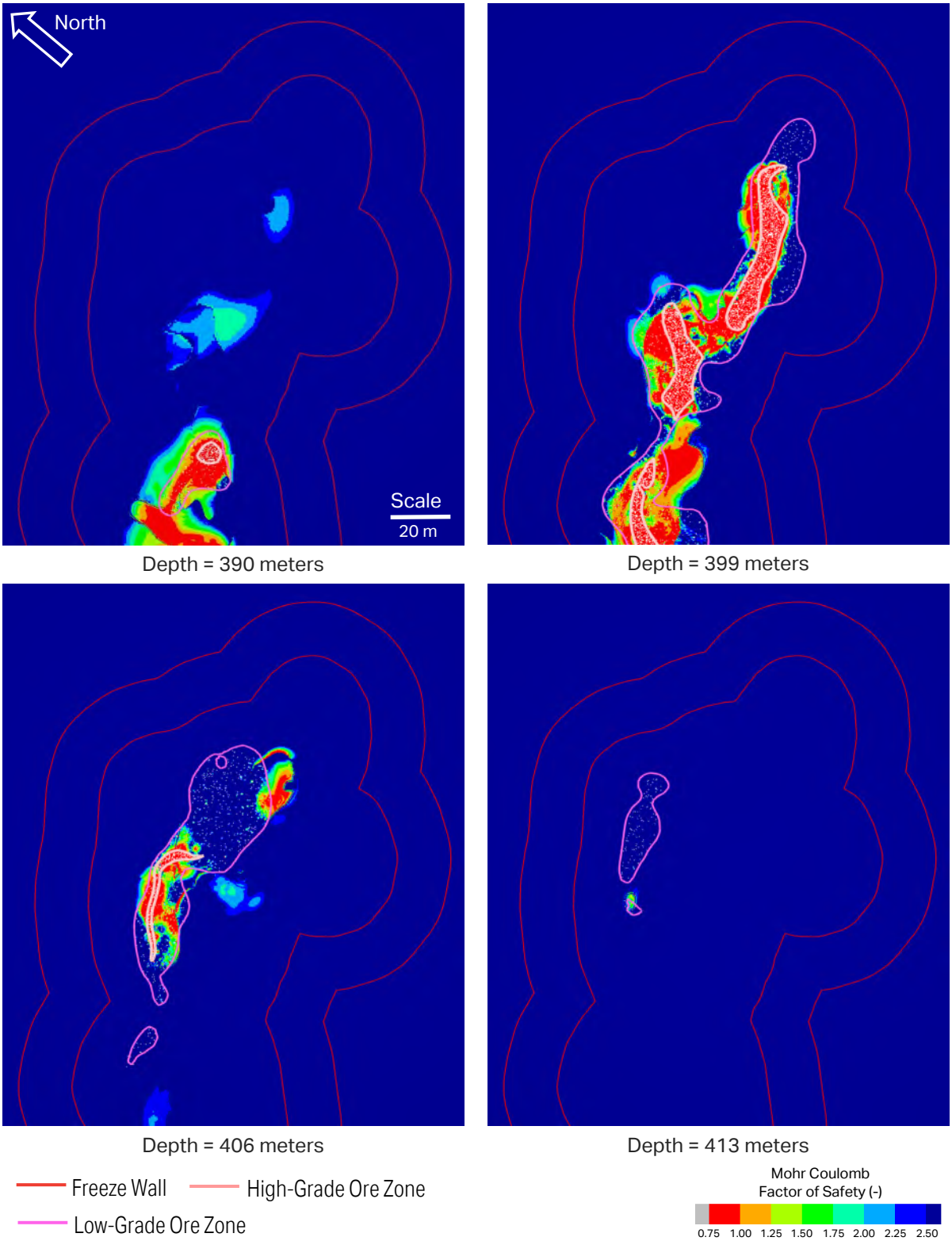

Figure 4. Plot of Mohr-Coulomb Factor of Safety Values on a Horizontal Plane Passing at a depth of 390, 399, 406, and 413 Meters Below Ground Surface.

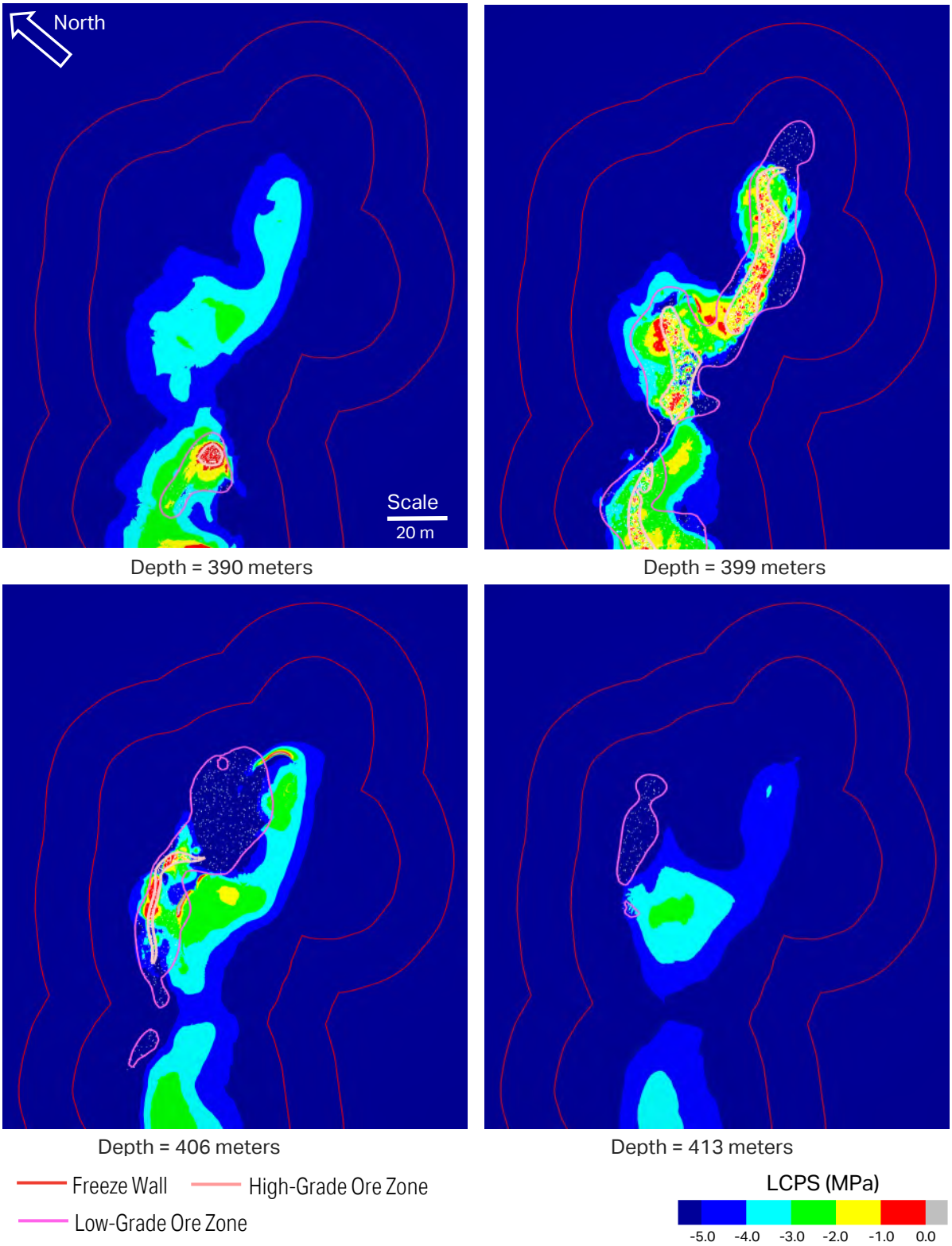

Figure 5. Plot of Least Compressive Principal Stress Values on a Horizontal Plane Passing at a Depth of 390, 399, 406, and 413 Meters Below Ground Surface.

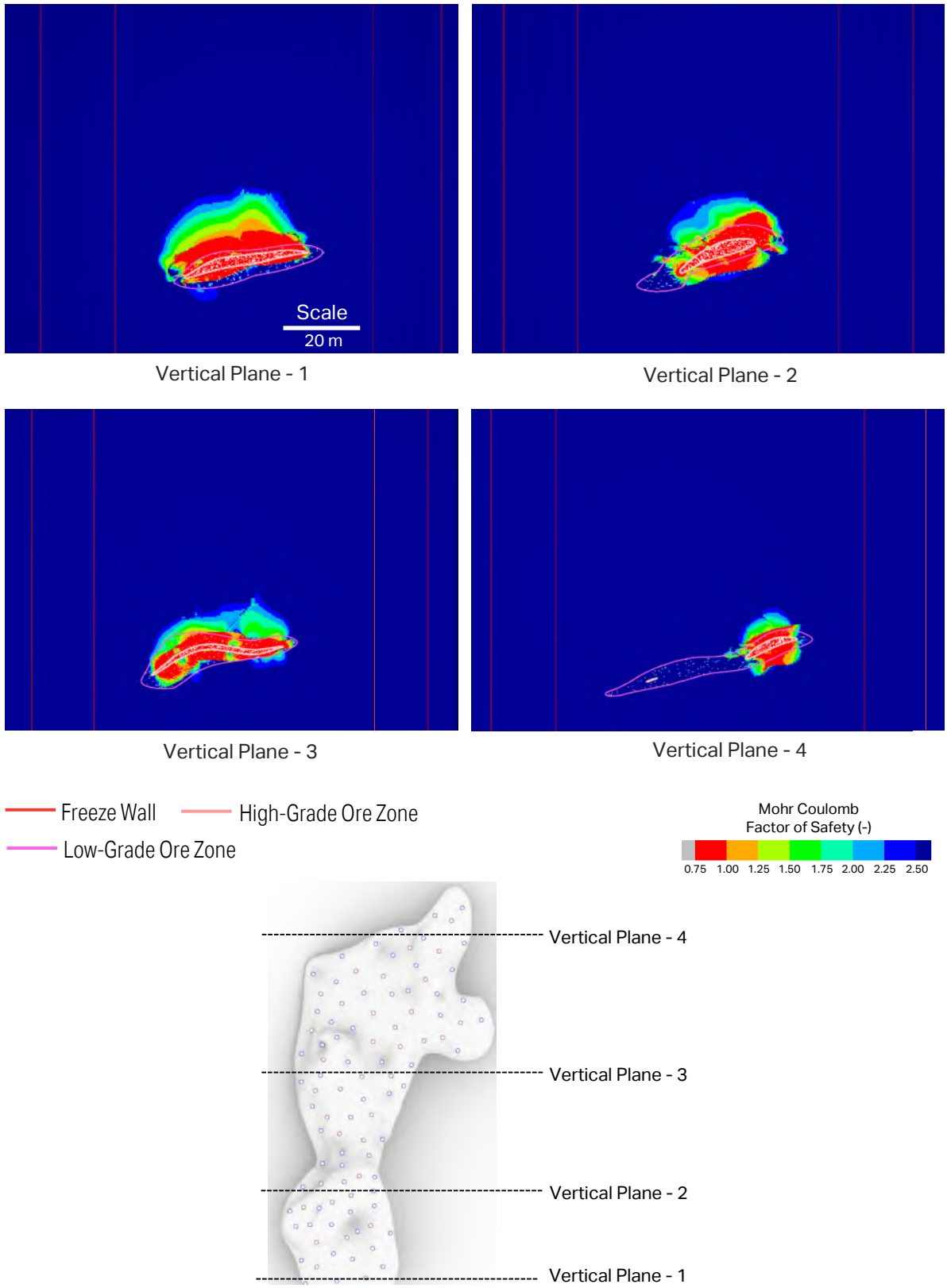

Figure 6. Plot of Mohr-Coulomb Factor of Safety Values on Multiple Vertical Planes.

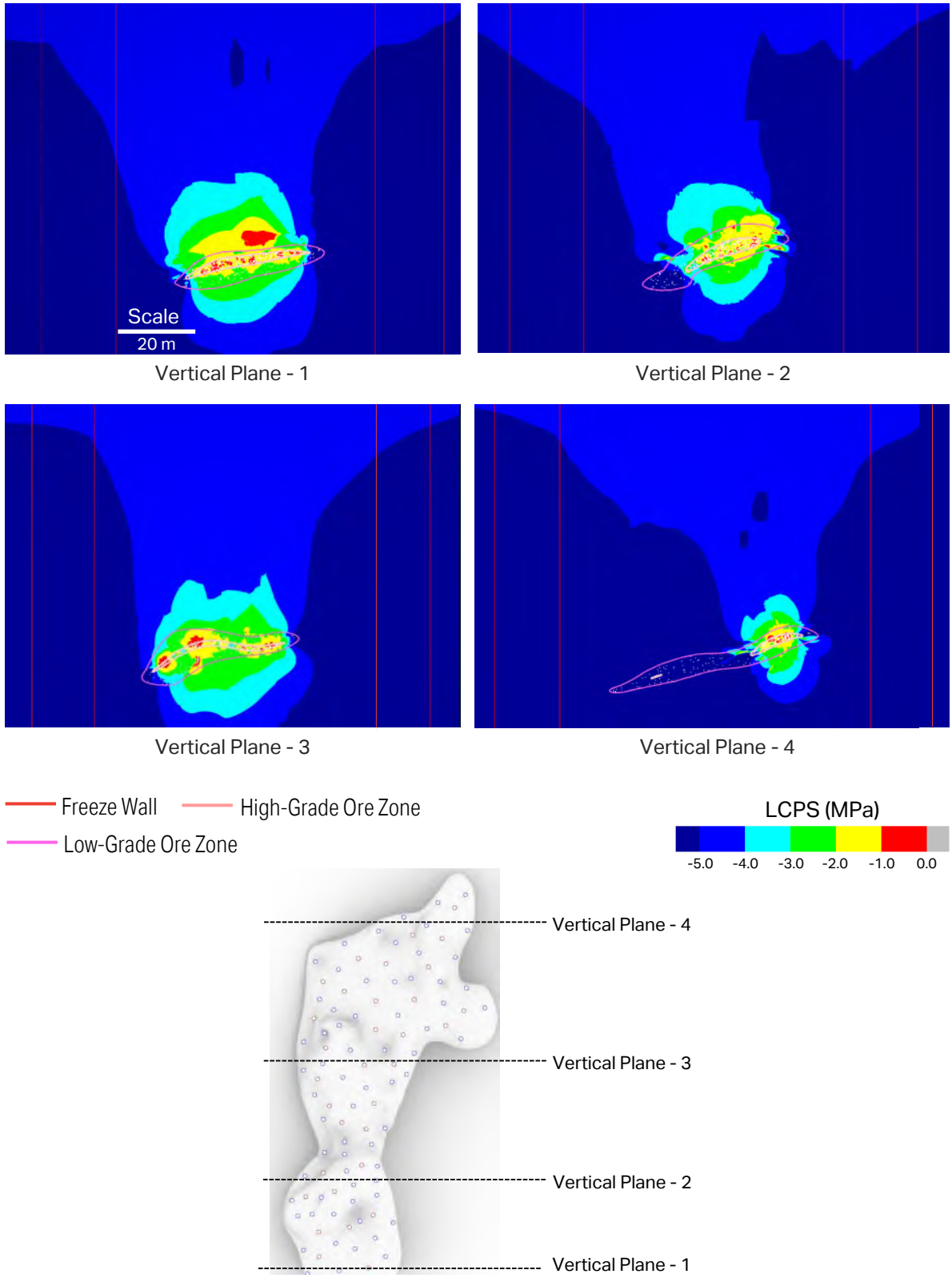

Figure 7. Plot of Least Compressive Principal Stress Values on Multiple Vertical Planes.

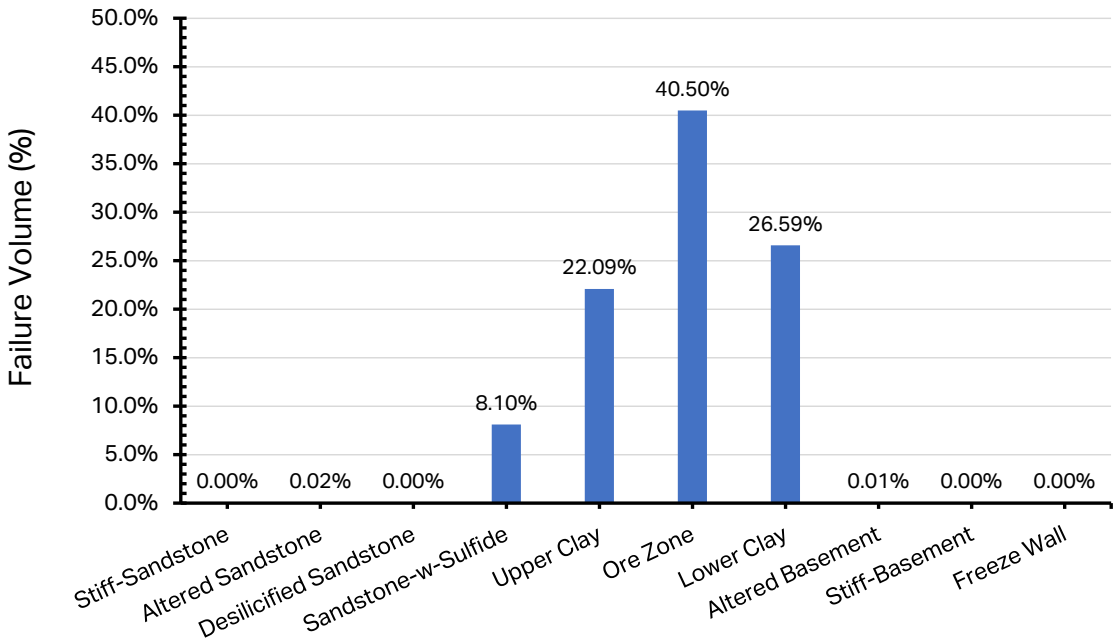

Figure 8. Failure Volume in Different Stratigraphic Units.

SURFACE SUBSIDENCE

In response to the proposed leaching process, the surrounding host rock will displace into the mined cavity, which manifests as subsidence at the ground surface. The numerical model predicted the negligible vertical displacement of approximately 2.5 millimeters (mm) on the ground surface. Figure 9 presents the contours of vertical displacement predicted on a vertical plane passing through the modeling domain's southern boundary. The contour on the vertical plane presents that the vertical displacement of the rock mass immediately above the low-grade ore zone ranges between 42 and 49 cm and quickly reduces to the range between 0 and 7 cm at a distance of 4 to 5 m from the low-grade ore zone. The current study's numerical model-predicted surface subsidence is significantly smaller than the surface subsidence of 7.5 cm predicted in the previous geomechanical study [Vining et al., 2023], which is likely attributed to the difference in the modeling domain and boundary conditions between the two models. In the previous study, the 3D strip model presumed an infinite array of modeled cross sections and corresponding excavation of uranium-enriched rock; in the current study, the full-scale model included the representative extent of Zone A at the Phoenix deposit.

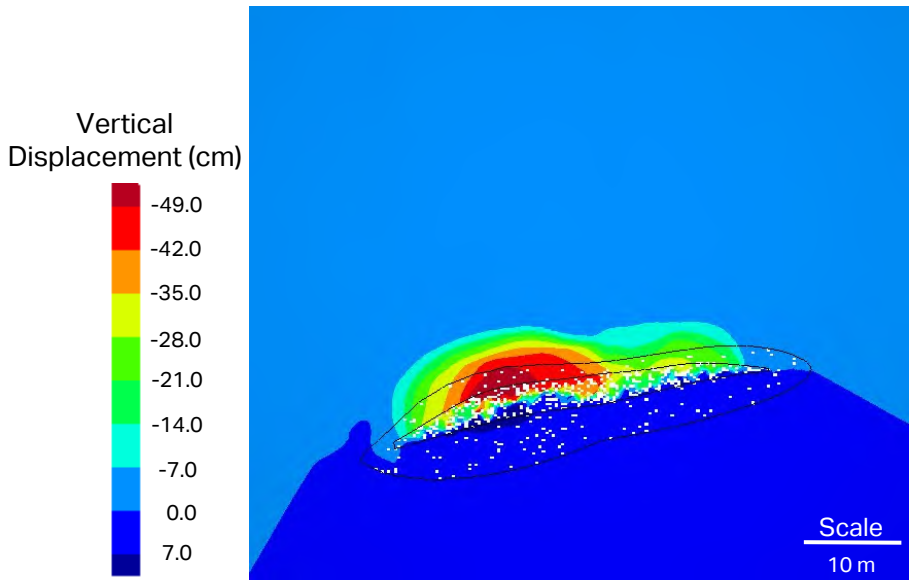

Figure 9. Contour of Vertical Displacement After the Proposed Volumetric Extraction on a Vertical Plane Passing Through the Modeling Domain's Southern Boundary.

CONCLUSIONS

The study objective was to better understand the anticipated response of the surrounding rock mass, particularly the freeze wall, after proposed volumetric rock extraction from the high- and low-grade ore zone. The significant outcomes from this study are as follows:

- **The geomechanical numerical model predicted stability against shear or tensile failure within the proposed extent of the freeze wall.** Considering the average estimate of the material properties of modeled stratigraphic layers, the predicted failure conditions in the rock mass are limited to 5 to 8 m of the extent of the low-grade ore zone. Within the proposed extent of the freeze wall, the MCFS values are greater than 2.50, and the magnitude of LCPS is greater than 5 MPa in compression, indicating the limited potential of instability in the freeze wall.
- **The numerical model predicted vertical displacement at the surface in response to the proposed volumetric extraction is negligible.** The vertical displacement of the rock mass near the modeling domain's southern extent is at a maximum immediately above the low-grade ore zone, ranging between 42 and 49 cm, which reduces to the range between 0 and 7 cm at a distance of 4 to 5 m from the low-grade ore zone. At the ground surface, the average vertical displacement is approximately 2.5 mm.

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Terzaghi, K., and R. B. Peck, 1967. *Soil Mechanics in Engineering Practice*, 2nd Ed., John Wiley & Sons, New York, NY.

Vining, C. A., N. Gupta, and J. Nopola, 2023. *Results of a Geomechanical Study Investigating the Influence of Uranium Extraction on Mining-Cavity Stability for the Wheeler River Uranium Project (Revision 2)*, RSI(RCO)-2924/5-21/14, prepared by RESPEC, Rapid City, SD, for X. Lu Dac and D. Harris, Denison Mines Corporation, Saskatoon, SK, February 9.

Appendix L Analysis of Tritium in Groundwater

The potential for tritium concentrations in groundwater to support ageing of groundwater and the development of the CSM for the Wheeler River program was evaluated using the available analytical data and information on tritium concentrations in precipitation.

Analysis

Information considered in the assessment is presented in the following text and associated tables: Table L1 and L2.

a) Table L1: Provides tritium concentrations in precipitation over time since the 1950s. The source of the tritium data for Canadian locations, including Churchill, Fort Smith and Ottawa, was from the International Atomic Energy Agency Global Network of Isotopes in Precipitation database (GNIP; **https://nucleus.iaea.org/wiser).** Tritium concentrations over time due to radioactive decay were calculated for examination against tritium concentrations in groundwater concentrations for the Wheeler River Project.

b) Table L2: Provides tritium concentrations measured in groundwater under baseline conditions for the Wheeler River Project. The tritium concentrations highlighted in yellow/orange were analyzed at the André E. Lalonde AMS Laboratory, University of Ottawa. The detection limit of < 15 Bq/L at the Saskatchewan Research council does not support interpretation of tritium concentrations with respect to groundwater flow conditions, considering the discussion below. The detection limit at the University of Ottawa is 0.8 TU (0.095 Bq/L). Tritium values measured in groundwater samples in 2021 at the University of Ottawa were examined further in the context of ageing groundwater for the Project.

Tritium concentrations in groundwater measured for the Wheeler River Project must consider several factors. These include:

a) Tritium concentrations in groundwater can be used to identify recharge to mostly granular aquifers in the last approximately 68-70 years, since the early 1950s (Cherry et al., 2004); water recharged prior to that time will have tritium values below analytical detection limits. This is shown in Table L1, where groundwater recharged prior to 1952, extrapolated out more than 60 years, has tritium values that are below the analytical detection limit of 0.1 Bq/L.

b) Maximum tritium concentrations in the precipitation, associated with "bomb tritium" were observed in the early 1960s. At the present time, tritium concentrations in groundwater recharged at that time would be in the range of 14 Bq/L to 53 Bq/L. Values

this high were not observed in groundwater at the Wheeler River Project in 2021, and only in one instance in 2020, which is discussed further below.

c) Tritium concentrations in precipitation have stabilized from historically high "bomb tritium" values to values of approximately 9-25 Tritium Units (TU), equivalent to 1.1 – 3.0 Bq/L, in the last approximately 20 years.

d) Tritium concentrations may reflect the influence of drilling fluids, which is generally other groundwater from the site.

e) Tritium is produced within the uranium ore deposits of the Athabasca region; this is evidenced by tritium concentrations at GWR-032 (Table L2) that were measured to be 950 Bq/L (2020) and 1800 Bq/L (2021) and are higher than can be explained by "bomb tritium". Tritium production in the ore zone is primarily by neutron capture by ^{6}Li (AECL, 1994). The groundwater sample from the paleoweathered zone (GWR-031; 910 Bq/L) are also considered to be reflecting tritium generation associated with the deposit.

It is Ecometrix's opinion, based on the above considerations and the discussion that follows, that measurement and analysis of tritium data at the Wheeler River Project is limited in value to conceptual model development, and the current data suggests it raises more questions than can be answered. Tritium concentrations in groundwater will continue to be measured as part of the routine groundwater sampling, to further evaluate the usefulness of this approach for refining the conceptual site model developed for the Wheeler River Project.

Table L1: Calculated Tritium Concentrations in Groundwater based on time period of recharge

Time Periods of Interest for recharge	Tritium concentrations in precipitation		Half-Lives of Tritium				
			1	2	3	4	5
			Years Elapsed				
			12.3	24.6	36.9	49.2	61.5
	TU	Bq/L[a]	Tritium concentration measured in Groundwater (Bq/L)[b,c]				
Recharged Prior to 1952 (Clark and Fritz, 1997)	8.2E+00	9.8E-01	4.9E-01	2.4E-01	1.2E-01	*6.1E-02*	*3.1E-02*
1953, annual average, Ottawa	2.7E+01	3.3E+00	1.6E+00	8.1E-01	4.1E-01	2.0E-01	1.0E-01
1956, annual average, Ottawa	1.5E+02	1.7E+01	8.7E+00	4.3E+00	2.2E+00	1.1E+00	5.4E-01
1959, annual average, Ottawa	5.4E+02	6.4E+01	3.2E+01	1.6E+01	8.0E+00	4.0E+00	2.0E+00
1963, monthly maximum, Fort Smith (NWT)	7.1E+03	8.5E+02	4.3E+02	2.1E+02	1.1E+02	5.3E+01	2.7E+01
1963, annual average, Fort Smith (NWT)	3.8E+03	4.6E+02	2.3E+02	1.1E+02	5.7E+01	2.9E+01	1.4E+01
1969, annual average, Fort Smith (NWT)	4.0E+02	4.8E+01	2.4E+01	1.2E+01	6.0E+00	3.0E+00	1.5E+00
1979, annual average, Ottawa	4.8E+01	5.8E+00	2.9E+00	1.4E+00	7.2E-01	3.6E-01	1.8E-01
1992 Average (Churchill, MB)	1.8E+01	2.1E+00	1.1E+00	5.3E-01	2.6E-01	1.3E-01	*6.6E-02*
2000-2019, Maximum annual average, Ottawa	2.3E+01	2.7E+00	1.3E+00	6.7E-01	3.4E-01	1.7E-01	*8.4E-02*
2000-2019, Minimum annual average, Ottawa	9.7E+00	1.2E+00	5.8E-01	2.9E-01	1.4E-01	*7.2E-02*	*3.6E-02*
Snow (AECL, 1994) (6 TU)	6.0E+00	7.1E-01	3.6E-01	1.8E-01	*8.9E-02*	*4.5E-02*	*2.2E-02*

Notes

a Tritium concentrations in TU were converted to Bq/L using the conversion factor of 0.1191 used by the André E. Lalonde AMS Laboratory at the University of Ottawa

b Yellow Highlighting indicates calculated concentration at approximate present-day (2019-2021)

c The detection limit for tritium at the André E. Lalonde AMS Laboratory, University of Ottawa in the water samples is 0.8 TU (0.095 Bq/L); *Values shown in italics are below the detection limit*

Table L2: Summary of Tritium Concentrations Measured in Groundwater for the Wheeler River EIS

Groundwater Well	Hydrostratigraphic Unit	Sampling Date	Tritium Concentration (Bq/L)
GWR-006	OB	2020-08-22	<15
GWR-006		2021-04-14	0.1
GWR-029	LSA	2020-08-30	<15
GWR-029		2021-04-12	0.1
GWR-003	OB	2020-08-16	<15
GWR-003		2021-04-18	1.1
GWR-025	LSA	2020-08-22	<15
GWR-025		2021-04-17	0.4
GWR-008	LSA/DSZ	2020-09-06	<15
GWR-008		2021-04-09	0.5
GWR-009	ISA/DSZ	2020-09-14	16
GWR-009		2021-04-10	1.2
GWR-033	LSA	2020-11-03	<15
GWR-033		2021-05-25	0.5
GWR-034	ISA	2020-10-30	<15
GWR-034		2021-05-24	1.2
GWR-035	USA	2020-11-03	<15
GWR-035		2021-05-24	0.80
GWR-005	OB	2020-08-29	<15
GWR-005		2021-05-22	<0.1
GWR-014	ISA/DSZ	2020-08-29	19
GWR-014		2021-05-21	0.13
GWR-012	LSA/DSZ	2020-08-29	<15
GWR-012		2021-05-23	<0.1
GWR-036	OB	2020-11-05	<15
GWR-036		2021-04-08	0.8
GWR-037	USA/DSZ	2020-10-24	<15
GWR-037		2021-04-09	0.1
GWR-031	PWZ	2020-08-09	<15
GWR-031		2021-06-04	910
GWR-011	LSA/DSZ	2020-08-08	<15
GWR-011		2021-06-01	0.13
GWR-013	ISA/DSZ	2020-08-09	<15
GWR-013		2021-06-02	0.78
GWR-032	OZ	2020-11-01	-
GWR-032		2020-08-08	950
GWR-032		2021-06-04	1800
GWR-046	ISA	9/14/2021	<40
GWR-047	ISA/DSZ	9/10/2021	<40
GWR-048	LSA	9/10/2021	<40

Overburden and Groundwater Wells in the uppermost Upper Sandstone Aquifer

There are there three wells monitored as part of the baseline program that are installed in overburden materials: GWR-006, GWR-003 and GWR-005. Two other wells are installed in the uppermost Athabasca Sandstone Group unit (MFd) immediately beneath the overburden. These wells are GWR-036, GWR-035. Tritium values in groundwater wells installed in the overburden and upper sandstone ranged from <0.1 Bq/L to 1.1 Bq/L. Tritium concentrations were 1.1 Bq/L in GWR-003, 0.8 Bq/L in GWR-036 and 0.8 Bq/L in GWR-035. These tritium concentrations in groundwater sampled in these wells is considered to have been recharged in the last 12-25 years. To check alignment between these results and the 3D hydrogeological model, particle tracking was done to estimate minimum groundwater residence times (in years) at each well cluster location. For the overburden unit, the particle tracking results indicated minimum residence times of between 0.5 and 20 years.

Tritium concentrations were at or below the detection limit of 0.1 Bq/L at GWR-006 and GWR-005. Monitoring well GWR-006 is very shallow (screened from 9-15 mbgs), whereas GWR-005 is the deepest of the overburden wells, with a screened interval from 117-123 mbgs. It is considered plausible that the low tritium values reflects the potential for longer residence groundwater times due to heterogeneity in hydraulic conductivities of till material in the overburden. However, tritium concentrations in snow are also lower than in precipitation (AECL, 1994). Thus, it is possible that in the localized areas to those groundwater monitoring wells, materials are lower hydraulic conductivity, and the tritium concentrations are relatively more influenced by snowmelt. Longer residence times in the overburden materials in wells GWR-006 and GWR-005 is supported by higher specific conductance in those wells GWR-003 and GWR-036. Field-measured specific conductance values in GWR-006 and GWR-005 were approximately 150 µS/cm in 2021, whereas values at GWR-003 and GWR-036 were < 75 u µS/cm in 2021 (Table 3-2 of Appendix 7-A to the EIS).

Deeper Groundwater

Interpretation of tritium values for "ageing" of groundwater was considered inappropriate beyond the shallowest units at the Site. This is because of the relatively low values of tritium in the groundwater in all but the ore zone, and the numerous confounding factors/complexities. Several tritium concentrations are within 1-3 times the analytical detection limits and are thus considered at the limits of interpretability.

One possible confounding factor at low tritium concentrations is contamination of the sample with drilling fluids. Influence is drilling fluids is possibly a factor in the tritium concentrations observed in groundwater well GWR-014. In that well, tritium values in 2020 were measured as 16 Bq/L at SRC. This is the highest value of tritium detected in groundwater in the Athabasca Sandstone hydrogeologic units and was not reproduced when the well was sampled in 2021; the tritium concentration fell significantly to 0.13 Bq/L. The higher relative concentration of tritium in that well is not considered to reflect "bomb tritium" because of the significant change upon resampling, and it is considered possible that the groundwater quality in that well was

influenced by drilling fluids/well construction materials, which was also noted for this well in terms of groundwater quality in the Baseline Report (Appendix 7-A of the EIS). Influence of drilling fluids is also considered the likely explanation for the tritium concentration of 1.2 Bq/L in monitoring well GWR-034. As was noted in the Baseline Report, the water quality in GRW-034 is considered to reflect influence from drilling fluids and additives and is not considered reliable. Tritium concentrations in groundwater will continue to be measured as part of the routine groundwater sampling, to further evaluate the usefulness of this approach for refining the conceptual site model developed for the Wheeler River Project.

Conclusion

The conclusion is that, beyond alignment between some samples in the overburden and the upper sandstone aquifer, tritium concentrations in groundwater do not provide a robust means of ageing groundwater in the subsurface within the LSA.

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Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

Section 7: Engagement Database Summary Table – Geology and Groundwater

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VPL-2.33	2	Workshop	2018-01-16	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Pinehouse Lake for community and Kineepik Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Pinehouse Lake	Desire for independent monitoring	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018.
18-EN-VPL-2.53	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	Is there water movement at that level?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. Groundwater flow is influenced by a number of factors and, as such, varies within the LSA. Baseline information on groundwater flow rates can be found in the Geology and Groundwater section of the EIS.
18-EN-VPL-2.57	2	Workshop	2018-01-16	Same as above	Village of Pinehouse Lake	From 1991-95 we did our major review of all the mines, for two reasons: First, what's the tipping point of the number of mines and activities versus the impact on the environment? When there were five we started getting nervous; that's when the CEM program came in. Now we're increasing again, are you building relationships with other mine sites? I'd like you to prove there's no long-range impact. Are you at the point where you need that relationship with other mine sites to make sure cumulative effects is proven to be zero rather than suggesting it will stay zero?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Pinehouse in the year 2018. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers cumulative impacts. Denison determined that there will be no significant impacts as a result of Project activities.
18-EN-VILX-3.103	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Ile a la Crosse	How do you sample streams underground?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Ile a la Crosse in the year 2018. Groundwater monitoring wells will be installed at various depths and locations in and around the wellfield. The monitoring wells have a variety of purposes including groundwater sample collection, measurement of groundwater levels, and detection of changes in pressure and temperature in the groundwater environment. A detailed groundwater monitoring program will be developed as component of the environmental management system as part of the licensing and permitting process. See the Project Description for more information.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VILX-3.105	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Why is the Wheeler River water not good?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Ile a la Crosse in the year 2018. At present, groundwater is unsuitable for consumption as it interacts with the uranium ore body, resulting in high levels of uranium. When mining is over, the groundwater will remain unsuitable for consumption. Denison will remediate groundwater to meet acceptable regulatory standards.
18-EN-VILX-3.32	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Need to understand impact on groundwater and lakes.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Ile a la Crosse in the year 2018. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers accident and malfunction scenarios as well as potential impact to groundwater and lakes. Denison determined that there will be no significant impacts as a result of Project activities.
18-EN-VB-4.37	4	Workshop	2018-01-18	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Beauval for community members to attend. The workshop gathered community input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Beauval	Ground freezing would reduce the amount of water that is needed to be discharged.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Beauval in the year 2018.
18-EN-VB-4.38	4	Workshop	2018-01-18	Same as above	Village of Beauval	Once mining is over, is the water drinking water quality?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the geology and groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Pinehouse in the year 2018. The record reference serves to highlight pertinent information within the engagement database. At present, groundwater is unsuitable for consumption as it interacts with the uranium ore body, resulting in high levels of uranium. When mining is over, the groundwater will remain unsuitable for consumption. Denison will remediate groundwater to meet acceptable regulatory standards.
18-EN-ERFN-5.4	5	Workshop	2018-05-03	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for ERFN at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting	English River First Nation	In that area there are moose calving areas, whitefish spawning areas – a lot of creeks, inlets and outlets. The drilling – as a former driller back in the 80s, for water wells and diamond drilling – it may not impact underground hydrology right away but maybe 15-20 years down the road. Even the pH of the water changes with time with things that are happening. The ecosystem	Denison considered this in section: Spatial and Temporal Boundaries, Temporal Boundaries And in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from member of English River First Nation, who attended a workshop in the year 2018. The record reference serves to support the selected temporal boundaries. Denison has completed an environmental assessment to understand Project impacts on the environment. Denison has determined that there will be no significant impacts as a result of Project activities. Significance determination includes, but is not limited to, duration, reversibility, and context.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				had been delayed many times, and was held in the Health Clinic because there was a regional power outage.		becomes disrupted. Those are some of the things we wanted to express.		
18-EN-ERFN-5.72	5	Workshop	2018-05-03	Same as above	English River First Nation	On my lake, Millson Lake, there's nothing right now. The drilling affected the water 15 years after – they did 35-40 holes around that lake.	Denison considered this in section: Spatial and Temporal Boundaries, Temporal Boundaries And in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from member of English River First Nation, who attended a workshop in the year 2018. The record reference serves to support the selected temporal boundaries.
19-EN-ML37-62.9	62	Meeting	2019-11-05	Denison, MN-S representatives, and the Métis Local Presidents met to discuss process for engagement. Denison requested MN-S provide direction related to rescheduling the community workshops for January 2020.	A La Baie Métis Local #21, Kineepik Métis Local #9, Métis Local #67 (Dore/Sled Lake), Métis Nation - Saskatchewan, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Sipishik Métis Local #49	With the operating mines there is a lack of transparency with the environmental monitoring data and lack of workers from the north. The mines monitor themselves and then report to the regulators. Is there a potential for a company to start doing this?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a Métis Nation Saskatchewan representative/a Métis Local President who attended meeting in the year 2019. Each VC-specific section includes a discussion of any proposed monitoring and/or follow-up programs for each VC, by KI or MP as appropriate. Monitoring programs are designed to meet regulatory requirements (e.g., permit or license conditions), and/or to demonstrate compliance with environmental commitments made in the EIS. Follow up programs are those that are proposed to address any uncertainties identified during the EA process (e.g., to verify predictions made during the EA; determine the effectiveness of proposed and implemented mitigation measures) and to determine if and when to implement adaptive management measures. Monitoring requirements will be directed by the provincial or federal regulators and as requested by Indigenous groups during the Project licensing process and will include requirements related to scheduling, sampling design, frequency, and reporting.
19-EN-ML82-62.21	62	Meeting	2019-11-05	Same as above	A La Baie Métis Local #21, Kineepik Métis Local #9, Métis Local #67 (Dore/Sled Lake), Métis Nation - Saskatchewan, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Sipishik Métis Local #49	If one of the pipes breaks, what would happen?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a Métis Nation Saskatchewan representative/a Métis Local President who attended meeting in the year 2019. Mitigation and monitoring will be implemented, thereby decreasing the likelihood of accidents and malfunctions, such as leaks. In the event of an accident or malfunction, a detailed process outline within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).
16-EN-VPL-105.5	105	Community Meeting	2016-09-07	Denison hosted a community meeting in Pinehouse Lake to introduce the company and the Wheeler River Project.	Village of Pinehouse Lake, Kineepik Métis Local #9, Pinehouse Business North	What are you doing environment baseline collection on? Any Cumulative Effects Monitoring?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended community meeting in Pinehouse in the year 2016. Baseline studies were conducted on selected valued components (VCs). The selected VCs reflect identified scientific, LK and IK, and community interests

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								regarding the Project and its potential effects and are typically identified early in the EA process as a result of questions and concerns raised through engagement with government departments and agencies, Indigenous and community groups, and the general public. VC-specific cumulative effects sections contain a discussion of any proposed environmental and/or monitoring programs, when applicable.
16-EN-VILX-109.29	109	Community Meeting	2016-12-07	Denison hosted a community meeting in Ile a la Crosse to introduce the company and introduce the Wheeler River Project.	MLA - Athabasca, Village of Ile a la Crosse	I sat on the EQC myself and noticed the companies tend to show water sampling results when there's no snow compared to when it's six feet deep; the drainage is different and sometimes you don't get the proper results. That's why I asked if it was independent.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended community meeting in Ile a la Crosse in the year 2016.
17-EN-NSEQC-112.6	112	Board / Committee	2017-11-29	Denison presented the Wheeler River Project to the Northern Saskatchewan Environmental Quality Committee	Northern Saskatchewan Environmental Quality Committee	Is anyone telling you what your baseline studies should be?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a member of the Northen Saskatchewan Environmental Monitoring Committee, who attended meeting in the year 2017. Baseline studies were conducted on selected valued components (VCs). The selected VCs reflect identified scientific, local knowledge, Indigenous knowledge, and community interests regarding the Project and its potential effects.
19-EN-ERFN-140.25	140	Site Visit	2019-08-28	Denison provided a site tour of the Wheeler River Project to the Chief of English River First Nation, along with three ERFN Councillors. Also on the tour was the local ERFN land user who resides near to the Wheeler River Project site location.	English River First Nation, ERFN Trapper	What will be the impact to water from the operation? Those freeze plants could affect the groundwater.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from member of English River First Nation, who attended a site visit in the year 2019. We have completed an environment assessment to understand Project impacts on groundwater and lakes. We have determined that there will be no significant impacts as a result of Project activities.
19-EN-ERFN-140.28	140	Site Visit	2019-08-28	Same as above	English River First Nation, ERFN Trapper	What is your reclamation plan? How will you deal with the hot items from the mining activities?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from member of English River First Nation, who attended a site visit in the year 2019. The record reference serves to highlight pertinent information within the engagement database. The conceptual decommissioning plan highlights that remediation of the mining area will continue until water reached and is demonstrated to be stabilized at acceptable mining area decommissioning objectives as set out in regulatory requirements. Additional detail will be provided in the preliminary decommissioning plan (PDP), which will be submitted to regulators as part of Project licensing and permitting. Prior to executing decommissioning activities, Denison shall prepare and submit a detailed decommissioning plan, that builds upon the PDP, to regulators for acceptance. A Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and licence conditions. The monitoring program will be

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								conducted until the site-specific decommissioning and reclamation objectives for the Project are met.
20-EN-VILX-343.2	343	Phone Call	2020-07-06	Discussions with Ile a la Crosse regarding upcoming field work and COVID-19 protection standards	Village of Ile a la Crosse	Are there aquifers in the area?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual from Ile a la Crosse, who took part in a phone call in the year 2020. A description of the existing environment in the Project Area in terms of groundwater, including aquifers, is presented in the EIS. Specific detail pertaining to aquifers properties in the Project area can be found in the Geology and Groundwater section of the EIS.
21-EN-LLRIB-392.5	392	Meeting	2021-03-05	As a result of their request, Denison provided a presentation on the Wheeler River Project to the Lac La Ronge Indian Band Lands and Resources Subcommittee.	Lac La Ronge Indian Band	How many wells would you need on surface?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a member/representative of the Lac La Ronge Indian Band who attended a meeting in the year 2021. The record reference serves to highlight pertinent information within the engagement database. The wellfield is expected to include approximately 300 wells. Additional detail can be found in the Project Description section of the EIS.
21-EN-VILX-443.17	443	Virtual Meeting	2021-02-10	Denison hosted a virtual meeting for the municipality of Ile a la Crosse. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Ile a la Crosse	Is the environment monitored after the closure of the mine? Who monitors it?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual from Ile a la Crosse who attended a virtual meeting in the year 2021. The record reference serves to highlight pertinent information within the engagement database. The Post-Decommissioning monitoring program will be designed and conducted in accordance with the provincial and federal regulations and licence conditions. The monitoring program will be conducted until the site-specific decommissioning and reclamation objectives for the Project are met. Additional detail can be found in the Project Description section of the EIS.
21-EN-VILX-443.19	443	Virtual Meeting	2021-02-10	Same as above	Village of Ile a la Crosse	What happens when the freeze wall melts? Will there be monitoring of ground water during this?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual from Ile a la Crosse who attended a virtual meeting in the year 2021. Mining area remediation will continue until recovered water reaches and is demonstrated to be stabilized (maintained) at acceptable mining area decommissioning objectives. Once the mining area decommissioning objectives have been met, the perimeter freeze wall will be turned off and allowed to thaw. This will allow the eventual re-establishment of the pre-operational groundwater flow regime in the former mining area.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
21-EN-SUR-446.92	446	Survey	2021-02-16	As part of engagement activities for the municipalities of Beauval, Ile a la Crosse and Pinehouse Lake, Denison prepared and shared an online survey which included information about Denison, the Wheeler River Project, and posed validation questions about the Valued Components being assessed as part of the environmental assessment process. A total of 68 responses were received and 62 of the responses were considered complete, for a 91% completion rate. The information related to the Valued Components was incorporated into the assessment and questions asked on the surveys was incorporated into the overall engagement database.	Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: The quality of the water if something were to leak. Ile a la crosse is a basin where all of the rivers meet, so if something were to spill into the water system it would be concerning for our community	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual from Beauval, Ile a la Crosse, or Pinehouse, who completed a survey in the year 2021 The record reference serves to highlight pertinent information within the engagement database as it relates to the geology and groundwater section of the EIS. Mitigation and monitoring will be implemented, thereby decreasing the likelihood of accidents and malfunctions, such as leaks. In the event of an accident or malfunction, a detailed process outline within the Emergency Preparedness and Response Program will be followed. The Emergency Preparedness and Response Program is being developed as a condition of licensing and is consistent with guidance provided by the CNSC in REGDOC-2.10.1, Nuclear Emergency Preparedness and Response (CNSC 2016).
21-EN-ERFN-447.19	447	Virtual Meeting	2021-03-31	Denison hosted a virtual meeting for English River First Nation (Patuanak, La Plonge and Urban Members). Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	English River First Nation	How far is the closest underground river?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a virtual meeting in the year 2021. Groundwater flow is influenced by a number of factors and, as such, varies within the LSA. Baseline information on groundwater flow rates can be found in the Geology and Groundwater section of the EIS.
21-EN-ERFNSUR-456.24	456	Survey	2021-04-09	As part of engagement activities for English River First Nation, Denison prepared and shared an online survey which included information about Denison, the Wheeler River Project, and posed validation questions about the Valued Components being assessed as part of the environmental assessment process. A total of 23 responses were received. The information related to the Valued Components was incorporated into the assessment and questions asked on the surveys was incorporated into the overall engagement database.	English River First Nation	Denison Question: Based on what you know so far about the Wheeler Project, what aspects of the project could be challenging or cause concern for your community? Response: Contamination of the land by not looking far enough into the future and making it useless for future generations looking forward 500 years.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who completed a survey in the year 2021. Denison has completed an environmental assessment to understand Project impacts on the environment. Denison has determined that there will be no significant impacts as a result of Project activities. Significance determination includes, but is not limited to, duration, reversibility, and context.
21-EN-ERFN-458.12	458	Advisory Committee Meeting	2021-04-22	English River First Nation and Denison held its first Nuhtsiye-kwi Benéne (Ancestral Lands Committee) meeting. Topics discussed were visioning for the Committee, an overview of the	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	What do the monitoring wells do?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a committee meeting in the year 2021.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				Wheeler River Project, the 2021 geotechnical permitting program, and planning for the next meeting.				The monitoring wells have a variety of purposes including groundwater sample collection, measurement of groundwater levels, and detection of changes in pressure and temperature in the groundwater environment. Additional detail can be found in the Project Description section of the EIS.
21-EN-ERFN-473.8	473	Advisory Committee Meeting	2021-06-15	Denison and the Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee) of ERFN held a meeting. During the meeting topics discussed were: concluding discussions related to the geotechnical permit for the Wheeler River Project for 2021, site access considerations (related to ERFN usage of the Fox Lake road), a report on a subsidence assessment report undertaken by Denison and requested by ERFN, and an overview of a pilot project being undertaken by Denison related to reclamation of linear features in and around the Wheeler River Project area.	Nuhtsiye-kwi Benéne Committee (Ancestral Lands Committee)	Denison comment: Subsidence occurs when ground shifts due to activity underground. We've worked with third-party experts to help determine what is happening because what we are doing underground is quite different with our mining method. What we are taking out is quite minimal. Max amount of subsidence is 7.5 cms – shorter than a pencil. The third-party also found that the risk of mining cavity collapse is minimal. A graphic was shown as part of the presentation to illustrate what it would look like underground. Response: Thank you for that. It is a lot less of anthill maze than what we had envisioned.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from an individual who attended workshop in Pinehouse in the year 2018.
21-EN-ERFN-474.1	474	Meeting	2021-06-30	Denison, its third party consultants for socioeconomic and health and wellness assessment (Intergroup) and the English River First Nation Lands & Resources Officer and the third party consultant for English River First Nation (Shared Value Solutions) held a meeting in which Denison provided an overview of the Wheeler River Project scope, and Intergroup provided an overview of the approach taken for the socioeconomic and wellness assessment for the Environmental Assessment.	English River First Nation	Any difference in spill management for ISR operation relative to from other standard mining operations?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a meeting in the year 2021. The Environmental Assessment was conducted based on anticipated Project components, one of which includes the ISR mining method. A Spill Management Plan will be developed as part of the Environmental Management Program as condition of licensing and regulatory requirements.
21-EN-BNFN-479.7	479	Email	2021-05-10	Birch Narrows First Nation provided correspondence to the Canadian Nuclear Safety Commission regarding their interest in being consulted by the Crown and by Denison.	Birch Narrows Dene Nation	Based on the level of detail included in the Project Description it is not possible to fully evaluate BNDN's concerns or the degree of potential impacts associated with the Project. Based on a preliminary review of Denison's Project, we would like to highlight the following areas of interest to BNDN: Impacts to groundwater quality	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Geology and Groundwater section of the EIS serves as a northern perspective, documented as coming from a member/representative of Birch Narrows Dene Nation of English River First Nation who corresponded with the CNSC regarding BNDN interest in being consulted. Denison has completed an environment assessment to understand Project impacts on groundwater. We have determined that there will be no significant impacts as a result of Project activities.

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

Powering
PEOPLE, PARTNERSHIPS AND PASSION.

NUMERICAL MODELLING: POST-DECOMMISSIONING EVALUATION

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NUMERICAL MODELLING: POST-DECOMMISSIONING EVALUATION

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EXECUTIVE SUMMARY

Denison has collected geological, geotechnical, hydrogeological, geophysical, mineralogical, chemical, and hydrological data for over 16 years as part of their exploration and characterization efforts. From a hydrogeological standpoint, these data were subsequently analyzed and interpreted by Denison, Ecometrix and other consultants and were documented in the Baseline Hydrogeology Report. As additional data were collected, the Conceptual Site Model was refined, and in 2021, groundwater flow and reactive transport modelling tools were constructed to help understand the migration and attenuation of constituents dissolved in groundwater from the Phoenix ore zone, toward Whitefish Lake. This report describes the modelling results which evaluate the transport and fate of the neutralized recovered solution post-decommissioning.

A three-dimensional groundwater flow model was developed at the regional scale and was calibrated to observed water level and stream baseflow data. The groundwater flow patterns in the calibrated groundwater flow model are consistent with the Conceptual Model and observed hydrochemistry in the Upper and Lower Sandstone Aquifers systems. Groundwater flow at the site is dominated by flow through the Upper Aquifer system. Groundwater discharge to Whitefish Lake is primarily through the Upper Aquifer (overburden and upper sandstone aquifer), with a lesser component flowing from the Lower Sandstone Aquifer, through the Desilicified Zone, into the base of Whitefish Lake near its eastern shore.

Groundwater flow from the vicinity of the ore body is observed and simulated in the calibrated groundwater model to travel eastward within the Lower Sandstone Aquifer before moving upward through the Desilicified Zone in the Athabasca Supergroup sandstone units and overlying overburden deposits toward Whitefish Lake. The Desilicified Zone is described as a porous media rather than a fractured rock environment and it facilitates the connection between the Upper and Lower groundwater flow systems in the area east of the Phoenix deposit.

Transport of dissolved constituents was simulated using a three-dimensional geochemical reactive transport approach whereby the chemical reactions were computed using PHREEQC and the transport was computed using FEFLOW. In this manner, dissolved constituents interact with the geologic media through which they are flowing. The modelling approach is complex as numerous constituents in groundwater were considered and chemical reactions included sorption to a limited number of well-understood sorbing phases that were verified through geochemical modelling in other In-Situ Recovery (ISR) projects. Precipitation of mineral phases was also included using learnings from the other ISR projects. This geochemical modelling approach considered sensitivity analysis that included attenuation through redox-driven processes, including reduction of U(VI) (i.e., hexavalent uranium, U^{+6}) to U(IV) (i.e., tetravalent uranium, U^{+4}) and re-immobilization as uraninite downgradient of the mineralized zone. Transport analysis incorporated background conditions that were derived from groundwater quality observations throughout the Site, geochemical reactions sites based on solid phase constituent concentrations and mineralogical assemblages from core analyses, and source conditions consistent with those observed during lab core leaching and flushing experiments.

Transport of dissolved constituents generally follows the predicted groundwater flow paths, with additional spreading due to dispersion, and retardation due to sorption reactions. Dispersion reduces the concentrations as time progresses and the dissolved plume spreads, leading to lower concentrations reaching Whitefish Lake than those that are left in the sub-surface at the mined ore zone. In addition to the dispersion, constituents adsorb to available reaction sites on mineral surfaces (i.e., quartz, goethite, and clay) as the dissolved constituents reach these sites. Sorption removes mass from the dissolved phase and retards its migration through the sub-surface, which effectively reduces the dissolved mass and concentrations that are available to be transported toward Whitefish Lake.

By accounting for these reactions, the simulated dissolved constituent plumes emanating from the ore zone reach their maximum extents within the deeper units (i.e., Lower Sandstone Aquifer and deeper parts of the Desilicified Zone) after approximately 10,000 years. Consequently, concentrations at Whitefish Lake throughout the future centuries are simulated to be similar to background concentrations. Under the base case scenario, which represents a conservative estimate of the conditions present, no exceedances of the groundwater quality screening criteria protective of freshwater aquatic life in the receiving environment were predicted.

A suite of parameter and process uncertainty scenarios were performed to evaluate the potential for concentrations to reach Whitefish Lake above the groundwater quality screening criteria (GQSC) threshold values. A suite of 16 additional scenarios is presented; all scenarios indicated that concentrations of most constituents would not exceed GQSC thresholds. The exceptions include constituents with naturally elevated concentrations or naturally outside of the GQSC range (e.g., iron, manganese, and pH), and a scenario with conservative dispersivity values wherein selenium and cobalt concentrations were simulated to exceed the GQSC by a factor of 1.1 and 1.2, respectively.

The simulated conditions indicate that the natural setting has a large assimilative capacity, such that the mass left in solution within the Phoenix ore zone will be naturally sorbed to available mineral sites within the sub-surface, limiting the potential to be transported to Whitefish Lake throughout the future centuries. Sorption and geochemical reaction, coupled with dispersion is predicted to reduce the concentrations of constituents reaching Whitefish Lake to relatively minor variations from background conditions.

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ACRONYMS AND ABBREVIATIONS

1D	One-dimensional
3D	Three-dimensional
7Q10	Seven-day average low streamflow with a return frequency of once in 10-years
AECL	Atomic Energy Canada Limited
BC MOE	British Columbia Ministry of Environment
CCME	Canadian Council of Ministers of the Environment
CEC	Cation Exchange Coefficient
COPC	constituent of potential concern
DEM	Digital elevation model
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ERA	environmental risk assessment
FEFLOW	Finite element groundwater modelling code
GQSC	Groundwater quality screening criteria
GWMP	Groundwater Monitoring Plan
IAEA	International Atomic Energy Agency
IC	Initial condition
IMPACT	Integrated Model for the Probabilistic Assessment of Contaminant Transport
IES	Iterative Ensemble Smoother
ISS	Intermediate Sandstone
ISR	in-situ recovery
Kd	Distribution (i.e., Partitioning) coefficient between a solid and liquid form
Kv, Kvertical	Vertical hydraulic conductivity
Kh, Khorizontal	Horizontal hydraulic conductivity
K_xx	Hydraulic conductivity in the X-direction (i.e., horizontal)
LSA	local study area
LSS	Lower Sandstone
MFa, MFb, MFc, and MFd	Sub-units of the Athabasca Supergroup sandstones
Minteq	Geochemical reaction database
MOE	Ministry of Environment
NRMS	Normalized Root Mean Squared
ORP	Oxidation-reduction potential
PEST	Parameter Estimation modelling code
pe	REDOX potential
PIMA	Portable Infrared Mineral Analyzer
pH	A measure of the acidity of a solution.
PHREEQC	Geochemical reaction modelling code (pH-REdox-EQuilibrium)
QEMSCAN	Quantitative Evaluation of Materials by Scanning Electron Microscopy

REDOX	REDuction / OXidation
RMS	Root Mean Squared
RSA	regional study area
RS1	Restored solution 1
RQD	Rock quality designation
SEQG	Saskatchewan environmental quality guidelines
Ss	Specific Storage
Sy	Specific Yield
TDS	Total Dissolved Solids
US EPA	United States Environmental Protection Agency
w/w	Weight by weight

Units of Measure

%	percent
a	annum (year)
µg/L	Micrograms per litre
µg/m3	micrograms per cubic metre
µg/kg/d	micrograms per kilogram per day
Bq/L	becquerels per litre
g	grams
g/d	grams per day
g/m2/yr	grams per square metre per year
km	kilometre
km2	square kilometre
L/s	Litres per second
L/kg	Litres per kilogram
m	Metre
m asl	metres above sea level
min	Minute
m/a or m/yr	Metres per annum or metres per year
m2/s	Metres squared per second
m3/hr	cubic metre per hour
m3/d	cubic metre per day
m3/s	cubic metre per second
m/s	metres per second
m/d	Metres per day
mg/L	milligrams per litre
mg CaCO3/L	milligrams of calcium carbonate per litre
mg/cm2/30 days	milligrams per square centimetre per 30 days
mg/d	milligrams per day
mg/kg	milligrams per kilogram
mg/kg/d	milligrams per kilogram per day

mm/yr	millimeters per year
yr	Year

1.0 Introduction

Denison Mines Corp. (Denison) is the operator of the Wheeler River Joint Venture that has proposed the development of the high-grade Phoenix uranium deposit located approximately 35 km north-northeast of Cameco's Key Lake Operation and 35 km southwest of Cameco's McArthur River Operation in the eastern portion of the Athabasca Basin region in northern Saskatchewan (See Figure 1-1). The Phoenix uranium deposit is proposed to be mined through an in-situ recovery (ISR) mining operation with on-site processing.

This Groundwater Modelling Report is part of the Environmental Impact Statement (hereafter referred to as "the EIS") submission (Denison, 2024a). The objective of the groundwater flow modelling tasks within the Wheeler River Project EIA is to identify and predict the potential influence of groundwater quality achieved through remediation of the IRS mining area in Decommissioning on the hydrogeological system and nearby surface water features. Groundwater modelling was used to inform our professional judgement regarding the attenuation of constituents in groundwater during transport from the remediated mining area. Consistent with other impact assessments at neighbouring mine sites which have been successfully evaluated and permitted, numerical models are used as predictive tools to understand and evaluate potential impacts from operations. Models are the only appropriate means of evaluating future conditions, as they facilitate bringing proven scientific principles and processes (e.g., groundwater flow, contaminant transport, and geochemical reaction processes) into the evaluation. Not all parameter values will be known *a priori*; as such, models are used as tools to inform professional judgement (i.e., using conservative approaches and through evaluation of uncertainty realizations).

The Baseline Geology and Hydrogeology Report (Ecometrix, 2024a) describes the conceptual understanding of the current physical environment, and hydrogeologic setting present in the study area and the data and information contained in that report are not reiterated herein. As such, the reader is encouraged to review the Baseline Hydrogeology Report for information on the Conceptual Site Model that is numerically represented in the groundwater flow model. The Baseline Hydrogeology Report forms the technical foundation of the groundwater flow modelling undertaken in this study. The Baseline Hydrogeological Report reflects the conceptual hydrogeologic understanding based on the dataset of sub-surface conditions developed from over 16 years of exploration, analysis, and interpretation by Denison, as well as the results of hydrogeologic field investigations carried out in recent years.

This Groundwater Modelling Report describes the development and calibration of the numerical groundwater model and insights gained from application of that model. Figure 1-2 illustrates how the groundwater modelling assessment, and this report, fits into the EIS scope; the groundwater modelling assessment addresses effects post-decommissioning and extending into the future centuries. The results and predictions from the groundwater modelling assessment inform the development of the Groundwater Monitoring Plan (GWMP). The GWMP is an iterative process, that is designed at each Project stage (Pre-Construction through to Post-Decommissioning) to demonstrate compliance with regulations and predictions and protection

of the environment, and to monitor for any changes in groundwater conditions during operations relative to current baseline conditions.

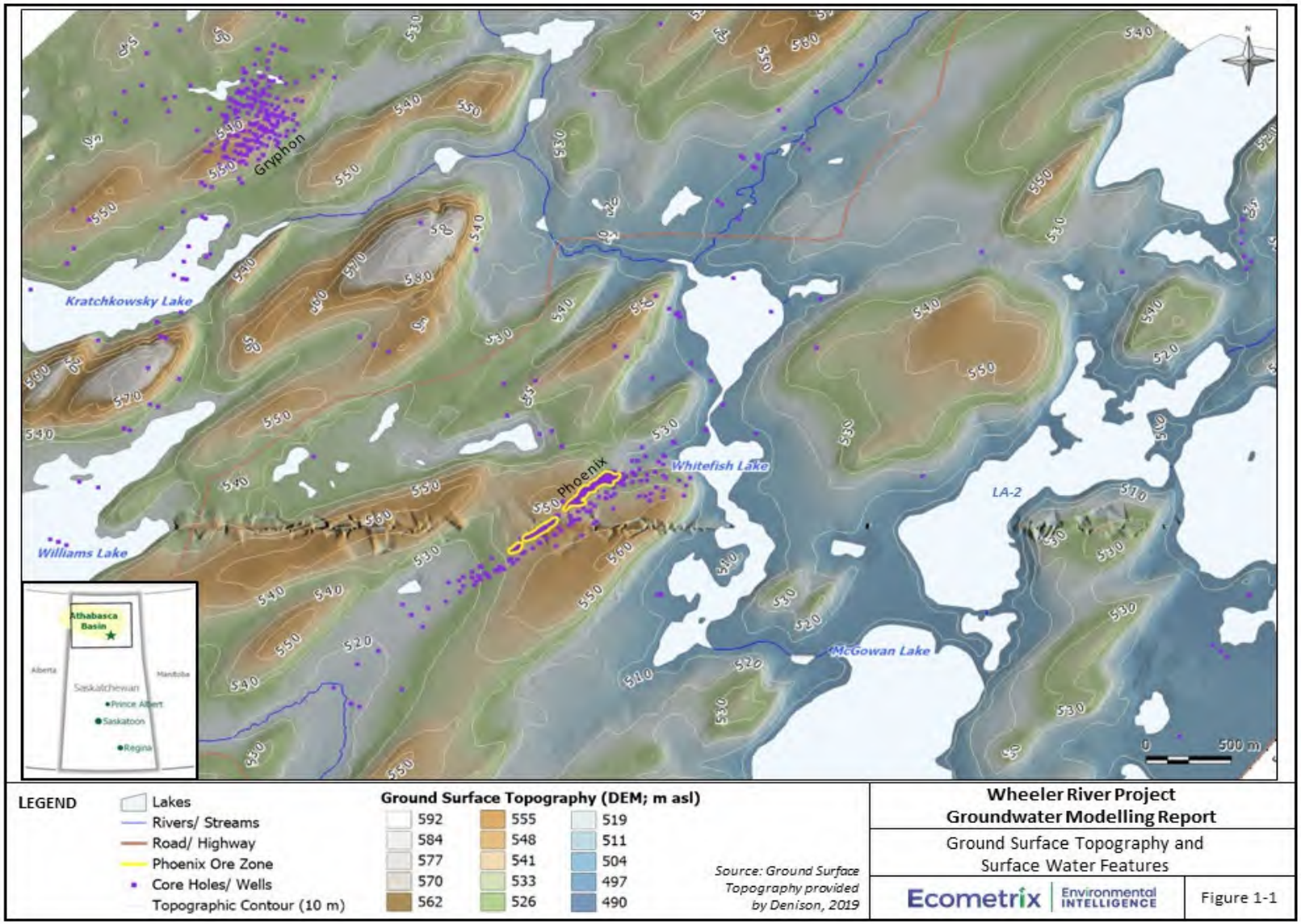


Figure 1-1: Ground Surface Topography and Surface Water Features

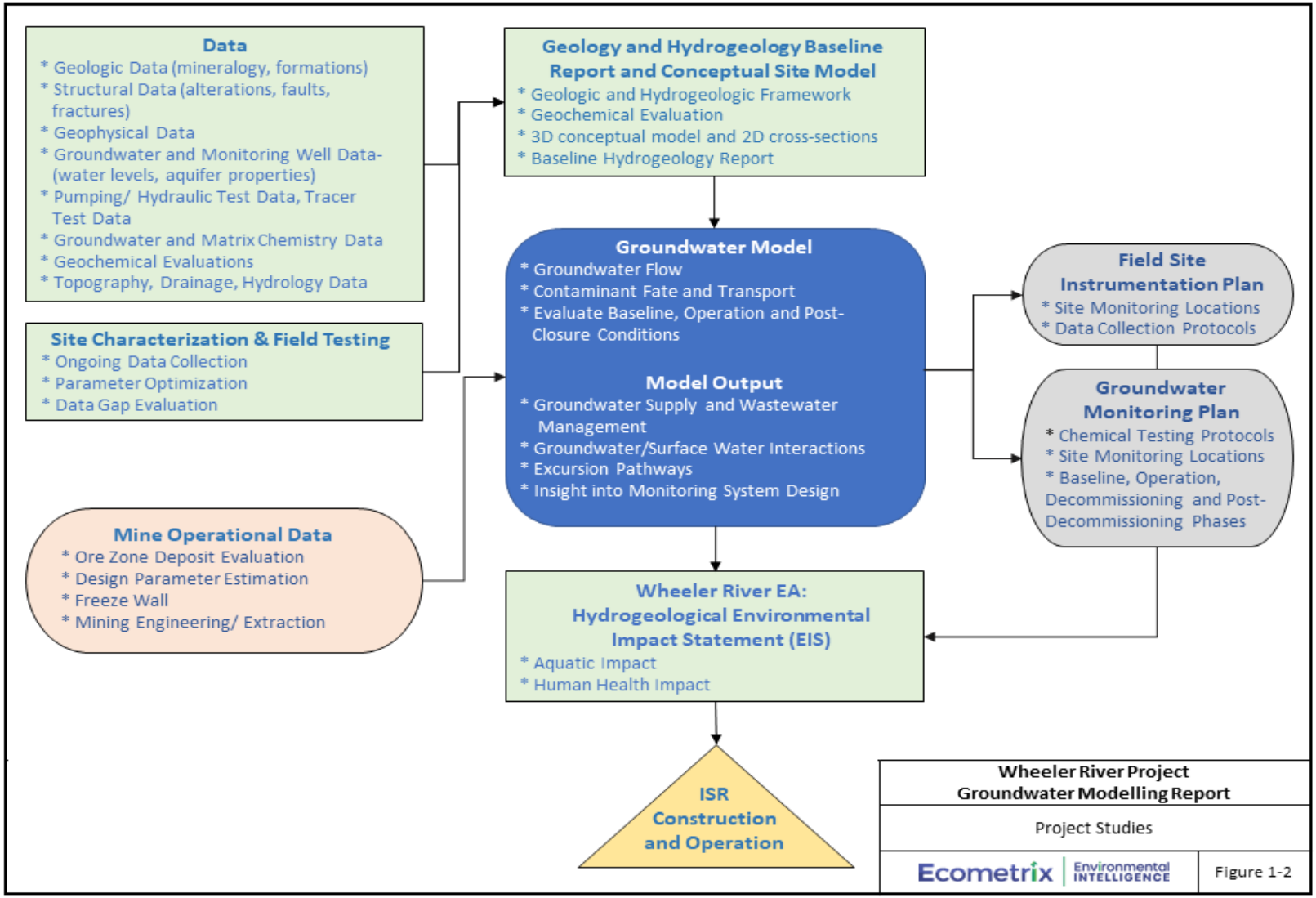


Figure 1-2: Project Studies and Key Deliverables

1.1 Scope of Work

The scope of work for this project involved the development, calibration and application of groundwater flow and contaminant transport modelling tools to support Environmental Assessment (EA) and the (EIS) for the Wheeler River Project. The objective of the modelling completed was to predict potential changes to groundwater quality and quantity following remediation of groundwater quality in the mining area during Decommissioning. Predicted changes in groundwater quantity were evaluated against baseline conditions and in groundwater quality were evaluated against groundwater quality screening criteria. Screening-Level criteria applied were for the protection of aquatic life within the receiving environment (surface water bodies). Potential risks to humans and ecological receptors were further evaluated through environmental risk assessment (Ecometrix, 2024b).

The approach developed to predict groundwater conditions (quality and quantity) associated with the Project was to use a three-dimensional (3D) numerical groundwater flow and transport model (developed using FEFLOW), coupled with a geochemical model (developed using PHREEQC) to complete reactive transport evaluations. This type of approach has been shown to provide advanced insights into complex geochemical reactions involving uranium (Miller, 1993; Bain et al. 2001; Appello and Dimer 2004; U.S.EPA 2012; Bea et al. 2013, Nicholai, 2015; Moore 2020). The modelling approach, although complex in that numerous constituents in groundwater are considered, is relatively straightforward in that the primary interaction of those constituents with the rock matrix is through sorption. The sorbing phases included in the model reflect the mineral composition of the rock matrix and the well-understood sorptive capacities for these minerals. Precipitation of key mineral phases was also included. The modelling approach is one that has been used for several ISR projects (e.g., Johnson et al., 2016; Lagneau et al., 2019; Reimus et al., 2019; de Boissezon et al., 2020).

The 3D numerical model was calibrated to existing groundwater flow conditions beneath and surrounding the Phoenix deposit under current (i.e., 2021) hydrogeologic conditions and then applied to evaluate fate and transport of groundwater migrating from the mining area toward surface water features following remediation of the mining area in Decommissioning. Geochemical reactions were developed to reflect observed geochemical conditions, expected geochemical reactions, and the understanding of groundwater flow patterns. The 3D numerical model is considered conservative as not all potential attenuating processes are simulated, including matrix diffusion, and chemical reactions that include redox transformations of COPCs.

This report outlines the development of modelling tools, their calibration to represent observed conditions at the Site, and modelling applications to develop the understanding required to support conclusions made in the EIS, extending into the future centuries. The modelling was specifically designed to:

- Characterize current (baseline) conditions regarding groundwater flow around and through the Phoenix uranium deposit, and document potential migration pathways for COPCs under existing conditions.

- Simulate post-decommissioning changes to the groundwater flow system and identify potential migration pathways for uranium and other COPCs.

- Simulate post-decommissioning fate and transport of dissolved constituents in groundwater following remediation of the mining area in Decommissioning.

Pathways from the Phoenix deposit toward potential environmental receiving bodies at the surface, such as wetlands, streams, and lakes of ecological importance, were evaluated in support of the EIS. Surface water is considered the appropriate media for evaluation of environmental effects as groundwater is not currently used for domestic purposes based on the following insights:

- there are no non-industrial potable wells listed in the Saskatchewan Groundwater Well Database within the regional study area (100 km radius) surrounding the Wheeler River Project (Ecometrix 2024a). A single domestic well is listed in the search area; this is a shallow well drilled by Cameco Corporation in 1969 to a depth of approximately 72 m bgs, installed in sand. There is also a shallow drinking water well at the existing Wheeler River Project camp, located over two kilometres southwest of the Phoenix deposit. There are no records in the database of groundwater wells for non-industrial use (i.e., being used by residents in the area as a potable water source);

- groundwater use for potable water has not been documented throughout Denison's public engagement process; and

- Existing (baseline) water quality in the deep groundwater beneath the Phoenix area is characterized by several groundwater constituents exceeding drinking water guidelines (Ecometrix, 2024a).

As a result, this study is focused on evaluating groundwater quality that would reach surface water bodies during future centuries for areas where groundwater is interpreted and predicted to be at least partly sourced from the mining area.

1.2 Organization of Report

This report is organized into the following sections:

Section 1.0: Introduction describes the modelling objectives and approach to achieve the defined objectives.

Section 2.0: Three-Dimensional Groundwater Model Development describes the three-dimensional groundwater flow and contaminant transport model, including the input parameters, boundary conditions, and calibration of the groundwater flow model. Analysis of parameter uncertainty is also described.

Section 3.0: Geochemical Reactions and Modelling describes the data and understanding applied to characterize the expected geochemical reactions affecting fate and transport of minerals post-decommissioning.

Section 4.0.: Post-Decommissioning Reactive Transport Modelling describes the modelling predictions for the potential effects on the surface water environment, including the effect of parameter uncertainty on model predictions.

Section 5.0: Summary and Conclusions outlines the summary and conclusions of the modelling work completed, as well as the limitations of the work.

2.0 Three-Dimensional Groundwater Model Development

The numerical groundwater flow and transport model was developed from the Conceptual Model described in the Wheeler River Project Baseline Geology and Hydrogeology report (EcoMetrix, 2024a; hereafter referred to herein as "the Baseline Report"). The groundwater flow model was designed to encompass potential ecological receptors, including the lakes surrounding, upgradient and down-gradient of the Phoenix mining operation area. The model structure is outlined in Section 2.2, the Model Properties in Section 2.3 and model boundary conditions in Section 2.4.

Model calibration is outlined in Section 2.5 and was completed by varying model input parameters and boundary conditions until: 1) the model simulated water level elevations in wells and lakes were a reasonable match to those observed in the area, and 2) the groundwater discharge volume was consistent with estimated stream baseflow. Initial model calibration was completed manually using insights gained through the conceptual model development.

Beyond manual model calibration to groundwater flow conditions, parameter optimization tools were employed to determine parameter combinations that yield an equivalent match to observed conditions. Such alternative, calibrated parameter sets are used to evaluate prediction uncertainty in subsequent simulations, as outlined in Section 2.8.

The 3D groundwater modelling tool developed was subsequently used to complete reactive transport simulations and evaluate fate and transport of dissolved constituents remaining in groundwater (porewater) within the mining area after Decommissioning.

The understanding gained through modelling analyses has been used to inform a groundwater monitoring network and sampling plan over the life of the Project (the EIS, Section 7). Monitoring changes in groundwater levels, gradients and water quality will act as an early-warning system to identify potential excursions from the mining area (i.e., within the freeze wall) and facilitate fine-tuning of mining operations to mitigate any potential identified risks.

2.1 Modelling Code Selection

The code FEFLOW (Diersch, 2014) was selected for use in this assessment because it offers the flexibility to represent complex spatial features at surface and within the subsurface and can represent saturated and unsaturated flow and transport. The modelling code was applied without any modifications to the processes simulated in the code.

FEFLOW is a finite element code whereby the model area (domain) is subdivided horizontally and vertically into a set of triangular prisms called elements that represent a unit of porous media. Each element has specified hydraulic properties such as hydraulic conductivity and storage values that are assigned. FEFLOW simulates the flow of groundwater using the properties assigned within the elements, water level elevations (hydraulic heads) at known locations such as surface water features like lakes and rivers (i.e., boundary conditions) and specified flow through the domain (i.e., groundwater recharge).

2.2 Model Structure

2.2.1 Model Domain

The model domain was designed to simulate the groundwater flow at and surrounding the Phoenix deposit and is illustrated on Figure 2-1. The outer reaches of the model were extended a sufficient distance away from the Phoenix ore zone so the boundaries applied at the perimeter of the model do not influence the simulated groundwater flow conditions in the vicinity of the Phoenix ore zone where model predictions will be made. The model domain extends from Kratchkowsky Lake in the northwest, approximately 5 km east to Whitefish and McGowan Lakes. The model domain is approximately 4.5 kilometers from north to south (Figure 2-1).

The Local Study Area (LSA) for the Geology and Groundwater Valued Components in the EIS was defined by the Model Domain presented in Figure 2-1. The "model domain" and the LSA are referred to interchangeably within this document.

2.2.2 Model Mesh and Hydrostratigraphic Layers

As noted in Section 2.1, FEFLOW is a finite element groundwater modelling software package that simulates groundwater flow by solving mathematical equations governing groundwater flow, contaminant and/or heat transport at discrete node points within the model domain. The first step in building a groundwater flow model using the finite element method is to subdivide the model domain into elements that are collectively referred to as the finite element mesh. Figure 2-1 illustrates a plan view of the model mesh, which consists of triangular elements with nodes at the vertices of the elements. The triangular shaped elements can be of any size; the use of variably shaped elements throughout the domain allows model boundary conditions to accurately conform to natural features such as streams and lakes. The spacing between finite element nodes and the size of the elements is smallest in areas of the model where a more detailed simulation of groundwater levels and contaminant transport is desired. These include the areas around pumping wells and surface water features, such as lakes and rivers.

In this project, the mesh was refined in areas where the representation of drawdown or changes in water levels or chemistry under current or future conditions are expected. Specifically, the mesh was refined to an element size of approximately 5 to 15 m along the Phoenix ore deposit, and to less than 15 m along the margins of the local surface water features in the area. The largest element sizes (less than 200 m) were defined at the periphery of the model further away from the areas of hydrogeologic interest.

The model is flexible and if an additional area of interest, such as a new pumping well, is identified within the model domain, the mesh can readily be refined at that location without negatively impacting the model or its predictions.

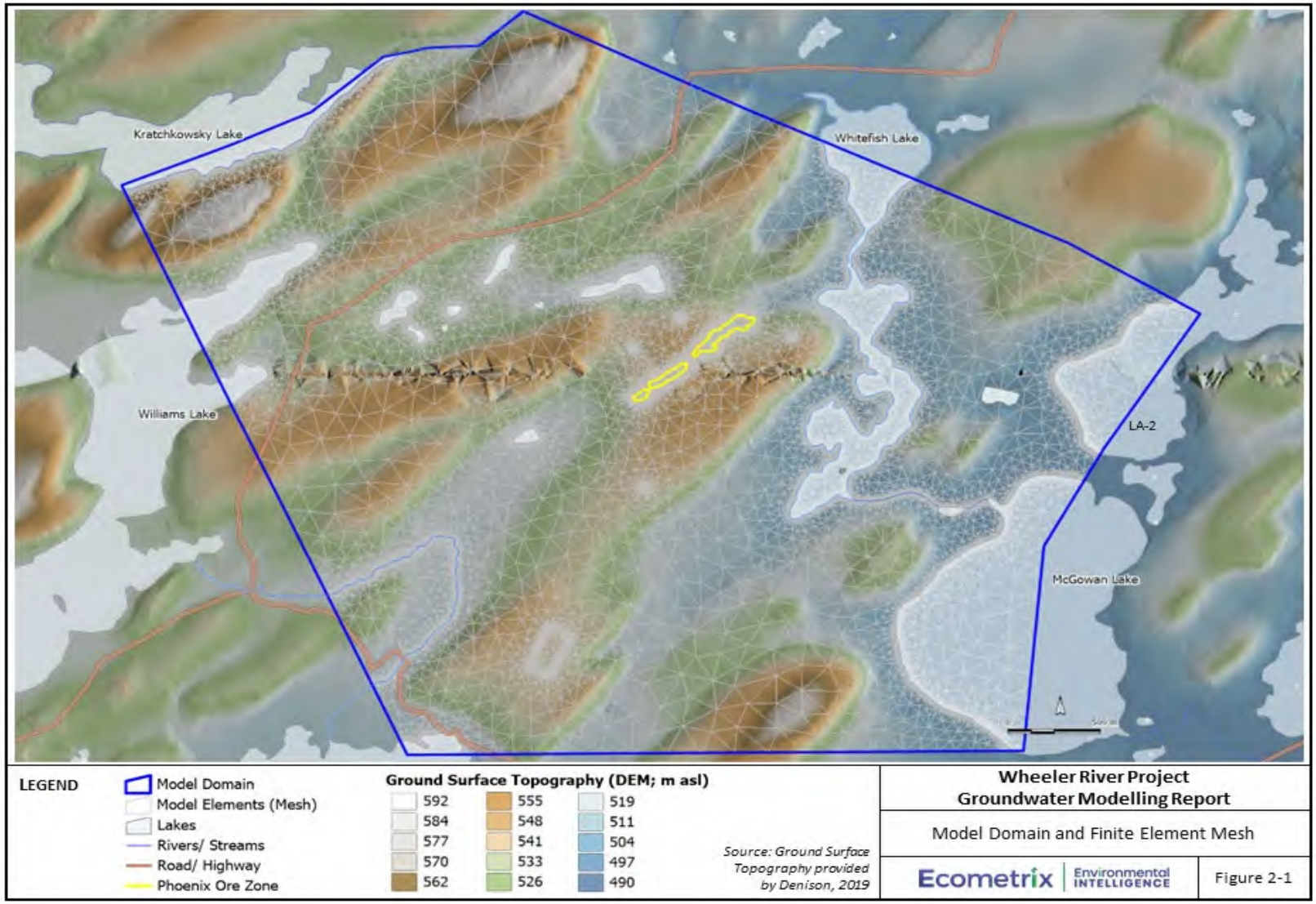


Figure 2-1: Model Domain and Finite Element Mesh

2.2.3 Hydrostratigraphic Layers

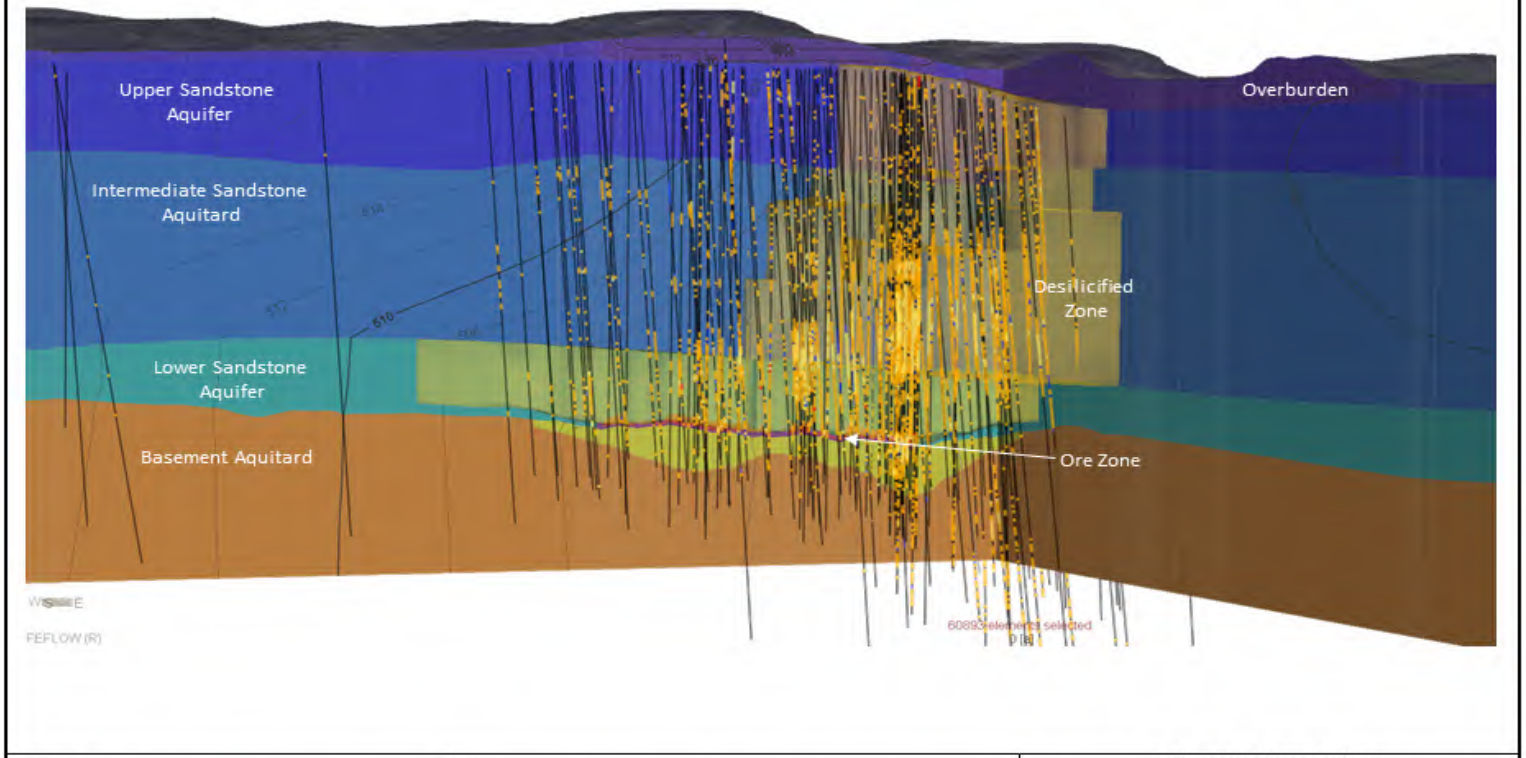
In addition to the mesh discretization horizontally, the model domain is also discretized vertically into layers that represent the changing hydrogeologic conditions with depth. As discussed in the Baseline Report, several hydrostratigraphic units were identified and mapped in three dimensions within the Phoenix area. Table 2-1 and Appendix A outlines how each of the numerical model layers assigned within the groundwater flow model were created. The bedrock and basement aquifers and aquitards were subdivided into multiple numerical model layers to capture the changes in groundwater flow directions and gradients with depth.

Table 2-1: Conceptual and Numerical Hydrostratigraphic Layers

Conceptual Model Layer Number	Numerical Model Layer Number	Hydrostratigraphic Unit	Description
1	1	Overburden	Upper Aquifer (Aquitard where Till is present)
2	2, 3, 4	Upper Sandstone Aquifer	Manitou Falls Group; Dunlop Fm unit and upper portion of Collins Fm
3	5 to 9	Intermediate Sandstone Aquitard	Manitou Falls Fm; Collins Fm, lower portion of Bird Fm and upper portion of Read Fm
4	10 to 13	Lower Sandstone Aquifer	Lower portion of Read Fm
5	14	Upper Barrier Zone Aquitard	Upper clay cap and sulphide cemented rock
6	15	Ore Zone Aquifer	Ore Zone
	16	Lower Barrier Zone Aquitard	Lower clay cap and sulphide cemented rock
7	17, 18	Upper Basement Aquitard	Paleoweathered Basement
8	19	Basement Aquitard	Competent Basement

The numerical model layers in this model are continuous across the model domain; however, some of the model layers, such as the clay cap are only present in the vicinity of the ore zone. In these cases, where the layer is interpreted to be absent it is assigned a minimum layer thickness that varies from 0.5 to 5 m, and the hydraulic properties of the overlying unit are applied so the properties of the clay cap are only assigned where it is present. Where multiple layers are "pinched out", the hydraulic properties of the overlying unit are applied to the underlying minimally thick layers, so the numerical model closely replicates the conceptual model. Figure 2-2 illustrates a vertical cross-section through the model where the vertical discretization (i.e., elements) and the hydrostratigraphic model layers listed in Table 2-1 are evident.

The base of the model was specified to lie at a uniform elevation corresponding to sea level (i.e., 0 m asl). Due to the low hydraulic conductivity of the basement rock, vertical leakage was not simulated to occur in or out of the base of the model.



LEGEND Symbol	FRIABILITY
	0
	1
	2
	5
	4
	3

Note:
Southeast to Northwest trending cross-section through the Ore Zone Illustrating how elevated friability values in exploration core holes was used to delineate the desilicified zone.

Wheeler River Project
Groundwater Modelling Report
Three-dimensional View of Elevated Friability Values in the Desilicified Zone
Ecometrix Environmental INTELLIGENCE
Figure 2-2

Figure 2-2: Three-dimensional View of Elevated Friability Values in the Desilicified Zone

2.3 Model Properties

Hydrogeologic properties assigned within the FEFLOW model included hydraulic conductivities and storage values (i.e., specific storage and specific yield) as outlined in the following subsections.

2.3.1 Hydraulic Conductivity Values

Hydraulic conductivity values represent the ability of a hydrostratigraphic unit to transmit water. Geologic materials that are highly permeable and able to transmit large volumes of water (e.g., gravel) have high hydraulic conductivity values, while geologic materials that are not as transmissive (e.g., clay) have low hydraulic conductivity values.

Hydraulic conductivities tend to be anisotropic, meaning groundwater travels more easily in one direction than another. Often hydraulic conductivity values in the vertical direction are lower than the horizontal direction as a result horizontal bedding or layering in sedimentary units. Based on literature and professional judgement, an anisotropy ratio of 10 horizontal to 1 vertical was assigned in the model for the unaltered overburden and sandstone hydrostratigraphic units. An anisotropy ratio of 1:1 was assigned to the desilicified sandstone and basement hydrostratigraphic units as the bedding orientations in these units are not expected to be horizontal like the overlying sedimentary layers.

When developing groundwater flow models, initial hydraulic conductivity values are assigned to zones within the various hydrostratigraphic units based on conductivity estimates from field tests conducted in the area (see Appendix B of the Baseline Report), and local knowledge and conceptualization. Literature values (Freeze and Cherry 1979; Anderson and Woessner 2002) were also consulted to ensure the initial and calibrated hydraulic conductivity values were reasonable.

After the initial hydraulic conductivity values are assigned, they are adjusted through the model calibration process (Section 2.5) before arriving at a set of values that produced the best overall simulation of groundwater levels as compared to the observed field data. The range of field-based hydraulic conductivity values are outlined on Table 2-2 alongside the final calibrated hydraulic conductivity values applied in the model. The underlying sections describe the calibrated conductivity values assigned in the model. Appendix B contains plan view maps illustrating the hydraulic conductivity values applied in each model layer.

Table 2-2: Calibrated Hydraulic Conductivity and Anisotropy Values

Hydrostratigraphic Units	Calibrated Horizontal Hydraulic Conductivity Value (m/s)	Anisotropy ($K_{horizontal}$: $K_{vertical}$)
Overburden Aquifer/ Aquitard	$5x10^{-7}$ (till) to $8x10^{-5}$ (sand)	10:1
Upper Sandstone Aquifer	$5x10^{-6}$ (competent rock) to $5x10^{-5}$ (desilicified rock)	10:1 in competent; 1:1 in desilicified
Intermediate Sandstone Aquitard	$1x10^{-8}$ (competent rock) to $5x10^{-6}$ (desilicified rock)	
Lower Sandstone Aquifer	$2x10^{-7}$ to $1x10^{-5}$	
Desilicified Zone Aquifer	$5x10^{-6}$	1:1
Upper Barrier Zone (overlying Ore Zone)	$1x10^{-9}$ to $1x10^{-8}$	10:1
Ore Zone	$7x10^{-10}$ to $2x10^{-5}$	1:1
Lower Barrier Zone (underlying Ore Zone)	$1x10^{-9}$	1:1
Basement Aquitards	$1x10^{-9}$ to $5x10^{-9}$	1:1

2.3.1.1 Overburden

Overburden in the area is a mixture of sand and gravel outwash, and coarse-grained sandy till with 2 - 30% fine grained material (i.e., silt and clay). Coarse-grained sand till is interpreted to lie in the centre and on the surface of the drumlins in the area and horizontal hydraulic conductivity values of $5x10^{-7}$ to $1x10^{-6}$ m/s were assigned to represent this unit (Figure B1, Appendix B). These values are comparable but slightly lower than the interpreted results of hydraulic testing in the Gryphon area ($3.2x10^{-6}$ to $6.3x10^{-6}$ m/s; Golder, 2018), and the Phoenix area ($3x10^{-6}$ m/s; as provided in the Baseline Report) for sand-rich tills.

Outwash sediments flank the sides of the drumlins and in some lowland areas, so higher horizontal hydraulic conductivity values ($5x10^{-5}$ to $8x10^{-5}$ m/s) were applied to represent these silty sands. These values are consistent with the hydraulic testing in the Gryphon area of $3.3x10^{-5}$ m/s, and by Ecometrix (2024a) of $2x10^{-4}$ m/s. The horizontal hydraulic conductivity values applied in the uppermost layer of the model are illustrated on Figure B1 of Appendix B.

2.3.1.2 Upper Sandstone Aquifer

The Upper Sandstone Aquifer consists of fine to medium-grained sandstone with low (less than 3%) normative clay content. Groundwater flow within the sandstone is controlled by the fracture spacing, orientation, connectivity, and aperture thickness, as well as the permeability of the matrix, which in some places has been influenced by diagenesis and alteration.

The calibrated horizontal hydraulic conductivity values of this unit vary depending on the cementation, alteration and fracturing of the sandstone (Figure B2; Appendix B). The Desilicified Zone that extends northeast of the Phoenix deposit to Whitefish Lake consists of fractured and highly friable sandstone and was assigned a horizontal and vertical hydraulic conductivity value of approximately $5x10^{-5}$ m/s. Outside this Desilicified Zone, the more competent and less

fractured sandstone was assigned a lower horizontal conductivity value of $5x10^{-6}$ m/s. These values are consistent with hydraulic conductivity values interpreted from hydraulic tests completed in this aquifer unit that ranged from $4x10^{-7}$ to $2x10^{-4}$ m/s, with a geomean of $3.7x10^{-6}$ m/s (as provided in the Baseline Report).

As the Desilicified Zone is interpreted to have a higher hydraulic conductivity value as compared to the competent Upper Sandstone Aquifer (and Intermediate Sandstone Aquitard) care was taken when mapping the three-dimensional extent of the unit within the groundwater flow model. Three dimensional boreholes illustrating zones of friability were imported into the FEFLOW model to help visualize the location of the Desilicified Zone, as illustrated on Figure 2-2. In addition, four geotechnical parameters (i.e., friability, fracture frequency, normative clay, and Rock Quality Designation) were also mapped in three-dimensions (Figure 2-3) and plan view for each model layer (Figure 2-4) onto the model elements to illustrate the changes in geotechnical properties of the rock. The geotechnical datasets were used to define the spatial extent of the Desilicified Zone through the Lower Sandstone Aquifer, Intermediate Sandstone Aquitard, and Upper Sandstone Aquifer (Figure 2-5).

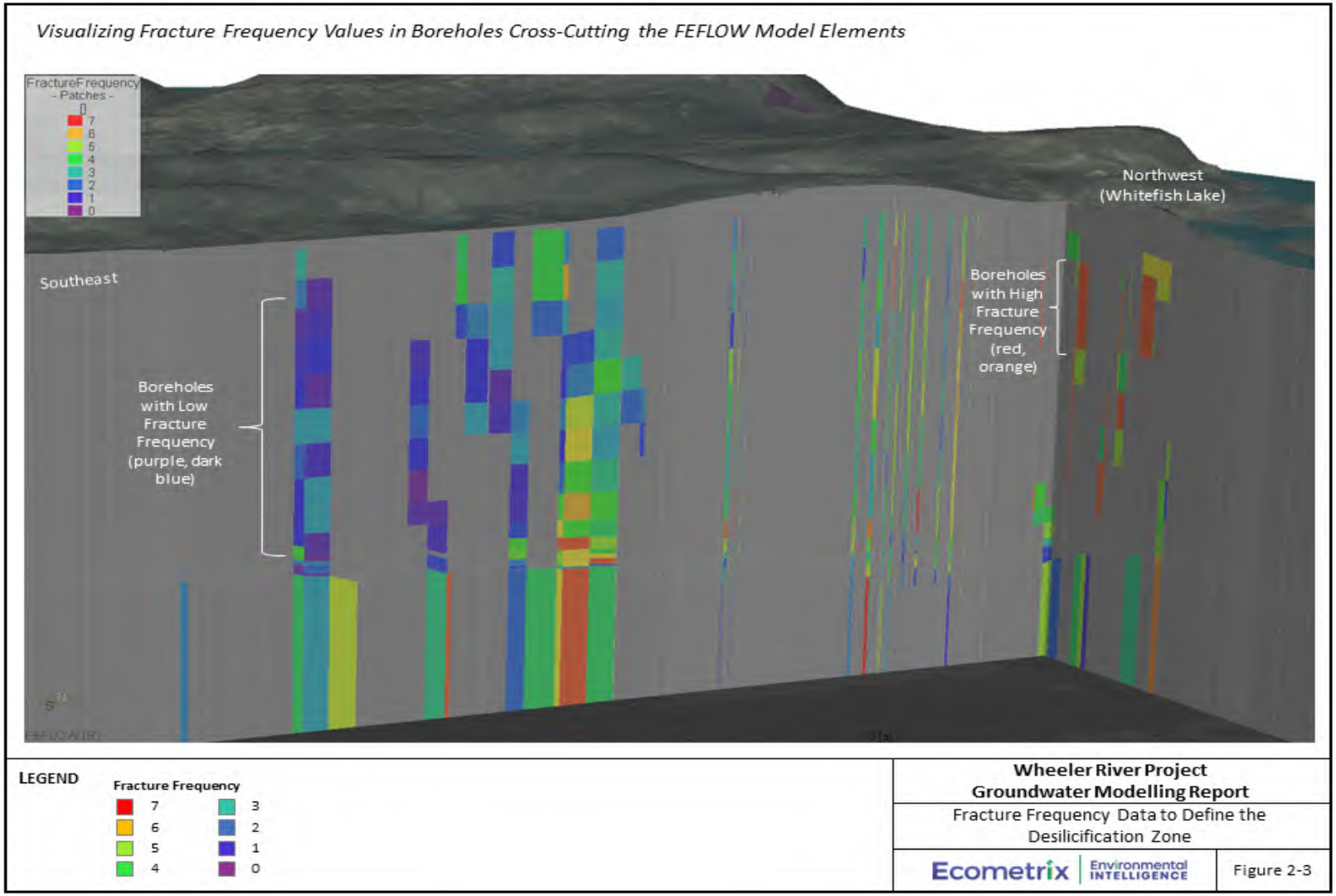


Figure 2-3: Fracture Frequency Data to Define the Desilicification Zone

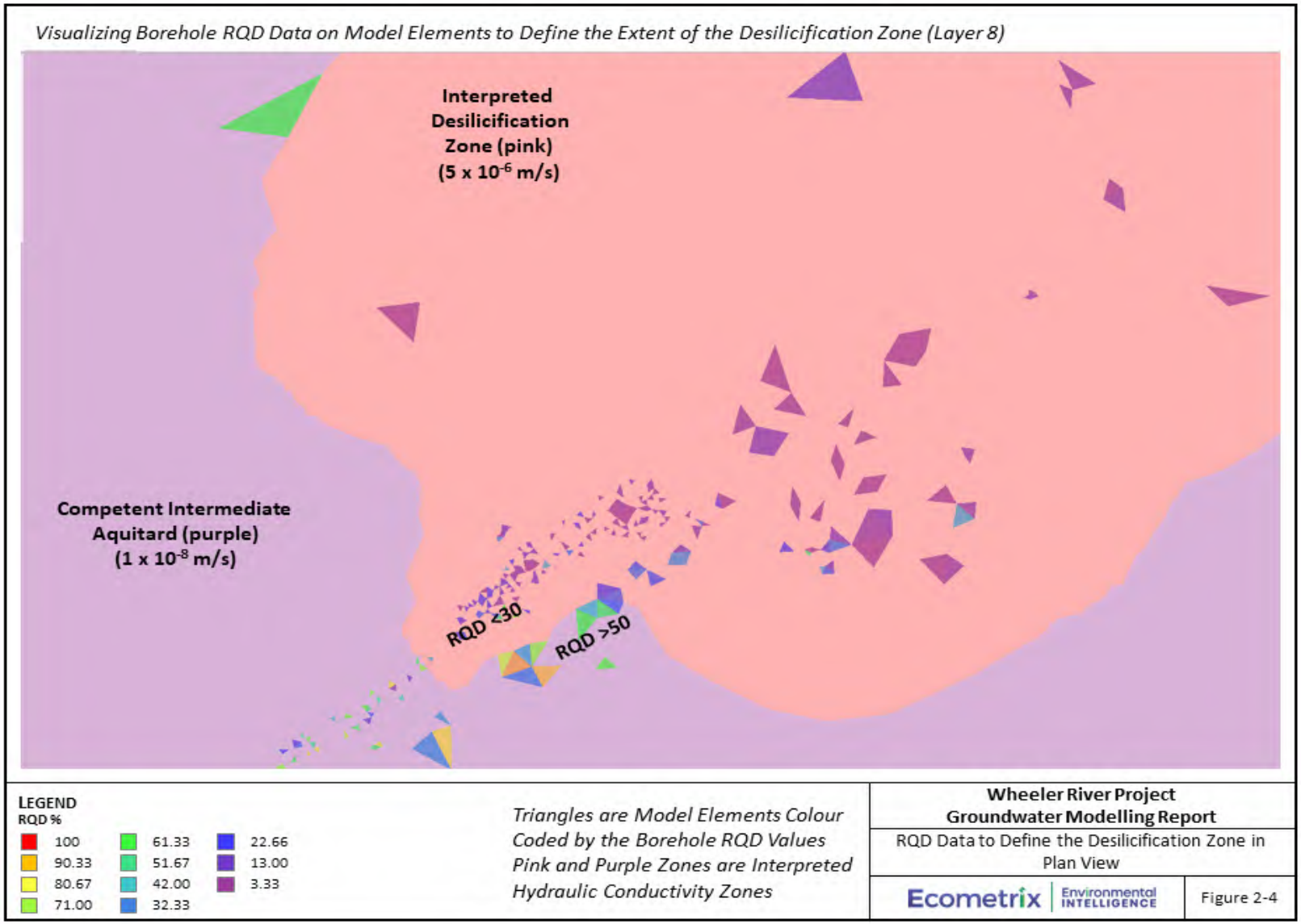


Figure 2-4: RQD Data to Define the Desilicification Zone in Plan View

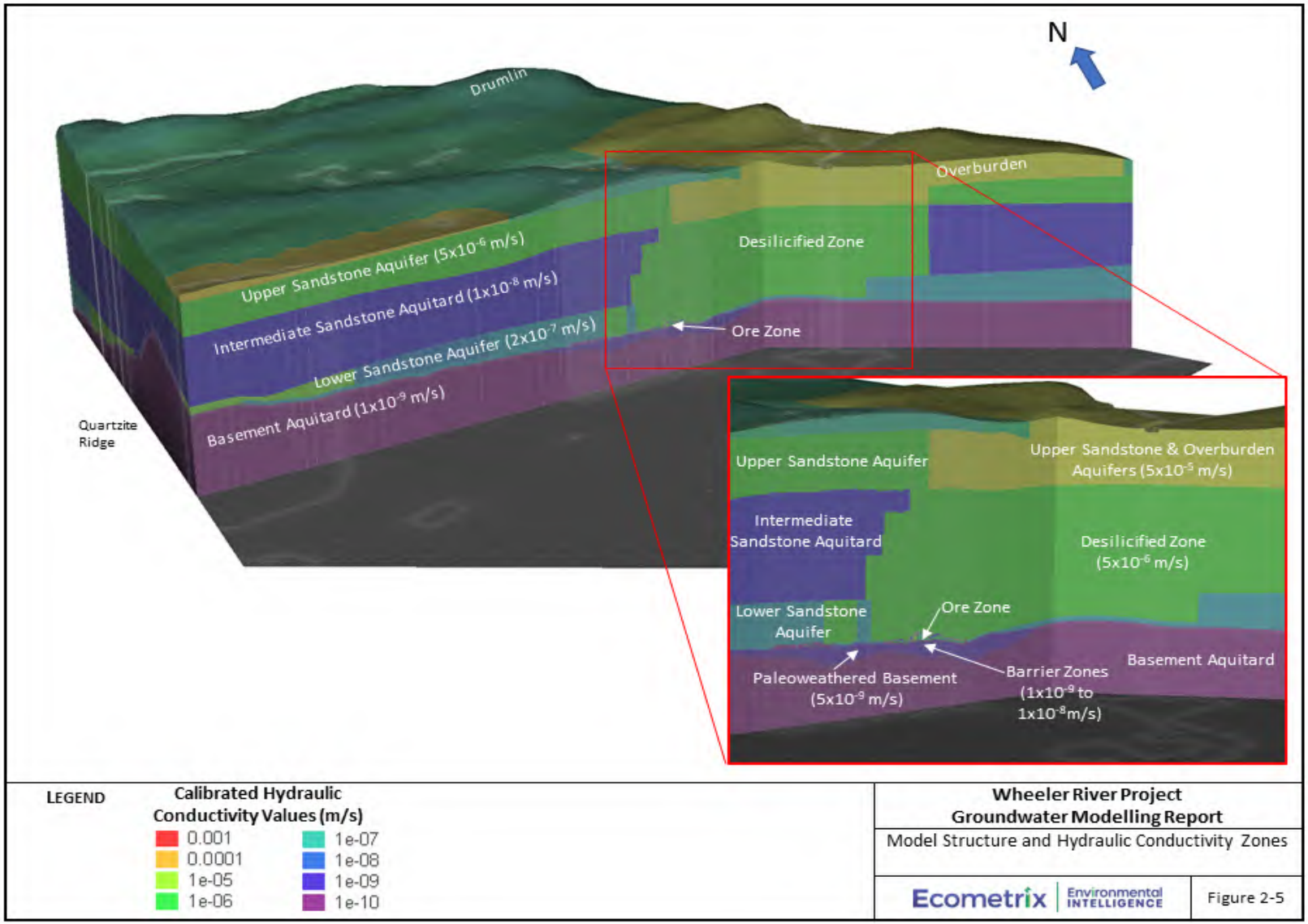


Figure 2-5: Model Structure and Hydraulic Conductivity Zones

2.3.1.3 Intermediate Sandstone Aquitard

The Intermediate Sandstone Aquitard is comprised of competent fractured sandstone with a normative clay content that varies from 4 to 10%. Groundwater flow in this unit is controlled by fracture spacing, orientation, connectivity, and aperture thickness; however, the normative clay is conceptualized to reduce or heal the fractures, reduce their connectivity, and reduce the hydraulic conductivity of this unit.

The calibrated horizontal hydraulic conductivity values of the Intermediate Sandstone Aquitard vary depending on the cementation, alteration and fracturing of the sandstone (Figures B3 and B4; Appendix B). Hydraulic conductivity typically assigned in the model for this unit was $1x10^{-8}$ m/s, which is consistent with values estimated from field-based studies on the competent rock that ranged from $1x10^{-10}$ to $3.8x10^{-6}$ m/s, with a geomean of $8.4x10^{-9}$ m/s (as provided in the Baseline Report).

2.3.1.4 Desilicified Zone

The Desilicified Zone is a distinct zone in the area overlying and east of the Phoenix deposit where the bedrock was subject to hydrothermal alternation resulting in desilicification of the sandstone. The Desilicified Zone is most noticeable in the Intermediate Sandstone Aquitard as the Desilicified Zone is characterized by poor RQD values, and enhanced fracture and friability which are in sharp contrast to the rock qualities of the Intermediate Sandstone Aquitard.

A hydraulic conductivity value of $5x10^{-6}$ m/s was uniformly assigned to the model layers representing the Desilicified Zone. This value is consistent with packer and pumping tests screened in this unit that have interpreted hydraulic conductivity values ranging from $1x10^{-6}$ to $2x10^{-5}$ m/s, with a calculated geomean value of $4.8x10^{-6}$ m/s. As within other units, the geomean value was not applied directly, but rather a rounded value slightly higher than the geomean was applied throughout the entire desilicified zone. The value applied within the desilicified zone is considered conservative as it is a factor of 1.9 higher than the most-reliable hydraulic conductivity estimates (i.e., values obtained through pumping tests measured the conductivity as $2.7x10^{-6}$ m/s) and is equivalent to the geomean value.

Given these differences in the hydraulic conductivity values between the Desilicified Zone ($5x10^{-6}$ m/s) and the Intermediate Sandstone Aquitard ($1x10^{-8}$ m/s), the Desilicified Zone is considered a natural preferential pathway for groundwater to flow from the ore zone and Lower Sandstone Aquifer to Whitefish Lake.

2.3.1.5 Lower Sandstone Aquifer

The Lower Sandstone Aquifer is comprised of fractured and faulted sandstone that overlies the Canadian Shield basement rocks. This unit has a consistently low normative clay content (< 4%), and this trend of low clays is observed in corehole data across the Phoenix and nearby Gryphon areas.

As the normative clay content in this aquifer unit is low, the horizontal hydraulic conductivity value assigned in the model to unfaulted areas is $2x10^{-7}$ m/s, which is higher than the value assigned to the unaltered zone in the overlying Intermediate Sandstone Aquitard ($1x10^{-8}$ m/s). This value is consistent with the range of field values for the Lower Sandstone Aquifer.

Where the fracture spacing and friability are observed to be high, including within the Desilicified Zone, a higher hydraulic conductivity value of $5x10^{-6}$ m/s was assigned (Figure B5; Appendix B). The geomean of hydraulic test values calculated for wells screened in the Desilicified Zone was $4.8x10^{-6}$ m/s and $2.2x10^{-6}$ m/s for wells screened in the Lower Sandstone Aquifer. The desilicified portion of the Lower Sandstone Aquifer is interpreted to follow the trajectory of the WS Shear fault in the basement rock; the interpretation is that there is enhanced fracturing associated with the faulting that follows the WS shear. Cross-faults associated with the WS shear were not interpreted to cause hydrogeologic parameter changes at the scale of the model elements.

The Lower Sandstone Aquifer thins north of the Phoenix deposit where a ridge of quartzite rock protrudes through the sandstone unit. Figure B5 illustrates the zone of low hydraulic conductivity ($1x10^{-8}$ m/s) that corresponds to the quartzite ridge and an area where the Lower Sandstone Aquifer pinches out and has zero thickness.

2.3.1.6 Upper Barrier Zone (Clay Cap and Sulphide Cemented Rock) Aquitard

The deposits associated with the mineralized zone were mapped by Denison (2021) and include a permeable and friable high-grade zone (Unit 2b), with surrounding units that are clay-rich (Unit 2a and 2e), or sulphide-cemented (Unit 1b and 2d). Each unit is interpreted to be discontinuous based on the core data. Clay features are mapped as extending laterally beyond the ore zone by as much as 25 m in some areas, while less than 5 m in other areas; the thickness is interpreted between or beyond coreholes (Denison, 2022b). The combination of clay-rich and sulphide-cemented regions provide a natural barrier between the friable, high-grade ore zone and the overlying sandstone. This barrier has isolated the high-grade ore from groundwater flowing past it (i.e., natural leaching) during the millions of years since deposition of the uranium mineralization. This inference - regarding the natural barrier unit's role to limit migration of chemical constituents away from the ore zone – is the authors' professional opinions on the present-day conditions which includes persistence of the ore body over geologic time and differences in groundwater chemistries within and outside the ore body. The information reviewed and used to formulate this inference is presented in detail in Ecometrix (2024a).

The Upper Barrier Zone includes clay-rich and sulphide cemented rock that overlies the uranium ore zone (Units 1b and 2a). Permeameter-based hydraulic conductivity measurements for the Upper Barrier Zone units ranged from $4x10^{-8}$ to $3x10^{-10}$ m/s.

The percentage of clay within this unit is variable, and as such the hydraulic conductivity value represented in the model is also variable. A Leapfrog model was developed by Petrotek (2020) using available core data. Layers that represent the interpreted percentage of clays and values ranged from 1% to over 50% (Petrotek, 2020). The distribution of the percentage of clay was

used to guide the assignment of hydraulic conductivity values in this layer. Zones in the Leapfrog model where the percentage of clays ranged from 25 to 50% were assigned a hydraulic conductivity of $1x10^{-9}$ m/s in the groundwater model. Zones where the percentage of clays was 9 to 25% were assigned a hydraulic conductivity value of $1x10^{-8}$ m/s in the groundwater model. Zones where the percentage of clays was less than 9% were assumed to be absent and were conservatively assigned the same conductivity value as the ore zone ($1x10^{-6}$ m/s). The Upper Barrier Zone only exists in the area surrounding the ore zone; therefore, the thickness of the model layer representing this unit is minimally thin outside the ore zone. Figure B6 (Appendix B) illustrates the hydraulic conductivity values applied in the model for this unit.

2.3.1.7 Ore Zone

The deposits associated with the mineralized zone were mapped by Denison (2021) and include a permeable and friable high-grade zone (Unit 2b). Permeameter-based hydraulic conductivity measurements for the high-grade zone are reported to have a median of $2x10^{-7}$ m/s and an upper quartile conductivity of $7x10^{-7}$ m/s (Denison, 2022b); those measures are biased low as they are focused on the rock core rather than the fractured media, but they provide an indication of the background matrix hydraulic conductivity.

Hydraulic conductivity values within the ore zone were assigned in the groundwater flow model using the hydraulic conductivity values applied in a detailed MODFLOW groundwater flow model of the ore zone in Phases 1 and 2 (Petrotek, 2020). The horizontal hydraulic conductivity zones and values from the Petrotek groundwater flow model ranged from $2x10^{-5}$ to $7x10^{-10}$ m/s, and these zones were applied in the regional scale groundwater flow model. The values applied are consistent with interpreted hydraulic conductivity results from pumping tests screened within Phases 1 and 2 of the Phoenix deposit (Figure B7; Appendix B). A hydraulic conductivity value of $1x10^{-6}$ m/s was uniformly applied in the ore zone within Phases 3 and 4 as these zones had not been subject to additional hydrogeologic characterization at the time of this report.

2.3.1.8 Lower Barrier Zone Aquitard

The deposits associated with the Lower Barrier Zone Aquitard were also mapped by Denison (Denison, 2022b) and included a clay-rich unit (2e), and a sulphide-cemented unit (2d). Permeameter-based hydraulic conductivity measurements for the lower barrier units ranged from $3x10^{-8}$ to $8x10^{-13}$ m/s.

To be conservative, the Lower Barrie Zone aquitard is interpreted to have the same properties as the Upper Barrier Zone. The Lower Barrier Zone aquitard lies within the basement rock where the percentage of clay minerals is much higher. The thickness of the Lower Barrier Zone Aquitard was provided by Denison (Denison, 2022b) and assigned a horizontal hydraulic conductivity of $1x10^{-9}$ m/s (Figure B8, Appendix B). This value is consistent with the hydraulic conductivity values estimated from permeameter testing conducted by Denison (Denison, 2022b).

2.3.1.9 Paleoweathered and Competent Basement Aquitard

The upper Paleoweathered Basement Aquitard is comprised of more fractured and faulted basement rocks as compared to the lower competent basement rock. The more fractured portion is interpreted to be limited to the area surrounding the WS Shear fault. A horizontal hydraulic conductivity value for the paleoweathered zone was estimated at $5x10^{-9}$ m/s. This value is consistent with the geomean of interpreted hydraulic testing of the Basement Aquitard, which was $4.8x10^{-9}$ m/s. The paleoweathered zone extends in a southwest to northeast direction along the trend of the WS Shear as illustrated on Figure B9 (Appendix B).

The Competent Basement Aquitard is comprised of competent basement rocks with little to no fracturing. Where unfractured, the basement rocks have very low permeability and porosity values. A hydraulic conductivity value of $1x10^{-9}$ m/s was applied in the model to represent the competent basement rock, which is within the range of field-based values ($1.1x10^{-11}$ m/s to $1.1x10^{-5}$ m/s, with a geomean of $4.8x10^{-9}$ m/s).

The low hydraulic conductivity assigned to the competent basement aquitard is consistent with observed water quality and dissolved minerals.

2.3.2 Storage Values

Groundwater storage is defined as the quantity of water released from storage due to a unit change in pressure head. Specific storage and yield values are not used in calculating water level elevations in steady-state (i.e., long term average annual simulations), but are used in simulating or predicting time varying (transient) conditions. Specific yield and specific storage values control the timing and response of the groundwater system to external stresses such as pumping and injection.

The storage coefficient used during FEFLOW calculations varies depending on if the aquifer is unconfined or confined. Where confined, the storage coefficient is referred to as Specific Storage (Ss), which for bedrock aquifer materials ranges from $1x10^{-6}$ to $5x10^{-4}$ /m. In an unconfined aquifer, the storage is referred to as specific yield (Sy) where the predominant source of water is gravity drainage from pores at the water table.

Storage estimates assigned to the model layers in the groundwater flow model were within the ranges of values outlined in the Baseline Report. Specific yield and specific storage values were assigned to zones coincident with the hydraulic conductivity zones and are listed in Table 2-3 and illustrated on the figures in Appendix B.

Table 2-3: Storage Values Applied in the Model

Hydrostratigraphic Units	Specific Yield (Unconfined Aquifers)	Specific Storage (1/m)
Overburden Aquifer	0.2	$1x10^{-4}$
Upper Sandstone Aquifer	0.2	$1x10^{-4}$
Intermediate SandstoneAquitard	(Units are confined,	$1x10^{-5}$

Hydrostratigraphic Units	Specific Yield (Unconfined Aquifers)	Specific Storage (1/m)
Lower Sandstone Aquifer	Sy values not assigned)	$1x10^{-4}$
Desilicified Zone Aquifer		$1x10^{-4}$
Upper and Lower Barrier Zone Aquitards		$1x10^{-6}$
Ore Zone Aquifer		$3x10^{-4}$
Basement Aquitard		$1x10^{-6}$

2.3.2.1 Porosity Values

Groundwater flow models provide estimates of the Darcy flux, or flow rate of groundwater per unit cross-sectional area through porous media (i.e., overburden or rock). To estimate the linear groundwater velocity, representing the speed at which a particle of water might travel, the Darcy flux is divided by the effective porosity of the porous media. Effective porosity is less than the total porosity of a porous media, as it represents only the portion of pores that are interconnected. While a fractured rock may have a high proportion of pore space, many of those pores may not be interconnected. Disconnected pores do not act as pathways for groundwater to travel, but rather act as storage locations.

As outlined in the Baseline Hydrogeology Report, the overburden aquifer is estimated to have an effective porosity of 0.25 on the coarse-grained sand outwash, 0.20 on silty sands and 0.18 on silty sand tills (Table 2-4).

In fractured bedrock, porosity consists of the space between grains (primary porosity), and fractures and dissolution features (secondary porosity). A proportion of the primary and secondary porosity features will be disconnected and will not act as pathways for groundwater flow or contaminant transport. Based on permeameter testing completed on rock core samples (Scibek, 2019), the total porosity within the sandstone units is estimated to average from 10 to 40%, whereas the fracture volume that leads to effective porosity is estimated to be much lower (i.e., 0.01%).

As tracer test results to estimate effective porosity were unavailable at the time of modelling, effective porosity values for the sandstone bedrock and basement units were sourced from literature values (Table 2-4). The Cigar Lake uranium mine is located approximately 75 kilometres northeast of the Phoenix deposit and has similar geologic and hydrogeologic properties as the Phoenix deposit. The effective porosities from the Cigar Lake study (AECL, 1994) are a suitable analogue for this study and are listed on Table 2-4 alongside effective porosity values applied in the numerical model in this study.

Table 2-4: Effective Porosity Values Applied in the Model

Hydrostratigraphic Units	Effective Porosity (%)	
	This Study	AECL (1994)
Overburden Aquifer	18% (till) to 25% (sand)	30%
Upper Sandstone Aquifer	1 to 3%	2% to 5%
Intermediate Sandstone Aquitard	1% to 3% (10 to 20% in Desilicified Zone)	1% to 5% (20% in "weathered sandstone")
Lower Sandstone Aquifer	1%, 10 to 20% in Desilicified Zone	20% in "fractured/ altered sandstone"
Upper and Lower Barrier Zone Aquitards	20%	5%
Desilicified Zone	20%	20%
Ore Zone Aquifer	1%	5%
Basement Aquitard	0.1%	0.1%

Effective porosity does not affect the simulated groundwater water level elevations, or the flux of water computed to move through an aquifer or discharging to a boundary condition. Linear groundwater velocities are required for particle tracking and calculating travel time, for example, advective travel time from the ore zone to nearby receptors.

2.3.3 Exploration Coreholes

Exploration coreholes drilled in the Phoenix area, where not decommissioned, have the potential to act as preferential flow paths between the Upper and Lower Sandstone Aquifers. Most exploration boreholes were partially plugged with grout approximately 10 to 20 m above and below the ore zone, while the remainder of the corehole was left to naturally collapse, to protect surficial aquifers. In areas where the Rock Quality Designation (RQD) is low, such as in the Desilicified Zone, the coreholes are expected to have readily collapsed and are thus interpreted to be infilled with sand from the area surrounding the corehole. In areas where the RQD was high, indicating dense intact rock core was recovered, less infill is expected to have occurred. Infill is expected to be sand from the Desilicified, or more friable portions of the Athabasca sandstone.

There are over 400 boreholes that lie along the WS Shear in the vicinity of the Phoenix deposit, most of which were drilled as NQ diameter holes (diameter = 75 mm). The hydraulic impact of these exploration coreholes was evaluated in the model using one-dimensional line elements superimposed on the three-dimensional finite element mesh. Clusters of exploration coreholes were grouped together based on location and represented in the model as one line element. Figure 2-6 illustrates the locations of grouped coreholes represented in the model, along with the number of exploration coreholes represented at each location, and the relative hydraulic conductivity assigned to the line element. The cross-sectional area specified in the model was increased to reflect the number of coreholes represented by each cluster, as labeled on Figure 2-6. The hydraulic conductivity was assigned based on a review of the RQD for each cluster of

coreholes; coreholes with high RQD were assigned a higher hydraulic conductivity, and conversely lower RQD areas were assigned a lower hydraulic conductivity. The corehole hydraulic conductivity simulated was a factor of 2 to 100 times greater than the surrounding host media, based on the background conductivity and the expected infill characteristics.

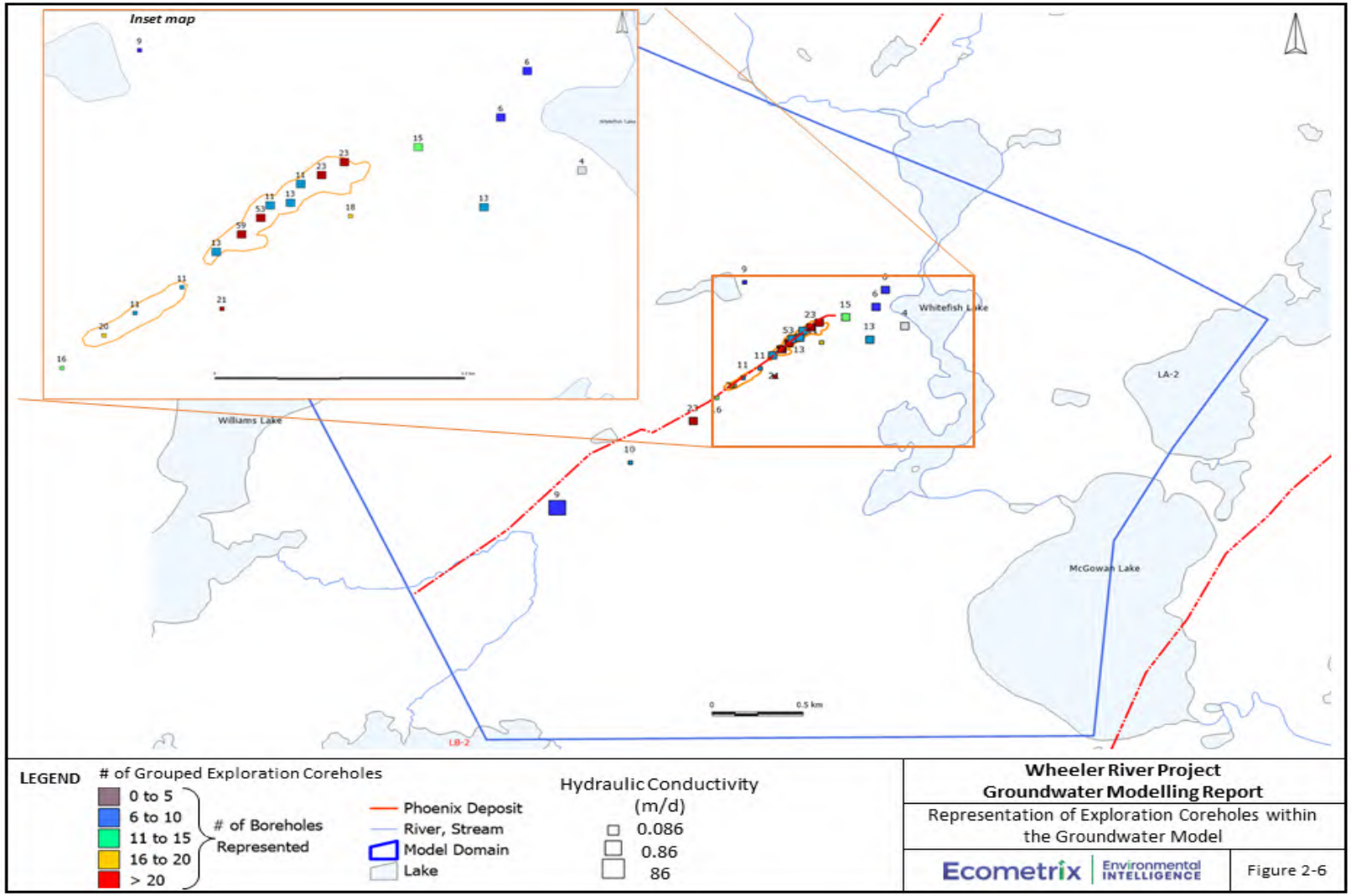


Figure 2-6: Representation of Exploration Coreholes within the Groundwater Model

2.4 Model Boundary Conditions

Boundary conditions applied in the groundwater flow model were chosen to approximate the regional groundwater flow patterns and to approximate the major groundwater fluxes in the model domain. Boundary conditions applied in the model consisted of two types:

- Specified head boundary conditions are boundaries where the value of the hydraulic head is assigned to nodes within the model, and the amount of discharge into or out of the model fluctuates to satisfy the head condition. Physically, these boundary conditions (specified heads) are commonly used to simulate areas where hydraulic potentials are expected to remain at a constant level. This is commonly used to simulate flow to and from large rivers, lakes, or areas where water enters or exits the model domain.

- Specified flux boundary conditions are boundary conditions for which a flux value is assigned to specific nodes. The hydraulic head within the surrounding elements is computed to meet that flux condition. These boundary conditions are used to represent groundwater extraction or injection wells, and recharge to the groundwater system. No flow boundaries are one type of specified flux boundary where the rate of lateral flow across the boundary is assumed to be negligible or equal to zero. In general, no flow boundaries are applied to simulate groundwater divides or impermeable geologic units.

Boundary conditions applied in this model include groundwater recharge, flow into and out of surface water features such as rivers and lakes, groundwater pumping wells, and flow into and out of the model along the perimeter of the model. The boundary conditions applied are described in the following subsections.

2.4.1 Groundwater Recharge

Groundwater recharge refers to the amount of water that infiltrates through the unsaturated zone and reaches the underlying watertable. The rate of groundwater recharge is dependent on precipitation, vegetation, surficial soil type (geology), physiography, and ground surface topography. Recharge is enhanced in areas where the ground surface is hummocky as the potential for overland flow to nearby creeks and rivers is reduced.

As noted in the Baseline Report, the estimated average annual recharge rate for the Phoenix site is approximately 156 mm/year. The groundwater recharge rates applied in the model are illustrated on Figure 2-7 and range from a low of 100 mm/year on the drumlins and areas where tills are interpreted to lie at surface, to a high of 165 mm/year where sands are interpreted to lie at surface.

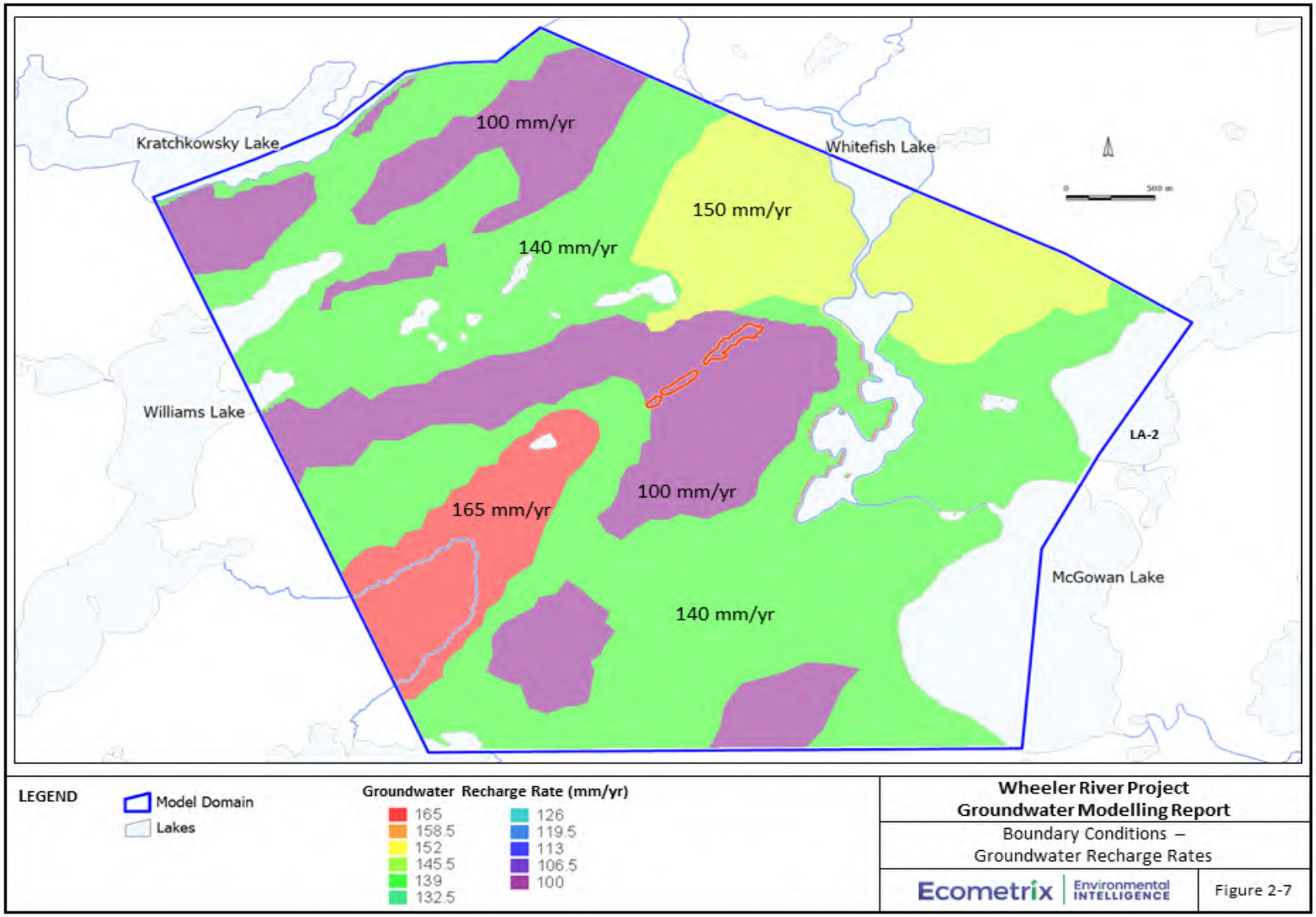


Figure 2-7: Boundary Conditions – Groundwater Recharge Rates

2.4.2 Surface Water Features

Interaction between groundwater and surface water features are simulated in the model using specified head boundary conditions. Based on the model simulated groundwater level, and the water level assigned to represent the surface water stage, groundwater may be simulated to discharge into the surface water body or recharge the underlying aquifer.

Several lakes located within the model domain were modelled using specified head boundary conditions. The water level elevations of these lakes were assigned based on observed water level elevations (within the Baseline Report), as outlined in Table 2-5 and Figure 2-8.

Table 2-5: Model Simulated Lake Stage Elevations

Lake Name	Lake Stage Elevation (m asl)
Whitefish Lake	500.0
McGowan Lake	494.2
Kratchkowsky Lake	520.8
Williams Lake	518.4
LA-2	494.4

Several smaller lakes were also assigned using specified head boundary conditions and where water level data were unavailable, the ground surface elevation represented in the Digital Elevation Model (DEM) was applied (Figure 2-8).

In addition to the boundary conditions represented for the lakes and ponds, two rivers and streams were simulated in the model by assigning declining specified head boundary conditions along each stream segment. The specified head assigned in the model to represent the stream or river stage elevation was estimated using the DEM. These surface water boundary conditions are illustrated on Figure 2-8.

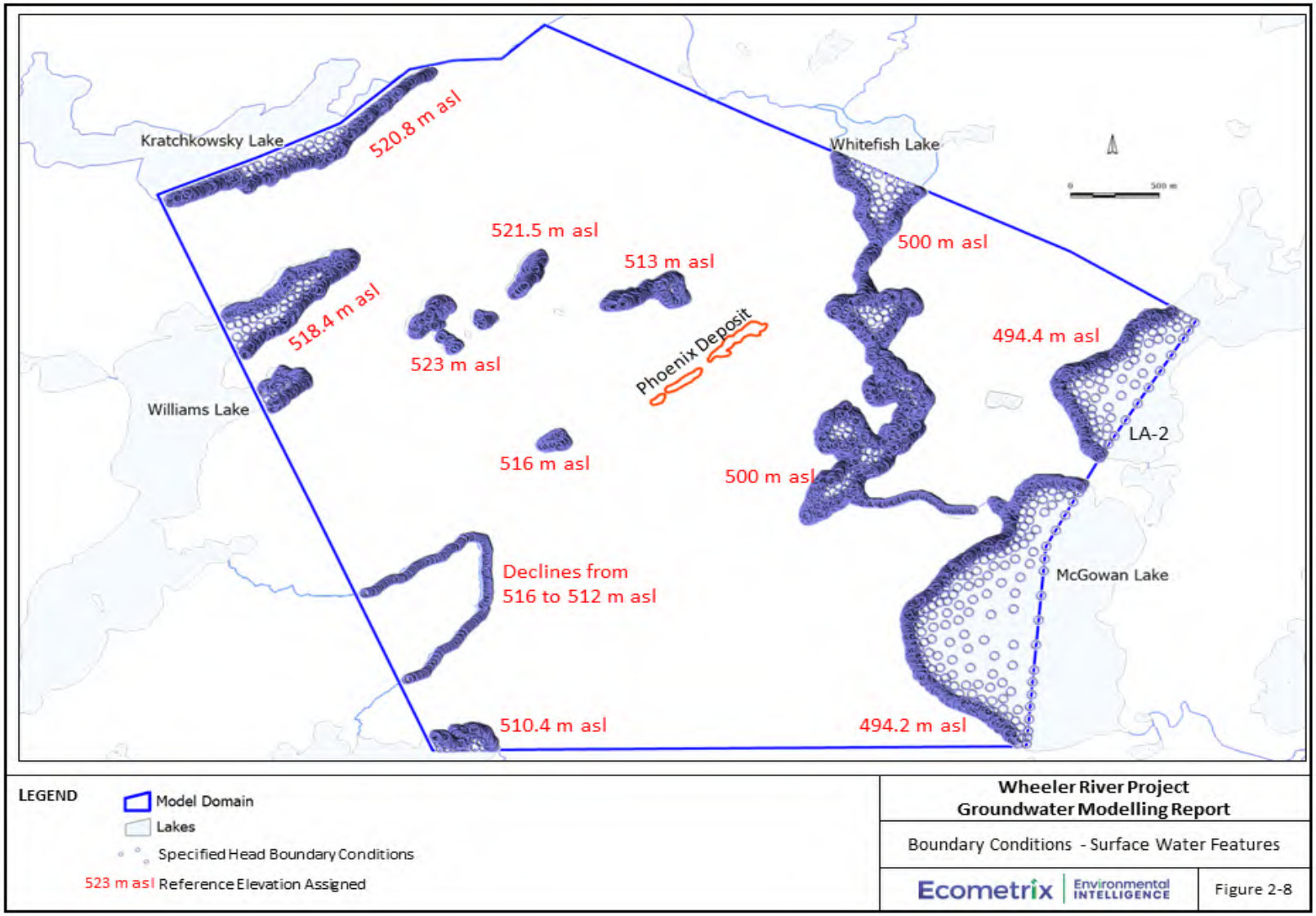


Figure 2-8: Boundary Conditions – Surface Water Features

2.4.3 Perimeter Boundary Conditions

The model domain extends from Kratchkowsky and Williams Lakes in the west to Whitefish, McGowan, and LA-2 Lakes in the east. Aside from these natural boundaries, additional boundary conditions were applied to simulate the flow of groundwater into and out of the model domain along the perimeter of the model domain (Figure 2-9).

Specified head boundary conditions were assigned in the Lower Sandstone Aquifer along the northwestern and southwestern edges of the model domain to allow water to enter the model; an elevation of 520 m asl was selected for the area near Kratchkowsky Lake based on observed water level elevations in the Gryphon area, while the area near Williams Lake was assigned an elevation of 516 m asl based on water levels within the overlying stream.

A specified head boundary condition was also assigned in the Lower Sandstone Aquifer along the south edge the model domain to allow groundwater to flow out of the model domain toward Russell Lake (Figure 2-9). For this boundary condition, the hydraulic gradient between the Phoenix deposit and Russell Lake was used to linearly estimate an appropriate hydraulic head value at the model boundary.

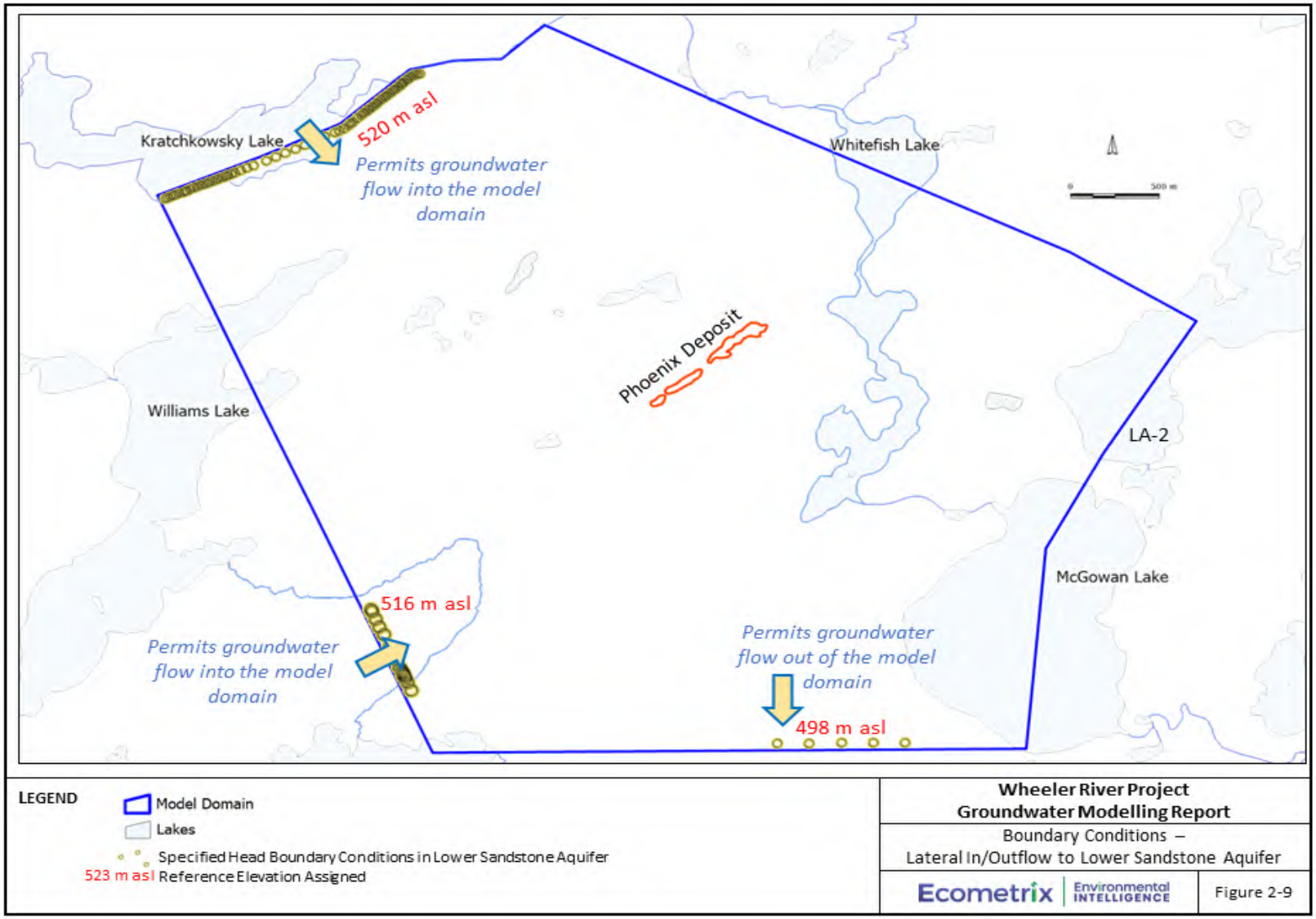


Figure 2-9: Boundary Conditions – Lateral In/Outflow to Lower Sandstone Aquifer

2.5 Groundwater Model Calibration

The purpose of model calibration is to determine a set of parameter and boundary condition values such that the groundwater flow model can reproduce field-measured water level elevations in wells, and groundwater discharge estimated in surface water features. Numerical groundwater flow models are typically calibrated by systematically adjusting the model input parameters and boundary conditions to determine the optimum match (within an acceptable margin of error) between the model predicted results and field observations. The model's ability to represent observed conditions is assessed qualitatively by comparing to trends in water levels and distribution of groundwater discharge and quantitatively through statistical measures of fit to field-measured water levels and stream baseflow.

The model calibration approach included calibration to long term, average annual (i.e., steady state) water level elevations collected in monitoring wells and exploration boreholes across the model domain. The model was also calibrated to estimated groundwater discharge (i.e., stream baseflow) values.

2.5.1 Calibration Targets

Calibration targets are measurements of hydraulic heads or flows that are compared to the model-predicted values during the model calibration process. The steady-state groundwater flow model was calibrated to water level measurements reported in GWR monitoring wells, as well as lower-quality water level measurements collected in exploration boreholes. The model was also calibrated to a range of streamflow measurements collected for stream reaches within the model domain.

2.5.1.1 Water Level Elevations

Groundwater level elevations observed in the GWR monitoring wells represent the highest quality water level data in the study area and attempts were made to match these water levels as closely as possible using the groundwater flow model. The locations of the GWR monitoring wells that had available water level data are illustrated as pink circles on Figure 2-10. Of the 21 monitoring wells available at the time of model calibration, seven were screened in the Overburden and Upper Sandstone Aquifers, six were screened in the Sandstone Aquitard, and eight were screened in the Lower Sandstone, Basement Aquitards and the ore zone.

Observed water levels in 172 exploration boreholes within the model domain were also used as lower quality calibration targets as there is much more data and it extends spatially across the model domain (Figure 2-10; orange squares). Most of the boreholes do not contain a screened interval and are able to exchange water along their entire open length (i.e., from the top of bedrock to the basement aquitard); as such observed water levels represent a blended water level for the length of open interval. The observed water levels in the exploration boreholes were interpreted to be representative of the Lower Sandstone Aquifer as the water levels in these wells closely matched observed water level elevations in nearby GWR wells that are screened in this aquifer unit.

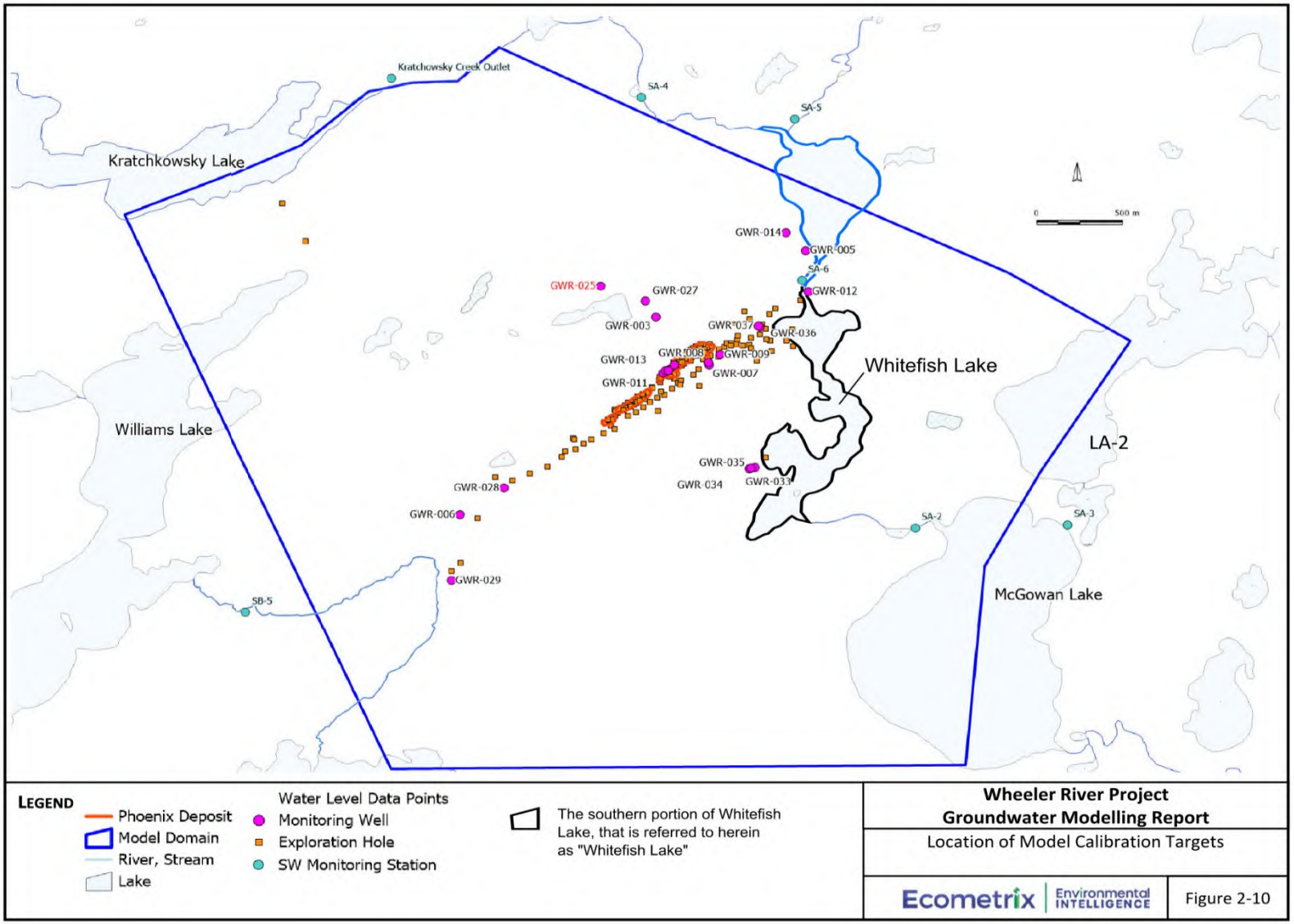


Figure 2-10: Location of Model Calibration Targets

2.5.1.2 Groundwater Discharge Data

In addition to calibrating against water level elevation data, the model was also calibrated to groundwater discharge (i.e., stream baseflow) data. Stream baseflow refers to the slow release of water in a watershed. Baseflow calibration targets were developed using spot flow measurement data. Spotflow measurements refer to instantaneous measurement of streamflow collected during interpreted baseflow conditions.

2.5.2 Calibration Results

The following subsections provide an overview of the model calibration results and establish that the three-dimensional numerical model designed to assess potential environmental change under future scenarios is suitably calibrated. The calibration achieved is evaluated as follows:

- Quantitative error, based on the difference between observed and simulated water levels, is minimal and there are no spatial trends in this error.
- Locally within the vicinity of the ore zone, the simulated water levels and hydraulic head patterns are close to observed conditions.
- Simulated groundwater discharge rates agree favourably with measured flow differences between monitoring stations upstream and downstream of Whitefish Lake.

2.5.2.1 Water Level Elevations – Quantitative Calibration

Figures 2-11 and 2-12 illustrate the simulated water level elevations in the Upper Sandstone and Lower Sandstone Aquifers, respectively. The calibration residuals in the monitoring wells are illustrated on the maps and illustrate the excellent fit between the model-predicted and observed water levels.

The model simulated fit to observed water levels is illustrated in a scatterplot (Figure 2-13), which illustrates the level of fit between observed (horizontal axis) and model-simulated (vertical axis) water levels. The line of ideal fit, which corresponds to an exact match between observed and simulated values, is illustrated as a 45-degree line extending through the origin. A deviation of ±2 m is shown on the plots as parallel lines offset from the line of ideal fit, which illustrates that most of the simulated water levels are within 2 m of the observed values. Points that lie outside may be due to generalization of modelled hydrogeologic parameters or errors associated with the field-observed data such as incorrect location coordinates, ground surface elevation, or water level readings.

The scatterplot also illustrates that there is no bias towards over-estimating or under-estimating groundwater levels. These trends appear to be consistent throughout the targets with the range in scatter being constant across the range of observed water levels.

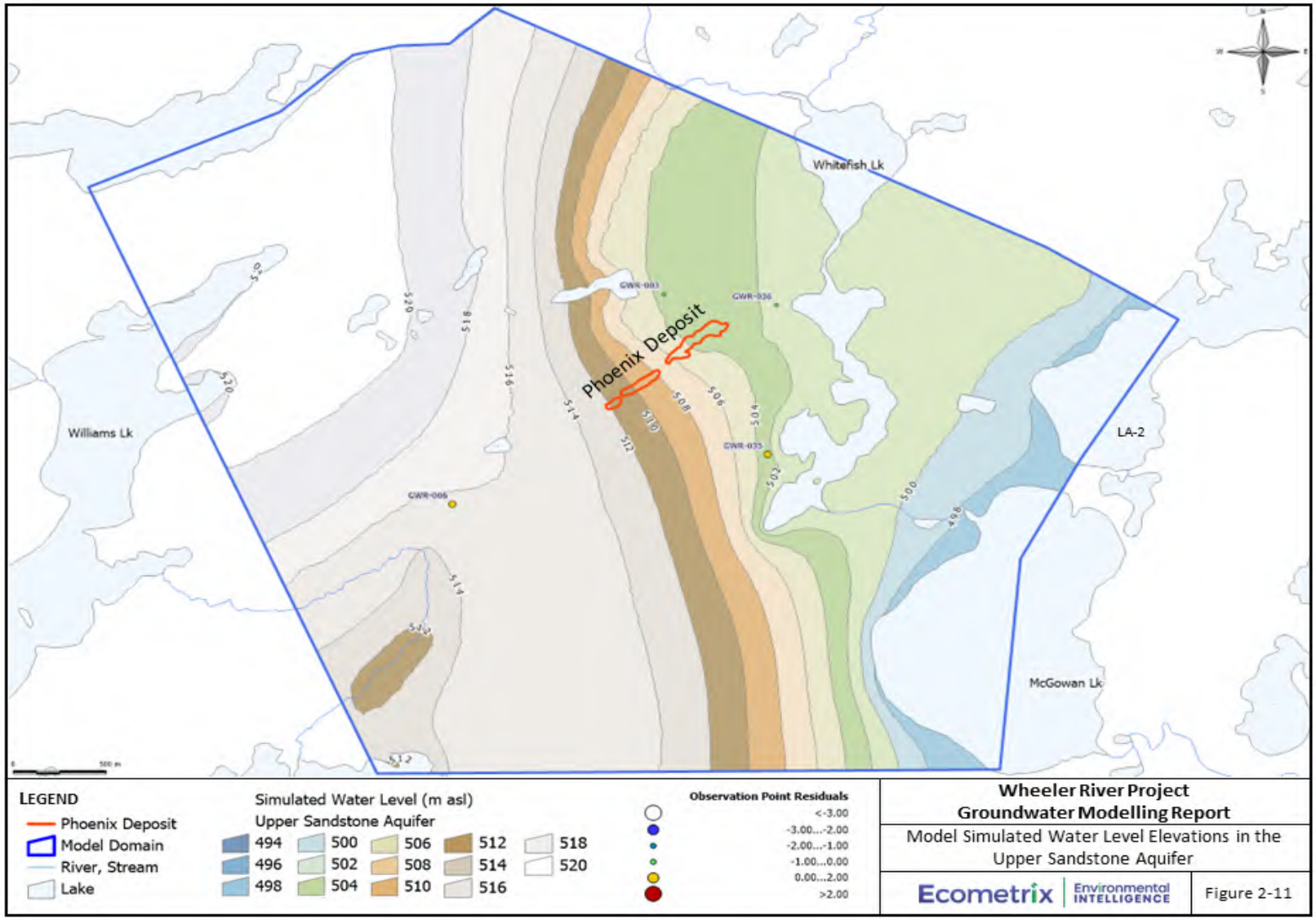


Figure 2-11: Model Simulated Water Level Elevations in the Upper Sandstone Aquifer

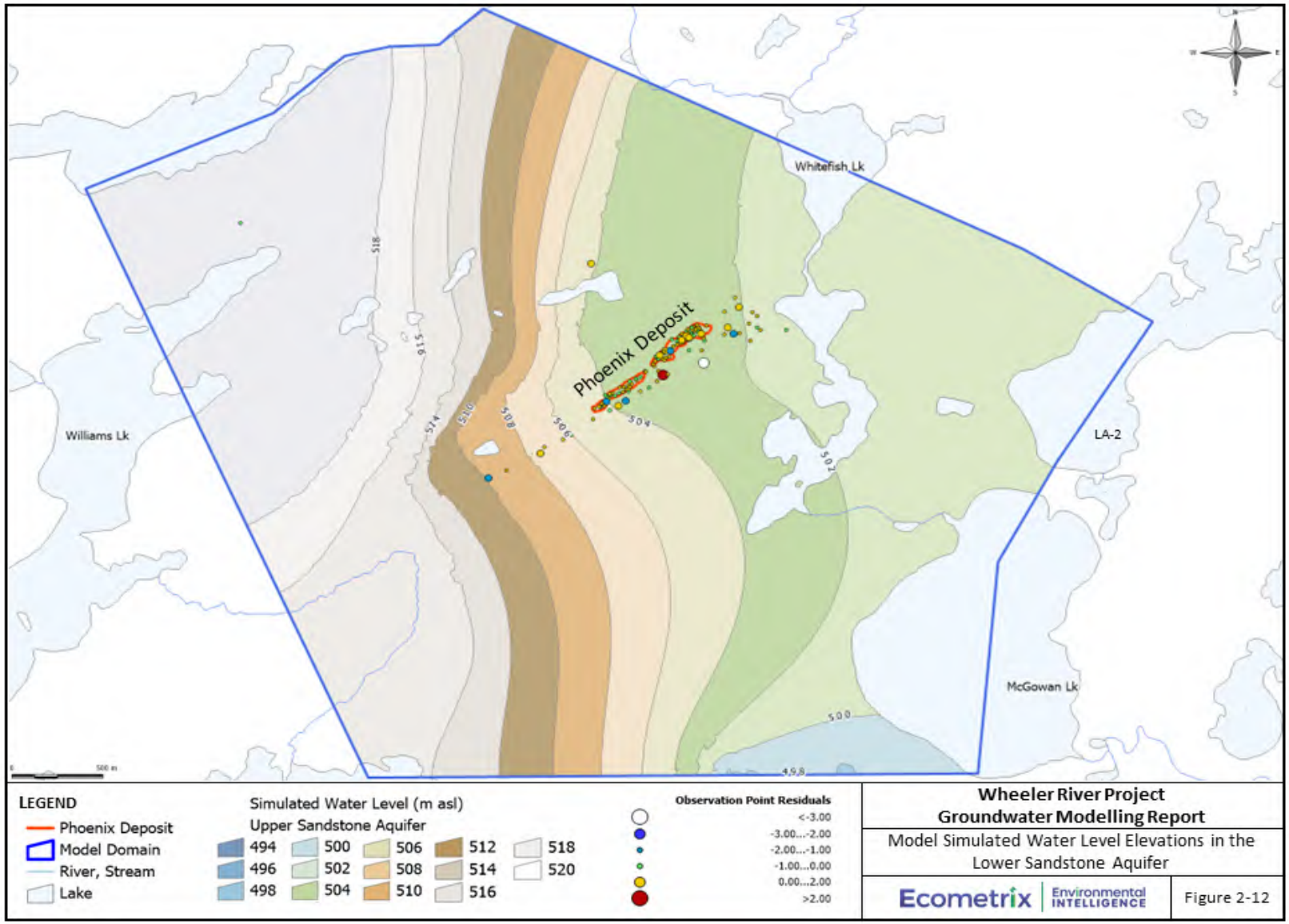
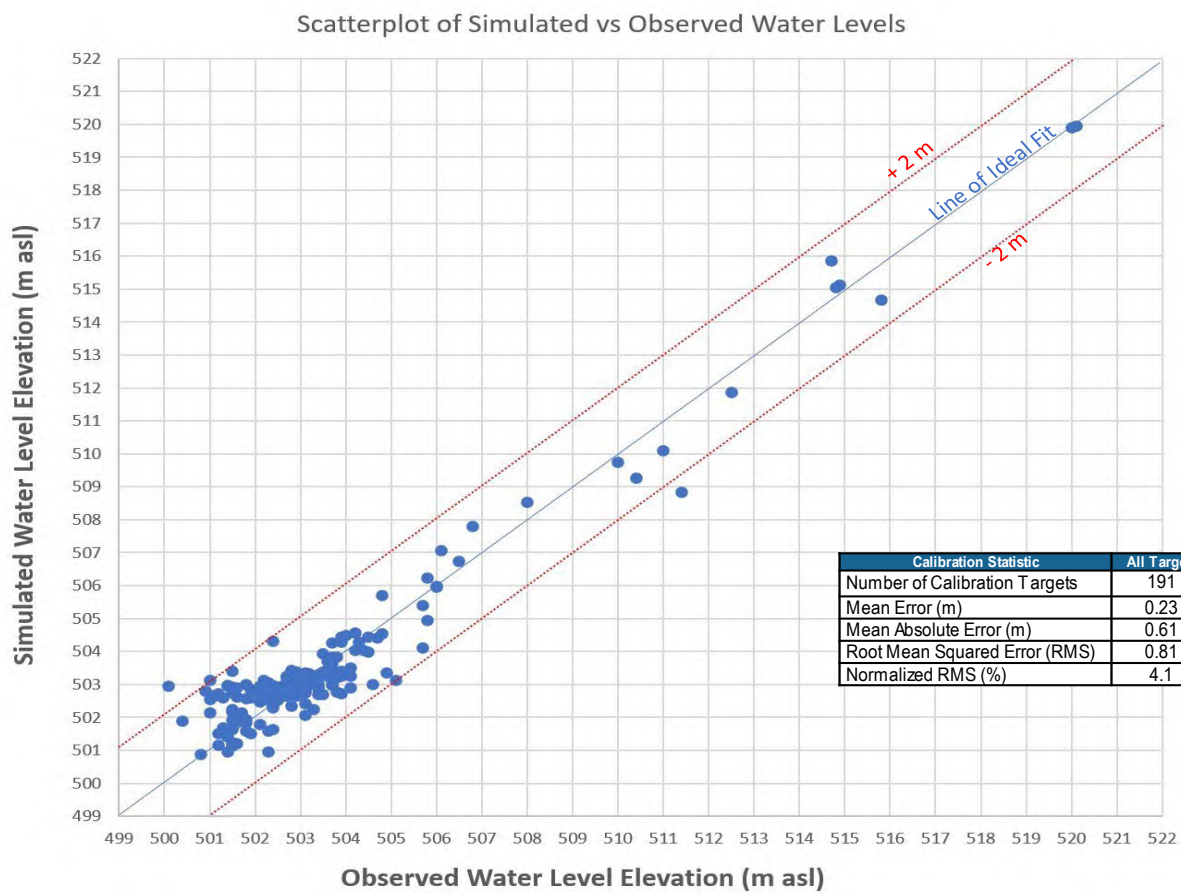


Figure 2-12: Model Simulated Water Level Elevations in the Lower Sandstone Aquifer



Calibration Statistic	All Targets	GWR Wells	Exploration Boreholes
Number of Calibration Targets	191	19	172
Mean Error (m)	0.23	0.28	0.23
Mean Absolute Error (m)	0.61	0.81	0.59
Root Mean Squared Error (RMS)	0.81	1.10	0.77
Normalized RMS (%)	4.1	5.8	3.9

LEGEND
- Water Level Monitoring Point
- Line of Ideal Fit for observed and simulated water levels

Wheeler River Project
Groundwater Modelling Report
Model Calibration Scatterplot

Ecometrix Environmental INTELLIGENCE

Figure 2-13

Figure 2-13: Model Calibration Scatterplot

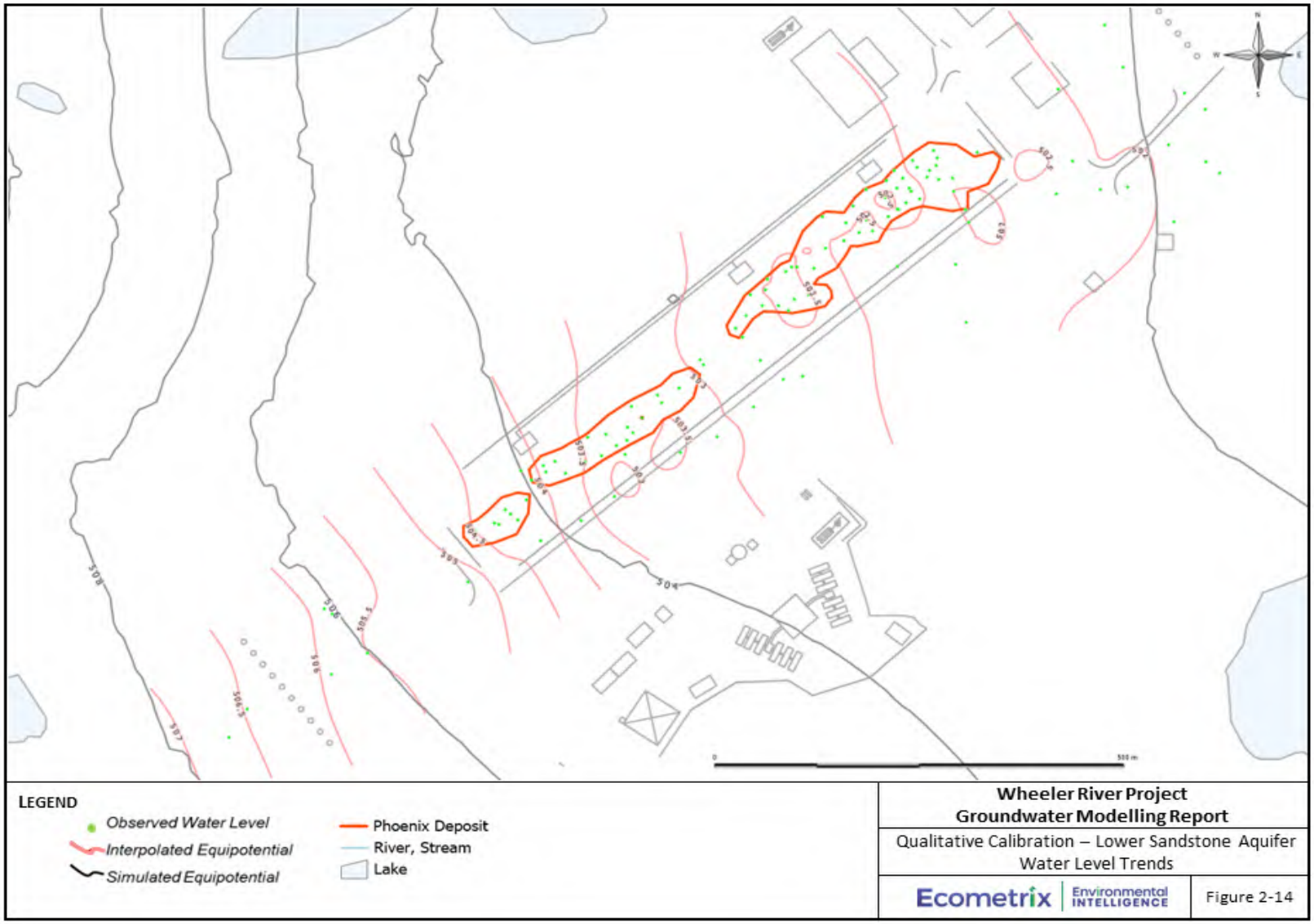


Figure 2-14: Qualitative Calibration – Lower Sandstone Aquifer Water Level Trends

2.5.2.2 Water Level Elevations – Qualitative Calibration

Figure 2-14 illustrates the match between contoured water level trends within the Lower Sandstone Aquifer and those simulated within the groundwater flow model. As shown, there is an excellent match between the contoured water levels and the simulated water levels in the immediate vicinity of the observation well locations. In many cases, throughout the ore zone the corresponding simulated and interpolated water level contours are within 50 meters of one another. It is important to note that the simulated water levels are achieved using idealized, simplified parameter zones, and as such simulated water levels are generally smoother and intended to represent the general patterns of observed conditions. In this case, the match achieved is excellent.

2.5.2.3 Statistical Measures of Calibration to Water Levels

Calibration statistics were calculated as a measure of the statistical goodness of fit between the model-simulated and observed water level elevations and are outlined in Table 2-6.

Table 2-6: Water Level Calibration Statistics

Calibration Statistic	All Targets	GWR Wells	Exploration Boreholes
Number of Calibration Targets	191	19	172
Mean Error (m)	0.23	0.28	0.23
Mean Absolute Error (m)	0.61	0.81	0.59
Root Mean Squared Error (RMS)	0.81	1.10	0.77
Normalized RMS (%)	4.1%	5.8%	3.9%
Range of Observed Water Levels	20.0	20.0	20.0

- Mean Error = 0.23 m for all targets. The mean error is a measure of whether, on average, simulated water levels are higher or lower than those observed. Ideally, the Mean Error should be as close as possible to zero. This statistic indicates that on average the simulated water levels are higher than the observed values by 0.23 m. This represents an excellent match to the observed water levels.

- Root Mean Squared Error = 0.81 m. The root mean squared error is comparable to a standard deviation and provides a measure of the degree of scatter about the 1:1 line. It is calculated by averaging the squares of each residual error (i.e., difference between simulated and observed) and then taking the square root of that average. It is most desirable to have a low RMSE, especially for high-quality data. The model RMSE indicates that most predicted water levels in the model domain lie within 0.81 m of the observed values.

- Normalized Root Mean Squared (NRMS) Error is calculated by dividing the Root Mean Squared Error by the maximum range in observed water level elevations. This percentage value allows the goodness-of-fit in one model to be compared to another model regardless of the scale of the model. Typically, a groundwater flow model is considered calibrated when the NRMS is less than or equal to 10% (Spitz and Moreno, 1996); however,

the NRMS error is dependent on the range of observed water levels. The NRMSE for all targets in the current model is 4.1% which is very good, especially considering the total range in observed water levels is only 20 m across the model domain.

The spatial distribution of the residuals (difference between simulated and observed water levels at each well) are illustrated on Figure 2-15. The lack of a trend in residual values (colours) reflects that there is no trend in the calibration residuals (i.e., they are randomly distributed).

2.5.2.4 Simulated Vertical Gradients

Observed and simulated vertical gradients at available the well clusters presented in Appendix 7-A (Table 3-1), are summarized in Table 2-7. Observed static water levels are presented as there were issues with the barometric pressure correction for transient water levels. Vertical gradients are implicitly incorporated into the 3D model calibration as water levels from all observation wells are incorporated as calibration targets using their coordinates in 3D space.

As indicated by the results presented in Figure 2-7 , the model provides an excellent representation of the observed gradients estimated using these monitoring well clusters.

- At the northwest (NW) cluster, the observed and simulated gradients are virtually identical.

- At the southeast (SE) cluster, the gradient from the shallow overburden (OVB) to the intermediate sandstone aquitard (ISA) is under-estimated in the model, however the water level at GWR-007 is believed to be perched above the regional water table, and therefore not a good representation of vertical gradients; regardless both the model and observed data indicate a downward vertical gradient. The gradient between the ISA and the lower sandstone aquifer (LSA) is negligible, which is replicated within the model.
- At the up-gradient cluster, the observed are very well represented by the simulated gradients, including the flow directions.

- At the down-gradient cluster, the gradient between the ISA and the LSA is negligible, which is replicated within the model. The gradient between the OVB and ISA is observed to be downward. However, GWR-005 is located near the shore of Whitefish Lake but has an observed water level 2 m higher than the average lake level. Consequently, the simulated upward is considered reasonable.

- At the Whitefish Lake Bay, the simulated and observed gradients between the upper sandstone aquifer (USA) and the overburden (OVB) are both upward and of similar magnitude. It is noted that he hydraulic head difference between the two observation wells is rounded to 0.1 m.

Table 2-7: Observed and Simulated Vertical Gradients at Available Well Clusters

Cluster	Well	Hydrostratigraphic Unit	Observed Water Level (static) (m asl)	Simulated Water Level (m asl)	Screen mid-point Elevation (m asl)	Observed Gradient (m/m)[a]	Simulated Gradient (m/m)[a]	Notes
NW	GWR-003	Overburden	503.97	503.87	467.8			
	GWR-027	ISA	500.91	501.00	246.3	0.0138	0.0130	
	GWR-025	LSA	502.34	502.40	146.3	-0.0143	-0.0140	
SE	GWR-007	Overburden	514.12	503.48	515.2			perched aquifer at GWR-007 impacts gradient calculation
	GWR-009	ISA	502.20	502.57	285.5	0.0519	0.0039	
	GWR-008	LSA	502.40	502.37	166.2	-0.0017	0.0017	
Up- gradient	GWR-006	Overburden	514.70	515.81	504.75			
	GWR-028	ISA	511.00	510.40	241	0.0140	0.0205	Wells GWR-028 and GWR-029 are 520 m apart.
	GWR-029	LSA	514.80	515.07	172.25	-0.0553	-0.0680	
Down-gradient	GWR-005	Overburden	501.99	500.94	382.55			
	GWR-014	ISA	501.60	501.21	348.05	0.0113	-0.0079	Wells GWR-014 and GWR-012 are 430 m apart.
	GWR-012	LSA	501.27	501.40	166.5	0.0018	-0.0010	
Whitefish Lake Bay	GWR-036	Overburden	502.3	501.59	459.9			
	GWR-037	USA	502.4	501.62	441.3	-0.0054	-0.0017	

Notes:

[a] – Downward gradients are indicated by positive values and upward gradients by negative values.

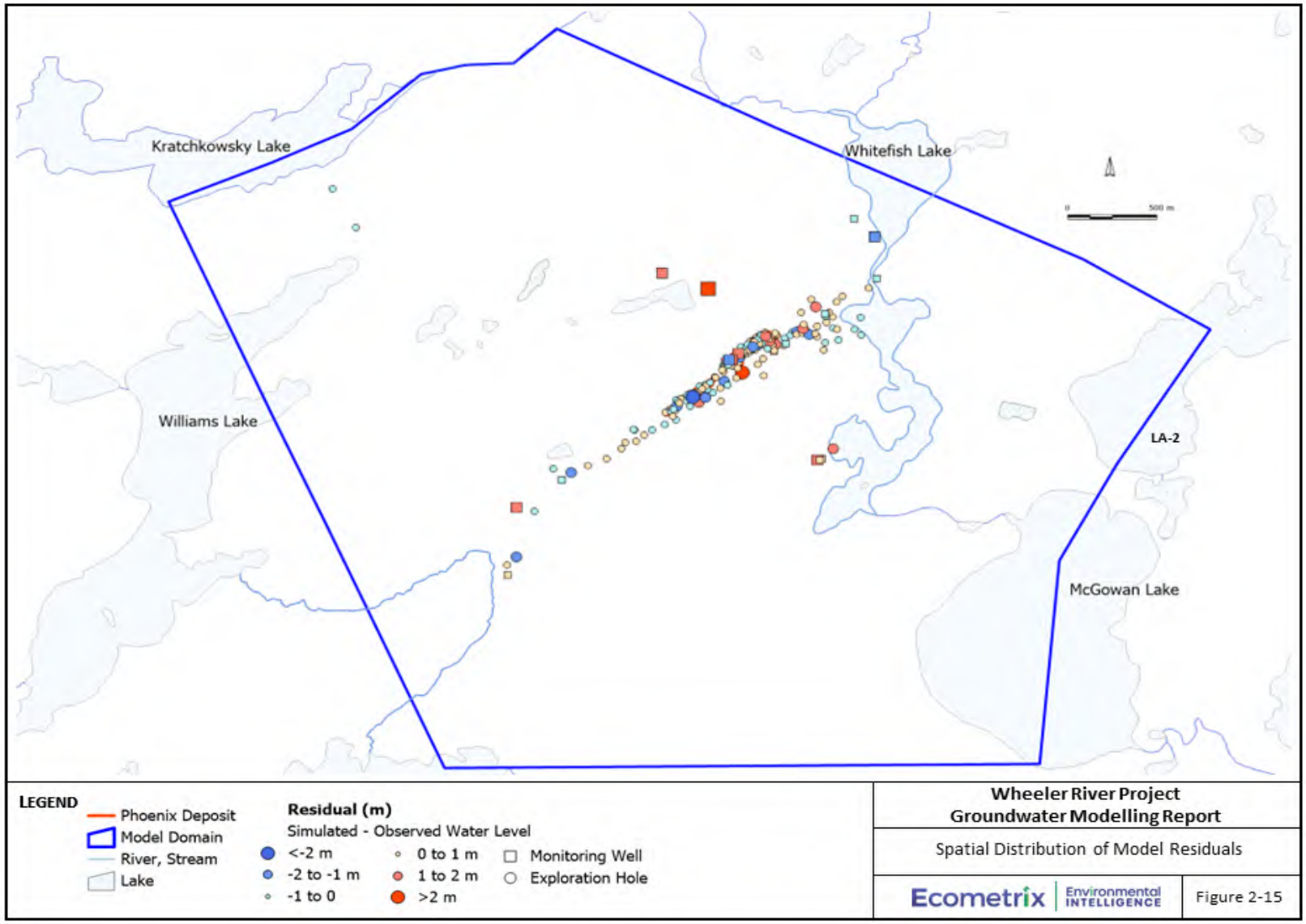


Figure 2-15: Spatial Distribution of Model Residuals at All Locations

2.5.2.5 Baseflow Calibration Results

In addition to calibrating to water level elevations targets, the model was calibrated to estimates of groundwater discharge to Whitefish Lake. A match between simulated and observed flows helps to support that groundwater recharge rates are reasonable, and to provide validation for water budget assessments. Baseflow calibration targets were developed using point streamflow measurements collected upstream and downstream of Whitefish Lake. Figure 2-10 shows the locations of the baseflow calibration targets, and Table 2-8 illustrates the model-simulated groundwater discharge rates in relation to the estimated range of baseflow from stream measurements. The simulated baseflow to Whitefish Lake is in good agreement with the estimated representative baseflow.

Table 2-8: Baseflow Calibration Results

Surface Water Stations	Feature Monitored	Range of Observed Baseflow (L/s)			Simulated Baseflow (l/s)
		Low	Representative	High	
SA-6 to SA-2	Flow through the Southern portion of Whitefish Lake as indicated on Figure 2-10	29.3	40	50.6	40.6

2.5.3 Overall Calibration Assessment

Overall, the calibration assessment indicates that the model is well calibrated, and the model can be used as a tool to guide predictions of groundwater flow directions and gradients. The differences between observed and simulated water levels at monitoring wells (i.e., residuals) were minimized, and there are no spatial trends in residuals that are expected to impact the groundwater flow model predictions. The simulated heads at monitoring wells are close to observed values, and simulated groundwater discharge rates agree favourably with the available baseflow estimates.

2.6 Enhanced Groundwater Flow Understanding

2.6.1 3D Groundwater Flow Patterns

Groundwater flow contours within the Upper and Lower Sandstone Aquifers are presented on Figures 2-11 and 2-12. Regionally, groundwater flow extends from the area near Kratchkowsky Lake in the west, where the highest water levels and lake levels are present, to the southeast towards McGowan Lake. This creates a regional groundwater gradient from the northwest to the southeast. Near the Phoenix Deposit, the local hydraulic gradient is from the southwest to the northeast. Within the Upper Sandstone Aquifer, the local hydraulic gradient is influenced by the Desilicified Zone and the thick coarse-grained overburden deposits underlying Whitefish Lake. Within the Lower Sandstone Aquifer, the hydraulic gradient is influenced by the presence of 1) the Desilicified Zone, and 2) an area of higher hydraulic conductivity along the trajectory of the WS Shear which is interpreted to have been caused by enhanced fracturing along the fault trajectory and thermal alteration.

The flow patterns for groundwater discharging to Whitefish Lake are illustrated in plan and cross-section view on Figure 2-16, based on backward-tracking particles that were started at Whitefish Lake (orange dots) and tracked backward in time toward their source area. Particle traces illustrate that while Whitefish Lake receives groundwater from all directions, most groundwater starts in areas west of Whitefish Lake. Review of the cross-section illustrates that most of the groundwater flow to Whitefish Lake is sourced from waters flowing through the Upper Sandstone Aquifer and Overburden units, with a lesser contribution flowing from the Lower Sandstone Aquifer through the Desilicified Zone. Review of the hydraulic head isolines illustrates the lateral hydraulic gradients within the Upper and Lower Sandstone Aquifers, and the predominantly vertical gradient through the Intermediate Sandstone Aquitard. Downward gradients from the Upper Sandstone Aquifer are found near the western (i.e., upgradient) edge of the Desilicified Zone where flow from the Upper Sandstone Aquifer expands to flow through the permeable Desilicified Zone; the gradient transitions to upward beneath Whitefish Lake. Similarly, slight upward flow paths from the Lower Sandstone Aquifer are also experienced near the western (i.e., upgradient) edge of the Desilicified Zone, where flow through the Lower Sandstone Aquifer also extends vertically to flow into the overlying Desilicified Zone (Figure 2-16). This transitions to dominantly upward hydraulic gradients and groundwater flow throughout the eastern (i.e., downgradient) portion of the Desilicified Zone.

The colours on the particle traces (Figure 2-16) illustrate that groundwater discharging to Whitefish Lake through the Upper Sandstone Aquifer requires less than 50 years of travel time for groundwater recharging near the Phoenix site; groundwater recharge west of the Phoenix site would require 50 to 500 years (i.e., groundwater discharge to Whitefish Lake is generated from precipitation hundreds of years earlier). Groundwater travel time from the Lower Sandstone Aquifer through the Desilicified Zone to Whitefish Lake requires 250 to 400 years of travel time.

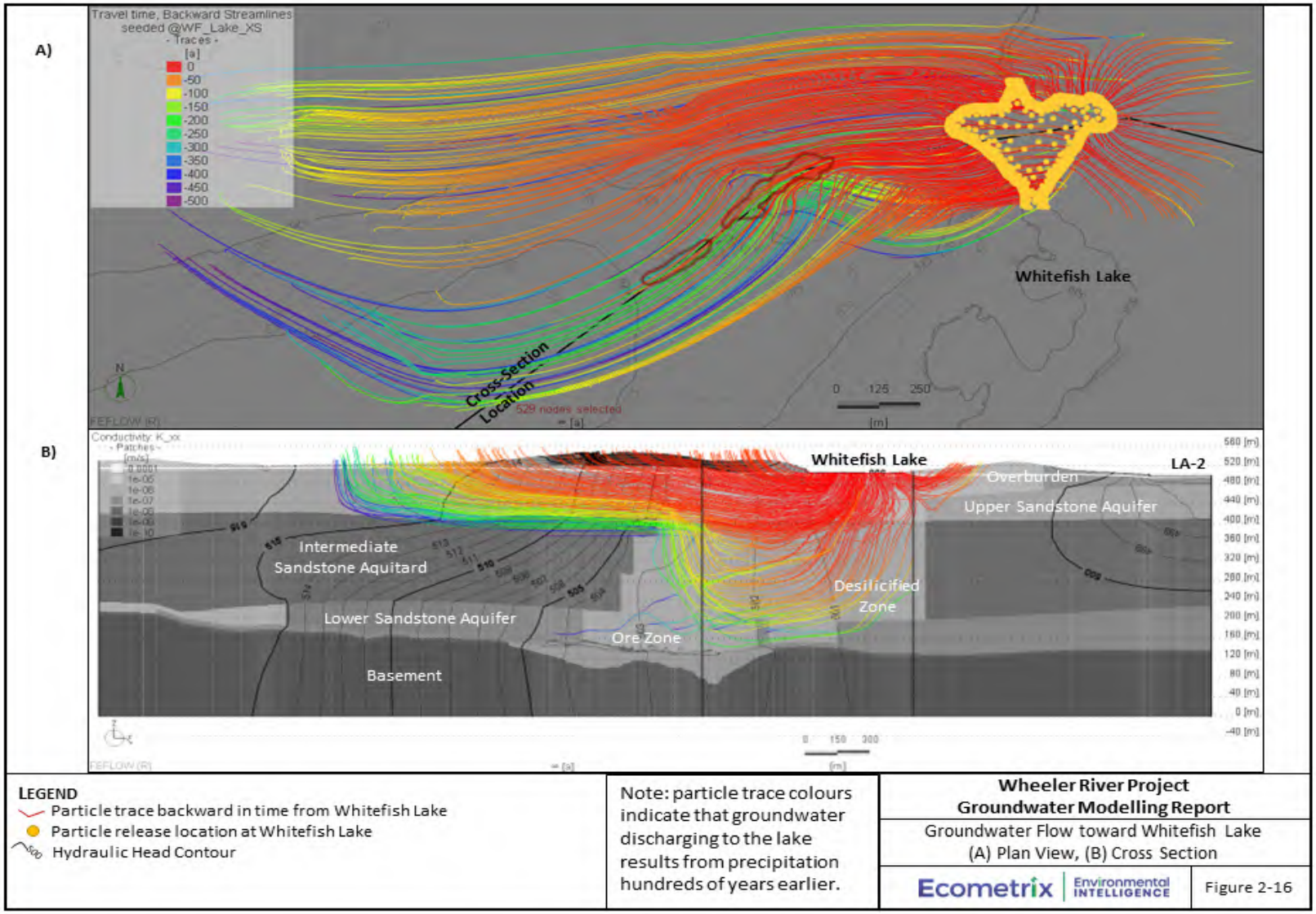


Figure 2-16: Groundwater Flow toward Whitefish Lake (A) Plan View, (B) Cross Section

2.6.2 Evaluation of Potential Receiving Bodies

Identification of potential receiving bodies involved review of available groundwater level, streamflow, and stream or lake level elevation data. The potential hydraulic gradients and flow rates were also evaluated to identify the potential for groundwater to migrate from the ore zone to each potential receiving body. The observed (and calibrated) groundwater flow patterns identify a primarily west to east groundwater flow direction at the Phoenix deposit, which suggests that surface water bodies east of the site are the most likely downgradient receiving water bodies. Water bodies located east of the site (Figure 2-8 and 2-9) include Whitefish Lake (500 m east), McGowan Lake (2 km southeast) and an un-named lake (LA-2) east of McGowan Lake (1.9 km east). Russell Lake, located 6 km south of the Phoenix deposit, was also considered a potential regional discharge location.

Hydraulic gradients were estimated based on water level differences between the ore zone and each potential surface water receptor. In addition, calculations of potential groundwater flow rates to each surface water receptor were evaluated for a range of interpreted hydraulic conductivity values. Hydraulic gradients toward McGowan Lake and Lake LA-2 are 50% larger than the gradient toward Whitefish Lake. However, the groundwater flow rate through the Desilicified Zone where a relatively high hydraulic conductivity is conservatively interpreted to exist, is estimated to be more than ten times greater than other areas where the intermediate sandstone aquitard is unaltered. As a result, the groundwater flow rate potential is estimated to be highest (i.e., by an order of magnitude or more) toward Whitefish Lake than any other surface water body in the area. Groundwater flow potential toward Russell Lake is the lowest of any surface water feature evaluated. Groundwater discharge to Whitefish Lake is also most conservative from a predictive perspective as groundwater flow and discharge into other nearby surface water bodies such as McGowan or Russell Lakes, would predict lower concentrations due to dispersion along those longer flow paths.

Given this potential flow rate evaluation, Whitefish Lake is considered the most likely receiving body of groundwater flowing through and around the Phoenix deposit. Additionally, as Whitefish Lake represents the shortest potential transport distance, evaluation of this lake as the receptor-of-interest is conservative.

Despite the physical evaluation of potential receiving bodies highlighting Whitefish Lake as the most likely receiving body, boundary conditions applied in the model (Figures 2-8 and 2-9) were designed to permit groundwater to migrate toward, and discharge at, any of the surface lakes (including flow south toward Russell Lake). However, calibration to the horizontal and vertical gradients evident at the site, coupled with the interpretation of the Desilicified Zone as a higher hydraulic conductivity zone, supports the upward migration of groundwater toward Whitefish Lake from the ore zone area. Upward flow from the ore zone toward Whitefish Lake is also consistent with geochemical and mineralogical trends. The implication of this interpretation is that the primary potential receiving body, for groundwater constituents of potential concern associated with the ore body, is Whitefish Lake.

2.6.3 Groundwater Flow Quantity

The calibrated model was utilized to evaluate the regional groundwater budget (Table 2-9). The water budget is presented for steady-state, pre-mining conditions, and as such represents what is expected to occur within a typical year.

Groundwater inflow to the model area is dominated by groundwater recharge, which is supplied through annual precipitation (i.e., infiltration of rainfall, runoff, and snowmelt). Additional inflow is provided via a) recharge from some of the surface ponds within the model footprint (e.g., near GWR-025 and west toward the Gryphon deposit), and b) deep regional groundwater flow entering the model in the Lower Sandstone Aquifer near Kratchkowsky (north) and Williams (west) Lakes. Water supplied through surface ponds is also expected to be derived from rainfall runoff and snowmelt. Deep regional groundwater flow is estimated to be a relatively minor (i.e., <1% of total inflow) part of the groundwater flow budget. Similarly, deep regional outflow south toward Russell Lake is also estimated to be minor (i.e., 0.2% of total outflow).

Groundwater leaving the model is dominantly simulated to exit as groundwater discharge (seepage) to surface water bodies. Such groundwater discharge supports stream baseflow in otherwise dry conditions. As noted above, there is a minor component of deep groundwater flow out of the model south toward Russell Lake.

Table 2-9: Regional Water Budget (Average Annual Rates)

Element	Water In (m^3/d)	Water Out (m^3/d)	Comment
Groundwater Recharge from Precipitation	6,365		Inflow at Ground Surface
Interaction with Lakes	510	6,903	In/Outflow at Ground Surface
North Inflow	22		Lateral Inflow to Lower Sandstone Aquifer
South Outflow		15	Lateral Outflow from Lower Sandstone Aquifer toward Russell Lake
West Inflow	21		Lateral Inflow to Lower Sandstone Aquifer
Sum	6,918	6,918	

The distribution of groundwater discharge to the various lakes is presented in Table 2-10. Here the discharge is presented as a percentage of the groundwater discharging at each lake relative to the total flow through the model domain (i.e., 6,918 m^3/d).

Through this analysis, Whitefish Lake is simulated to receive 51% of the groundwater flowing through the model domain, with smaller amounts discharging to lakes in the southeast (McGowan and LA-2) and southwest (LB-2 and the river between Williams Lake and LB-2), respectively. Kratchkowsky and Williams Lakes receive relatively small amounts of the groundwater recharged within the model domain; they are expected to dominantly receive groundwater discharge from further upgradient areas (i.e., northwest), which are outside of the model domain.

Table 2-10: Groundwater Discharge to Surface Water Bodies

Element	Water In (m^3/d)	Water Out (m^3/d)	% of Groundwater Inflow which Discharges to Each Surface Feature within the Model
Whitefish Lake		3,517	51%
McGowan & LA-2		1,938	28%
Kratchkowsky & Williams Lakes		445	6%
LB-2 & Inflowing River		1,003	14%
Interior Ponds	510		
Sum	510	6,903	

As indicated through this water budget analysis, most of the groundwater flow through the model occurs within the shallow portions of the model domain (i.e., the Overburden and Upper Sandstone Aquifer). Additional sub-domain water budgeting suggests that 99% of the groundwater flow occurs through the Upper Sandstone Aquifer and Overburden deposits, extending from the groundwater recharge areas to discharge areas at the respective lakes and rivers. Similarly, it is calculated that flow from the Lower Sandstone Aquifer migrating up through the Desilicified Zone, accounts for < 1% of the groundwater discharge to Whitefish Lake. This suggests that any deep groundwater discharge from the vicinity of the ore zone will be a small proportion of the groundwater discharging into Whitefish Lake.

2.6.4 Water Budget for Whitefish Lake

As noted above in Section 2.6.3, it is estimated that 99% of the groundwater discharge to Whitefish Lake is derived from groundwater that has only flowed through shallow deposits (i.e., Overburden and Upper Sandstone Aquifers). Contribution of deep groundwater flow through the Desilicified Zone within the Intermediate Sandstone Aquitard is estimated to be less than 1% of the groundwater discharging to Whitefish Lake.

Groundwater discharge to Whitefish Lake is estimated to be 40 L/s (3,456 m^3/d or 0.04 m^3/s), which is a small component (~ 3%) of the average surface flow through the lake (average of 1.4 m^3/s). The component of groundwater discharge emanating from the Lower Sandstone Aquifer is 1% of the total groundwater discharge, or 0.03% of the total flow through Whitefish Lake. At low flow conditions (i.e., 7Q10), the estimated flow through Whitefish Lake is 0.81 m^3/s, indicating that the portion of deep groundwater discharge could reach a maximum level of 0.05% of the flow through Whitefish Lake.

2.7 Groundwater Conditions During Mine Operations

2.7.1 Groundwater Demand

Mining operations will include the use of groundwater for several purposes, including supply make-up water to the ISR plant, support freeze wall development, wash bay requirements, and drilling activities (pre-development). Pumping demand was estimated and provided by Denison as follows:

a) 20 m^3/hr (5.6 L/s) during mine construction (Years 1-3) to support drilling activities and development of the freeze wall,

b) 31.3 m^3/hr (8.7 L/s) during mine operation (Years 3-18), and

c) 35.5 m^3/hr (9.9 L/s) during mine decommissioning (18-23 years).

Groundwater pumping was simulated in the model to be derived from three pumping wells located outside the ore zone and proximal to the mine operations. The wells were simulated to pump water from the Upper Sandstone Aquifer.

2.7.2 Groundwater Recharge

In addition to this water demand, groundwater recharge is also anticipated to be reduced (estimated at 50%) within the freeze wall area during the mine construction and ISR phases and enhanced within the borrow pit area (20%). In addition, groundwater inflow from the septic effluent pond is estimated at 2.5 m^3/hr (0.7 L/s) during all mine construction, operation, and decommissioning phases. The reduced hydraulic conductivity associated with the vertical freeze walls was also incorporated within the model simulations.

The calibrated, steady-state model was used as the basis for the transient model used to evaluate drawdown during operations. Only conditions immediately at the mining zone were altered within the transient model to reflect the proposed changes during mine operations. All boundary conditions that drive regional groundwater flow were unchanged for the transient model, and all hydrogeologic properties outside of the mining area were left unchanged. Changes made to the hydrogeologic properties were implemented transiently to represent the phased implementation of the freeze wall. Groundwater recharge changes were made to reflect alterations to surficial land use and the implication to groundwater recharge, and transient well boundary conditions were added to simulate the planned pumping demand for camp and ISR water requirements.

The transient version of the model was used to evaluate changes to the groundwater discharge occurring at Whitefish Lake. The model simulation was started at the beginning of mine construction, with initial conditions taken from the calibrated model. The simulation period was extended for 40 years to include the entire period of construction, operation, and decommissioning, and extending through 17 years post-decommissioning.

2.7.3 Hydrogeological Change Due to Mine Operations

Figure 2-17 illustrates the predicted change in water levels due to planned pumping at the mine relative to current conditions, as simulated in the base case model. Three groundwater wells for water supply are planned and their proposed locations are shown in Figure 2.2-1 of the EIS. The wells are shown as freshwater wells “A”, “B” and “C” in (Figure 2-20). The expected drawdown ranges from a high of 9 m at Well B to a low of 2.4 m at Well C; predicted drawdown is proportional to the estimated hydraulic conductivity value applied in the model at the pumping well locations.

Figure 2-18 illustrates the predicted changes that will occur within Whitefish Lake during mine construction, operation, and decommissioning periods. Groundwater discharge to Whitefish Lake is predicted to be reduced by as much as 25% (from 41 to 31 L/s), with a 10% reduction lasting from the start of operation to 1-year into the post-decommissioning period. The reduction in groundwater discharge is interpreted to be due to the Mine groundwater demand (Section 2.7.1) from the Upper Sandstone Aquifer.

The simulated decommissioning phase ends at year 23 on the graph (Figure 2-18), and full recovery of groundwater discharge is asymptotically approached and achieved by year 34 (i.e., 9-years later); 90% recovery is achieved within 4 years (by the end of year 26). However, because groundwater discharge to Whitefish Lake is a small component of the flow through the Lake (i.e., average flow estimated as 1.41 m^3/s or 1,410 L/s), the change in water quantity conditions within Whitefish Lake are predicted to be negligible and too small to measure (Figure 2-18; blue line).

Consequently, the water quantity impact on Whitefish Lake is expected to be of low magnitude, and for a moderate length of time. This outcome is considered likely as the onsite water use is small relatively to the surface flow through the Lake which has been measured over several years of streamflow monitoring (2011 to 2019).

Effect of Freeze Wall

The effect of the freeze wall on groundwater flow conditions within the LSA was simulated using the regional groundwater flow model. Hydraulic conductivity of the freeze wall was simulated as a reduction of the baseline hydraulic conductivity by four (4) orders of magnitude, which was consistent with expected hydraulic conductivity changes as reported by Newmans (2020). The recharge reduction on top of the ore zone was estimated at 50% of the pre-development recharge based on the expected regrading and surface drainage at the site to accommodate all of the surficial operations. The simulated effect of the active freeze walls is illustrated through Figure 2-19 and Figure 2-20, which illustrate the change in groundwater flow paths resulting from the freeze wall and operational groundwater pumping.

Figure 2-19 illustrates the pre-mining (and pre-pumping) groundwater flow paths toward Whitefish Lake. The particle traces shown were released at Whitefish Lake and tracked backward in time / space to their recharge area. They provide an understanding of the west-east groundwater flow toward Whitefish Lake, with local recharge creating the driving force for that groundwater flow. On this figure, the groundwater level contours are shown in black, while the flowlines (particle traces) are shown in blue. Note the flowlines closest to the pumping wells (red circles; three freshwater wells “A”, “B” and “C”) and the ore body (light brown outline). The colours in the background reflect the shallow hydraulic conductivity zones, which help to explain inflections in the hydraulic head contours and flowlines.

Figure 2-20 illustrates the same groundwater flow paths toward Whitefish Lake during mining operations, while pumping will occur at the three freshwater wells and the freeze walls for (mining/ore zone) Phases 1 through 5 are in place. From this figure, the effect of the freeze walls

on groundwater flow can be seen to be limited to the immediate area around the freeze walls. The addition of the freeze walls creates a cluster of water level contours consistent with the freeze wall locations, representing the change in water levels between the area inside and outside of the freeze wall. Note that the water levels outside the freeze wall are simulated to be relatively unchanged during freeze wall operations.

Also evident in Figure 2-20 are the water level drawdown contours, which deflect around the pumping wells. Note the additional level of drawdown experienced at wells simulated to pump from the lower hydraulic conductivity zone (i.e., green area, as opposed to the yellow area).

The flowlines in Figure 2-20 indicate how the groundwater flow patterns will change due to the addition of the freeze wall and the onsite pumping. Flowlines are noted to travel around the freeze wall and in between the pumping wells to discharge at the lake. The pumping wells will capture water flowing from the west which would otherwise discharge to Whitefish Lake.

The impact of the freeze wall on the local and semi-regional groundwater flow regimes is minor. The footprint of the freeze walled area represents < 0.04% of the area of the regional groundwater flow model, and as described above, the freeze walled area is a relatively small disruption to the regional groundwater flow system. Post mining, the groundwater flow path patterns would return to a condition similar to that simulated for pre-mining.

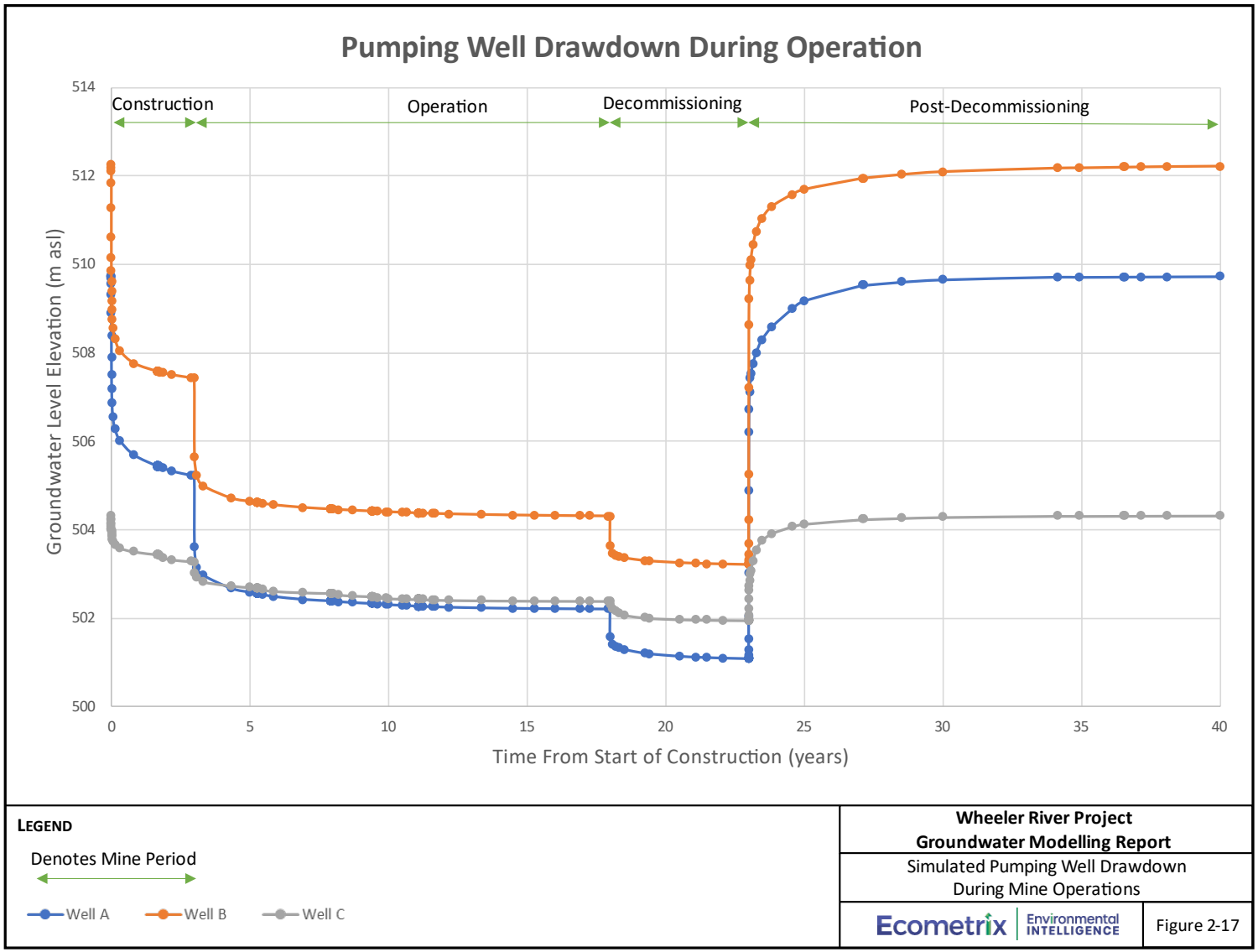
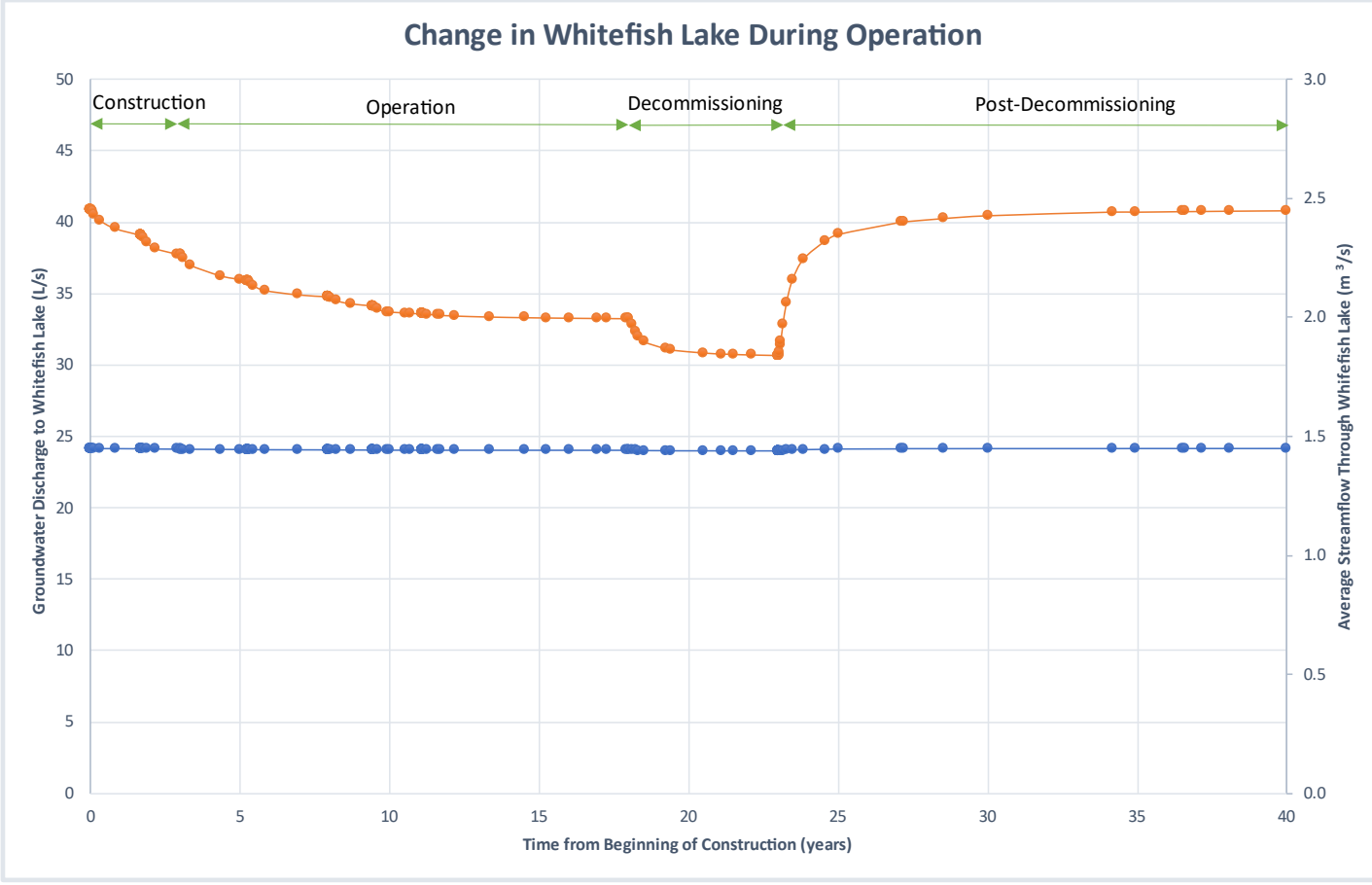


Figure 2-17: Simulated Pumping Well Drawdown During Mine Operations



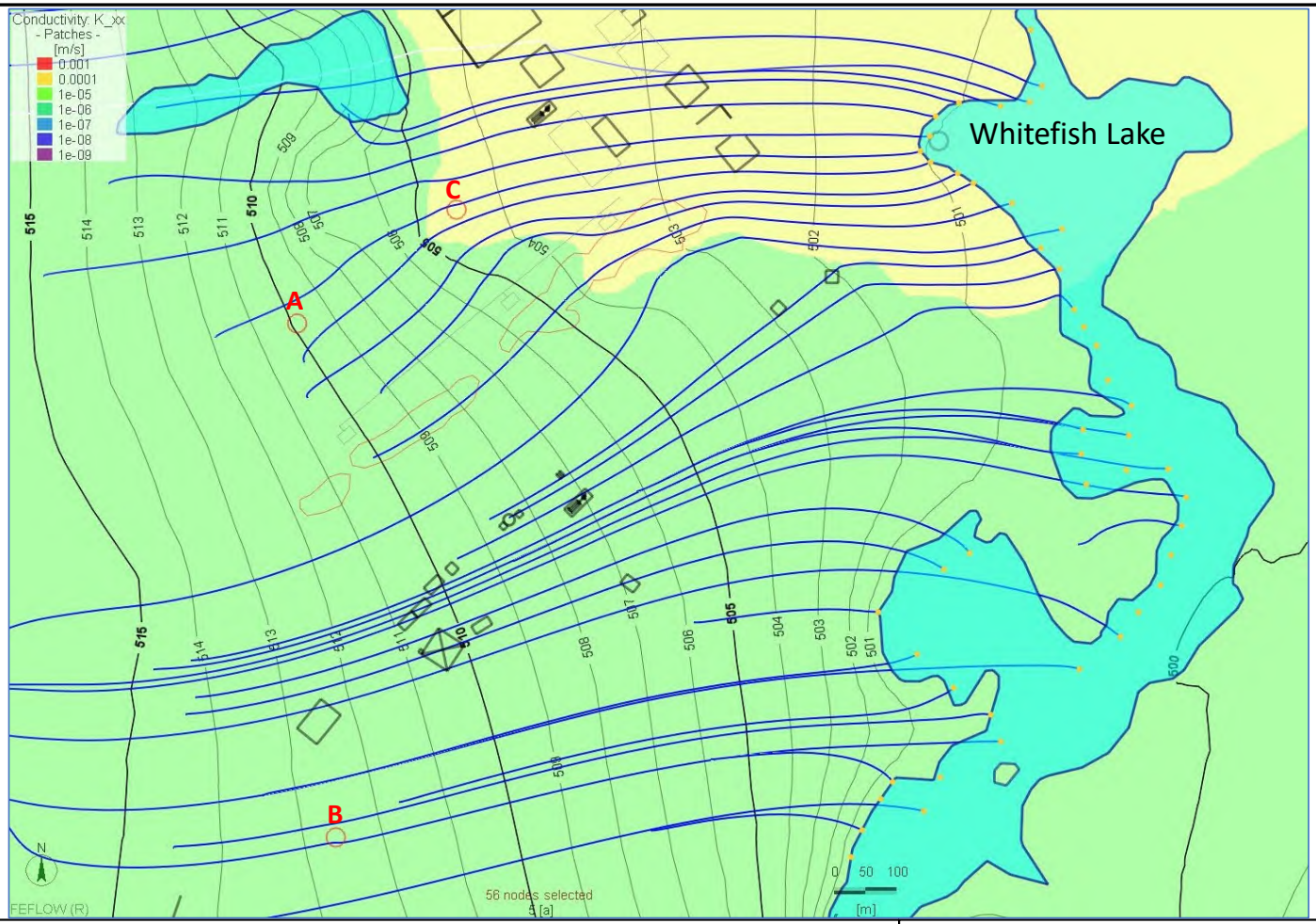
Denotes Mine Period

Groundwater Discharge to Whitefish Lake

Streamflow Through Whitefish Lake

Wheeler River Project Groundwater Modelling Report	
Simulated Change in Groundwater Discharge and Flow through Whitefish Lake	
Ecometrix Environmental INTELLIGENCE	Figure 2-18

Figure 2-18: Simulated Change in Groundwater Discharge and Flow through Whitefish Lake



Particle trace backward in time from Whitefish Lake
Particle release location at Whitefish Lake
Hydraulic Head Contour
Freshwater wells (A, B, and C)

Wheeler River Project
Groundwater Modelling Report

Groundwater Flow Paths Pre-Mining

Ecometrix Environmental INTELLIGENCE | Figure 2-19

Figure 2-19: Groundwater Flow Paths Pre-Mining

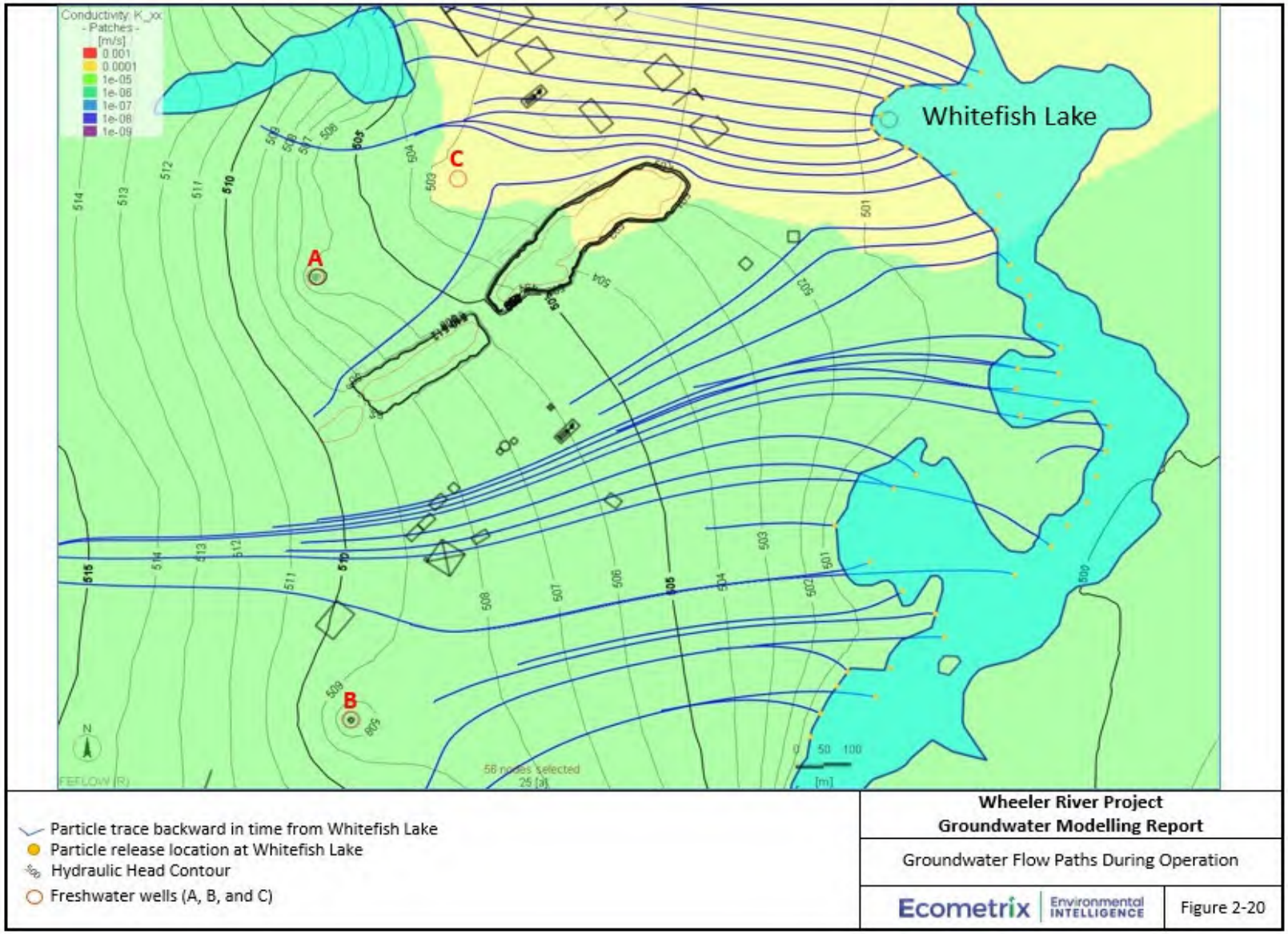


Figure 2-20: Groundwater Flow Paths During Operation

2.8 Parameter Uncertainty Assessment

Beyond the manual model calibration to groundwater flow conditions (Section 2.5), parameter estimation tools were employed to determine parameter combinations that yield an equivalent match to observed conditions. Such alternative, calibrated parameter sets are used to evaluate prediction uncertainty in subsequent simulations of post-decommissioning fate and transport.

2.8.1 Parameter Uncertainty within the 3D Model

All numerical models are approximations of the real-world environment and generalizations are necessary to take a complex hydrogeologic system and bring it into the numerical model.

The hydrostratigraphic characterization was conducted using all available data; however, additional heterogeneities within the aquifer and aquitard units may be present between or beyond available borehole data. The degree of scatter regarding the model calibration achieved is small (i.e., residuals are generally smaller than 0.81 m) however, the impact of such variability should be tested within prediction simulations.

Hydraulic conductivity values applied in the model were guided by aquifer test results which provided local estimates of parameters within the ore zone and Lower Sandstone Aquifers. Some hydraulic test data also exists beyond the ore zone. This data was used to assign parameter values throughout the model domain.

Recognizing these data and parameterization limitations, evaluation of alternative, calibrated parameter sets is important to understand the potential uncertainty regarding predictions of post-decommissioning scenarios.

2.8.2 Focus of Parameter Uncertainty Assessment

As described in Section 2.6.1, the primary flow pattern of interest is from the ore zone toward Whitefish Lake. This flow path presents the most conservative potential pathway for contaminants at depth to reach a sensitive environmental receptor. Recognizing this, the uncertainty regarding parameters along this flow path were the focus of the uncertainty analysis performed. Such parameter zones (i.e., groups of finite elements) included the following (Figure 2-21):

1) Lower Sandstone Aquifer immediately overlying the ore zone (subdivided into 3 zones);
2) Lower Sandstone Aquifer downgradient of the ore zone, extending northeast toward the area beneath Whitefish Lake, which is interpreted to contain desilicified sands;
3) Desilicified Zone extending through the Intermediate Sandstone Aquitard that overlies the ore zone;
4) Upper Sandstone Aquifer overlying the Desilicified Zone; and
5) Overburden Aquifer underlying Whitefish Lake.

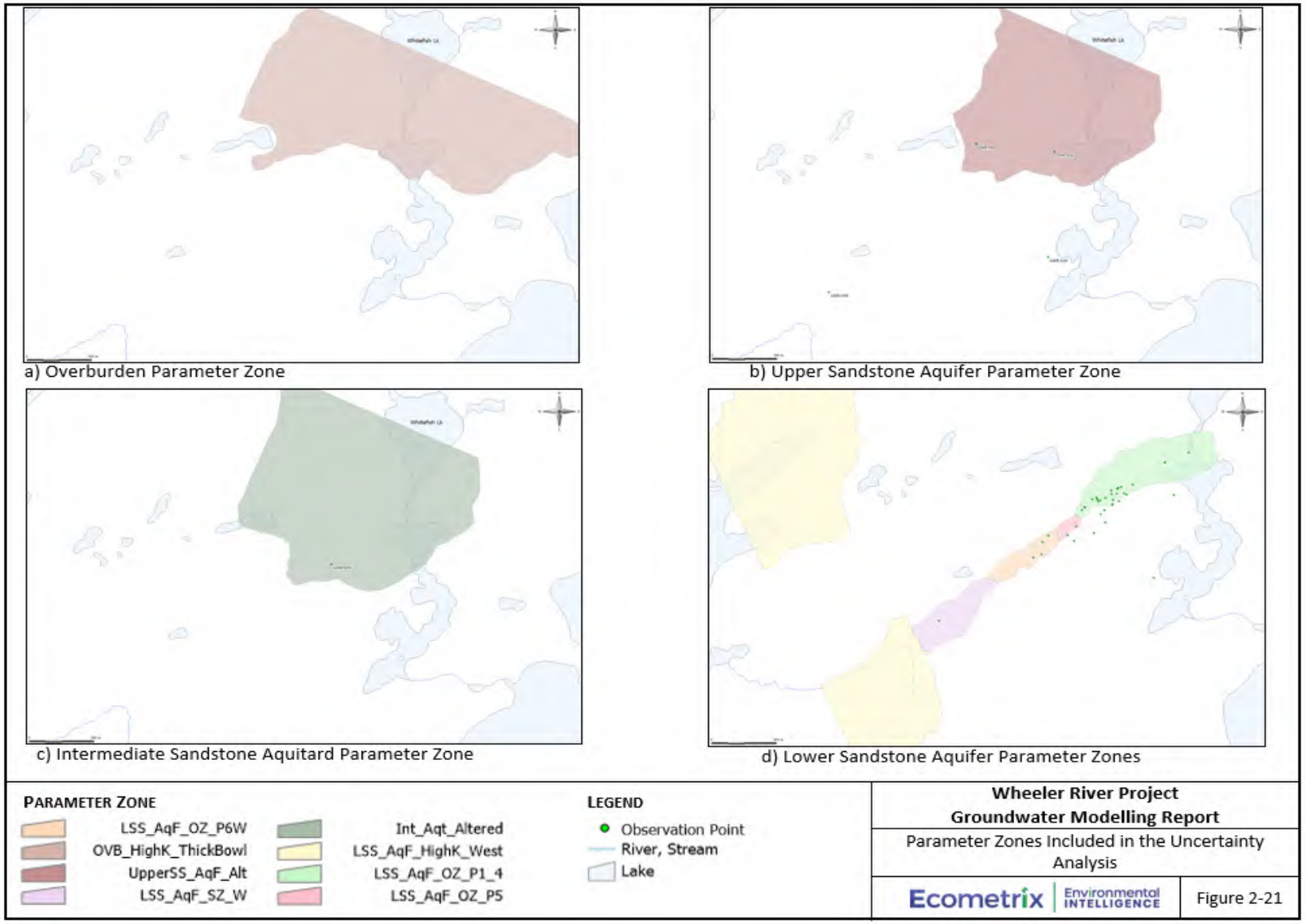


Figure 2-21: Parameter Zones Included in the Uncertainty Analysis

Each of the above zones lies along the predicted flow path between the ore zone and Whitefish Lake, and as such is important to defining the predicted fate and transport of contaminants along this flow path.

Parameter values for each of these zones were allowed to vary independently within a specified range to find combinations of parameter values that met statistical calibration criteria. By varying combinations of parameter values, increases in one parameter value were often offset by lowering other parameter values to maintain calibration. In this manner, 50 models (i.e., realizations) were generated that incorporate a range of parameter combinations that are consistent with the conceptual hydrogeologic model and available water level calibration data.

2.8.3 Parameter Uncertainty Assessment Approach and Results

To complete the parameter uncertainty assessment, a Parameter ESTimation utility, PEST++ IES (Doherty, 2015 and 2018; White, 2018 and 2020) was applied. PEST is a platform-independent utility that contains a suite of programs to support model parameter optimization and prediction uncertainty analysis. PEST embraces the fact that model calibration is non-unique and that a range of parameter combinations should be evaluated to understand potential environmental predictions.

The version of PEST++ employed used the Iterative Ensemble Smoother (IES) technique developed by White (2018) to produce a series of model parameter realizations, which each have different parameter values that produce a model that is as well calibrated as the original base case model. The group of model parameter realizations (i.e., model ensemble) are considered a representative sample of possible parameter sets, and the model predictions conducted using this ensemble can be considered a representative sample of possible predictions. The ensemble is created by randomizing the parameter values of the model within the probability distribution of parameter values. The group of model realizations are then calibrated using a sophisticated algorithm (modified Gauss-Levenberg-Marquardt algorithm) to produce a suite of realizations that all meet calibration target values (i.e., objective function).

Using this approach, fifty (50) calibrated realizations were generated for the Denison groundwater flow model. The range of hydraulic conductivity values applied for each parameter zone (Figure 2-22) indicates the potential variability of each parameter value that can be applied to maintain an equivalent degree of calibration to observed water levels. There is a relatively small range of acceptable parameter values along the primary flow path between the ore zone and Whitefish Lake (i.e., LSS_AqF_OZ_P1_4, Int_AqT_Altered, UpperSS_AqF_ Alt, and OVB_HighK_ThickBowl in Figure 2-21 and Figure 2-22). This indicates that the available water level calibration data is sufficient to constrain the values of these parameters. The hydraulic conductivity of the zone overlying Phase 5 of the proposed Phoenix mine was found to have the highest range of potential hydraulic conductivity values as there is less calibration data available to constrain that hydraulic conductivity.

Three (3) of the fifty (50) calibrated realizations were selected to represent the parameter value combinations (Figure 2-23) that would result in faster groundwater flow, and thus greater

transport of dissolved concentrations between the ore zone and Whitefish Lake. These realizations included:

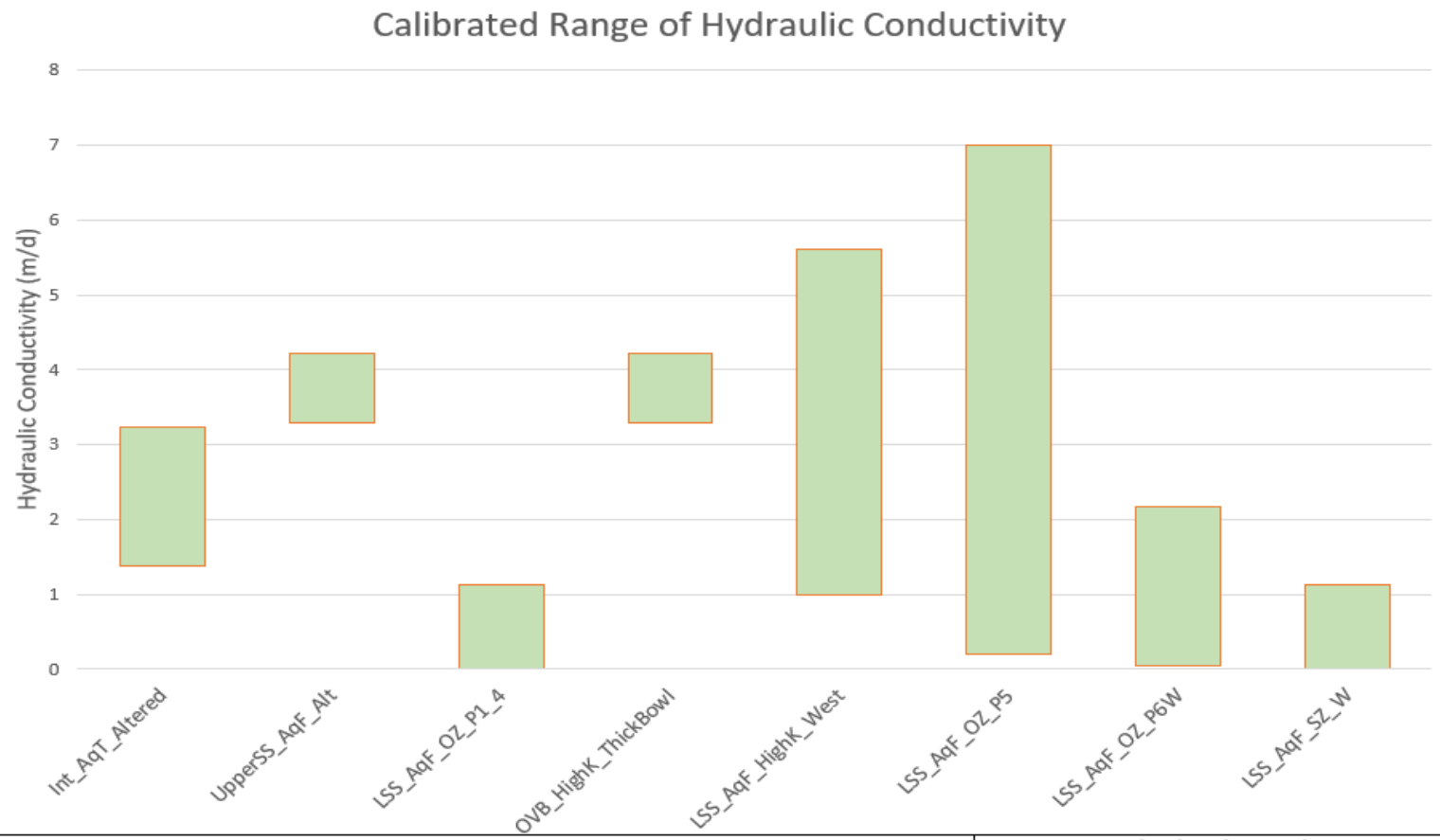
a) Realization 3: higher hydraulic conductivity for the Lower Sandstone Aquifer (ore zone Phases 1-4, 5, and 6) as well as in the altered Desilicified Zone) within the Intermediate Sandstone Aquitard.

b) Realization 7: highest hydraulic conductivity for the combination of the Lower Sandstone Aquifer (ore zone Phase 5) and the Desilicified Zone within the Intermediate Sandstone Aquitard.

c) Realization 27: highest hydraulic conductivity for the Lower Sandstone Aquifer (ore zone Phase 5).

The statistical calibration (i.e., objective function value, phi; red asterisk in Figure 2-23) is similar for each realization, such that all realizations are considered well calibrated, and the model predictions are equally likely as the base case groundwater flow model.

The reactive transport simulations performed using these alternative parameter realizations are described within Section 4.6.



LEGEND

Range of Calibrated Hydraulic Conductivity Satisfying Calibration Constraints

Wheeler River Project
Groundwater Modelling Report

Hydraulic Conductivity Range Satisfying Calibration Constraints

Ecometrix Environmental INTELLIGENCE | Figure 2-22

Figure 2-22: Hydraulic Conductivity Range Satisfying Calibration Constraints

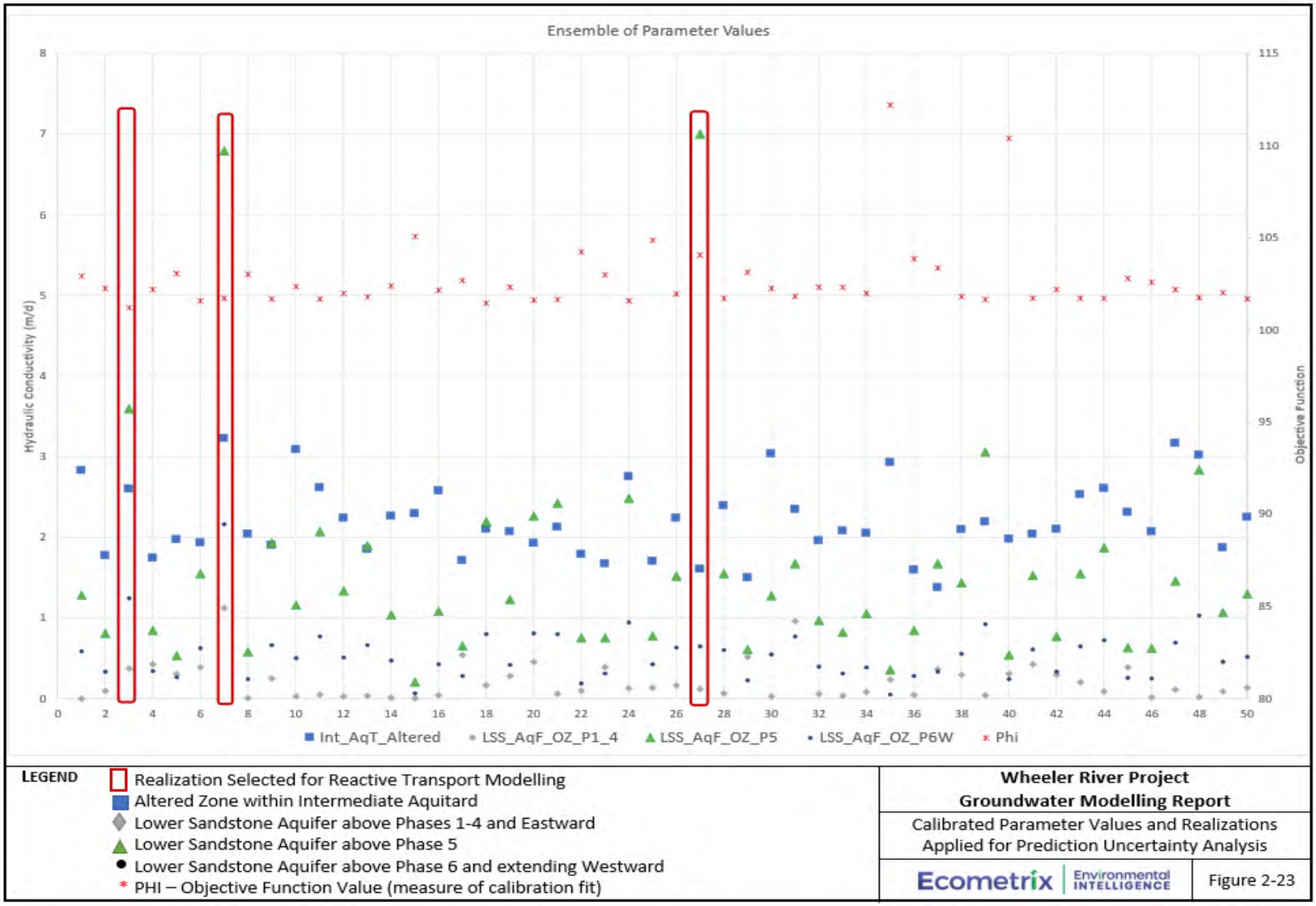


Figure 2-23: Calibrated Parameter Values and Realizations Applied for Prediction Uncertainty Analysis

3.0 Geochemical Reactions and Modelling

Together with understanding groundwater flow conditions, a robust characterization of subsurface geochemistry is the foundation for evaluating how the concentrations of chemical constituents in groundwater, and in the receiving surface water environment, may be affected by the Project. The subsurface geochemical conditions include the form and abundance/concentration of chemical constituents in the solid phase (the rock or sediment matrix), entrained particles (colloids or larger), and dissolved in groundwater. While constituents in groundwater can chemically interact with the solids along the groundwater pathway, only the dissolved constituents can migrate with the groundwater.

3.1 Important Concepts in Subsurface Assessment for ISR Projects

There are two aspects of primary importance for hydrogeological and geochemical assessments in support of ISR Projects. These are groundwater restoration or remediation post decommissioning and the assimilative capacity, including geochemical interactions in the groundwater system downflow from the mined ore zones.

3.1.1 Groundwater Remediation

During mining, mineralogical and hydrochemical conditions within the ore zone are altered, with the introduction of highly oxidizing solutions and the solubilization of uraninite and other ore minerals. When the mining of the ore zone is complete, remediation/restoration of groundwater quality within the ore zone begins. The objective of groundwater remediation is to achieve water quality within the leached mine chamber/area that does not pose a risk to receptors at a point of exposure.

The restoration phase of ISR projects globally have generally involved one or more approaches/phases, which are discussed in Davis and Curtis, 2007 (NUREG/CR-6870).

a) Groundwater Sweep: after injection of mining fluids is stopped, water continues to be pumped from the ore zone through both production and injection wells. This results in native groundwater being drawn into the ISR mining area to replace the solution being pumped out, and thus, flushing the remnant mining solution from the ore zone.

b) Groundwater Recirculation with or without amendment(s): after mining stops, groundwater is recirculated through the ore zone, with above-ground treatment of COPCs, as required. Amendments can be added to the recirculation stream to re-establish specific, designed geochemical conditions within the leaching zone. Examples of amending chemicals may be pH-neutralizing or buffering agents (alkaline solutions) or oxygen scavenger solutions, to establish reducing conditions.

Restoration is complete when remediation goals are achieved. For the Project, remediation will continue until groundwater quality in the mining area, which is defined spatially in Section 4.1

and shown in Figure 4-1, meets acceptable levels. These acceptable levels are considered to be the 'Decommissioning objectives' (the EIS, Section 2)

3.1.2 Assimilative Capacity

The assimilative capacity of the subsurface system downgradient of an ISR project is important to understand when developing restoration goals for groundwater quality after remediation. Natural geological/groundwater systems are characterized by a range in ability to sequester – and naturally attenuate uranium and other COPCs. Processes that contribute to this sequestration and natural attenuation are discussed in more detail in the sections below, but include advection, dispersion, matrix diffusion and chemical reactions of the constituents with other constituents in groundwater and with the solid phase (the rock and soil matrix). These natural processes that, on a spatial and temporal basis, act to (physically) spread the mass of constituents and transfer dissolved mass to the solids. The result is a permanent or temporary removal of dissolved constituents from groundwater and overall reductions in dissolved groundwater concentrations with increasing distance from the source location. Along with active remediation of groundwater, as described in Section 3.1.1, the assimilative capacity of the system acts to attenuate (i.e., reduce) concentrations of mining-associated constituents, with the potential to reduce concentrations to levels that do not pose a risk in the receiving environment. In general, the natural system surrounding the Phoenix deposit has been shown, based on baseline water quality, and is predicted to have high assimilative capacity into the future.

Conservative constituents in groundwater are those that undergo no or limited chemical reactions and whose velocity in the system reflects advection and dispersion only. Dissolved chloride is a good example of a constituent with conservative behaviour and, along with other conservative constituents, can be used better understand the groundwater flow system. Other constituents, such as uranium, can undergo chemical reactions such that that transport of uranium in the subsurface away from a source can be limited.

3.1.3 Geochemical Assessment Framework

The geochemical assessment is presented as follows:

- characterization of the mineral composition of the geologic materials in the groundwater flow system (Section 3.2.1);
- characterization of groundwater (hydro)chemistry within and surrounding the mineralized zone under pre-mining conditions (Section 3.2.2). Engineering design and mitigation measures (i.e., the freeze wall) will maintain groundwater quality outside of the mining zone at baseline conditions;
- identification of constituents of potential concern (COPCs) and ranges of concentrations associated with the remediated groundwater after mining (Section 3.3); and

- a conceptualization of the chemical reactions and physical processes that will occur and may affect the COPC concentrations in the remediated groundwater during migration along the groundwater flow pathways post-decommissioning (Section 3.4).

All of the above are the foundation for geochemical modelling that simulates COPC migration and identifies key chemical reactions (Section 3.5) that were included in the 3D geochemical reactive modelling (Section 4.0).

3.2 Pre-Mining Existing Conditions

3.2.1 Mineralogical Composition

Understanding the mineralogical composition of the geologic materials, including overburden and bedrock units in the LSA is important for understanding existing groundwater chemistry, and for conceptualizing the fate and transport of chemicals in groundwater post-decommissioning. The mineralogical compositions, including the chemical formulae for minerals, of the major lithologic units for the Project are summarized in Table 3-1. The mineralogical and groundwater quality discussion in this section and the next, respectively, do not address the competent basement aquitard. The influence of this unit on groundwater flow conditions and quality is considered very limited due to the low permeability and storage (Section 2.3.2), and any influence is accounted for in the description and discussion of conditions in the paleoweathered zone.

The mineralogical compositions presented in Table 3-1 summarize the extensive data set collected by Denison from core at the site using a number of analytical techniques: elemental analysis, infrared mineral analysis (i.e., PIMA), electron microscopy (i.e. QEMSCAN) and petrography. Composite samples were collected from core material every 5-20 m through the Athabasca Supergroup Sandstones and discrete samples collected every 0.5 m within and proximal to the ore zone. Clay mineralogy was determined from the bulk geochemical composition of the samples (elemental analysis) using a normative clay calculation, as described in the Baseline Report. Mineralogy was further evaluated in a subset of location and depth intervals by infrared mineral analysis (i.e., PIMA) and/or petrography.

The mineralogy of each unit is broken down into major – representing ≥ 2% w/w components – and minor components. Minor components represent < 2% (w/w), but also classified with "minor" components are those that were identified by petrography, and those with a small number of samples results resulting in greater uncertainty about their relative proportions. The ore zone has complex mineralogy, including sulfide, oxide, carbonate, clay minerals and quartz. The upper and lower clay units, and the paleoweathered zone are dominated by clay minerals and quartz. The Athabasca Supergroup sandstones are dominated by quartz (greater than 90%), with smaller proportions of iron and clay minerals. The mineralogy of the overburden has not been evaluated in detail and is not presented in Table 3-1. Grain size analysis on several overburden samples collected as part of a drilling program at the site in 2020 indicate that clay minerals make up from 1-9% by weight.

Clay, iron mineral, and CaO (as a proxy for calcite, $CaCO_3$) content of the Athabasca Supergroup sandstones and paleoweathered zone are shown in Table 3-2. The lithologic units of the Athabasca Supergroup sandstones are shown (i.e., Manitou Falls Group formations; MFa, MFb, MFc, and MFd), but results have also been tabulated for the Desilicified zone in the inferred downgradient direction from the mining area. The borehole locations included in the downgradient Desilicified zone are shown in Figure 3-1. The Desilicified zone was included as a hydrogeologic unit to reflect groundwater flow conditions, through the Desilicified Zone, to the receiving environment.

The calcite content of all the lithologic units is low (generally <0.2% CaO). The content of iron (as Fe_2O_3) varies by lithologic unit, and median values are in the range of 0.1-1%, except for the paleoweathered zone, where the median hematite (Fe_2O_3) content is approximately 2%. The clay content, reflecting the normative clay calculated from elemental concentrations, also varies by lithologic unit, with median concentrations ranging from approximately 2-6% in the Athabasca Supergroup sandstones and approximately 50% in the paleoweathered zone. Within the Athabasca Supergroup sandstones, the Bird Formation (MFb) is the richest in clay minerals. The distribution of total clay into mineral phase indicates that illite dominates the clay mineral content in the Athabasca Supergroup sandstones and, while illite is still present, chlorite dominates the clay mineral content in the paleoweathered zone. Understanding of changes to the mineralogy of the ore zone post-mining gained from metallurgical testing is discussed in Appendix F.

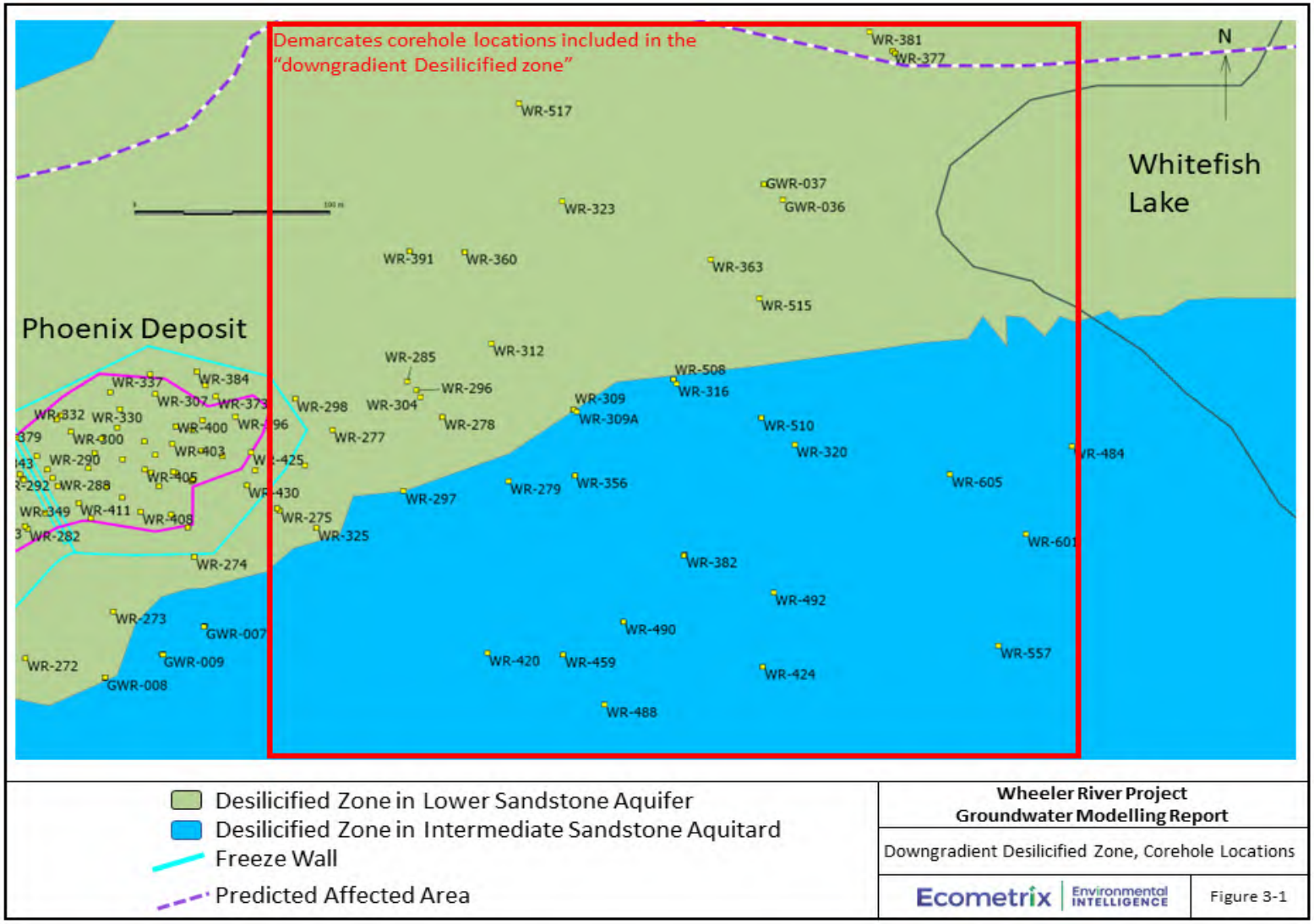


Figure 3-1: Downgradient Desilicified Zone, Corehole Locations

Table 3-1: Mineralogy by Unit

Unit	Mineral	Ideal Formula	Major (≥2% w/w)	Minor (< 2% w/w, or, shown to be present in Petrography or core logging)
Ore Zone	Pyrite	FeS2	X	
	Galena	PbS	X	
	Chalcopyrite	CuFeS2	X	
	Quartz	SiO2	X	
	Chlorite	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	
	Muscovite/Illite	KAl2(Si3Al)O10(OH;F)2	X	
	Kaolinite	Al2Si2O5(OH)4	X	
	Fe-oxy-hyroxides	FeO(OH)·nH2O	X	
	Uraninite	UO2	X	
	UO2.33	U3O7	X	
	UO2.25	U4O9	X	
	Schoepite	UO3:2H2O	X	
	Siderite	FeCO3	X	
	Fluorite	CaF2	X	
	Gersdorffite	NiAsS		X
	Nickeline	NiAs		X
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)		X
	Pyrrhotite	$Fe_{1-x}S$ (x=0-0.17)		X
	Sphalerite	(Zn,Fe)S		X
	Feldspar	KAlSi3O8		X
	Calcite	CaCO3		X
	Apatite	Ca5(PO4)3(F,Cl,OH)		X
	Corundum	Cr2O3		X
	APS Minerals	CaAl3(PO4)(PO3OH)(OH)6		X
Paleoweathered Basement	**Quartz**	SiO2	X	
	Chlorite	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	
	Illite	(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,(H2O)]	X	
	Kaolinite	Al2Si2O5(OH)4	X	
	Hematite	Fe2O3	X	
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)	X	
	Uraninite/Pitchblende	UO2		X
	Chalcopyrite	CuFeS2		X
	Pyrite	FeS2		X
	Galena	PbS		X
Upper and Lower Clay Zones	**Quartz**	SiO2	X	
	Chlorite	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	
	Illite	(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,(H2O)]	X	
	Kaolinite	Al2Si2O5(OH)4	X	
	Hematite	Fe2O3	X	
	Uraninite/Pitchblende	UO2	X	
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)		
	Uranophane	Ca(UO2)2(SiO3OH)2:5H2O		X
	Graphite	C		X
	Carbonates	various		X
	Chalcopyrite	CuFeS2		X
	Pyrite	FeS2		X
Athabasca Group sandstones	**Quartz**	SiO2	X	
	Hematite	Fe2O3	X	
	Chlorite[a]	(Fe,Mg)2(Al;Fe3+)3Si3AlO10(OH)8	X	X
	Illite[a]	(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,(H2O)]	X	X
	Kaolinite[a]	Al2Si2O5(OH)4	X	X
	Dravite	NaMg3Al6(Si6O18)(BO3)3(OH)3(OH)		X
	Pyrite/Sooty Pyrite	FeS2		X

Notes

Uraninite Indicates dominant minerals; can be present at values exceeding 40% w/w

Chlorite Indicates that the clay minerals bolded, combined, represent a dominant mineral group (i.e. > 40% w/w)

[a] In the Athabasca Group sandstones, the relative dominance of the clay minerals varies by HU. The individual and combined clay minerals do not always represent a major mineral group.

Table 3-2: CaO, Fe Oxide and Clay Content of the Athabasca Supergroup sandstones and Paleoweathered Zone

Lithologic Unit	Number of Samples (CaO and Fe2O3, %)	Number of Samples (Clay %)	Statistic	Elemental Analysis (wt % in sediment/rock)		Normative Clay (wt % in sediments/rock)[b]					PIMA (% of total clay content)[c]			
				CaO (%, Total)	Fe2O3 (%, Total)[a]	Clays (%)	Kaolinite (%)	Illite (%)	Dichlorite (%)	Dravite (%)	Illite (%)	Chlorite (%)	Kaolinite (%)	Dravite1 (%)
Overburden	8	84	Max	0.21	0.38	6.7	3.63	5.23	2.17	0.62	Data Not Collected			
			Min	0.005	0.03	0.20	0.00	0.06	0.00	0.01				
			Median	0.165	0.28	1.74	0.29	1.06	0.04	0.03				
			Average	0.14	0.26	1.94	0.47	1.22	0.25	0.08				
			Standard Deviation	0.063	0.10	1.23	0.52	0.94	0.47	0.11				
MFd	3077	3556	Max	0.71	1.7	39.6	17.2	24.4	15.2	8.03				
			Min	0.005	0.02	0.02	0.00	0.00	0.00	0.00				
			Median	0.005	0.05	2.05	0.32	1.45	0.00	0.28				
			Average	0.009	0.085	2.27	0.47	1.49	0.30	0.45				
			Standard Deviation	0.014	0.120	1.45	0.76	1.20	0.66	0.53				
MFc	8532	9065	Max	1.44	9.1	60.5	18.9	46.1	27.8	16.3				
			Min	0.005	0.02	0.03	0.00	0.00	0.00	0.00				
			Median	0.01	0.29	3.76	0.44	2.60	0.08	0.30				
			Average	0.02	0.52	4.08	0.84	2.73	0.49	0.66				
			Standard Deviation	0.02	0.60	2.50	1.23	1.96	1.17	0.99				
MFb	6086	7115	Max	2.48	7.23	64.3	32.61	31.95	52.59	21.60				
			Min	0.005	0.04	0.03	0.00	0.00	0.00	0.00				
			Median	0.02	0.89	5.85	0.95	4.17	0.00	0.17				
			Average	0.02	1.10	6.23	1.56	4.24	0.41	0.51				
			Standard Deviation	0.06	0.87	3.28	1.99	2.20	2.12	1.07				
MFa	10436	10817	Max	3.74	25.8	68.0	34.2	38.2	63.7	45.0				
			Min	0.005	0.01	0.03	0.00	0.00	0.00	0.00				
			Median	0.01	0.14	3.53	0.67	1.74	0.20	0.33				
			Average	0.021	0.52	4.76	1.16	2.67	0.93	1.00				
			Standard Deviation	0.056	1.08	4.73	1.94	2.95	2.79	2.03				
MFa in Downgradient DSZ	510	542	Max	0.28	5.77	41.3	28.8	17.0	20.9	9.22				
			Min	0.005	0.03	0.40	0.00	0.00	0.00	0.01				
			Median	0.02	0.09	2.62	0.51	0.42	1.18	0.15				
			Average	0.021	0.30	3.96	0.78	1.66	1.52	0.52				
			Standard Deviation	0.022	0.64	3.95	1.70	2.55	1.89	1.23				
Downgradient Desilicified Zone, All Units	1376	1459	Max	0.28	6.73	41.3	28.8	17.0	20.9	9.2				
			Min	0.005	0.03	0.30	0.00	0.00	0.00	0.01				
			Median	0.02	0.23	4.14	0.47	2.42	0.64	0.17				
			Average	0.019	0.58	4.63	0.79	2.94	0.90	0.47				
			Standard Deviation	0.017	0.78	3.05	1.28	2.60	1.36	0.89				
Paleoweathered Zone	109	109	Max	10.1	23.598	67.1	17.9	36.0	65.3	43.3	98.5	95.4	21.1	11.1
			Min	0.1	0	2.81	0.00	0.00	0.00	0.06	0	1.5	0	0
			Median	0.29	2.05	47.1	0.00	9.20	35.5	0.97	13.1	69.5	NC[d]	NC[e]
			Average	0.61	3.4	48.5	1.70	10.10	36.7	1.67	28.1	64.5	NC[d]	NC[e]
			Standard Deviation	1.51	4.2	10.4	3.60	7.60	12.60	4.10	33.2	30	NC[d]	NC[e]

Notes

[a] Iron oxide content for the paleoweathered zone is % Hematite (vs. total iron as Fe_2O_3)

[b] Normative clay values for predominantly basement-hosted paleoweathered zone may be erroneous due to variable host lithology chemistry

[c] The number of samples analyzed by PIMA for the paleoweathered zone was 9 (i.e., n= 9)

[d] Kaolinite was only detected in 3 samples in the paleoweathered zone using PIMA, and was "0" in all other samples. A. Median, average and standard deviation values were not calculated.

[e] Dravite was only detected in 1 sample in the paleoweathered zone using PIMA, and was "0" in all other samples. A. Median, average and standard deviation values were not calculated.

3.2.2 Hydrochemistry

Groundwater monitoring for the projects has occurred in a network of 21 discrete interval groundwater monitoring wells. The monitoring wells and the lithostratigraphy and hydrostratigraphic unit in which they are installed is summarized in Table 3-3. Groundwater quality collected to date in each well is provided in Appendix D.

Table 3-3: Existing Groundwater Monitoring Network for the Wheeler River Project

Well Name	Lithologic Unit	Hydrostratigraphic Unit
GWR-003	Overburden	Overburden Aquifer
GWR-005	Overburden	Overburden Aquifer
GWR-006	Overburden	Overburden Aquifer
GWR-008	MFa	Lower Sandstone Aquifer/Desilicified Zone
GWR-009	MFb	Intermediate Sandstone Aquitard/ Desilicified Zone
GWR-011	MFa	Lower Sandstone Aquifer/ Desilicified Zone
GWR-012	MFa	Lower Sandstone Aquifer/ Desilicified Zone
GWR-013	MFb	Intermediate Sandstone Aquitard/ Desilicified Zone
GWR-014	MFc	Intermediate Sandstone Aquitard/ Desilicified Zone
GWR-025	MFa	Lower Sandstone Aquifer
GWR-029	MFa	Lower Sandstone Aquifer
GWR-031	Ore and Barrier Zones	Paleoweathered Zone
GWR-032	MFa, Ore Zone, Barrier Zones, Basement Aquifer	Ore Zone
GWR-033	MFa	Lower Sandstone Aquifer
GWR-034	MFb	Intermediate Sandstone Aquitard
GWR-035	Overburden/MFd	Upper Sandstone Aquifer
GWR-036	Overburden	Overburden Aquifer
GWR-037	MFd	Upper Sandstone Aquifer/ Desilicified Zone
GWR-046	MFc	Intermediate Sandstone Aquitard
GWR-047	MFb	Lower Sandstone Aquifer/ Desilicified Zone
GWR-048	MFa	Lower Sandstone Aquifer

The GWR-series wells were installed in all lateral directions around the ore zone. The well network is shown in Figure 3-2. For the most part, the wells occur in clusters of three, with installations targeting the a) the Overburden and Upper Sandstone Aquifers (overburden, MFd, and upper MFc); b) the Intermediate Sandstone Aquitard (lower MFc and upper MFb), and c) the Lower Sandstone Aquifer (Lower MFb and MFa). Overlying the Phoenix deposit there are also five discrete interval monitoring wells that were sampled as part of the baseline program. These wells are GWR-011 (MFa) and GWR-013 (MFb), GWR-046 (MFc), GWR-047 (MFb), and GWR-048 (MFa). Groundwater quality within the mineralized zone is sampled in well GWR-032. The screened interval for GWR-031 straddles the paleoweathered zone, ore zone and the Basement Aquitards.

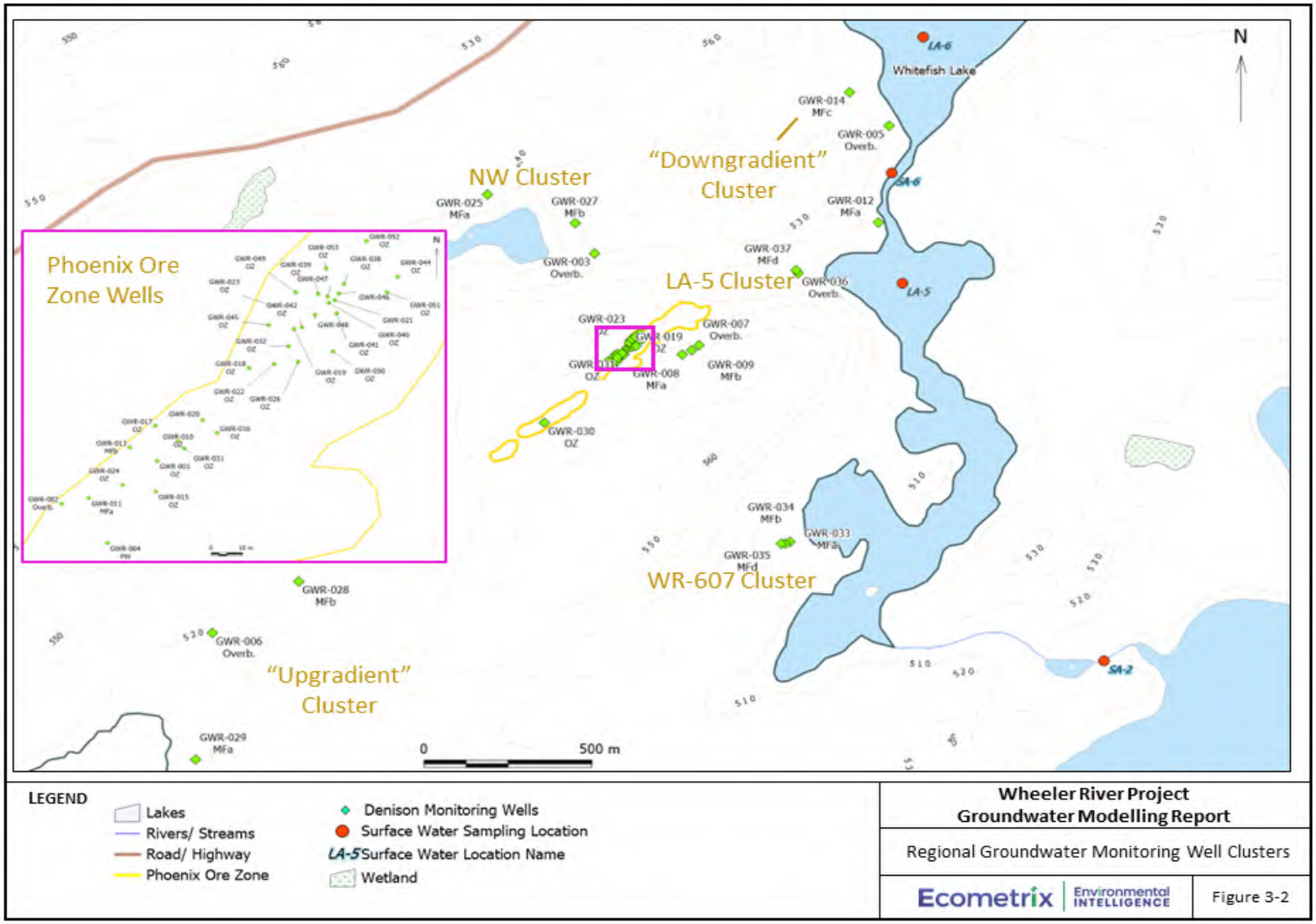


Figure 3-2: Regional Groundwater Monitoring Well Clusters

To evaluate the groundwater chemistry at the site, basic statistics were prepared and groundwater hydrochemical types were presented in the Baseline Report. Characterization of geochemical conditions in groundwater in the hydrostratigraphic units was further evaluated herein in support of geochemical modelling by examining pH and redox-dependent speciation of major constituents, using Pourbaix (pH-pe) diagrams.

Generally, groundwater associated with the Athabasca Supergroup sandstones and overburden is of circumneutral pH, with total dissolved solids (TDS) typically less than 250 mg/L, and alkalinity concentrations in the rang of 10 to126 mg/L (Appendix D). Groundwater in the ore zone is circumneutral, with TDS values greater than 500 mg/L and with, higher concentrations of radionuclides and some metals/trace elements than are measured in hydrostratigraphic units within the Athabasca Supergroup sandstones and overburden.

Summary statistics, including maximum, minimum and median concentrations in groundwater by hydrostratigraphic unit are provided as Table 3-4. In addition to the groundwater results, analytical results for surface water samples collected as part of the Wheeler River Project: Baseline Aquatic Environment Study (EcoMetrix, 2020) are also included, so that the quality of groundwater can be compared to that in surface water in the region surrounding the Phoenix deposit.

Table 3-4: Summary Statistics, Groundwater and Surface Water Quality, Wheeler River Project

Well Cluster	Units	Ore Zone (OZ)				Paleoweathered Zone (PWZ)				Lower Sandstone Aquifer (MFa)				Intermediate Sandstone Aquitard (MFb and MFc)[a]				Local Groundwater Flow System (OB and MFd)				Surface Water[b,c]				Constituent "Group"
		Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	
Field Parameters																										
Field pH	pH units	2	6.83	6.79	6.81	2	7.21	7.03	7.12	13	8.70	6.08	7.02	5	10	6.4	7.4	12	7.5	5.9	6.5	-	-	-	-	(2) 3*
Field Temp.	°C	2	19	8.0	13	2	17	11.3	14	13	18	3.6	7.5	6	10	3.3	8.1	12	15	3.4	5.0	-	-	-	-	See note d
Field Conductivity	µS/cm	2	1486	737	1112	2	1162	588	875	13	1392.0	56.7	144.8	6	362	97	227	12	98	17	46	-	-	-	-	(2) 3*
ORP	mV	-	-	-	-	-	-	-	-	1	-57.5	-57.5	-	2	51	-85	-17	-	-	-	-	-	-	-	-	
Field SPC	µS/cm	2	1683	958	1321	2	1374	789	1082	13	2315	87.6	219	6	618	138	334	12	151	28	77	-	-	-	-	2
Field TDS	mg/L	2	1094	623	859	2	893	513	703	13	1505	0.11	142	6	402	0	218	12	98	18	53	-	-	-	-	2
Analytical Results																										
Bicarbonate	mg/L	3	174	118	155	2	167	160	164	13	112	29	51	6	188	75.20	85.7	12	35	12	24	32	20	2.0	8.1	2
Carbonate	mg/L	3	<1	<1	-	2	<1	<1	-	13	<1	<1	-	6	18	<1	-	12	<1	<1	-	32	<1	<1	-	2
Chloride	mg/L	3	234	202	220	2	151	145	148	13	319	2.7	7.4	6	8.6	<1	0.85	12	10	<0.1	0.90	32	0.80	0.10	0.37	2
Hydroxide	mg/L	3	<1	<1	-	2	<1	<1	-	13	<1	<1	-	6	<1	<1	-	12	<1	<1	-	32	<1.1	<1	-	See note e
P. alkalinity	mg/L	3	<1	<1	-	2	<1	<1	-	12	<1	<1	-	4	15	<1	-	12	<1	<1	-	32	<1.1	<1	-	See note e
pH	pH units	3	7.52	7.33	7.40	2	7.83	7.36	7.60	13	7.83	6.90	7.34	6	9.1	7.1	7.64	12	7.32	6.38	6.90	32	7.17	6.33	6.8	See note e
Specific conductivity	µS/cm	3	1000	860	965	2	810	686	748	13	1110	68	139	6	289	141	183	12	71	19	43	32	42	12	18	See note e
Sum of ions	mg/L	3	598	504	566	2	504	439	472	12	610	54	142	4	252	126	164	12	75	20	44	32	25	6.0	13	See note e
Total alkalinity	mg/L	3	143	97	127	2	137	131	134	13	92	24	42	6	154	62	81	12	29	10	20	31	16	2.0	6.9	See note e
Total hardness	mg/L	3	267	182	256	2	190	148	169	13	283	17	43	6	104	29	66	12	32	6.0	12	31	12	4.0	5.3	See note e
Ammonia as nitrogen	mg/L	2	1	0.31	0.5	2	0	0.05	0.2	13	0.35	<0.005	0.12	6	3.4	<0.005	0.05	12	0.17	<0.01	0.02	32	1.2	<0.01	-	2
N)	mg/L	3	0.04	<0.04	-	2	<0.04	<0.04	-	13	<0.04	<0.02	-	6	0.13	<0.02	-	12	0.49	<0.04	-	32	0.25	<0.04	-	1
Nitrite	mg/L	2	<0.03	<0.03		2	<0.03	<0.03	-	13	<0.03	<0.01	-	6	0.23	<0.01	-	12	0.05	<0.03	-	-	-	-	-	1
Nitrite+Nitrate as nitrogen	mg/L	2	0.01	<0.01	-	2	<0.01	<0.01	-	13	<0.01	<0.01	-	6	0.05	<0.01	-	12	0.11	<0.01	-	-	-	-	-	1
Ortho-phosphate as P	mg/L	2	0.01	<0.01	-	2	0.01	<0.01	-	12	0.16	<0.01	0.08	4	0	0.005	0.06	12	0.14	0.01	0.05	-	-	-	-	1
Organic carbon, dissolved	mg/L	2	36	6	21	2	68	6	37	13	16	1.0	2.0	6	35	2.0	13.5	12	3.9	0.40	1.2	32	8.40	1.50	2.4	2
Iron (II)		1	0.04	0.04	-	1	<0.02	<0.02	-	3	2.30	0.02	0.09	4	7.8	<0.02	-	4	0.07	<0.02	0.03					2
Fluoride	mg/L	3	0.23	0.19	0.22	2	0.42	0.32	0.37	13	0.24	0.01	0.14	6	0.2	0.06	0.08	12	0.14	0.01	0.04	32	0.06	0.01	0.02	2
Total dissolved solids	mg/L	3	639	599	628	2	536	393	465	13	653	59	122	6	264	132	169	12	199	45	65	32	35.00	11.00	23.17	See note e
Total suspended solids	mg/L	2	17	11.0	14	2	41	5.0	23	12	171	0.5	9.0	4	208	13.0	19	12	838	1.00	19	32	23.00	<1.5	-	1
Calcium	mg/L	3	84	55	78	2	58	43	51	13	84	4.7	13	6	33	8.2	23	12	5.2	1.2	2.8	32	3.50	1.00	1.39	2
Magnesium	mg/L	3	15	11.0	14	2	11	9.9	10	13	18	1.2	2.6	6	7.6	0.40	2.6	12	4.7	0.4	1.1	32	0.70	0.30	0.40	2
Potassium	mg/L	3	6	4.6	5.4	2	6	5.3	5.4	13	4.4	1.5	2.1	6	7	1.2	4	12	5.3	0.3	1.4	32	0.80	0.10	0.35	2
Sodium	mg/L	3	83	75	81	2	71	69	70	13	83	5.3	8.9	6	23	9.0	17	12	12	1.7	3.9	32	1.85	1.14	1.51	2
Sulfate	mg/L	3	30	8.0	13	2	40	6.6	23	13	67	0.70	5.9	6	10	2.3	4.7	12	8.0	0.90	3.8	32	8.30	0.30	0.68	2

Notes

	Shading is used to highlight median values
	Shading is used to indicate "Group 1" constituents - see text for details.
	Shading is used to indicate "Group 2" constituents - see text for details.
	Shading is used to indicate "Group 3" constituents - see text for details.
-	Indicates where median values were not calculated. Median values were only calculated when the frequency of detection for the constituent exceeded 50% of the samples from each group. Where values were below detection, the detection limit was used to calcualate median values.
	Blank Cells mean the constituent was not measured
a	Sample GWR-034 was not included in the summary statistics, as the groundwater was influenced by drilling fluids and additives and is not reflective of natural groundwater.
b	The surface water samples include all 32 lake and stream sample locations reported in Ecometrix, 2020 (Wheeler River Project: Baseline Aquatic Environment Study). Surface water quality at each location was measured on 1-6 occasions. Arithmetic mean values were reported in Ecometrix, 2020 at each location were used herein (i.e. the reported "max" value is the maximum arithmetic mean value, etc.,). This was considered acceptable for the comparison only purposes within this report.
c	Metal and trace element concentrations in the surface water samples are for Total concentrations, not disssolved.
d	Temperature and Dissolved oxygen are likely to be influenced to some extent by ambient conditions, and are thus not considered further in the interpretation of groundwater conditions at the Site.
e	These constituents are considered part of Group 2 but are not discussed further in the interpretation of groundwater conditions at the site because they are correlated to or represented by other parameters being carried forward (e.g. Fe^{2+} by Dissolved Iron; laboratory-measured TDS by field-measured TDS, etc.)
f	U-234 was calculated from U-238 assuming secular equilibrium. This assumption may not hold in the groundwater flow systems. This constittuent is not considered further in the interpretation of groundwater condtions at the Site.
g	Tritium concentrations were very low, with the exception of the ore zone and paleoweathered zone groundwater samples.

Table 3-4: Summary Statistics, Groundwater and Surface Water Quality, Wheeler River Project (continued)

Well Cluster	Units	Ore Zone				Paleoweathered Zone (PWZ)				Lower Sandstone Aquifer (MFa)				Intermediate Sandstone Aquitard (MFb and MFc)[a]				Local Groundwater Flow System (OB and MFd)				Surface Water[b,c]				Constituent "Group"
		Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	Number	Max	Min	Median	
Aluminum, dissolved	mg/L	3	0.21	0.0006	0.01	2	0.0025	0.0005	-	13	0.05	<0.0005	0.002	6	0.8	0.003	0.02	12	0.48	<0.0005	0.01	32	0.028	0.001	0.005	(1) 3*
Antimony, dissolved	mg/L	3	0.00	<0.002	-	2	<0.002	<0.002	-	13	0.001	<0.0001	-	6	0.0007	<0.0001	-	12	<0.0002	<0.0002	-	32	0.00	<0.0002	-	1
Arsenic, dissolved	ug/L	3	3.40	0.2	0.3	2	1.20	1.00	1.1	13	4.1	<0.1	0.20	6	11	0.50	2.3	12	1.4	0.1	0.35	32	0.0003	<0.0001	-	(1) 3*
Barium, dissolved	mg/L	3	0.09	0.063	0.08	2	0.05	0.035	0.04	13	0.25	0.005	0.06	6	0.2	0.06	0.13	12	0.02	0.01	0.01	32	0.01	<0.00215	0.00	1
Beryllium, dissolved	mg/L	3	0.00	<0.0001	-	2	<0.001	<0.001	-	13	<0.0001	<0.00002	-	6	0.0002	<0.00002	-	12	0.0001	<0.0001	-	32	0.00	<0.0001	-	1
Bismuth, dissolved	mg/L	2	<0.002	<0.002	-	2	<0.002	<0.002	-	13	<0.0002	<0.00005	-	6	<0.0002	<0.00005	-	12	<0.0002	<0.0002	-	-	-	-	-	1
Boron, dissolved	mg/L	3	0.6	0.43	0.58	2	0.6	0.50	0.53	13	0.40	0.03	0.04	6	0.02	<0.01	0.02	12	0.03	<0.01	-	32	<0.01	<0.01	-	2
Bromine	µg/L	2	2300	2000	2150	2	1500	1100	1300	13	3600	34	100	6	34	<5	6.0	12	79	5.0	-	-	-	-	-	2
Cadmium, dissolved	mg/L	1	0.00001	<0.00001	-	2	<0.0001	<0.0001	-	13	<0.00001	<0.000005	-	6	0.00003	<0.000005	-	12	0.00005	<0.00001	0.00001	31	0.00	<0.00001	-	(1) 3*
Chromium, dissolved	mg/L	3	0.013	<0.0005	0.001	2	0.009	0.001	0.005	13	0.0007	<0.0005	-	6	0.0058	<0.0005	-	12	<0.0005	<0.0005	-	32	<0.0005	<0.0005	-	3
Cobalt, dissolved	mg/L	3	0.0007	<0.0001	0.00	2	0.0020	0.0002	0.00	13	0.0005	<0.0001	-	6	0.01	<0.0001	0.0002	12	0.001	<0.0001	0.0004	32	0.00	<0.0001	-	(1) 3*
Copper, dissolved	mg/L	3	<0.0002	<0.0002	-	2	<0.002	<0.002	-	13	0.002	<0.0002	-	6	0.01	<0.0002	0.0009	12	0.002	<0.0002	0.001	32	0.00	<0.0002	-	(1) 3*
Iron, dissolved	mg/L	3	6.4	3.83	4.2	2	3.6	0.09	1.8	13	16	0.01	2.8	6	15	0.01	3.05	12	4.8	0.01	0.41	32	9.50	0.01	0.10	(1) 3*
Lead, dissolved	mg/L	3	0.0005	<0.0001	0.0003	2	0.0010	<0.0001	-	13	0.0002	<0.00005	-	6	0.00157	<0.00005	-	12	0.0002	<0.0001	-	32	<0.00012	<0.0001	-	(1) 3*
Lithium, dissolved	µg/L	2	75	65	70	2	90	89	90	13	40	9.9	14	6	14	6.20	9.0	12	11	0.8	6.3	-	-	-	-	1
Manganese, dissolved	mg/L	3	0.2	0.20	0.2	2	0.2	0.13	0.2	13	2.6	0.085	0.4	6	3.9	0.0018	1.18	12	0.2	0.04	0.1	32	0.34	0.003	0.013	2
Molybdenum, dissolved	mg/L	3	0.08	0.004	0.01	2	0.06	0.01	0.04	13	0.03	<0.0001	0.001	6	0.01	0.0024	0.004	12	0.003	0.0001	0.0008	32	<0.00011	<0.0001	-	(1) 3*
Nickel, dissolved	mg/L	3	0.01	0.00	0.00	2	0.04	0.00	0.02	13	0.001	<0.0001	0.0002	6	0.05	0.0006	0.002	12	0.010	<0.0001	0.002	32	0.0003	<0.0001	-	(1) 3*
Selenium, dissolved	mg/L	3	0.0001	0.0001	0.0001	2	<0.001	<0.0001	-	13	0.0011	<0.00005	0.0001	6	0.0004	<0.0001	-	12	0.0008	<0.0001	-	32	<0.0001	<0.0001	-	(1) 3*
Silica, soluble, dissolved	mg/L	2	14	13.3	13	2	10	9.1	10	13	26	11	18	6	30	11.8	16	12	35	17	22	-	-	-	-	2
Silver, dissolved	mg/L	2	0.00005	<0.00005	-	2	<0.0005	<0.0001	-	13	<0.00005	<0.00001	-	6	0.00005	<0.00001	-	12	0.0001	<0.0001	-	32	<0.00005	<0.00005	-	1
Strontium, dissolved	mg/L	3	3	1.7	2.4	2	1	1.2	1.3	13	2.19	0.10	0.17	6	0.26	0.08	0.13	12	0.06	0.01	0.02	32	0.02	0.01	0.01	2
Sulfur	mg/L	2	4	2.7	4	2	13	2.2	8	13	22	0.2	2.0	6	8.7	0.80	1.6	12	2.7	0.30	1.3	-	-	-	-	See note e
Thallium, dissolved	mg/L	3	<0.002	<0.002	-	2	<0.002	<0.002	-	13	<0.0002	<0.00001	-	6	<0.0002	<0.00001	-	12	<0.0002	<0.0002	-	32	<0.0002	<0.0002	-	1
Tin, dissolved	mg/L	3	<0.0001	<0.0001	-	2	<0.001	<0.0001	-	13	<0.0001	<0.0001	-	6	0.0003	<0.0001	-	12	<0.0001	<0.0001	-	32	0.0007	<0.0001	-	1
Titanium, dissolved	mg/L	3	0.0003	<0.0002	-	2	<0.002	<0.0002	-	13	0.0004	<0.0002	-	6	0.009	<0.0002	-	11	0.005	<0.0002	-	32	0.0008	<0.0002	-	1
Vanadium, dissolved	mg/L	3	0.0074	<0.0001	0.0004	2	0.0005	<0.0001	-	13	<0.0005	<0.0001	-	6	0.002	<0.0005	-	12	0.0004	<0.0001	-	32	0.0005	<0.0001	-	3
Zinc, dissolved	mg/L	3	5	2.62	2.9	2	18	0.69	9.5	13	0.015	0.001	0.003	6	0.0	0.0007	0.001	12	0.010	0.001	0.004	32	0.0014	<0.0005	-	3
Phosphorus, dissolved	mg/L	2	<0.01	<0.01	-	2	<0.1	<0.01	-	13	0.29	<0.01	0.06	6	0	<0.05	0.06	12	0.06	<0.01	-	30	0.15	<0.01	-	1
Radionuclides																										
Uranium, dissolved	µg/L	3	299	5.7	11	2	50	17.0	34	13	9.0	0.10	0.70	6	55	0.30	11.60	12	5.8	<0.1	0.5	32	<0.0001	<0.0001	-	3
Uranium-234 calculated	Bq/L	2	2	0.21	0.95	2	11	0.46	5.58	12	0.36	0.001	0.01	4	11	0.02	0.2	12	0.1	0.001	0.0	-	-	-	-	See Note f
Uranium-238 calculated	Bq/L	2	2	0.21	0.95	2	11	0.46	5.58	12	0.36	0.001	0.01	4	11	0.02	0.2	12	0.1	0.001	0.01	32	<0.025	<0.02	-	3
Lead-210	Bq/L	3	3300	1200	2200	2	7300	1100	4200	13	0.66	0.01	0.1	6	8.0	0.08	1.0	12	0.60	<0.02	0.08	32	0.02	<0.005	-	3
Polonium-210	Bq/L	3	260	110	120	2	650	460	555	13	1.3	0.02	0.2	6	13	0.03	0.6	12	0.22	0.02	0.1	32	0.01	<0.005	-	3
Radium-226	Bq/L	3	400	180	300	2	120	76	98	13	1.6	0.07	0.3	6	17	0.06	0.3	12	0.36	0.02	0.1					3
Radon-222	Bq/L	3	3800000	400000	2700000	2	12000000	5900	6002950	13	620	<3	10	6	1800	<4	11	12	86	<5	20	28	<0.013	<0.01	-	3
Thorium-230	Bq/L	3	14	2.0	7.0	2	30	1.1	15.6	13	0.30	<0.01	0.01	6	4.70	<0.01	0.1	12	0.12	<0.01	-					3
Tritium	Bq/L	2	1800	950	1375	2	910	<15	-	13	0.5	0.1	-	6	19	0.1	1.0	12	1.1	0.10	-	-	-	-	-	See Note g

Notes

	Shading is used to highlight median values
	Shading is used to indicate "Group 1" constituents - see text for details.
	Shading is used to indicate "Group 2" constituents - see text for details.
	Shading is used to indicate "Group 3" constituents - see text for details.
(1) 3*	Indicates where a groundwater constituent was categorized as a Group 1 (or 2) constituent based on baseline groundwater quality, but was given a final categorization as a Group 3 constituent based on other information.
-	Indicates where median values were not calculated. Median values were only calculated when the frequency of detection for the constituent exceeded 50% of the samples from each group. Where values were below detection, the detection limit was used to calcualate median values.
	Blank Cells mean the constituent was not measured
a	Sample GWR-034 was not included in the summary statistics, as the groundwater was influenced by drilling fluids and additives and is not reflective of natural groundwater.
b	The surface water samples include all 32 lake and stream sample locations reported in Ecometrix, 2020 (Wheeler River Project: Baseline Aquatic Environment Study). Surface water quality at each location was measured on 1-6 occasions. Arithmetic mean values were reported in Ecometrix, 2020 at each location were used herein (i.e. the reported "max" value is the maximum arithmetic mean value, etc.,). This was considered acceptable for the comparison only purposes within this report.
c	Metal and trace element concentrations in the surface water samples are for Total concentrations, not disssolved.
d	Temperature and Dissolved oxygen are likely to be influenced to some extent by ambient conditions, and are thus not considered further in the interpretation of groundwater conditions at the Site.
e	These constituents are considered part of Group 2 but are not discussed further in the interpretation of groundwater conditions at the site because they are correlated to or represented by other parameters being carried forward (e.g. Fe^{2+} by Dissolved Iron; laboratory-measured TDS by field-measured TDS, etc.)
f	U-234 was calculated from U-238 assuming secular equilibrium. This assumption may not hold in the groundwater flow systems. This constittuent is not considered further in the interpretation of groundwater condtions at the Site.
g	Tritium concentrations were very low, with the exception of the ore zone and paleoweathered zone groundwater samples.

Examining the median values, three constituent "groups" emerged. These groupings are color coded in Table 3-4.

Group 1: This group, highlighted in pale green highlighting in Table 3-4, includes constituents for which concentrations in groundwater in all the hydrostratigraphic units and surface water did not vary significantly. This group generally included constituents present in low concentrations, often at or below analytical detection limits, and were not discussed further when interpreting baseline groundwater quality conditions for the Project in the Baseline Report.

Group 2: This group, highlighted by pale yellow shading in Table 3-4 includes general groundwater quality indicators, and select trace elements. Concentrations of this group of constituents informs the conceptualization of the groundwater flow systems at the Site.

Group 3: This group, highlighted in blue in Table 3-4, primarily includes radionuclides, but also some trace elements (Cr, V, and Zn). Median concentrations/activities of Group 3 constituents in the ore zone groundwater samples are generally more than two orders of magnitude higher than those in the Athabasca Supergroup sandstone and overburden hydrostratigraphic units. Elevated levels of these constituents are, like those of radionuclides, attributed to the mineralogy and geochemical conditions within the ore zone.

Median concentrations/activities of Group 3 constituents in the ore zone groundwater samples are generally more than two orders of magnitude higher than those in the Athabasca Sandstone Supergroup and overburden hydrostratigraphic units. The apparent attenuation of dissolved-phase constituents associated with the ore zone groundwater reflects the existing assimilative capacity and aquitard nature of the barrier zone, containing clay and sulphide minerals that cement the rock particles and which overlies and underlies the ore body. The resulting low flux of water and chemical constituents in groundwater from the ore zone to Semi-Regional and Shallow Flow systems, and ultimately to surface water is controlled by the clay barrier zone.

3.2.2.1 Hydrochemical Type, pH and Redox Conditions

The hydrochemical type for the groundwaters in the groundwater system are shown in Figure 3-3, and are interpreted to indicate:

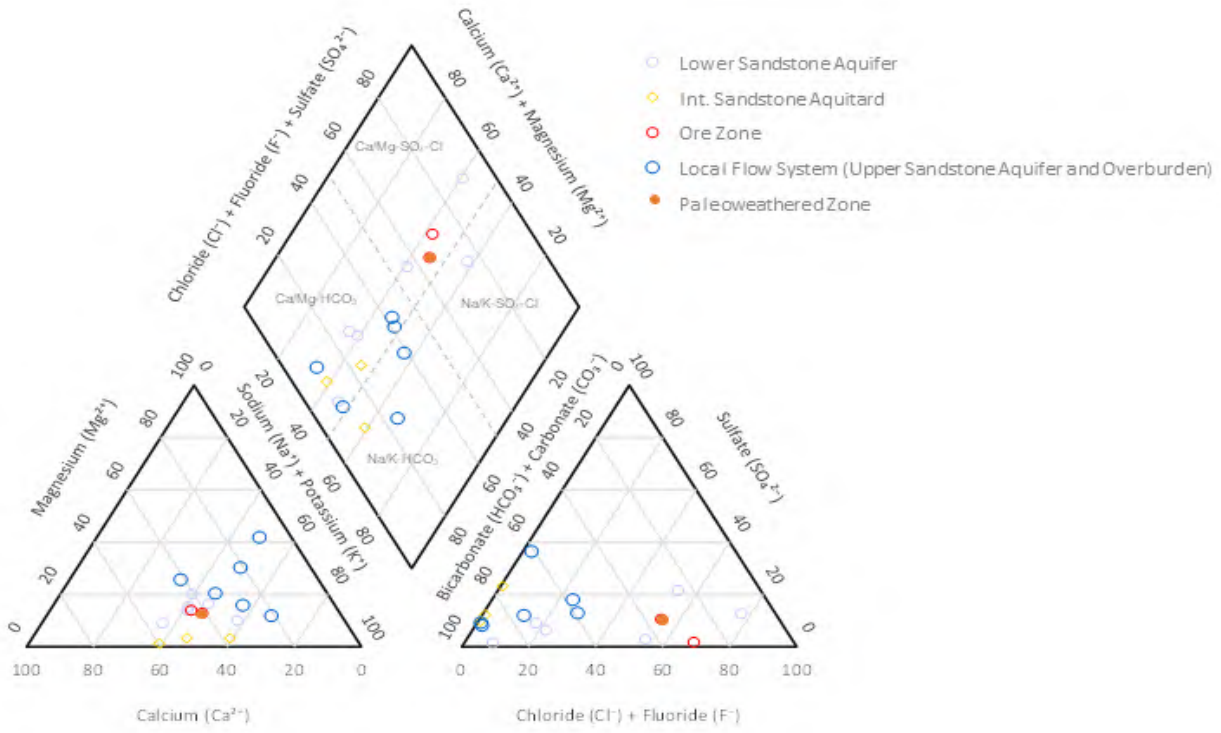
1) Groundwaters in the Upper Sandstone Aquifer and overburden materials are of Ca-Na-HCO3 or Na-Ca-HCO3 type, and also contain Mg, K and sulphate. The groundwater chemistry reflects relatively fresh recharge water that becomes mineralized through the dissolution of quartz, feldspars, kaolinite and illite (AECL, 1994). Groundwater in the Intermediate Sandstone Aquitard and parts of the Lower Sandstone Aquifer also show these dominant hydrochemical types, reflecting the relatively uniform mineralogical composition in the MFa, MFb, MFc, MFd Formations. The low mineralization groundwater in the Lower Sandstone Aquifer is interpreted to be a result of fracture/fault conditions, such that some areas of the MFa are characterized by younger/recharge groundwaters.

2) There is a shift to higher mineralization and to a hydrochemical type more dominated by chloride (i.e., fall within the Ca/Mg-SO4-Cl quadrant of the Piper Diagram in Figure 3-3), areas of the Lower Sandstone aquifer, cross-gradient and downgradient of the uranium deposit. The higher chloride content occurs where the MFa has been interpreted to have been affected by hydrothermal alteration/desilicification. In this zone, prior work at Cigar Lake has attributed higher salinity groundwater in the MFa to the presence of remnant halides associated with the hydrothermal alteration (AECL, 1994).

3) Groundwater in the paleoweathered zone and ore zone also have higher chloride and sulphate concentrations relative to the fresher water in the Athabasca Supergroup sandstone units. This is interpreted as reflecting the different mineralogy in these zones, and the longer residence times and lower volumetric flow rates through these zones in comparison to the Athabasca rSupergoup sandstones.

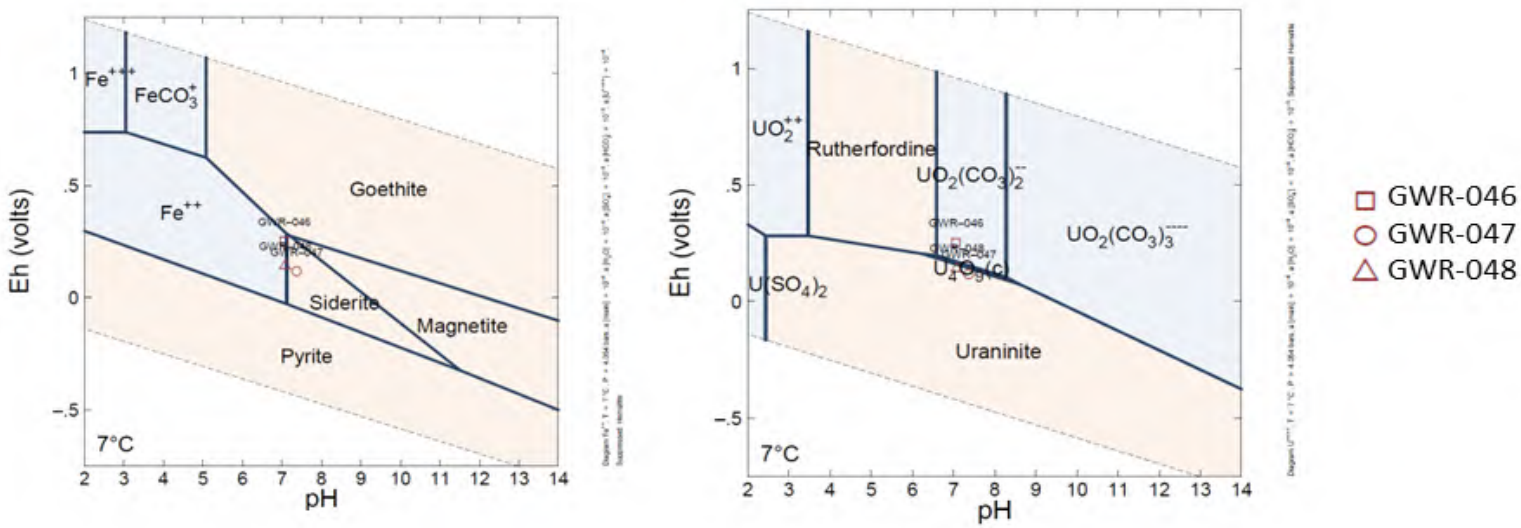
Redox Conditions: Iron is a major constituent of the groundwater in the system, with concentrations reaching greater than10 mg/L in some of the monitoring wells. Dissolved Fe concentrations greater than 1 mg/L suggest that ferrous ion (Fe^{2+}) is present, and that the groundwater is anoxic or devoid of oxygen. Groundwater is anoxic and mildly reducing across the majority of the system, with moderately to strongly reducing conditions observed only in the ore zone; methanogenic bacteria were noted in the Cigar Lake study only in the ore zone (AECL, 1994). Measured oxidation-reduction potential (ORP) measurements are generally a qualitative indicator of redox conditions in groundwater and have been collected for a subset of groundwater samples for the project. ORP measurements collected in groundwater from the ore zone (data collected during preparations for a tracer test, Petrotek, 2022) are approximately -265 mV (Eh = -65 mV, pe = -1.3 at 7^0C, as shown in Table 3-5)

ORP measurements were collected in wells GWR-046 (MFc, Intermediate Sandstone Aquitard), GWR-047 (MFb, Intermediate Sandstone Aquitard, - Desilicified) and GWR-048 (MFa, Lower Sandstone Aquifer) in the Fall 2021 sampling event. Groundwater quality in those wells, as plotted on Pourbaix (Eh-pH) Diagrams (Figure 3-4), show that dissolved-phase Fe concentrations are primarily controlled in the Athabasca Supergroup sandstone units by the solubility of iron oxyhydroxides such as goethite (FeO_2H) and, potentially siderite ($FeCO_3$) and that ferrous iron (Fe^{2+}) is the stable form of iron in groundwater.



Wheeler River Project Groundwater Modelling Report	
Hydrochemical Type by Hydrostratigraphic Unit, Piper Diagram	
Ecometrix Environmental INTELLIGENCE	Figure 3-3

Figure 3-3: Hydrochemical Type by Hydrostratigraphic Unit, Piper Diagram



Pourbaix Diagrams were prepared in Geochemist's Workbench, Community Edition, version 15.0

Wheeler River Project Groundwater Modelling Report	
Pourbaix Diagrams, Select Monitoring Wells	
Ecometrix Environmental INTELLIGENCE	Figure 3-4

Figure 3-4: Pourbaix Diagrams, Select Monitoring Wells

Dissolved-phase uranium concentrations are considered likely to reflect equilibrium with a number of uranium solid-phase associations, discussed in more detail in Section 3.5.6.2.1, but increasingly by uraninite, representing reduced uranium (U(IV)) minerals, with depth. Monitoring wells GWR-047 and GWR-048 are installed deeper in the subsurface than is GWR-046 and these two samples plot on/within the uraninite stability field in the Pourbaix diagram.

The data support the interpretation that redox conditions in the Athabasca Supergroup sandstones are lacking oxygen that, if present, would be represented by the top slanted line bordering the Goethite zone in the Eh-pH diagram, and not so reducing that methane (CH_4) is being produced as would be indicated by values in the lower regions of the pyrite or uraninite zones. This would suggest that the lower end of the redox zones are likely controlled by the reducing power of the sulphide mineral, pyrite and/or the reduced uranium mineral, uraninite.

3.3 Source Condition: Remediated Mining Area Water Quality

Metallurgical testing on the ore, including column tests, and core flooding tests, undertaken at the Saskatchewan Research Council, were completed to understand the anticipated evolution of groundwater hydrochemistry as the groundwater quality in the mineralized zone is remediated. Metallurgical testing for the Project is detailed in Appendix F. The constituents with concentrations that were outside of the range of values observed for baseline conditions in the leachate during metallurgical testing reflect the mineralogy of the ore zone (Table 3-1) and the mining fluids. The mining fluids are made up of sulfuric acid, ferric iron (Fe^{3+}) sulphate and hydrogen peroxide (the EIS, Section 2). Groundwater constituents identified as COPCs and carried forward for geochemical reactive transport modelling include: pH, sulphate, and dissolved Al, As, Cd, Co, Cu, Cr, Fe, Pb, Mo, Ni, Se, V, Zn and U and other radionuclides (discussed further in Section 3.5.6).

The chemical characteristics of the remediated groundwater used to conceptualize remediated groundwater quality for input into the reactive transport model were primarily from two coreflood tests: Coreflood#2B and Coreflood#3C. In the coreflood tests, core flushing was completed using groundwater and groundwater amended with sodium hydroxide (1.5 g/L; Coreflood #2B) or sodium bicarbonate (150-1500 mg/L $NaHCO_3$; Coreflood #3C). The coreflood tests simulated, in the lab, the rinsing of the ore zone that can be achieved in the field at the end of the mining operation. Results from these two tests were used primarily because they provided the most detailed information from which to understand remediated water quality at the time when the numerical model (presented herein) was being developed (2020-2021). As is detailed in Appendix F, more information from column and coreflood tests has become available that supports the use of results from Coreflood #2B and Coreflood 3C to conceptualize remediated groundwater quality.

"Restored Solution #1" and "Restored Solution #2" were developed to represent the bounding scenarios for groundwater quality evaluated in the reactive transport model, to assess the potential for environmental effects following remediation of the ore zone. The hydrochemistry of Restored Solutions #1 and #2 are shown in the Table 3-5. Included in Table 3-5 is the range in UBS constituent concentrations that represent the end of mining conditions (i.e., prior to

remediation) from the metallurgical testing, presented in Appendix F. Also, in Table 3-5 are groundwaters representative of baseline conditions in the hydrostratigraphic units in the LSA that are used as initial conditions in the numerical modelling. These are discussed in more detail in Section 3.5.4. Restored Solutions #1 and #2 generally are characterized by COPC concentrations outside of baseline conditions (i.e., uranium, radionuclide and metals/trace element concentrations are higher, and pH is lower) in the ore zone and in the overlying hydrostratigraphic units.

With the Wheeler River project, as with other ISR projects, it is anticipated that there will be a certain degree of outward migration (horizontal and vertical) of the oxidizing solution beyond the boundary of the operational well pattern/production area during the mining operation. This outward migration is a result of normal hydrodynamic behaviour, and the area affected outside of the well pattern is often referred to as the area affected by "flare" (IAEA, 2001). For the Wheeler River project, Denison has committed to containing flare through optimization of the well pattern and operational conditions and to limit the flare to 50 m vertically above the ore zone, through additional engineering means, as necessary. Laterally, any outward migration will be mitigated by the freeze wall.

Inclusion of flare in predictive numerical modelling has precedence in ISR projects, related both to ISR performance (e.g., Cameco, 2012) and fate and transport modelling downgradient of the ore zone (e.g., Johnson et al., 2016). For the numerical modelling of the mining area, herein, the flare was assumed to have a groundwater composition represented by 50% solution of the associated active mining area restored solution, diluted using typical groundwater chemistry from the Desilicified zone (Table 3-5). The resulting groundwater quality for the 50% solutions is summarized in Table 3-5. The assumptions made in the numerical model with respect to the groundwater quality at Decommissioning are described in more detail in Section 4.1.

Table 3-5: UBS Constituent Concentrations at end of mining, Restored Solutions and Representative Groundwater Composition by Hydrostratigraphic Unit

Parameter/ Groundwater or Restored Solution	Unit	Ore Zone (GWR-032)	PWZ (GWR-031 and Cigar Lake)	Lower Sandstone Aquifer and Decilisified Zone (GWR-011)	Intermediate Sandstone Aquitard (GWR-046)	Overburden and Upper Sandstone Aquifer (GWR-036, Primarily)	Range of Values of UBS constituent concentrations across Metallurgical tests from 2018-2021 representative of End of mining conditions		Restored Solution #1	50% Restored Solution #1	Restored Solution #2	50% Restored Solution #2
							Minimum	Maximum				
pH	unit	6.83	6.7	6.46	7.053	6.45	0.63	2.1	4.3	5.1	6.1	6.3
pe	unitless	-1.3	1.9	2.3	4.5	1.2	9.80	14.7	10	(set) 7	7.8	(set) 4
temp	^{0}C	7	7	7	7	7	7	7	7	7	7	7
Al	mg/L	6.00E-04	3.40E-02	5.20E-02	8.00E-01	3.70E-02	6.90E+01	4.61E+03	7.00E+00	3.53E+00	5.60E-01	3.06E-01
As	mg/L	2.00E-04	5.00E-02	1.30E-03	4.75E-06	3.00E-04	<0.1	2.12E+01	6.00E-02	3.07E-02	1.00E-01	5.07E-02
Ba	mg/L	6.30E-02	3.60E-02	5.40E-02	2.41E-01	5.70E-03	<0.05	<0.5	5.00E-02	5.20E-02	5.00E-02	5.20E-02
C(4)	mg/L	1.76E+02	1.54E+02	8.66E+01	1.01E+02	3.39E+01	-	-	5.80E+01	7.23E+01	1.05E+02	9.58E+01
Ca	mg/L	5.50E+01	6.76E+00	9.78E+00	1.07E+01	2.70E+00	5.80E+01	7.23E+02	1.10E+02	6.00E+01	1.00E+01	9.89E+00
Cd	mg/L	1.00E-05	1.00E-05	1.00E-05	3.36E-05	1.00E-05	1.80E-02	1.81E+00	1.50E-02	7.52E-03	4.00E-03	2.01E-03
Cl	mg/L	1.90E+02	8.65E+01	7.20E+00	8.63E+00	6.86E+00	<10	1.22E+03	2.00E+02	1.04E+02	5.00E+01	2.86E+01
Co	mg/L	1.00E-04	1.00E-02	1.00E-04	5.84E-03	4.00E-04	5.00E-01	1.49E+01	2.00E+00	1.00E+00	1.00E-02	5.05E-03
Cr	mg/L	5.00E-04	4.50E-03	5.00E-04	1.69E-03	5.00E-04	<0.1	9.14E+00	5.00E-02	2.53E-02	5.00E-02	2.53E-02
Cu	mg/L	2.00E-04	5.00E-03	1.80E-03	6.29E-03	6.00E-04	5.16E+00	9.64E+02	1.70E-01	8.60E-02	2.00E-02	1.09E-02
F	mg/L	2.30E-01	5.30E-01	1.80E-01	5.90E-02	6.00E-02	1.00E+00	3.40E+01	-	9.00E-02	8.00E-01	4.90E-01
Fe	mg/L	4.20E+00	4.90E-01	8.60E-01	6.03E+00	4.05E-01	8.20E+02	4.09E+03	1.00E+02	5.05E+01	4.70E+00	2.78E+00
K	mg/L	4.60E+00	5.60E+00	2.00E+00	6.77E+00	2.80E+00	6.20E+00	1.49E+02	9.00E+00	5.51E+00	3.50E+00	2.75E+00
Mg	mg/L	1.10E+01	3.09E+00	1.60E+00	3.91E+00	1.80E+00	<10	2.40E+02	6.00E+00	3.80E+00	3.00E+00	2.30E+00
Mn	mg/L	2.20E-01	7.00E-01	3.60E-01	3.91E+00	1.40E-01	2.70E+00	4.10E+01	3.40E+00	1.88E+00	4.80E-01	4.20E-01
Mo	mg/L	3.80E-03	1.28E-02	4.20E-03	3.89E-03	7.00E-04	1.65E+00	5.96E+01	1.00E-01	5.22E-02	1.30E-01	6.71E-02
Na	mg/L	8.10E+01	7.61E+01	6.10E+00	8.96E+00	2.90E+00	6.00E+00	1.23E+04	1.90E+02	9.82E+01	9.00E+01	4.81E+01
Ni	mg/L	1.00E-03	1.50E-02	1.00E-04	4.87E-02	1.80E-03	<1	2.68E+01	9.70E+00	4.86E+00	1.00E-02	5.05E-03
Pb	mg/L	1.00E-04	1.00E-04	1.00E-04	1.57E-03	1.00E-04	2.00E-01	1.95E+01	3.10E+00	1.55E+00	3.20E-01	1.60E-01
S(6)	mg/L	1.30E+01	4.55E+00	4.70E+00	1.01E+01	1.90E+00	5.21E+03	2.09E+05	7.03E+02	3.54E+02	1.36E+02	7.04E+01
S(-2)	mg/L	1.00E-08	1.00E-09	1.00E-09	1.00E-09	1.00E-09	-	-	1.00E-09	1.00E-09	1.00E-09	1.00E-09
Se	mg/L	1.00E-04	1.00E-04	1.00E-04	3.59E-04	8.00E-04	<0.025	2.64E+01	8.00E-02	4.01E-02	1.00E-02	5.05E-03
Si	mg/L	1.33E+01	9.18E+00	2.41E+01	1.31E+01	2.62E+01	3.07E+01	1.92E+02	4.00E+01	3.21E+01	4.00E+01	3.21E+01
Sr	mg/L	1.66E+00	1.17E+00	1.20E-01	1.15E-01	1.20E-02	6.00E-01	5.19E+00	4.40E+00	2.26E+00	2.40E+00	1.26E+00
Zn	mg/L	2.62E+00	4.25E-03	1.20E-02	1.25E-02	4.40E-03	2.30E+00	3.31E+02	1.40E+00	7.07E-01	5.00E-02	3.10E-02
P	mg/L	1.00E-02	1.00E-02	1.00E-01	5.00E-02	4.00E-02	2.20E+00	7.54E+01	4.00E+00	2.05E+00	4.00E+00	2.05E+00
U	mg/L	1.10E-02	1.24E-02	7.00E-04	2.26E-02	5.00E-04	7.70E+02	3.88E+04	1.00E+02	5.01E+01	3.00E+01	1.50E+01
V	mg/L	1.00E-04	1.00E-04	1.00E-04	1.20E-03	1.00E-04	6.16E+00	1.61E+02	5.10E-01	2.55E-01	1.60E-01	8.01E-02
^{226}Ra	mg/L	4.92E-06	5.47E-09	1.37E-08	2.54E-08	1.64E-09	6.29E-06	8.21E-05	5.47E-06	2.75E-06	1.01E-05	5.06E-06
^{230}Th	mg/L	9.17E-06	1.00E-06	1.31E-07	2.62E-07	2.62E-08	2.75E-02	2.88E-01	3.93E-06	2.02E-06	1.31E-06	7.14E-07

3.4 Expected Geochemical Reactions Along Flow Paths

Fate and transport mechanisms affecting the potential migration of COPCs from the remediated mining area, include the following:

- Advection: (physical) transport of dissolved mass along with groundwater flow.
- Dispersion: (physical) spreading of dissolved mass due to hydrodynamic mixing at the pore scale, and through the tortuosity of the fracture network within the fractured rock setting.
- Diffusion: (physical) spreading of mass due to concentration gradients. This is often associated with dispersion, however it is particularly important in fractured rock environments where diffusion into the rock matrix, where advection is minimal, further spreads the dissolved mass.
- Geochemical interactions, which may retard the velocity of COPCs in groundwater relative to that of groundwater and/or transfer constituents from groundwater to the host rock or soil structure (i.e., precipitation of mineral phases) such that further transport by groundwater is limited; and
- Decay: radioactive constituents will naturally decay.

In the LSA, geochemical reactions and radioactive decay will occur within the desilicified porous media, fracture spaces, as well as within the rock matrix. As such, the coupled effects of matrix diffusion and geochemical reactions compound the potential retardation and spreading effects. Key geochemical interactions in the fate and transport of uranium, other radionuclides, and trace elements are outlined in Table 3-6 (after US EPA 1999).

Table 3-6: Summary of Key Geochemical Processes for Transport of Uranium, other Radionuclides and Trace Elements (US EPA 1999)

Process	Mechanism	Effect on Constituent Mobility
Aqueous Complexation	Constituents in solution react with ligands to form dissolved-phase complexes	Can increase or decrease mobility
Redox Reactions	Some constituents, including U, can be present environmentally in a one or more redox states.	Redox state may enhance or reduce mobility
Adsorption (specific)	Dissolved constituents can form inner-sphere surface complexes on iron oxides, clay minerals, and quartz.	Retards constituent migration in groundwater; generally, a (fully) reversible process.
Ion Exchange (nonspecific adsorption)	Ions from the recovered solution replace other ions from soil or rock surfaces at exchange sites	Reduce mobility

Process	Mechanism	Effect on Constituent Mobility
Precipitation of solid phases	Concentrations of dissolved constituents may be such that the solubility of mineral phases is exceeded and may precipitate.	Reduce mobility
Subsurface colloids	Transport of colloidal precipitates in groundwater, that include (either through precipitation or sorption) constituents of the mining solution and/or uranium-bearing solution.	Enhances mobility

These key geochemical processes were explored in the geochemical modelling for the Project, as outlined in Section 3.5. The exception was subsurface colloids transport. U(VI) transport as colloids has been evaluated and considered at several sites and was concluded not to be an important transport mechanism (Colon et al., 2000). Average particle concentrations in the deep groundwater were found to be too low to have a significant effect on radionuclide migration (e.g., AECL, 1994). Based on the similarity of hydrochemical/geochemical conditions between the Wheeler River Project and those reported for Cigar Lake, it was considered reasonable to exclude colloidal transport of COPCs in this assessment. Further, complexation with dissolved organic matter was likewise not considered explicitly in this assessment; concentrations of dissolved organic carbon in the Athabasca Supergroup sandstones vary but are generally in the range of 2 mg/L. In the Cigar Lake studies (AECL, 1994), organic matter in groundwater was not predicted to have a significantly mobilizing effect on uranium (U(VI)) in groundwater.

3.5 Geochemical Modelling Approach

Geochemical modelling was used to simulate the behaviour of COPCs in groundwater migrating from the remediated mining area in Post-Decommissioning, when the freeze wall is thawed. A one-dimensional geochemical reactive transport model was developed as part of the overall numerical modelling approach for the Project. The goal of the one-dimensional (1D) model was to conceptualize and appropriately parameterize those reactions that will be important for the fate and transport away from the ore zone post-decommissioning, which were modelled ultimately in a 3D reactive transport model (Section 4.0). The 1D model and results of the assessment are the focus of the remainder of this section. The 1D and 3D models were used together iteratively to gain an understanding of COPC fate and transport in the groundwater system.

The 1D geochemical modelling supports an understanding of how and to what extent the key geochemical reactions may influence the migration of COPCs, and specifically, how these reactions will affect predictions of timelines and concentrations of COPCs in groundwater at the interface with the primary receiving body, Whitefish Lake.

3.5.1 Discussion of Solid Liquid Partition Coefficients (K_ds)

In groundwater modelling, sorption is often implemented using an equilibrium solid-liquid partition coefficient (K_d) to partition a constituent from the groundwater to the solid phase, and thus attenuate its concentrations in the aqueous phase relative that in the initial solution (source). This approach is often taken because it is a simple model and straightforward to include a K_d value into a 3-D groundwater fate and transport model to consider sorption effects. While the K_d model is simple, it is challenging to apply over a wide range of concentrations and other geochemical conditions such as pH. Recognizing the limitations of the K_d approach, analysis of reactive transport, herein, of COPCs away from the mining area employed more representative reactions, which more comprehensively address the multiple controls on the behaviour of metals, radionuclides, and trace elements in groundwater systems.

There is precedent for using geochemical codes, such as PHREEQC (Section 3.5.2) and other reactive transport computer codes, to predict and evaluate changes to groundwater quality associated with ISR projects as shown in the literature, including: Johnson et al., (2016); Lagneau et al., (2019); Reimus et al., (2019); de Boissezon et al., (2020). Driving the decision to move from a simpler K_d approach to using a geochemical model included the following:

- K_d values are derived for a specific set of conditions and are sensitive to pH values, and in this project, as in other ISR projects, pH values can vary considerably and need to be incorporated. This makes rationalizing a K_d value, or a set of K_d values difficult;

- The K_d model is reversible and assumes a linear relationship, meaning that the concentration in the water has a constant proportionality to that in the solid over a wide range of concentrations. However, the sorptive capacity of matrix materials/soils can decrease at higher aqueous concentrations, and the amount of sorbed mass that will desorb depends upon other geochemical conditions (e.g., pH, pE), which cannot be practically specified *a priori*. In practical terms, the K_d model is only linear over small ranges of concentrations in solution for most COPCs and application over wider ranges can result in over-estimation of sorption and underestimation of the aqueous concentrations. Alternatively, if the linear relationship for the high range of concentrations is applied to lower concentrations, the sorption will be biased high and concentrations in the water will be unrealistically overpredicted.

- Several COPCs will compete for sites at mineral surfaces. Thus, not accounting for this competition may over-estimate the amount of sorption. Further, aqueous species like carbonates are known to play an important role in the sorption of metals to solid surfaces. The interactions of metals with aqueous ligands are accounted for with site-specific sorption in the geochemical model, but not with a Kd approach.

Thus, in the geochemical model developed for the Project, rather than application of K_d values, ion exchange reactions and metal/trace element adsorption at solid surfaces by surface complexation was applied to evaluate sorption. The only exception to this was within the lake

bottom sediments. The application of the K_d values in the lake-bottom sediments is detailed in Section 3.5.6.2.4.

3.5.2 One-Dimensional Geochemical Evaluation

Fate and transport of COPCs in the remediated groundwater was explored in 1D with PHREEQC (Parkhurst and Appelo, 2013). PHREEQC (original acronym pH-REdox-EQuilibrium) is based on equilibrium chemistry of aqueous solutions interacting with minerals, gases, solid solutions, exchangers, and sorption surfaces.

The 1D transport model in PHREEQC includes a series of cells along a groundwater flow pathway. The advection of water from cell to cell is determined by the average linear groundwater velocity and size of the cells. Each cell also acts as a continuous stirred reactor in which the simulated geochemical reactions (e.g., sorption, redox, precipitation, etc.) occur. Only reactions that can plausibly be in thermodynamic equilibrium were considered in this assessment, including sorption-desorption and precipitation reactions. Dissolution reactions that are likely to be kinetically controlled were not included in this evaluation.

This approach provides the ability to simulate groundwater flow and mass transport along a single flow path parallel to the direction of groundwater flow, with the appropriate chemical reactions occurring in each cell along the flow path. The approach however also assumes no interaction with the volume surrounding the flow path, as would occur by diffusion and transverse dispersion in a real groundwater flow system and is thus considered a conservative assessment of potential transport and fate of constituents. A simplified schematic of a 1D transport simulation in PHREEQC is shown in Figure 3-5.

The conceptual geochemical site model is a simplified representation of the understanding of the real system. Two 1D models for the project were conceptualized and are shown in Figure Figures 3-6a and 3-6b. The first conceptualization was developed to examine sorption reactions primarily and included the ore zone, the Paleoweathered Zone, the Desilicified Zone and lake bottom sediments. The second conceptualization was streamlined, to focus on other key geochemical reactions and emphasized a groundwater pathway from the flare (zone of 50% restored solution above the ore zone; described in Section 4.1) through the Desilicified zone, (Figure 3-6b).

Development of the two conceptualizations followed from the early runs evaluating groundwater and geochemical reactive transport models in 3D, that demonstrated the following:

1) Multi-Zone Pathway: Groundwater from the ore zone and mined portion of the paleoweathered zone (i.e., zones of groundwater quality assumed to be 100% restored solutions) first flows primarily through the paleoweathered zone. This zone is rich in clay and is characterized by small groundwater velocities and long residence. Sorption of COPCs to clay is expected to be a key geochemical reaction in this hydrostratigraphic unit.

2) Desilicified Zone Pathway: The mass that first reaches Whitefish Lake from the remediated mining area is that of COPCs that behave conservatively (i.e., no geochemical interactions) and which originate in the flare and move along a flow path from the mining area to Whitefish Lake that is dominated by the Desilicified zone.

Geochemical modelling requires a number of detailed assumptions and checks on model simulations. These have been presented in the sections below, or, as appropriate, as part of the Supporting Information in Appendix E.

The length of the ore zone is approximately 700 m from the southwest to the northeast (see inset, Figure 2-6). Following from initial simulations in 3D that showed that groundwater followed more than one migration pathway, with not all mass migrating to Whitefish Lake (see Figure 4-6), the source length for the ore zone in the 1D model was assumed to be 450 m, which is the approximate length of the (longer) northeast portion of the ore deposit. The average linear groundwater velocity within the Desilicified zone was set at $8x10^{-8}$ m/s, derived from a hydraulic conductivity of $5x10^{-6}$ m/s (Table 2-2), a hydraulic gradient of 0.0032 m/m, and a porosity of 0.2 (Table 4-2). The same average linear velocity was assumed for the mining area (source zone), following from the discussion in Section 4.4.2, where the hydraulic conductivity value in this zone following mining was set to $5x10^{-6}$ m/s, and a porosity of 0.2 is assumed for the ore zone (Table 4-2). In the 1D model, the average linear velocity of the paleoweathered zone was conservatively set to $3x10^{-8}$ m/s to reflect the interpretation of a higher hydraulic conductivity values in the basement aquitard along the WS Shear due to this being an enhanced fracture zone (Section 4.7).

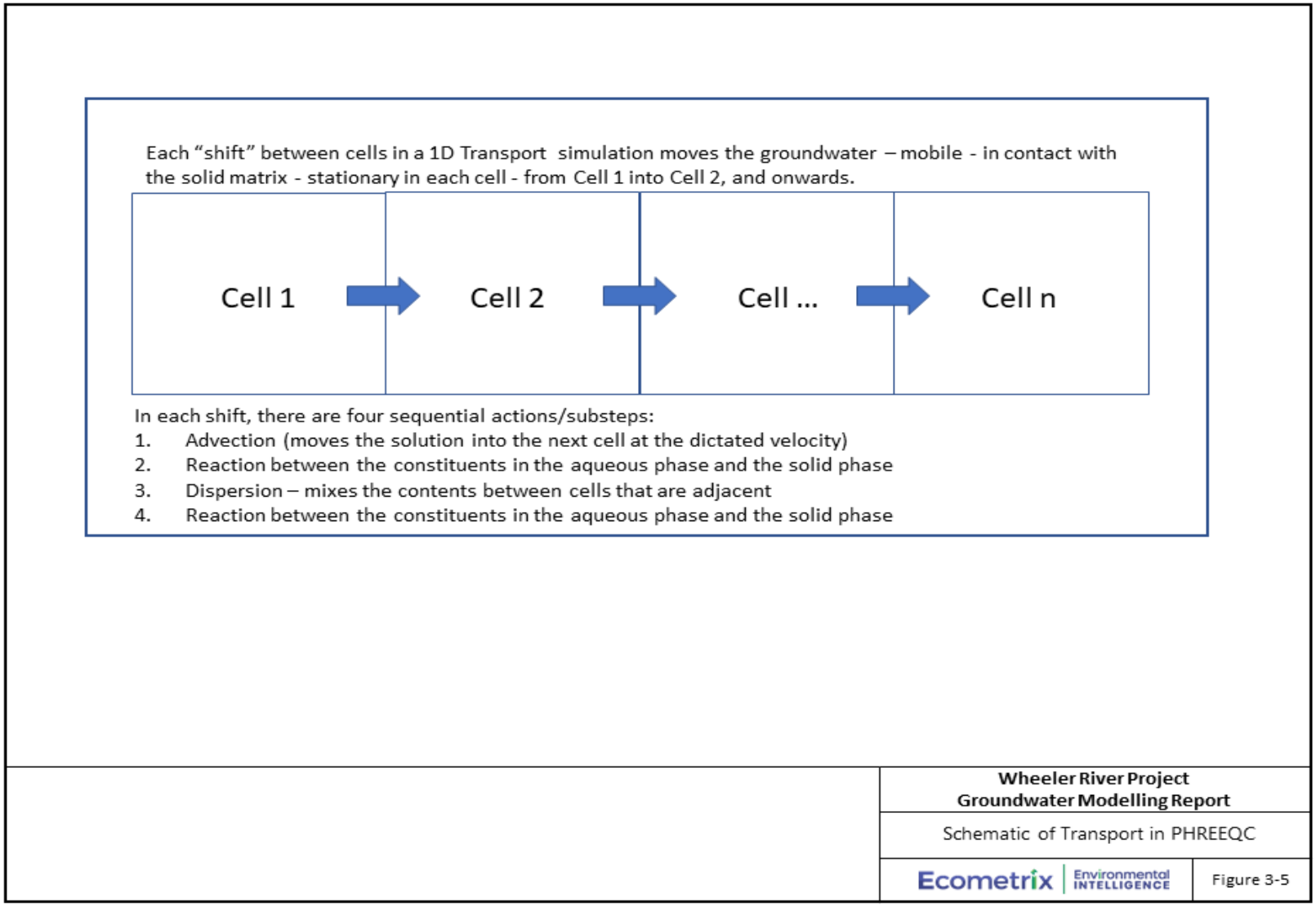


Figure 3-5: Schematic of Transport in PHREEQC

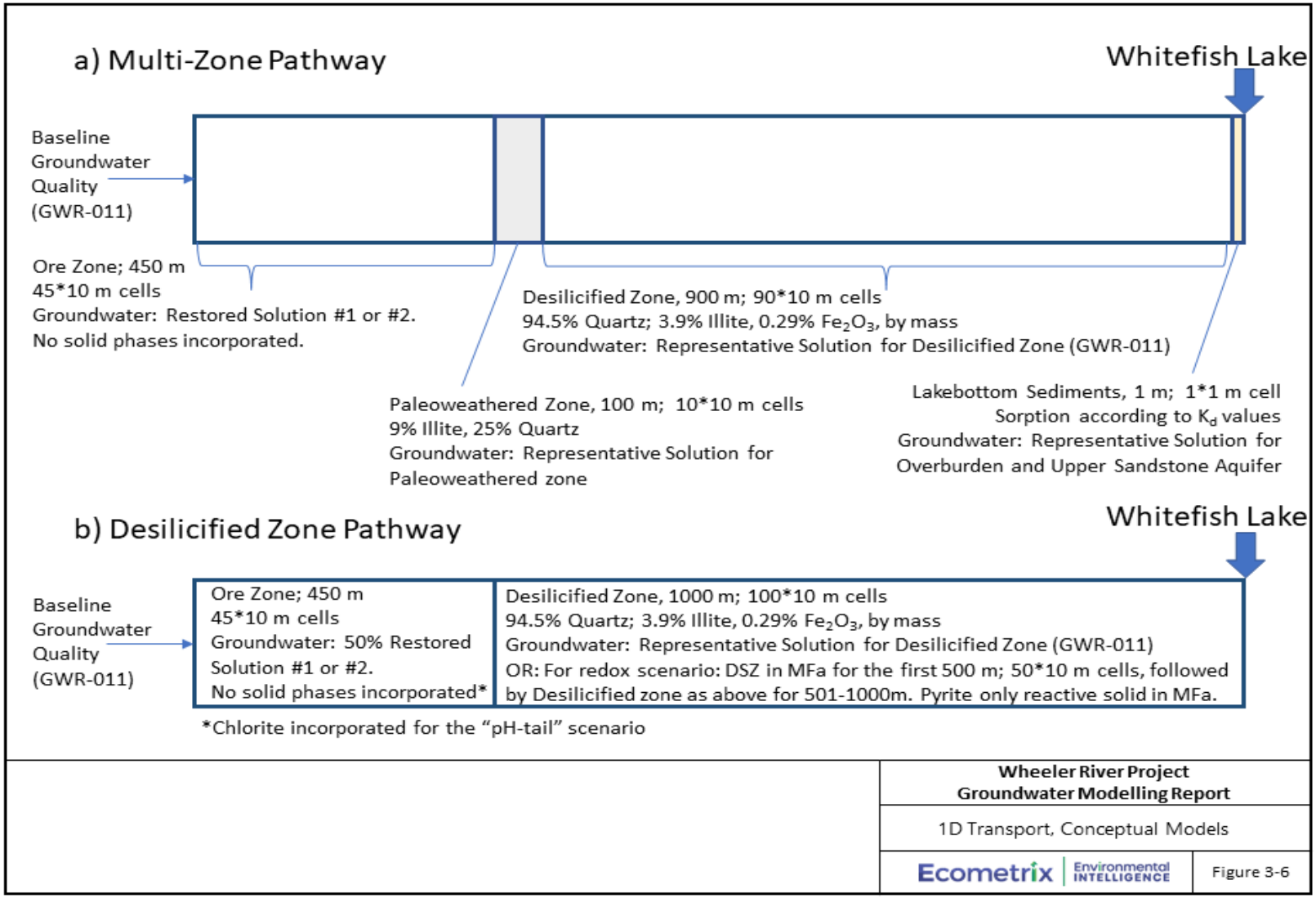


Figure 3-6: 1D Transport, Conceptual Models

3.5.3 Thermodynamic Database

The thermodynamic database used in PHREEQC was modified from/built on the minteq.v4 database that is available with the PHREEQC download. The database was updated with respect to current understanding of uranium complexation in solution with carbonate species (Guillaumont et al. 2003; Gorman-Lewis et al., 2008; Grenthe et al., 2020) and ternary complexes of uranium with calcium and magnesium and carbonates (Dong and Brooks, 2006). The database was also modified to contain aqueous speciation for radium and thorium and solid phases for uranium, radium and thorium, from the sit.dat database, also available with the PHREEQC download. Redox chemistry for Cr(III) (i.e., oxidation to Cr(VI)) was removed from the database as formation of Cr(VI) is not expected under the redox conditions in groundwater at the site.

The sources of binding constants for uranium, metals and radionuclides to sorbing mineral phases included in the database are discussed in more detail in Appendix E .

Note on ^{210}Po and ^{210}Pb

Thermodynamic data was not available for ^{210}Po. As such, this COPC was not evaluated directly in the numerical modelling. ^{210}Po is understood to be attenuated through adsorption in low to circumneutral water (Carvalho et al., 2017, Szabo et al., 2020). The distribution of ^{210}Po in the subsurface is strictly controlled by that of it's parent ^{210}Pb, and Pb behaviour is modelled.

3.5.4 Initial Solutions

For each hydrostratigraphic unit in the 1D model, an initial solution was required. The solutions used as input solutions in the model are presented in Table 3-5. The exception is for oxidation-reduction potential (as pe). For the reasons given below (Section 3.5.5), the redox conditions of the input solutions in the model were modified from those measured in the hydrostratigraphic units presented in Table 3-5.

Baseline groundwater quality for the ore zone (from GWR-032) was also presented in Table 3-5 but this solution was not used in the numerical modelling. As a result of ISR mining, groundwater conditions in the ore zone will change and the baseline water quality was included in Table 3-5 only for the purposes of comparison to the remediated groundwater quality, Post-Decommissioning. Groundwater quality in the mining area evaluated in the 1D models was represented by the remediated groundwater quality (Restored Solutions #1 and #2, and 50% restored solutions), as shown in Figure 3-6a and 3-6b, respectively.

For the other hydrostratigraphic units, the representative solutions were selected or developed as follows:

- Paleoweathered Zone: There is one well with water quality considered representative of the paleoweathered zone within the existing well network for the Wheeler River Project (GWR-031). As such, groundwater quality reported for a well installed in the paleoweathered zone at Cigar Lake (AECL, 1994; sampling location #199) was also

considered. The groundwater quality relied more heavily on that reported for Cigar Lake because of the cross-completion of well GWR-031 with other hydrostratigraphic units. Some constituent concentrations were adjusted to higher or lower values where there was discrepancy between groundwater quality between GWR-31 and the Cigar Lake sampling location.

- Desilicified Zone and Lower Sandstone Aquifer: GWR-011. This well is installed in desilicified sediments of the Lower Sandstone Aquifer. Concentrations/values of groundwater constituents in this well were close to the calculated median values for the Lower Sandstone Aquifer hydrostratigraphic unit, provided in Table 3-4.

- Intermediate Sandstone Aquitard: GWR-046. Groundwater quality was used for this hydrostratigraphic unit for the same reasons given above for the Desilicified Zone/Lower Sandstone Aquifer.

- Overburden and Upper Sandstone Aquifer: These two units make up the Local Groundwater flow system. Groundwater quality from well GWR-036 is close to median concentrations for this flow system. Concentrations of a small number of constituents were adjusted moderately to better reflect median values for the flow system.

The pe values shown in Table 3-5 reflect measured ORP values for the Project, discussed in Section 3.2.2.1, and, where not available, were supplemented with conditions reported for Cigar Lake (AECL, 1994) for the same hydrostratigraphic units. In alignment with the discussion of redox conditions above (Section 3.2.2.1), the lower pe values applied to the Athabasca Supergroup sandstones and paleoweathered zone are not understood to be so low as to reduce key chemical species, such as uranium and sulphate, that would cause precipitation or removal as reduced low solubility solid phases such as uraninite and pyrite (FeS_2), respectively. However, the pe in the deeper zones allowed ferrous iron to remain stable in solution rather than forcing oxidation to ferric iron and causing precipitation of ferric oxyhydroxide solid phases. The range of understood pe values also reflects any potential reduction and precipitation of key species that would not be expected in the absence of reducing substances such as organic matter, that current conditions indicate is not present at sufficiently high levels in the system (outside of the ore zone) to drive moderately to strongly reducing redox conditions.

Prior to use in the model, concentrations in groundwater samples were charge balanced and equilibrated to CO2(g) pressures in PHREEQC, at the depth of the well screened intervals. Each solution pH and total inorganic carbon concentration ("C(4)" in the model) was adjusted using the measured alkalinity – which is conserved at all pressures – and setting the partial pressure of CO2(g) based on sampling interval depth. Groundwater quality reported from the Cigar Lake studies, has already been corrected for CO2(g) partial pressures and was charge balanced (AECL, 1994). The representative solutions for each hydrostratigraphic unit presented in Table 3-5 have been charge balanced and pH corrected.

3.5.5 Subsurface Conditions Incorporated

The following subsurface conditions were assumed in the geochemical site conceptual models, (Figures 3-6a and 3-6b) except where indicated:

- The occurrence and extent of chemical reactions reflect thermodynamic equilibrium conditions. As such, sorbed COPCs can desorb to achieve thermodynamic equilibrium with the groundwater composition at each stage of modelling. This is a conservative assumption in the geochemical modelling because in natural systems, desorption is not always complete (i.e., does not always obey thermodynamic equilibrium; e.g. Allen et al., 2019). This is also a conservative assumption in evaluating COPC-containing mineral phases (precipitates) formed in the system. Often in natural systems, the chemical form/structure of the mineral phases changes over time, decreasing the solubility.

- although not an accurate reflection of (largely, anoxic) subsurface conditions, the solutions, once in the Paleoweathered Zone and Desilicified Zone, were equilibrated with atmospheric concentrations of oxygen. This is a modelling approach, that maintains U(VI), and other redox-reactive constituents, present in the oxidized form. This is conservative because the important redox-active constituents of concern are more mobile in their oxidized forms.

- the concentrations of iron in the remediated groundwater are elevated with respect to environmental concentrations (i.e., 100 mg/L in Restored Solution #1) and expected to occur as ferrous (Fe^{2+}) iron as a result of reduction by the residual uraninite and sulphide minerals such as pyrite (FeS_2) in the ore zone. Oxygenated conditions are not expected over most of the groundwater system and therefore ferrous iron will remain stable in the groundwater, with the potential exception of the upper portion of the Athabasca Supergroup sandstone units. Thus, the redox reaction resulting in oxidation of ferrous iron to ferric iron was supressed in the model, and it was conservatively assumed that ferrous iron (Fe^{2+}) would remain in solution with no solubility controls. This is supported by the presence of elevated dissolved iron concentrations at near neutral pH for existing conditions at the site (Appendix D). The formation of ferric iron solid phases from oxidation of ferrous iron can result in the production of hydronium ions that can lower the pH. The influence of iron oxidation and precipitation as ferric oxide/oxyhydroxide minerals on pH in the upper elevations of the flow system (where oxygenated conditions may be encountered) was also evaluated in the modelling scenarios ("Fe oxidation").

- Conceptually, the paleoweathered zone mineral assemblage was made up of 9% clay by mass, as illite, and 25% quartz. The illite content was based on the normative clay composition determined from site-specific corehole elemental analysis (median illite by mass is 9.20%; Table 3-2). Portable infra-red mineral analysis supported the normative clay content in that chlorite is the dominant clay mineral (median 69.5% relative abundance) followed by illite (median 13.1% relative abundance; Table 3-2). The quartz content was based on a regional study by Macdonald (1980) evaluating the mineralogical composition of the weathered bedrock/saprolite regionally. The mineral composition of the

paleoweathered zone was conceptualized in this manner because the data set for the project with respect to clay minerals was for the sorptive properties of illite. Using the relatively smaller illite content of the paleoweathered zone compared to the more dominant chlorite content is conservative in that not all sorptive capacity of the clays is accounted for in the simulated paleoweathered zone.

- The conceptualization of the Desilicified Zone is based upon site-specific information from the extensive coring and is modelled as being made up of (by mass): 94.5% quartz, 3.9% illite and 0.29% Fe_2O_3 as goethite. This composition reflects the data from elemental analysis (including normative clay content) presented in Table 3-2. Illite was used to represent the total clay content, which varies from 1.74% to 5.85% by mass in the hydrostratigraphic units within the Athabasca Supergroup sandstones and Desilicified Zone.

- The remediated mining area is modelled as a finite source of COPCs and does not include any geochemically reactive surfaces/minerals, except in the "pH-tail" scenario that assumed that previously sorbed H^+ ions would be desorbed into groundwater flushing through and replacing the remediated ISR groundwater in the ore zone . The migration of dissolved constituents in porewater from the remediated mining area was simulated by the flushing by upstream groundwater. The residual reduced minerals, such as uraninite and pyrite were not considered to be a source of COPCs. This was considered appropriate because the upstream groundwater, passing through the mined zone, will not be oxidizing and groundwater conditions are expected to be similar to pre-mine conditions that indicated low and baseline concentrations of dissolved COPCs associated with the original mineralization.

- Carbonate minerals, which are important pH-buffering minerals and for the migration behaviour of some groundwater constituents (i.e., formation of gypsum following release of Ca from calcite dissolution), were, conservatively, not included in the numerical simulations. Calcite concentrations (calculated from median CaO wt % in Table 3-2) are less than 0.05 wt% over much of the groundwater flow path. is less than 0.05 %.

- The lowest pH solution initially in the ore zone was pH 4.3, representing Restored Solution #1 in Table 3-5. However, it was conservatively assumed that mineral dissolution to buffer pH does not occur. In the real system, it is expected that some minerals, such as gibbsite ($Al(OH)_3$), carbonates and some aluminosilicate minerals can dissolve to neutralize pH.

3.5.6 Evaluation of Geochemical Processes

There are several geochemical reactions that are expected to occur as the remediated groundwater (Restored Solution) migrates through the various regions along the groundwater flow path. The reactions were considered individually and tested to ensure that they were being applied properly with the appropriate input parameters and quality assurance reviews of the results were completed for each of the reactions. The simulations were also sequentially incorporated to evaluate the coupled affect of the reactions (e.g., redox and precipitation

reactions, along with limited sorption, or enhanced source conditions). The groundwater transport was first tested by assuming that there were no geochemical reactions, assuming all COPCs were chemically conservative. Reactions were then progressively incorporated in steps to illustrate the effects of each of the reactions. Some reactions were omitted in some runs to illustrate the sensitivity of the results to changes in reactions. The list of the simulations and the associated reactions that were considered in each simulation are summarized in Table 3-7.

Table 3-7: Progressive Geochemical Evaluation using the 1D Model

Simulation	Geochemical Interactions
Conservative	The system as a whole is assumed to be devoid of mineral phases that are reactive and all COPCs are considered to be chemically conservative.
Solubility Controls	Authigenic precipitation of uranyl mineral phases and other mineral phases was allowed to control or remove COPCs from the groundwater when thermodynamic conditions were appropriate
Base Case - Sorption	Dissolved constituents were allowed to adsorb and exchange at reactive sites associated with goethite, clay minerals, and quartz. Sorption was conservatively modeled as reversible for all constituents and reactions. Because minerals characterizing the subsurface – namely clays and iron oxyhydroxide minerals – are known to be important sorbing phases, sorption was considered to some extent in all model runs.
Sorption to fewer sites	The concentration of sorptive sites available for reaction with the solution phase was decreased from the total expected as a sensitivity scenario, to compare to the Base Case.
Redox - lower limits	The Redox scenario focused on the reactivity of uranium along the downgradient groundwater flow path, and the potential for U(VI) reduction to U(IV) to be a reaction that immobilizes uranium in the presence of a naturally occurring reductant, represented by pyrite (FeS_2), that is known to be present in the hydrothermally altered sediments of the lower Athabasca Supergroup sandstones.
Protons desorption from Clays ('proton tail')	Clay minerals in the ore zone were pre-equilibrated with protons at the pH of Restored Solution #1 to evaluate the effect of proton desorption on the pH of the downgradient plume, and potential effect on migration of other COPCs.

Radioactive Decay and Ingrowth: In the scenarios presented below, radioactive decay was not included in the geochemical processes for uranium isotopes because of the long half-lives of those isotopes and of the daughter product ^{230}Th. The radioactive decay of ^{230}Th and ingrowth of ^{226}Ra was evaluated along the groundwater flow path, as was decay of ^{226}Ra. Details are provided in Appendix E. In the numerical model scenarios presented below, radioactive decay was not included, because it was not shown to be a key process in the behaviour of those elements within the period modelled (maximum time on the order of 60,000 -100,000 years; see Section 4.7). The simulations are thus conservative with respect to concentrations of those

radionuclides in the subsurface. As introduce above, ^{210}Po could not be modelled, and contributions of ^{210}Pb from radioactive decay of ^{226}Ra to total Pb modelled was too small to be measurable, and ^{210}Pb produced will behave like Pb. Potential risks to ecological and human receptors associated with ^{210}Pb and ^{210}Po were evaluated through Environmental Risk Assessment (ERA) using the modelled mass flux of ^{226}Ra in groundwater at Whitefish Lake (Section 4.9, Ecometrix 2024b, and Denison, 2024a).

3.5.6.1 Solubility Controls

3.5.6.1.1 Mineral Saturation Indices

Some minerals, including COPCs, are naturally present within the geologic materials along the groundwater flow path and some minerals may also form within the system from direct precipitation from the dissolved phase. Minerals that are formed through direct precipitation from solution because equilibrium solubility of that mineral phase is reached (or, often, exceeded) in the dissolved phase are called authigenic minerals. Both authigenic minerals and existing minerals present already in a system can also dissolve when the solution composition changes and thermodynamic conditions are appropriate, adding COPC mass to the groundwater.

Previous studies have shown that precipitation of authigenic mineral phases resulting from higher trace metal/element concentrations in uranium mining-influenced groundwater can attenuate dissolved-phase concentrations over the period being examined. For example, Bain et al., 2001 found that precipitation of $Cr(OH)_3$ was an important control on the Cr(III) dissolved-phase concentrations in a sandstone aquifer receiving uranium mining-affected groundwater, but that $Ni(OH)_2$, for example, was not an important controlling phase for nickel for the conditions encountered.

Potentially important mineral phases were evaluated within the LSA by examining the saturation indices of the representative solutions and Restored Solutions. The saturation indices were calculated in PHREEQC for the solution conditions provided in Table 3-5. As a first step, the saturation indices for mineral phases were examined for existing/baseline conditions in the subsurface. The saturation index illustrates when a mineral phase is undersaturated with respect to dissolved concentrations in the water and therefore will be prone to dissolve if it is present in the solids and when it is supersaturated and will be prone, thermodynamically to precipitate from solution to re-establish equilibrium.

The concentrations of elements in association with the overburden and rock units in the LSA are well understood, and are provided in Appendix B. However, elemental concentrations were determined through total and partial digestion, and as such, do not provide information on the specific chemical speciation in which the elements are found, including mineral phases. Examining the saturation indices provides insight into mineral phases that may be controlling dissolved-phase concentrations of COPCs, through solubility control. Although, as introduced above, the baseline groundwater quality in the ore zone is not used as part of the numerical modelling, an examination of the saturation indices was undertaken as part of this assessment

to evaluate how the predicted mineral phase saturations aligns with the known mineral composition of the ore zone.

Mineral saturation indices were also examined in the Restored Solutions (and 50% restored solutions), as COPC concentrations were, generally, higher in the remediated groundwater in the mining area than are observed under baseline conditions. This was done to provide insight into the mineral phases to be considered for inclusion in the geochemical reaction model as important controls on solution-phase concentrations of COPCs.

Saturation indices for mineral phases examined are provided in Table 3-8. Noted is that reduced sulphur values (S(-2)) were not measured in groundwater (and thus, do not appear in Table 3-4 and Appendix D), but were added at a very low value in the groundwater composition of the representative samples for the inclusion of sulphide mineral phases in the PHREEQC speciation/output.

The saturation indices summarized in Table 3-8 indicate:

a. groundwater quality across the hydrostratigraphic units reflect, as expected based on the mineralogy, equilibrium with (primarily, ferric) iron mineral phases, quartz, clays, and potentially gibbsite (for aluminum);

b. groundwaters in the system are generally undersaturated with respect to carbonate minerals; groundwaters closest to saturation with respect to carbonate minerals occur in the ore zone and the intermediate sandstone aquitard, where the highest alkalinities in groundwater are observed (Appendix D; Table 3-4);

c. uranium concentrations in groundwater under existing conditions may reflect equilibrium with a reduced U(IV) oxide mineral phase (uraninite or other) at depth (i.e., within the Lower Sandstone Aquifer and Intermediate Sandstone Aquitard). The work done by Percival (1989) and discussed in detail below (Section 3.5.6.2.1) suggests that in the sandstones most closely overlying the ore zone, uraninite likely represents at least a portion of the uranium present and it's origin was the hydrothermal processes that formed the ore body (i.e., it is has been dissolved to a very limited extent over more than 1 billion years).

d. Uranyl (U(VI)) mineral phases are not predicted to be controlling dissolved-phase uranium concentrations under existing conditions; however, the restored solutions are supersaturated with respect to U(VI)-phosphate minerals (Uranyl Hydrogen Phosphate and Uranyl Orthophosphate), U(VI)-silicate minerals (Uranophane, Soddyite) and a U(VI)-vanadate mineral (Tyuyamunite). This suggests that the potential for those minerals could be important authigenic mineral phases to consider for uranium behaviour downgradient of the mining area.

e. Overall, the saturation indices suggest that under existing conditions in the paleoweathered zones, Athabasca Supergroup sandstones and overburden, the

dissolved phase concentrations of very few COPCs in groundwater are solubility controlled. Potential exceptions may be Mn (through equilibrium with rhodochrosite ($MnCO_3$)) and Cr(III) (through an oxide/hydroxide mineral phase). All solutions are supersaturated with respect to ThO_2 but this was not considered further as a mineral phase in the modelling for the reasons given below (Section 3.5.6.1.2).

There are important limitations to the above assessment because there may be other important mineral phases in an environment for which solubility constants are not known or are uncertain.

Table 3-8: Saturation Indices for Select Solid Phases in Groundwater Representative of Hydrostratigraphic Units

Mineral Groupings	Sample/Paramter	Ideal Formula	Ore Zone (GWR-032)	Paleoweatherd zone (GWR-031 and Cigar Lake Samples)	Lower Sandstone Aquifer/Desilicified Zone (GWR-011), high pe	Lower Sandstone Aquifer/Desilicified Zone (GWR-011), low pe	Intermediate Sandstone Aquitard (GWR-046), high pe	Intermediate Sandstone Aquitard (GWR-046), low pe	Overburden and Upper Sandstone Aquifer, single pe	Restoration Solution #1	50% Restoration Solution #1	Restoration Solution #2	50% Restoration Solution #2
	pH		6.79	6.71	6.36	6.36	7.03	7.05	6.46	4.24	5.07	6.20	6.31
	pe (calculated in PHREEQC)		-2.7	1.9	2.5	0.3	4.4	-3.0	1.2	10.0	7.0	7.6	4.0
	Partial Pressure CO2(g)		-1.8	-1.8	-1.8	-1.8	-2.2	-2.2	-2.2	-1.8	-1.8	-1.8	-1.8
Primary Host/Matrix Minerals	Goethite	FeOOH	-1.4	2.1	2.0	-0.2	6.3	-0.6	0.7	4.5	4.1	5.5	3.8
	Hematite	Fe2O3	-0.4	6.6	6.2	1.9	14.9	1.2	3.7	11.4	10.5	13.3	9.9
	Kaolinite	Al2Si2O5(OH)4	1.2	4.0	4.9	4.9	7.7	7.7	5.1	0.3	4.7	6.4	6.2
	Quartz	SiO2	0.6	0.4	0.9	0.9	0.6	0.6	0.9	1.1	1.0	1.1	1.0
Carbonate	Siderite	FeCO3	-0.7	-1.8	-2.2	-2.2	-0.9	-0.4	-2.8	-5.0	-3.2	-3.6	-1.9
	Calcite	CaCO3	-1.1	-2.1	-2.6	-2.6	-1.7	-1.6	-3.5	-6.1	-4.6	-3.1	-2.8
	CuCO3	CuCO3	-10.0	-3.7	-3.9	-5.8	-2.5	-7.6	-5.7	-6.0	-4.6	-2.9	-2.9
	Gypsum	CaSO4:2H2O	-2.5	-3.7	-3.5	-3.5	-3.1	-3.2	-4.4	-0.8	-1.2	-2.2	-2.4
	NiCO3	NiCO3	-8.1	-7.0	-9.8	-9.8	-6.2	-6.2	-8.8	-9.3	-7.9	-8.2	-8.3
	Otavite	CdCO3	-4.9	-4.9	-5.5	-5.5	-4.0	-4.0	-5.7	-6.9	-5.4	-3.3	-3.4
	Rhodochrosite	Mn(CO3)	-1.0	-0.6	-1.5	-1.5	0.4	0.5	-2.2	-5.1	-3.6	-1.8	-1.6
	Smithsonite	ZnCO3	-1.2	-4.1	-4.3	-4.3	-3.4	-3.4	-5.0	-6.8	-5.3	-4.1	-4.1
	Strontianite	SrCO3	-2.1	-2.4	-4.0	-4.0	-3.1	-3.1	-5.3	-7.0	-5.5	-3.1	-3.1
Oxides	Gibbsite	Al(OH)3	-0.56	0.98	1.02	1.02	2.68	2.68	1.09	-1.47	0.83	1.55	1.54
	Cd(OH)2	Cd(OH)2	-11.5	-11.5	-12.1	-12.1	-10.3	-10.3	-11.9	-13.6	-12.1	-10.0	-10.0
	Co(OH)2	Co(OH)2	-8.5	-6.6	-9.2	-9.2	-6.2	-6.1	-8.4	-9.5	-8.0	-7.7	-7.7
	Cr(OH)3(am)	Cr(OH)3	-0.9	0.0	-1.5	-1.5	0.0	0.1	-1.3	-4.6	-2.6	0.1	0.0
	Cr2O3	Cr2O3	-1.5	0.2	-2.8	-2.8	0.3	0.4	-2.4	-9.0	-5.0	0.5	0.3
	Cu(OH)2	Cu(OH)2	-10.7	-4.5	-4.7	-6.6	-2.8	-7.9	-5.9	-6.8	-5.3	-3.6	-3.7
	MoO2(s)	MoO2	2.0	-6.3	-6.5	-2.2	-13.2	1.5	-5.2	-12.2	-9.4	-14.8	-8.3
	Ni(OH)2	Ni(OH)2	-8.3	-7.2	-10.0	-10.0	-6.0	-6.0	-8.5	-9.5	-8.1	-8.4	-8.5
	Pb(OH)2	Pb(OH)2	-5.1	-5.2	-5.6	-5.6	-3.4	-3.4	-5.4	-5.7	-4.2	-2.6	-2.6
	Ra(OH)2(s)	Ra(OH)2	-29.9	-33.0	-33.2	-33.2	-31.7	-31.6	-33.9	-35.3	-33.9	-30.9	-30.9
	Sr(OH)2(s)	Sr(OH)2	-20.6	-20.8	-22.5	-22.5	-21.2	-21.1	-23.2	-25.4	-24.0	-21.6	-21.6
	ThO2(cr)	ThO2	3.3	2.4	1.8	1.8	2.0	2.0	1.5	-1.2	2.1	2.9	2.6
	V(OH)3	V(OH)3	-13.2	-13.2	-13.2	-13.2	-14.0	-12.1	-13.2	-15.0	-11.3	-15.8	-10.3
	V2O5	V2O5	-41.2	-23.1	-22.2	-30.8	-13.1	-38.9	-26.8	-4.2	-5.4	-7.3	-10.4
	VO(OH)2	VO(OH)2	-12.4	-7.9	-7.7	-9.8	-5.7	-11.3	-8.8	-4.1	-2.5	-5.2	-3.3
	Zn(OH)2	Zn(OH)2	-3.2	-6.1	-6.3	-6.3	-5.0	-4.9	-6.5	-8.8	-7.3	-6.1	-6.1

Table 3-8: Saturation Indices for Select Solid Phases in Groundwater Representative of Hydrostratigraphic Units, continued

Mineral Groupings	Sample/Paramter	Ideal Formula	**Ore Zone (GWR-032), high pe**	Ore Zone (GWR-032), low pe	Paleoweatherd zone (GWR-031 and Cigar Lake Samples)	Lower Sandstone Aquifer/Desilicified Zone (GWR-011), low pe	Intermediate Sandstone Aquitard (GWR-046), high pe	Overburden and Upper Sandstone Aquifer, single pe	Restoration Solution #1	50% Restoration Solution #1	Restoration Solution #2	50% Restoration Solution #2
Sulphate	Barite	BaSO4	-0.4	-0.4	-0.9	-0.6	0.3	-2.0	1.0	0.9	0.6	0.4
	Anglesite	PbSO4	-6.1	-6.1	-6.3	-6.0	-4.8	-6.3	0.0	-0.3	-1.3	-1.8
	Celestite	SrSO4	-2.4	-2.4	-2.8	-3.7	-3.4	-5.0	-0.5	-0.9	-1.1	-1.6
	CuSO4	CuSO4	-21.4	-22.9	-16.8	-18.1	-15.4	-18.1	-12.2	-12.6	-13.5	-14.0
	Ra(SO4)(s)	Ra(SO4)	-4.3	-4.3	-7.5	-7.0	-6.5	-8.3	-3.0	-3.3	-2.9	-3.4
Sulfides and Other Minerals in the Ore Body	Chalcopyrite	CuFeS2	-9.4	13.1	-54.6	-24.8	-98.3	-41.4	-136.7	-101.9	-134.8	-77.7
	Galena	PbS	-8.4	3.7	-32.9	-17.2	-54.4	-25.5	-71.6	-54.4	-69.8	-42.2
	Greenockite	CdS	-9.6	2.3	-34.1	-18.6	-56.2	-26.9	-74.5	-57.2	-72.2	-44.5
	MoS2	MoS2	-13.3	13.7	-67.6	-31.1	-121.0	-51.3	-150.0	-115.6	-155.2	-93.2
	NiAs(cr)	NiAs	-14.2	-6.7	-27.6	-20.6	-51.0	-24.9	-67.0	-51.3	-64.6	-40.4
	NiS(gamma)	NiS	-9.5	2.6	-32.8	-19.5	-55.0	-26.6	-73.4	-56.2	-73.6	-46.0
	Pyrite	FeS2	-16.2	4.8	-60.1	-32.0	-99.7	-47.3	-128.6	-99.7	-130.6	-80.5
	Sphalerite	ZnS	-7.1	4.9	-34.4	-18.4	-56.6	-27.3	-75.4	-58.1	-74.0	-46.2
Uanium Minerals	Coffinite	U(SiO4)	2.1	5.1	-2.8	0.8	-8.3	-0.8	-11.3	-5.9	-9.5	-2.8
	Metaschoepite	UO3:2H2O	-5.2	-5.2	-3.9	-4.6	-3.8	-4.1	-1.7	-0.7	-0.7	-0.9
	Rutherfordine	UO2CO3	-4.8	-4.8	-3.5	-4.2	-3.8	-4.3	-1.3	-0.3	-0.4	-0.6
	Schoepite	UO2(OH)2:H2O	-5.8	-5.8	-4.5	-5.2	-4.4	-4.8	-2.3	-1.3	-1.4	-1.6
	Soddyite	(UO2)2SiO4:2H2O	-7.9	-7.9	-5.5	-6.4	-5.1	-5.5	-0.4	1.5	1.4	0.9
	Sodium-compreignacite	Na2(UO2)6O4(OH)6:7H2O	-32.1	-32.1	-24.6	-31.5	-25.0	-29.4	-15.6	-8.4	-6.6	-8.2
	Tyuyamunite	Ca(UO2)2(VO4)2	-30.7	-36.7	-17.1	-26.6	-5.9	-22.0	2.3	4.6	4.1	0.9
	U2O7Na2(s)	U2O7Na2	-14.4	-14.4	-12.1	-16.3	-13.0	-15.9	-11.9	-8.7	-6.7	-7.4
	UO2.34(beta)	UO2.34	0.7	2.6	-2.1	-0.2	-5.7	-1.1	-7.3	-3.4	-5.9	-1.4
	Uraninite	UO2	2.6	5.6	-2.2	1.0	-7.8	-0.6	-11.3	-5.8	-9.5	-2.7
	Uranophane	Ca(UO2)2(SiO3OH)2:5H2O	-4.7	-4.7	-3.5	-4.5	-2.0	-3.9	-1.8	1.5	3.2	2.8
	Uranyl Hydrogen Phosphate	UO2HPO4:3H2O	-6.9	-6.9	-5.4	-4.6	-5.0	-4.7	1.5	1.5	0.9	0.3
	Uranyl Orthophosphate	(UO2)3(PO4)2:4H2O	-10.5	-10.5	-6.4	-5.5	-5.4	-5.2	9.6	10.7	9.4	8.0
Other	Cumetal	Cu	1.1	2.6	-0.2	1.6	-4.3	0.2	-13.8	-7.9	-9.9	-2.9
	Fluorite	CaF2	-2.4	-2.4	-2.5	-3.3	-4.2	-4.7	NA	-7.5	-3.1	-3.0
	Plumbgummite	PbAl3(PO4)2(OH)5:H2O	-3.8	-3.8	1.1	3.7	8.5	3.2	2.6	9.0	11.8	10.9
	Semetal(am)	Se	2.6	-0.4	2.1	5.3	-9.2	6.9	-15.2	-7.5	-16.4	-2.8

Notes

1.0	Groundwater is saturated with respect to this mineral (calculated saturation index>0)
-3.0	Groundwater is unsaturated with respect to this mineral (calculated saturation index<-2)

3.5.6.1.2 Incorporation of Mineral Phases in the Geochemical Model

Model simulations were also completed to evaluate the potential importance of solid-phase solubility on the behaviour of COPCs along the groundwater flow path from the mining area to Whitefish Lake.

In the discussion below, as with discussion of results throughout the remainder of Section 3.0, results are focused on uranium and other key COPCs, including Radium-226 and pH. Results for all COPCs are discussed in more detail for the results of the 3-D numerical modelling (Section 4.0).

Uranium

The uranyl mineral phases included above in Table 3-8 were included in model simulations involving the Desilicified Zone conceptual model (Figure 3-6b). Uranium concentrations in porewater were first simulated in the absence of any chemical reactions along the groundwater flow path. Because this is a 1D plug flow model, incorporating modest to low longitudinal dispersivity, the uranium concentrations at breakthrough (i.e., at the point of discharge) are largely unchanged from the concentrations in the mining area (50% Restored Solution #1). Travel time to Whitefish Lake, for all COPCs that were considered as chemically conservative, is approximately 300-500 years.

Authigenic uranyl (U(IV)) minerals Soddyite, Tyuyamunite, Uranophane and Uranyl Orthophosphate were predicted to precipitate. In the absence of other geochemical reactions, precipitation of authigenic uranyl minerals resulted in a order of magnitude decrease in peak uranium concentrations in groundwater adjacent to Whitefish Lake compared to the simulation with no geochemical reactions (Figure 3-7). Both sorption and authigenic mineral formation were then explored by adding in the sorption processes described below (Section 3.5.6.2). Figure 3-7 shows the predicted uranium concentrations when "full solids", based in the understood LSA mineralogy, were included. Concentrations of uranium in groundwater discharging to Whitefish Lake in the 4000 years following Decommissioning were not substantively different if precipitation of authigenic mineral phases and sorption were included in the model versus sorption alone.

The sensitivity to the density of reactive sorption sites on mineral surfaces was evaluated by decreasing the number of sorption sites in the Desilificified Zone by a factor of 10. The rationale for this sensitivity evaluation is discussed further is Section 3.5.6.2. Simulated uranium concentrations were higher when authigenic minerals were not included in the model run. In both the full sorption and 10% sorption scenarios, authigenic uranyl precipitation was predicted to occur only within approximately 100 m of the remediated mining area, where uranium and other constituents were initially present in highest concentrations post closure.

There is some evidence that authigenic uranyl minerals are present with the Athabasca Supergroup sandstones because of groundwater re-work of localized U(IV) mineralization (Kermeen, 1955), and for other environments where uranium in the dissolved form has been

released from the shallow subsurface (e.g., Arai et al., 2007; Bond et al, 2007). However, the specific potential for precipitation of authigenic uranyl minerals in the LSA is currently unknown. As such, it was considered conservative to assume no precipitation of uranyl minerals and that sorption, which is a well documented controlling reaction for uranium downgradient of ISR mining areas, will be the dominant controlling reaction for uranium (Colon et al., 2000; Johnson et al., 2016; de Boissezon et al., 2020).

^{226}Radium

All of the solutions examined are undersaturated with respect to $Ra(SO_4)(s)$. However, a number of studies have demonstrated that a solid solution of radium sulphate ($RaSO_4$) and barite ($BaSO_4$) is an important phase for ^{226}Ra migration downgradient of ISR mining areas (e.g., Intera, 2013; de Boissezon et al., 2020). This solid solution was evaluated in the 1D model simulations.

The influence of the precipitation of barium-radium sulphate ($(Ba,Ra)SO_4$) as a solid solution with barite ($BaSO_4$) on predicted ^{226}Ra concentrations in porewater was evaluated and results are shown in Figure 3-8. Sulphate from the mining area behaves conservatively and with no geochemical reactions exhibits peak concentrations at about 500 years after decommissioning. When formation of the solid solution is considered alone, ^{226}Ra concentrations first decrease reflecting the formation of the solid solution under conditions of maximum sulphate concentrations in the system interacting with background radium (and barium) concentrations. However, as the sulphate decreases with continuing groundwater flow, the solid solution is rapidly re-dissolved when groundwater with much lower sulphate concentrations flow into the system. This results in a peak ^{226}Ra concentration that arrives later than that when no precipitation and dissolution of the barium-radium sulphate solid occurs.

When sorption is considered (both 'full solids' and '1 in 10 solids', see Section 3.5.6.2), the solid solution continues to be formed and re-dissolved in the system, but the processes work together to attenuate peak ^{226}Ra concentrations. Because both sorption and formation of the solid solution are understood to be important in ISR mining activities (e.g. de Boissezon et al., 2020), both processes are incorporated in 3D modelling.

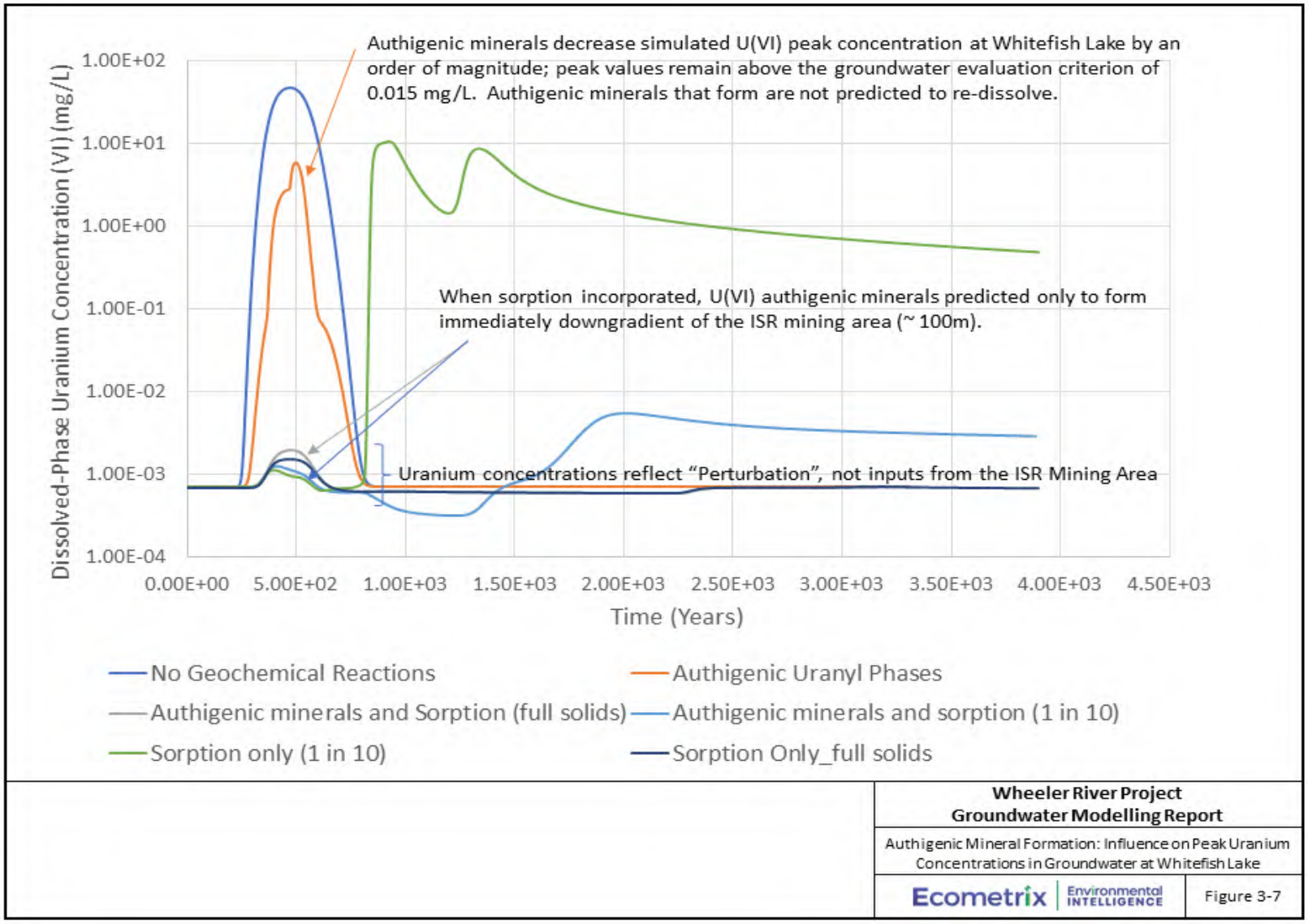
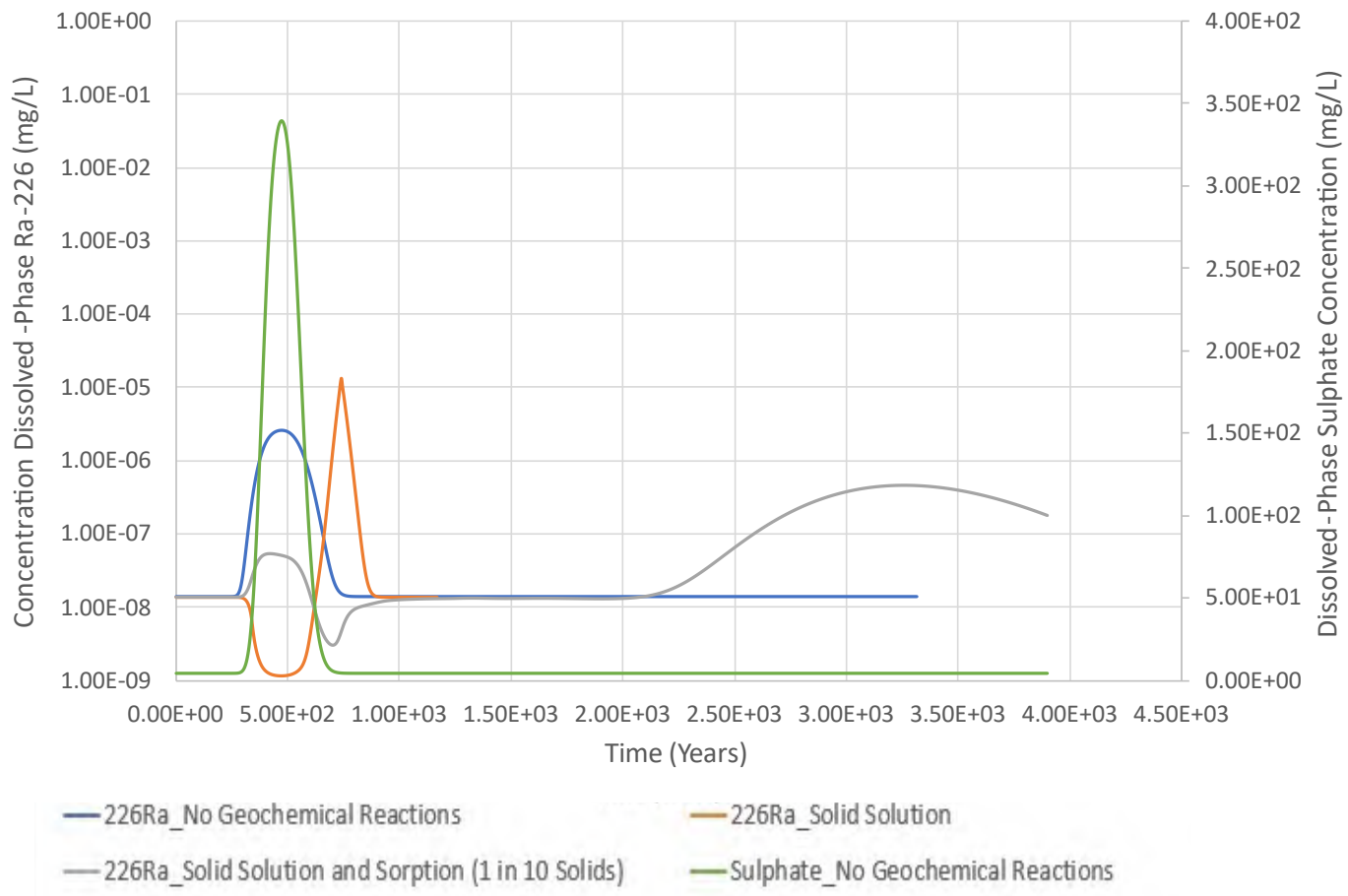


Figure 3-7: Authigenic Mineral Formation: Influence on Peak Uranium Concentrations in Groundwater at Whitefish Lake



Wheeler River Project Groundwater Modelling Report	
Authigenic Mineral Formation: Influence on Peak ^{226}Radium Concentrations in Groundwater at Whitefish Lake	
Ecometrix Environmental INTELLIGENCE	Figure 3-8

Figure 3-8: Authigenic Mineral Formation: Influence on Peak ^{226}Radium Concentrations in Groundwater at Whitefish Lake

Other Minerals

ThO_2 was not evaluated as a mineral phase in the model because:

- Th is known to be present not as ThO_2 but as part of the solid solution series of the crandellite group (aluminophosphate minerals; Mwenifumbo and Bernius, 2007) in the Athabasca Supergroup sandstones and particularly the Bird Formation. This is likely the reason that all baseline groundwaters are supersaturated with respect to ThO2 – it is not the correct solid phase to reflect the existing Th solid-phase speciation.

- Multiple studies have demonstrated that Th (IV) has a high sorptive affinity for mineral phases such as those present in the LSA (iron oxides/oxyhydroxides and clay minerals; e.g. Laflamme and Muray, 1987; Iida et al., 2016). A study by Melson (2011) shows that dissolved-phase Th concentrations solubility-controlled by ThO2 and those expected from sorption at mineral surfaces (iron oxides and clays) are comparable over the pH range being examined in this study. Thus, it was considered appropriate and conservative to evaluate sorption as the primary geochemical reaction for Th in the model.

The precipitation of $Cr(OH)_3$ was evaluated and was not found to substantively change the concentrations of Cr(III) along the groundwater flow path. As such, this mineral phase was not included as a solid phase. Aluminum concentrations in the system were controlled through solubility with gibbsite ($Al(OH)_3$). Controls on dissolved-phase iron concentrations are discussed in more detail in Section 3.5.6.5.

3.5.6.2 Incorporation of Sorption Processes

As introduced above (Table 3-7), sorption – including both ion exchange and adsorption at solid surfaces – was considered to some extent in all the model simulations for COPC geochemical reactive transport. Incorporation of sorption is supported by reviewed literature, which has demonstrated that sorption of uranium and other metals/trace elements occurs on the surfaces of quartz, iron oxides and clays (e.g., Dzombak and Morel, 1991), and assemblages of those mineral phases (e.g., Dong and Wan, 2014). Sorption was implemented using geochemical reactions rather than using a simplified partitioning coefficient approach, as described below.

3.5.6.2.1 Information Supporting Incorporation of Sorption

To the best of our knowledge, there is very little information published about the solid-phase speciation of uranium and other constituents associated with ore bodies and the overlying and underlying rocks in the Athabasca basin. Information on solid-phase speciation, meaning, how uranium and other elements occur in the subsurface can provide supporting information for model simulations.

One study was identified of core samples at Cigar Lake (Percival, 1989), wherein solid-phase uranium speciation in core samples from a) the sandstones closest to the clay barrier material, b) the unconformity, and c) the "altered basement" were examined using sequential extraction. The

objective of that study was to identify if uranium associated with these units resulted form primary ore-formation or because of secondary alteration/hydromorphic dispersion – meaning remobilization and movement of uranium after primary mineralization. Five extraction solutions were used in the sequential extraction, and the results are summarized in Table 3-9.

Table 3-9: Solid Phase Speciation of Uranium, Existing Conditions (after Percival, 1989)

Unit	Extraction	% of Total U (range, and median value)[a]	Interpretation of uranium speciation (Percival, 1989)
Clay-Rich Sandstones Overlying the Unconformity (n = 11, < 2 µm fraction)	Carbonate Associated and Exchangeable	2-16%, 9%	Generally low, probably the most mobile form of uranium
	Uraninite, Sulfide and Organic Bound	13-73%, 35%	No visible reaction on addition of reagent, unlikely that an organic-bound form of U is present. Uraninite is assumed to be the main digestible fraction by this treatment.
	Amorphous Fe-bound	1-14%, 3%	Relatively low contribution reflects the overall low concentrations of these mineral phases in the subsurface
	Crystalline Fe-bound	6-54%,18%	Associated with noeformed (during the period of hydrothermal alteration) iron oxides
	Residual	10-46%, 33%	Associated with noeformed (during the period of hydrothermal alteration) clay minerals, and strong relationship with illite.
Paleoweathered Zone (n=1, < 2µm fraction)	Carbonate Associated and Exchangeable	13%	Same interpretations as above.
	Uraninite, Sulfide and Organic Bound	31%	
	Amorphous Fe-bound	4%	
	Crystalline Fe-bound	10%	
	Residual	42%	

Notes

Fraction representing the greatest percentage of the total uranium in the sample

a Values presented for the Paleoweathered Zone reflect only a single sample analyzed

Percival (1989) concluded that uranium present outside of the ore zone is primarily related to ore-forming processes, and that there has been very limited secondary mobilization of uranium. This was concluded on the basis that uranium concentrations in the overlying sandstones remain low, and most of the uranium is associated with uraninite, crystalline iron oxides, and the residual phase. The uranium in the residual phase was interpreted to be associated with silicate minerals, including clay minerals (illite, sudoite, and kaolinite), quartz, tourmaline, and zircon. Uranium, dispersed because of the hydrothermal alteration, was interpreted to have been incorporated into neoformed clay minerals and iron oxides.

The results of Percival (1989) inform the modelling evaluation herein in that they indicate uranium is present in a number of chemical forms (species) in the subsurface, and that there is evidence for reactivity of clay minerals and iron oxides (amorphous and crystalline) for uranium. Specifically, the reactivity of illite is suggested by observation that samples with higher illite content and furthest from the unconformity had higher proportion of uranium associated with the residual/silicate fraction. Further, the redox conditions in the subsurface have allowed for

uranium to remain stable and largely immobilized, meaning, even outside of the ore zone, some portion of the uranium naturally in the samples is likely present as uraninite.

3.5.6.2.2 Ion Exchange and Surface Complexation

Partitioning of metals or trace elements can also occur because of chemical or electrostatic interactions between the solution species and reactive sites associated with a solid phase. When the interaction occurs at the surface of a solid particle, the term "surface complexation" is used to describe the interaction.

Surface complexation reactions included in the geochemical model described herein are generally those in which a chemical bond is formed between a reactive site at the surface and the species from solution, a process referred to as "adsorption". Surface complexation reactions involve a known (input), including the total number of, typically, diprotic reactive sites at the mineral surface. The number of sites and the constants driving adsorption of protons, metals and other species are specific to individual mineral phases and are based on experimental derivation. Because there are a finite number of diprotic sites, surface complexation modelling inherently considers the competition between protons and other elements/species for the same sites, and thus, provides a means of understanding how adsorption of elements/species changes with pH. Further, the finite number of sites means that competition amongst metals/species is accounted for, and the sites can become saturated, such that no further adsorption to the solid is allowed.

Adsorbing mineral surfaces were included in the geochemical model for the paleoweathered zone, Desilicified Zone, and in the Lake Bottom Sediments (described in more detail in Section 3.5.6.2.4). The nature of the adsorbing surfaces is detailed in Table 3-10. Illite was selected as the clay mineral phase because this was reported to be the dominant clay mineral (i.e., of illite, kaolinite and dichlorite) in the Athabasca Supergroup sandstones, and paleoweathered lithologic unit (Table 3-2 and Denison, 2022b).

Because there are multiple COPCs and other groundwater constituents being considered in the modelling simulations, it was important to ensure, as much as possible, that surface complexation reactions and associated surface complexation (binding) constants for COPCs were related to the same mineral. For this reason, a substantive literature review was undertaken to identify and compile appropriate surface complexation constants for COPCs to illite and quartz. The metals for which surface complexation constants were applied in the model and the sources of the constants are outlined in Table 3-10 and further explained in Appendix E. Metal/species adsorption to goethite was used as a proxy for sorption to hematite and other ferric oxyhydroxides (limonite) present in the system. Surface complexation constants for trace elements and radionuclides with goethite were, for the most part, taken from Mathur and Dzombak (2006), with exceptions outlined in Appendix E.

Table 3-10: Properties of Adsorbing Mineral Phases

Sorbent Phase	Site Density (mol/kg)	Specific Area (m2/g)	Reference
Goethite (FeOOH)	0.203	60	Mathur and Dzombak, 2006
Quartz (SiO_2)	0.00118	0.31	Prikryl et al., 2001
Illite	Strong Sites: 0.002 (metals and protons sorb); Weak Sites; 0.04 (protons only sorb)	97	Bradbury and Baeyans, 2009

Sorption to a mineral phase can also include electrostatic-driven interactions. Ion exchange reactions were included in the geochemical model for clay minerals. For exchangeable cations, the cation exchange capacity (CEC) for illite of 225 meq/kg was taken from Bradbury and Baeyans (2009). The exchanger was defined (as Y-) and reactions of cations and protons with the exchange site were written as half reactions. For example, the reaction of exchange sites on illite, saturated with Na and then exchanged with Ca is:

Ca^{2+} + 2Y- = CaY2

K = 11; log K = 1.04 (Thermodynamic constant from Bradbury and Baeyans, 2009).

3.5.6.2.3 Model Check – Baseline Conditions

An important step in developing the model was a check that the sorptive capacity of the mineral surfaces for COPCs applied in the model using literature values for the mineral properties (i.e. surface area, site density) and surface complexation constants under initial/baseline conditions, did not exceed the existing/baseline solid phase concentrations of those COPCs. In PHREEQC, the solids are "pre-loaded" (pre-equilibrated) with COPCs to bring the solid phase concentrations into equilibrium with the dissolved phase concentrations before the transport simulation is started. For example, for a given dissolved concentration of uranium, the solid phases in each zone (e.g., desilicified zone) are pre-loaded with uranium on the reactive sorption sites. The pre-loading continues in accordance with the surface complexation constants for uranium with those minerals, until equilibrium is reached between uranium in the dissolved phase (set in the initial solution) and uranium sorbed on the solids (calculated in PHREEQC).

Shown in Table 3-11 are the solid-phase concentrations of COPCs calculated in the manner described above in PHREEQC. Also shown are "apparent K_d" values (with units of L/kg). These values express the dissolved concentration of the COPC (mg/L) to the total sorbed concentration of the COPC (mg/kg); the total sorbed concentration is the total concentration of COPC on all sorbing phases (quartz and/or illite and/or goethite depending on availability of surface complexation constants; see Appendix E). For the majority of the COPCs and for both the Desilicified and paleoweathered zones, the modelled solid phase concentrations and apparent K_d values were below those measured, and calculated from measured values, respectively. This indicates that the model is not overpredicting solid-phase concentrations based on sorption, nor are the apparent K_d values exceeding those reported in the literature.

Noted is that these represent existing/pre-restoration solid phase concentrations and K_d values; the solid phase concentration and K_d value will change during the reactive transport of the plume, reflecting binding of COCPs and the saturation level of the reactive sites on the mineral surfaces.

Work done to verify that the adsorption of COPCs was aligned with the adsorption behaviour of those constituents in the literature is provided in Appendix E. In Appendix E are a series of figures that plot the adsorption behaviour using the solid properties and thermodynamic database developed for this project, and where relevant, it is compared to adsorption behaviour in the literature.

Table 3-11: Solid-Phase Concentrations and Partitioning Constants for COPCs, measured and simulated

Desilicified Zone													
	Units	As (Partial)	Cd	Co	Cr	Cu	Mo	Ni	Pb	Se (Partial)	U	V	Zn
Solid Phase Concentration - Maximum	mg/kg	8.46E+00	7.00E-01	2.25E+01	1.09E+02	1.09E+02	4.51E+00	1.58E+02	7.33E+01	4.00E-01	2.13E+02	3.71E+02	9.30E+01
Solid Phase Concentration - Minimum	mg/kg	9.00E-02	5.00E-02	1.20E-01	2.00E+00	2.00E-01	4.00E-02	1.00E+00	7.80E-01	1.00E-01	5.00E-01	1.40E+00	5.00E-01
Solid Phase Concentration - Median	mg/kg	5.60E-01	1.00E-01	4.90E-01	8.00E+00	2.00E+00	1.70E-01	6.00E+00	2.95E+00	1.00E-01	1.77E+00	7.70E+00	3.00E+00
Concentration in Representative Groundwater	mg/L	1.30E-03	1.00E-05	1.00E-04	5.00E-04	1.80E-03	4.20E-03	1.00E-04	1.00E-04	1.00E-04	7.00E-04	1.00E-04	1.20E-02
K_d - maximum value	L/kg	6.51E+03	7.00E+04	2.25E+05	2.18E+05	6.06E+04	1.07E+03	1.58E+06	7.33E+05	4.00E+03	3.04E+05	3.71E+06	7.75E+03
K_d - minimum value	L/kg	6.92E+01	5.00E+03	1.20E+03	4.00E+03	1.11E+02	9.52E+00	1.00E+04	7.80E+03	1.00E+03	7.14E+02	1.40E+04	4.17E+01
K_d - median value	L/kg	4.30E+02	1.00E+04	4.90E+03	1.60E+04	1.11E+03	4.05E+01	6.00E+03	2.95E+04	1.00E+03	2.53E+03	7.70E+04	2.50E+02
Modelled Solids Concentration **Base Case**	mg/kg	7.70E-03	1.11E-04	5.62E-03	1.90E+00	3.57E+00	5.51E-07	1.30E-02	8.68E-02	6.60E-06	7.25E-02	3.90E-07	1.37E+00
Apparent K_d value in the **Base Case** model	(L/kg)	5.92E+00	1.11E+01	5.62E+01	3.81E+03	1.98E+03	1.31E-04	1.30E+02	8.68E+02	6.60E-02	1.04E+02	3.90E-03	1.14E+02
Apparent K_d value in the model; **1/10 reactive sites**	(L/kg)	5.92E-01	1.11E+00	5.62E+00	3.81E+02	1.98E+02	1.31E-05	1.30E+01	8.68E+01	6.60E-03	1.04E+01	3.90E-04	1.14E+01
Paleoweathered Zone													
	Units	As (Partial)	Cd	Co	Cr	Cu	Mo	Ni	Pb	Se (Partial)	U	V	Zn
Solid Phase Concentration - Maximum	mg/kg	5.66E+02	8.00E+00	4.23E+02	4.41E+02	5.24E+04	3.93E+03	5.88E+02	5.15E+03	2.00E+02	5.56E+04	6.05E+03	1.58E+03
Solid Phase Concentration - Minimum	mg/kg	5.00E-01	1.00E-01	6.00E+00	6.00E+00	5.00E+00	5.00E-01	4.40E+01	1.00E+00	5.00E-01	9.00E+00	2.20E+01	7.00E+00
Solid Phase Concentration - Median	mg/kg	2.40E+01	1.00E+00	2.80E+01	1.55E+02	2.28E+02	5.00E+00	1.67E+02	4.60E+01	1.00E+00	4.03E+02	3.10E+02	3.10E+01
Concentration in Representative Groundwater	mg/L	5.00E-02	1.00E-05	1.00E-02	4.50E-03	5.00E-03	1.28E-02	1.50E-02	1.00E-04	1.00E-04	1.24E-02	1.00E-04	4.25E-03
K_d - maximum value	L/kg	1.13E+04	8.00E+05	4.23E+04	9.80E+04	1.05E+07	3.07E+05	3.92E+04	5.92E+07	2.00E+06	4.49E+06	6.05E+07	3.72E+05
K_d - minimum value	L/kg	1.00E+01	1.00E+04	6.00E+02	1.33E+03	1.00E+03	3.91E+01	2.93E+03	7.00E+04	5.00E+03	7.26E+02	2.20E+05	1.65E+03
K_d - median value	L/kg	4.80E+02	1.00E+05	2.80E+03	3.44E+04	4.56E+04	3.91E+02	1.11E+04	8.30E+05	1.00E+04	3.25E+04	3.10E+06	7.29E+03
Modelled Solids Concentration **Base Case**	mg/kg	1.87E-01	9.80E-05	4.69E-01	0.00E+00	5.30E+00	0.00E+00	2.34E+00	6.34E-02	2.87E-06	3.63E-01	0.00E+00	4.41E-01
Apparent K_d value in the **Base Case** model	(L/kg)	3.74E+00	9.80E+00	4.69E+01	0.00E+00	1.06E+03	0.00E+00	1.56E+02	6.34E+02	2.87E-02	2.93E+01	0.00E+00	1.04E+02
Apparent K_d value in the model; **1/10 reactive sites**	(L/kg)	3.74E-01	9.80E-01	4.69E+00	0.00E+00	1.06E+02	0.00E+00	1.56E+01	6.34E+01	2.87E-03	2.93E+00	0.00E+00	1.04E+01
Literature K_d values (mean value and range)[a,b]	L/kg	550 (25-3000)	15 (2.0-250)	1.9×10^3 (29-99,000)	18 (1.0-1600)	530 (760-2700)	40 (7-130)	58 (7.0-1100)	2000 (25-130,000)	56 (4-1600)	740 (2.6 - 6.2×10^4)	1.1-2.7	1.6×10^3 (6.2-30,000)

Notes

[a] Literature K_d values are for pH values ranging from 5-8 from IAEA, 2010. These values show mean values (and range). Value for Cd is for soils with pH < 6.5. Where pH dependent K_d values were not available, the mineral soil texture values were obtained. Where a K_d was not available for mineral soil, the value for "All soil" texture or "Sand" was used.

[b] Literature range of K_d values for Vanadium taken from US EPA, 2005

[c] Literature value of maximum K_d for pH values ranging from 5-7 from IAEA, 2010.

3.5.6.2.4 Lake Bottom Sediments

A 1 m layer of lake-bottom sediments was simulated for Whitefish Lake. Reversible sorption of chemical constituents in groundwater to the lake-bottom sediments was simulated by applying the water-to-sediment partition coefficients (K_d) applied in the Wheeler River IMPACT Model (Ecometrix, 2024b). The K_d values (Table 3-12) consist of regional published values that have been calibrated on similar sites in northern Saskatchewan and have been checked against Wheeler River measurement data (Ecometrix 2024b; ERA Report).

Table 3-12: Distribution Coefficients (Coefficients (K_d) Used in the IMPACT Model

COPC	Distribution Coefficient L/kg (dw)
Arsenic	9.64E+04
Cadmium	1.50E+04
Chromium	1.16E+04
Cobalt	2.50E+03
Copper	3.00E+03
Molybdenum	3.17E+03
Selenium	2.00E+04
Uranium	2.00E+04
Vanadium	9.10E+04
Zinc	1.50E+04
Radium-226	1.20E+04
Thorium-230	2.30E+03

Water quality in the porewater of the lake bottom sediments was not available. Initial porewater quality in the model was assumed to be that of groundwater in the Upper Sandstone Aquifer/obverburden (Table 3-5).

3.5.6.2.5 Sensitivity Analysis, Fewer Sorption Sites

A sensitivity analysis was run assuming that only 10% of the total sites on the adsorbing solids are reactive ("Sorption to fewer sites" in Table 3-8). This order of magnitude decrease was based on the understanding that the number of reactive sites is very sensitive to surface area and that the available surface area of mineral phases in situ in the LSA may be different from those assumed based on literature sources. In addition, the decision to decrease sites by an order of magnitude was made after evaluation of the apparent K_d values presented in Table 3-11 Generally, the apparent K_d values were comparable to or lower than the K_d values from the literature. For Cr, Cu and Ni, the apparent K_d values in the Desilicified zone and paleoweathered zones were better aligned with the literature values when the number of reactive sites assumed was 10% of those in the base case (full solids).

3.5.6.2.6 Results from Sorption Assessment

3.5.6.2.6.1 Dissovled Uranium, and "Perturbation" Effects

Uranium concentrations in groundwater at Whitefish Lake are predicted to change only marginally from existing baseline conditions in the more than 100,000 years following Decommissioning in the base case scenario (Figure 3-10). When there is a lower concentration

of reactive sorption sites assumed, the simulation results indicate the potential for uranium in groundwater to be elevated with respect to baseline conditions. The results for uranium migration between the base case and the lower sorption site density scenario, shown in Figure 3-10, and in Figure 3-7, point to the need to further evaluate the sensitivity of the modelling results in 3D to the concentrations of reactive surface sites.

Noted in Figure 3-7 is a marginal increase in dissolved uranium concentrations in groundwater at Whitefish Lake between approximately 300 and 500 years. This is referred to herein as uranium concentrations that result from system 'perturbation'.

Many groundwater constituents behave conservatively with respect to migration. The plume of conservative constituents and pH results in a "perturbation" to the existing system with respect to the binding of metals like uranium. What this means is that aqueous concentrations of species like sulphate, and carbonate change, and bring about an associated shift in the speciation of U(VI) in solution. This, in turn, affects the equilibrium between aqueous U(VI) and the pre-mine naturally occurring sorbed U(VI) in solids along the groundwater flow path. Thus, the increase in dissolved uranium concentrations is a result of the chemical conditions in the groundwater affected and does not reflect dissolved uranium arriving at Whitefish Lake from the mining area in that period.

3.5.6.2.6.2 Other COPCs

Results for the 1D modelling have not been shown for all constituents. The sorption assessment indicates the following general behaviour for COPCs and other constituents (e.g., chloride):

- sulphate, arsenic, selenium, ferrous iron, molybdenum, vanadium and chloride behave conservatively, meaning they do not interact appreciably with the solid phase, and thus, they are transported at the average linear groundwater velocity from the mineralized zone to the lake.
- Hydronium ions do interact with the solid phases, and thus, pH changes occur somewhat later than changes in concentrations for conservative constituents.
- Constituents that do not behave conservatively, meaning they interact to various degrees with the solid phase include Al, Cd, Co, Cr, Cu, Ni, Pb, U(VI), Zn, ^{226}Ra, and ^{230}Th.

3.5.6.3 Redox Scenario

Uraninite is known to be present in the native Athabasca Supergroup sandstones, which could act as a secondary source of uranium, however, there are no known oxidants downgradient of the restored solution capable of oxidizing the uranium and mobilizing it as the oxidized U(VI) form in solution. Pyrite is known to be present from hydrothermal alteration of the Athabasca Supergroup Sandstones (i.e., associated with the Desilicified zone), which, through reactions with the uranyl ion could lead to reduction of U(VI) and re-precipitation as U(IV)/uraninite, similar to the process that resulted in the formation of the ore body. The latter reaction was explored through geochemical modelling.

The model set-up for the Redox scenario was a modification of the Desilicified Zone Pathway conceptual model shown in Figure 3-6b. A small amount of reactive pyrite was assumed for the first 500 m of transport away from the ore zone in the model, primarily in the desilicified sediments of the Lower Sandstone Aquifer, and deeper portion of the Intermediate Sandstone Aquitard. Support for the presence of pyrite in hydrothermally altered materials came from the core logging by Denison personnel, and specifically, from coreholes advanced in the locations shown in Figure 3-1. Alterations with the potential to affect (decrease) matrix permeability were logged, including the occurrence and strength (weak, moderate, high) of the alteration for mineral phases including diagenetic hematite, hydrothermal hematite, pyrite, sooty pyrite and limonite. Related to the latter, the occurrence Liesgang bands were also reported.

The presence of pyrite was reported between an approximate depth interval of 240-390 mbgs. There were two exceptions to this where pyrite was noted at two shallower depth intervals (less than 150 m bgs). Generally, the pyrite was observed within fractures, or as 'fractured hosted-stringers'. Sooty pyrite often occurred pervasively over intervals upwards of 50 m in depth within the larger depth interval indicated above. Hydrothermal hematite also, typically, present over the same depth range, as bands or irregular beds. The median iron oxide (Fe_2O_3) content of the MFa is 0.14 wt%. The core logging and elemental analysis do not provide the means to apportion the iron content further between oxidized and reduced forms.

In the modelling simulations, pyrite was allowed to come to equilibrium with the groundwater/restored solution plume. As a result of this equilibrium, dissolved U(VI) was reduced to U(IV) and precipitated as uraninite. Groundwater conditions over the long term (i.e., baseline groundwater quality in the Desilicified zone, including pe conditions) are such that the uraninite is stable and is not predicted to re-dissolve. Following the 500m reactive zone with pyrite, the plume was allowed to react with adsorbing phases as it travelled upwards through the Desilicified zone toward Whitefish Lake. No sorbing phases were included in the first 500 m of the groundwater pathway (where pyrite was present).

The exact solid that will be formed through the reaction of dissolved U(VI) with pyrite in the subsurface is not known; experimental work has suggested a mixed U(VI)/U(IV) solid (U_3O_8/U_4O_9/U_3O_7) (e.g., Yang et al., 2014) is formed. Thus, the solid formed through reaction of U(VI) with pyrite in the subsurface was assumed to be U_3O_7 (as $UO_{2.24}$(beta)) in the thermodynamic database). The model simulations demonstrated that a small fraction (<1%) of the total concentration of solid-phase Fe in this zone would have to be present as reactive pyrite (FeS_2) to react with dissolved uranium (U(VI)) in the remediate groundwater from the mining area and immobilize it as a reduced solid phase. Through the reduction and precipitation reactions of U(VI), concentration of dissolved uranium in groundwater at a distance of 500 m downgradient of the mining area, are consistent with measured baseline conditions.

3.5.6.4 Proton Desorption from Clay; 'pH Tail'

Other ISR projects have indicated that sorption of protons on clays in the ore zone as a result of the mining process result in long-term desorption of the protons with an associated depression

in pH compared to background (e.g., de Boissezon et al., 2020). This was evaluated herein by pre-equilibrating clay surfaces in the ore zone with the Restored Solution #1, for the multi-zone pathway conceptual model (Figure 3-6a).

The dominant clay in the ore zone is chlorite. It is possible that the mining process itself will affect the structure/mineralogy of the chlorite; however, it was assumed that chlorite will remain the dominant phase. The amount of chlorite in the ore zone was assumed to be 7.5% based on information provided by Denison (Denison, 2022c).

The sorptive properties of chlorite for protons was taken from Zazzi et al., 2012, and Zazzi, 2009. Proton sorption occurred on surface sites as several studies have shown that chlorite has a small cation exchange capacity (less than 5 meq/100 g) so protons exchanged at the surface were not included in the modelling simulations.

Table 3-13: Sorbent Properties of Chlorite

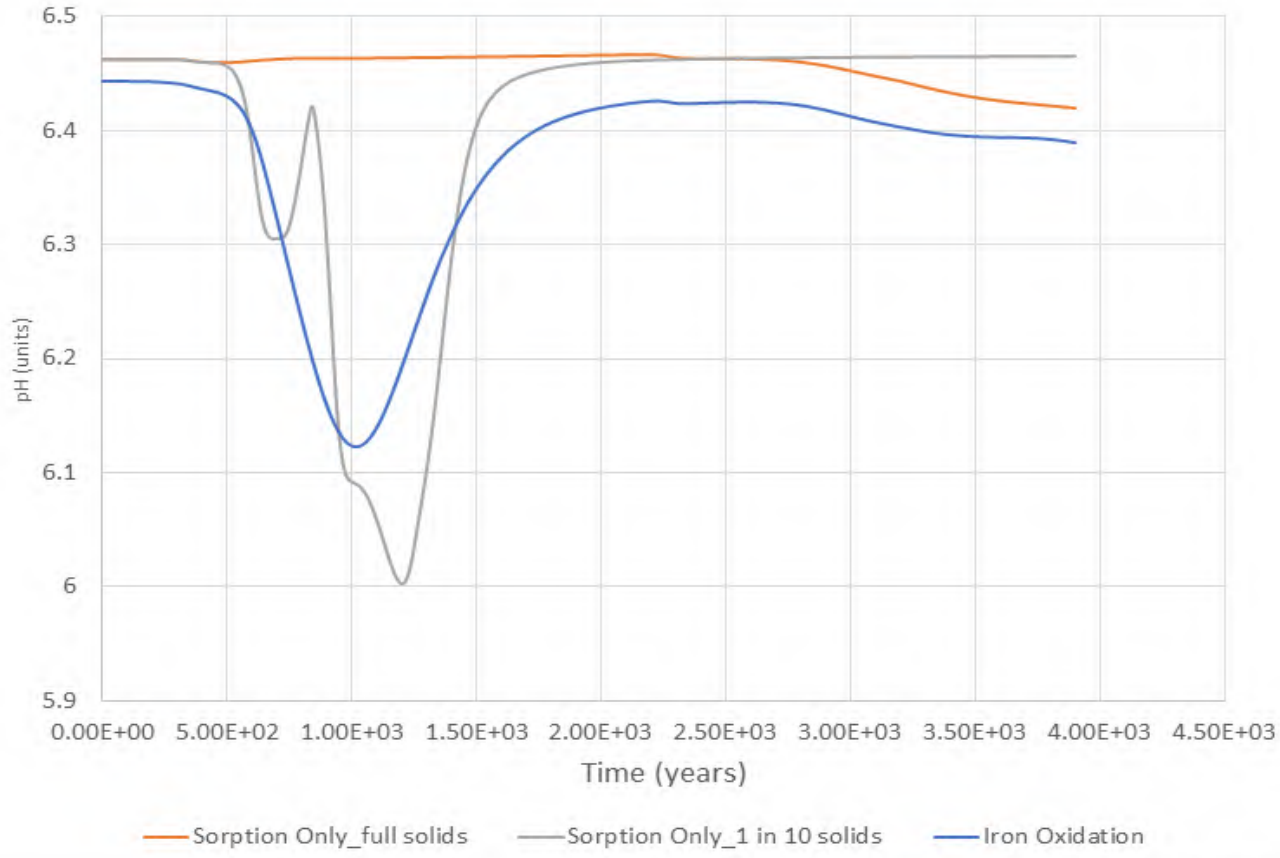
Sorbent Phase	Site Density (mol/kg)	Specific Area (m2/g)	Reference
Chlorite	0.00168	0.5	Zazzi et al., 2012

Results for the pH Tail scenario are shown in Figures 3-10 and 3-11. Sorption of protons to the clay mineral chlorite within the mining area is predicted to influence pH at the point of discharge over a longer period. Minimum pH values were approximately 6 under baseline conditions (Table 3-4 and Appendix D). The proton tail scenario is predicted to depress pH to some extent versus baseline conditions. Concentrations of uranium in groundwater at Whitefish Lake remain low with the changes in pH predicted.

3.5.6.5 Iron oxidation

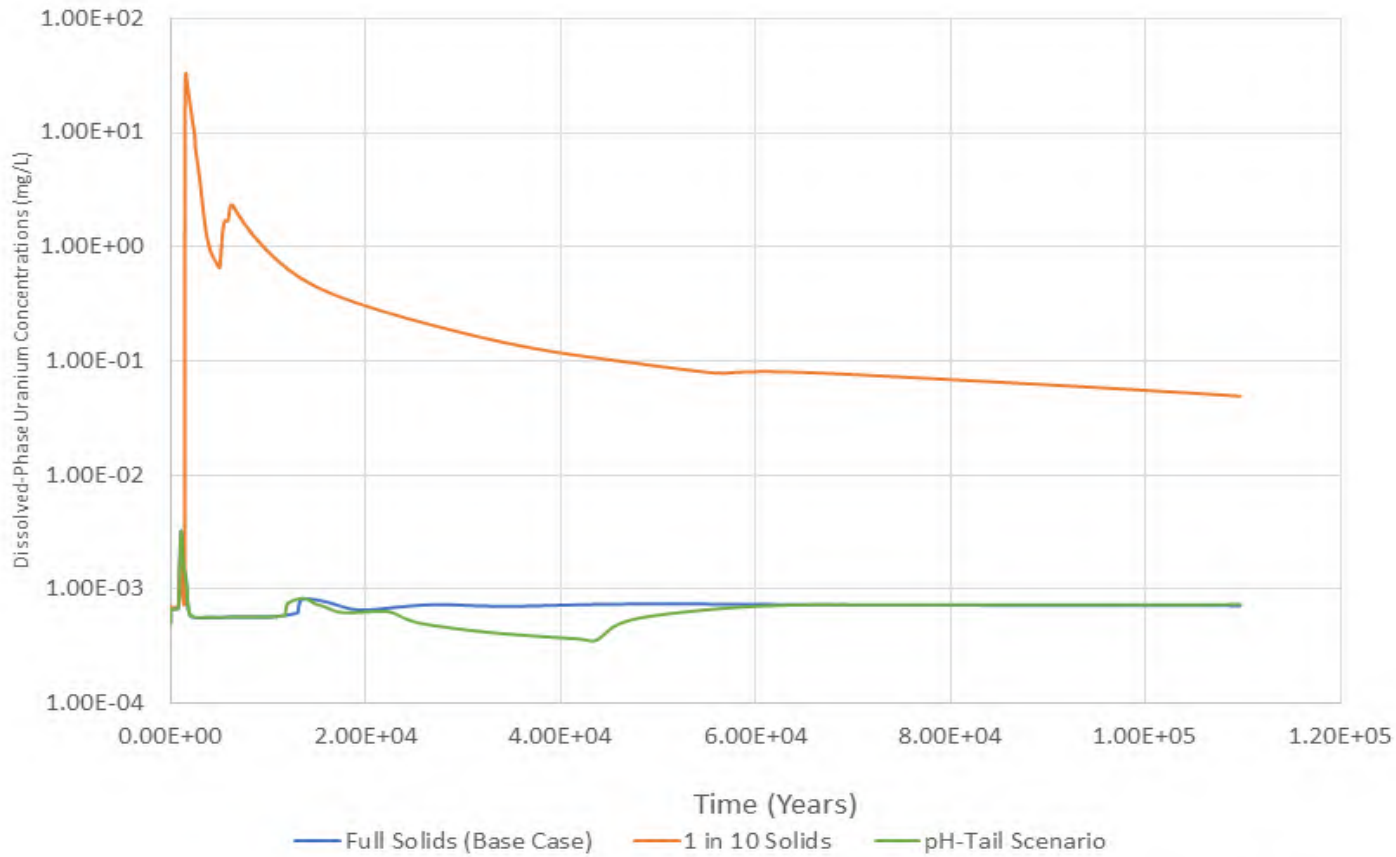
The coreflood information shows that soluble iron concentrations remain high with flushing. Residual ferric iron is not expected within the Restored solution, as it will be consumed with reactions with uraninite and sulphide minerals, mainly pyrite (FeS_2), while conditions remain adequately oxidizing. In Restored Solution #1, with a pH of 4.3, the 100 mg/L of iron is expected to be present as dissolved ferrous iron.

However, there is evidence in the core logging (introduced in Section 3.5.6.3) of limonite in the shallow bedrock of the Athabasca Supergroup sandstones, suggesting oxidation of ferrous iron in that zone. Thus, ferrous iron was allowed to be oxidized by dissolved oxygen and to precipitate as ferrihydrite within the last 100 m of the flow path in order to evaluate the potential effects on pH if oxidation of the ferrous iron occurred along the groundwater flow path. The influence on pH is shown in Figure 3-9. The pH is depressed slightly by the oxidation of ferrous iron and precipitation of ferrihydrite, but the pH is not predicted to fall outside of minimum pH conditions (~ 6) under baseline conditions (Table 3-4 and Appendix D).



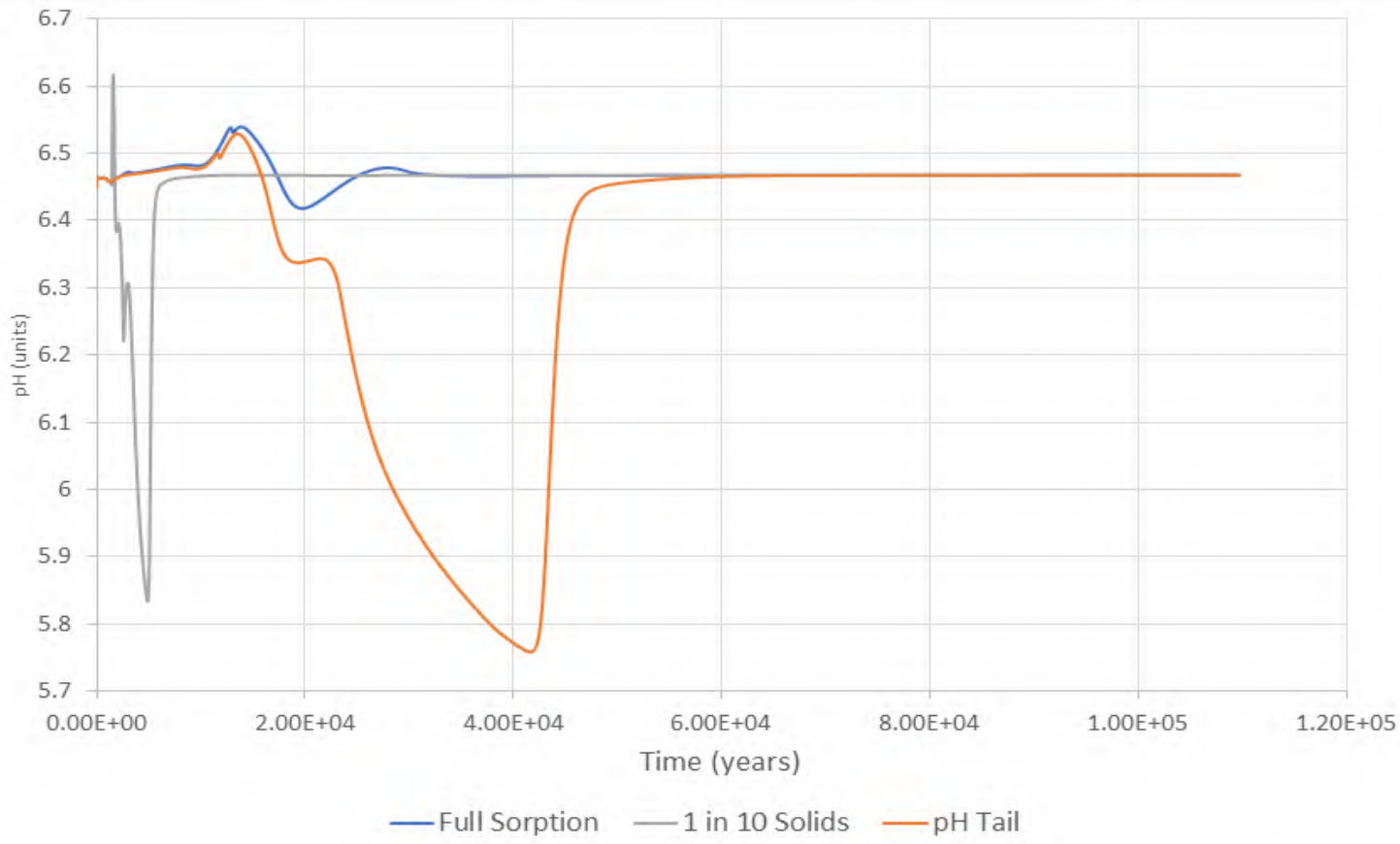
Wheeler River Project Groundwater Modelling Report	
Iron Oxidation: Influence on pH of Groundwater at Whitefish Lake	
Ecometrix Environmental INTELLIGENCE	Figure 3-9

Figure 3-9: Iron Oxidation: Influence on pH of Groundwater at Whitefish Lake



	Wheeler River Project **Groundwater Modelling Report**
	Sorption and pH-tail: Influence on Peak Uranium Concentrations in Groundwater at Whitefish Lake
	Ecometrix Environmental INTELLIGENCE — Figure 3-10

Figure 3-10: Sorption and pH-tail: Influence on Peak Uranium Concentrations in Groundwater at Whitefish Lake



Wheeler River Project Groundwater Modelling Report	
Sorption and pH-tail: Influence on pH of Groundwater at Whitefish Lake	
Ecometrix Environmental INTELLIGENCE	Figure 3-11

Figure 3-11: Sorption and pH-tail: Influence on pH of Groundwater at Whitefish Lake

3.6 Understanding Gained through 1D Geochemical Modelling

Key understanding gained through the 1D geochemical reactive transport modelling includes:

- Concentrations of uranium and several other COPCs arriving at Whitefish Lake are sensitive to the sorptive capacity assumed for the system. Some COPCs and other groundwater constituents, including sulphate, arsenic, selenium, ferrous iron, molybdenum, chloride, and vanadium behave conservatively, meaning they do not interact appreciably with the solid phase, and thus, they are transported at the average linear groundwater velocity from the mineralized zone to the lake.

- The base case (sorption) scenario, based on very well understood mineralogical conditions at the site, shows very strong attenuation of uranium and other COPCs in the subsurface. Reducing the density or number of reactive sites available in association with mineral surfaces results in less sequestration of uranium in the subsurface. For this reason, modelling in 3-D conservatively focused on the base case and simulations with fewer reactive sites associated with the mineralogical assemblages.

- The precipitation of authigenic mineral phases was not considered a key geochemical process controlling the behaviour of dissolved-phase U(VI) precipitation and was not carried forward as geochemical reaction in the 3D numerical modelling. Precipitation of uranyl solid phases was simulated, and when no adsorption was assumed, the concentration of uranium is attenuated to some extent. However, assuming the formation of secondary uranyl mineral phases in the absence of sorption along the entire subsurface pathway is not realistic.

- Solubility control/precipitation of authigenic mineral phases was evaluated and was carried forward into 3D numerical modelling as key geochemical reactions for dissolved aluminum (dissolved-phase concentrations controlled by formation of gibbsite ($Al(OH)_3$)), and dissolved 226Ra (through the formation of a solid solution of $RaSO_4$ and $BaSO_4$).

- In zones of hydrothermal alteration where pyrite has been observed, the effective immobilization of dissolved U(VI) was demonstrated to be possible through reduction of U(VI) dissolved in solution and formation of a solid phase - uraninite (UO_2) or mixed U(IV) and U(VI) oxide phase. This is aligned with the redox buffering by pyrite present in the ore zone and surrounding clay barrier zones considered important for maintaining uranium in the reduced form and solid form in the Athabasca basin unconformity ore deposits, since their formation (AECL, 1994).

- pH is a COPC and an important control on the extent of sorption of COPCs in the subsurface. Thus, the potential for pH to be depressed outside of baseline conditions through desorption of protons from clays in the mining area after remediation and for ferrous iron oxidation in the downgradient portion (Upper Sandstone Aquifer) of the groundwater flow path was evaluated further in the 3D numerical modelling.

3.7 Control Files for Three-Dimensional Modelling Analysis

Using the knowledge developed through the 1D PHREEQC modelling, input files for the 3D reactive transport modelling were developed. The input files generated control the following:

- initial groundwater constituent concentrations within each hydrostratigraphic unit (corresponding to the representative solutions given in Table 3-5).
- reactions conceptualized as key geochemical reactions through the 1D modelling for each hydrostratigraphic unit (e.g., redox conditions, pH, authigenic mineral formation, etc.,);
- available sorption reaction sites, calculated for each hydrostratigraphic unit based on the interpreted effective porosity; and
- concentrations for water quality at boundary conditions in the model at depth and within the shallow system, again corresponding to representative water quality in the hydrostratigraphic units presented in Table 3-5.

More details regarding the input files utilized within the 3D reactive transport model are contained in Sections 4.2, 4.5 and 4.6.

4.0 Post-Decommissioning Reactive Transport Modelling

The focus of the geochemical reactive transport modelling is post-decommissioning conditions. As documented in the EIS, decommissioning (i.e., remediation) of the ore zone and surrounding area within the freeze wall will be initiated once mine operation is completed and will continue until dissolved concentrations reach an acceptable decommissioning level (i.e., where natural attenuation processes can be relied upon to effectively mitigate risk to potential receptors). The following steps are planned to complete decommissioning in the mining area (the EIS; Section 2):

- Water will be injected into the mining area via injection wells and then recovered through the recovery wells, the same way mining was conducted during operations.
- Produced water will be processed through the processing plant until non-economic uranium concentrations are observed. Non-economic produced waters will be treated and mixed with fresh water for continued circulation in the mining area. Circulation through the mining area will continue until recovered water reaches acceptable groundwater quality decommissioning objectives.
- During groundwater restoration, reagents such as sodium bicarbonate and sodium hydroxide may be added to the injected water to accelerate groundwater quality recovery.
- After remediation has been completed, the freeze wall will be turned off and allowed to thaw. This will allow the eventual re-establishment of the pre-construction groundwater flow regime in the Phoenix area.

Metallurgical testing, including batch reactions, column tests, and core flooding tests have been undertaken at the Saskatchewan Research Council, to understand the anticipated evolution of groundwater hydrochemistry as the groundwater quality in the mining area is remediated. "Restored Solution #1" and "Restored Solution #2" (Table 3-5) were developed to represent the bounding scenarios for groundwater quality considered in the reactive transport model to evaluate the potential for environmental effects following remediation of the mining area. As Restored Solution #1 (RS1) contains the higher remaining concentrations, and lower pH (i.e., differs more from baseline conditions in the ore zone), this solution was primarily applied within the geochemical reactive transport modelling to evaluate environmental effects.

4.1 Post Decommissioning Source Zones

During mine operation and decommissioning, Denison has committed to actively manage any excursions within the zone immediately surrounding the ore zone (the EIS, Section 2). As such modelling of conditions during mine operation was not undertaken. During mine operation, the planned freeze walls will limit the potential lateral extent of any excursions, while active pumping will be used to create hydraulic controls that will limit vertical migration to a zone that lies within 50 m above the ore zone (the EIS, Section 2). Below the ore zone, the underlying basement rock has very low hydraulic conductivity (Section 2.3) that will act to limit the

downward vertical migration. Despite this limit to downward migration, the solubility enhancing fluids used during mine operation, which will have a density and specific gravity greater than sea water, has the potential to migrate downward to the base of the Paleoweathered Basement Aquitard. Details regarding the planned mine operation and decommissioning are contained within the EIS (Section 2).

Given these hydraulic and hydrogeologic controls, the expected distribution of restored solutions (Table 3-5) includes the following attributes:

- The mining area, which is simulated to contain two zones.
- Zone containing restored solution at 100% strength, and including the:
    - The active mining area (ore zone),
    - 15 m above the ore zone,
    - Paleoweathered Basement underlying the ore zone,
    - Each of the above zones extend laterally to the freeze wall location.
- Zone containing restored solution at 50% strength will be limited to:
    - Zone above the ore zone from 15 m to a maximum of 50 m above the ore zone,
    - Extending laterally to the freeze wall location.

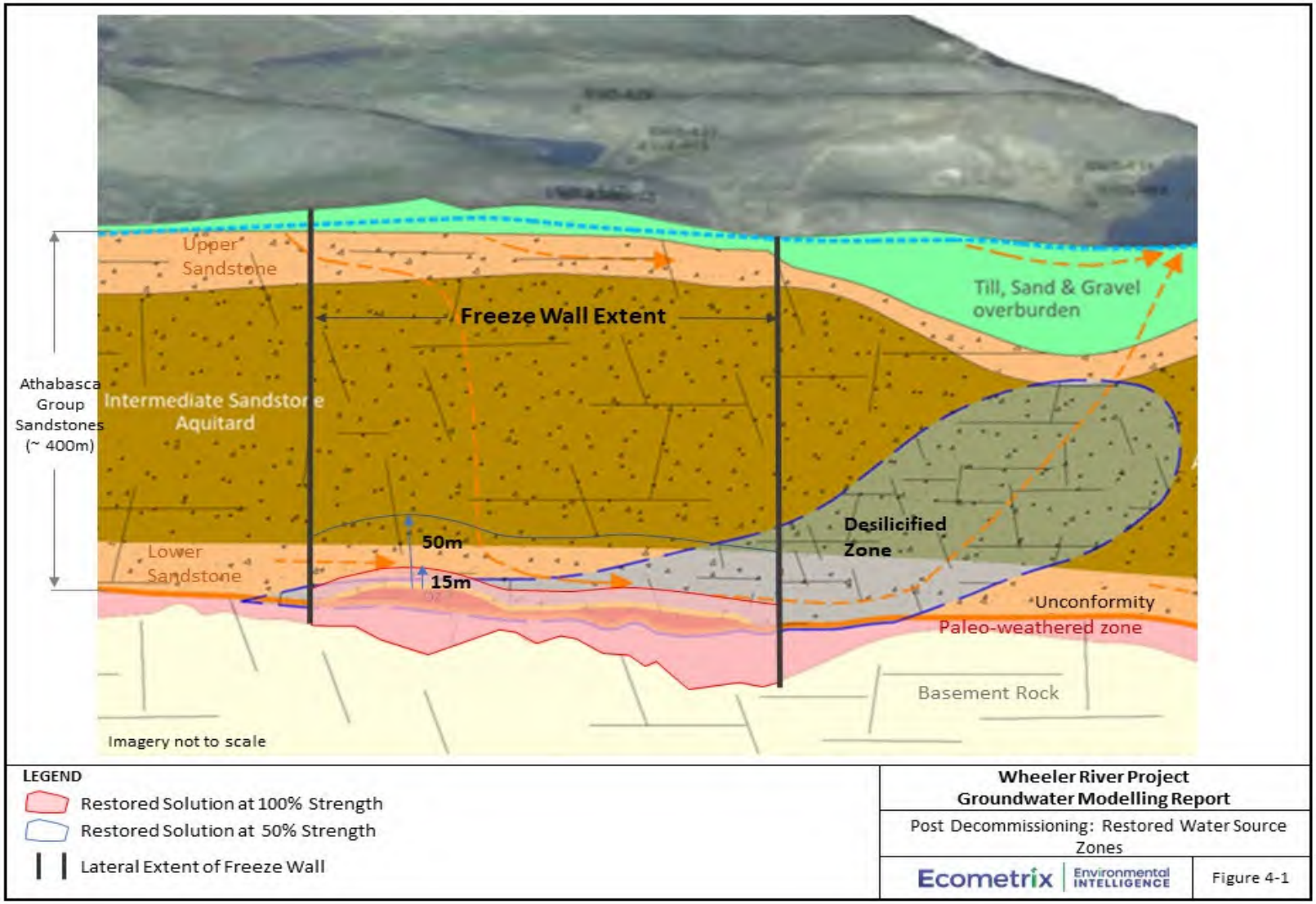


Figure 4-1: Post Decommissioning: Restored Water Source Zones

These zones describe above are illustrated in Figure 4-1. The zone containing restored solution at 50% strength is referred to as the operational flare (i.e., flare zone), which is considered to be a conservative estimation of the zone that could receive vertical migration of solutions during ISR operation and decommissioning. Testing to date suggests that the maximum upward migration of mining fluids will be approximately 11 to 13 m, so the extension of the source zone to 50 m above ore zone is considered to represent a conservative source condition.

These two defined zones are used as the source zones for the geochemical reactive transport model; migration from these source zones results in fate and transport of dissolved chemical constituents in groundwater following the cessation of the freeze wall (i.e., post-decommissioning). Given the active hydraulic controls planned by Denison for conditions during mine operation, the estimated source zones described above are considered conservatively large but appropriate for the environmental impact assessment.

Geochemical reactive transport modelling was undertaken to support Denison in developing restoration water quality targets, defined as residual concentrations of constituents in the restored groundwater that would not pose an adverse effect on the receiving water body. The focus of geochemical reactive transport modelling is evaluation of the COPC fate and transport from the defined source zones to the potential receiving water body, Whitefish Lake.

4.2 Simulated COPCs in 3D Reactive Transport Model

The COPCs simulated within the 3D geochemical reactive transport model are those documented in Section 3.5. As noted in Section 3.7, PHREEQC control files were established for model node groups to define the initial concentrations associated within each geochemical zone (Table 3-5). Each node within the model was assigned to belonged to one group, such that initial concentrations were specified for every simulation node. To simplify, uniform initial concentrations were applied withing each node group; this led to discontinuity of initial concentrations at geochemical zone boundaries, which are smoothed as the simulation progresses.

The initial groundwater quality within the mining area is described above (Section 4.1). Beyond the active mining area and flare zones, initial concentrations were specified based on representative water quality samples within each geochemical zone (Section 3.5.4). Initial concentrations are further discussed within section 4.4.

4.3 Groundwater Quality Screening Criteria

Denison's commitment in the EIS is to protect the receiving surface water environment. As such, groundwater quality screening criteria were compiled from available generic guidelines protective of aquatic life and were used, at a screening level, to evaluate the quality of groundwater at the interface with Whitefish Lake. The groundwater evaluation criteria and sources of the criteria are provided in Table 3-7.

Table 4-1: Groundwater Quality Screening Criteria

Constituent	Unit	CCME Protection of Aquatic Life (1)		Federal Environmental Quality Guideline		Saskatchewan Environmental Quality Guidelines (SEQG Online) (2)		Other		Selected Groundwater Quality Screening Criteria	Source
		Long Term	Note	Long Term	Note	Long Term	Note	Long Term	Note		
Aluminum, dissolved	mg/L	1.0E-01	(3)	-	-	1.0E-01	-	5.0E-02	(4)	5.0E-02	BC MOE
Arsenic, dissolved	mg/L	5.0E-03	-	-	-	5.0E-03	-	-	-	5.0E-03	SEQG/CCME
Barium, dissolved	mg/L	-	-	-	-		-	-	-	-	
Boron, dissolved	mg/L	1.5E-03	(5)	-	-	1.5E-03	-	-	-	1.5E-03	SEQG/CCME
Cadmium, dissolved	mg/L	4.0E-05		-	-	4.0E-05	-	-	-	4.0E-05	SEQG/CCME
Chromium, dissolved	mg/L	8.9E-03	(6)	-	-	8.9E-03	-	-	-	8.9E-03	SEQG/CCME
Cobalt, dissolved	mg/L	-	-	7.8E-04	(7)		-	-	-	7.8E-04	FEQG
Copper, dissolved	mg/L	2.0E-03	(8)	-	-	2.0E-03	(8)	-	-	2.0E-03	SEQG/CCME
Iron, dissolved	mg/L	3.0E-01		-	-			-	-	3.0E-01	CCME
Lead, dissolved	mg/L	1.0E-03	(8)	-	-	1.0E-03	(8)	-	-	1.0E-03	SEQG/CCME
Manganese, dissolved	mg/L	2.3E-01	(9)	-	-	-		-	-	2.3E-01	CCME
Molybdenum, dissolved	mg/L	7.3E-02	-	-	-	3.1E+01	-	-	-	3.1E+01	SEQG
Nickel, dissolved	mg/L	2.5E-02	(8)	-	-	2.5E-02	(8)	-	-	2.5E-02	SEQG/CCME
Selenium, dissolved	mg/L	1.0E-03				1.0E-03		2.0E-03	(10)	2.0E-03	BC MOE
Strontium, dissolved	mg/L	-	-	2.5E+00	(11)	-	-	-	-	2.5E+00	FEQG
Uranium, dissolved	mg/L	1.5E-02	-	-	-	1.5E-02	-	-	-	1.5E-02	SEQG/CCME
Vanadium, dissolved	mg/L	-	-	1.2E-01	(12)	-	-	-	-	1.2E-01	FEQG
Zinc, dissolved	mg/L	1.1E-02	(13)	-	-	3.0E-02	-	-	-	1.1E-02	CCME
Ammonia as nitrogen	mg/L	5.7E+00	(14)	-	-	5.7E+00	(14)	-	-	5.7E+00	SEQG/CCME
Chloride	mg/L	1.2E+02		-	-	1.2E+02	-	-	-	1.2E+02	SEQG/CCME
Sulphate	mg/L	-	-	-	-	-	-	1.28E+02	(15)	1.28E+02	BC MOE
Radium-226	Bq/L	-	-	-	-	1.1E-01		-	-	-	-
Radium-226 (converted)	mg/L	-	-	-	-	3.0E-09	-	-	-	3.0E-09	SEQG
Lead-210	Bq/L	-	-	-	-	-	-	2.2E+01	(16)	-	-
Lead-210 (converted)	mg/L	-	-	-	-	-	-	7.8E-09	-	7.8E-09	US DOE
Polonium-210	Bq/L	-	-	-	-	-	-	1.4E+01	(16)	-	-
Polonium-210 (converted)	mg/L	-	-	-	-	-	-	8.1E-11	-	8.1E-11	US DOE
Thorium-230	Bq/L	-	-	-	-	-	-	9.5E+01	(16)	-	
Thorium-230 (converted)	mg/L	-	-	-	-	-	-	1.24E-04	-	1.24E-04	US DOE
pH	units	6.5 -9		6.5-9		6.5-9		<6.5 and 6.5-9	(17)	6.5-9	SEQG/CCME

Notes:

(1) CCME, 2008. Canadian Water Quality Guidelines.

(2) Saskatchewan Water Quality Objectives, SEQG on-line (https://envrbrportal.crmp.saskatchewan.ca/seqg-search/) for groundwater.

(3) Guideline is for total Al. Based on a median pH in suface waters of 6.8 (i.e. pH of >6.5).

(4) British Columbia Ministry of Environment (BC MOE). 2001. Water Quality Criteria for Aluminum: Overview Report. Water Protection and Sustainability Branch, Environmental Sustainability and Strategic Policy Division. August 7, 2001. Victoria, B.C. Guideline is for dissolved Al. Based on a median pH in suface waters of 6.8 (i.e. pH of >6.5).

(5) CCME, 2009. Canadian Water Quality Guidelines for the Protection of Aquatic Life, Boron.

(6) Value for inorganic chromium (Cr(III)) is an interim guideline.

(7) Environment Canada 2017. Federal Environmental Quality Guidelines, Cobalt, May. Value adopted is for a hardness of 52 mg/L, as extrapolation of the equation for hardness-dependence

(8) Hardness dependent WQOs. Median hardness in surface water samples (Table) is 5.3 mg/L; Cu guideline reflects hardness >0 to <82 mg/L; Ni and Pb guidelines reflect hardness > 0 to ≤

(9) Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life - Manganese, Appendix B - Canadian Water Quality Guidelines Calculator (pH = 6.8, hardness = 10 mg/L). Guideline is based on dissolved manganese.

(10) BC MOE, 2014. Companion Document to: Ambient Water Quality Guidelines for Selenium Update.

(11) Environmenta and Climate Change Canada (ECCC). 2020. Federal Environmental Quality Guidelines Strontium. July.

(12) Environment Canada 2016. Federal Environmental Quality Guidelines, Vanadium. May.

(13) Based on a hardness of 23.4 mg/L (bottom of recommended range), and site-specific pH of 6.8 and DOC of 2.4 mg/L. pH and DOC reflect median values for baseline surface water

(14) Total ammonia-N calculated from the total ammonia guideline for a temperature of 15°C and a pH of 7.0.

(15) British Columbia Ministry of Environment & Climate Change Strategy Water Protection & Sustainability Branch (BC MECCS). 2021. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf

(16) US DOE 2019. A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota

(17) (BC MECCS) British Columbia Ministry of Environment and Climate Change Strategy. 2021. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary. Water Quality Guideline Series, WQG-20. Prov.B.C., Victoria B.C. Unrestricted changed permitted within the range of 6.5-9.0. At pH levels <6.5, the requirement is to show no statistically significant decrease in pH value from background.

4.4 3D Sub-Domain Model Development

The computational requirements of a 3D geochemical reactive transport model with multiple constituents exceeded what was practically achievable within the regional-scale 3D model. To facilitate the efficient simulation of fate and transport, a sub-domain model was developed (Figure 4-2). The sub-domain model was designed to encompass flow and transport pathways simulated using the regional-scale 3D model described in Section 2, allowing for a buffer of approximately 200 m beyond the simulated transport pathways. Hydrogeologic units, parameter values, boundary conditions, and calibration data were taken from the 3D regional-scale model to efficiently construct the sub-domain model. In this manner, the sub-domain model is founded on the calibrated, regional-scale model.

4.4.1 Sub-Domain Model Area and Mesh

While the sub-domain model mesh was redesigned from the regional-scale model, the model area was designed based on flow conditions within the regional-scale model, as follows:

- Western boundary of the sub-domain model follows a simulated equipotential from the regional-scale 3D model
- North and south boundaries of the sub-domain model follow simulated flow lines, and
- Eastern boundary of the sub-domain model follows a shallow groundwater divide.

The sub-domain model is approximately 1 km in width (i.e., north to south), and 2.1 km long, extending 250 to 300 m upgradient of the source and downgradient beyond Whitefish Lake (Figure 4-2). The sub-domain model also extends from ground surface to the basement rock (Figure 4-3).

The sub-domain model was discretized into 91,179 nodes to achieve element lengths of 20 m within the plume trajectory indicated through particle tracking (Figure 4-2); element sizes were designed to be relatively uniform to maintain appropriate Peclet and Courant criteria for reactive transport simulations. The number of nodes in the sub-domain model is a significant reduction from the 804,000 nodes required within the 3D regional-scale model, making the sub-domain model much more efficient for the 3D geochemical reactive transport modelling.

4.4.2 Sub-Domain Model Hydrogeologic Parameters

The property zones calibrated within the regional model were directly mapped onto the sub-domain model mesh (Figure 4-3), to ensure the sub-domain model parameters were consistent with those calibrated within the regional model. An additional layer of elements was added 1 m below ground surface within the sub-domain model to permit simulation of lake bottom sediments (see insert on Figure 4-3). Additional layers of elements were also inserted within hydrostratigraphic layers to create relatively uniform vertical layer thicknesses.

One key difference between the sub-domain model input parameters and those assigned in the 3D Regional Model were in the assignment of the properties associated with the Upper Barrier Aquitard Zone, the ore zone, and the Lower Barrier Aquitard Zones. As there is uranium mineralization contained within the Upper and Lower Barrier Zones, the hydraulic conductivity of those zones is expected to be enhanced during ISR mine operation and as such, the hydraulic conductivity values representing these units were replaced with elevated hydraulic conductivity values relative to those assigned in the regional scale model. Specifically, a hydraulic conductivity value of $5x10^{-6}$ m/s was assigned to represent the mining horizon post-decommissioning. This value ($5x10^{-6}$ m/s) is a factor of 5 greater than (i.e., 5x) the value assumed for the ore zone in the 3D regional-scale model and conservatively simulates that the Upper and Lower Barrier Zones no longer result in effective barriers for mineral transport from the ore zone.

4.4.3 Sub-Domain Model Flow Boundary Conditions

Boundary conditions applied to the sub-domain model were also made to be consistent with the regional model as follows:

- Groundwater recharge zones were mapped to the sub-domain mesh and the same recharge rates applied,
- The mesh was designed to conform to surface water boundary locations and the same hydraulic heads were applied,
- Equivalent lateral flow through the sub-domain was achieved by specifying hydraulic head values, sourced from the regional-scale model, around the perimeter of the sub-domain model domain.

4.4.4 Sub-Domain Model Transport Boundary Conditions

Transport boundaries were added to the sub-domain model perimeter to allow inflowing water to enter with constituent concentrations consistent with background geochemistry (Figure 4-4). Inflowing water via groundwater recharge and lateral inflow within the Upper Sandstone were specified to have inflow concentrations consistent with the local groundwater flow system (Table 3.4). Water inflow to the Lower Sandstone Aquifer was specified to have concentrations consistent with that unit (Table 3.4).

As described in Section 4.2, restored water quality was specified within the ore zone and surrounding area (Section 4.1) using initial conditions. Similarly, a 50% strength restored water quality solution was specified as the initial concentration in the flare zone, overlying the mining horizon. Initial conditions throughout the remainder of the model were specified to represent interpreted background geochemistry, which were based on field-measured parameters (see Section 3.2 and Appendix D).

Transport parameters were specified for diffusion ($1x10^{-9}$ m^2/s), longitudinal dispersivity (10 m along the plume trajectory), and transverse dispersivity (5 m). A literature value was applied for diffusion as migration to Whitefish Lake is advection-dominated such that diffusion along the

flow path would not appreciably enhance transport timing. The longitudinal dispersivity value is consistent with the expected dispersivity within a sandstone unit for a plume of 0.9 to 1.7 km (Gelhar et al, 1992; Schulze-Makuch, 2005; Chapman et al., 2014; Martin, 2019). Alternative literature (e.g., Neuman, 1995) suggests an even larger value. Elements of transverse dispersivity (i.e., horizontal and vertical), which are typically differentiated due to anisotropic hydraulic conductivity settings, are uniformly applied for this site as a reflection of the interpreted isotropic conditions within desilicified hydrogeologic units.

Neither decay, nor matrix diffusion processes were simulated to produce conservative predictions of fate and transport; adsorption, ion exchange and precipitation reactions were simulated using PHREEQC (Parkhurst and Wissmeier, 2015), as discussed in Section 4.5.

4.4.5 Sub-Domain Model Calibration Check

Prior to applying the sub-domain model for geochemical reactive transport simulations, the model calibration was checked to ensure that it was consistent with that achieved in the regional-scale model. This calibration check provided confidence that the sub-domain model was able to represent the 3D groundwater flow system to an equivalent degree as the 3D regional-scale model. The calibration checks included comparison of both the calibration statistics, as well as the advective flow path and rates.

Observation wells from the 3D regional model were carried forward into the sub-domain model and used to confirm that a statistically equivalent local calibration was maintained (see table in Figure 4-4).

Flow paths and flow rates were checked by comparing particle track trajectory and timing to verify the representation of conditions simulated within the 3D regional-scale model were replicated in the sub-domain model. The simulated groundwater flow paths from the ore zone and flare within the sub-domain model (Figure 4-4) follow the same trajectory as those within the regional-scale model (Figure 2-16). Note that the image in Figure 4-4 contains a vertical exaggeration factor of 2, which exaggerates the horizontal to vertical transition in the flow paths. Figure 4-4 also contains a table summarizing the flow path lengths and advective travel times to Whitefish Lake from the flare and ore zones. Travel times within the sub-domain model are comparable to those simulated using the regional-scale model.

As noted in Figure 4-4, flow path lengths from the ore zone and flare to Whitefish Lake range from 900 to greater than 1700 m. Advective travel time was simulated to range from less than 400 to almost 1200 years, depending on the distance along the travel pathways, and the hydraulic conductivities experienced along each pathway. The average velocity of particles was simulated to range from 1.4 to 2.3 m/annum (i.e., m/a), reflecting the relatively slow groundwater flow rates through the groundwater system. The range of travel distances, timing, and velocities simulated using particle tracking indicate that significant spreading of COPCs transported from the mining horizon will naturally occur; this observation further supports the need for 3D analysis of geochemical reactive transport (i.e., plug flow conditions assumed for a 1D model are not able to represent the entire plume).

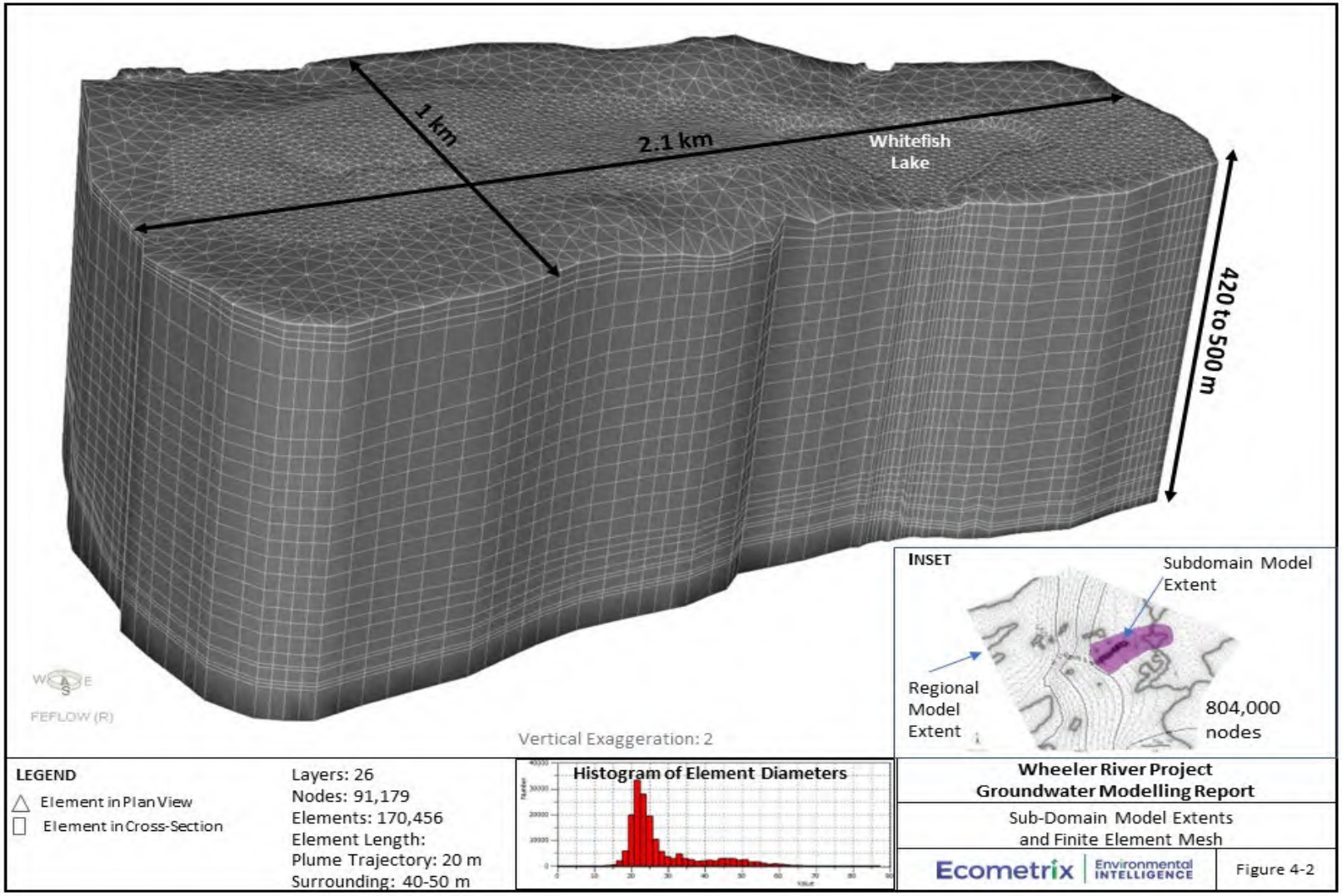


Figure 4-2: Sub-Domain Model Extents and Finite Element Mesh

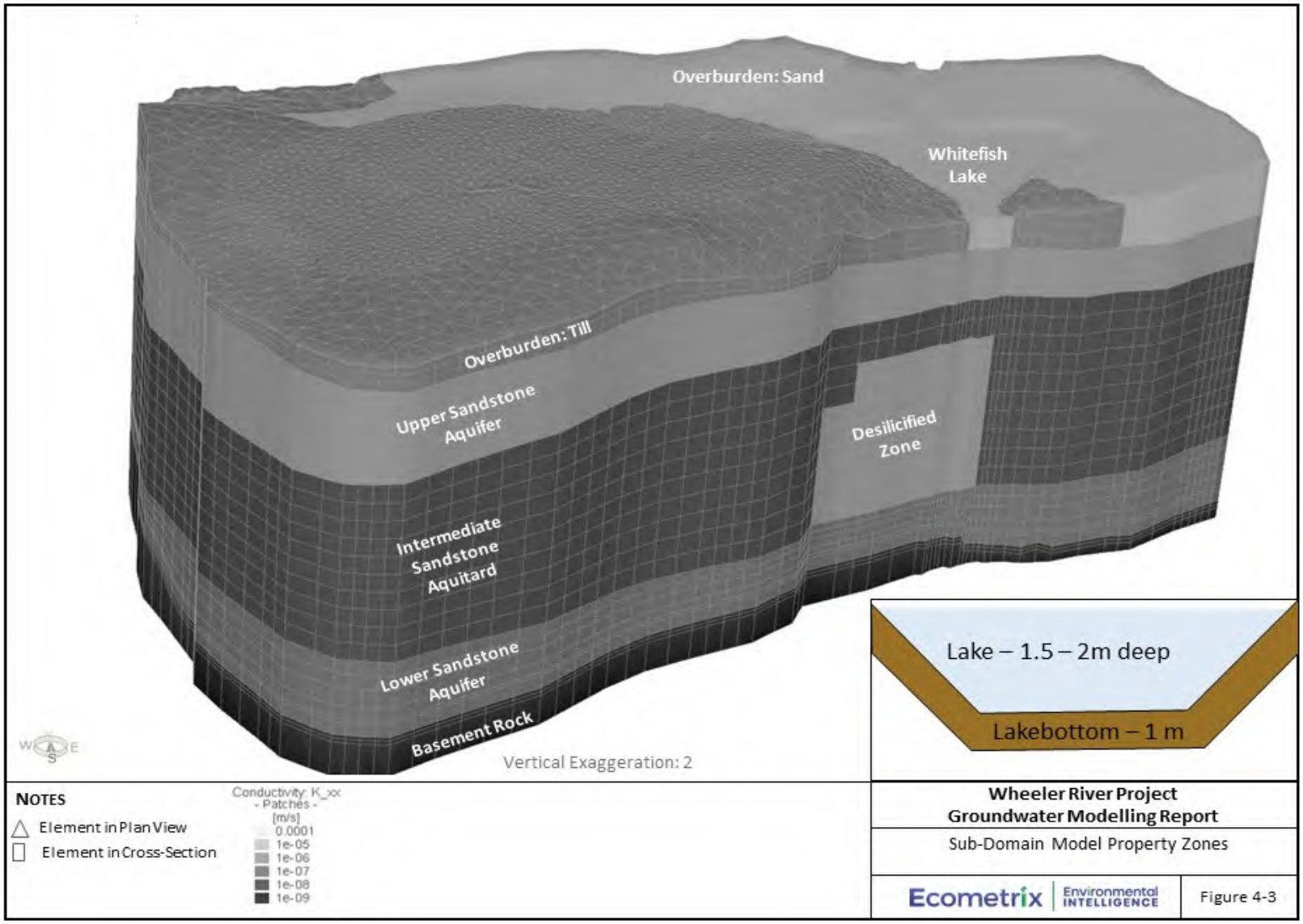
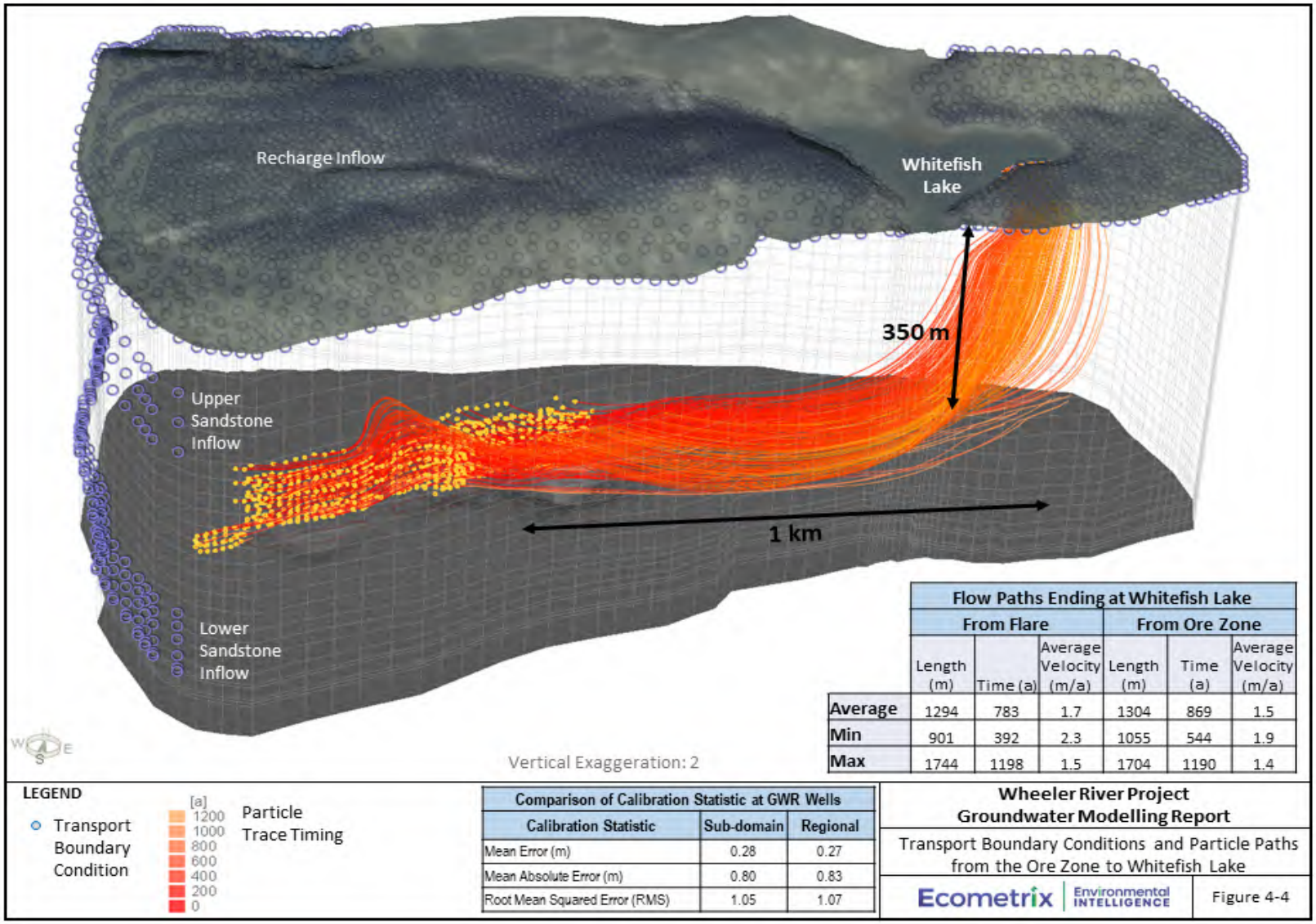


Figure 4-3: Sub-Domain Model Property Zones



Flow Paths Ending at Whitefish Lake						
	From Flare			From Ore Zone		
	Length (m)	Time (a)	Average Velocity (m/a)	Length (m)	Time (a)	Average Velocity (m/a)
Average	1294	783	1.7	1304	869	1.5
Min	901	392	2.3	1055	544	1.9
Max	1744	1198	1.5	1704	1190	1.4

Comparison of Calibration Statistic at GWR Wells		
Calibration Statistic	Sub-domain	Regional
Mean Error (m)	0.28	0.27
Mean Absolute Error (m)	0.80	0.83
Root Mean Squared Error (RMS)	1.05	1.07

Figure 4-4: Transport Boundary Conditions and Particle Paths from the Ore Zone to Whitefish Lake

4.5 3D Geochemical Reactive Transport Simulation: PiChem

Geochemical reactive transport modelling required integrating multi-component, time-varying flow and transport simulations using FEFLOW's simulator with the chemical processes that affect the migration of COPCs along the groundwater flow path. 3D geochemical reactive transport modelling was accomplished using the piChem "plug-in" option available with the FEFLOW software. PiChem (Wissmeier, 2016) facilitates the linkage of multi-component, time-varying flow and transport simulations using FEFLOW's simulator with geochemical reactions simulated using PHREEQC (Parkhurst and Wissmeier, 2015). FEFLOWs multi-component transport capabilities permit simultaneous simulation of multiple, interactive constituents. Reactive transport is simulated using an operator splitting technique, wherein solute transport and geochemical reactions are decoupled into sequential calculation steps.

The piChem reaction module takes multiple component concentrations from each model node, runs geochemical reactions using the capabilities of PHREEQC, and returns updated component concentrations to each node (Parkhurst and Wissmeier, 2015). The split operator technique is applied in piChem using a sequential, non-iterative, approach at every model timestep. The ion constituent composition is reconstructed from the transported element assembly and charge balanced before it is speciated with the available solid phases.

As described in Section 3.0, the PHREEQC model reactions were first evaluated and confirmed to be appropriate using the 1D model before implementing the simulations in 3D. To enable piChem, PHREEQC control files are required for each of the following:

1) Reaction database specifying the solution master species, appropriate stochiometric equations, exchange species, surface master species, etc.

2) Transport boundary conditions where inflowing water is simulated. Control files specify the constituents and dissolved background concentrations within the influent water.

3) Initial conditions / geochemical reactions / reactants for groups of elements within the model domain (IC files).

Independent transport boundary conditions were established for water entering the shallow units (Overburden and Upper Sandstone Aquifers), and deep units (Lower Sandstone Aquifer). The water type entering the Upper Sandstone Aquifer through lateral inflow is interpreted to be of similar quality as water recharging the overburden units, as the overburden units are derived from the underlying sandstones (see Figure 4-4 for locations of boundary conditions where inflow concentrations are specified).

To represent the geochemical heterogeneity throughout the 3D model domain, independent initial condition (IC) files were generated for each of the node groups listed in Table 4-2. These zones conform to hydraulic conductivity and effective porosity zones defined in the model and utilized during model calibration. Independent initial conditions and reactions were designed to replicate the variability observed in field samples; reactions were adjusted from one zone to

another based on understanding of geochemical conditions (e.g., redox conditions and sorption potential).

A forced gradient tracer test undertaken by Petrotek (2022) which was designed to evaluate the degree of capture that could be achieved using injection and extraction wells oriented in a star pattern within a relatively small (i.e., 5 to 10 m radius surrounding GWR-040) portion of the ore zone. The tracer test was performed after permeability enhancement efforts (e.g., MaxPerf, Gas Gun and Kraken tools) which are designed to enhance the effective porosity beyond the natural state. Effective porosity values were derived from the peak arrival time of the injected potassium chlorate solution at extraction wells, utilizing the recorded distance and hydraulic conductivity values estimated from pumping tests performed after permeability enhancement efforts. Effective porosity values ranged from 1% (GWR-038) to 7% (GWR-041). The lower value (i.e., 1%) supports the effective porosity assigned within the deep sandstone units (e.g., Lower Sandstone Aquifer) as it is interpreted to reflect areas where permeability enhancement was unsuccessful. The higher value (i.e., 7%) provides a lower bound on the effective porosity for the ore zone post-mining; higher values are expected within the ore zone post-mining which will result in increased travel times.

Table 4-2: Geochemical Zones in 3D Reactive Transport Model

Node Group	Porosity	Description
Lake Bottom Sediments	0.25	Silt/clay rich sediments, which promote adsorption
Overburden	0.18	Lower porosity zone representing sand-till regions.
	0.22	Moderate porosity zone representing transition between sand-till and sand-rich regions.
	0.25	High porosity zone representing sandy regions.
Upper Sandstone Aquifer	0.02	Fractured Sandstone
Lower and Intermediate Sandstone outside of the Desilicified Zone	0.01	Fractured Sandstone
Desilicified Zone (Lower and intermediate sandstone)	0.20	Loose sand with minor clay and mineral content.
Ore Zone and Immediate Surroundings (to 15 m above the Ore Zone)	0.20	Contains restored solution at full strength initially. After initial time, solution disperses, diffuses, and reacts throughout the simulation. Porosity reflects post-decommissioning conditions.
Flare above ore zone (to 50 m above the ore zone)	0.20	Contains restored solution at 50% strength. After initial time, solution disperses, diffuses, and reacts throughout the simulation. Porosity reflects post-decommissioning conditions.
Paleoweathered Basement Aquitard	0.10	Fractured basement rock with higher mineral content. Total porosity specified to simulate matrix diffusion effects.

While the variable initial conditions files allowed for specification of heterogeneous geochemical parameter and reaction zones throughout the model domain, differences in these specified

conditions lead to initial disequilibrium where differing initial condition zones meet (e.g., boundary between the Upper Sandstone and Desilicified Zone, or at the margins of the restored solution source zone). Such differences led to some numerical instability at early time (e.g., the first 10-years of simulation), which reduced as the simulation progressed and spatial transitions were smoothed.

4.6 3D Sub-Domain Model: Base Case Scenario Predictions

The base case scenario within the 3D sub-domain model incorporated the following features:

- Restored mining horizon with a pH of 4.1, and enhanced concentration of dissolved minerals that reflect the post-decommissioning, restored-groundwater conditions (Section 3.3). As noted above, the restored solution extended laterally to the freeze walls, to 15 m above the ore zone, and below the ore zone to the base of the Paleoweathered Basement Aquitard.

- Flare zone that extended from 15 to 50 m above the ore zone. The flare zone is conservatively estimated to have enhanced dissolved mineral contents at 50% of the restored mining horizon. As noted above, the extension to 50 m above the ore zone is considered conservative as testing and analysis to date suggests this flare zone will be limited to 11 to 13 m.

- Paleoweathered Basement Aquitard with high mineral and clay content to promote adsorption, and a relatively high effective porosity that reflects matrix diffusion processes.

- Desilicified Zone with a relatively low mineral content, and modest clay content (moderate adsorption potential).

- Remaining sandstone units (Lower Sandstone Aquifer, Upper Sandstone Aquifer, and Intermediate Sandstone Aquitard) with low porosity and moderate adsorption potential.

- Overburden sands with relatively high porosity but moderate adsorption potential.

- Lake bottom sediments (estimated as 1 m thick) with high porosity, higher silt and clay content, and a higher adsorption potential.

4.6.1 Advective Transport of Dissolved Constituents

Figure 4-4 illustrates particle tracking (advective transport without dispersion, adsorption, or any other reactions) from the ore zone and overlying flare (i.e., the source) to Whitefish Lake. As illustrated, the general groundwater flow path extends horizontally through the Lower Sandstone Aquifer from the source for approximately 1 km before migrating vertically upward through the Desilicified Zone toward Whitefish Lake (note that the image in Figure 4-4 contains a vertical exaggeration factor of 2, which exaggerates the horizontal to vertical transition in the flow paths). Upward migration through the Desilicified Zone is the dominant flow path due to its higher hydraulic conductivity relative to the non-desilicified Intermediate Sandstone

Aquitard. Path lengths and travel times from the ore zone and flare to Whitefish Lake are documented on Figure 4-4, indicating a minimum path length of 900 m and a minimum travel time of just under 400 years; this path length and timing represents particles emanating from the eastern edge of the source. Maximum travel times can reach 1,200 years, and a length of 1,700 m (almost double the shortest paths) for particles that migrate from the western-most portion of the ore zone and flare, and/ or for particles that travel through lower hydraulic conductivity zones. Average linear groundwater velocities calculated for minimum and maximum path lengths, range from 1.4 to 2.3 m/annum, respectively.

This broad spread of particle travel times, travel lengths, and average groundwater velocities indicates that the restored solution transport post-decommissioning:

- Timing: will take centuries to reach Whitefish Lake.
- Duration: will continue seep into Whitefish Lake over many centuries.
- Change: will cause a gradual change from background conditions over a long time-period.

4.6.2 Advection and Dispersion of Dissolved Constituents

To better understand fate and transport conditions occurring along these path lines, mass transport conditions were simulated. While all simulations are completed in 3D, for ease of interpretation, transport results on figures within this and subsequent report sections are illustrated along a vertical cross-section that transects the model domain from west to east. The cross-section bends to extend through the ore zone and follow the trajectory of the flow paths from the ore zone to Whitefish Lake (Figure 4-5).

As an example of transport patterns, conditions for a chemically conservative or non-reactive constituent, chloride, are presented. Figure 4-6 illustrates a time-series of plume snapshots from 50 to 800 years post-decommissioning. This figure illustrates that as the dissolved constituents migrate toward Whitefish Lake through the Desilicified Zone, the concentration decreases. The result is that the concentration reaching Whitefish Lake is less than 10 mg/L, whereas the concentration in the initial restored solution (Table 3-5) is 200 mg/L. The reduction in concentration along the flow path for this non-reactive constituent is caused by hydrodynamic dispersion (i.e., dispersion due to mechanical mixing, and diffusion due to concentration gradients). Dissolved chloride is transported along with groundwater along the flow paths illustrated in Figure 4-4; however, hydrodynamic dispersion tends to spread the concentrations throughout the advective migration period. Hydrodynamic dispersion results from both concentration gradients (transport from areas of higher to lower concentrations) and mechanical mixing as the water travels through the tortuous pathways along interconnected fractures (fractured sandstone and basement rocks), or through variably-sized pore spaces between soil grains (i.e., within the Desilicified Zone and overburden). Note that the high concentrations persist within the Paleoweathered Basement Aquitard for much longer than within the Lower Sandstone Aquifer due to the relatively low hydraulic conductivity ($5x10^{-9}$ m/s) simulated within

the Paleoweathered Basement. As noted earlier, this low hydraulic conductivity is supported by both site-specific testing as well as the geochemical nature of the water found within this unit.

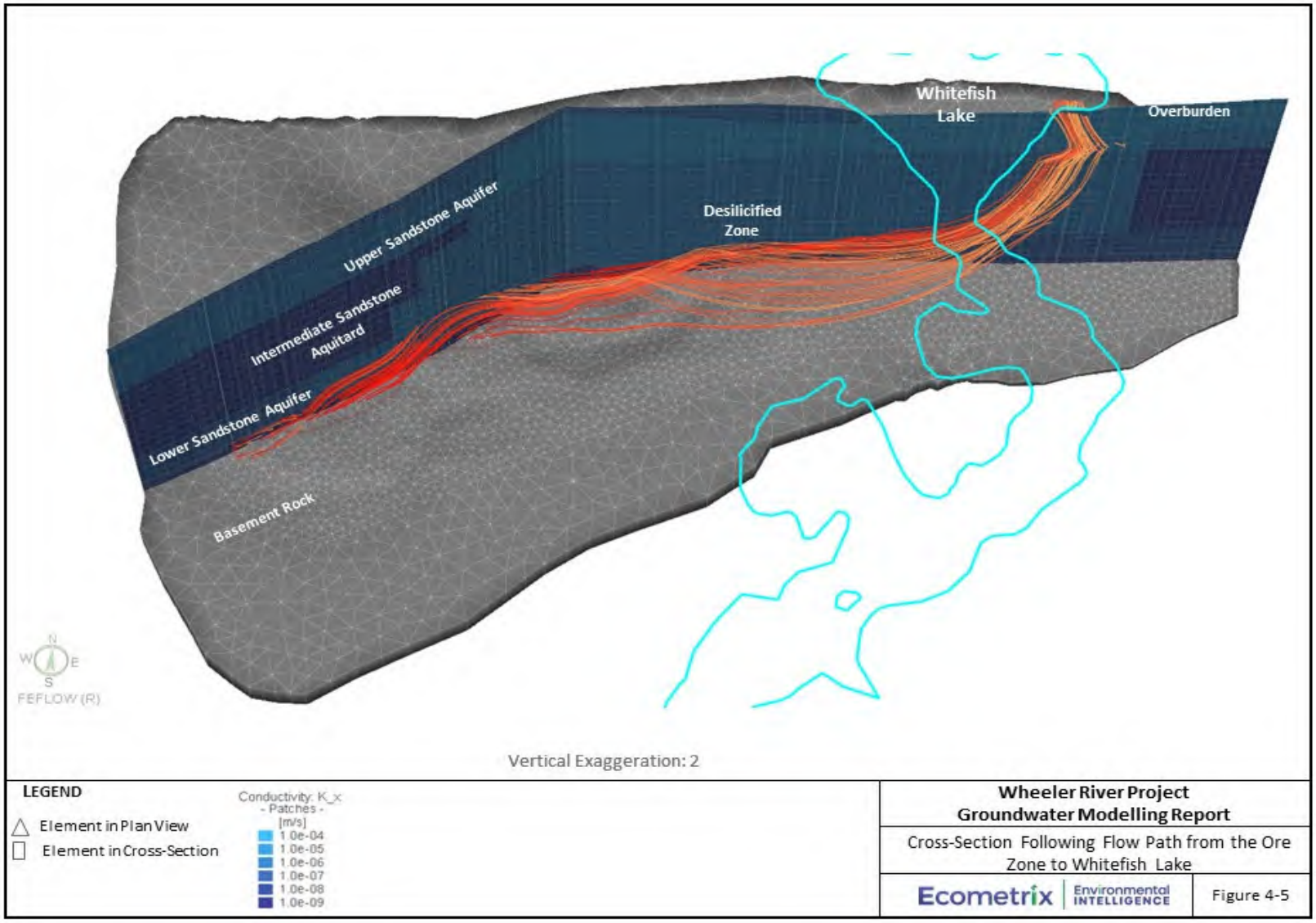


Figure 4-5: Cross-Section Following Flow Path from the Ore Zone to Whitefish Lake

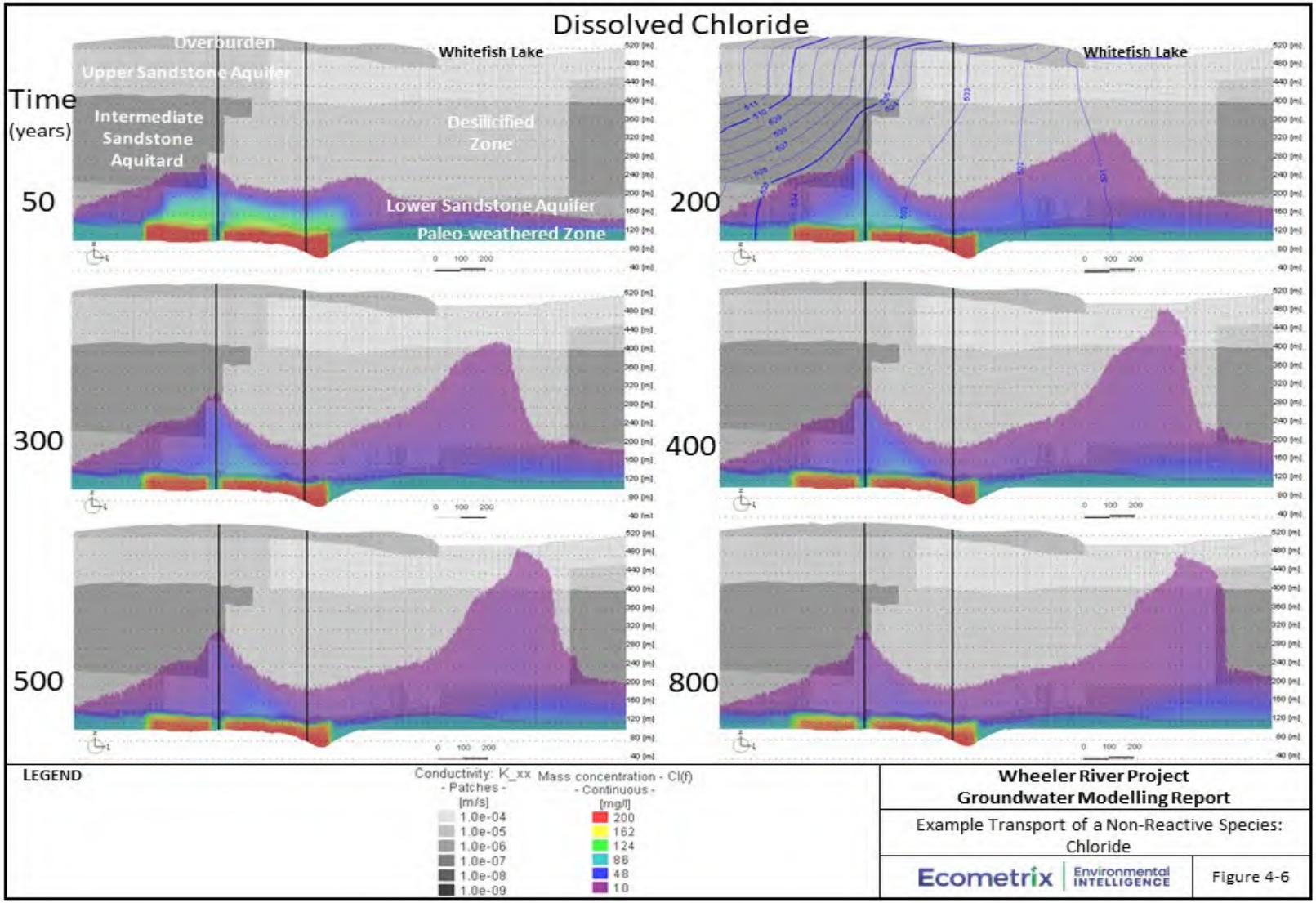


Figure 4-6: Example Transport of a Non-Reactive Species: Chloride

4.6.3 Advection, Dispersion, and Geochemical Reactions

There are several types of chemical reactions that can affect the concentrations of COPCs along the groundwater flow path. Chemical reactions that can act to retard the velocity of groundwater plumes relative to the average linear velocity of groundwater (i.e., advection) and/or attenuate COPC concentrations in groundwater include precipitation as a mineral phase, sorption, and redox transformation (and subsequent precipitation and/or sorption). Other processes, like radioactive decay and ingrowth can affect concentrations of radiological constituents along the groundwater flow path but were not included in the simulations.

Many of the geochemical constituents simulated as part of the restored solution (Table 3-5) experience geochemical reactions along the travel pathway in addition to advection and dispersion. Geochemical reactions have the effect of reducing the mass of a constituent within the dissolved phase and distributing a portion of that mass onto sorbed or solid phases. Sorbed or solid phases of the constituent becomes immobile until conditions change, and desorption or re-dissolution occur. When concentrations within the dissolved phase significantly reduce, desorption or re-dissolution can occur, re-mobilizing the sorbed mass. The rate of sorption and desorption depends upon the affinity of the constituent to be in solution verses sorbed in the conditions being simulated at a point in space and time within the sub-surface. The ratio of sorbed to dissolved mass depends on the overall composition of the water, including the ionic strength, pH, redox conditions, competing ions, ligands in solution, and the availability of sorption sites.

At all times, an equilibrium between the dissolved mass and the sorbed mass was maintained. The slow advection rate facilitates ample time for water-rock interactions to occur. The availability of sorption sites was calculated from mineral analyses completed for extracted core samples, as described in Section 3.5.6.2. Sorption was simulated to occur to clay, quartz, and goethite minerals. The percentage of available sorption sites were varied in the simulations to reflect the potential that in situ mineral surface conditions (i.e., number of reactive sites; particle size, available surface area) may differ from those assumed from available literature sources.

As an example of the effect of sorption reactions taking place throughout the simulation, Figure 4-7a and 4.7b illustrate the transport of dissolved selenium (left column) and its partitioning onto clay minerals contained within the host rock (right column). The image sequence illustrates the changes in dissolved and sorbed concentration distribution over time as the dissolved phase migrates from the source location. At early time (i.e., 50-years post-decommissioning), the mineral phase initially forms at the up- and down-gradient edges of the source zone (see Figure 4-1 for location). As the dissolved plume migrates into areas where there are additional available sorption sites (note: only sorption to clay minerals is shown in Figure 4-7a) mass in solution is sorbed onto the sorption site, reducing the concentrations in the dissolved phase. This slows the velocity of the dissolved plume relative to the average linear groundwater velocity (i.e., advection); this process is referred to as plume retardation. As time progresses, in areas where the concentration within the dissolved phase decreases, the mass of selenium sorbed onto the clay surfaces is reduced as it desorbs back into solution. Selenium shows a low affinity for the

solid phase and thus migration to Whitefish Lake is retarded to a limited extent in comparison to chloride, which is a conservative constituent.

In addition to the sorption of mass and retardation of the dissolved plume, dispersion processes around the perimeter of the dissolved plume reduce the concentrations below the plotted threshold; in this case, the threshold illustrated is the groundwater evaluation criterion for selenium. The combination of sorption and dispersion processes act to limit the plume migration distance from the source. This concept is known as reaching a steady-state plume (Cherry, personal conversation) which is a term used to illustrate that the limits of a plume, at a concentration above a threshold, will not migrate as far as the associated groundwater. As noted with chloride, the plume source persists within the paleoweathered Basement Aquitard due to the low hydraulic conductivity of that unit.

Figures 4-8a and 4-8b illustrate similar trends in the dissolved and sorbed mass for cadmium, but over a much longer period of time (50,000 years) than for selenium (2,500 years). Similar to that observed with selenium, dispersion and sorption processes act to restrict the migration of dissolved cadmium, at concentrations above the groundwater quality screening criteria (GQSC). Most of the dissolved constituents experience similar transport conditions that act to limit the migration toward Whitefish Lake.

4.6.3.1 Uranium Fate and Transport

Figures 4-9a and 4.9b illustrate the dissolved and sorbed uranium mass over a 50,000-year time-period. Uranium is very strongly sorbed to the mineral phases present within the Athabasca Supergroup sandstone units and underlying paleoweathered bedrock. Because of this, migration is very strongly retarded and uranium in the dissolved phase is not predicted to reach Whitefish Lake in 50,000 years or beyond. Like cadmium, the distance that the uranium plume (i.e., concentrations above the GQSC) migrates is limited by the sorption reactions and dispersion. The uranium plume is simulated to grow modestly over the first 5,000 years of the simulation, but then start to retract (i.e., shrink) for later times as the source concentrations are depleted. Depletion of the source concentration occurs as background water carrying lower constituent concentrations flows through the source area. Concentrations above the GQSC remain longest within the paleoweathered zone due to the lower hydraulic conductivity of, and the lower flow rates through, that unit.

Figure 4-10 illustrates the distribution of uranium mass within the model between the dissolved and various sorbed phases (i.e., sorbed to clay, goethite, quartz, and lake-bottom sediments). As illustrated, the dissolved uranium is simulated to decrease as time progresses. Dissolved mass is transferred to available sorption sites on clay, quartz, and goethite minerals; mass sorbed to clay is approximately one order of magnitude greater than that sorbed to quartz or goethite. The mass adsorbed to clay is the dominant form and is the majority of all uranium mass in the model (i.e., total uranium mass).

Figure 4-11 illustrates the 3D extent of uranium plume 5,000 years post-decommissioning. The plume iso-surface illustrated is for the GQSC of 0.015 mg/L. These figures illustrate that the

uranium mass above the GQSC is simulated to remain at depth in the area surrounding, and down-gradient of the ore zone. Lateral spreading is predicted to be limited as well due to the relatively low groundwater velocities.

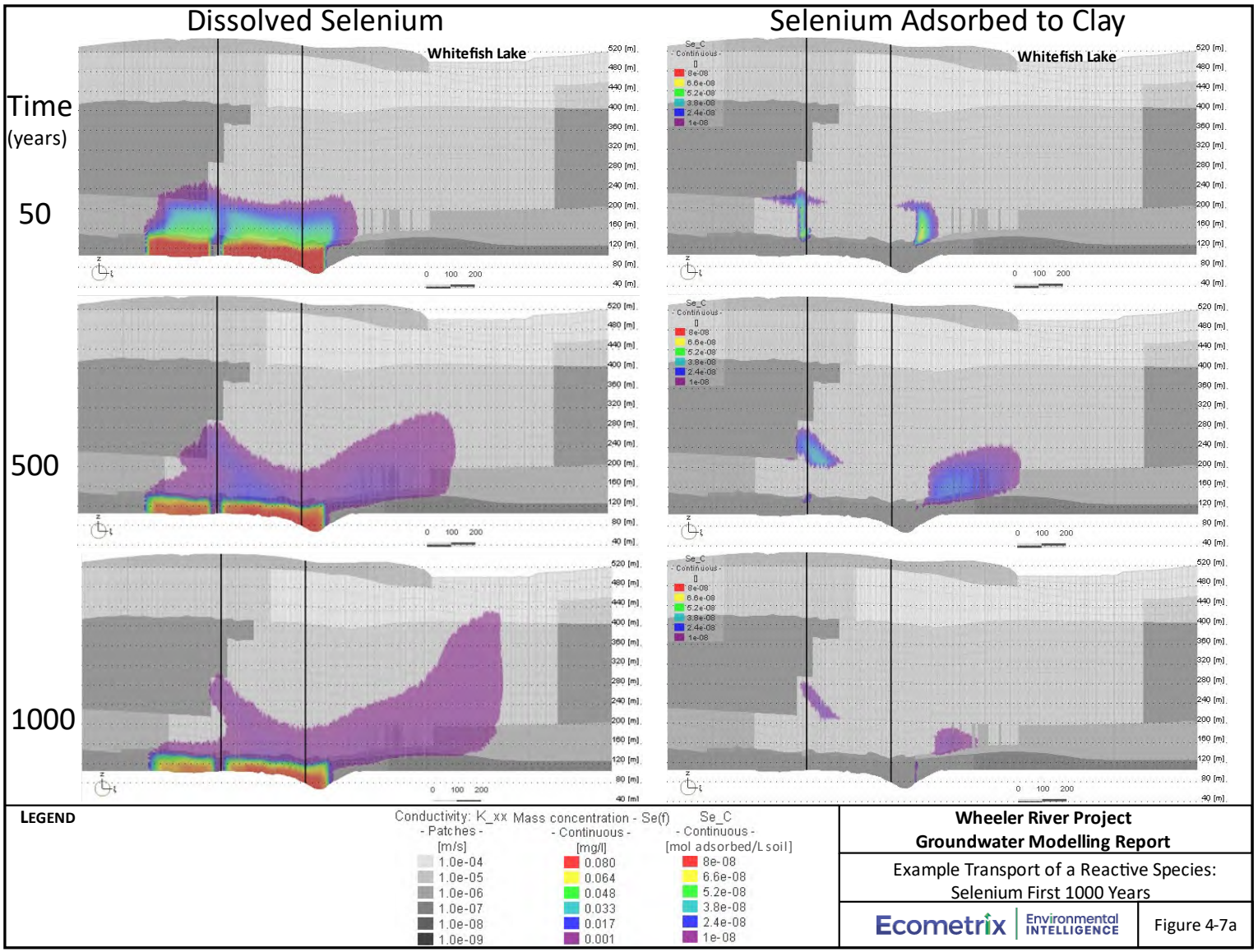


Figure 4-7a: Example Transport of a Reactive Species: Selenium First 1000 Years

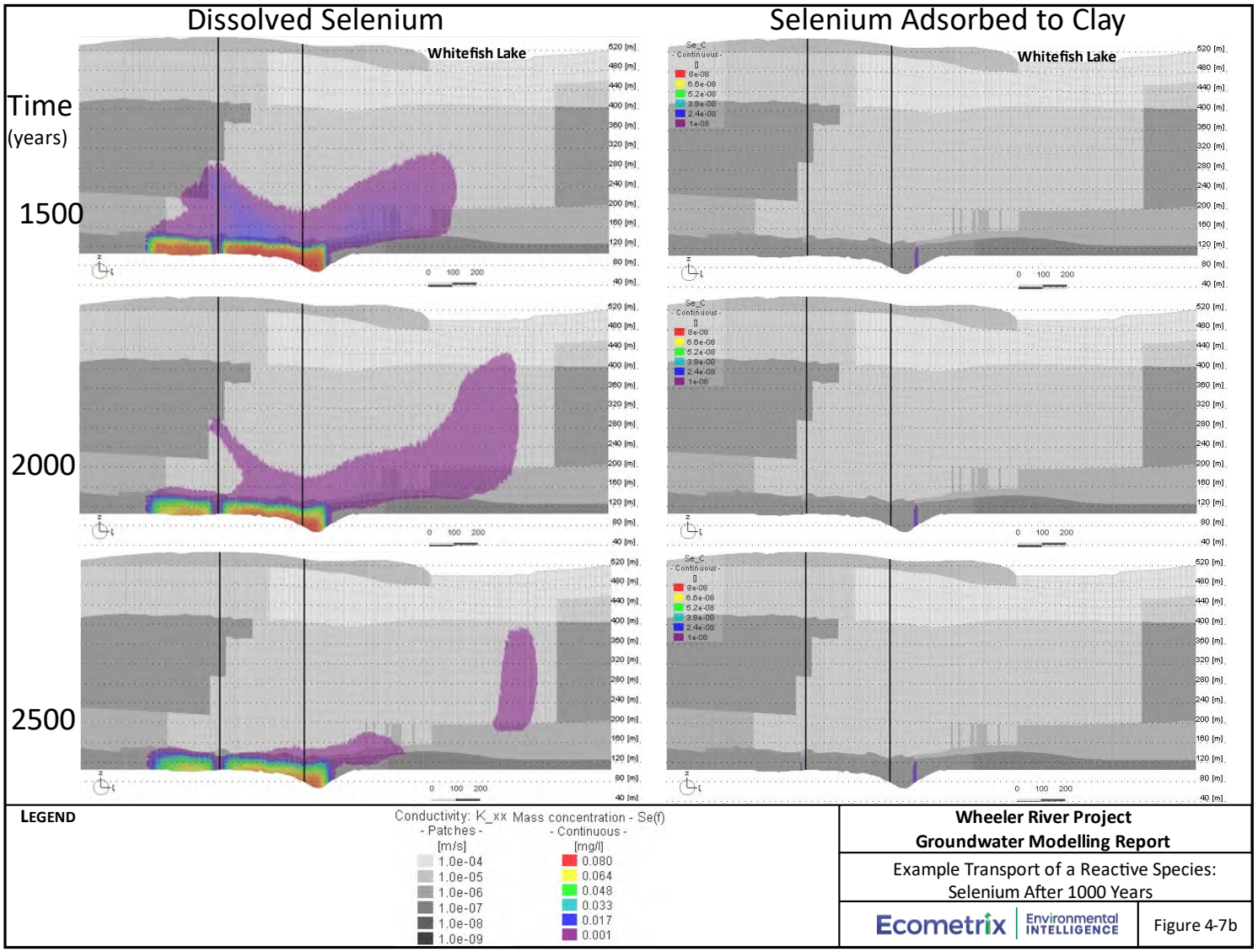


Figure 4-7b: Example Transport of a Reactive Species: Selenium After 1000 Years

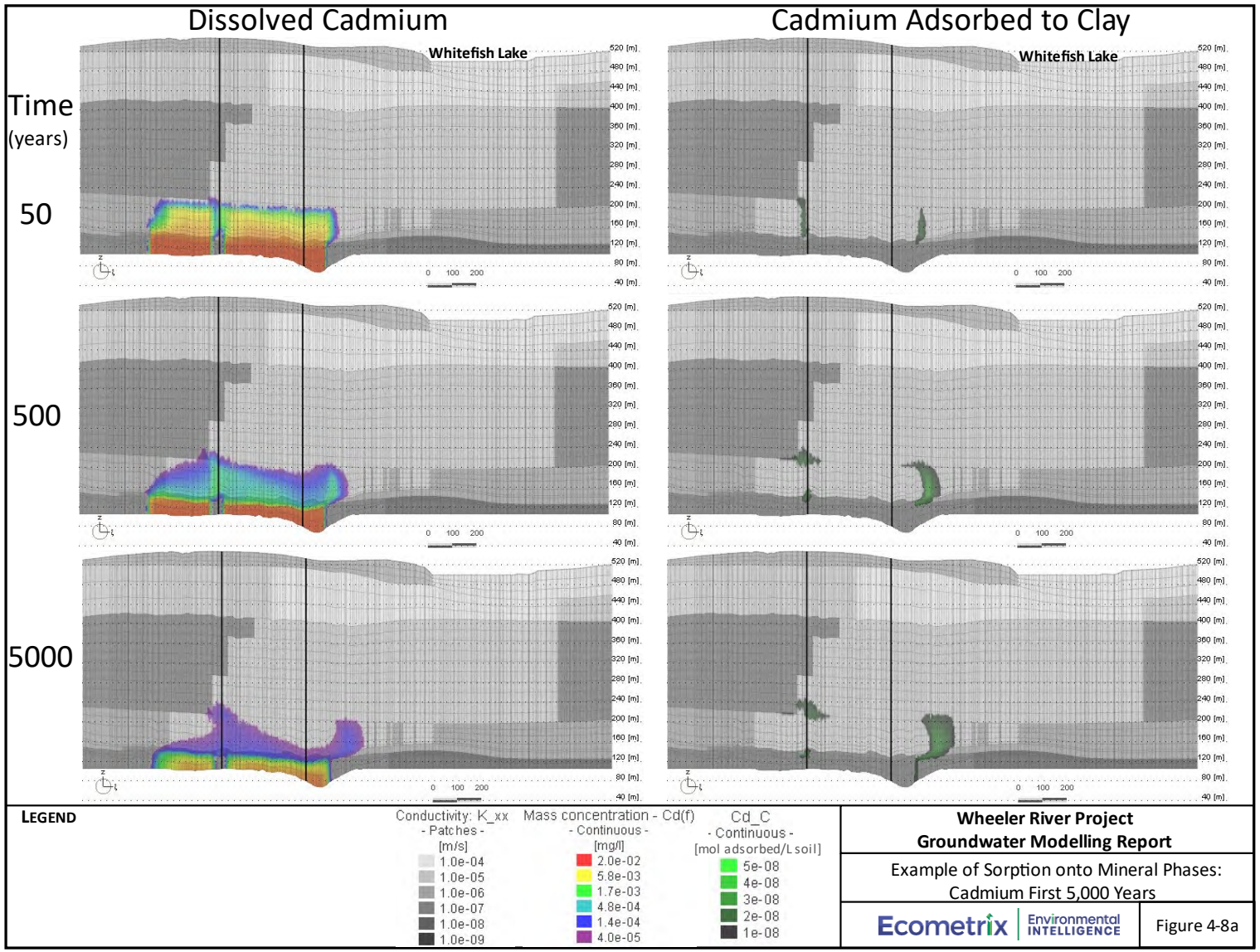


Figure 4-8a: Example of Sorption onto Mineral Phases: Cadmium First 5,000 Years

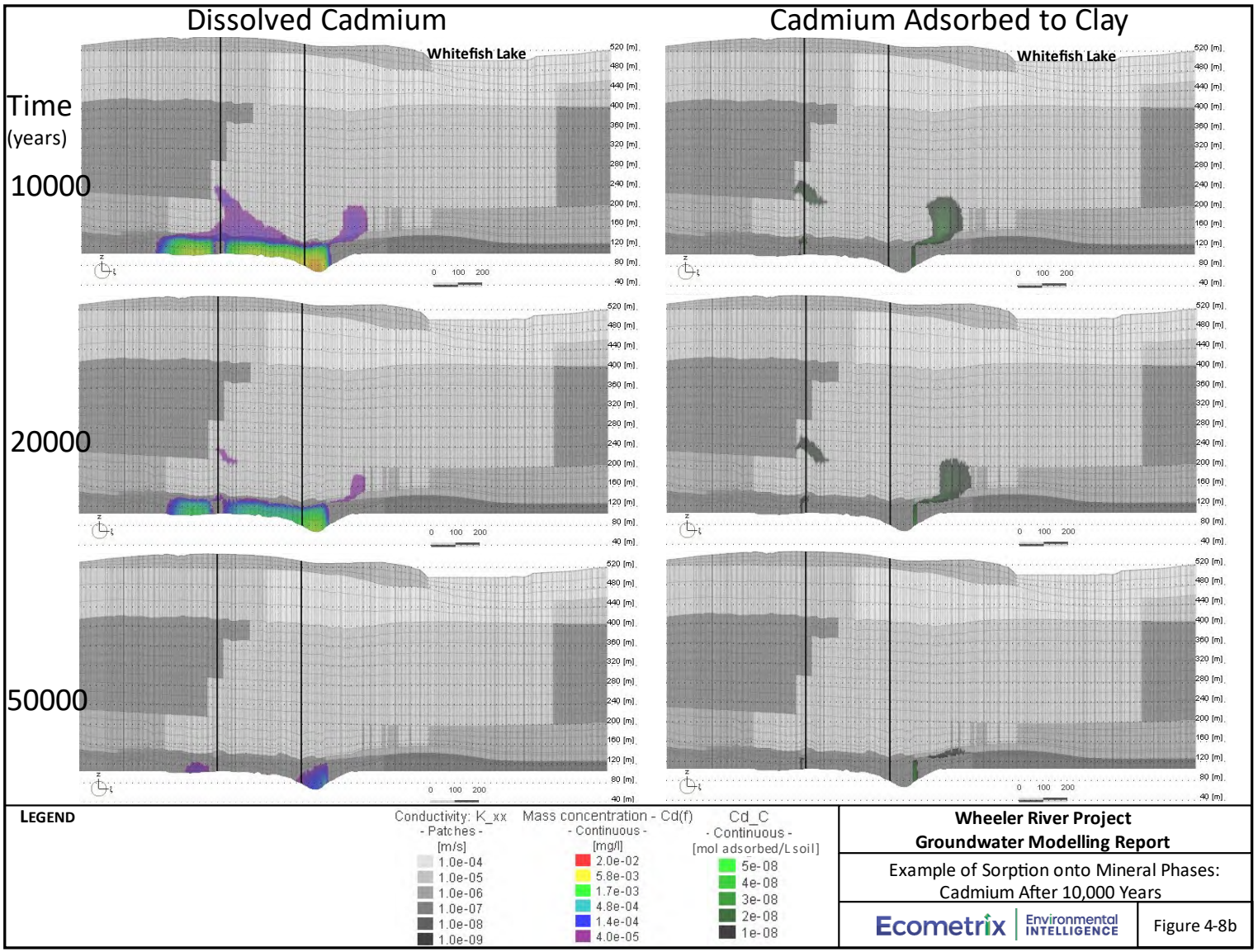


Figure 4-8b: Example of Sorption onto Mineral Phases: Cadmium After 10,000 Years

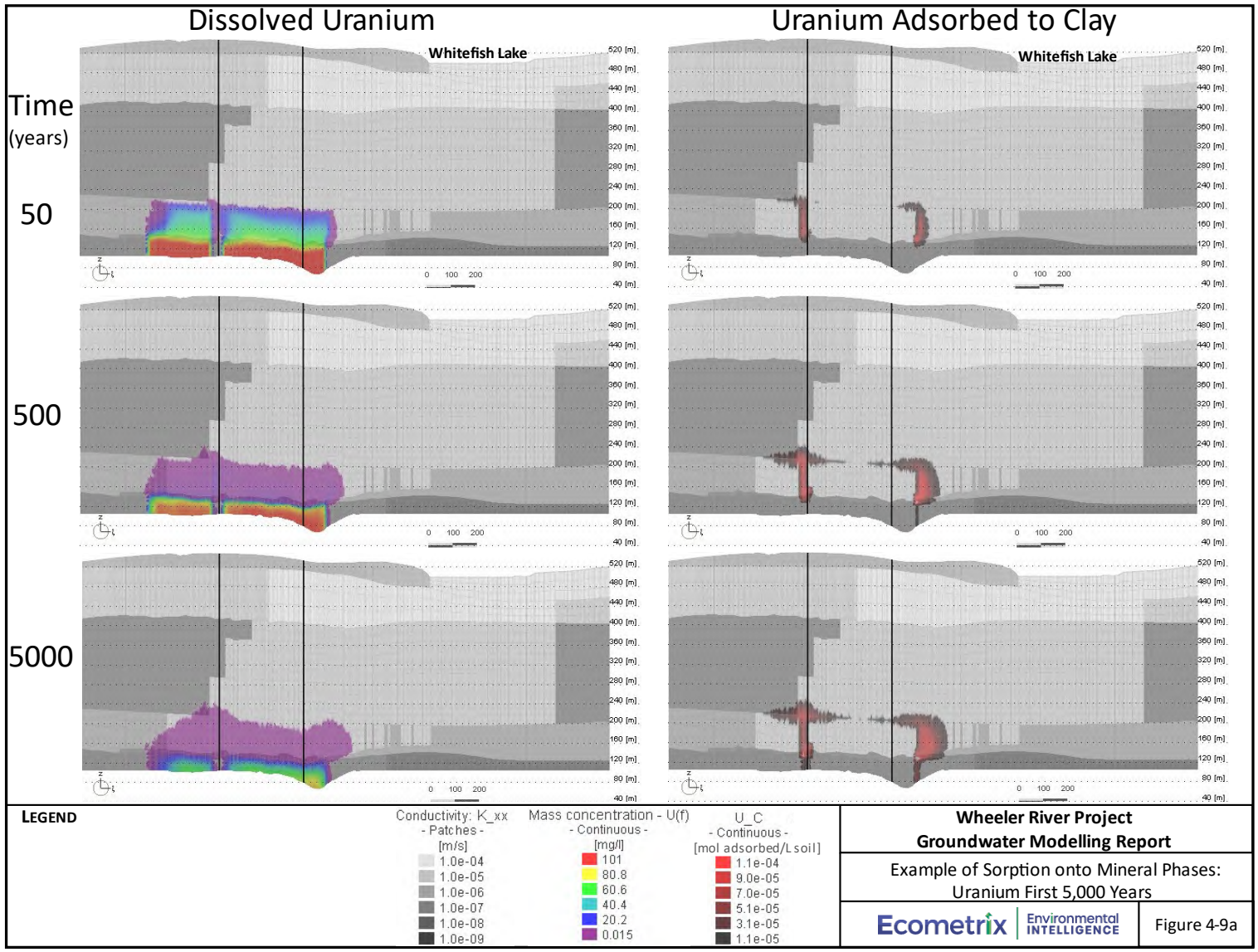


Figure 4-9a: Example of Sorption onto Mineral Phases: Uranium First 5,000 Years

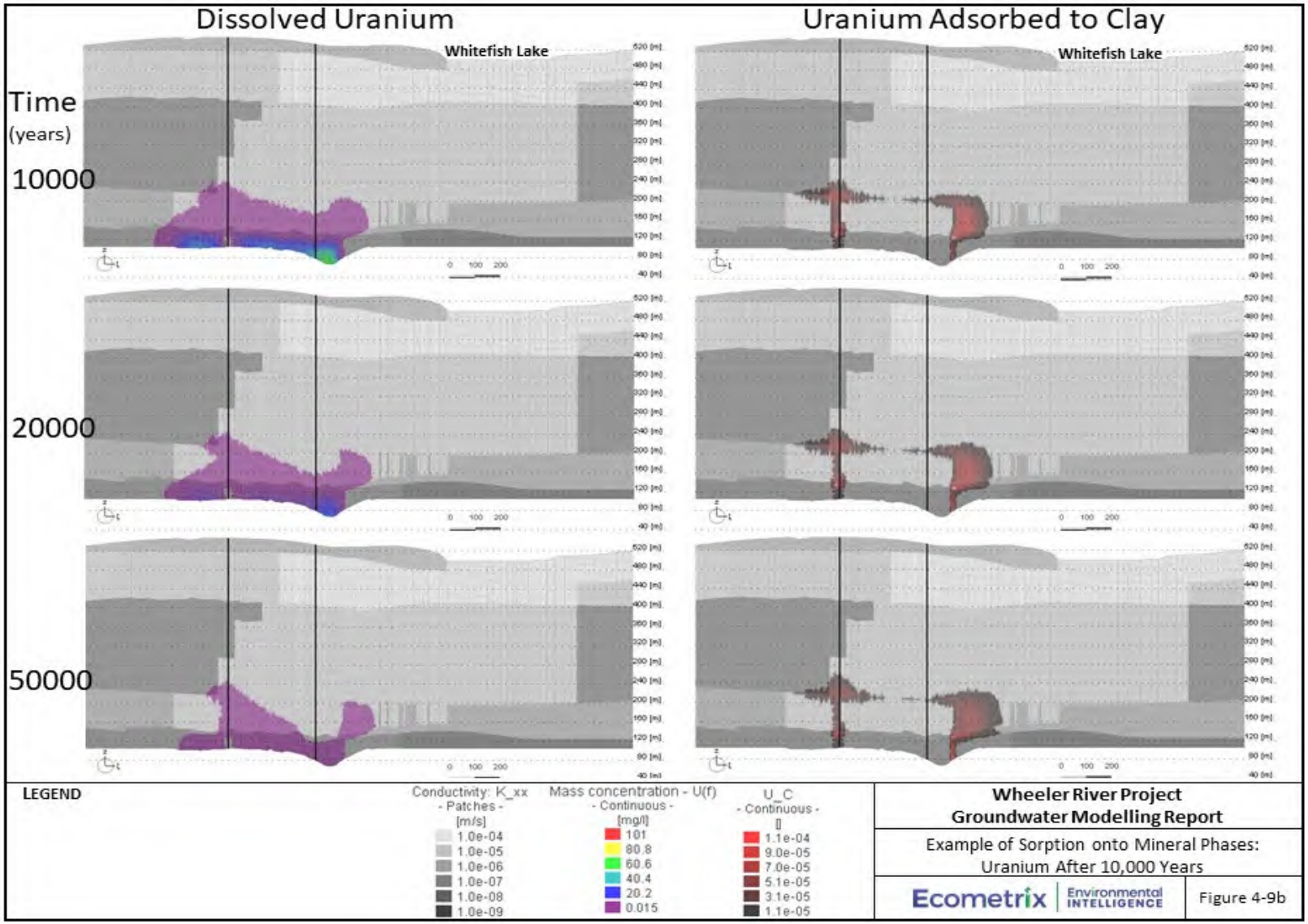


Figure 4-9b: Example of Sorption onto Mineral Phases: Uranium First 10,000 Years

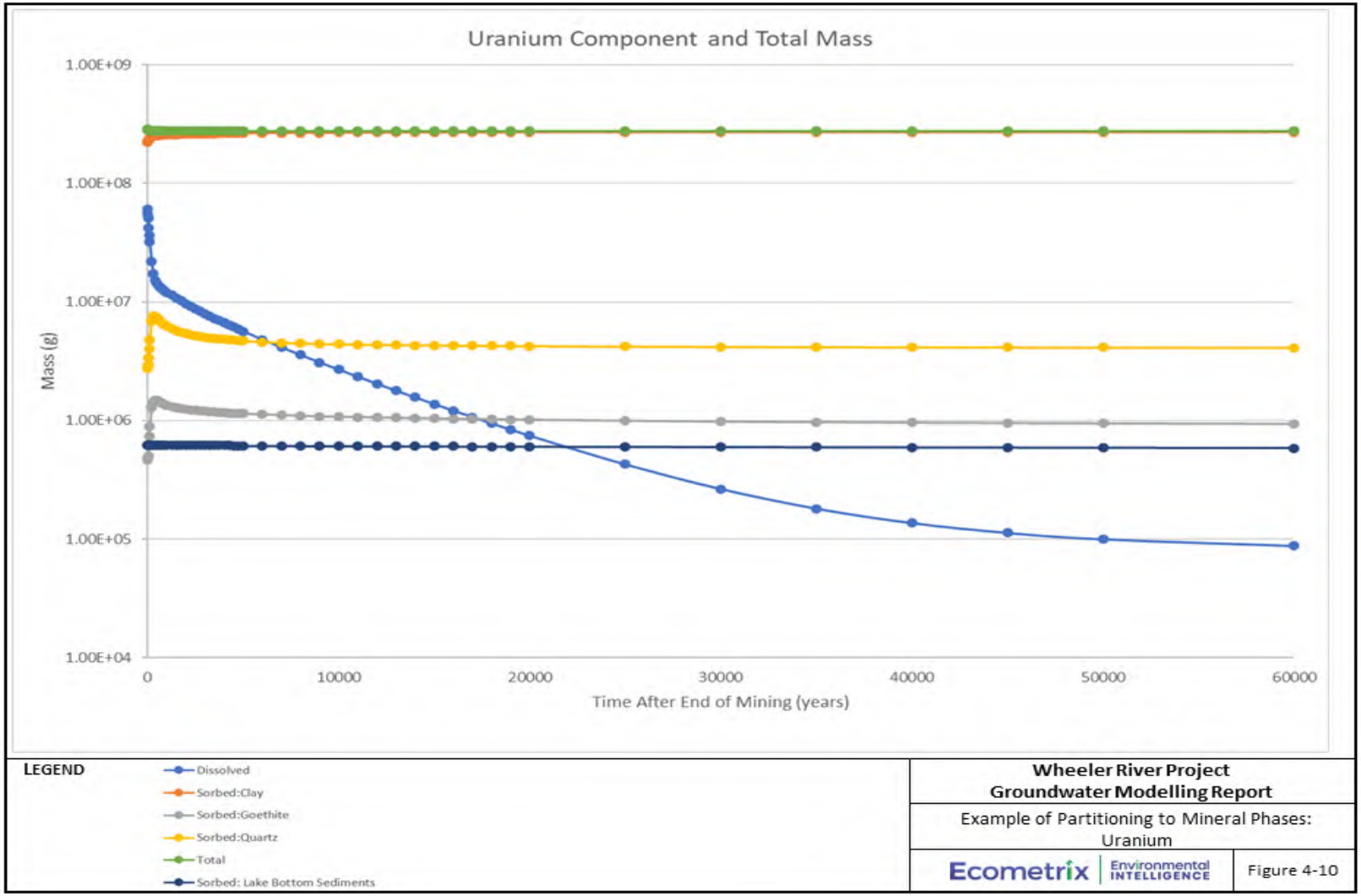


Figure 4-10: Example of Partitioning to Mineral Phases: Uranium

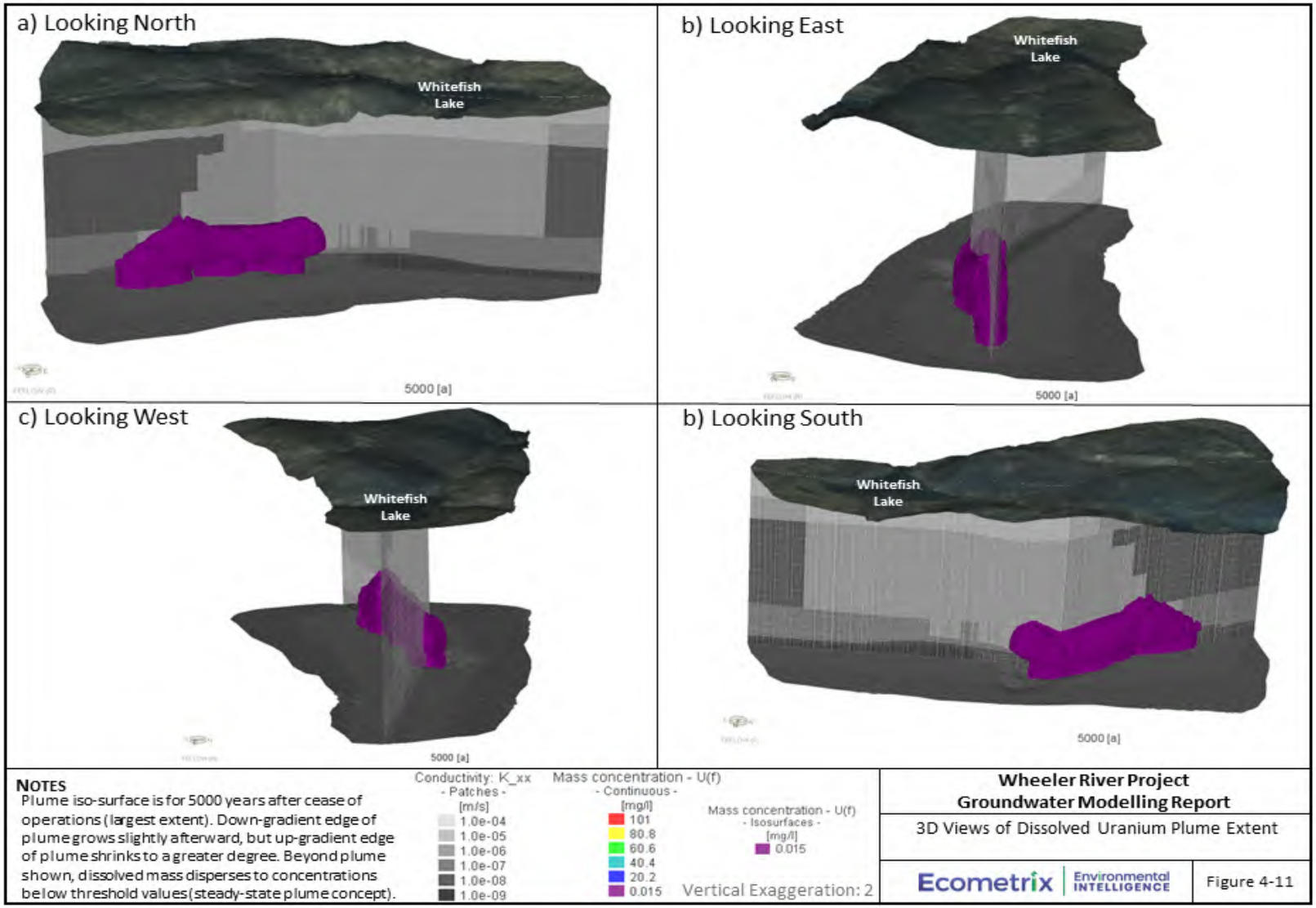


Figure 4-11: 3D Views of Dissolved Uranium Plume Extent

4.6.4 Matrix Diffusion

An additional process that is expected to occur in the natural system, but is not simulated in the results presented, is matrix diffusion. Matrix diffusion is expected to occur within the fractured rock portions of the sub-surface and will act to further retard the migration of dissolved-phase constituents. It is interpreted to be most prevalent within the Paleoweathered Basement Aquitard, but it can also likely occur within fractured media surrounding and within the ore zone. Without matrix diffusion, which is a physical process, the model is conservatively overpredicting the migration of all constituents.

4.6.5 Constituents Reaching Whitefish Lake

The groundwater model simulates the potential flow of groundwater and transport of constituents toward multiple downstream surface water bodies, including Whitefish Lake, McGowan Lake, LA-2, and Russell Lake. Whitefish Lake was found to be the most likely receiving water body based on proximity to the Phoenix ore zone, and observed water level data, and model simulation results further support that Whitefish Lake is the primary receiving water body. Other receptors located further away, including Russell Lake, are predicted to experience no measurable effects as a result of their increased distance from the Phoenix site, and additional dispersion that would occur along the potential transport pathways. Consequently, the groundwater quality reaching the base of Whitefish Lake is the focus of the discussion in the following sections. Figures 4-12 and 4-13 illustrate results from the base simulation.

Figure 4-12 illustrates concentrations of select COPCs reaching Whitefish Lake over the first 2,000 years post-decommissioning (i.e., future centuries). Primary and secondary vertical axes are used to plot constituents with higher and smaller mass flux on the same figure. Note that COPCs and other constituents that did not have a measurable change in concentration throughout the first 2000 years of the simulation are not included in this figure. As shown on Figure 4-12, concentrations for contaminants of potential concern are simulated to not vary appreciably from initial, baseline, conditions; changes are gradual and will result in an evolution of the groundwater quality reaching Whitefish Lake. Of note are the elongated peaks for vanadium and selenium; these peaks are stretched due to storage of mass within the lake bottom sediments.

The maximum concentrations for COPCs, over the entire 60,000-year period simulated, are also presented in Table 4-2. The constituent concentrations are for groundwater seeping into the base of the lake and do not reflect the mixing that will occur within the lake. Beyond these groundwater simulations, environmental effects within Whitefish Lake were also assessed, as described in Section 4.9. All constituents, with exception of iron (Fe), manganese (Mn) and pH, were simulated to have concentrations that remain below the GQSC throughout the period of simulation (60,000 years post-decommissioning). Both iron and manganese are naturally observed to have elevated concentrations in groundwater, with background iron concentrations observed to be above the GQSC (See Table 3-4). The simulated pH is very marginally below the lower value of the GQSC (pH 6.5), and all simulated pH values were within the range of natural groundwater pH values in the Local Groundwater System (overburden and Upper Sandstone

Aquifer). Background conditions are also discussed in detail in the Baseline Report (Ecometrix, 2024a).

As evident on Figure 4-12 (and documented on Table 4-3), more conservative constituents (chloride, iron, sulphate) are simulated to reach their peak concentrations in groundwater at the lake in approximately 400-years; this is consistent with the early arrival particle traces illustrated on Figure 4-4. Other constituents that react to a greater degree with the mineral surfaces (e.g., selenium) reach their peak concentrations much later, and highly reactive constituents (e.g., arsenic, uranium) reach their peak concentration after tens-of-thousands of years, or never reach the Lake at noticeable concentration levels. Conservative transport was experienced for strontium (Sr), chloride (Cl), iron III (Fe), sulphate ($S0_4$), and vanadium (V) with peak concentrations occurring within 400-500 years. Other constituents experienced very little change during the first 2000-years of post-decommissioning (e.g., uranium, cobalt, cadmium, Thorium-230 and Radium-226); these are interpreted to remain at background concentrations throughout this period. Minor fluctuations in all concentrations were simulated at early time (e.g., less than 100 years) as the model approached a continuous, smooth equilibrium from the piece-wise constant node groups used to apply initial concentrations.

Table 4-3 documents the mass flux of constituents reaching Whitefish Lake, while Figure 4-13 illustrates this mass flux over the first 2000 years (i.e., future centuries). This evaluation of mass flux over time provides an indication of how much conditions will change within Whitefish Lake over the future centuries period post-decommissioning. Primary and secondary vertical axes are used to plot constituents with higher and smaller mass flux on the same figure. As Figure 4-13 illustrates, the simulated change in mass flux for all constituents is relatively small. Sulphate is shown to experience the largest change in mass flux (14%), however most of the constituent's experience less than 5% change in mass flux. The predictions of mass flux to Whitefish Lake, summarized in Table 4-4, are further used within a subsequent effects assessment (Section 4.9), to understand the implication of changes in COPC mass flux to Whitefish Lake.

The 60,000-year simulation time was chosen because by that time the source concentration for uranium is reduced to 1/100th the initial conditions, and as such, the potential for a plume from the source is all but eliminated as conditions have returned to background.

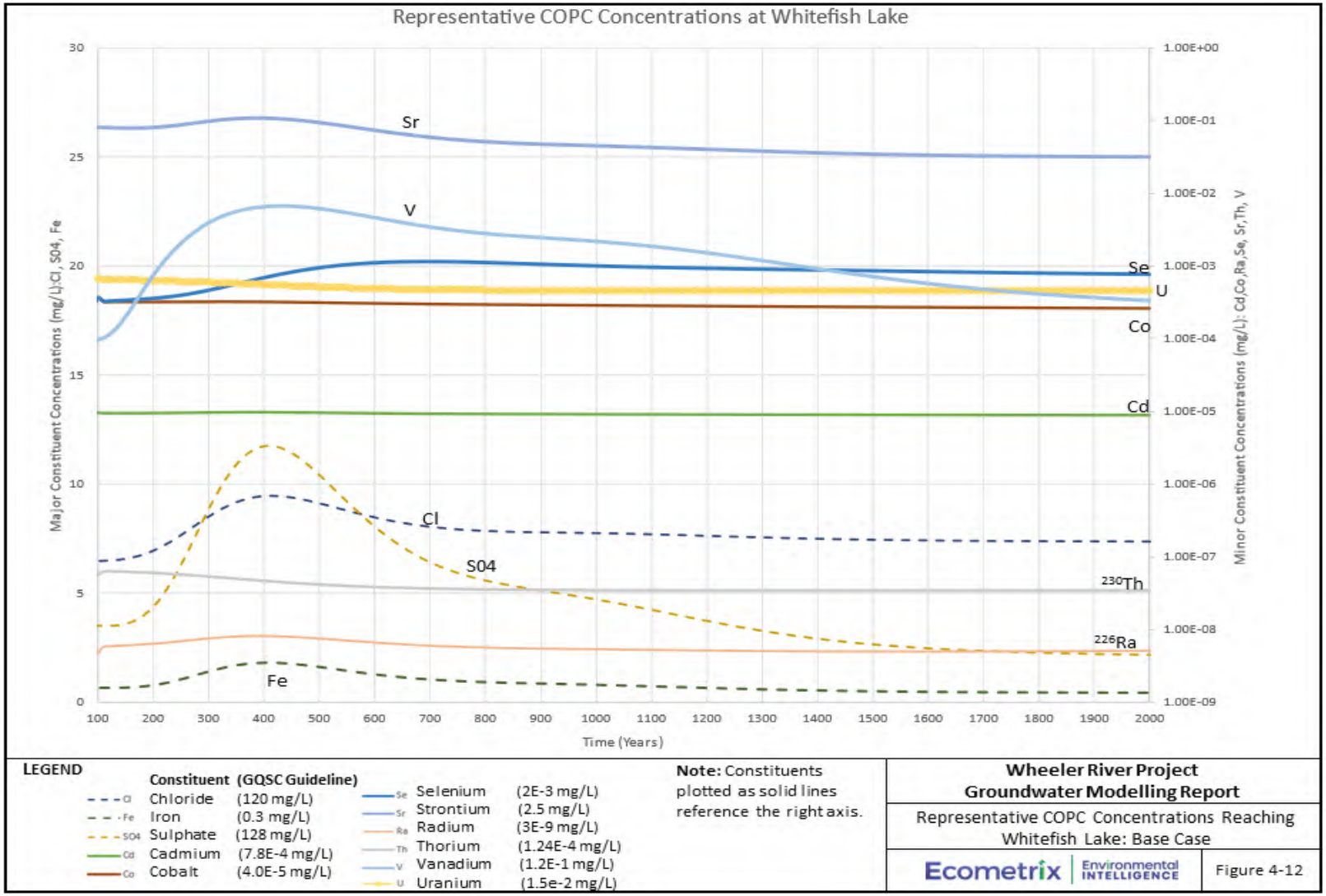


Figure 4-12: Representative COPC Concentrations Reaching Whitefish Lake: Base Case

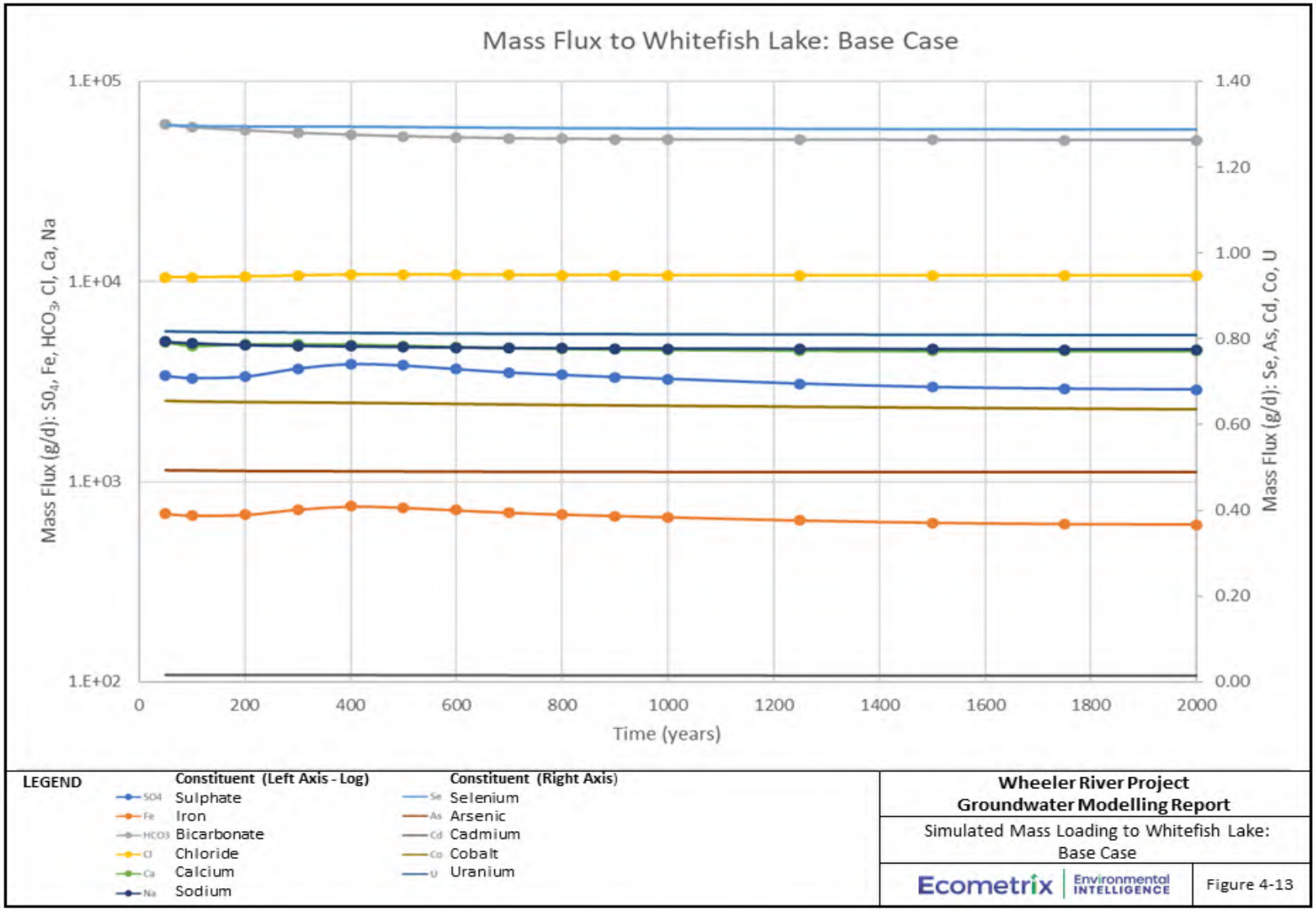


Figure 4-13: Simulated Mass Loading To Whitefish Lake: Base Case

Table 4-3: Peak Concentrations in Groundwater Reaching Whitefish Lake Base Case

Element	Groundwater Quality Screening Criteria	Concentration (mg/L)	Peak Time (Yr)	Comment
Al	0.05	0.040	9000	Background, naturally near threshold
As	0.005	$8x10^{-4}$	47075	Background
Ba*	--	0.039	50	Background
Ca	--	7.01	370	Conservative transport from Ore Zone
Cd	$4.0x10^{-5}$	$1.1x10^{-5}$	510	Background
Cl	120	10.0	420	Conservative transport
Co	$7.8x10^{-4}$	$4.2x10^{-4}$	400	Background
Cr*	$8.9x10^{-3}$	$5.3x10^{-4}$	400	Background
Cu*	$2.0x10^{-3}$	$7.0x10^{-4}$	100	Background
F*	--	0.06	8720	Background
Fe	0.3	**1.94**	410	Conservative transport, naturally above threshold
K	--	3.05	20	Background
Mg	--	2.76	75	Background
Mn*	0.23	**0.28**	500	Conservative transport, naturally near threshold
Mo*	31	$3.1x10^{-3}$	400	Background
Na	--	5.1	380	Conservative transport
Ni	$2.5x10^{-2}$	$1.9x10^{-3}$	400	Conservative transport
P*	--	0.074	1250	Background
Pb	$1.0x10^{-3}$	$1.2x10^{-4}$	50	Background
pH	6.5-9	6.45	400	Reactive transport, naturally below threshold
SO_4	128	12.6	410	Conservative transport
Se	$2.0x10^{-3}$	$8.3x10^{-4}$	700	Reactive transport
Sr*	2.5	0.12	400	Conservative transport
Ra*	$3.0x10^{-9}$	$2.3x10^{-9}$	8720	Reactive transport
Th*	$1.24x10^{-4}$	$3.2x10^{-8}$	8720	Reactive transport
U	0.015	$5.5x10^{-4}$	60000	Reactive transport
V*	0.12	$6.6x10^{-3}$	430	Conservative transport
Zn*	0.011	$4.7x10^{-3}$	8720	Reactive transport

* Simulation limited to 8720 years for full suite of constituents. **BOLD = Exceedance**

Table 4-4: Mass Flux to Whitefish Lake: Base Case

	Mass Flux to Whitefish Lake (g/d)																												
Time	Al	As	Ba	C	Ca	Cd	Cl	Co	Cr	Cu	F	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Ra	S	Se	Si	Sr	Th	U	V	Zn
50	4.79E+1	4.95E-1	1.85E+1	1.25E+4	5.23E+3	1.63E-2	1.09E+4	6.52E-1	8.18E-1	1.00E+0	7.52E+1	7.27E+2	4.36E+3	3.00E+3	2.47E+2	1.15E+0	5.23E+3	2.95E+0	6.77E+1	1.68E-1	2.69E-6	1.18E+3	1.31E+0	1.91E+4	4.03E+1	4.24E-5	8.19E-1	1.64E-1	7.18E+0
75	4.80E+1	4.95E-1	1.78E+1	1.24E+4	5.07E+3	1.63E-2	1.09E+4	6.51E-1	8.18E-1	9.99E-1	8.03E+1	7.20E+2	4.36E+3	3.03E+3	2.45E+2	1.15E+0	5.20E+3	2.95E+0	6.64E+1	1.68E-1	2.69E-6	1.17E+3	1.31E+0	1.91E+4	3.86E+1	4.25E-5	8.18E-1	1.64E-1	7.18E+0
100	4.81E+1	4.95E-1	1.72E+1	1.23E+4	5.04E+3	1.63E-2	1.09E+4	6.51E-1	8.17E-1	9.98E-1	8.27E+1	7.15E+2	4.33E+3	3.00E+3	2.47E+2	1.15E+0	5.17E+3	2.95E+0	6.71E+1	1.67E-1	2.69E-6	1.16E+3	1.31E+0	1.91E+4	3.73E+1	4.25E-5	8.18E-1	1.63E-1	7.17E+0
200	4.82E+1	4.95E-1	1.53E+1	1.19E+4	5.10E+3	1.63E-2	1.09E+4	6.49E-1	8.17E-1	9.93E-1	8.62E+1	7.21E+2	4.22E+3	2.89E+3	2.57E+2	1.16E+0	5.08E+3	2.94E+0	7.07E+1	1.66E-1	2.70E-6	1.18E+3	1.31E+0	1.92E+4	3.45E+1	4.26E-5	8.19E-1	1.63E-1	7.17E+0
300	4.82E+1	4.95E-1	1.37E+1	1.16E+4	5.10E+3	1.63E-2	1.11E+4	6.48E-1	8.16E-1	9.91E-1	8.82E+1	7.67E+2	4.20E+3	2.86E+3	2.58E+2	1.16E+0	5.04E+3	2.94E+0	7.15E+1	1.66E-1	2.70E-6	1.29E+3	1.31E+0	1.92E+4	3.42E+1	4.28E-5	8.18E-1	1.64E-1	7.17E+0
400	4.83E+1	4.95E-1	1.25E+1	1.13E+4	5.09E+3	1.63E-2	1.12E+4	6.47E-1	8.16E-1	9.88E-1	8.98E+1	7.92E+2	4.18E+3	2.84E+3	2.59E+2	1.16E+0	5.01E+3	2.94E+0	7.20E+1	1.65E-1	2.70E-6	1.35E+3	1.31E+0	1.92E+4	3.37E+1	4.29E-5	8.18E-1	1.64E-1	7.17E+0
500	4.83E+1	4.95E-1	1.17E+1	1.11E+4	5.03E+3	1.63E-2	1.12E+4	6.46E-1	8.15E-1	9.86E-1	9.09E+1	7.83E+2	4.16E+3	2.81E+3	2.59E+2	1.17E+0	4.98E+3	2.94E+0	7.23E+1	1.65E-1	2.71E-6	1.33E+3	1.31E+0	1.92E+4	3.21E+1	4.29E-5	8.17E-1	1.64E-1	7.17E+0
600	4.83E+1	4.95E-1	1.11E+1	1.10E+4	4.96E+3	1.63E-2	1.11E+4	6.44E-1	8.14E-1	9.84E-1	9.18E+1	7.60E+2	4.15E+3	2.77E+3	2.58E+2	1.17E+0	4.95E+3	2.93E+0	7.25E+1	1.64E-1	2.71E-6	1.28E+3	1.31E+0	1.92E+4	3.01E+1	4.30E-5	8.17E-1	1.65E-1	7.16E+0
700	4.83E+1	4.95E-1	1.07E+1	1.09E+4	4.91E+3	1.63E-2	1.11E+4	6.43E-1	8.14E-1	9.83E-1	9.24E+1	7.39E+2	4.14E+3	2.74E+3	2.57E+2	1.17E+0	4.93E+3	2.93E+0	7.26E+1	1.64E-1	2.71E-6	1.23E+3	1.31E+0	1.92E+4	2.85E+1	4.30E-5	8.17E-1	1.65E-1	7.16E+0
800	4.83E+1	4.95E-1	1.04E+1	1.08E+4	4.87E+3	1.63E-2	1.11E+4	6.42E-1	8.13E-1	9.82E-1	9.28E+1	7.25E+2	4.13E+3	2.72E+3	2.56E+2	1.17E+0	4.92E+3	2.93E+0	7.27E+1	1.64E-1	2.71E-6	1.20E+3	1.31E+0	1.92E+4	2.73E+1	4.30E-5	8.16E-1	1.65E-1	7.15E+0
900	4.83E+1	4.95E-1	1.01E+1	1.08E+4	4.84E+3	1.63E-2	1.11E+4	6.40E-1	8.12E-1	9.81E-1	9.31E+1	7.13E+2	4.13E+3	2.70E+3	2.56E+2	1.17E+0	4.91E+3	2.92E+0	7.27E+1	1.64E-1	2.71E-6	1.17E+3	1.31E+0	1.93E+4	2.64E+1	4.31E-5	8.16E-1	1.65E-1	7.15E+0
1000	4.83E+1	4.96E-1	9.96E+0	1.07E+4	4.82E+3	1.63E-2	1.11E+4	6.39E-1	8.12E-1	9.81E-1	9.33E+1	7.03E+2	4.13E+3	2.69E+3	2.55E+2	1.17E+0	4.90E+3	2.92E+0	7.27E+1	1.64E-1	2.71E-6	1.15E+3	1.31E+0	1.93E+4	2.58E+1	4.31E-5	8.16E-1	1.66E-1	7.15E+0
1250	4.83E+1	4.96E-1	9.74E+0	1.07E+4	4.78E+3	1.63E-2	1.11E+4	6.37E-1	8.11E-1	9.81E-1	9.37E+1	6.78E+2	4.14E+3	2.67E+3	2.53E+2	1.17E+0	4.89E+3	2.92E+0	7.26E+1	1.63E-1	2.72E-6	1.09E+3	1.30E+0	1.93E+4	2.46E+1	4.31E-5	8.16E-1	1.66E-1	7.15E+0
1500	4.83E+1	4.96E-1	9.65E+0	1.07E+4	4.76E+3	1.63E-2	1.10E+4	6.34E-1	8.09E-1	9.80E-1	9.40E+1	6.61E+2	4.14E+3	2.65E+3	2.52E+2	1.17E+0	4.87E+3	2.91E+0	7.25E+1	1.63E-1	2.72E-6	1.05E+3	1.30E+0	1.93E+4	2.38E+1	4.32E-5	8.16E-1	1.66E-1	7.15E+0
1750	4.83E+1	4.96E-1	9.58E+0	1.07E+4	4.75E+3	1.63E-2	1.10E+4	6.32E-1	8.08E-1	9.81E-1	9.43E+1	6.52E+2	4.15E+3	2.64E+3	2.50E+2	1.17E+0	4.86E+3	2.91E+0	7.23E+1	1.63E-1	2.73E-6	1.03E+3	1.30E+0	1.93E+4	2.33E+1	4.32E-5	8.15E-1	1.66E-1	7.15E+0
2000	4.83E+1	4.96E-1	9.50E+0	1.07E+4	4.75E+3	1.63E-2	1.10E+4	6.30E-1	8.08E-1	9.81E-1	9.44E+1	6.48E+2	4.16E+3	2.63E+3	2.49E+2	1.17E+0	4.85E+3	2.91E+0	7.21E+1	1.63E-1	2.73E-6	1.02E+3	1.30E+0	1.93E+4	2.31E+1	4.32E-5	8.15E-1	1.66E-1	7.15E+0
2250	4.83E+1	4.96E-1	9.43E+0	1.06E+4	4.75E+3	1.63E-2	1.10E+4	6.28E-1	8.07E-1	9.81E-1	9.45E+1	6.46E+2	4.16E+3	2.63E+3	2.48E+2	1.17E+0	4.84E+3	2.90E+0	7.19E+1	1.63E-1	2.74E-6	1.02E+3	1.30E+0	1.93E+4	2.30E+1	4.32E-5	8.15E-1	1.66E-1	7.15E+0
2500	4.83E+1	4.97E-1	9.39E+0	1.06E+4	4.75E+3	1.63E-2	1.10E+4	6.26E-1	8.06E-1	9.81E-1	9.46E+1	6.45E+2	4.17E+3	2.63E+3	2.47E+2	1.17E+0	4.83E+3	2.90E+0	7.17E+1	1.63E-1	2.74E-6	1.02E+3	1.30E+0	1.93E+4	2.29E+1	4.33E-5	8.15E-1	1.66E-1	7.16E+0
2750	4.83E+1	4.97E-1	9.36E+0	1.06E+4	4.75E+3	1.63E-2	1.10E+4	6.24E-1	8.05E-1	9.82E-1	9.47E+1	6.44E+2	4.18E+3	2.62E+3	2.46E+2	1.17E+0	4.83E+3	2.90E+0	7.15E+1	1.63E-1	2.75E-6	1.02E+3	1.30E+0	1.93E+4	2.28E+1	4.33E-5	8.15E-1	1.66E-1	7.16E+0
3000	4.83E+1	4.97E-1	9.34E+0	1.06E+4	4.75E+3	1.62E-2	1.10E+4	6.22E-1	8.04E-1	9.82E-1	9.47E+1	6.44E+2	4.18E+3	2.62E+3	2.44E+2	1.17E+0	4.82E+3	2.90E+0	7.13E+1	1.63E-1	2.76E-6	1.01E+3	1.30E+0	1.93E+4	2.26E+1	4.33E-5	8.14E-1	1.66E-1	7.16E+0
3250	4.83E+1	4.97E-1	9.33E+0	1.06E+4	4.75E+3	1.62E-2	1.10E+4	6.21E-1	8.03E-1	9.82E-1	9.48E+1	6.44E+2	4.19E+3	2.62E+3	2.43E+2	1.17E+0	4.81E+3	2.89E+0	7.11E+1	1.63E-1	2.76E-6	1.01E+3	1.30E+0	1.93E+4	2.25E+1	4.33E-5	8.14E-1	1.66E-1	7.16E+0
3500	4.83E+1	4.97E-1	9.32E+0	1.06E+4	4.75E+3	1.62E-2	1.10E+4	6.19E-1	8.02E-1	9.82E-1	9.48E+1	6.43E+2	4.19E+3	2.61E+3	2.42E+2	1.17E+0	4.81E+3	2.89E+0	7.10E+1	1.63E-1	2.77E-6	1.01E+3	1.30E+0	1.93E+4	2.24E+1	4.34E-5	8.14E-1	1.66E-1	7.17E+0
3750	4.83E+1	4.97E-1	9.31E+0	1.06E+4	4.74E+3	1.62E-2	1.10E+4	6.17E-1	8.01E-1	9.83E-1	9.48E+1	6.43E+2	4.19E+3	2.61E+3	2.41E+2	1.17E+0	4.80E+3	2.89E+0	7.08E+1	1.63E-1	2.77E-6	1.01E+3	1.30E+0	1.93E+4	2.22E+1	4.34E-5	8.14E-1	1.66E-1	7.17E+0
4000	4.83E+1	4.97E-1	9.31E+0	1.06E+4	4.74E+3	1.62E-2	1.10E+4	6.15E-1	8.00E-1	9.83E-1	9.49E+1	6.43E+2	4.20E+3	2.61E+3	2.40E+2	1.17E+0	4.80E+3	2.89E+0	7.06E+1	1.63E-1	2.78E-6	1.01E+3	1.30E+0	1.93E+4	2.21E+1	4.34E-5	8.14E-1	1.66E-1	7.17E+0
4250	4.83E+1	4.98E-1	9.30E+0	1.06E+4	4.74E+3	1.62E-2	1.10E+4	6.14E-1	7.99E-1	9.83E-1	9.49E+1	6.43E+2	4.20E+3	2.61E+3	2.39E+2	1.17E+0	4.79E+3	2.88E+0	7.04E+1	1.63E-1	2.78E-6	1.01E+3	1.30E+0	1.93E+4	2.20E+1	4.34E-5	8.13E-1	1.66E-1	7.18E+0
4500	4.83E+1	4.98E-1	9.30E+0	1.06E+4	4.73E+3	1.62E-2	1.10E+4	6.12E-1	7.99E-1	9.83E-1	9.49E+1	6.43E+2	4.21E+3	2.61E+3	2.38E+2	1.17E+0	4.79E+3	2.88E+0	7.02E+1	1.63E-1	2.79E-6	1.01E+3	1.30E+0	1.93E+4	2.19E+1	4.34E-5	8.13E-1	1.66E-1	7.18E+0
4750	4.83E+1	4.98E-1	9.30E+0	1.06E+4	4.73E+3	1.62E-2	1.10E+4	6.10E-1	7.98E-1	9.84E-1	9.49E+1	6.43E+2	4.21E+3	2.61E+3	2.37E+2	1.17E+0	4.79E+3	2.88E+0	7.01E+1	1.63E-1	2.79E-6	1.01E+3	1.30E+0	1.93E+4	2.18E+1	4.34E-5	8.13E-1	1.66E-1	7.18E+0
5000	4.83E+1	4.98E-1	9.30E+0	1.06E+4	4.73E+3	1.62E-2	1.10E+4	6.09E-1	7.97E-1	9.84E-1	9.49E+1	6.43E+2	4.21E+3	2.61E+3	2.36E+2	1.17E+0	4.78E+3	2.88E+0	6.99E+1	1.63E-1	2.80E-6	1.01E+3	1.30E+0	1.93E+4	2.17E+1	4.35E-5	8.13E-1	1.66E-1	7.18E+0
6000	4.82E+1	4.98E-1	9.29E+0	1.06E+4	4.71E+3	1.62E-2	1.09E+4	6.03E-1	7.93E-1	9.85E-1	9.50E+1	6.42E+2	4.23E+3	2.60E+3	2.33E+2	1.16E+0	4.77E+3	2.86E+0	6.92E+1	1.63E-1	2.82E-6	1.01E+3	1.30E+0	1.93E+4	2.13E+1	4.35E-5	8.12E-1	1.66E-1	7.20E+0
7000	4.82E+1	4.99E-1	9.29E+0	1.06E+4	4.70E+3	1.62E-2	1.09E+4	5.97E-1	7.90E-1	9.85E-1	9.51E+1	6.42E+2	4.24E+3	2.60E+3	2.31E+2	1.16E+0	4.76E+3	2.85E+0	6.86E+1	1.63E-1	2.83E-6	1.01E+3	1.30E+0	1.93E+4	2.11E+1	4.36E-5	8.11E-1	1.66E-1	7.21E+0
8000	4.82E+1	4.99E-1	9.29E+0	1.06E+4	4.69E+3	1.62E-2	1.09E+4	5.93E-1	7.87E-1	9.86E-1	9.51E+1	6.42E+2	4.25E+3	2.60E+3	2.29E+2	1.16E+0	4.76E+3	2.84E+0	6.81E+1	1.63E-1	2.85E-6	1.01E+3	1.30E+0	1.93E+4	2.08E+1	4.36E-5	8.10E-1	1.66E-1	7.22E+0

4.6.6 Summary of Base Case Transport Analysis

The base-case simulations indicated that post-decommissioning conditions would not generate any exceedances at Whitefish Lake for the future centuries period, apart from those that reflect natural conditions. The only exceedances noted in the base case simulation were iron, manganese and pH, but concentrations/values of these parameters are naturally above or near the guideline criteria for freshwater aquatic life.

Simulations illustrate that the geochemical reactive transport conditions interpreted for the site would sorb and retain most of the restored groundwater concentrations in the vicinity of the ore zone (Figures 4-9 to 4-10), such that only minor changes from background would occur at Whitefish Lake throughout the future centuries period. Simulation of key constituents such as uranium, indicate that the mass will be removed from the dissolved solution and sorbed onto available sorption sites of clay, iron, and goethite contained throughout the Athabasca Supergroup sandstone units. This process, coupled with dispersion in three-dimensions, acts to limit the maximum extent of the dissolved plume at concentrations above the groundwater quality screening criteria.

The simulations presented are considered conservative, as they do not consider all potential attenuating processes. Matrix diffusion is expected to further constrain transport of dissolved constituents, particularly based on the long travel times.

4.7 Prediction Uncertainty Analysis

The understanding of the geochemistry and important processes evolved throughout the geochemical simulation progress. Initial simulations were performed using a subset of constituents (19 constituents solved using multi-species transport). Results were reviewed and parameters, or geochemical conditions were varied to test hypotheses and uncertainties in parameter assumptions. Areas of simulation evolution and testing regarding parameter uncertainty included the following:

- suite of COPC necessary to be simulated,
- characteristics of the paleoweathered zone,
- characteristics of lake-bottom sediments and their capacity for sorption and attenuation,
- importance of incorporating spatially variable porosity in computing solids fractions,
- variability in clay content within and surrounding the ore zone related to post-decommissioning migration and reactive transport,
- availability of iron within different hydrostratigraphic units, and
- availability of potential sorption sites along the transport pathway.

As part of the uncertainty scenarios, the period of simulation was varied. The 3D geochemical reactive transport model simulations were run for thousands, to tens-of-thousands of years after thawing of the freeze wall (i.e., post-decommissioning and beyond). Simulations of up to 100,000 years were performed to ensure that desorption, ion exchange and other processes had reached a stable equilibrium and would not yield additional mass available for transport. However, through the base case simulation, the following key time periods were observed:

- the dissolved uranium mass was reduced by 90% within the first 5,000 years,
- a steady-state uranium plume was achieved within the first 10,000 years,
- by 25,000 years, the dissolved uranium mass was reduced to 1% of the decommissioning restored solution mass with the majority of the dissolved mass remaining within the low conductivity paleoweathered bedrock.
- By 60,000 years, maximum dissolved concentrations for uranium were reduced to 1% the initial conditions with the highest concentrations persistent within the low conductivity paleoweathered bedrock.
- Beyond 60,000 years when peak concentrations are predicted to be 1% of the source concentrations, the potential for a continued groundwater plume from the ISR mining area is all but eliminated and conditions have returned to baseline conditions.

Through these findings, the most important period for simulation was considered to be the first 10,000 years; this period is generally considered sufficient time to understand geochemical processes. Simulation of conditions beyond 50,000 to 60,000 years was generally found to produce very little change from background conditions.

Table 4-5 outlines a suite of additional simulations that were performed to explore uncertainty regarding the source condition, hydrogeologic parameters, and the geochemical transport processes that can affect predicted concentrations reaching Whitefish Lake. The scenarios were designed to evaluate the potential uncertainties associated with peak concentrations that may reach Whitefish Lake. Each scenario provide insight into the potential changes in predictions if the model parameters differ from those applied in the base case model simulations.

Uncertainties with respect to the source conditions included a) the suite of constituents within the source zone and transported to Whitefish Lake (Base+ scenario), b) the spatial extent of the source zone, and c) the temporal extent of the source zone. The Base+ scenario evaluates the fate and transport of the full suite of characterized COPCs, including Barium, Chromium, Copper, Floride, Potassium, Magnesium, Manganese, Molybdenum, Phosphorous, Radium, Strontium, Thorium, Vanadium, and Zinc. In addition to the Base+ scenario, uncertainty scenarios (Table 4-5) are further described as follows:

1. Scenario 1: To evaluate the spatial extent, the flare zone overlying the restored solution (Figure 4-1) was considered to have the same solution strength as the area immediately surrounding the ore zone. This extends the source zone vertically; the lateral extent is physically constrained by the freeze walls. This scenario effectively simulates an increase in the dissolved mass of the source.

2. Scenario 2: To evaluate the temporal extent of the source, clay content and proton sorption to clays within the source zone were tested. Simulation of proton desorption from clay can result in a plume of lower pH for a longer period. This lower pH plume can affect the sorption behaviour of COPCs.

Uncertainty with respect to transport conditions between the ore zone and Whitefish Lake was evaluated by extending the simulated time period for transport, varying hydraulic conductivity

of materials along the flow path (6 scenarios), reducing the number of available reaction sites along the flow path (3 scenarios), reducing the dispersion that tends to reduce concentrations in three dimensions in groundwater, enhancing the iron oxidation and ferric iron precipitation such that lower pH conditions may be present within the shallower zones, and evaluating the effect of dissolved U(VI) with pyrite in the desilicified sediments (Redox scenario, Section 3.5.6.3). In Scenarios 3, 4 and 5, the values for increased hydraulic conductivities in the Lower Sandstone Aquifer and Desilicified Zone of the Intermediate Sandstone Aquitard were developed using a robust uncertainty analysis (Section 2.8). This approach was used in recognition that model calibration is non-unique and that a range of parameter combinations should be evaluated to understand potential environmental predictions.

These scenarios are further described as follows:

3. Scenario 3: The transport simulation time was extended to 100,000 years following cessation of mining to evaluate the potential that desorption, ion exchange and other processes could yield additional mass available for transport.

4. Scenario 4: A set of higher hydraulic conductivity values selected from the groundwater flow uncertainty assessment (Section 2.8.3). Realization 3, from the parameter uncertainty assessment, contains a higher hydraulic conductivity for the Lower Sandstone Aquifer (above Phoenix mining phases 1-4, 5, and 6) as well as within the altered (desilicified) portion of the Intermediate Sandstone Aquitard (Figure 2-23).

5. Scenario 5: A set of higher hydraulic conductivity values selected from the groundwater flow uncertainty assessment (Section 2.8.3). Realization 7, from the parameter uncertainty assessment, contains the highest hydraulic conductivity for the combination of the Lower Sandstone Aquifer (above Phoenix phase 5) as well as within the altered (desilicified) portion of the Intermediate Sandstone Aquitard (Figure 2-23).

6. Scenario 6: A set of higher hydraulic conductivity values selected from the groundwater flow uncertainty assessment (Section 2.8.3). Realization 27, from the parameter uncertainty assessment, contains the highest hydraulic conductivity for the Lower Sandstone Aquifer (above Phoenix phase 5) of any of the 50 calibrated realizations (Figure 2-23).

7. Scenario 7: Higher hydraulic conductivity within the ore zone, representing the potential that the ore zone may have enhanced flow through rate, and thus create a greater mass flux leaving the ore zone.

8. Scenario 8: Higher hydraulic conductivity along the WS Shear, within the paleo-weathered zone. The WS Shear is interpreted to have an enhanced fracture zone (damaged zone) surrounding the fault plane, with the frequency and apertures of fractures decreasing exponentially away from the fault plane (i.e., typical interpretation for fracturing surrounding a fault). The enhanced fracturing along the WS shear is only

expected to be relevant within the paleoweathered portion of the sub-surface as the overlying sediments have been desilicified, and thus are expected to behave more like porous media than fractured media.

9. Scenario 9: The hydraulic conductivity was enhanced along exploration coreholes where grout was only placed in the 15 m above the ore zone. The overlying coreholes were simulated to have enhanced hydraulic conductivity through the Intermediate Sandstone Aquitard (Figure 2-6).

10. Scenario 10: The number of available reaction sites at mineral surfaces was reduced to 10% ('1 in 10 solids') assumed in the base case to reflect the potential that site densities and other mineral properties (e.g., surface area) from the literature may not accurately reflect those found in situ. This was evaluated in the 1D model in Section 3.5.6.2.5. Consequently, the potential for dissolved mass to adsorb (and thus have transport retarded) was reduced.

11. Scenario 11: The number of available reaction sites at the mineral surfaces was reduced 10% (as above, #10), but with the full suite of constituents.

12. Scenario 12: Reduction in the number of available reaction sites within the Lower Sandstone Aquifer. The Lower Sandstone Aquifer naturally has relatively low clay and iron concentrations. These minerals were removed altogether from this zone to evaluate the influence on the COPC migration.

13. Scenario 13: The longitudinal and transverse dispersivity were reduced by a factor of 2 to reduce the potential dispersion of the plume along the flow path to values of 5 m and 2.5 m respectively. This has the effect of increasing the maximum concentrations along the dominant flow paths.

14. Scenario 14: Oxygenated conditions may be encountered in the upper flow zone. Oxidation of ferrous iron from the mining area to ferric iron and subsequent precipitation of the ferric hydroxide to goethite was simulated, and the effect on pH and COPC behaviour evaluated.

15. Scenario 15: Alternative REDOX conditions were considered for the transformation of uranium and other COPCs. The groundwater is largely anoxic and pyrite is present in the zone of thermal alteration in the Lower Sandstone Aquifer. The potential for U(VI) reduction to (U(IV) linked to pyrite oxidation was explored. In this scenario, no sorption was assumed in the Lower Sandstone Aquifer for U(VI) or other COPCs.

Each of these uncertainty scenarios provides a means to evaluate the variation in the predicted outcomes (i.e., concentrations) reaching Whitefish Lake.

Table 4-5: Predictive Uncertainty Simulations

#	Description	Key Changes			
		Number of Constituents	Source	Transport	Objective
Base	Base Case	19	RS1	Reactive along entire flow path	Best estimate of expected transport including geochemical reactions.
Base+	Base Case with Additional Constituents	31	RS1++	Base	Potential for other constituents to reach Whitefish Lake.
1	Expanded Source into Overlying Flare	19	Flare @ 100% Restored Solution	Base	Conservative source extent and total mass
2	Elongated Source due to Slow Release of sorbed Constituents	19	RS1+sorbed mass	Base	Conservative source timing and total mass
3	Extended Transport time	19	RS1	Base	Potential for any longer-range changes
4	Higher hydraulic conductivity (Realization 3)	19	RS1	Base Transport Processes, but with enhanced hydraulic conductivity	Potential for earlier breakthrough of constituents and less time for constituents to react along the flow path.
5	Higher hydraulic conductivity (Realization 7)	19	RS1		
6	Higher hydraulic conductivity (Realization 27)	19	RS1		
7	Higher hydraulic conductivity in ore zone	19	RS1		Ore zone does not collapse, leaving higher conductivity in source area
8	Higher hydraulic conductivity along the WS Shear within the paleo-weathered zone	19	RS1		Potential for enhanced fracturing along WS Shear
9	Higher hydraulic conductivity along exploration coreholes	19	RS1		Potential for exploration coreholes to be preferential transport pathways
10	Fewer Reaction Sites	19	RS1	Reaction sites limited to 1 in 10 of base case	Conservative number of reaction sites
11	Fewer Reaction Sites, full suite of constituents	31	RS1	Reaction sites limited to 1 in 10 of base case	Conservative number of reaction sites, full suite of constituents
12	Minimal Sorption within Lower Sandstone Aquifer	31	RS1	Iron sorption sites omitted within the Lower Sandstone Aquifer	Lower potential for sorption, potentially higher peak breakthrough
13	Lower Dispersivity	19	RS1	Less dispersion	Potential for less dispersion
14	Iron Oxidation Causing low pH	19	RS1	Reduced pH due to iron oxidation	Lower potential for sorption
15	Alternative REDOX conditions	31	RS1	Reduced potential transformation of uranium	Less potential for uranium transport to be retarded due to REDOX transformations.

*Effects assessment completed using the results from the Base+ scenario, which contained the complete set of constituents.

4.7.1 Prediction Uncertainty Results

Table 4-5 presents a summary of the predicted concentrations reaching Whitefish Lake under each of the evaluated uncertainty scenarios. The constituent concentrations are for groundwater seeping into the base of the lake and do not reflect the mixing that will occur within the lake. Exceedances of the groundwater quality screening criteria (GQSC) are shown as using a bold, red font.

Exceendances of the GQSC for iron (Fe^{3+}), manganese (Mn) and pH were found in most simulations. Exceedances of for iron are not surprising as initial conditions for iron were observed to be above criteria throughout the Athabasca Supergroup sandstone units and even in surface water samples (Table 3-4). Similarly, exceedances of the GQSC for manganese were anticipated as Mn was observed to have concentrations above the GQSC in the Lower Sandstone Aquifer, the Intermediate Sandstone Aquitard, as well as surface water (Table 3-4). These GQSC exceedances are not caused by mining activities, rather they are naturally occurring within the Athabasca Supergroup sandstone units. pH values were also marginally lower than the GQSC but varied to a very limited extent and were within the range of pH values measured in the overburden and Upper Sandstone Aquifer (Table 3-4 and Appendix D).

Modest exceedances of the GQSC for cobalt (Co) and selenium (Se) were also simulated for the scenario where a lower dispersivity value was applied; exceedances were a factor of 1.2 and 1.1 times the GQSC for these two elements, respectively. Figure 4-14 illustrates that a minor portion area of the groundwater below the lake would be subjected to concentrations greater than the GQSC for selenium, while Figure 4-15 illustrates a similar occurrence for cobalt. The timing of the exceedance is dependent upon the reactive nature of each constituent, and so the exceedance for cobalt is not predicted to occur until 30,000 years post-decommissioning, while the exceedance for selenium is predicted to occur 500 years post-decommissioning. The area of the lake experiencing concentrations above the GQSC in the underlying groundwater is small, and the mass flux entering the lake would not change appreciably. The predicted concentrations in the groundwater entering the base of Whitefish Lake would be further readily reduced during mixing within the lake, as evaluated through the Effects Assessment (Section 4.9).

The uncertainty scenario that yielded the most change was the reduction of the longitudinal dispersivity value from 10 to 5 m (Scenario 13). Over the length of the plume (i.e., 1 km), and recognizing the potential tortuosity associated with flow paths through fractured rock horizons, the 10 m dispersivity value (i.e., base case) is considered the most appropriate value, while the uncertainty value (i.e., longitudinal dispersivity of 5 m; transverse dispersivity of 2.5 m) is considered conservative.

These uncertainty scenarios provide a measure of the potential range of concentrations that may be observed in groundwater beneath Whitefish Lake via groundwater transport. The consistency of the scenario results illustrates the ability of the natural conditions to attenuate restored mining solutions such that elevated concentrations will remain at depth, and concentrations that reach Whitefish Lake will be similar to existing, background conditions. In

addition, the consistency of the uncertainty results with the base case affirms that the base case simulation is appropriate for decision-making.

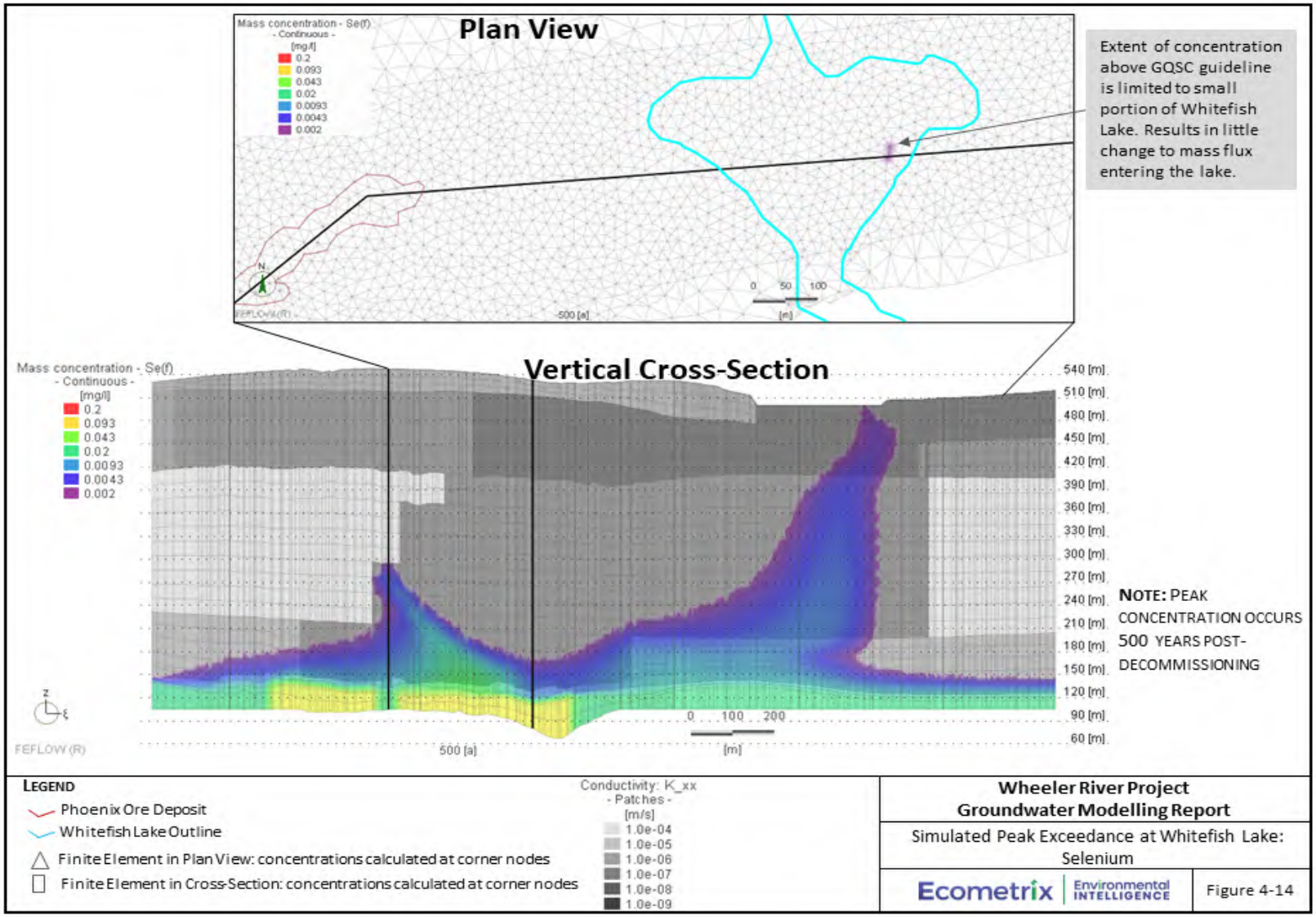


Figure 4-14: Simulated Peak Exceedance at Whitefish Lake: Selenium

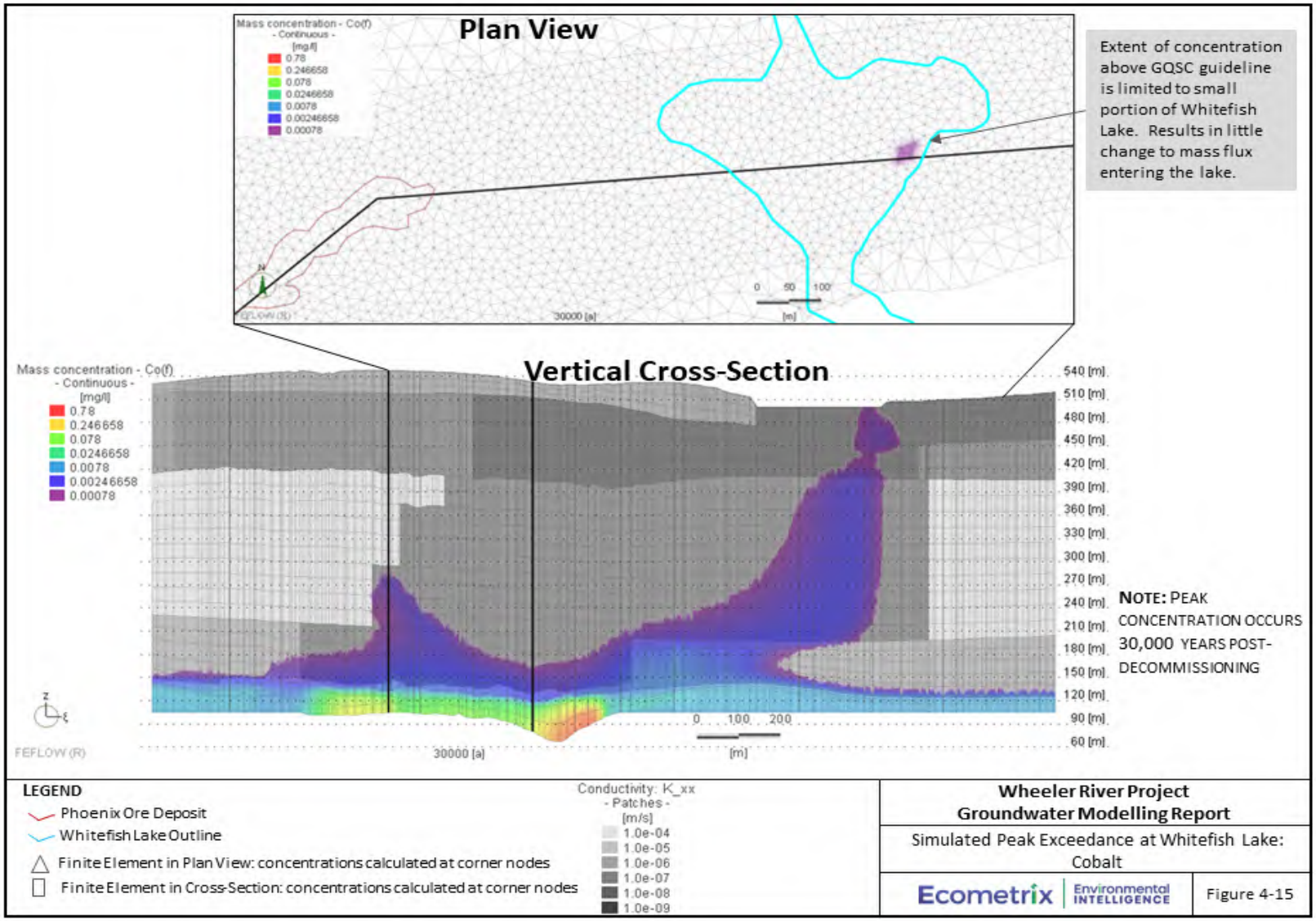


Figure 4-15: Simulated Peak Exceedance at Whitefish Lake: Cobalt

Table 4-6: Uncertainty Results: Groundwater Concentrations at Whitefish Lake

Scenario	MaxTime	pH	Al	As	C	Ca	Cd	Cl	Co	Fe	K	Mg	Na	Ni	Pb	SO_4	Se	Si	U	Ba	Cr	Cu	F	Mn	Mo	P	Ra	Sr	Th	V	Zn
Base	**60000**	**6.45**	**4.00E-2**	**7.82E-4**	**1.34E+1**	**7.01E+0**	**1.07E-5**	**9.98E+0**	**4.23E-4**	**1.94E+0**	**3.05E+0**	**2.76E+0**	**5.12E+0**	**1.92E-3**	**1.18E-4**	**1.26E+1**	**8.35E-4**	**1.22E+1**	**5.50E-4**												
Base+*	8720	6.47	2.98E-2	3.22E-4	1.34E+1	7.02E+0	1.07E-5	9.88E+0	4.22E-4	**1.95E+0**	3.05E+0	2.78E+0	5.13E+0	1.92E-3	1.19E-4	**1.27E+1**	8.36E-4	1.22E+1	5.45E-4	3.94E-2	5.25E-4	7.00E-4	6.14E-2	2.79E-1	3.09E-3	7.43E-2	2.28E-9	1.19E-1	3.16E-8	6.64E-3	4.71E-3
1	50000	6.43	4.01E-2	4.19E-4	1.34E+1	8.36E+0	1.10E-5	1.17E+1	4.33E-4	2.85E+0	3.05E+0	2.87E+0	5.58E+0	1.96E-3	1.18E-4	**1.89E+1**	8.48E-4	1.22E+1	5.50E-4												
2	50870	6.42	4.20E-2	4.11E-4	1.34E+1	7.06E+0	1.07E-5	1.00E+1	4.24E-4	1.95E+0	3.05E+0	2.78E+0	5.14E+0	1.92E-3	1.18E-4	**1.26E+1**	8.35E-4	1.22E+1	5.51E-4												
3	100000	6.45	3.98E-2	1.40E-3	1.34E+1	5.83E+0	1.43E-5	1.03E+1	4.85E-4	2.10E+0	3.42E+0	3.08E+0	6.17E+0	1.90E-3	1.17E-4	**1.37E+1**	1.37E-3	1.22E+1	8.71E-4												
4	35000	6.45	4.01E-2	1.03E-3	1.47E+1	5.03E+0	1.30E-5	1.05E+1	4.19E-4	8.55E-1	3.26E+0	3.20E+0	5.87E+0	1.91E-3	1.21E-4	**5.03E+0**	1.38E-3	1.22E+1	1.70E-3												
5	25450	6.45	4.02E-2	9.82E-4	1.47E+1	5.01E+0	1.42E-5	9.87E+0	4.19E-4	8.13E-1	3.23E+0	3.19E+0	5.47E+0	1.91E-3	1.21E-4	**4.74E+0**	1.28E-3	1.22E+1	1.54E-3												
6	25075	6.45	4.01E-2	1.10E-3	1.46E+1	5.02E+0	1.38E-5	1.10E+1	4.19E-4	1.06E+0	3.28E+0	3.18E+0	6.32E+0	1.91E-3	1.21E-4	**6.46E+0**	1.44E-3	1.22E+1	1.81E-3												
7	10000	6.44	4.02E-2	1.58E-3	1.34E+1	6.10E+0	2.27E-5	1.00E+1	4.16E-4	1.95E+0	3.17E+0	2.94E+0	6.59E+0	1.89E-3	1.18E-4	**1.27E+1**	1.47E-3	1.22E+1	7.69E-4												
8	10000	6.44	4.02E-2	2.00E-3	1.34E+1	6.18E+0	2.59E-5	1.05E+1	4.16E-4	2.02E+0	3.17E+0	2.95E+0	6.92E+0	1.89E-3	1.18E-4	**1.31E+1**	1.57E-3	1.22E+1	7.69E-4												
9	10000	6.45	4.00E-2	3.21E-4	1.34E+1	7.01E+0	1.07E-5	9.95E+0	4.23E-4	1.94E+0	3.05E+0	2.76E+0	5.12E+0	1.92E-3	1.18E-4	**1.26E+1**	8.35E-4	1.22E+1	5.50E-4												
10	50000	6.44	4.02E-2	4.68E-4	1.34E+1	6.61E+0	1.14E-5	9.95E+0	6.33E-4	1.95E+0	2.95E+0	2.71E+0	6.98E+0	1.92E-3	1.18E-4	**1.26E+1**	8.35E-4	1.22E+1	1.40E-3												
11	11175	6.46	4.69E-2	3.33E-4	1.34E+1	6.68E+0	1.18E-5	9.86E+0	4.48E-4	1.95E+0	2.95E+0	2.72E+0	6.66E+0	1.92E-3	1.19E-4	**1.27E+1**	8.36E-4	1.22E+1	1.37E-3	3.93E-2	5.27E-4	7.86E-4	6.17E-2	2.82E-1	9.14E-4	9.41E-2	2.52E-9	1.20E-1	3.80E-8	1.30E-4	4.93E-3
12	8540	6.47	2.98E-2	3.25E-4	1.34E+1	6.95E+0	1.07E-5	9.89E+0	4.22E-4	1.95E+0	3.05E+0	2.78E+0	5.29E+0	1.92E-3	1.19E-4	**1.27E+1**	8.36E-4	1.22E+1	5.45E-4	3.94E-2	5.25E-4	6.99E-4	6.14E-2	2.79E-1	9.12E-4	7.46E-2	2.26E-9	1.20E-1	3.15E-8	1.30E-4	4.70E-3
13	35000	6.43	4.15E-2	1.93E-3	1.49E+1	7.48E+0	3.96E-5	1.20E+1	9.10E-4	2.91E+0	3.27E+0	3.21E+0	8.38E+0	1.92E-3	1.21E-4	**1.93E+1**	2.19E-3	1.22E+1	9.58E-3												
14	50000	6.38	4.21E-2	1.49E-3	1.34E+1	6.14E+0	2.22E-5	1.00E+1	6.62E-4	6.48E-3	3.17E+0	2.94E+0	6.62E+0	1.90E-3	1.17E-4	**1.26E+1**	1.40E-3	1.22E+1	3.15E-3												
15	15000	6.39	3.83E-2	6.97E-4	1.34E+1	6.96E+0	1.07E-5	9.89E+0	4.22E-4	2.00E+0	3.05E+0	2.78E+0	5.30E+0	1.91E-3	1.18E-4	**1.26E+1**	8.34E-4	1.22E+1	5.34E-4	3.94E-2	5.14E-4		6.17E-2	2.89E-1	9.12E-4	7.74E-2	2.61E-9	1.20E-1	3.41E-8	1.30E-4	5.00E-3
Groundwater Quality Screening Criteria		6.5-9	5.00E-2	5.00E-3			4.00E-5	1.20E+2	7.80E-4	3.00E-1				2.50E-2	1.00E-3	1.28E+2	2.00E-3		1.50E-2		8.90E-3	2.00E-3		2.30E-1	3.10E+1		3.00E-9	2.50E+0	1.24E-4	1.20E-1	1.10E-2

Notes:
* Base+ Scenario used to evaluate effects within Whitefish Lake in the l
Exceedances of Groundwater Quality Screening Criteria are shown in red

4.8 Summary of Reactive Transport Results

Transport of dissolved constituents was simulated using a 3D groundwater flow modelling approach with coupled geochemical reactive transport wherein the chemical reactions were computed using PHREEQC and the transport was computed using FEFLOW. In this manner, dissolved constituents were allowed to interact with the geologic media through which they are migrating, allowing realistic sorption reactions to be incorporated into the transport calculations. Simulations extended post-decommissioning for thousands of years to evaluate potential effects throughout the future-centuries period.

Transport of dissolved constituents generally follows the predicted flow paths (Figure 4-4), with additional spreading and mixing related to dispersion. Dispersion reduces the concentrations as time progresses and the dissolved plume migrates (Figure 4-6), and results in much lower concentrations reaching Whitefish Lake than those that are simulated post-decommissioning within the mining area (see Section 4.1 for source conditions). In addition to the dispersion, constituent's experience geochemical reactions along the flow path including sorption reactions. Dissolved groundwater constituents sorb to available reaction sites on minerals within the host material (i.e., quartz, and/or goethite, and/or clay) as the dissolved constituents reach these sites. Sorption and precipitation reactions have the effect of taking mass out of the dissolved phase and making it stationary in the sub-surface until conditions are appropriate for desorption or re-dissolution. These reactions effectively retard the dissolved mass available to be transported toward Whitefish Lake (Figures 4-7 a, b to 4-9 a, b). The transformation of mass from the dissolved to a sorbed state is illustrated in Figure 4-10 for uranium. Similar mass distributions occurs for all reactive constituents. Sorption occurs to different extents for each constituent, and there can be competition for sorption sites by multiple constituents in solution. All constituents are, therefore, simultaneously transported and allowed to react within the simulations to appropriately evaluate the transport and fate of the suite of constituents.

By accounting for the reactions included in the model, the simulated plumes of dissolved COPCs migrating from the mining area are found to reach a maximum extent within the Lower Sandstone Aquifer and the deeper part of the Desilicified Zone (Figure 4-11) after about 5,000 to 10,000 years, depending on the constituent. Consequently, the conditions at Whitefish Lake are predicted to experience modest variations from background/baseline conditions. For example, a maximum change of 14% for the mass flux of sulphate, a chemically conservative constituent in the groundwater was predicted from background conditions, as shown in Figures 4-12 and Figure 4-13). Under the base case scenario, there are only minor exceedances of GQSC for constituents (e.g., iron, manganese) which are naturally found at elevated levels within the Athabasca Supergroup sandstones, and pH is marginally below the GWSC but within baseline range. Consequently, these GQSC exceedances are attributed to natural processes, not the mine post-decommissioning.

Assessment of parameter and geochemical uncertainty suggested there may be a low probability for modest GQSC exceedances for cobalt and selenium in groundwater below the lake. The portion of Whitefish Lake predicted to experience such potential exceedances is relatively small (see Figure 4-14 and 4-15) such that the mass flux to Whitefish Lake is not expected to be

appreciably altered. Similarly, the concentrations within Whitefish Lake, which will be subject to considerable mixing (see Section 2.6.4), are not expected to be measurably altered.

4.9 Output for Effects Assessment at Whitefish Lake

Predictions of mass flux to Whitefish Lake (Section 4.6.5) were further incorporated within a subsequent effects assessment, to understand the implication of such changes in mass flux to Whitefish Lake. Such effects are documented under separate cover (Ecometrix, 2024b) with a summary contained within the EIS (Section 10).

To evaluate the effect of predicted dissolved concentrations seeping into the base of Whitefish Lake, predicted concentration and mass flux changes from the 3D groundwater flow and reactive transport model were further assessed using the IMPACT model (Ecometrix, 2024b). IMPACT is used to assess the potential risks to in the environment, including humans, from exposure to COPCs.

Concentration data (Table 4-3) and mass flux data (Table 4-4; Figure 4-13), from the Base+ scenario were used within IMPACT; the Base+ was used as that scenario represents the best estimate of concentrations and mass loading to Whitefish Lake, for the full suite of constituents.

5.0 Summary and Conclusions

Groundwater flow and reactive transport modelling tools were constructed to simulate conditions in the Phoenix area. The models reflects over 16 years of data collection and interpretation by Denison and the hydrogeologic site conceptual model detailed in Ecometrix, 2024a.

The groundwater flow model was calibrated to observed water level and stream baseflow data. The calibrated groundwater flow patterns were also found to be consistent with natural geochemical trends in groundwater chemistry in the region associated with the Phoenix ore deposit. Groundwater flow within the calibrated groundwater model is dominated by lateral flow within the overburden and Upper Sandstone aquifers, but also includes some flow through the deeper, Lower Sandstone Aquifer. Deep groundwater flow travels eastward within the Lower Sandstone Aquifer before moving upward through the remaining Athabasca Supergroup Sandstone and overburden deposits toward Whitefish Lake. This flow path is largely influenced by the interpreted Desilicified Zone, which is better described as a porous media rather than a fractured rock and that facilitates the connection between the Upper Sandstone Aquifer and Lower Sandstone Aquifer flow systems. From a water budget perspective, the calibrated groundwater flow model was used to identify that groundwater discharge to Whitefish Lake is primarily through the local groundwater flow system (i.e., Overburden and Upper Sandstone Aquifer), with a lesser component flowing from the Lower Sandstone Aquifer, through the Desilicified Zone, into the base of Whitefish Lake near its eastern shore.

Transport of dissolved constituents was simulated for post-decommissioning using a 3D geochemical reactive transport approach wherein the chemical reactions were computed using PHREEQC and the transport was computed using FEFLOW. In this manner, dissolved constituents were allowed to interact with the geologic media through which they are migrating, allowing physically-based adsorption, precipitation, redox and ion exchange reactions to be incorporated into the transport calculations. Transport of dissolved constituents generally followed predicted groundwater flow paths, with additional spreading of chemical concentrations from the plume centre-line due to dispersion. Dispersion acts to attenuate dissolved constituent concentrations in groundwater as time progresses and the dissolved plume migrates. In addition to the dispersion, geochemical reactions (e.g., sorption to reaction sites on minerals such as quartz, goethite, and clay) act to retard and further attenuate dissolved constituent concentrations in groundwater.

By accounting for these transport and fate processes, the simulated plumes of dissolved constituents sourced in the mining area were assessed throughout the future centuries period; they were found to reach maximum spatial extents within the Lower Sandstone Aquifer unit and the deeper part of the Desilicified Zone within 5,000 to 10,000 years, with elevated concentrations of COPCs generally remaining within these deep hydrogeologic units. Consequently, the conditions at Whitefish Lake are simulated to represent modest variations from the background conditions.

A suite of parameter and process uncertainty scenarios were performed to evaluate the potential for COPC concentrations in groundwater to reach Whitefish Lake at levels above/outside of GQSC. Fifteen additional scenarios are presented; all scenarios indicated that concentrations of most constituents would not exceed GQSC in groundwater at the lake. The exceptions include:

- constituents consistently simulated to be outside of GQSC because they are naturally elevated (iron and manganese) or are naturally below the GQSC range (pH); and
- A scenario with conservative dispersivity values wherein selenium and cobalt concentrations were simulated to exceed the GQSC to a moderate extent (1.1 and 1.2 times their GQSCs, respectively) and over a very localized area of the lake.

The 3D geochemical reactive transport model is considered conservative as not all potential attenuating processes are simulated, such as matrix diffusion. The geochemical reactions are site-specific and are well-founded on available literature and site-specific data. Transport analysis incorporates background conditions that were derived from groundwater quality observations throughout the site, geochemical reactions sites based on solid phase constituent concentrations and mineralogical assemblages from core analyses, and source conditions consistent with those observed during lab core leaching and flushing experiments.

5.1.1 Understanding of Post-Decommissioning Fate and Transport

Based on the detailed numerical modelling completed, the restored solution remaining within and surrounding the mining area following remediation in Decommissioning was predicted to result in no adverse conditions to the surface environment over the 'future centuries' period. Constituents dissolved and mobilized as part of the mining process are interpreted and simulated to react with, and sorb to mineral (quartz, clay, goethite) surfaces as they are transported away from the mining area.

Less reactive constituents such as chloride, sulphate and selenium are simulated to exhibit small increases in concentrations in groundwater reaching Whitefish Lake. Concentrations of all COPCs, with are simulated to remain below GQSC with the exceptions of iron, manganese and pH. For these parameters, concentrations/values in groundwater are outside of the GQSC under baseline conditions.

The validity of the simulation results was tested by performing a suite of over 16 process and parameter uncertainty scenarios. All scenarios produced similar results, providing enhanced confidence that the future predicted conditions at Whitefish Lake under the base case scenario represent the likely outcome. The consistency of the scenario results illustrates the capacity of the natural setting to attenuate COPC concentrations associated with restored mining solutions such that elevated concentrations will remain at depth, and concentrations that reach Whitefish Lake will be similar to existing, background conditions.

5.2 Limitations

5.2.1 Simplifications

As with any numerical model, the groundwater flow model developed for Denison's Phoenix deposit is a simplification of the real hydrogeologic setting. The development of the model follows Occam's Razor which can be paraphrased as "the simplest solution is most likely the right one" and is similar to Einstein's teachings that hypotheses "should be made as simple as it can be [to explain observed conditions], but not simpler." With respect to numerical modelling of groundwater flow and transport, the adoption of these principles infers that the model should only incorporate conceptual features, boundary conditions and parameter heterogeneity that are important to explain primary variations in observed data; where practical, generalized parameter distributions should be applied. In the context of groundwater modelling this is referred to as applying the "principle of parsimony" (Hill and Tiedeman, 2007).

Following this approach, simplifications contained within the calibrated numerical model include:

- Structure of the model layers is generalized to the interpreted hydrostratigraphic units for the Phoenix site.

- Hydrogeologic property values are applied uniformly for:

  - Sandy and till regions of the overburden,
  - Upper Sandstone Aquifer,
  - Intermediate Sandstone Aquitard, outside of the Desilicified Zone,
  - Desilicified Zone;
  - Lower Sandstone Aquifer beyond the immediate area of desilicified materials,
  - Paleoweathered bedrock zone, and
  - Basement aquitard

- Boundary conditions were applied only where surface water was mapped, or to allow regional groundwater inflow and outflow, where such flow was evident. No specified head or concentration boundary conditions exist within the numerical model footprint; they are only located at the model perimeter.

- Groundwater recharge was applied in two generalized zones, representing upland recharge (tills) and lowland recharge (sandy zones).

While natural variability of parameters is expected, the level of generalization applied replicates the observed groundwater flow conditions and produces an acceptable degree of calibration. As such, additional heterogeneity and complexity was not warranted.

In addition to the groundwater flow conceptualization, simplifications were also incorporated within the transport simulation approach applied as follows:

- Parameters such as dispersivity, and diffusion were applied uniformly throughout the model.

- Transport properties were assigned uniformly within hydrostratigraphic units that have the same effective porosity values.
- Reactive transport boundary conditions were applied uniformly within the shallow aquifer zones, and deep aquifer zones to represent average "background conditions" for areas of inflowing water.
- Reactive transport initial conditions were assigned uniformly within hydrostratigraphic units with the same effective porosity values.
- Geochemical reactions were assigned uniformly within hydrostratigraphic units with the same effective porosity values.

5.2.2 Assumptions

Assumptions that are inherent in the simulation results presented are outlined in the following section. These assumptions are consistent with the conceptual understanding, and would equally impact each scenario, so would not affect the comparison of results in each scenario.

- The regional groundwater system is assumed to have groundwater levels and gradients that are stationary and reflect a groundwater flow system that is in equilibrium. Observed water levels from monitoring wells are assumed to represent long-term average conditions. Thus, a steady-state groundwater flow simulation approach is appropriate.
- Groundwater recharge, pumping, and other hydraulic conditions were simulated to remain constant during the simulation period (i.e., 100,000 years into the future).
- Hydraulic conductivities values measured and interpreted through on-site fieldwork investigations are representative of conditions throughout the model footprint.
- Exploration coreholes that lie within the Desilicified Zone are interpreted to have collapsed and thus are interpreted to not act as preferential pathways.
- Surface water boundary conditions are assumed to be constant elevations in time, which allows groundwater discharge to be naturally simulated.
- The Desilicified Zone was delineated based on available geotechnical parameters collected within exploration coreholes including fracture frequency, friability, RQD, and similar data.
- Adsorption reactions occur throughout the model domain. Reaction sites are assumed to be uniformly available throughout the sub-surface parameter zones.
- Mineral distribution, and associated reaction sites are assumed to be uniformly distributed throughout each hydrogeologic unit. Samples collected by Denison are assumed to provide representative information regarding mineral content and availability.

At the time of this report, all these assumptions are believed to be reasonable and appropriate. In many cases (e.g., reaction site availability) even more conservative assumptions are applied in the prediction uncertainty assessment (Section 4.7).

5.2.3 Limitations

This report has been prepared for the exclusive use of Denison. Information, interpretations, and summary comments contained herein are provided for the purpose stated in the scope of modelling (Section 1.0). Under no circumstance may this information be used for purposes other than those specified unless formal authorization is provided.

This report must be read in its entirety as some sections could be falsely interpreted when taken individually or out-of-context. Further, the contents and findings of this document reference and rely on the contents of the baseline hydrogeology report (EcoMetrix, 2024a) and should not be interpreted independently. The final version of this report and its content supersedes any other text, opinion or preliminary version produced by EcoMetrix Incorporated.

Groundwater systems are naturally complex at a level that cannot be explicitly replicated, and conditions must be interpolated between observation and measurement points; as such, groundwater models are a simplification of nature. The validity and accuracy of the model depends on the amount and quality of data available for characterization and model calibration relative to the degree of complexity of the geologic setting, as well as the complexity of the groundwater flow and transport processes. For this assessment, the breadth of data collected provides confidence in the characterization as well as the numerical model calibration.

The groundwater modelling described in this report was conducted in a manner exceeding the level of care and skill typically exercised by engineering and science professionals currently practising under similar conditions. The developed model was used to refine understanding of the conceptualization by determining conceptual hypotheses that can successfully replicate observed conditions, and conversely those that cannot (i.e., model calibration). Typically, more than one conceptualization can replicate observed conditions and prediction uncertainty analyses were completed which incorporate multiple levels of conservatism.

The groundwater flow and reactive transport assessment provided in this report presents the understanding gained through completing the detailed model development, calibration, and predictive uncertainty assessments, and as such this work follows recognized professional approaches for numerical modelling (e.g., Anderson et al., 2015).

Despite the level of care employed, no warranty, express or implied, is made regarding individual modelling predictions. The insights gained through the breadth of modelling scenarios evaluated, in which multiple levels of conservatism were explored, should be used to guide decisions; decision confidence is strengthened because of the detailed approach followed and the bracketed outcome analysis provided.

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Appendix A Creation of Numerical Model Surfaces

Hydrostratigraphic Model Layers
The following sections outline the methodology and data sets used to create the hydrostratigraphic model layers represented in the regional scale groundwater flow model. The layers are discussed stratigraphically from ground surface to the bottom of the competent basement rock.

Ground Surface / Top of Overburden
The ground surface represented in the FEFLOW model is illustrated on Figure B1. The surface was provided by Denison at the onset of the project and was derived by stitching together two digital elevation model surfaces that joined on a west-east line at the Phoenix deposit. Some ground surface anomalies were noted at the interface between the two surface and these anomalies were smoothed in the FEFLOW model.

As illustrated on Figure B1 the ground surface elevation is highest on the drumlin ridges and lowest along the surface water features including Whitefish Lake (approximately 500 m asl) and McGowan Lake (494 m asl).

Top of Upper Sandstone Aquifer/ Bottom of Overburden
The surface representing the top of the Upper Sandstone Aquifer unit was the bottom of overburden surface that was created and provided by Denison in April 2020 ("overburden_Wheeler_bottom.grd").

The top surface of the unit is highest (510 m asl) in the southwest and declines in a northeasterly direction towards the western portion of Whitefish Lake where there is an interpreted deepening of the bedrock surface in an interpreted glacially scoured bedrock trough that is incised approximately 50 m into the surrounding topographic surface (Figure B2). The bedrock the centre of this trough has an elevation of approximately 400 m asl.

Top of Intermediate Sandstone Aquitard / Bottom of Upper Sandstone Aquifer
The surface representing the top of the Intermediate Sandstone Aquitard was created by the Ecometrix team by generating and interpreting cross-sections using normative clay values reported at each exploration borehole in the study area. The contact between the two was identified at the interface between the Upper Sandstone Aquifer that has normative clay content generally less than 4%, and the underlying Intermediate Sandstone Aquitard that has normative clay content greater than 4 to 6%. The contact was picked at each borehole where data was available and the elevations at the points were interpolated in FEFLOW to generate the continuous surface.

The top surface of the intermediate sandstone aquitard is highest (430 m asl) in the area southeast of the Phoenix deposit and declines to an elevation of approximately (390 m asl) in the area west of Phoenix near the Gryphon deposit (Figure B3).

Top of Lower Sandstone Aquifer / Bottom of Intermediate Sandstone Aquitard

Like the overlying surface, the top of the Lower Sandstone Aquifer was created by the Ecometrix project team by interpreting cross-sections using normative clay values reported at each exploration borehole in the study area. The contact between these two units in each borehole was picked at the elevation where normative clay was higher than 4% in the overlying aquifer, and less normative clay values in the underlying aquifer unit.

The top surface of the Lower Sandstone Aquifer varies from a high of 320 m asl at the highest point on the quartzite ridge (where the unit is absent) to a low of approximately 120 m asl in the western reaches of the study area near Kratchkowsky Lake (Figure B4).

Top of Clay Cap/ Bottom of Lower Sandstone Aquifer
The exact position of the clay cap overlying the ore zone was not defined by Petrotek or Denison, so was assumed to have a uniform thickness of 2 m overlying the ore zone. This surface was continuous only along the ore zone itself so the surface representing the unconformity was assigned in the areas of the model that lie outside the ore zone ("Unconformity_Detailed_Explicit_10m" provided in Feb 2021). As noted in the modelling report, the hydraulic conductivity values of the units above were assigned where the paleoweathered portion of the basement is interpreted to be absent, and the layer is minimally thin.

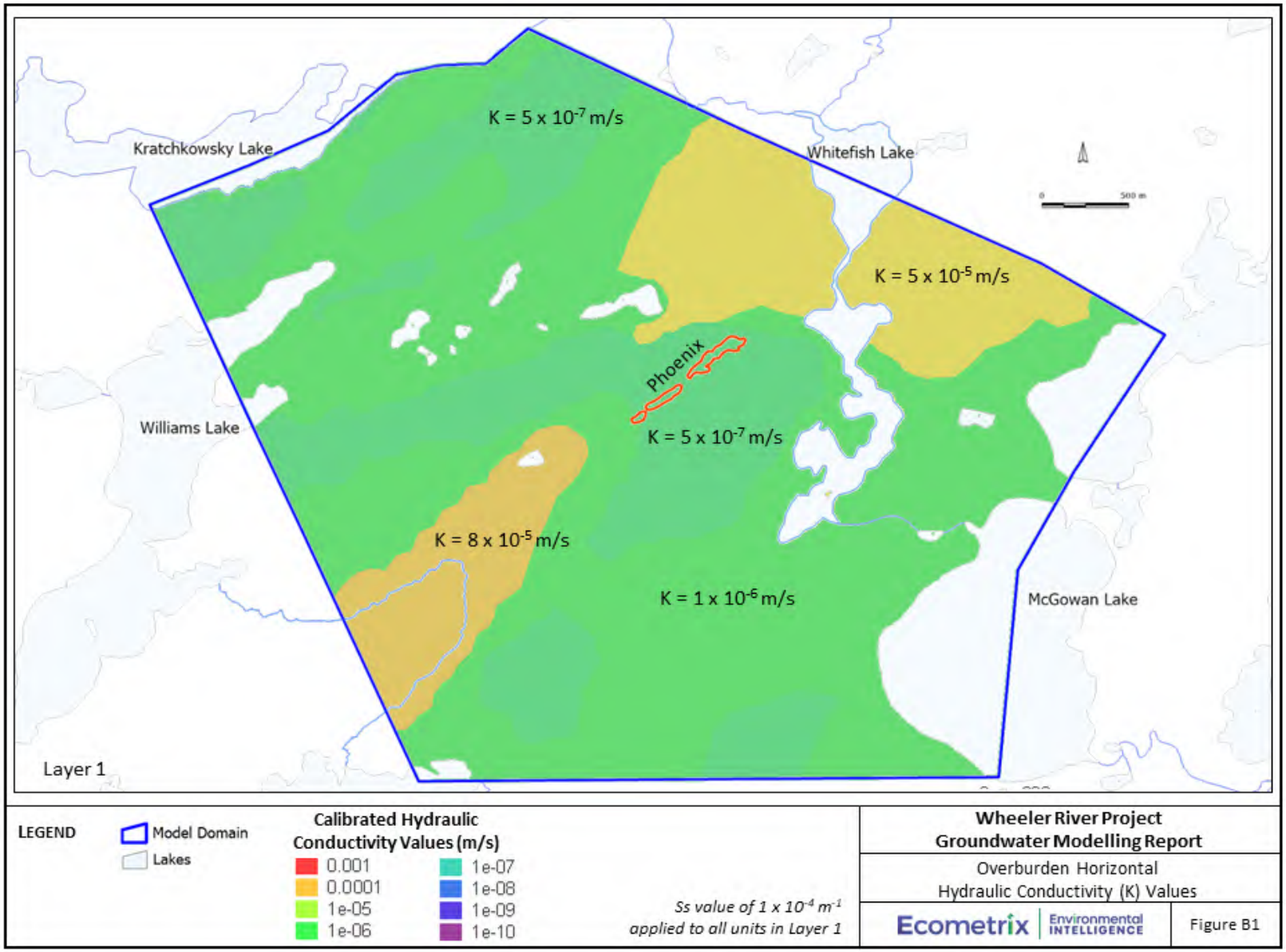
Top of Ore Zone / Bottom of Upper and Lower Barrier Zones
The surface representing the top of the ore was provided by Denison in April 2020 ("Mineralization_Phoenix_top"). This surface was continuous only along the ore zone itself so the surface representing the unconformity (minus one metre) was assigned in the areas of the model that lie outside the ore zone ("Unconformity_Detailed_Explicit_10m" provided in Feb 2021). As noted in the modelling report, the hydraulic conductivity values of the units above were assigned where the weathered basement aquitard is interpreted to be absent, and the layer has a minimal thickness.

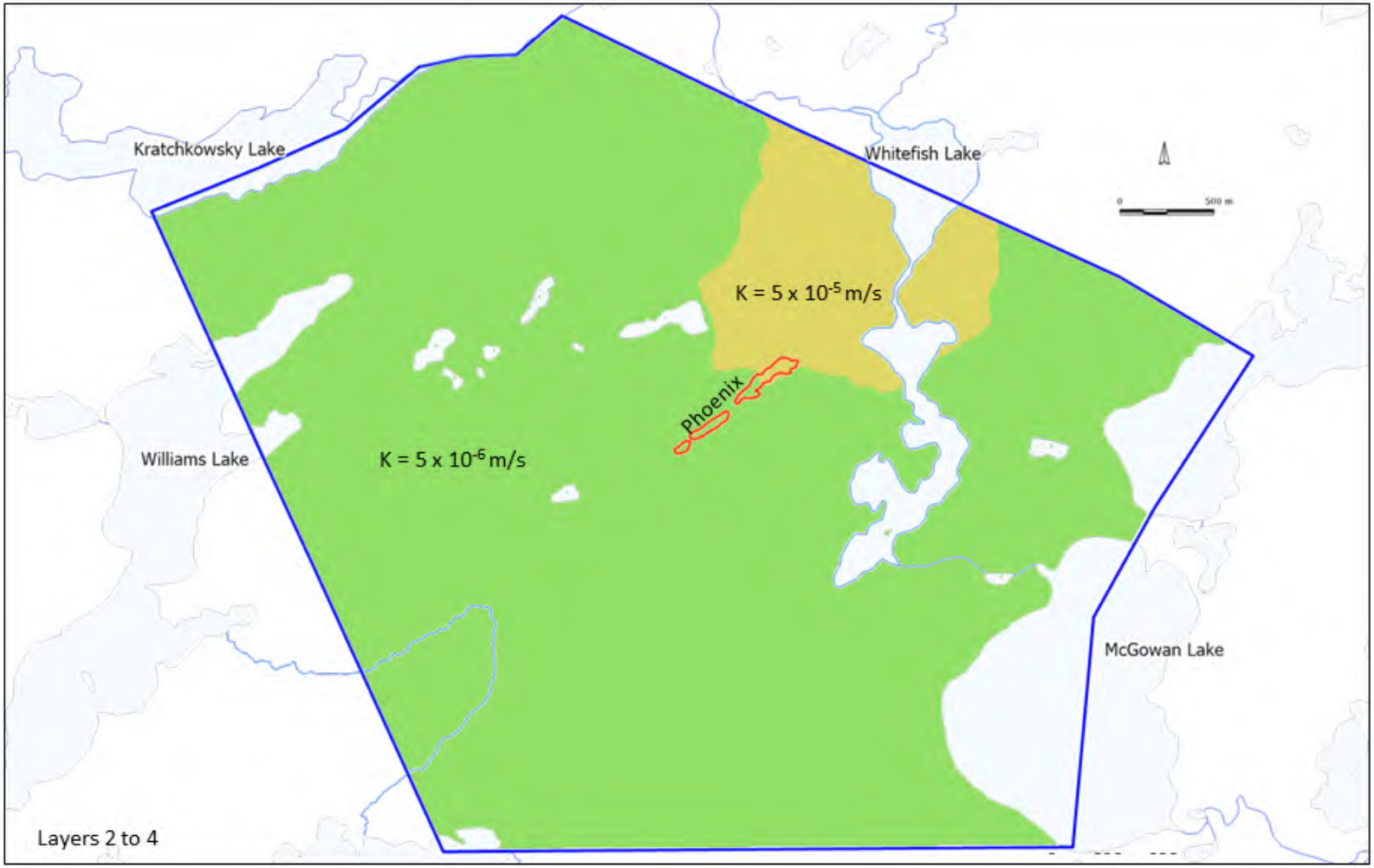
Top of Paleoweathered Basement Aquitard / Bottom of Ore Zone
The surface representing the top of the weathered basement aquitard and the base of the ore zone was provided by Denison in April 2020 ("Mineralization_Phoenix_Bottom"). This surface was continuous only along the ore zone itself so the surface representing the unconformity (minus three metres) was assigned in the areas of the model that lie outside the ore zone ("Unconformity_Detailed_Explicit_10m" provided in Feb 2021). As noted in the modelling report, the hydraulic conductivity values of the units above were assigned where the basement aquifer is interpreted to be absent, and the layer has a minimal thickness.

Top of Competent Basement Aquitard/ Bottom of Weathered Basement
The surface representing the top of the Competent Basement Aquitard (and the base of the Weathered Basement Aquitard) was developed by Denison and provided to the Ecometrix team in February 2021("Baseofpaleoweatheredzone").

Bottom of Model
The bottom of the model was arbitrarily set at sea level

Appendix B Calibrated Hydraulic Conductivity Distributions by Model Layer


K = 5 x 10-7 m/s
Kratchkowsky Lake
Whitefish Lake
K = 5 x 10-5 m/s
Phoenix
Williams Lake
K = 5 x 10-7 m/s
K = 8 x 10-5 m/s
K = 1 x 10-6 m/s
McGowan Lake
Layer 1
LEGEND
Model Domain
Lakes
Calibrated Hydraulic Conductivity Values (m/s)
0.001
0.0001
1e-05
1e-06
1e-07
1e-08
1e-09
1e-10
Ss value of 1 x 10-4 m-1 applied to all units in Layer 1
Wheeler River Project
Groundwater Modelling Report
Overburden Horizontal Hydraulic Conductivity (K) Values
Ecometrix Environmental INTELLIGENCE
Figure B1



LEGEND
Model Domain
Lakes

Calibrated Hydraulic Conductivity Values (m/s)
0.001
0.0001
1e-05
1e-06
1e-07
1e-08
1e-09
1e-10

Ss value of 1 x 10^{-4} m^{-1} applied to all units in Layers 2 to 4

Wheeler River Project
Groundwater Modelling Report

Upper Sandstone Aquifer – Horizontal Hydraulic Conductivity (K) Values

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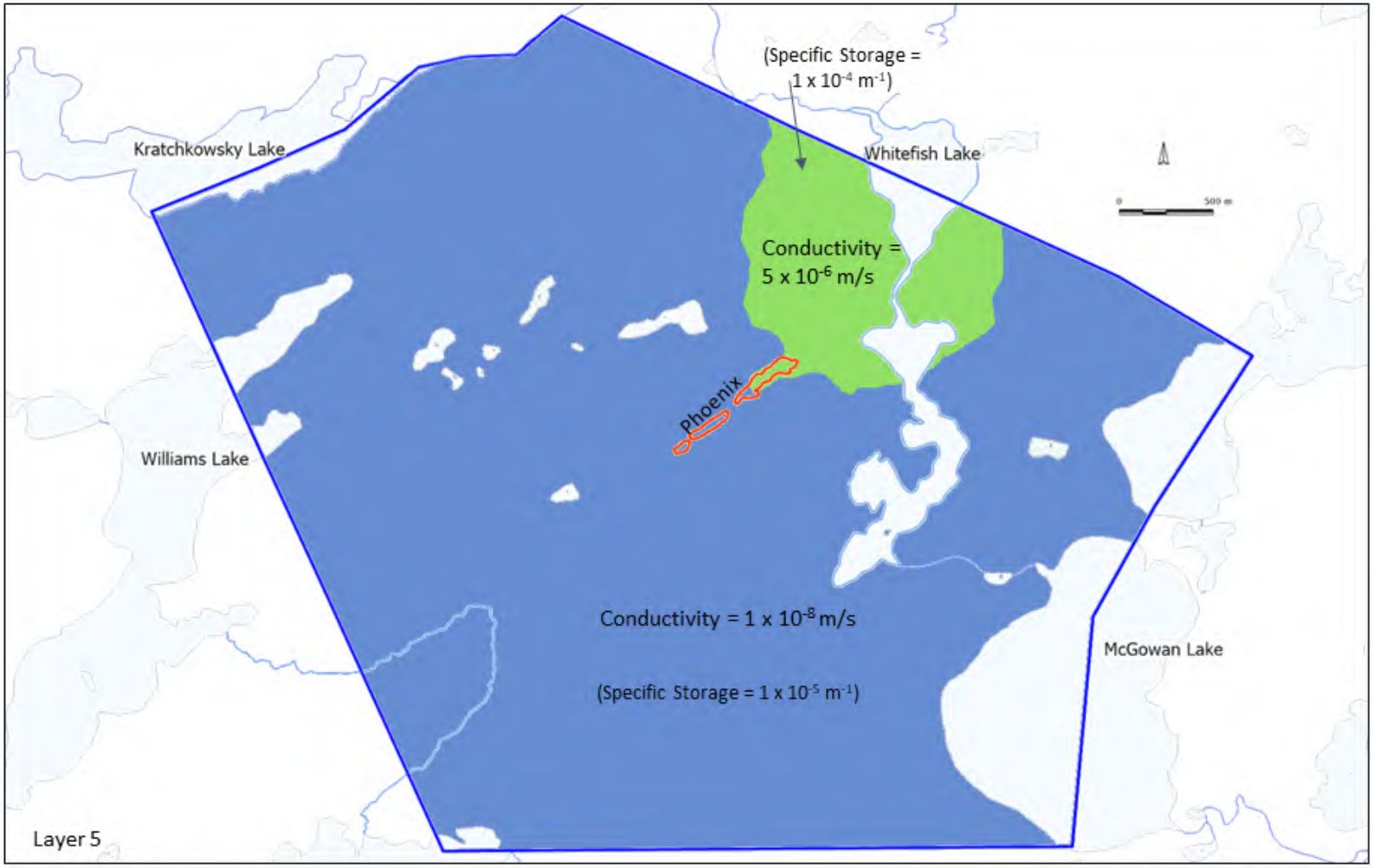
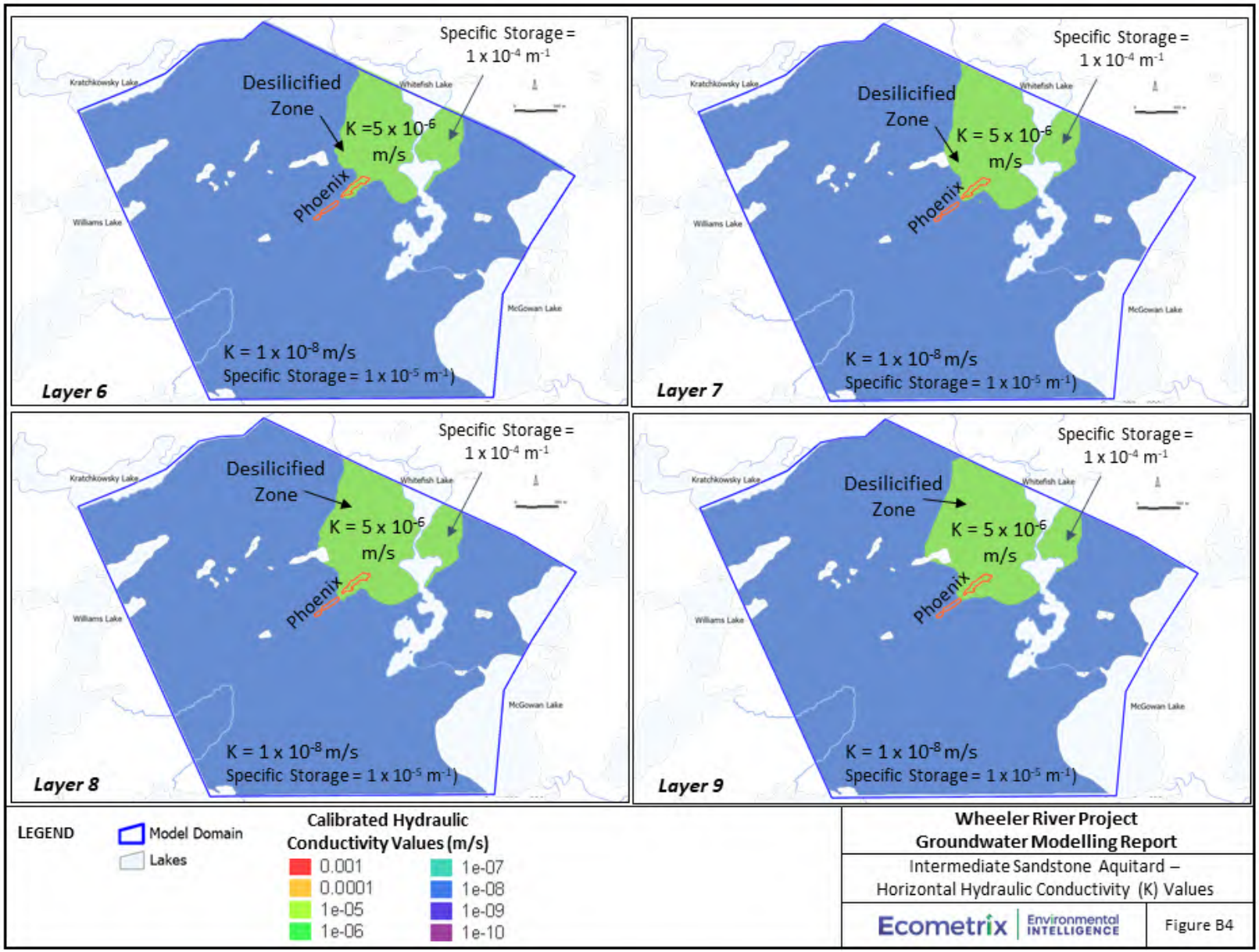
Figure B2

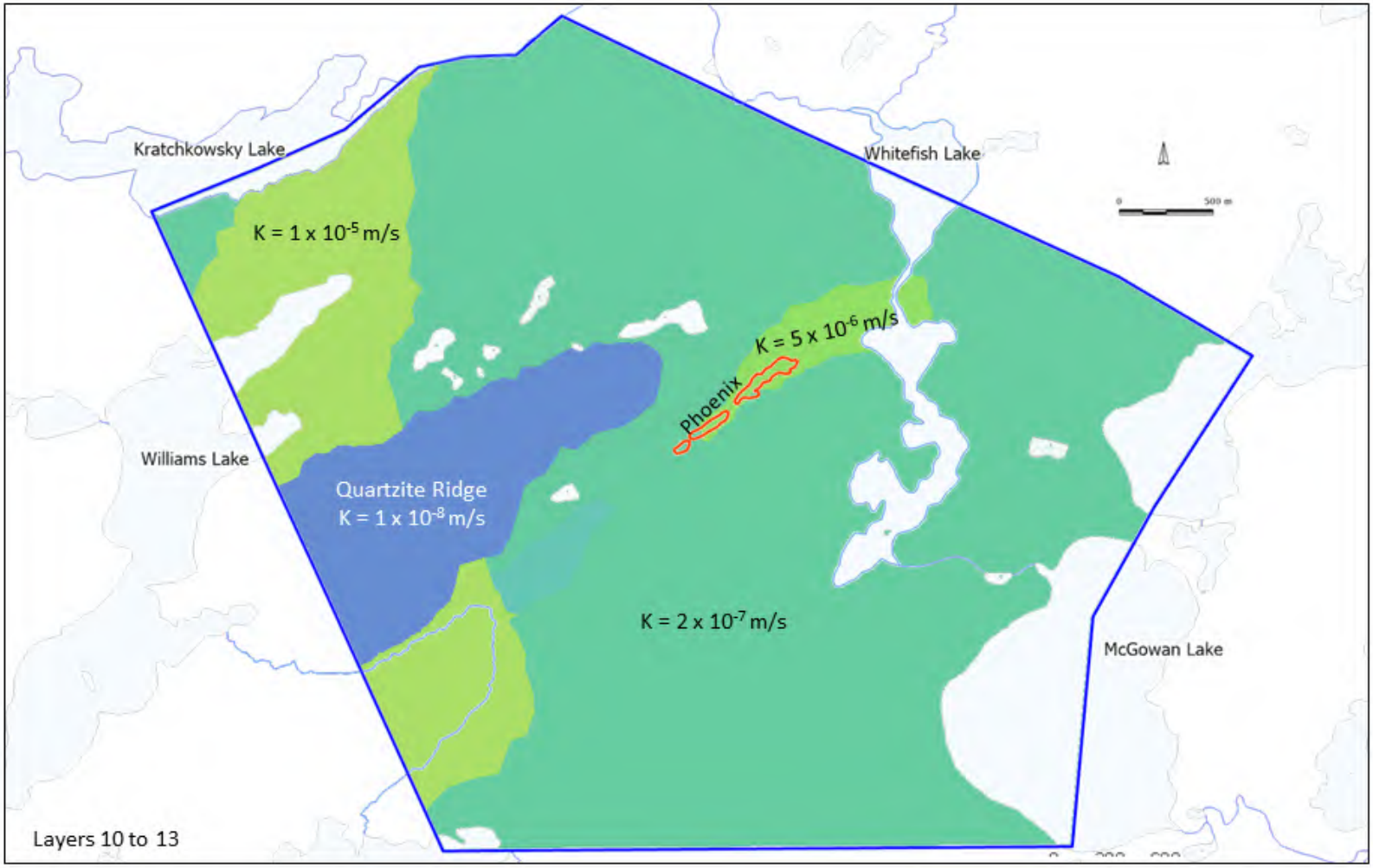


LEGEND
Model Domain
Lakes

Calibrated Hydraulic Conductivity Values (m/s)
0.001
0.0001
1e-05
1e-06
1e-07
1e-08
1e-09
1e-10

Wheeler River Project
Groundwater Modelling Report
Intermediate Sandstone Aquitard – Horizontal Hydraulic Conductivity (K) Values
Ecometrix Environmental INTELLIGENCE
Figure B3


Specific Storage = 1 x 10-4 m-1
Desilicified Zone
K =5 x 10-6 m/s
Phoenix
Kratchkowsky Lake
Whitefish Lake
Williams Lake
McGowan Lake
K = 1 x 10-8 m/s
Specific Storage = 1 x 10-5 m-1)
Layer 6
Specific Storage = 1 x 10-4 m-1
Desilicified Zone
K = 5 x 10-6 m/s
Phoenix
K = 1 x 10-8 m/s
Specific Storage = 1 x 10-5 m-1)
Layer 7
Specific Storage = 1 x 10-4 m-1
Desilicified Zone
K = 5 x 10-6 m/s
Phoenix
K = 1 x 10-8 m/s
Specific Storage = 1 x 10-5 m-1)
Layer 8
Specific Storage = 1 x 10-4 m-1
Desilicified Zone
K = 5 x 10-6 m/s
Phoenix
K = 1 x 10-8 m/s
Specific Storage = 1 x 10-5 m-1)
Layer 9
LEGEND
Model Domain
Lakes
Calibrated Hydraulic Conductivity Values (m/s)
0.001
0.0001
1e-05
1e-06
1e-07
1e-08
1e-09
1e-10
Wheeler River Project
Groundwater Modelling Report
Intermediate Sandstone Aquitard – Horizontal Hydraulic Conductivity (K) Values
Ecometrix Environmental INTELLIGENCE
Figure B4



LEGEND

Model Domain
Lakes

Calibrated Hydraulic Conductivity Values (m/s)

0.001	1e-07
0.0001	1e-08
1e-05	1e-09
1e-06	1e-10

Ss value of 1 x 10^{-4} m^{-1} applied to all units in Layers 10 to 13

Wheeler River Project
Groundwater Modelling Report

Lower Sandstone Aquifer –
Horizontal Hydraulic Conductivity (K) Values

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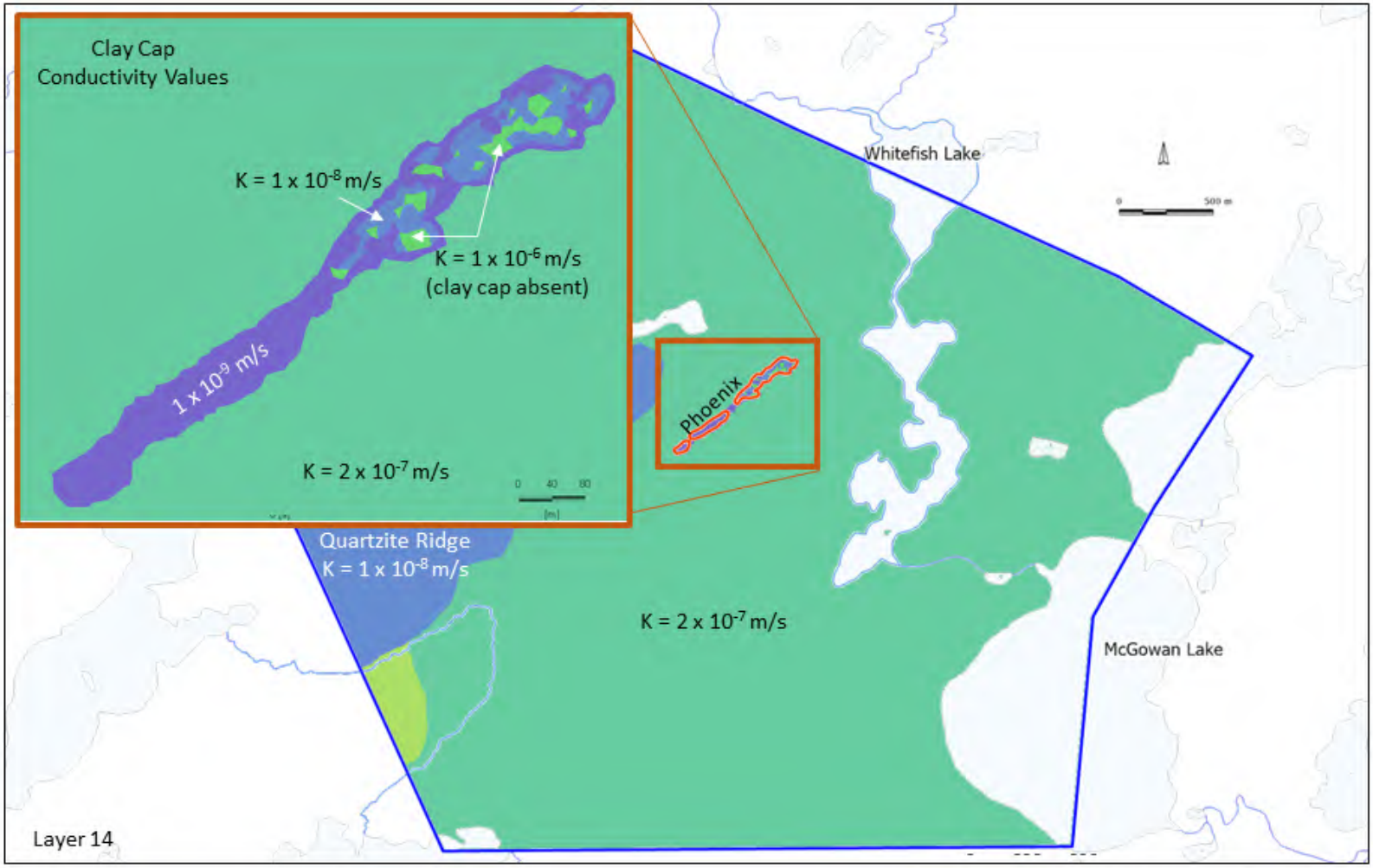
Figure B5



LEGEND

Model Domain
Lakes

Calibrated Hydraulic Conductivity Values (m/s)

0.001	1e-07
0.0001	1e-08
1e-05	1e-09
1e-06	1e-10

Ss value of 1 x 10^{-6} m^{-1} applied to the clay cap in Layer 14. Where clay is absent, 1 x 10^{-4} m^{-1} was applied.

Wheeler River Project
Groundwater Modelling Report

Clay Cap overlying Ore Zone –
Horizontal Hydraulic Conductivity (K) Values

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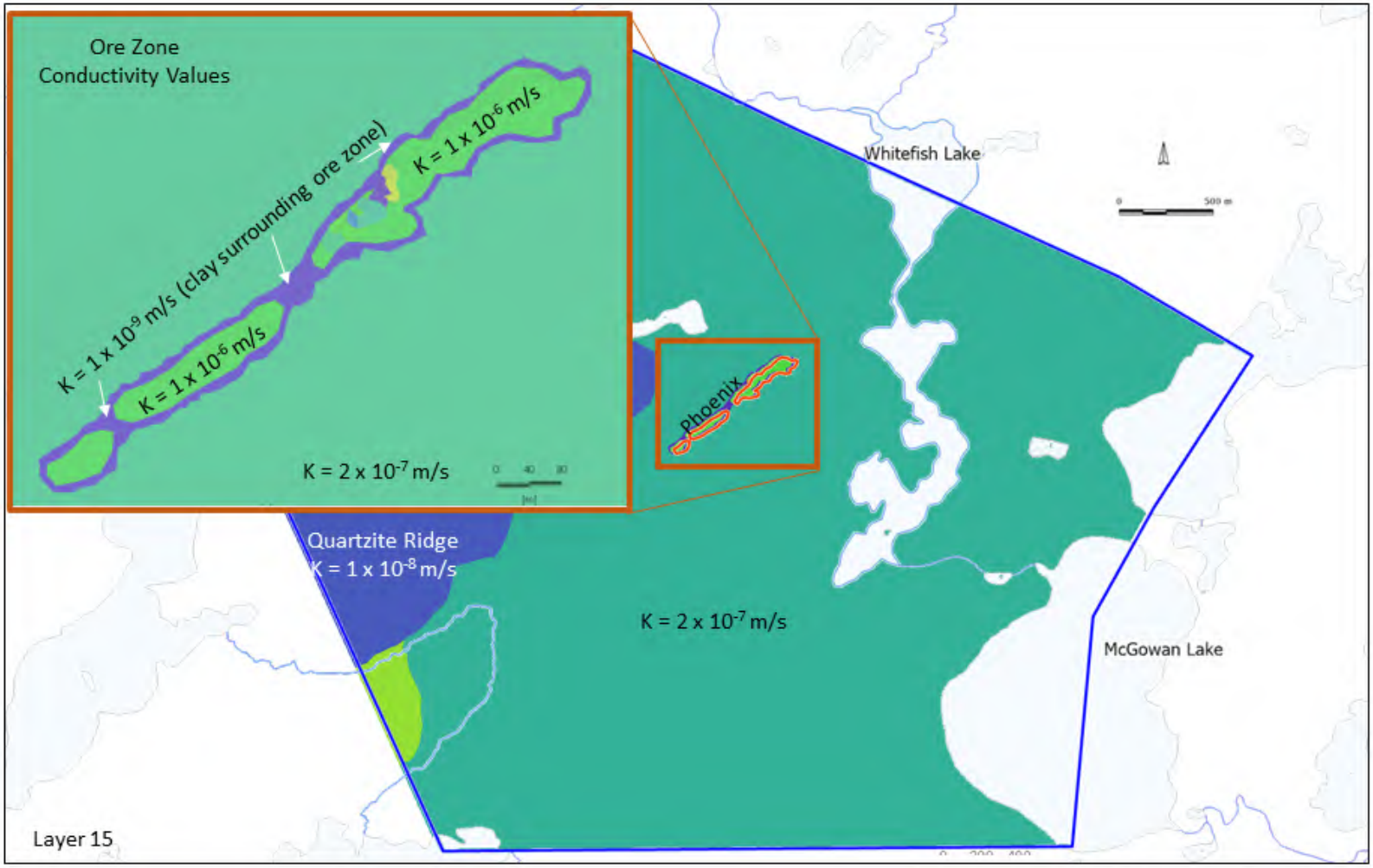
Figure B6



LEGEND

Model Domain

Lakes

Calibrated Hydraulic Conductivity Values (m/s)

0.001	1e-07
0.0001	1e-08
1e-05	1e-09
1e-06	1e-10

Ss value of 3 x 10^{-4} m^{-1} applied to the Ore Zone in Layer 15. Where it is absent, 1 x 10^{-4} m^{-1} was applied.

Wheeler River Project
Groundwater Modelling Report

Ore Zone –
Horizontal Hydraulic Conductivity (K) Values

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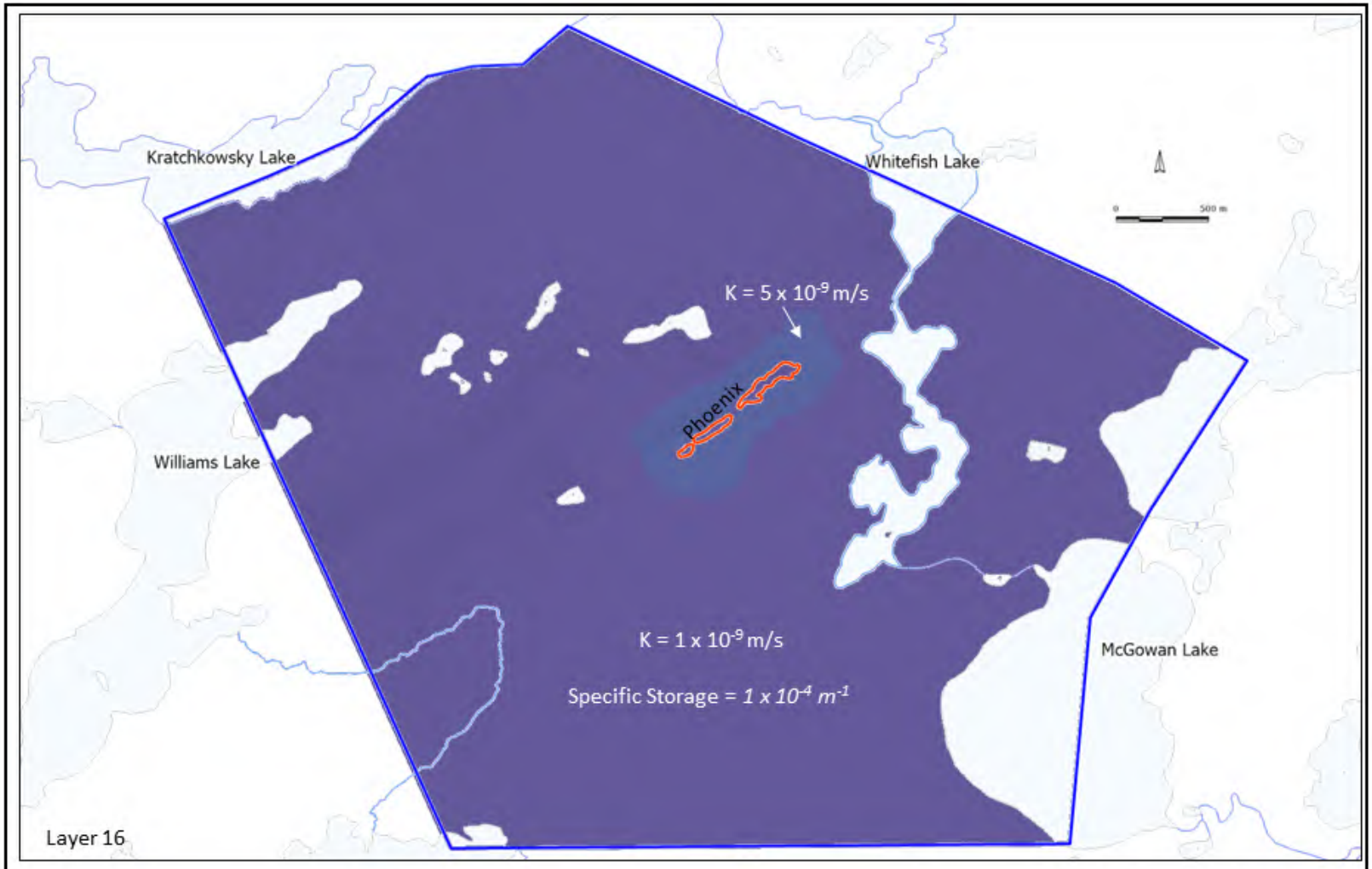
Figure B7



LEGEND
Model Domain
Lakes

Calibrated Hydraulic Conductivity Values (m/s)
0.001
0.0001
1e-05
1e-06
1e-07
1e-08
1e-09
1e-10

Wheeler River Project
Groundwater Modelling Report

Clay underlying the Ore Zone –
Horizontal Hydraulic Conductivity (K) Values

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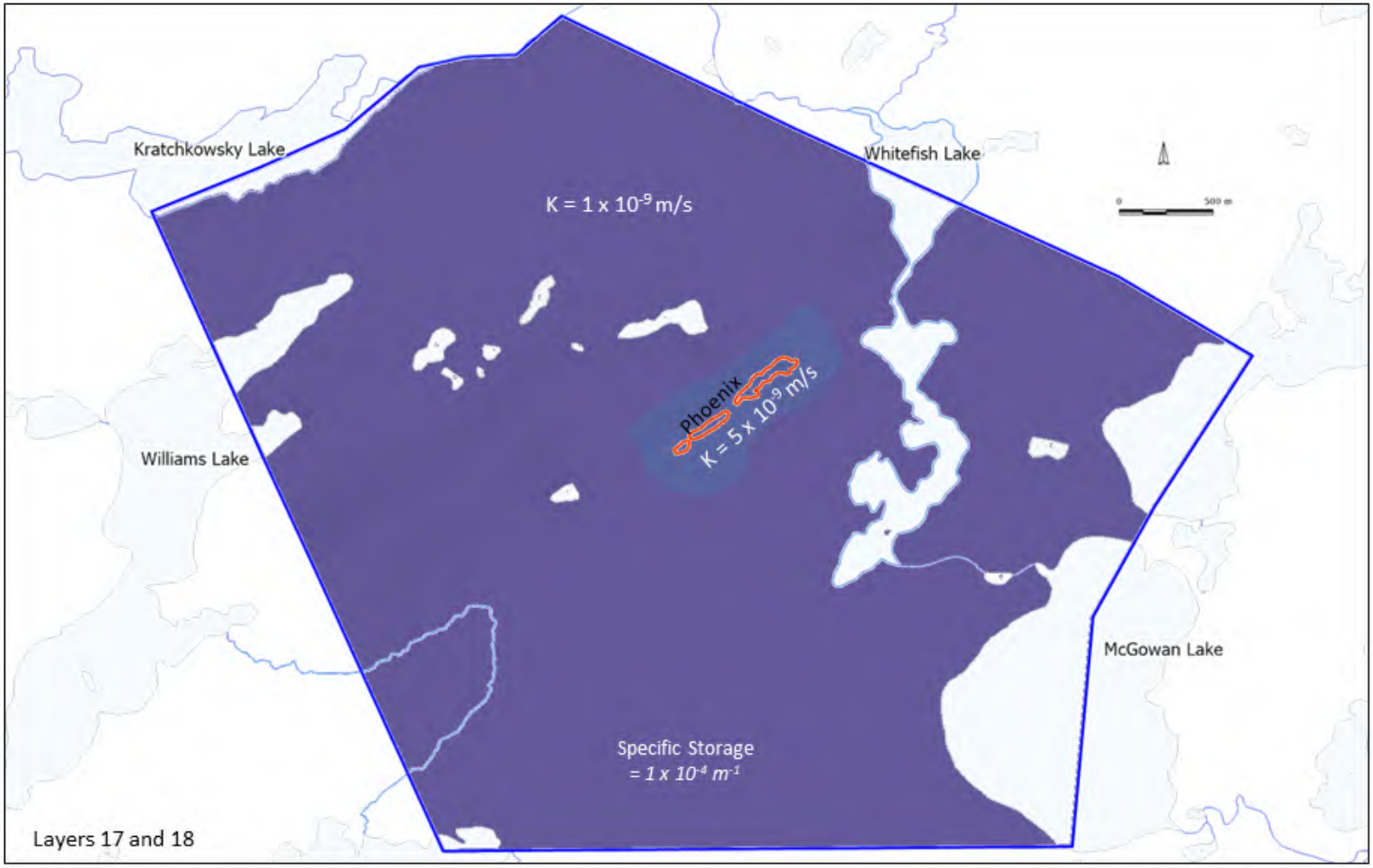
Figure B8



LEGEND

Model Domain

Lakes

Calibrated Hydraulic Conductivity Values (m/s)

0.001	1e-07
0.0001	1e-08
1e-05	1e-09
1e-06	1e-10

Wheeler River Project
Groundwater Modelling Report

Paleoweathered Basement Rock–
Horizontal Hydraulic Conductivity (K) Values

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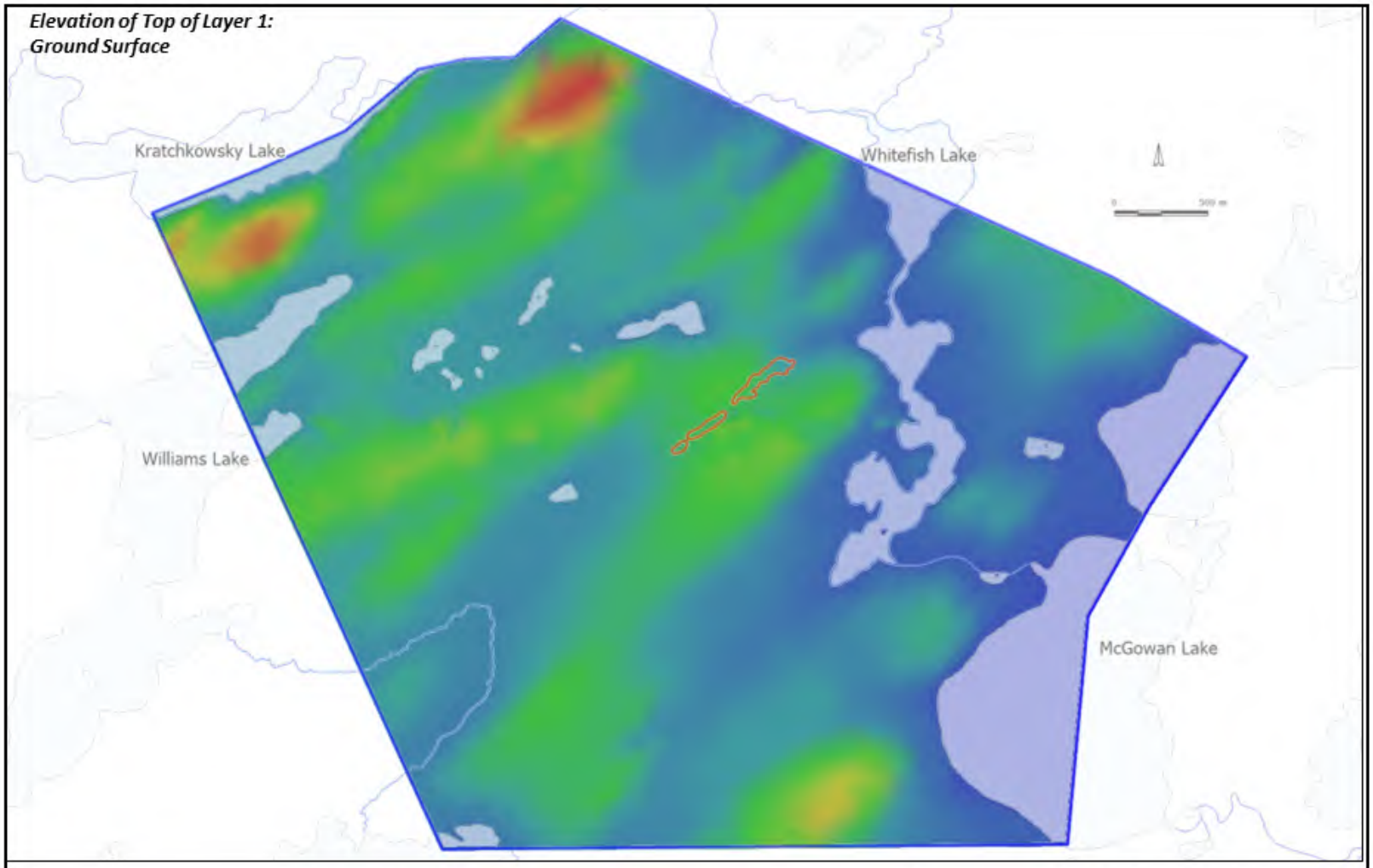
Figure B9

Appendix C Model Layer Elevations



LEGEND

- Model Domain
- Lake, Pond
- River

Layer Elevation
m ASL

590, 580, 570, 560, 550, 540, 530, 520, 510, 500, 490

Wheeler River Project
Groundwater Modelling Report

Elevation at Ground Surface/
Top of Overburden Aquifer

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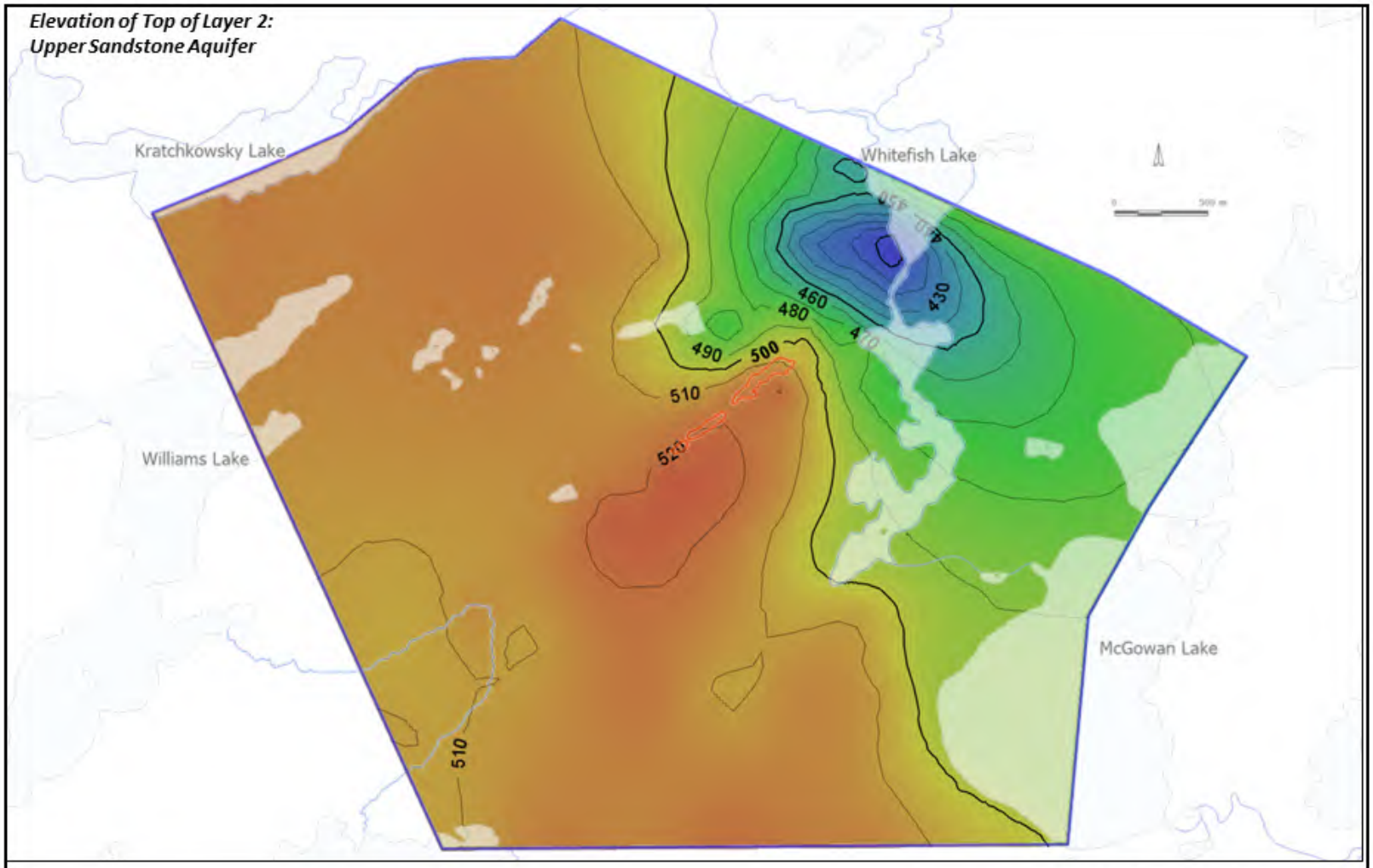
Figure C1



LEGEND

- Model Domain
- Lake, Pond
- River

Layer Elevation
m ASL

530	450
510	430
490	410
470	390

Wheeler River Project
Groundwater Modelling Report

Elevation at the Top of Upper Sandstone Aquifer / Bottom of Overburden

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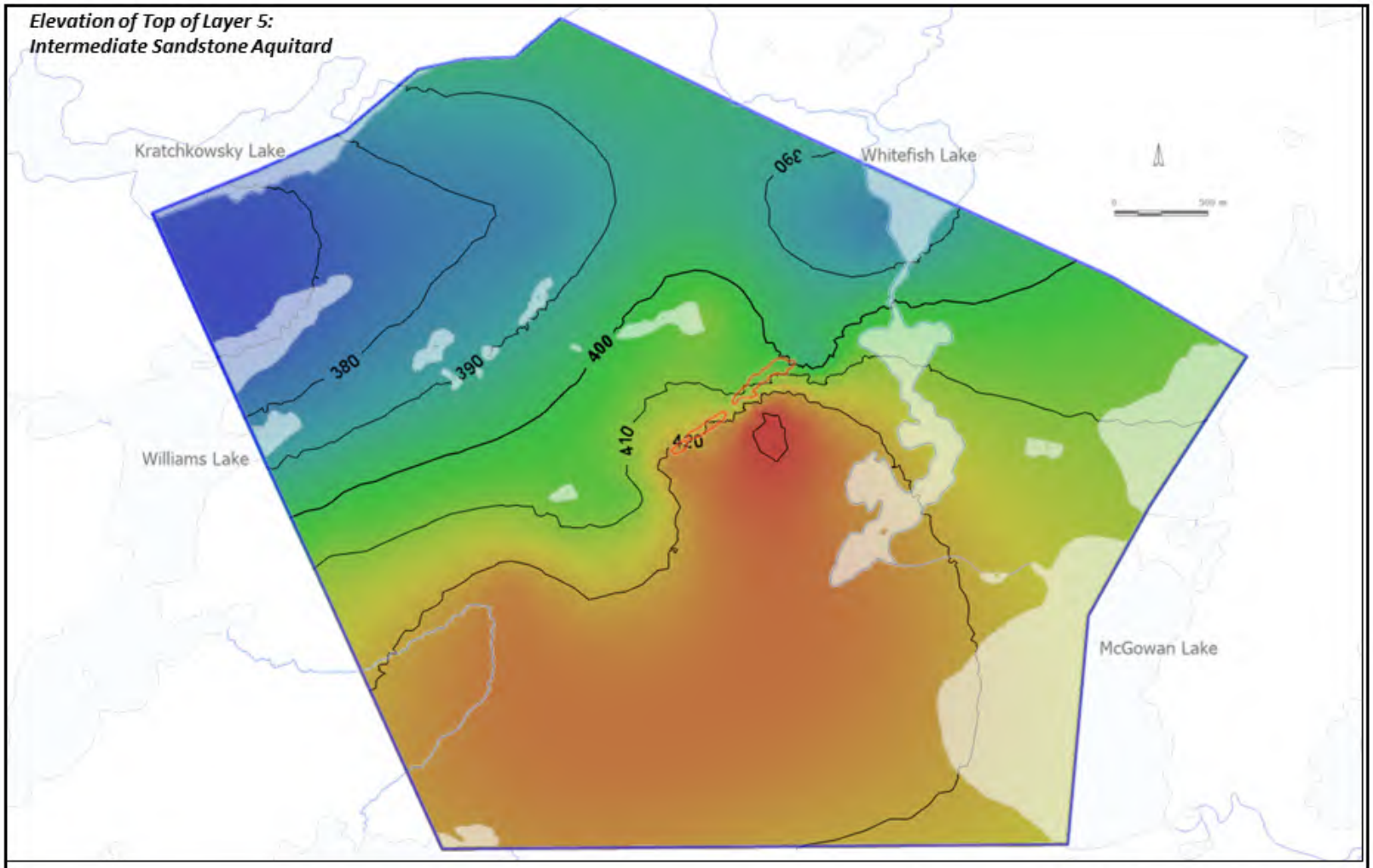
Figure C2



LEGEND

- Model Domain
- Lake, Pond
- River

Layer Elevation
m ASL

430	390
420	380
410	370
400	360

Wheeler River Project
Groundwater Modelling Report

Elevation at the Top of Intermediate Sandstone Aquitard / Bottom of Upper Sandstone Aquifer

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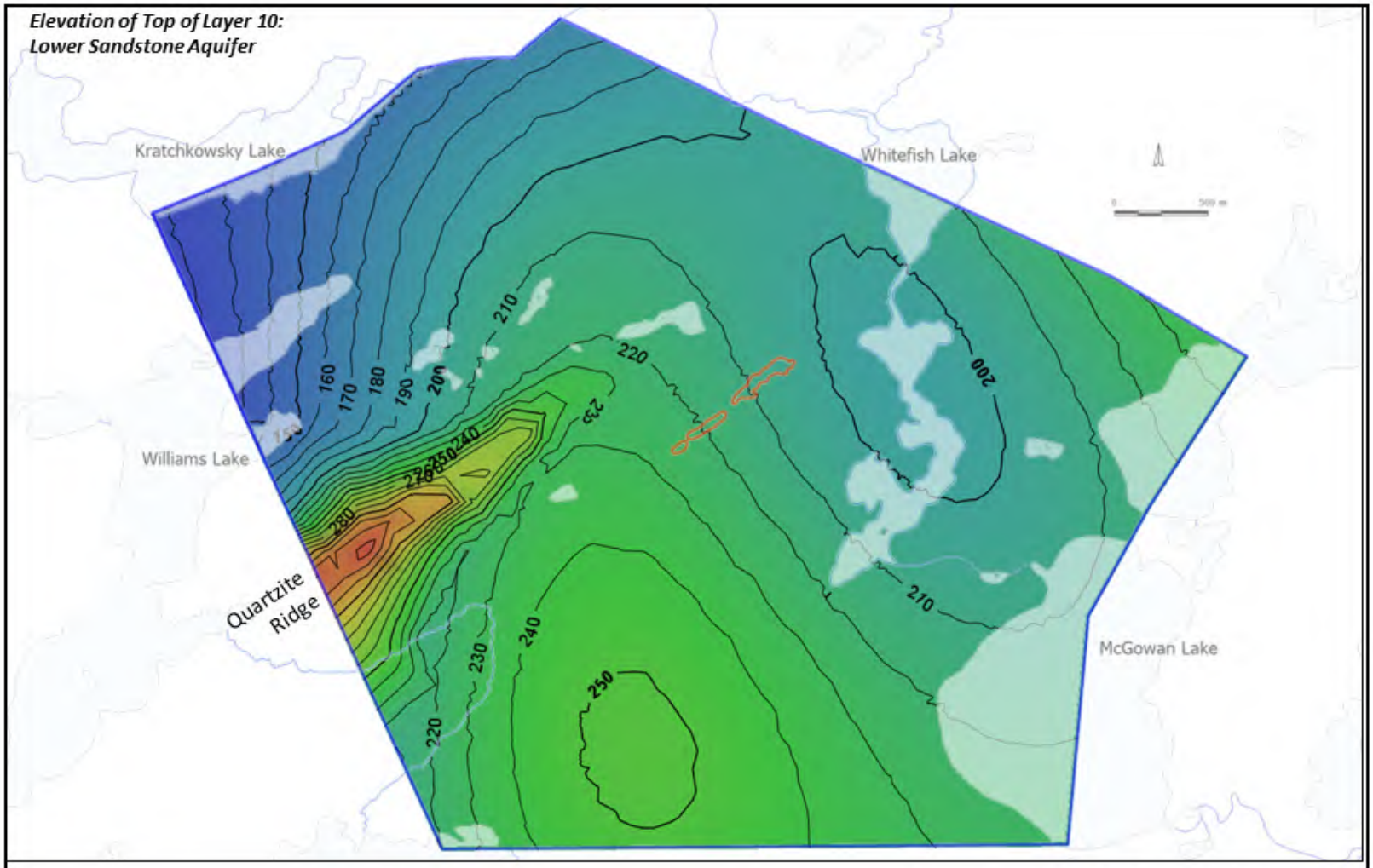
Figure C3



LEGEND

- Model Domain
- Lake, Pond
- River

Layer Elevation
m ASL

340	180
300	140
260	100
220	

Wheeler River Project
Groundwater Modelling Report

Elevation at the Top of Lower Sandstone Aquifer / Bottom of Intermediate Sandstone Aquitard

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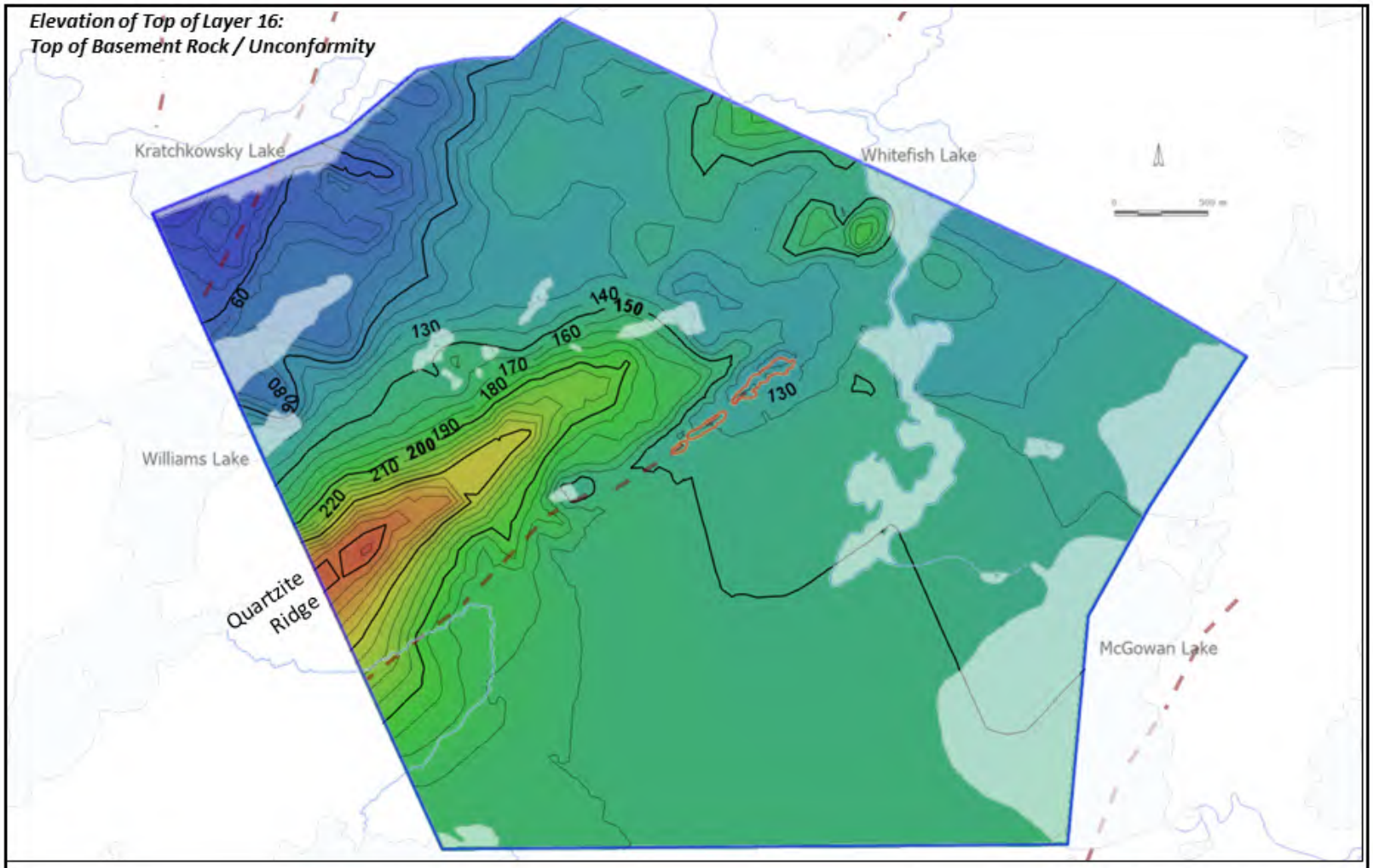
Figure C4



LEGEND

- Model Domain
- Lake, Pond
- River
- Fault

Layer Elevation
m ASL

320	120
280	80
240	40
200	0
160	

Wheeler River Project
Groundwater Modelling Report

Elevation at the Top of Basement Rock / Bottom of Lower Sandstone Aquifer

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Figure C5

Appendix D Groundwater Chemistry

Hydrochemistry results for five (5) groundwater wells (GWR-038 through GWR-042) is included in the groundwater chemistry summary tables presented in this Appendix, but these wells do not appear in Table 3-4 or in the hydrochemistry discussion in Section 3.2.2. The groundwater quality results for those wells have been included herein for completeness, and borehole logs are provided for those wells in the Baseline Geology and Hydrogeology Report (Ecometrix, 2024a). However, water quality in those wells was compromised by inadvertent introduction of KCl. Groundwater quality associated with these wells was thus not used in modelling or in the calculation of summary statistics.

Table D-1: Existing, Pre-Mining, Groundwater Chemistry

Well Cluster	Units	Upgradient Cluster				NW Cluster[b]				SE Cluster[c]				WR-607 Cluster[d]						Downgradient Cluster					
Groundwater Monitoring Well		GWR-006		GWR-029		GWR-003		GWR-025		GWR-008		GWR-009		GWR-033		GWR-034		GWR-035		GWR-005		GWR-014		GWR-012	
Lithology		OB		Mfa		OB		MFa		MFa		MFb		MFa		MFb		OB / MFd		OB		MFc		MFa	
Hydrostratigraphic Unit		OB		LSA		OB		LSA		LSA/DSZ		ISA/DSZ		LSA		ISA		USA		OB		USA/DSZ		LSA/DSZ	
Sampling Date		2020-08-22	2021-04-14	2020-08-30	2021-04-12	2020-08-16	2021-04-18	2020-08-22	2021-04-17	2020-09-06	2021-04-09	2020-09-14	2021-04-10	2020-11-03	2021-05-25	2020-10-30	2021-05-24	2020-11-03	2021-05-24	2020-08-29	2021-05-22	2020-08-29	2021-05-21	2020-08-29	2021-05-23
Field Parameters																									
Field pH	pH units	6.75	6.90	6.46	7.30	6.35	5.86	6.49	7.06	6.92	7.42	10.87	7.67	7.02	7.32	8.77	7.57	6.48	6.30	7.49	6.8	11.38*	9.77	6.94	7.17
Field Temp.	°C	6.7	4.8	6.5	3.6	14.6	5.1	9.6	4.1	9.1	3.9	5.9	3.3	6.5	7.5	2.8	7.2	4.3	5.4	10.4	6.3	8.4	6.2	11.5	7.9
Field Conductivity	µS/cm	53.1	92.8	56.7	108	28.2	17.2	668	1392	71.9	98.9	153	362.1	229.9	461.9	303.3	666	40.3	71	68.2	97.5	275.6	270.3	351.8	602
ORP	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field SPC	µS/cm	80.4	150.9	87.6	183.1	35.3	27.8	946	2315	102	165.7	241	618	351.4	694	520	1007	66.7	113.6	93.4	150.5	397.2	421.5	470.5	896
Field TDS	mg/L	52	98	57	119	23	18	615	1505	66	108	157	402	231	451	343	654	43	74	61	98	259	274	306	582
Diss. O2	mg/L	3.76	4.70	2.48	12.83	9.05	3.82	3.15	12.35	7.53	12.56	3.00	12.47	3.22	6.09	9.52	5.16	3.87	8.01	2.33	11.82	1.07	12.20	1.63	11.61
Fe2+	mg/L	1.0	1.3	2.0	-	0.0	0.0	2.0	1.0	2.5	1.5	0	1.5	2.0	1.0	0.0	0.0	0.5	0.0	2.0	1.5	0.0	0.0	2.0	1.5
Analytical Results																									
Bicarbonate	mg/L	35	35	33	29	12	17	51	35	55	39	<1	188	43	51	166	156	22	27	34	26	115	76	112	77
Carbonate	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	49	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	18	<1	<1
Chloride	mg/L	10	1.4	6.1	6.1	0.1	<0.1	233	319	3	2.7	0.3	0.4	57	67	<1	<1	5.8	5.7	3.3	3.3	0.4	0.4	81	86
Hydroxide	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	46	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	15	<1	<1
pH	pH units	7.04	7.32	7.14	7.36	6.76	6.88	6.9	6.96	7.44	7.16	10.06	7.59	7.48	7.43	8.07	7.63	7.04	6.79	6.99	6.8	7.68	9.05	7.62	7.24
Specific conductivity	µS/cm	71	61	72	68	27	19	918	1110	86	69	215	289	331	334	481	480	54	46	70	49	190	175	452	416
Sum of ions	mg/L	75	64	56	54	20	23	488	610	78	56	127	252	191	194	329	318	44	44	57	43	190	138	284	245
Total alkalinity	mg/L	29	29	27	24	10	14	42	29	45	32	87	154	35	42	136	128	18	22	28	21	94	92	92	63
Total hardness	mg/L	30	32	21	21	12	8	222	283	24	17	53	104	59	73	21	19	14	12	11	9	84	45	121	106
Ammonia as nitrogen	mg/L	0.15	0.17	0.03	0.05	0.09	<0.01	0.08	0.14	0.05	0.08	0.96	0.07	0.12	0.27	0.08	0.19	<0.01	0.03	<0.01	0.01	3.4	1.9	0.35	0.33
Nitrate (calc. from NO2+NO3-N)	mg/L	0.09	0.09	<0.04	<0.04	<0.04	0.13	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.04	<0.04	<0.04	0.09	<0.04	0.04	<0.04	<0.04	0.09	<0.04	<0.04	<0.04
Nitrite	mg/L	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.11	<0.03	<0.03	<0.03	<0.03	0.25	<0.03	<0.03	<0.03	<0.03	0.23	0.11	<0.03	<0.03
Nitrite+Nitrate as nitrogen	mg/L	0.02	0.02	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Ortho-phosphate as P	mg/L	0.13	0.14	0.08	0.02	0.05	0.01	0.08	<0.01	0.12	0.16	0.04	0.2	<0.01	0.01	26	62	<0.01	0.01	0.05	0.02	<0.01	0.06	0.08	0.04
Organic carbon, dissolved	mg/L	2.4	1.3	1.6	1.2	1.4	0.8	2.2	1.1	7	1	10	33	3.4	2	8.7	7.9	2.1	0.4	0.5	0.7	18	8.3	4.1	1.9
Iron (II)	mg/L	-	0.04	-	0.02	-	<0.02	-	0.09	-	-	-	<0.02	-	-	-	-	-	-	-	0.07	-	<0.02	-	-
Fluoride	mg/L	0.14	0.14	0.09	0.1	0.04	0.03	0.21	0.21	0.07	0.17	0.08	0.1	0.09	0.12	0.02	0.02	<0.01	0.02	0.09	0.11	0.08	0.18	0.01	0.24
Total dissolved solids	mg/L	199	178	71	82	64	63	566	653	72	59	139	264	132	209	375	402	50	45	75	51	160	142	274	250
Total suspended solids	mg/L	838	413	<1	6	133	<1	7	17	3	4	9	13	10	8	3	6	3	<1	18	20	13	24	10	26
Calcium	mg/L	4.9	5.2	5.6	5.3	2.9	2.4	66	84	6.8	4.7	20	29	18	23	7.7	6.7	3.5	3	2.9	2.3	33	17	37	31
Magnesium	mg/L	4.3	4.7	1.7	1.9	1.1	0.5	14	18	1.8	1.2	0.8	7.6	3.4	3.8	0.5	0.5	1.3	1	1	0.8	0.4	0.7	7	6.9
Potassium	mg/L	1.8	1.5	1.6	1.5	1	0.3	3.5	4.1	1.7	1.5	8.6	1.2	2.1	2.1	149	148	1.1	0.7	1.1	1.2	6.3	4.4	4.4	3.7
Sodium	mg/L	12	9	5.3	5.5	2.1	1.7	68	83	8.6	5.4	21	23	36	30	3.7	3.9	4.9	3.9	10	6.1	21	15	36	32
Sulfate	mg/L	6.4	7	2.4	4.2	1	0.9	52	67	0.7	0.9	24	2.5	31	17	1.8	2.2	5.9	3	4.5	3	10	4.2	5.9	8.1

Notes

a	Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
a	Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
c	Monitoring Well GRW-007, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
d	The water quality in GRW-034 is considered to reflect influence from drilling fluids and additves, and is not considered reliable. Analysitcal well for this data is not used further in this baseline report.
e	Monitoring Well GRW-002, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
f	Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214
g	Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L.
h	Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.
i	The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

TableD-2: Existing, Pre-Mining, Groundwater Chemistry

Well Cluster	Units	LA-5 Cluster				Paloeweathered Zone		Phoenix Ore Zone[e]															
Groundwater Monitoring Well		GWR-036		GWR-037		GWR-031		GWR-011		GWR-013		GWR-032			GWR-038[i]	GWR-039[i]	GWR-040[i]		GWR-041[i]	GWR-042[i]	GWR-046	GWR-047	GWR-048
Lithology		OB		MFd		PWZ		MFa		MFb		OZ			OZ	OZ	OZ		OZ	OZ	MFc	MFb	Mfa
Hydrostratigraphic Unit		OB		USA/DSZ		PWZ		LSA/DSZ		ISA/DSZ		OZ			OZ	OZ	OZ		OZ	OZ	ISA	ISA/DSZ	LSA
Sampling Date		2020-11-05	2021-04-08	2020-10-24	2021-04-09	2020-08-09	2021-06-04	2020-08-08	2021-06-01	2020-08-09	2021-06-02	2019-11-14[h]	2020-08-08	2021-06-04	2021-09-04	2021-09-05	2021-09-01	2021-09-01 DUP	2021-09-06	2021-09-07	2021-09-14	2021-09-10	2021-09-10
Field Parameters																							
Field pH	pH units	6.45	6.62	6.13	6.02	7.03	7.21	8.70	6.82	9.68	7.35	-	6.79	6.83	7.54	6.74	6.84	6.84	6.88	6.71	6.37	6.47	6.08
Field Temp.	°C	4.4	3.4	4.8	4.1	11.3	16.8	17.5	7.2	10.5	7.8	-	8.0	18.5	7.7	8.9	11.3	11.3	8	8.6	10.24	9.51	8.44
Field Conductivity	µS/cm	18.3	42.8	26.4	49.1	588	1162	98.5	144.8	174.8	182.7	-	737	1486	7233	23173	11290	11290	9996	16567	136	97	111
ORP	mV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51.1	-84.5	-57.5
Field SPC	µS/cm	30.5	73.1	43.1	81.1	789	1374	114	219.2	238.4	271.5	-	958	1683	10811	33458	15302	15302	14820	24146	192	138	163
Field TDS	mg/L	20	48	57	53	513	893	74	142	155	176	-	623	1094	7027	21748	9947	9947	9633	15695	123	90	106
Diss. O2	mg/L	9.80	8.36	4.01	3.00	4.62	3.65	4.64	11.91	3.60	11.83	-	1.16	2.26	5.57	4.59	2.57	2.57	6.69	6.28	12.2	3.14	1.74
Fe2+	mg/L	0.0	0.0	0.5	1.0	0.5	0.0	0.0	1.0	0.0	1.0	-	1.5	1.5	-	-	-	-	-	-	-	-	-
Analytical Results																							
Bicarbonate	mg/L	30	16	15	16	167	160	54	41	105	85	155	174	118	104	40	76	76	80	61	86.3	75.2	57
Carbonate	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	24	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloride	mg/L	0.2	<0.1	0.4	0.1	151	145	7.4	7.2	0.6	1.3	202	234	220	1600	4760	2560	2580	2270	3590	8.63	6.13	4.14
Hydroxide	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
P. alkalinity	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-
pH	pH units	6.96	6.91	6.57	6.38	7.36	7.83	7.83	7.34	9.3	7.76	7.52	7.33	7.4	7.56	6.49	6.98	7.39	6.91	6.51	7.06	7.37	7.08
Specific conductivity	µS/cm	21	35	32	39	810	686	115	99	248	141	965	1000	860	5380	16100	7530	7530	7050	11530	277	160	139
Sum of ions	mg/L	47	28	32	29	504	439	92	71	210	126	566	598	504	3130	9220	4360	4350	4130	6760	-	-	-
Total alkalinity	mg/L	25	13	12	13	137	131	44	34	126	70	127	143	97	85	33	62	62	66	50	70.7	61.6	46.7
Total hardness	mg/L	16	14	8	6	190	148	38	26	57	48	267	256	182	614	2470	1830	1830	1340	1900	89.5	29.4	43.4
Ammonia as nitrogen	mg/L	<0.01	<0.01	0.04	0.02	0.05	0.35	0.26	0.13	0.68	0.02	-	0.31	0.73	-	44	12	12	18	-	0.026	<0.005	<0.005
Nitrate (calc. from NO2+NO3-N)	mg/L	0.49	0.49	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	0.13	<0.4	0.04	<0.04	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.02	<0.02	<0.02
Nitrite	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	-	<0.03	<0.03	-	<0.03	<0.03	<0.03	0.04	-	<0.01	<0.01	<0.01
Nitrite+Nitrate as nitrogen	mg/L	0.11	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.03	-	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05
Ortho-phosphate as P	mg/L	0.09	0.08	0.02	0.04	<0.01	0.01	0.11	0.12	0.03	0.06	-	<0.01	0.01	-	0.04	0.02	<0.01	0.02	-	-	-	-
Organic carbon, dissolved	mg/L	1.1	0.5	3.9	2	68	6.2	3.6	1	7.9	2	-	36	5.8	-	40	19	19	21	-	34.6	8.95	15.6
Iron (II)	mg/L	-	-	-	<0.02	-	<0.02	-	-	-	-	-	-	0.04	-	0.07	-	-	0.05	-	7.77	<0.02	2.3
Fluoride	mg/L	0.01	0.06	<0.01	0.01	0.32	0.42	0.2	0.18	0.13	0.08	0.22	0.19	0.23	0.27	0.14	0.21	0.21	0.21	0.18	0.059	0.074	0.142
Total dissolved solids	mg/L	112	66	90	55	536	393	101	98	182	177	639	628	599	3280	10400	4640	4080	4510	7830	188	132	122
Total suspended solids	mg/L	180	71	<1	<1	5	41	171	34	28	208	-	11	17	-	68	28	26	31	-	-	-	-
Calcium	mg/L	1.2	2.7	2	1.8	58	43	13	7.9	21	14	84	78	55	190	843	590	590	431	665	29.4	8.24	13.1
Magnesium	mg/L	3.2	1.8	0.7	0.4	11	9.9	1.3	1.6	1.1	3.1	14	15	11	34	90	88	88	64	58	3.91	2.14	2.6
Potassium	mg/L	5.3	2.8	1.9	1.8	5.5	5.3	2.4	2	6.7	1.8	5.6	5.4	4.6	955	3000	767	732	975	2000	6.77	4.46	1.89
Sodium	mg/L	3.9	2.9	3.6	2.8	71	69	8.4	6.1	34	15	75	83	81	137	189	203	205	154	152	8.96	18.6	8.87
Sulfate	mg/L	2.6	1.9	8	6.5	40	6.6	5.5	4.7	17	5.2	30	8	13	110	300	71	67	160	230	10.1	2.28	6.26

Notes

a	Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
a	Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
c	Monitoring Well GRW-007, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
d	The water quality in GRW-034 is considered to reflect influence from drilling fluids and additves, and is not considered reliable. Analysitcal well for this data is not used further in this baseline report.
e	Monitoring Well GRW-002, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
f	Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214
g	Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L.
h	Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.
i	The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

Table D-3: Existing, Pre-Mining, Groundwater Chemistry

Well Cluster	Units	Upgradient Cluster				NW Cluster[b]				SE Cluster[c]				WR-607 Cluster[d]						Downgradient Cluster					
Groundwater Monitoring Well		GWR-006		GWR-029		GWR-003		GWR-025		GWR-008		GWR-009		GWR-033		GWR-034		GWR-035		GWR-005		GWR-014		GWR-012	
Lithology		OB		Mfa		OB		MFa		MFa		MFb		MFa		MFb		OB / MFd		OB		MFc		MFa	
Hydrostratigraphic Unit		OB		LSA		OB		LSA		LSA/DSZ		ISA/DSZ		LSA		ISA		USA		OB		USA/DSZ		LSA/DSZ	
Sampling Date		2020-08-22	2021-04-14	2020-08-30	2021-04-12	2020-08-16	2021-04-18	2020-08-22	2021-04-17	2020-09-06	2021-04-09	2020-09-14	2021-04-10	2020-11-03	2021-05-25	2020-10-30	2021-05-24	2020-11-03	2021-05-24	2020-08-29	2021-05-22	2020-08-29	2021-05-21	2020-08-29	2021-05-23
Aluminum, dissolved	mg/L	0.0096	0.016	0.014	<0.0005	0.0065	0.0055	0.0024	<0.0005	0.0081	0.0023	0.012	0.21	0.025	0.0013	0.035	0.2	0.013	0.0058	0.0022	<0.0005	0.02	0.003	0.0038	<0.0005
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	0.0005	<0.0002	0.0055	<0.0002	<0.0002	<0.0002	0.0003	0.0007	<0.0002	<0.0002	<0.0002	<0.0002	0.002	<0.0002	<0.0002	<0.0002
Arsenic, dissolved	ug/L	1.3	0.8	0.3	<0.1	0.2	0.1	<0.1	<0.1	0.1	0.1	3.3	11	2.2	1.8	0.2	0.4	0.2	0.2	1.1	1.4	0.6	0.5	0.2	<0.1
Barium, dissolved	mg/L	0.0081	0.0095	0.0082	0.0053	0.0082	0.0056	0.12	0.11	0.1	0.042	0.059	0.22	0.059	0.059	0.011	0.018	0.015	0.016	0.024	0.015	0.15	0.11	0.25	0.15
Beryllium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Boron, dissolved	mg/L	0.01	0.01	0.04	0.04	<0.01	<0.01	0.32	0.4	0.03	0.03	<0.01	<0.01	0.04	0.05	<0.01	<0.01	<0.01	<0.01	0.03	0.03	0.02	0.02	0.15	0.15
Bromine	ug/L	22	18	85	79	<5	<5	2900	3600	40	34	<5	5	750	860	12	12	76	79	46	47	5	7	1000	1100
Cadmium, dissolved	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	0.00001	0.00001	<0.00001	0.00003	0.00006	0.00002	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0058	<0.0005	<0.0005	0.0048	0.0019	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt, dissolved	mg/L	0.0002	0.0002	<0.0001	<0.0001	0.0009	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0047	0.0005	0.0005	0.0003	0.0003	0.001	0.0012	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper, dissolved	mg/L	0.0008	<0.0002	<0.0002	<0.0002	0.0017	0.0007	<0.0002	<0.0002	<0.0002	0.0007	0.0008	0.0011	0.0003	<0.0002	0.016	0.025	0.0005	0.0003	<0.0002	<0.0002	0.0004	0.0009	<0.0002	<0.0002
Iron, dissolved	mg/L	0.49	0.53	4.86	2.16	0.039	0.16	16	9.7	3.55	2.81	0.21	15.3	0.47	0.66	0.61	0.75	0.32	0.16	3.71	4.84	0.055	0.064	5.6	1.32
Lead, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.0002	<0.0001	0.011	0.0054	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium, dissolved	ug/L	8.5	9.1	11	13	0.8	0.8	32	40	12	9.9	9	6.3	14	15	0.4	0.7	4	3.1	11	11	12	14	26	28
Manganese, dissolved	mg/L	0.14	0.16	0.23	0.24	0.14	0.073	0.97	1.14	0.4	0.33	0.021	2.75	0.21	0.27	0.019	0.037	0.14	0.23	0.17	0.2	0.0018	0.0037	0.57	0.59
Molybdenum, dissolved	mg/L	0.0012	0.0007	0.0001	<0.0001	0.0012	<0.0001	0.0005	0.0002	0.0003	0.0002	0.0087	0.0038	0.003	0.0026	0.0007	0.0004	0.0008	0.0009	0.0023	0.0007	0.0024	0.0034	0.0023	0.0007
Nickel, dissolved	mg/L	0.0004	0.0004	0.0002	<0.0001	0.0021	0.0017	0.0002	<0.0001	0.0004	0.0002	0.0012	0.0053	0.0011	0.0008	0.0035	0.002	0.005	0.01	0.0003	<0.0001	0.0027	0.0015	0.0006	0.0002
Selenium, dissolved	mg/L	<0.0001	<0.0001	0.0011	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0002	<0.0001
Silica, soluble, dissolved	mg/L	23	24.2	17.4	17.2	16.5	17.6	17.8	16.8	25.8	23.9	19.5	30.3	10.9	12.2	5.2	6.9	20.3	19.1	19.9	20.4	15.5	16.3	24.4	21.2
Silver, dissolved	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Strontium, dissolved	mg/L	0.034	0.029	0.12	0.12	0.02	0.02	1.88	2.19	0.12	0.1	0.24	0.21	0.3	0.36	0.021	0.022	0.033	0.031	0.057	0.059	0.26	0.15	0.61	0.59
Sulfur	mg/L	2.1	2.3	0.8	1.4	0.33	0.3	17	22	0.23	0.3	8	0.8	10.3	5.7	0.6	0.7	1.97	1	1.5	1	3.3	1.4	2	2.7
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Tin, dissolved	mg/L	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0017	0.0032	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium, dissolved	mg/L	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	0.0034	<0.0002	<0.0002	0.0011	0.0051	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Vanadium, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0018	<0.0001	<0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc, dissolved	mg/L	0.0009	0.0041	0.001	0.0016	0.01	0.009	0.003	0.0026	0.0029	0.0016	0.0014	0.017	0.015	0.004	0.14	0.12	0.0025	0.0045	0.0064	0.0014	0.0007	0.0008	0.0007	0.002
Phosphorus, dissolved	mg/L	0.06	0.02	0.06	<0.01	<0.01	<0.01	0.09	<0.01	0.06	0.1	0.05	0.19	<0.01	0.01	58.4	61	<0.01	<0.01	<0.01	<0.01	0.03	0.07	0.1	<0.01
Radionuclides																									
Uranium, dissolved	ug/L	1.4	0.2	0.2	0.2	0.5	<0.1	0.8	<0.1	2.4	0.7	5.3	22	3.6	0.8	136	87	0.2	<0.1	0.5	0.5	0.3	1.2	0.5	<0.1
Uranium-234 calculated	Bq/L	0.043	0.002	0.004	0.002	0.1	0.001	0.024	0.001	0.043	0.009	0.13	0.27	0.047	0.011	2.4	1.2	0.002	0.003	0.037	0.01	0.037	0.017	0.011	0.002
Uranium-238 calculated	Bq/L	0.043	0.002	0.004	0.002	0.1	0.001	0.024	0.001	0.043	0.009	0.13	0.27	0.047	0.011	2.4	1.2	0.002	0.003	0.037	0.01	0.037	0.017	0.011	0.002
Lead-210	Bq/L	0.09	0.08	0.1	0.07	0.6	0.03	0.08	0.08	<0.02	0.66	0.3	1.1	0.14	0.04	22	5.7	0.03	<0.02	0.28	<0.02	0.08	0.3	0.15	0.1
Polonium-210	Bq/L	0.13	0.22	0.02	0.34	0.2	0.05	0.02	0.18	0.05	0.67	0.07	0.73	0.16	0.12	6.3	4.4	0.06	0.03	0.11	0.02	0.03	0.52	0.03	0.26
Radium-226	Bq/L	0.36	0.06	0.07	0.09	0.27	0.02	0.26	0.29	0.81	0.32	0.33	0.3	1.6	0.13	3.6	0.9	0.14	0.04	0.16	0.03	0.08	0.06	0.17	0.12
Radon-222	Bq/L	32	20	35	<10	86	18	7	<4	38	<4	<3	<4	20	<3	25	8	30	20	15	<5	11	<6	23	<4
Thorium-230	Bq/L	0.12	<0.02	<0.01	0.04	0.08	<0.01	<0.01	0.03	0.01	0.02	0.03	0.22	0.03	<0.01	2.6	0.44	<0.01	<0.01	0.04	<0.01	0.01	<0.01	<0.01	<0.01
Tritium	Bq/L	<15	0.1	<15	0.1	<15	1.1	<15	0.4	<15	0.5	16	1.2	<15	0.5	<15	1.2	<15	0.8	<15	<0.1	19	0.1	<15	<0.1

Notes

a	Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
a	Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
c	Monitoring Well GRW-007, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
d	The water quality in GRW-034 is considered to reflect influence from drilling fluids and additves, and is not considered reliable. Analysitcal well for this data is not used further in this baseline report.
e	Monitoring Well GRW-002, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
f	Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214
g	Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L
h	Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.
i	The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

Table D-4: Existing, Pre-Mining, Groundwater Chemistry

Well Cluster	Units	LA-5 Cluster				Paloeweathered Zone		Phoenix Ore Zone[e]															
Groundwater Monitoring Well		GWR-036		GWR-037		GWR-031		GWR-011		GWR-013		GWR-032			GWR-038[i]	GWR-039[i]	GWR-040[i]		GWR-041[i]	GWR-042[i]	GWR-046	GWR-047	GWR-048
Lithology		OB		MFd		PWZ		MFa		MFb		OZ			OZ	OZ	OZ		OZ	OZ	MFc	MFb	Mfa
Hydrostratigraphic Unit		OB		USA/DSZ		PWZ		LSA/DSZ		ISA/DSZ		OZ			OZ	OZ	OZ		OZ	OZ	ISA	ISA/DSZ	LSA
Sampling Date		2020-11-05	2021-04-08	2020-10-24	2021-04-09	2020-08-09	2021-06-04	2020-08-08	2021-06-01	2020-08-09	2021-06-02	2019-11-14[h]	2020-08-08	2021-06-04	2021-09-04	2021-09-05	2021-09-01	2021-09-01 DUP	2021-09-06	2021-09-07	2021-09-14	2021-09-10	2021-09-10
Aluminum, dissolved	mg/L	0.15	0.037	0.48	0.06	<0.005	<0.0005	0.0082	0.052	0.025	0.011	0.21	0.0057	0.0006	-	0.005	<0.005	<0.005	0.01	-	0.8	0.0065	0.001
Antimony, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	0.0003	0.0014	<0.0002	0.0008	<0.0002	0.0003	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	0.00024	<0.0001	<0.0001
Arsenic, dissolved	ug/L	0.2	0.3	0.4	1	1	1.2	4.1	1.3	3.1	0.9	3.4	0.3	0.2	-	<1	<1	<1	<1	-	4.75	3.71	0.85
Barium, dissolved	mg/L	0.0095	0.0057	0.0073	0.0087	0.052	0.035	0.21	0.054	0.041	0.11	0.088	0.083	0.063	-	0.96	0.52	0.52	0.35	-	0.241	0.0626	0.0577
Beryllium, dissolved	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.000167	<0.00002	<0.00002
Bismuth, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	<0.00005	<0.00005	<0.00005
Boron, dissolved	mg/L	<0.01	<0.01	<0.01	<0.01	0.5	0.55	0.04	0.04	0.02	<0.01	0.58	0.59	0.43	-	0.4	0.5	0.5	0.5	-	0.023	0.018	0.041
Bromine	ug/L	<5	<5	<5	<5	1100	1500	100	100	8	<5	-	2300	2000	-	15800	9800	9800	6800	-	11	34	57
Cadmium, dissolved	mg/L	0.00001	<0.00001	0.00002	<0.00001	<0.0001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	-	<0.0001	<0.0001	<0.0001	<0.0001	-	0.0000336	<0.000005	<0.000005
Chromium, dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	0.009	0.0008	<0.0005	<0.0005	<0.0005	<0.0005	0.013	0.0011	<0.0005	-	<0.005	<0.005	<0.005	<0.005	-	0.00169	<0.0005	0.00068
Cobalt, dissolved	mg/L	0.0004	0.0002	0.0005	0.0004	0.002	0.0002	<0.0001	<0.0001	<0.0001	0.0001	0.0007	<0.0001	<0.0001	-	0.003	0.001	0.001	0.002	-	0.00584	0.00025	0.00036
Copper, dissolved	mg/L	0.002	0.0006	0.0013	0.0009	<0.002	<0.0002	0.0006	0.0018	0.0006	0.0008	<0.0002	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	0.00629	<0.0002	<0.0002
Iron, dissolved	mg/L	0.12	0.014	1.64	1.38	3.6	0.09	0.012	0.86	0.086	0.014	3.83	6.4	4.2	-	23	8.2	7.7	18.2	-	6.03	11.9	9.62
Lead, dissolved	mg/L	0.0001	<0.0001	0.0002	<0.0001	0.001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	0.0003	0.0005	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.00157	<0.00005	<0.00005
Lithium, dissolved	ug/L	3	2.8	9.2	9	89	90	10	13	8.8	6.2	-	75	65	-	470	250	250	210	-	8.3	9.6	15.5
Manganese, dissolved	mg/L	0.048	0.039	0.12	0.16	0.22	0.13	0.085	0.36	0.026	0.22	0.2	0.24	0.22	-	1.8	0.85	0.83	0.87	-	3.91	2.14	2.6
Molybdenum, dissolved	mg/L	0.0003	0.0007	<0.0001	0.0028	0.062	0.012	0.028	0.0042	0.018	0.0054	0.078	0.0059	0.0038	-	0.008	0.011	0.011	0.045	-	0.00389	0.00374	0.00298
Nickel, dissolved	mg/L	0.0023	0.0018	0.0037	0.0023	0.04	0.0019	0.0003	0.0001	0.0024	0.0018	0.012	0.0014	0.001	-	0.056	0.019	0.02	0.024	-	0.0487	0.00062	0.00066
Selenium, dissolved	mg/L	0.0007	0.0008	0.0001	0.0004	<0.001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	0.0001	<0.0001	<0.0001	-	0.003	0.002	0.002	0.002	-	0.000359	<0.00005	<0.00005
Silica, soluble, dissolved	mg/L	25.5	26.2	33.4	35.3	10	9.1	22.5	24.1	19.2	22.7	-	13.5	13.3	-	55.7	50.5	51.2	70.2	-	13.1	11.8	11.6
Silver, dissolved	mg/L	<0.00005	<0.00005	0.0001	0.00011	<0.0005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	-	<0.0005	<0.0005	<0.0005	<0.0005	-	0.000046	<0.00001	<0.00001
Strontium, dissolved	mg/L	0.012	0.012	0.014	0.012	1.4	1.17	0.13	0.12	0.16	0.08	2.37	2.51	1.66	-	23.5	16.1	16.1	11.2	-	0.115	0.0796	0.169
Sulfur	mg/L	0.87	0.6	2.7	2.1	13	2.2	1.8	1.6	5.7	1.7	-	2.7	4.3	-	100	24	22	53.3	-	8.69	1.34	3.58
Thallium, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	<0.00001	<0.00001	<0.00001
Tin, dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.00033	<0.0001	<0.0001
Titanium, dissolved	mg/L	0.0009	0.0004	0.0048	0.0006	<0.002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	-	<0.002	<0.002	<0.002	<0.002	-	0.00897	<0.0003	<0.0003
Vanadium, dissolved	mg/L	0.0001	0.0004	<0.0001	<0.0001	<0.001	<0.0001	0.0005	<0.0001	0.0019	<0.0001	0.0074	0.0004	<0.0001	-	<0.001	<0.001	<0.001	<0.001	-	0.0012	<0.0005	<0.0005
Zinc, dissolved	mg/L	0.0061	0.0044	0.0067	0.0041	18.4	0.69	0.0018	0.012	0.001	0.0016	2.94	5	2.62	-	0.09	0.01	0.011	0.065	-	0.0125	0.0011	0.0031
Phosphorus, dissolved	mg/L	0.04	0.04	0.01	0.03	<0.1	<0.01	0.15	0.01	0.1	0.01	-	<0.01	<0.01	-	<0.1	<0.1	<0.1	<0.1	-	<0.05	0.13	0.289
Radionuclides																							
Uranium, dissolved	ug/L	0.9	0.1	5.8	0.8	17	50	9	0.7	14	55	299	5.7	11	504	38	10	10	10	564	22.6	0.752	0.488
Uranium-234 calculated	Bq/L	0.042	0.002	0.08	0.01	0.46	10.7	0.36	0.008	0.29	10.5	-	0.21	1.69	-	15.9	0.24	0.56	1	-	-	-	-
Uranium-238 calculated	Bq/L	0.042	0.002	0.08	0.01	0.46	10.7	0.36	0.008	0.29	10.5	-	0.21	1.69	-	15.9	0.24	0.56	1	-	-	-	-
Lead-210	Bq/L	0.14	0.07	0.08	0.05	1100	7300	0.6	0.3	0.4	8	1200	3300	2200	-	2700	5000	5000	2300	-	0.9	1.1	0.46
Polonium-210	Bq/L	0.08	0.05	0.14	0.11	460	650	0.4	0.3	0.4	13	120	260	110	-	460	700	600	420	-	0.65	0.14	1.3
Radium-226	Bq/L	0.22	0.06	0.19	0.03	120	76	1	0.5	0.5	17	300	400	180	-	6200	1500	1100	10000	-	0.93	0.24	0.75
Radon-222	Bq/L	17	20	64	57	5900	12000000	90	<8	34	41	400000[f]	2700000	3800000	-	6000000	6000000	6000000	4000000	-	11	1800	620
Thorium-230	Bq/L	<0.01	0.02	<0.01	<0.01	1.1	30	0.3	<0.1	0.2	4.7	14	2	7	-	21	6	10	6	-	0.2	<0.01	0.01
Tritium	Bq/L	<15	0.8	<15	0.1	<15	910	<15	0.1	<15	0.8	-	950	1800	-	RTR	<15	<15	RTR	-	<40	<40	<40

Notes

a	Monitoring Well GWR-028, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
a	Monitoring Well GWR-027, completed in the MFb and part of the Upgradient Cluster, could not be sampled because it is damaged
c	Monitoring Well GRW-007, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
d	The water quality in GRW-034 is considered to reflect influence from drilling fluids and additves, and is not considered reliable. Analysitcal well for this data is not used further in this baseline report.
e	Monitoring Well GRW-002, completed in Overburden, and part of the SE cluster, could not be sampled because it was dry
f	Radon-222 concentration estimated based on the daughter products of Lead-214 and Bismuth-214
g	Samples sent to the A.E. Lalonde AMS Laboratory, University of Ottawa for Tritium analysis are in tritium units (TU) where 1TU=0.1191Bq/L. The final results are converted to Bq/L.
h	Sample was taken at the end of a 48 hour long pumping test on GWR-032. 5,680 gallons were pumped from the well during the test before sampling and no field parameters available.
i	The water quality in compromised by inadvertent introduction of KCl. Groundwater quality not used in model or to calculate summary statistics.

Appendix E 1D Model Supporting Information

Elemental Concentrations in Rock for the Project

Table E-1: Solid Phase Elemental Concentrations

Median Metal/Trace Element Concentrations (mg/kg)	MFd (n= 2754-3077)	MFc (n= 7116-8532)	MFb (n= 5279-6086)	Mfa (n=9415-10,436)	Ore Zone			Paleoweathered Basement (n=108)
					Black or Brown Friable High Grade U Zone (n=95)	Brown Redox U Zone (n=46)	Sulphide or Hematite Cemented U Zone (n=34)	
Total Digestion								
As	-	-	-	-	-	-	-	-
Co	0.16	0.37	0.49	0.58	105	85	91	28
Cr	8	9	13	11	119	150	180	155
Cu	1.5	1.2	1.3	3.7	2.32E+03	5.79E+03	1.11E+03	228
Mo	0.1	0.17	0.24	0.18	86	101.5	258.5	5
Ni	1.5	3.4	2.4	4.7	343.5	288.5	239	167
Pb	2.65	3.16	3.56	3.14	4055	3455	4205	83
Se	-	-	-	-	-	-	-	-
Sr	43	87	178	112	279	281	218	169
Th	3.36	11.9	23.2	11.4	73.5	131.5	96	25
U	1	1.16	1.4	2.24	4.18E+04	5.02E+04	7.58E+04	403
V	3	5.2	10.3	8.3	779	1.37E+03	713	310
Zn	2	2	2	3	333	185.5	247	31
Partial Digestion								
As	0.18	0.42	0.71	0.46	176	147	78.5	24
Co	0.06	0.12	0.16	0.22	90.5	63.5	75.5	16
Cr	-	-	-	-	-	-	-	-
Cu	0.65	0.58	0.665	2.02	2.18E+03	5.40E+03	1.05E+03	219
Mo	0.05	0.06	0.07	0.08	76	73	182	3
Ni	0.41	0.88	0.68	1.48	314	257	179	79
Pb	0.506	0.667	0.851	0.6905	3.71E+03	3.14E+03	3.72E+03	46
Se	0.1	0.1	0.1	0.1	4.5	12.5	5	1
Sr	-	-	-	-	-	-	-	-
Th	0.68	2.14	5.36	2.39	-	-	-	-
U	0.21	0.26	0.33	0.58	4.07E+04	4.88E+04	7.49E+04	335
V	0.4	0.9	1.8	1.2	561	892	507	104
Zn	0.6	0.7	0.6	0.7	262	119	77.5	14

Notes:
n= number of samples used to calculated median values; Median values calculated using value of detection limit where value <DL
"-" indicates element not analyzed following digestion by method indicated

Surface Complexation Binding Constants

The sources of binding constants for uranium, metals and radionuclides to adsorbing phases, including goethite, illite and quartz are provided in Table E-2. As is shown in Table E-2, binding constants for all elements/constituents could not always be associated with adsorbing phases.

Table E-2: Summary of Compiled Surface Complexation Constants

Aqueous-phase element/species being	Goethite	Reference	Quartz	Reference	Clay	Reference
Al	X	1	X	8		
As(III)						
As(V)	X	2			X	12
Cd	X	2	X	9	X	13
Co	X	2	X	10	X	13
Cr(III)	X	3				
Cu	X	2			X	13
Mo	X	2				
Ni	X	2			X	13
Pb	X	2			X	13
Se(IV)	X	2			X	14
Se(VI)	X	2			X	14
Zn	X	2			X	13
U	X	2	X	8	X	13
U-carbonate	X	4	X	8	X	15
V	X	5				
Ra	X	6	X	11	X	13
Th	X	7			X	13
Ca	X	2				
Ba	X	2				
Sr	X	2				
Mg	X	2				
PO4	X	2				
SO4	X	2				
Mn	X	2				
Fe2+						

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15. NRC, 1995

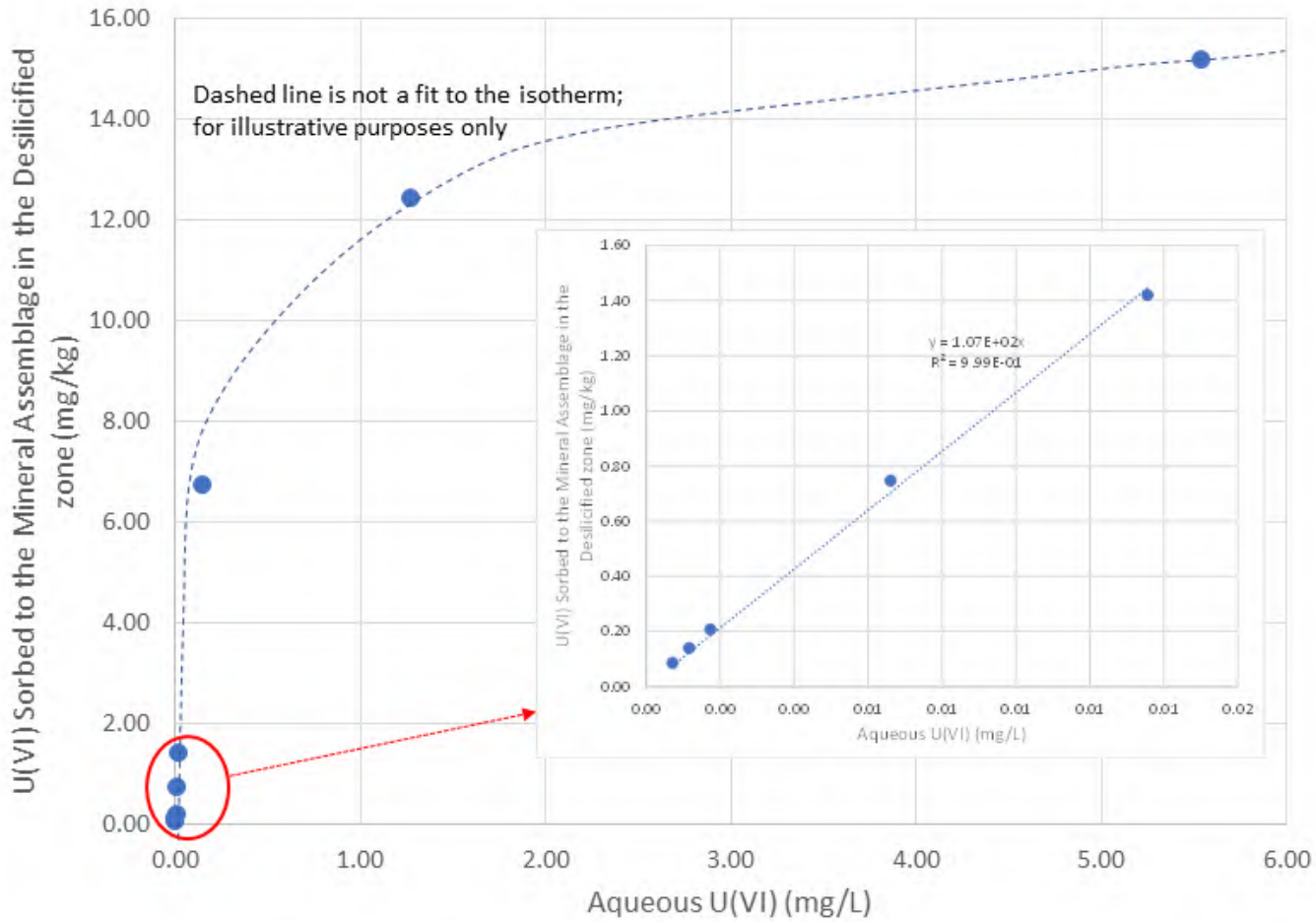
Adsorption Behaviour – Supporting Information

In Figure E1, a sorption isotherm for uranium to the solid assemblage conceptualized for the Desilicified Zone is shown (at pH 6.4; pH value used the model for this hydrostratigraphic unit). At the high end of dissolved uranium concentrations shown, the sorption is non-linear with lower relative ratios of concentrations in the solids to those in the water. This behaviour of lower apparent K_d values at higher concentrations in water is common to many chemical constituents. The figure shows that at higher uranium concentrations, similar to those that are being modelled in association with the Recovered solutions, the sorptive capacity of the solid becomes depleted. This is an important reason rationalizing the use of a more complex geochemical approach versus applying K_d values for this work.

At lower uranium concentrations, the sorption isotherm is linear, and the K_d (slope of the line) in this linear region is approximately 1.07×10^2 L/kg as shown in the insert/enlargement area and (very closely) corresponds to that shown in Table 3-11 (1.04×10^2 L/kg).

Figures E2 through E8 demonstrate that the sorption behavior of constituents to the different sorbing phases (quartz, illite and goethite) in the Desilicified Zone and Paleoweathered Zone (illite) is aligned with the studies from which the binding constants were taken as well as with results from other literature studies. In E2 through E8 there are two "panels" in each figure. Panel "a)" shows the sorption behaviour predicted in this in the geochemical model developed in this assessment and Panel "b)" shows the sorption behaviour in the literature. The following in shown:

- Figure E2: Sorption behaviour of U to quartz follows literature behaviour.
- Figure E3 and E4: Sorption behaviour of U to illite in the absence and presence of aqueous carbonate species, respectively, follows literature behaviour.
- Figure E5: Sorption behaviour of U to goethite in the presence of aqueous carbonate species, follows literature behaviour.
- Figure E6: Sorption behaviour of Cd to goethite shows a good alignment with literature behaviour but may overestimate sorption at low pH.
- Figure E7: Vanadium sorption to goethite does not follow literature behaviour; sorption in the literature is stronger and occurs over a broader pH range (compare the Kd values shown on both panels a) and b)). The difference is that the thermodynamic database developed for this project contains several vanadium complexes, shown in Figure E8, that limit the sorption, as the surface complexation constant is for the species VO_4^{-3}. The high Kd values observed in Table 3-11 for vanadium, suggest that some of these complexes may not be valid. In any case, the approach used in this work was conservative, in that vanadium sorption is underestimated.

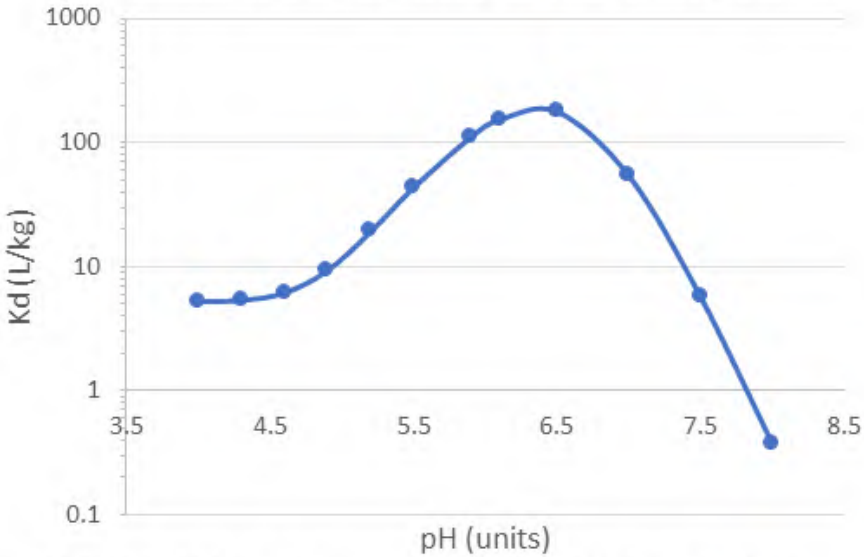


Legend

Blue markers dots in the plot show the information derived from PHREEQC modelling.

Wheeler River Project **Advanced Exploration Feasibility Field Test**	
U(VI) Sorption Isotherm at pH 6.4	
Ecometrix Environmental INTELLIGENCE	Figure E1

a) This work: U(VI) Sorption to Quartz; reproduces experimental sorption curve in Dong and Wan (2014)



SSA (0.036 m^2/g) from Don and Wang, 2014; moles of reactive sites (mol/kg solid) from Prikryl et al., 2001.

b) From Dong and Wan, 2014

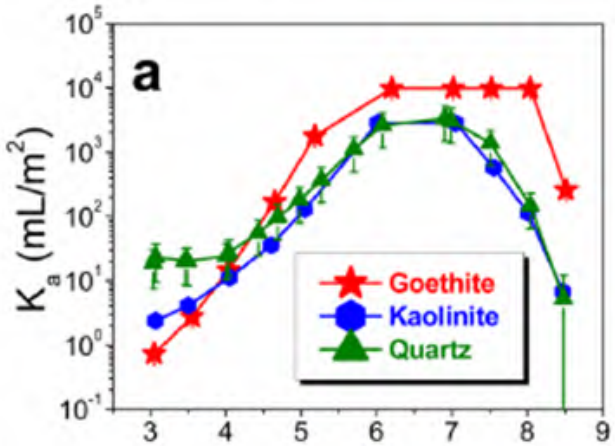


Figure 3. Comparison of U(VI) adsorption onto reference goethite, kaolinite and quartz (a). Surface complexation modeling of U(VI) adsorption onto goethite (b), kaolinite (c), and quartz (d). Symbols are experimental data points with estimated uncertainties. The solid lines are the overall model fits and the dashed lines are the fitted distribution of specific surface species: 1 = $(>FeOH)_2UO_2^+$, 2 = $(>FeOH)_2UO_2CO_3^-$, 3 = $>X_2UO_2$, 4 = $(>SOH)_2UO_2^+$, and 5 = $(>SOH)_2UO_2CO_3^-$, 6 = $(>QOH)_2UO_2^{2+}$, and 7 = $(>QOH)_2UO_2CO_3$.

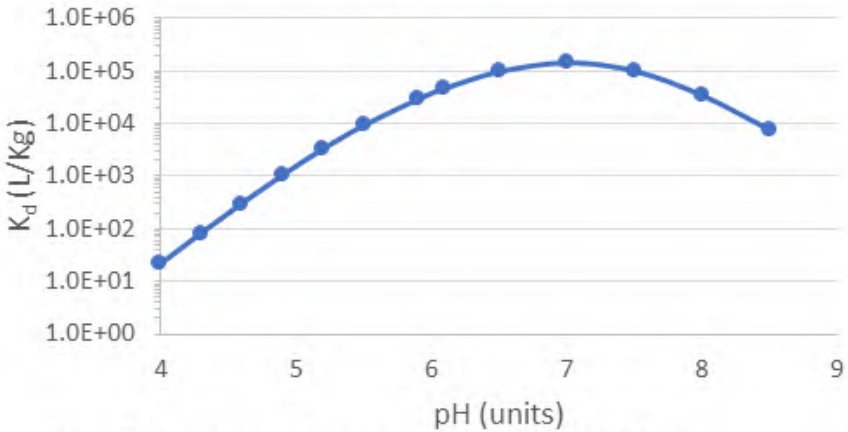
Surface area of quartz used in Don and Wang, 2014 is 0.036 m^2/g

Legend

Blue markers/dots in the plot show the information derived from PHREEQC modelling. The blue line is not a fit to the data; for illustrative purposes only

Wheeler River Project **Advanced Exploration Feasibility Field Test**	
U(VI) Sorption to Quartz	
Ecometrix Environmental INTELLIGENCE	Figure E2

a) This work: U(VI) Sorption to illite; no carbonate species



SSA (m^2/g) and moles of reactive sites (mol/kg solid) from Bradbury and Baeyens, 2009

b) From Bradbury and Baeyens, 2009

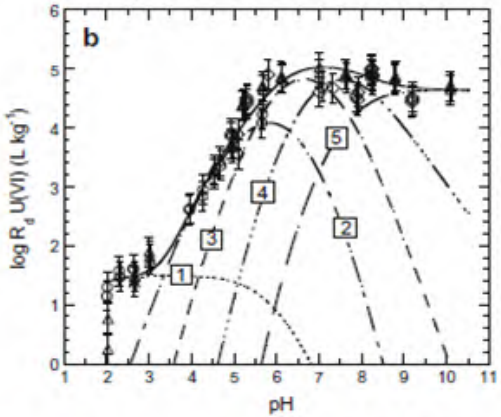


Fig. 4. (a) Aqueous speciation of U(VI) in 0.1 M $NaClO_4$. The hydrolysis constants are taken from Table 3, (b) U(VI) sorption edge measurements on conditioned Na-illite in 0.1 M $NaClO_4$ (symbols) and the modelled sorption (continuous line). (The different symbols represent different series of experiments.) The contributions to the overall sorption of the individual U(VI) surface species are shown by the different curves: (1) UO_2^{2+} cation exchange; (2) $\equiv S^SOUO_2^+$; (3) $\equiv S^SOUO_2OH^0$; (4) $\equiv S^SOUO_2(OH)_2^-$; (5) $\equiv S^SOUO_2(OH)_3^{2-}$. The continuous curves are the calculated U(VI) sorption edges using the 2SPNE SC/CE model and the parameters given in Tables 2–5.

Legend

Panel a: Blue markers/dots dots in the plot show the information derived from PHREEQC modelling. The blue line is not a fit to the data; for illustrative purposes only

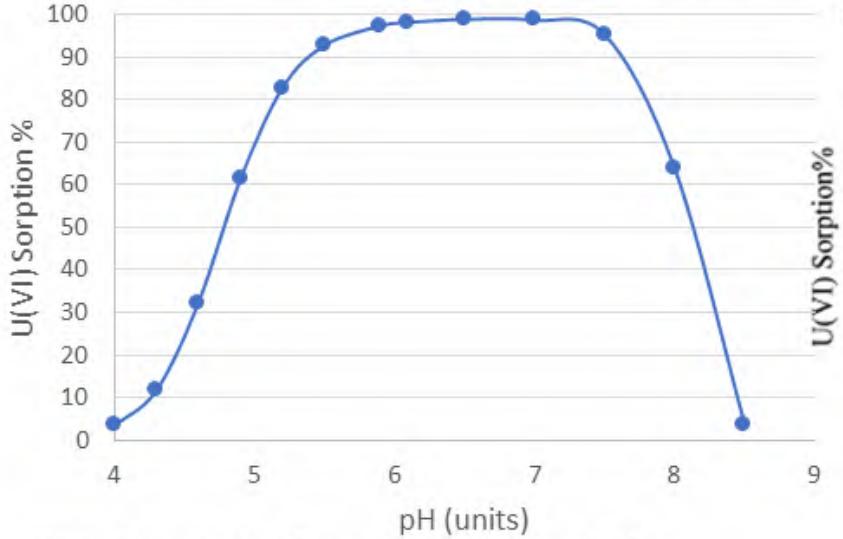
Wheeler River Project
Advanced Exploration Feasibility Field Test

U(VI) Sorption to Illite, no carbonate species

Ecometrix Environmental INTELLIGENCE

Figure E3

a) This work: U(VI) Sorption to illite; equilibrated with atmosphere (log CO_2(g) partial pressure = -3.5)



SSA (m^2/g) and moles of reactive sites (mol/kg solid) from Bradbury and Baeyens, 2009

b) From Bachmaf and Merkel, 2010; Sorption of U(VI) to Montmorillonite

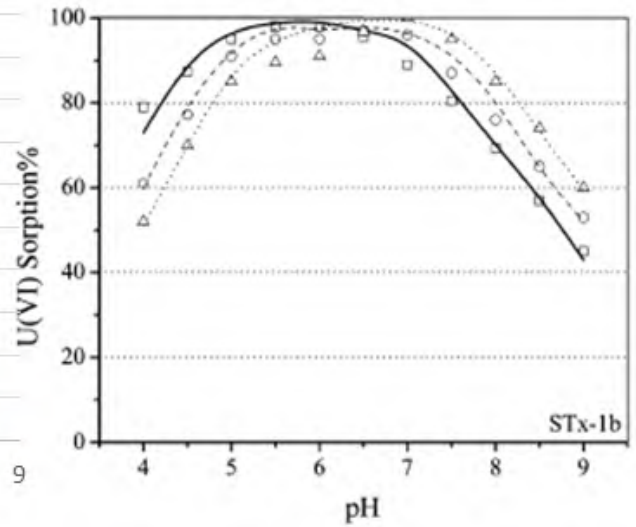


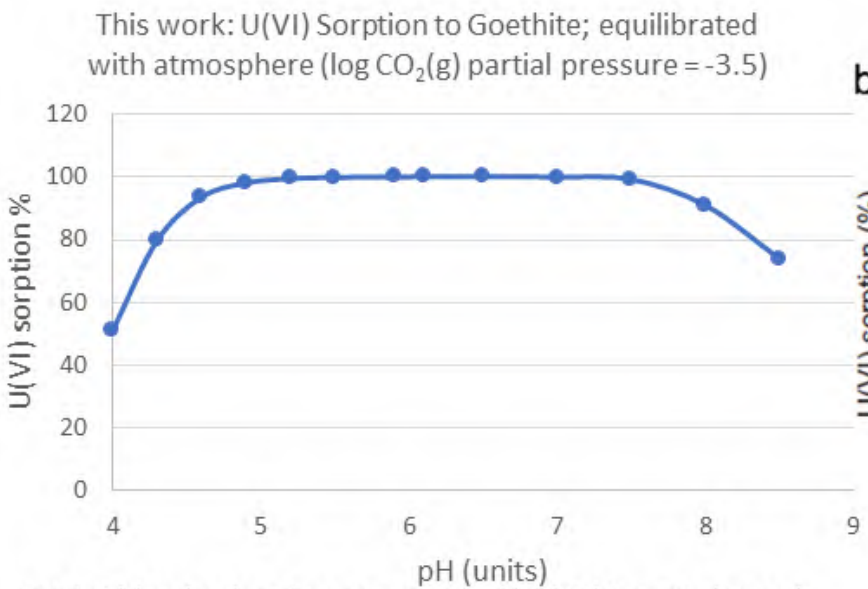
Fig. 3 Comparison of uraniumsorption data on kaolinite (KGa-1b), kaolinite (KGa-2), montmorillonite (STx-1b), montmorillonite (SWy-2), and natural bentonite (IBECO) and the surface complexation model (SCM). Experimental conditions: $\Sigma U = 100$ µg L^{-1}, suspension density = 1.66 g L^{-1}, $P_{CO_2} = 10^{-3.5}$ hPa, 25°C, $I = 0.001$.

Legend

Panel a: Blue markers/dots in the plot show the information derived from PHREEQC modelling. The blue line is not a fit to the data; for illustrative purposes only

** Change to draft, right panel needs to be updated to correct source – does not change intent/conclusion

Wheeler River Project **Advanced Exploration Feasibility Field Test**	
U(VI) Sorption to Illite, carbonate species present	
Ecometrix Environmental INTELLIGENCE	Figure E4



SSA (m^2/g) and moles of reactive sites (mol/mol Fe) from Mathur and Dzombak, 2006

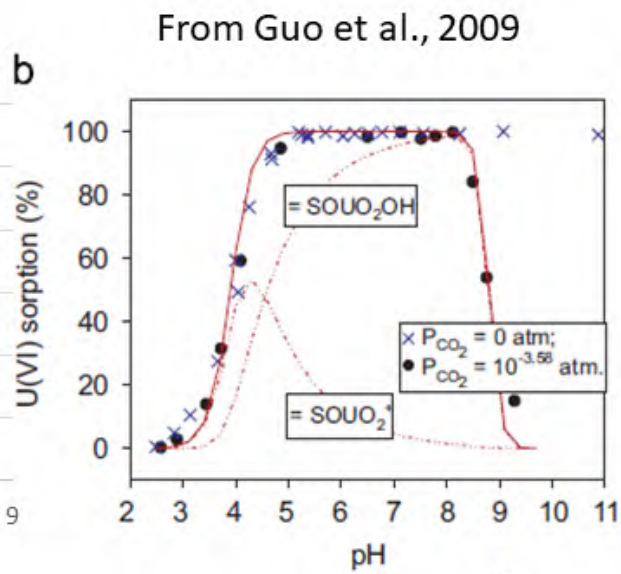


Fig. 4. pH sorption edges of U(VI) on goethite; (a) effect of phosphate; (b) effect of carbonate; (c) effect of FA; (d) FA sorption as a function of pH in the presence and absence of U(VI). Symbols in Fig. 4(a)–(c) represent the experimental data collected at [U(VI)] = 5.16e−5 mol/L, [NaCl] = 0.1 mol/l and m/V = 5 g/L; symbols in Fig. 4(d) represent the experimental data collected at [FA] = 20 mg/L, [NaCl] = 0.1 mol/L and m/V = 5 g/L; lines in Fig. 4(b) are the results calculated by model 2.

Legend

Panel a: Blue markers/dots in the plot show the information derived from PHREEQC modelling. The blue line is not a fit to the data; for illustrative purposes only

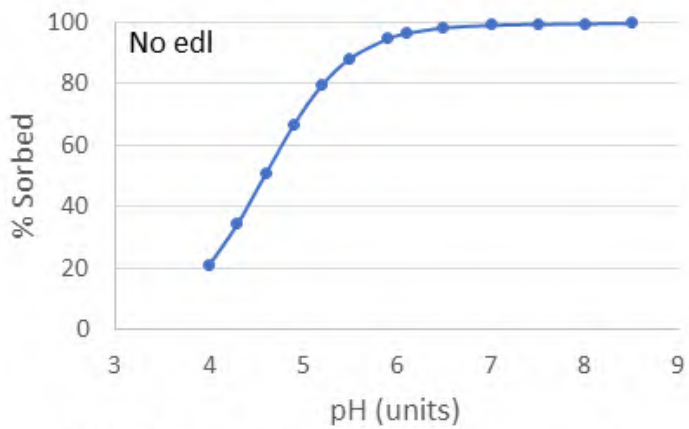
Wheeler River Project
Advanced Exploration Feasibility Field Test

U(VI) Sorption to goethite, carbonate species present

Ecometrix Environmental INTELLIGENCE

Figure E5

This work: Cd sorbed to Goethite; experimental conditions as modelled in Mathur and Dzombak, 2006



SSA (m^2/g) and moles of reactive sites (mol/mol Fe) from Mathur and Dzombak, 2006

From Mathur and Dzombak, 2006

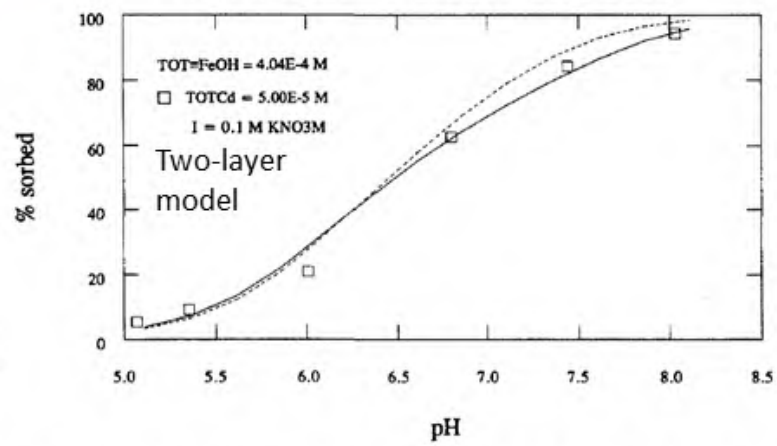
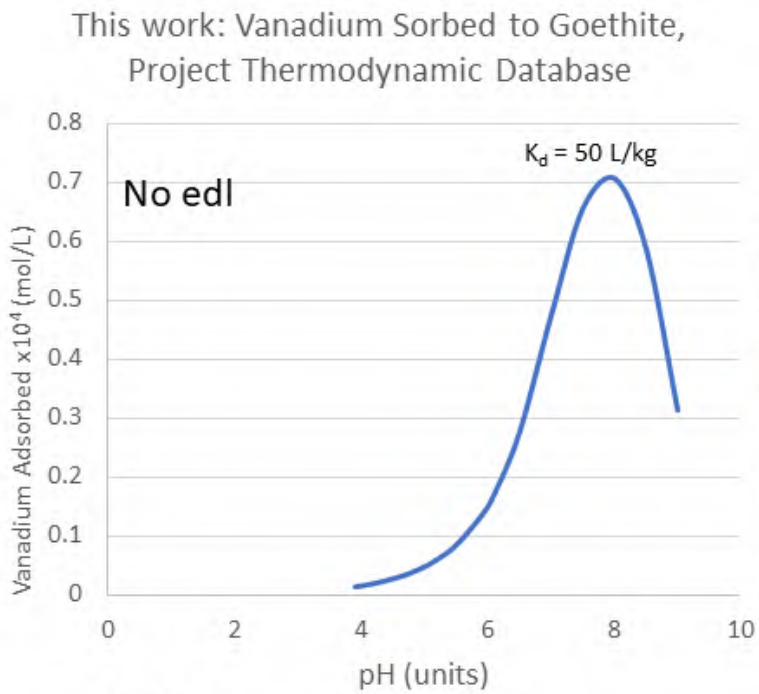


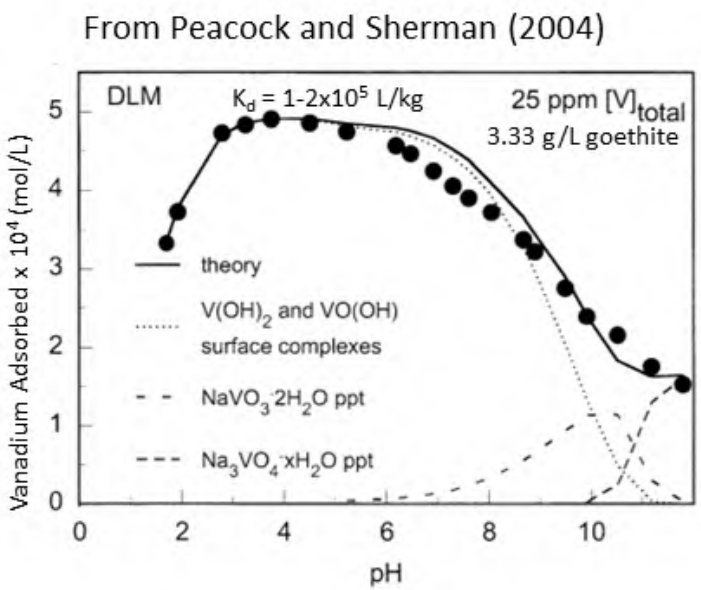
Fig. 1. Example fit of cation sorption data: cadmium sorption on goethite. Data from Barrow et al. [46]. FeOOH = 2.0 g L^{-1}, TOT≡FeOH = 4.04 x 10^{-4}M, TOTCd = 5 x 10^{-5} M, I = 0.1 M KNO_3. Model fits shown are from Mathur [24], Fig. 2ECD16, and include optimal fit for the particular data set (—) and fit provided by the best overall estimate surface complexation constants for cadmium given in Table 3 (- - -) for the same experimental conditions.

Legend

Panel a: Blue markers/dots in the plot show the information derived from PHREEQC modelling. The blue line is not a fit to the data; for illustrative purposes only

Wheeler River Project **Advanced Exploration Feasibility Field Test**	
Cd Sorption to Goethite	
Ecometrix Environmental INTELLIGENCE	Figure E6



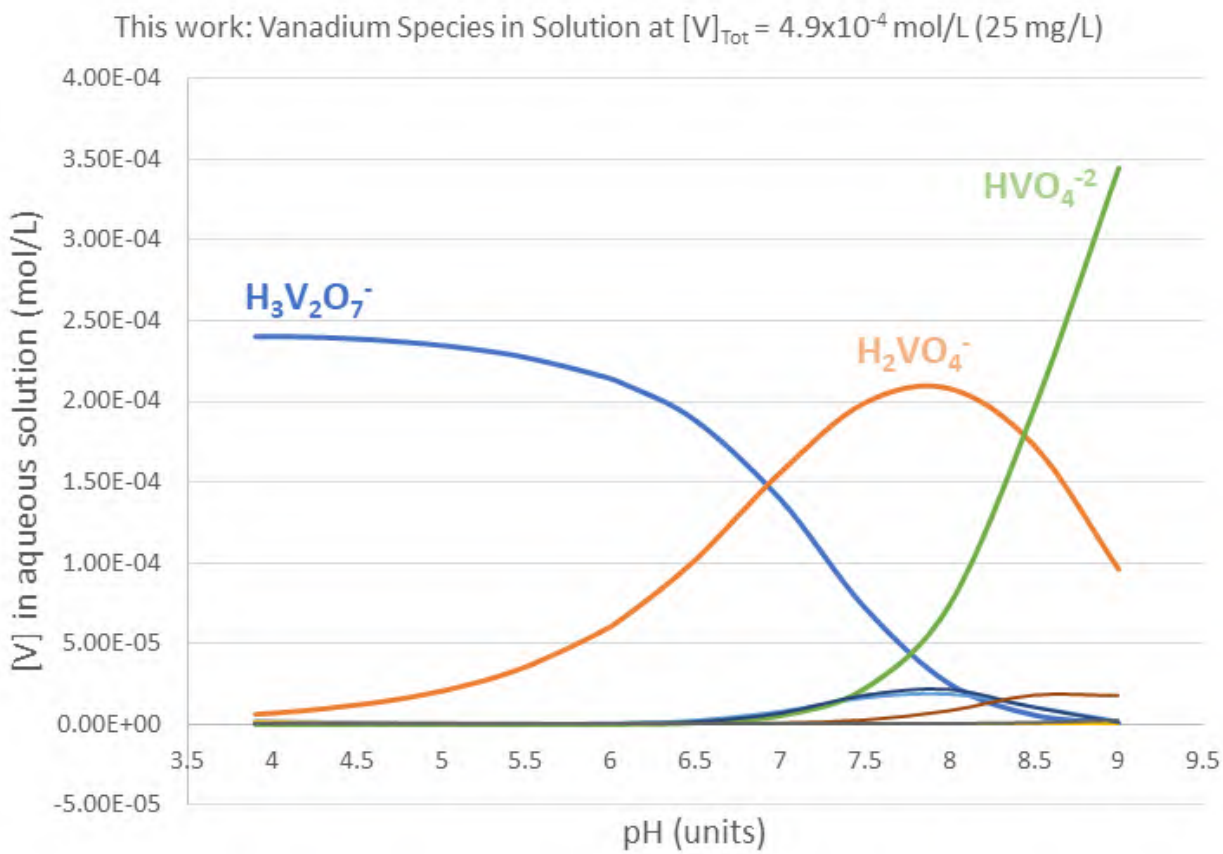


SSA (m^2/g) and moles of reactive sites (mol/mol Fe) from Mathur and Dzombak, 2006. [V]Tot = 25 mg/L; 3.33 g/L goethite.

Legend

Panel a: The blue line in the plot is a smoothed line derived from discrete points in the PHREEQC modelling. The line is not a fit to the data; for illustrative purposes only

Wheeler River Project **Advanced Exploration Feasibility Field Test**	
Vanadium Sorption to Geothite	
Ecometrix Environmental INTELLIGENCE	Figure E7



LEGEND

m_H3V2O7- m_H2VO4- m_H3VO4 m_VO2+ m_V3O9-3
m_HVO4-2 m_V4O12-4 m_HV2O7-3 m_V2O7-4

Wheeler River Project
Advanced Exploration Feasibility Field Test

Vanadium Speciation in Solution using the Thermodynamic Database for the Project

Ecometrix Environmental INTELLIGENCE

Figure E8

Radioactive Decay of ^{226}Radium and ^{230}Thorium and Production of Daughter Products

Radioactive decay was implemented in the 1D reactive transport model to account for decay and production of daughter products. The following radioactive decay chain was included in the model, following the work of Pique et al. (2013).

Th-230	→	Ra-226	→	Rn-222
	α		α	
$t_{1/2}$ 77,000 yr		$t_{1/2}$ 1,600 yr		$t_{1/2}$ 3.82 d

The 1D reactive transport model used was the 'Desilicified Zone Pathway' model (Figure 3-6b of the main text) and the low solids scenario was evaluated. The low solids scenario was evaluated because this is conservative for ^{226}Ra, as it will migrate more quickly along the groundwater flow path (i.e., less time for radioactive decay). Radioactive decay of ^{230}Th, resulting production of ^{226}Ra-226, and decay of ^{226}Ra was implanted in PHREEQC using the RATES and KINETICS keywords. The elements Th and Ra were used to represent ^{230}Th and ^{226}Ra, because the groundwater chemistry data collection for Th and Ra was limited to the radioactivity of these isotopes. This allowed for the modelling to be done without the need to specifically define these isotopes in PHREEQC. The decay rates for ^{230}Th and ^{226}Ra were calculated in the model as follows:

$$\partial C/\partial t = -\lambda \cdot C$$

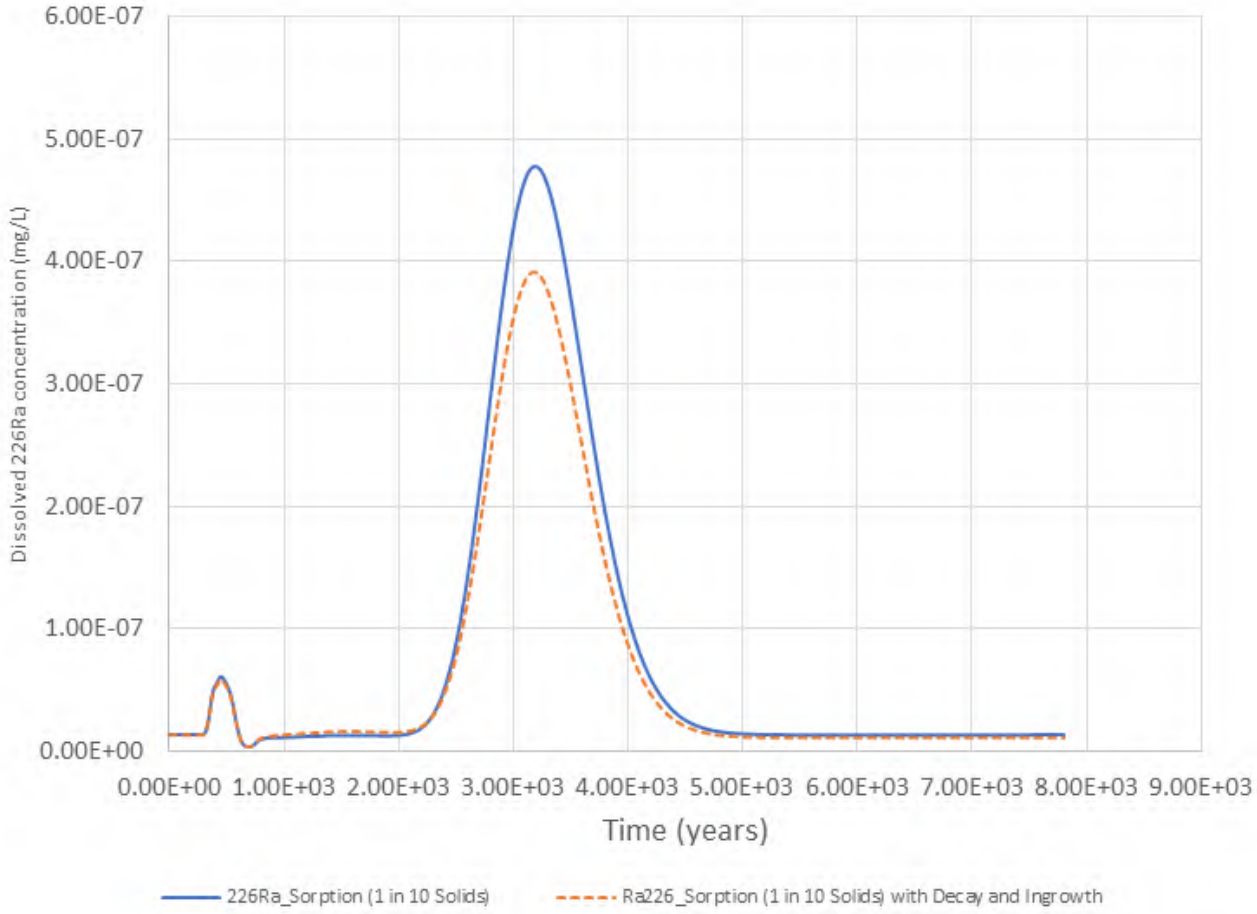
$$\lambda = \ln(2) / t_{1/2}$$

where C is the concentration of ^{230}Th and ^{226}Ra (mol/L), λ is the decay constant (seconds^{-1}), and $t_{1/2}$ is the half-life (seconds). Decay of ^{230}Th was modelled to produce ^{226}Ra with stoichiometry of 1:1, and Ra-226 was modelled to produce ^{222}Rn with stoichiometry of 1:1. The production of ^{226}Rn from the decay of ^{230}Th was modelled at each time step (3.9 years) in PHREEQC using this stoichiometry, such that the rate expression for ^{226}Rn did not need to account for this production.

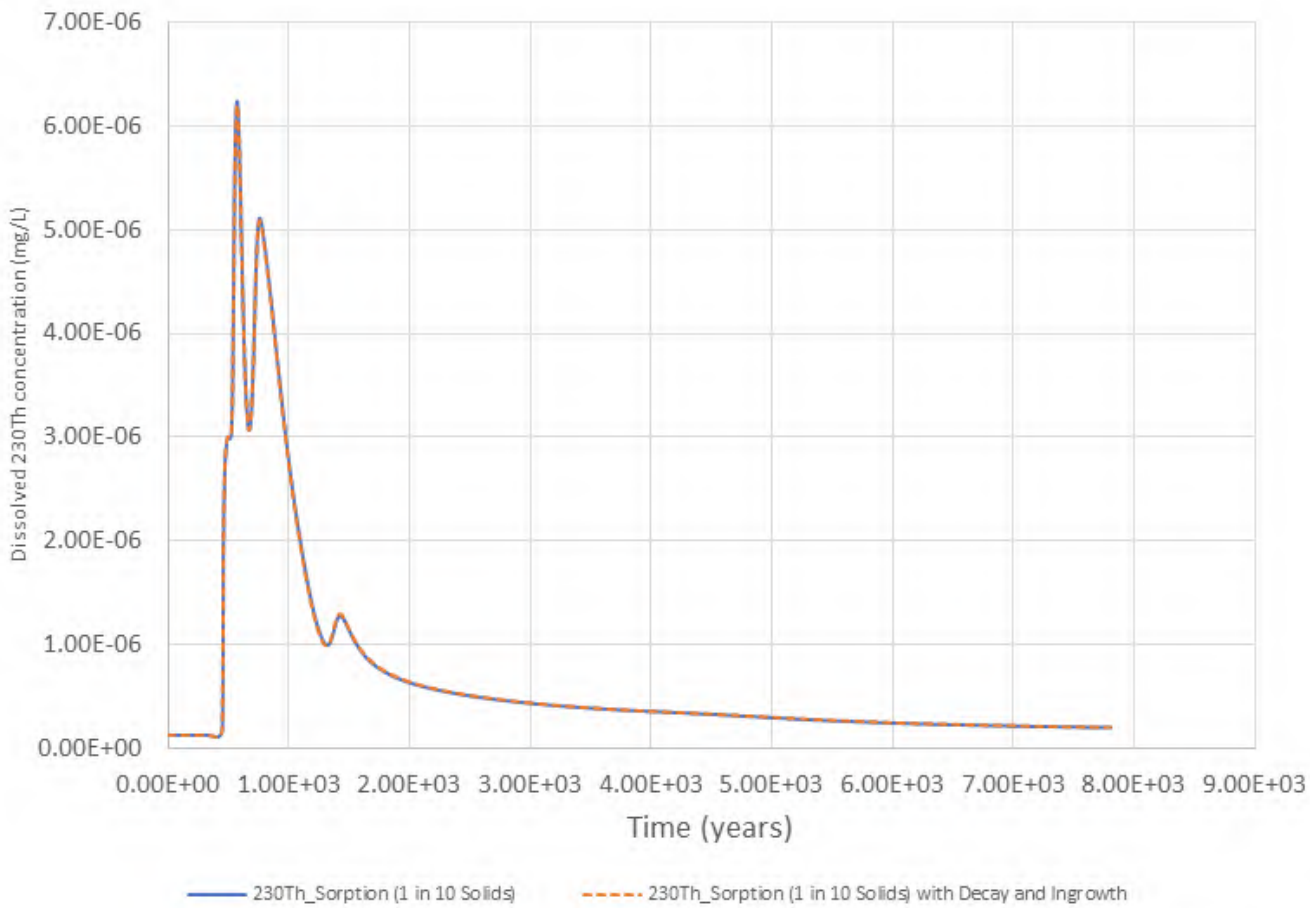
Results of modelling radioactive decay are shown in groundwater at the point of discharge to Whitefish Lake for ^{226}Ra and ^{230}Th in Figures E9 and E10, respectively. Accounting for radioactive decay results in modest decrease in the maximum ^{226}Ra concentration in groundwater (3.9×10^{-7} mg/L with decay versus 4.8×10^{-7} mg/L without decay), which was modelled to occur after approximately 3,200 years due to sorption and de-sorption processes. Decay of ^{230}Th results in negligible loss of ^{230}Th and production of ^{226}Ra due to the slow decay rate evident in its long half-life (77,000 years). Due to the long half-life of ^{230}Th decay and similarity of initial ^{230}Th and ^{226}Ra concentrations (within an order of magnitude), radioactive decay results in decreases in ^{226}Ra rather than increases from the ^{230}Th decay.

To provide a check on the model calculations for the radioactive decay, an arbitrary high concentration of ^{226}Ra (1.29 mol/L) was input to the model as the initial concentration, and the

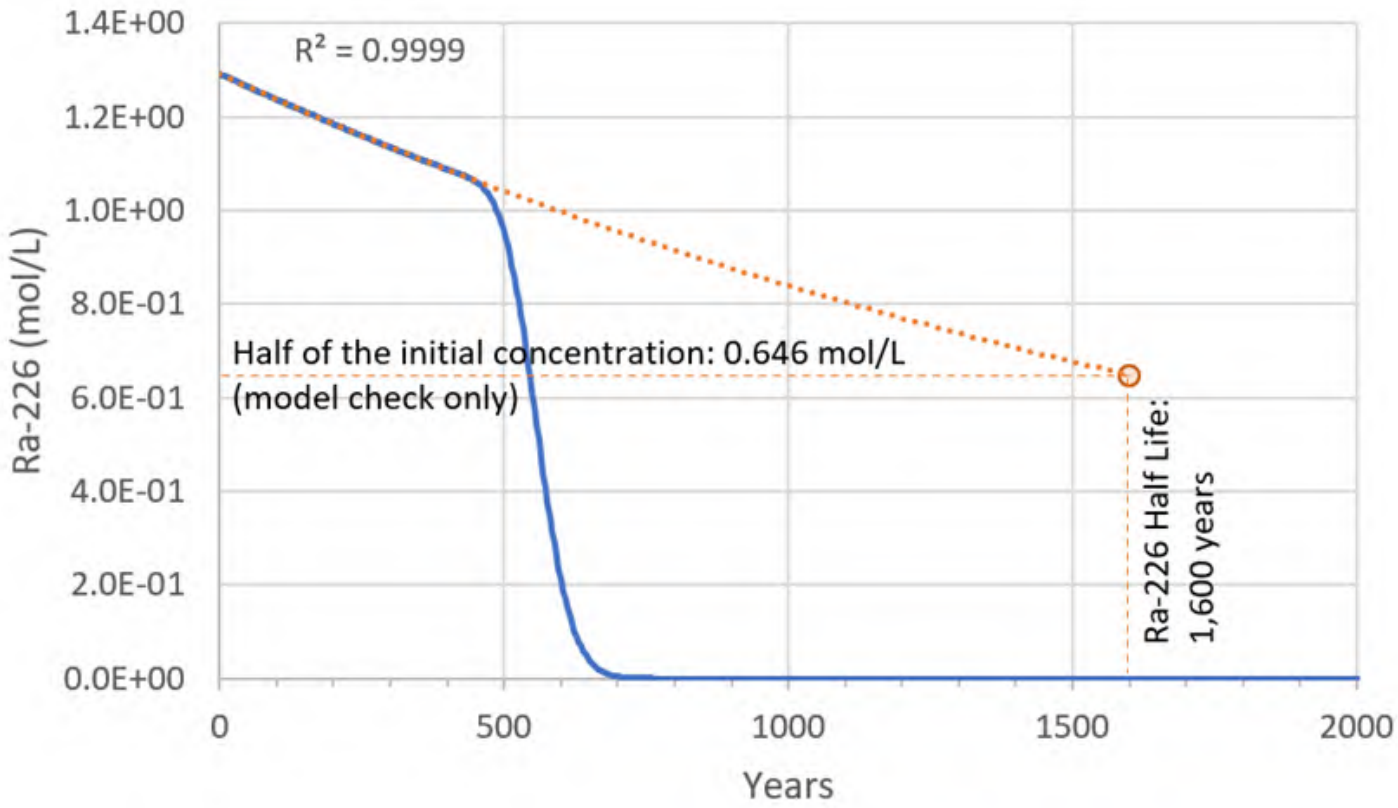
model was evaluated at the discharge location, 1,000 m downgradient of the ore zone. In this model simulation, the concentration of ^{226}Ra decreased exponentially for 460 years, when the concentration then decreased rapidly due to the flushing out of the initial waters by the infiltrating fresh water. The rate of decrease of ^{226}Ra during the initial 460 years was forecast out to 1,600 years, which is the half-life of ^{226}Ra (Figure E-11). The ^{226}Ra concentration forecasted using the initial decay rate was equal to half of the initial ^{226}Ra concentration. This check demonstrates that the radioactive decay was modelled correctly.



Wheeler River Project **Advanced Exploration Feasibility Field Test**	
Radium-226 Dissolved Phase Concentrations with Sorption, Decay and Ingrowth, 1 in 10 Solids	
Ecometrix Environmental INTELLIGENCE	Figure E9



Wheeler River Project **Advanced Exploration Feasibility Field Test**	
Thorium-230 Dissolved Phase Concentrations with Sorption and Decay, 1 in 10 Solids	
Ecometrix Environmental INTELLIGENCE	Figure E10



Wheeler River Project **Advanced Exploration Feasibility Field Test**	
Model Check: 226Ra Decay	
Ecometrix Environmental INTELLIGENCE	Figure E11

Example PHREEQC and PiChem Input Files

#PHREEQC Input File_Transport_PWZ_DSZ and Sediments2_Chlorite2.phr

```
DATABASE C:\PHREEQC OLD COMPUTER\phreeqc\database\Enhanced
PHREEQC4_Unified_May2022_Chlorite.dat

TITLE water quality evolution at Pheonix during gw restoration
# Authors: Elizabeth Haack; ehaack@ecometrix.ca
# Reactive Transport Model_Remediated Groundwater from Mining Area to below Lake
# Paleoweathered, Desilicified zones and Lake Bottom Sediments
# Natural groundwater from upgradient

EXCHANGE_MASTER_SPECIES

Y          Y-   # X- = Illite Exchange Site

SURFACE_MASTER_SPECIES
Hfo_     Hfo_OH# Goethite surface reactive site
Hao_s    Hao_sOH #Illite surface reactive sites
Hao_w    Hao_wOH
Hao_ww           Hao_wwOH
Q          QOH     # Quartz surface reactive sites
Hco_     Hco_OH            # chlorite

Linear Linear

SURFACE_SPECIES
Linear = Linear
Linear + H2AsO4- = LinearH2AsO4-
     -log_k -96.02
Linear + Cd+2 = LinearCd+2
           -log_k -96.82
Linear + Co+2 = LinearCo+2
     -log_k -97.60
Linear + Cr(OH)+2 = LinearCr(OH)+2
     -log_k -96.94
Linear + Cu+2 = LinearCu+2
    -log_k -97.52
Linear + MoO4-2 = LinearMoO4-2
     -log_k -97.50
Linear + Ni+2 = LinearNi+2
     -log_k -97.05
Linear + Pb+2 = LinearPb+2
     -log_k -95.92
Linear + Ra+2 = LinearRa+2
     -log_k -96.92
Linear + SeO4-2 = LinearSeO4-2
```

```
    -log_k -96.70
Linear + Th(OH)3(CO3)- = LinearTh(OH)3(CO3)-
    -log_k -97.64
Linear + Th(OH)2(CO3) = LinearTh(OH)2(CO3)
    -log_k -97.64
Linear + UO2CO3 = LinearUO2CO3
    -log_k -96.70
Linear + H2VO4- = LinearH2VO4-
    -log_k -96.40
Linear + Zn+2 = LinearZn+2
    -log_k -96.82

#######################################################

SOLUTION 0 #Groundwater Sweep;
units     mg/L
pH        6.467 charge
pe        15.535
Temperature     7
Al        5.20E-02
As        1.30E-03
Ba        5.40E-02
C(4)      8.66E+01
Ca        9.78E+00
Cd        1.00E-05
Cl        7.20E+00
Co        1.00E-04
Cr        5.00E-04
Cu        1.80E-03
F         1.80E-01
Fe        8.60E-01
K         8.60E-01
Mg        2.00E+00
Mn        3.60E-01
Mo        4.20E-03
Na        6.10E+00
Ni        1.00E-04
Pb        1.00E-04
S(6)      4.70E+00
Se        1.00E-04
Si        2.41E+01
Sr        1.20E-01
Zn        1.20E-02
P         1.00E-01
U         7.00E-04
V         1.00E-04
Ra        1.37E-08
Th        1.30E-07
```

```
END

SOLUTION 1-45 #EA Solution #1
units   mg/L
pH      4.3 charge
pe      14
Temp    7
Al      7
As      0.06
Ba      0.05
C(4)    58
Ca      110
Cd      0.015
Cl      200
Co      2
Cr      0.05
Cu      0.17
#F
Fe      100
K       9
Mg      6
Mn      3.4
Mo      0.1
Na      190
Ni      9.7
Pb      3.1
S(6)    703
Se      0.08
Si      40
Sr      4.4
Zn      1.4
P       4
U       100
V       0.51
Ra      5.47E-06
Th      3.93E-06

END

SOLUTION 46-55 #PWZ
units   mg/L
pH      6.7 charge
pe      14
temp    7
Al      0.034
As      0.05
Ba      0.036
```

```
C(4)    154
Ca      6.76
Cd      0.00001
Cl      86.5
Co      0.01
Cr      0.0045
Cu      0.005
F       0.53
Fe      0.49
K       5.6
Mg      3.09
Mn      0.7
Mo      0.0128
Na      76.1
Ni      0.015
Pb      0.0001
S(6)    4.55
Se      0.0001
Si      9.18
Sr      1.17
Zn      0.00425
P       0.01
U       0.01239
V       0.0001
Ra      5.47E-09
Th      1.00E-06

END

SOLUTION 56-145 #DSZ
units   mg/L
pH      6.46 charge
pe      14
Temperature     7
Al      0.052
As      0.0013
Ba      0.054
C(4)    86.6
Ca      9.78
Cd      0.00001
Cl      7.2
Co      0.0001
Cr      0.0005
Cu      0.0018
F       0.18
Fe      0.86
K       2
Mg      1.6
```

```
Mn      0.36
Mo      0.0042
Na      6.10
Ni      0.0001
Pb      1.00E-04
S(6)    4.7
Se      1.00E-04
Si      24.1
Sr      0.12
Zn      0.012
P       0.1
U       0.0007
V       0.0001
Ra      1.37E-08
Th      1.31E-07

END

solution 146 # Lake Bottom Sediments
units   mg/L
pH      6.45
pe      14
Temp    7
Al      0.037
As      0.0003
Ba      0.0057
C(4)    33.9
Ca      2.7
Cd      0.00001
Cl      6.86
Co      0.0004
Cr      0.0005
Cu      0.0006
F       0.06
Fe      0.405
K       2.8
Mg      1.8
Mn      0.14
Mo      0.0007
Na      2.9
Ni      0.0018
Pb      0.0001
S(6)    1.9
Se      0.0008
Si      26.2
Sr      0.012
Zn      0.0044
P       0.04
```

```
U        0.0005
V        0.0001
Ra       1.64117E-09
Th       2.61966E-08

Surface 1-45 #Chlorite in the mining area
-equilibrate with solution 1-45
Hco_     2.10E-02 0.5      795
-no_edl

EXCHANGE 46-55 #Illite in the paleoweathered zone
-equilibrate with solution 46-95
Y          0.483

EXCHANGE 56-145 #Illite in the desilicified zone
-equilibrate with solution 96-145
Y          0.093015

Surface 46-55 #Mineral Assemblage, reactive sites, paleoweathered zone
-equilibrate with solution 46-95
Hao_s    0.004293          97        2147
Hao_w    0.08586
Hao_ww           0.08586
-no_edl

QOH      7.06E-03          0.31      5963
-no_edl

Surface 56-145 #Mineral Assemblage, reactive sites, Desilicified zone
-equilibrate with solution 96-145
Hfo_     0.00693 60        34.2
-no_edl

Hao_s    0.0008268         97        413.4
Hao_w    0.0165
Hao_ww           0.0165
-no_edl

QOH      0.0119   0.31     10017
-no_edl

SURFACE 146 #Reactive sites, Lake bottom sediments
-equilibrate 146
    Linear 1e100 1 1
-no_edl

EQUILIBRIUM_PHASES 1-45 #Mining Area
O2(g) -0.68
```

```
Gibbsite 1.2 0
Gypsum          0 0

EQUILIBRIUM_PHASES 46-146 #Paleoweathered, Desilicified zones and Lake Bottom Sediments
O2(g) -0.68
Gibbsite 1.2 0

SOLID_SOLUTIONS 46-146 ##Paleoweathered, Desilicified zones and Lake Bottom Sediments
Ba(x)Ra(1-x)SO4
-comp1 Barite 0
-comp2 Ra(SO4)(s) 0

PRINT
-reset false

KNOBS
        -diagonal_scale
        -step 10
        -pe   5
        -iterations 200
        -tolerance 1e-15
        -convergence_tolerance  1e-8

SELECTED_OUTPUT
-file Full Solids_Chlorite Cell 146.sel
-reset false
-solution true
-distance true
-time true
-pH true
-pe true
-alkalinity true
-solid_solutions Barite Ra(SO4)(s)
totals U Al As Cu Cd Co Cr Ni Pb Mo Se Sr Zn V Ra Th S P Ba Mn Fe(2) Cl Ca Mg Na K Fe Br Si C(4) Se(4)
Se(6) As(3) As(5)
-equilibrium_phases      Gibbsite
-molalities Hfo_O- Hfo_OH Hfo_OH2+ QO- QOH QOH2+ Hao_sO- Hao_sOH Hao_sOH2+ Hao_wO-
Hao_wOH Hao_wOH2+ Hao_wwO- Hao_wwOH Hao_wwOH2+ YH CaY2 MgY2 YNa KY RaY2
USER_PUNCH
-head U_G U_Q U_C Al_G Al_Q Al_C As_G As_Q As_C Cu_G Cu_Q Cu_C Cd_G Cd_Q Cd_C Co_G Co_Q Co_C
Cr_G Cr_Q Cr_C Ni_G Ni_Q Ni_C Pb_G Pb_Q Pb_C Mo_G Mo_Q Mo_C Se_G Se_Q Se_C Sr_G Sr_Q Sr_C Zn_G
Zn_Q Zn_C V_G V_Q V_C Ra_G Ra_Q Ra_C Th_G Th_Q Th_C SO4_G SO4_Q SO4_C Phos_G Phos_Q Phos_C
Ba_G Ba_Q Ba_C Mn_G Mn_Q Mn_C Fe(II)_G Fe(II)_Q Fe(II)_C SO4_ppm U_ppm porevolumes years
mol_U(VI) Soln_density ULinear AsLinear CuLinear CdLinear CoLinear CrLinear NiLinear PbLinear MoLinear
SeLinear ZnLinear VLinear RaLinear ThLinear
50 PUNCH        SURF("U(6)","Hfo")
51 PUNCH        SURF("U(6)","Q")
52 PUNCH        SURF("U(6)","Hao")
```

```
60 PUNCH      SURF("Al","Hfo")
61 PUNCH      SURF("Al","Q")
62 PUNCH      SURF("Al","Hao")
70 PUNCH      SURF("As","Hfo")
71 PUNCH      SURF("As","Q")
72 PUNCH      SURF("As","Hao")
80 PUNCH      SURF("Cu","Hfo")
81 PUNCH      SURF("Cu","Q")
82 PUNCH      SURF("Cu","Hao")
90 PUNCH      SURF("Cd","Hfo")
91 PUNCH      SURF("Cd","Q")
92 PUNCH      SURF("Cd","Hao")
95 PUNCH      SURF("Co","Hfo")
96 PUNCH      SURF("Co","Q")
97 PUNCH      SURF("Co","Hao")
100 PUNCH     SURF("Cr","Hfo")
101 PUNCH     SURF("Cr","Q")
102 PUNCH     SURF("Cr","Hao")
110 PUNCH     SURF("Ni","Hfo")
111 PUNCH     SURF("Ni","Q")
112 PUNCH     SURF("Ni","Hao")
120 PUNCH     SURF("Pb","Hfo")
121 PUNCH     SURF("Pb","Q")
122 PUNCH     SURF("Pb","Hao")
130 PUNCH     SURF("Mo","Hfo")
131 PUNCH     SURF("Mo","Q")
132 PUNCH     SURF("Mo","Hao")
140 PUNCH     SURF("Se","Hfo")
141 PUNCH     SURF("Se","Q")
142 PUNCH     SURF("Se","Hao")
145 PUNCH     SURF("Sr","Hfo")
146 PUNCH     SURF("Sr","Q")
147 PUNCH     SURF("Sr","Hao")
150 PUNCH     SURF("Zn","Hfo")
151 PUNCH     SURF("Zn","Q")
152 PUNCH     SURF("Zn","Hao")
155 PUNCH     SURF("V","Hfo")
156 PUNCH     SURF("V","Q")
157 PUNCH     SURF("V","Hao")
160 PUNCH     SURF("Ra","Hfo")
161 PUNCH     SURF("Ra","Q")
162 PUNCH     SURF("Ra","Hao")
165 PUNCH     SURF("Th","Hfo")
166 PUNCH     SURF("Th","Q")
167 PUNCH     SURF("Th","Hao")
170 PUNCH     SURF("S","Hfo")
171 Punch     SURF("S","Q")
172 PUNCH     SURF("S","Hao")
```

```
175 PUNCH       SURF("P","Hfo")
176 Punch       SURF("P","Q")
177 PUNCH       SURF("P","Hao")
180 PUNCH       SURF("Ba","Hfo")
181 Punch       SURF("Ba","Q")
182 PUNCH       SURF("Ba","Hao")
185 PUNCH       SURF("Mn","Hfo")
186 Punch       SURF("Mn","Q")
187 PUNCH       SURF("Mn","Hao")
190 PUNCH       SURF("Fe(2)","Hfo")
191 Punch       SURF("Fe(2)","Q")
192 PUNCH       SURF("Fe(2)","Hao")
200 SO4_ppm = TOT("S(6)")*96.066* 1000
201 PUNCH       SO4_ppm
205 U_ppm = TOT("U")*238.02891*1000
206 PUNCH       U_ppm
210 PUNCH       (STEP_NO + .5) / 100
215 PUNCH       (total_time/365/24/60/60)
220 PUNCH       TOT("U(6)")
225 PUNCH       RHO
300 PUNCH       SURF("U","Linear")
301 PUNCH       SURF("As","Linear")
302 PUNCH       SURF("Cu","Linear")
303 PUNCH       SURF("Cd","Linear")
304 PUNCH       SURF("Co","Linear")
305 PUNCH       SURF("Cr","Linear")
306 PUNCH       SURF("Ni","Linear")
307 PUNCH       SURF("Pb","Linear")
308 PUNCH       SURF("Mo","Linear")
309 PUNCH       SURF("Se","Linear")
310 PUNCH       SURF("Zn","Linear")
311 PUNCH       SURF("V","Linear")
312 PUNCH       SURF("Ra","Linear")
313 PUNCH       SURF("Th","Linear")

TRANSPORT
-cells 146
-shifts 1500
-lengths 45*3.6 10*10 90*3.6 1*0.36
-time_step      3.46E+8
-boundary_conditions    3 3
-diffc 0.0e-9
-disp 45*1.79 10*5 90*1.79 1*0.179 #5
-correct_disp true
-punch_cells    146
-punch_frequency 1
-dump dump.file
-dump_frequency 10
```

```
USER_GRAPH 1
      -headings  mol_U(VI) Fe pH
      -chart_title "Uranium with years"
      -axis_scale x_axis 0 5000 auto
      -axis_scale y_axis 1e-8 1e-3 auto auto log
          -axis_scale sy_axis 4 7 auto auto
      -axis_titles "Years", "Concentration U(VI)", "pH"
      -initial_solutions false
 -start
10 x =  (total_time/365/24/60/60)
20 PLOT_XY x, TOT("U(6)"), color = Red, symbol = Square, symbol_size = 6, y-axis = 1
30 PLOT_XY x, TOT("Fe(2)"), color = Blue, symbol = Square, symbol_size = 6, y-axis = 1
40 PLOT_XY x, -LA("H+"), color = Green, symbol = Square, symbol_size = 6, y-axis = 2
 -end

USER_GRAPH 2
      -headings  YH        YNa      CaY2     MgY2    KY RaY2
      -chart_title "Exchange Species"
      -axis_scale x_axis 0 5000 auto
      -axis_scale y_axis 1e-10 1e-2 auto auto log
          -axis_scale sy_axis 1e-17 1e-10 auto auto log
          #-axis_scale sy_axis 4 7 auto auto
      -axis_titles "Years", "Equivalents of Exchangers"
      -initial_solutions false
 -start
10 x =  (total_time/365/24/60/60)
20 PLOT_XY x, MOL("YH"), color = Red, symbol = Square, symbol_size = 6, y-axis = 1
30 PLOT_XY x, MOL("YNa"), color = Green, symbol = Square, symbol_size = 6, y-axis = 1
40 PLOT_XY x, MOL("CaY2"), color = Blue, symbol = Square, symbol_size = 6, y-axis = 1
50 PLOT_XY x, MOL("MgY2"), color = Yellow, symbol = Square, symbol_size = 6, y-axis = 1
60 PLOT_XY x, MOL("KY"), color = Black, symbol = Square, symbol_size = 6, y-axis = 1
70 PLOT_XY x, MOL("RaY2"), color = Brown, symbol = Square, symbol_size = 6, y-axis = 2
 -end

USER_GRAPH 3
      -headings  Goethite          Gibbsite          Barite    Ra(SO4)(s) UonGoethite UonQuartz
          UonClay
      -chart_title "Solid Phases and Sorbed species"
      -axis_scale x_axis 0 5000 auto
      -axis_scale y_axis 1e-10 1e-1 auto auto log
          -axis_scale sy_axis 1e-10 1e-3 auto auto log
      -axis_titles "Years", "Moles Solid Phases"      "Moles Sorbed Species"
      -initial_solutions false
 -start
10 x =  (total_time/365/24/60/60)
20 PLOT_XY x, EQUI("Goethite"), color = Brown, symbol = Square, symbol_size = 6, y-axis = 1
```

```
 30 PLOT_XY x, EQUI("Gibbsite"), color = Red, symbol = Square, symbol_size = 6, y-axis = 1
 40 PLOT_XY x, S_S("Barite"), color = orange, symbol = Square, symbol_size = 6, y-axis = 1
 50 PLOT_XY x, S_S("Ra(SO4)(s)"), color = Black, symbol = Square, symbol_size = 6, y-axis = 1
 60 PLOT_XY x, SURF("U(6)","Hfo"), color = Green, symbol = Square, symbol_size = 6, y-axis = 2
 70 PLOT_XY x, SURF("U(6)","Q"), color = Blue, symbol = Square, symbol_size = 6, y-axis = 2
 80 PLOT_XY x, SURF("U(6)","Hao"), color = Yellow, symbol = Square, symbol_size = 6, y-axis = 2
  -end


USER_GRAPH 4
       -headings  mol_Cu mol_Co mol_Pb mol_Ra mol_SO4 mol_Th mol_Cd
       -chart_title "COPCs with years"
       -axis_scale x_axis 0 5000 auto
       -axis_scale y_axis 1e-8 1e-3 auto auto log
           -axis_scale sy_axis 1e-8 1e-3 auto auto log
       -axis_titles "Years", "Concentration COPCs", "Concentration Ra and Th"
       -initial_solutions false
  -start
 10 x =  (total_time/365/24/60/60)
 20 PLOT_XY x, TOT("Cu"), color = Red, symbol = Square, symbol_size = 6, y-axis = 1
 30 PLOT_XY x, TOT("Co"), color = Yellow, symbol = Square, symbol_size = 6, y-axis = 1
 40 PLOT_XY x, TOT("Pb"), color = Blue, symbol = Square, symbol_size = 6, y-axis = 1
 50 PLOT_XY x, TOT("Ra"), color = Black, symbol = Square, symbol_size = 6, y-axis = 2
 60 PLOT_XY x, TOT("S(6)"), color = Green, symbol = Square, symbol_size = 6, y-axis = 1
 70 PLOT_XY x, TOT("Th"), color = Orange, symbol = Square, symbol_size = 6, y-axis = 2
 80 PLOT_XY x, TOT("Cd"), color = Brown, symbol = Square, symbol_size = 6, y-axis = 1
  -end

USER_GRAPH 5
       -headings  mol_Se mol_As mol_Se(4) mol_Se(6) mol_As(3) mol_As(5)
       -chart_title "COPCs with years"
       -axis_scale x_axis 0 5000 auto
       -axis_scale y_axis 1e-10 1e-1 auto auto log
       -axis_titles "Years", "Concentrations Se and As"
       -initial_solutions false
  -start
10 x =   (total_time/365/24/60/60)
 20 PLOT_XY x, TOT("Se"), color = Red, symbol = Square, symbol_size = 6, y-axis = 1
 30 PLOT_XY x, TOT("As"), color = Yellow, symbol = Square, symbol_size = 6, y-axis = 1
 40 PLOT_XY x, TOT("Se(4)"), color = Blue, symbol = Square, symbol_size = 6, y-axis = 1
 50 PLOT_XY x, TOT("Se(6)"), color = Black, symbol = Square, symbol_size = 6, y-axis = 1
 60 PLOT_XY x, TOT("As(3)"), color = Green, symbol = Square, symbol_size = 6, y-axis = 1
 70 PLOT_XY x, TOT("As(5)"), color = Orange, symbol = Square, symbol_size = 6, y-axis = 1
   -end

USER_GRAPH 6
       -headings  mol_Mo mol_Se mol_V Mo_onSediment Se_onSediment V_onSediment
       -chart_title "Species on Sediment"
```

```
    -axis_scale x_axis 0 5000 auto
    -axis_scale y_axis 1e-10 1e-1 auto auto log
        -axis_scale sy_axis 1e-10 1e-1 auto auto log
    -axis_titles  "Years", "Concentrations Species", "Concentrations Sorbed on Sediment"
    -initial_solutions false
 -start
10 x =   (total_time/365/24/60/60)
 20 PLOT_XY x, TOT("Mo"), color = Red, symbol = Square, symbol_size = 6, y-axis = 1
 30 PLOT_XY x, TOT("Se"), color = Orange, symbol = Square, symbol_size = 6, y-axis = 1
 40 PLOT_XY x, TOT("V"), color = Blue, symbol = Square, symbol_size = 6, y-axis = 1
 50 PLOT_XY x, SURF("Mo","Linear"), color = Green, symbol = Square, symbol_size = 6, y-axis = 2
 60 PLOT_XY x, SURF("Se","Linear"), color = Black, symbol = Square, symbol_size = 6, y-axis = 2
 70 PLOT_XY x, SURF("V","Linear"), color = Brown, symbol = Square, symbol_size = 6, y-axis = 2
  -end

END
```

#Restored Solution 1_Minimal__ClayProtons_PWZonly_071922.phr

```
PRINT
-reset false

KNOBS
        -diagonal_scale
        -step 10
        -pe   5
        -iterations 200
        -tolerance 1e-15
        -convergence_tolerance  1e-8

SELECTED_OUTPUT
   -high_precision      true
   -time                true
   -ionic_strength      true
   -percent_error       true
-pH      true
-pe      true
-alkalinity         true
-totals U Al As Cd Co Ni Pb Se S(6) Fe(2) Cl Ca Mg Na K Fe C(4) Charge_Dummy
-equilibrium_phases      Gibbsite Gypsum
-molalities YH CaY2 MgY2 YNa KY Hco_OH Hco_OH2+ Hco_O-

USER_PUNCH
-head U_G U_Q U_C Al_G Al_Q Al_C As_G As_Q As_C Cd_G Cd_Q Cd_C Co_G Co_Q Co_C Ni_G Ni_Q Ni_C
Pb_G Pb_Q Pb_C Se_G Se_Q Se_C SO4_G SO4_Q SO4_C Fe(II)_G Fe(II)_Q Fe(II)_C SO4_ppm U_ppm
porevolumes years mol_U(VI) Soln_density ULinear AsLinear CdLinear CoLinear NiLinear PbLinear SeLinear
50 PUNCH        SURF("U(6)","Hfo")
51 PUNCH        SURF("U(6)","Q")
52 PUNCH        SURF("U(6)","Hao")
60 PUNCH        SURF("Al","Hfo")
61 PUNCH        SURF("Al","Q")
62 PUNCH        SURF("Al","Hao")
70 PUNCH        SURF("As","Hfo")
71 PUNCH        SURF("As","Q")
72 PUNCH        SURF("As","Hao")
90 PUNCH        SURF("Cd","Hfo")
91 PUNCH        SURF("Cd","Q")
92 PUNCH        SURF("Cd","Hao")
95 PUNCH        SURF("Co","Hfo")
96 PUNCH        SURF("Co","Q")
97 PUNCH        SURF("Co","Hao")
110 PUNCH       SURF("Ni","Hfo")
111 PUNCH       SURF("Ni","Q")
112 PUNCH       SURF("Ni","Hao")
120 PUNCH       SURF("Pb","Hfo")
```

```
121 PUNCH       SURF("Pb","Q")
122 PUNCH       SURF("Pb","Hao")
140 PUNCH       SURF("Se","Hfo")
141 PUNCH       SURF("Se","Q")
142 PUNCH       SURF("Se","Hao")
170 PUNCH       SURF("S(6)","Hfo")
171 Punch       SURF("S(6)","Q")
172 PUNCH       SURF("S(6)","Hao")
190 PUNCH       SURF("Fe(2)","Hfo")
191 Punch       SURF("Fe(2)","Q")
192 PUNCH       SURF("Fe(2)","Hao")
200 SO4_ppm = TOT("S(6)")*96.066* 1000
201 PUNCH       SO4_ppm
205 U_ppm = TOT("U")*238.02891*1000
206 PUNCH       U_ppm
210 PUNCH       (STEP_NO + .5) / 100
215 PUNCH       (total_time/365/24/60/60)
220 PUNCH       TOT("U(6)")
225 PUNCH       RHO
300 PUNCH       SURF("U","Linear")
301 PUNCH       SURF("As","Linear")
303 PUNCH       SURF("Cd","Linear")
304 PUNCH       SURF("Co","Linear")
306 PUNCH       SURF("Ni","Linear")
307 PUNCH       SURF("Pb","Linear")
309 PUNCH       SURF("Se","Linear")

SOLUTION 1 #Restored EA Solution 1
units     mg/L
pH        4.3 charge
pe        14
temperature     7
Al        7
As        0.06
C(4)      58
Ca        110.0
Cd        0.0150
Co        2
Cl        200.0
Fe        100.0
K         9.0
Mg        6.0
Na        190.0
Ni        9.7
Pb        3.1
S(6)      696
Se        0.08
Si        40.0
```

```
U          100.0

surface
-equilibrate 1
Hco_     0.0197   0.5        882
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
Gypsum           0 0
```

#Restored Solution 1_Minimal__ClayProtonsOreZone_071922.phr

```
PRINT
-reset false

KNOBS
        -diagonal_scale
        -step 10
        -pe   5
        -iterations 200
        -tolerance 1e-15
        -convergence_tolerance  1e-8

SELECTED_OUTPUT
   -high_precision      true
   -time                true
   -ionic_strength      true
   -percent_error       true
-pH      true
-pe      true
-alkalinity         true
-totals U Al As Cd Co Ni Pb Se S(6) Fe(2) Cl Ca Mg Na K Fe C(4) Charge_Dummy
-equilibrium_phases      Gibbsite Gypsum
-molalities YH CaY2 MgY2 YNa KY Hco_OH Hco_OH2+ Hco_O-

USER_PUNCH
-head U_G U_Q U_C Al_G Al_Q Al_C As_G As_Q As_C Cd_G Cd_Q Cd_C Co_G Co_Q Co_C Ni_G Ni_Q Ni_C
Pb_G Pb_Q Pb_C Se_G Se_Q Se_C SO4_G SO4_Q SO4_C Fe(II)_G Fe(II)_Q Fe(II)_C SO4_ppm U_ppm
porevolumes years mol_U(VI) Soln_density ULinear AsLinear CdLinear CoLinear NiLinear PbLinear SeLinear
50 PUNCH        SURF("U(6)","Hfo")
51 PUNCH        SURF("U(6)","Q")
52 PUNCH        SURF("U(6)","Hao")
60 PUNCH        SURF("Al","Hfo")
61 PUNCH        SURF("Al","Q")
62 PUNCH        SURF("Al","Hao")
70 PUNCH        SURF("As","Hfo")
71 PUNCH        SURF("As","Q")
72 PUNCH        SURF("As","Hao")
90 PUNCH        SURF("Cd","Hfo")
91 PUNCH        SURF("Cd","Q")
92 PUNCH        SURF("Cd","Hao")
95 PUNCH        SURF("Co","Hfo")
96 PUNCH        SURF("Co","Q")
97 PUNCH        SURF("Co","Hao")
110 PUNCH       SURF("Ni","Hfo")
111 PUNCH       SURF("Ni","Q")
112 PUNCH       SURF("Ni","Hao")
120 PUNCH       SURF("Pb","Hfo")
```

```
121 PUNCH       SURF("Pb","Q")
122 PUNCH       SURF("Pb","Hao")
140 PUNCH       SURF("Se","Hfo")
141 PUNCH       SURF("Se","Q")
142 PUNCH       SURF("Se","Hao")
170 PUNCH       SURF("S(6)","Hfo")
171 Punch       SURF("S(6)","Q")
172 PUNCH       SURF("S(6)","Hao")
190 PUNCH       SURF("Fe(2)","Hfo")
191 Punch       SURF("Fe(2)","Q")
192 PUNCH       SURF("Fe(2)","Hao")
200 SO4_ppm = TOT("S(6)")*96.066* 1000
201 PUNCH       SO4_ppm
205 U_ppm = TOT("U")*238.02891*1000
206 PUNCH       U_ppm
210 PUNCH       (STEP_NO + .5) / 100
215 PUNCH       (total_time/365/24/60/60)
220 PUNCH       TOT("U(6)")
225 PUNCH       RHO
300 PUNCH       SURF("U","Linear")
301 PUNCH       SURF("As","Linear")
303 PUNCH       SURF("Cd","Linear")
304 PUNCH       SURF("Co","Linear")
306 PUNCH       SURF("Ni","Linear")
307 PUNCH       SURF("Pb","Linear")
309 PUNCH       SURF("Se","Linear")

SOLUTION 1 #Restored EA Solution 1
units     mg/L
pH        4.3 charge
pe        14
temperature     7
Al        7
As        0.06
C(4)      58
Ca        110.0
Cd        0.0150
Co        2
Cl        200.0
Fe        100.0
K         9.0
Mg        6.0
Na        190.0
Ni        9.7
Pb        3.1
S(6)      696
Se        0.08
Si        40.0
```

```
U          100.0

surface
-equilibrate 1
Hco_     0.00355 0.5        159
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
Gypsum           0 0
```

#50% Restored Solution 1_Minimal_ClayProtons_071922.phr

```
PRINT
-reset false

KNOBS
        -diagonal_scale
        -step 10
        -pe   5
        -iterations 200
        -tolerance 1e-15
        -convergence_tolerance  1e-8

SELECTED_OUTPUT
   -high_precision      true
   -time                true
   -ionic_strength      true
   -percent_error       true
-pH      true
-pe      true
-alkalinity         true
-totals U Al As Cd Co Ni Pb Se S(6) Fe(2) Cl Ca Mg Na K Fe C(4) Charge_Dummy
-equilibrium_phases      Gibbsite Gypsum
-molalities YH CaY2 MgY2 YNa KY Hco_OH Hco_OH2+ Hco_O-

USER_PUNCH
-head U_G U_Q U_C Al_G Al_Q Al_C As_G As_Q As_C Cd_G Cd_Q Cd_C Co_G Co_Q Co_C Ni_G Ni_Q Ni_C
Pb_G Pb_Q Pb_C Se_G Se_Q Se_C SO4_G SO4_Q SO4_C Fe(II)_G Fe(II)_Q Fe(II)_C SO4_ppm U_ppm
porevolumes years mol_U(VI) Soln_density ULinear AsLinear CdLinear CoLinear NiLinear PbLinear SeLinear
50 PUNCH        SURF("U(6)","Hfo")
51 PUNCH        SURF("U(6)","Q")
52 PUNCH        SURF("U(6)","Hao")
60 PUNCH        SURF("Al","Hfo")
61 PUNCH        SURF("Al","Q")
62 PUNCH        SURF("Al","Hao")
70 PUNCH        SURF("As","Hfo")
71 PUNCH        SURF("As","Q")
72 PUNCH        SURF("As","Hao")
90 PUNCH        SURF("Cd","Hfo")
91 PUNCH        SURF("Cd","Q")
92 PUNCH        SURF("Cd","Hao")
95 PUNCH        SURF("Co","Hfo")
96 PUNCH        SURF("Co","Q")
97 PUNCH        SURF("Co","Hao")
110 PUNCH       SURF("Ni","Hfo")
111 PUNCH       SURF("Ni","Q")
112 PUNCH       SURF("Ni","Hao")
120 PUNCH       SURF("Pb","Hfo")
```

```
121 PUNCH       SURF("Pb","Q")
122 PUNCH       SURF("Pb","Hao")
140 PUNCH       SURF("Se","Hfo")
141 PUNCH       SURF("Se","Q")
142 PUNCH       SURF("Se","Hao")
170 PUNCH       SURF("S(6)","Hfo")
171 Punch       SURF("S(6)","Q")
172 PUNCH       SURF("S(6)","Hao")
190 PUNCH       SURF("Fe(2)","Hfo")
191 Punch       SURF("Fe(2)","Q")
192 PUNCH       SURF("Fe(2)","Hao")
200 SO4_ppm = TOT("S(6)")*96.066* 1000
201 PUNCH       SO4_ppm
205 U_ppm = TOT("U")*238.02891*1000
206 PUNCH       U_ppm
210 PUNCH       (STEP_NO + .5) / 100
215 PUNCH       (total_time/365/24/60/60)
220 PUNCH       TOT("U(6)")
225 PUNCH       RHO
300 PUNCH       SURF("U","Linear")
301 PUNCH       SURF("As","Linear")
303 PUNCH       SURF("Cd","Linear")
304 PUNCH       SURF("Co","Linear")
306 PUNCH       SURF("Ni","Linear")
307 PUNCH       SURF("Pb","Linear")
309 PUNCH       SURF("Se","Linear")

SOLUTION 1 #50% of Restored Solution #1 and GRW-011
units     mg/L
pH        5.1 charge
pe        1.40E+01
temperature     7.00E+00
Al        3.53E+00
As        3.07E-02
C(4)      7.23E+01
Ca        6.01E+01
Cd        7.52E-03
Co        1.00E+00
Cl        1.04E+02
Fe        5.05E+01
K         5.51E+00
Mg        3.80E+00
Na        9.82E+01
Ni        4.86E+00
Pb        1.55E+00
S(6)      3.51E+02
Se        4.01E-02
Si        3.21E+01
```

```
U          5.01E+01

surface
-equilibrate 1
Hco_     0.00355 0.5        159
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
Gypsum           0 0
```

```
#BackgroundGroundwater_USS_OB_bnd_071922.phr
PRINT
-reset false

KNOBS
        -diagonal_scale
        -step 10
        -pe   5
        -iterations 200
        -tolerance 1e-15
        -convergence_tolerance  1e-8

SELECTED_OUTPUT
   -high_precision      true
   -time                true
   -ionic_strength      true
   -percent_error       true
-pH      true
-pe      true
-alkalinity         true
-totals U Al As Cd Co Ni Pb Se S(6) Fe(2) Cl Ca Mg Na K Fe C(4) Charge_Dummy
-equilibrium_phases      Gibbsite Gypsum
-molalities YH CaY2 MgY2 YNa KY Hco_OH Hco_OH2+ Hco_O-

USER_PUNCH
-head U_G U_Q U_C Al_G Al_Q Al_C As_G As_Q As_C Cd_G Cd_Q Cd_C Co_G Co_Q Co_C Ni_G Ni_Q Ni_C
Pb_G Pb_Q Pb_C Se_G Se_Q Se_C SO4_G SO4_Q SO4_C Fe(II)_G Fe(II)_Q Fe(II)_C SO4_ppm U_ppm
porevolumes years mol_U(VI) Soln_density ULinear AsLinear CdLinear CoLinear NiLinear PbLinear SeLinear
50 PUNCH        SURF("U(6)","Hfo")
51 PUNCH        SURF("U(6)","Q")
52 PUNCH        SURF("U(6)","Hao")
60 PUNCH        SURF("Al","Hfo")
61 PUNCH        SURF("Al","Q")
62 PUNCH        SURF("Al","Hao")
70 PUNCH        SURF("As","Hfo")
71 PUNCH        SURF("As","Q")
72 PUNCH        SURF("As","Hao")
90 PUNCH        SURF("Cd","Hfo")
91 PUNCH        SURF("Cd","Q")
92 PUNCH        SURF("Cd","Hao")
95 PUNCH        SURF("Co","Hfo")
96 PUNCH        SURF("Co","Q")
97 PUNCH        SURF("Co","Hao")
110 PUNCH       SURF("Ni","Hfo")
111 PUNCH       SURF("Ni","Q")
112 PUNCH       SURF("Ni","Hao")
120 PUNCH       SURF("Pb","Hfo")
121 PUNCH       SURF("Pb","Q")
```

```
122 PUNCH       SURF("Pb","Hao")
140 PUNCH       SURF("Se","Hfo")
141 PUNCH       SURF("Se","Q")
142 PUNCH       SURF("Se","Hao")
170 PUNCH       SURF("S(6)","Hfo")
171 Punch       SURF("S(6)","Q")
172 PUNCH       SURF("S(6)","Hao")
190 PUNCH       SURF("Fe(2)","Hfo")
191 Punch       SURF("Fe(2)","Q")
192 PUNCH       SURF("Fe(2)","Hao")
200 SO4_ppm = TOT("S(6)")*96.066* 1000
201 PUNCH       SO4_ppm
205 U_ppm = TOT("U")*238.02891*1000
206 PUNCH       U_ppm
210 PUNCH       (STEP_NO + .5) / 100
215 PUNCH       (total_time/365/24/60/60)
220 PUNCH       TOT("U(6)")
225 PUNCH       RHO
300 PUNCH       SURF("U","Linear")
301 PUNCH       SURF("As","Linear")
303 PUNCH       SURF("Cd","Linear")
304 PUNCH       SURF("Co","Linear")
306 PUNCH       SURF("Ni","Linear")
307 PUNCH       SURF("Pb","Linear")
309 PUNCH       SURF("Se","Linear")

SOLUTION 1
units     mg/L
pH        6.45 charge
pe        15.5481
temperature     7
Al        3.70E-02
As        3.00E-04
C(4)      33.9
Ca        2.70E+00
Cd        1.00E-05
Co        4.00E-04
Cl        7.08E+00
Fe        4.05E-01
K         2.80E+00
Mg        1.80E+00
Na        2.90
Ni        1.80E-03
Pb        1.00E-04
S(6)      1.90E+00
Se        8.00E-04
Si        2.62E+01
U         5.00E-04
```

```
# BackgroundGroundwater_LSS_bnd_071922.phr
PRINT
-reset false

KNOBS
        -diagonal_scale
        -step 10
        -pe   5
        -iterations 200
        -tolerance 1e-15
        -convergence_tolerance  1e-8

SELECTED_OUTPUT
   -high_precision      true
   -time                true
   -ionic_strength      true
   -percent_error       true
-pH      true
-pe      true
-alkalinity         true
-totals U Al As Cd Co Ni Pb Se S(6) Fe(2) Cl Ca Mg Na K Fe C(4) Charge_Dummy
-equilibrium_phases      Gibbsite Gypsum
-molalities YH CaY2 MgY2 YNa KY Hco_OH Hco_OH2+ Hco_O-

USER_PUNCH
-head U_G U_Q U_C Al_G Al_Q Al_C As_G As_Q As_C Cd_G Cd_Q Cd_C Co_G Co_Q Co_C Ni_G Ni_Q Ni_C
Pb_G Pb_Q Pb_C Se_G Se_Q Se_C SO4_G SO4_Q SO4_C Fe(II)_G Fe(II)_Q Fe(II)_C SO4_ppm U_ppm
porevolumes years mol_U(VI) Soln_density ULinear AsLinear CdLinear CoLinear NiLinear PbLinear SeLinear
50 PUNCH        SURF("U(6)","Hfo")
51 PUNCH        SURF("U(6)","Q")
52 PUNCH        SURF("U(6)","Hao")
60 PUNCH        SURF("Al","Hfo")
61 PUNCH        SURF("Al","Q")
62 PUNCH        SURF("Al","Hao")
70 PUNCH        SURF("As","Hfo")
71 PUNCH        SURF("As","Q")
72 PUNCH        SURF("As","Hao")
90 PUNCH        SURF("Cd","Hfo")
91 PUNCH        SURF("Cd","Q")
92 PUNCH        SURF("Cd","Hao")
95 PUNCH        SURF("Co","Hfo")
96 PUNCH        SURF("Co","Q")
97 PUNCH        SURF("Co","Hao")
110 PUNCH       SURF("Ni","Hfo")
111 PUNCH       SURF("Ni","Q")
112 PUNCH       SURF("Ni","Hao")
120 PUNCH       SURF("Pb","Hfo")
121 PUNCH       SURF("Pb","Q")
```

```
122 PUNCH       SURF("Pb","Hao")
140 PUNCH       SURF("Se","Hfo")
141 PUNCH       SURF("Se","Q")
142 PUNCH       SURF("Se","Hao")
170 PUNCH       SURF("S(6)","Hfo")
171 Punch       SURF("S(6)","Q")
172 PUNCH       SURF("S(6)","Hao")
190 PUNCH       SURF("Fe(2)","Hfo")
191 Punch       SURF("Fe(2)","Q")
192 PUNCH       SURF("Fe(2)","Hao")
200 SO4_ppm = TOT("S(6)")*96.066* 1000
201 PUNCH       SO4_ppm
205 U_ppm = TOT("U")*238.02891*1000
206 PUNCH       U_ppm
210 PUNCH       (STEP_NO + .5) / 100
215 PUNCH       (total_time/365/24/60/60)
220 PUNCH       TOT("U(6)")
225 PUNCH       RHO
300 PUNCH       SURF("U","Linear")
301 PUNCH       SURF("As","Linear")
303 PUNCH       SURF("Cd","Linear")
304 PUNCH       SURF("Co","Linear")
306 PUNCH       SURF("Ni","Linear")
307 PUNCH       SURF("Pb","Linear")
309 PUNCH       SURF("Se","Linear")

SOLUTION 1
units     mg/L
pH        6.45926 charge
pe        15.5388
temperature     7
Al        4.60E-02
As        1.30E-03
C(4)      8.66E+01
Ca        9.82E+00
Cd        9.89E-06
Co        9.75E-05
Cl        7.20E+00
Fe        8.60E-01
K         2.00E+00
Mg        1.59E+00
Na        6.10E+00
Ni        9.99E-05
Pb        9.91E-05
S(6)      4.70E+00
Se        9.98E-05
Si        2.41E+01
U         6.95E-04
```

```
#Lake Bottom Sediments_071922.phr
SOLUTION_MASTER_SPECIES
Charge_dummy Charge_dummy- 0 Charge_dummy- 1

SOLUTION_SPECIES
Charge_dummy- = Charge_dummy-
log_k 0

SURFACE_MASTER_SPECIES
Linear Linear

SURFACE_SPECIES
Linear = Linear
Linear + H2AsO4- = LinearH2AsO4-
    -log_k -96.02
Linear + Cd+2 = LinearCd+2
        -log_k -96.82
Linear + Co+2 = LinearCo+2
    -log_k -97.60
Linear + Ni+2 = LinearNi+2
    -log_k -97.05
Linear + Pb+2 = LinearPb+2
    -log_k -95.92
Linear + SeO4-2 = LinearSeO4-2
    -log_k -96.70
Linear + UO2CO3 = LinearUO2CO3
    -log_k -96.70

solution
units    mg/L
pH       6.45
pe       14
temp     7
Al       0.037
As       0.0003
C(4)     33.9
Ca       2.7
Cd       0.00001
Co       0.0004
Cl       6.86
Fe       0.405
K        2.8
Mg       1.8
Na       2.9
Ni       0.0018
Pb       0.0001
S(6)     1.9
Se       0.0008
```

```
Si          26.2
U           0.0005
Charge_dummy 1000     charge

SURFACE
-equilibrate 1
    Linear 1e100 1 1
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

#OB_Porosity 0.18_Minimal_071922.phr

```
solution
units	mg/L
pH	6.45 charge
pe	14
temp	7
Al	0.037
As	0.0003
C(4)	33.9
Ca	2.7
Cd	0.00001
Co	0.0004
Cl	6.86
Fe	0.405
K	2.8
Mg	1.8
Na	2.9
Ni	0.0018
Pb	0.0001
S(6)	1.9
Se	0.0008
Si	26.2
U	0.0005

exchange
Y 0.0190
-equilibrate 1

surface
-equilibrate 1
Hfo_	0.00142 60	7.01
-no_edl

Hao_s	0.000169	97	84.7
Hao_w	0.00339
Hao_ww	0.00339
-no_edl

QOH	0.00243	0.31	2053
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

#OB_Porosity 0.22_Minimal_071922.phr

```
solution
units	mg/L
pH	6.45 charge
pe	14
temp	7
Al	0.037
As	0.0003
C(4)	33.9
Ca	2.7
Cd	0.00001
Co	0.0004
Cl	6.86
Fe	0.405
K	2.8
Mg	1.8
Na	2.9
Ni	0.0018
Pb	0.0001
S(6)	1.9
Se	0.0008
Si	26.2
U	0.0005

exchange
Y 0.0181
-equilibrate 1

surface
-equilibrate 1
Hfo_	0.00135 60	6.67
-no_edl

Hao_s	0.000161	97	80.6
Hao_w	0.00322
Hao_ww	0.00322
-no_edl

QOH	0.00231	0.31	1953
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

#OB_Porosity 0.25_Minimal_071922.phr

```
solution
units	mg/L
pH	6.45 charge
pe	14
temp	7
Al	0.037
As	0.0003
C(4)	33.9
Ca	2.7
Cd	0.00001
Co	0.0004
Cl	6.86
Fe	0.405
K	2.8
Mg	1.8
Na	2.9
Ni	0.0018
Pb	0.0001
S(6)	1.9
Se	0.0008
Si	26.2
U	0.0005

exchange
Y 0.0174
-equilibrate 1

surface
-equilibrate 1
Hfo_	0.00130 60	6.41
-no_edl

Hao_s	0.000155	97	77.5
Hao_w	0.00310
Hao_ww	0.00310
-no_edl

QOH	0.00222	0.31	1878
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

#USS_Porosity 0.02_Minimal_042522.phr

```
solution
units	mg/L
pH	6.45 charge
pe	14
temp	7
Al	0.037
As	0.0003
C(4)	33.9
Ca	2.7
Cd	0.00001
Co	0.0004
Cl	6.86
Fe	0.405
K	2.8
Mg	1.8
Na	2.9
Ni	0.0018
Pb	0.0001
S(6)	1.9
Se	0.0008
Si	26.2
U	0.0005

exchange
Y 0.00160
-equilibrate 1

surface
-equilibrate 1
Hfo_	0.000119	60	0.59
-no_edl

Hao_s	0.0000142	97	7.09
Hao_w	0.000284
Hao_ww	0.000284
-no_edl

QOH	0.000203	0.31	172
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

#DSZ_Porosity0.2_Minimal_071922.phr

```
solution
units	mg/L
pH	6.46 charge
pe	14
temperature	7
Al	0.052
As	0.0013
C(4)	86.6
Ca	9.82
Cd	0.00001
Co	0.0001
Cl	7.2
Fe	0.86
K	2
Mg	1.6
Na	6.10
Ni	0.0001
Pb	1.00E-04
S(6)	4.7
Se	1.00E-04
Si	24.1
U	7.00E-04

exchange
Y 0.0186
-equilibrate 1

surface
-equilibrate 1
Hfo_	0.00138 60	6.84
-no_edl

Hao_s	0.000165	97	82.68
Hao_w	0.0033
Hao_ww	0.0033
-no_edl

QOH	0.00237	0.31	2003
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

#LSS and ISS_Porosity0.01_Minimal_071922.phr

```
solution
units	mg/L
pH	6.46 charge
pe	14
temperature	7
Al	0.052
As	0.0013
C(4)	86.6
Ca	9.82
Cd	0.00001
Co	0.0001
Cl	7.2
Fe	0.86
K	2
Mg	1.6
Na	6.10
Ni	0.0001
Pb	1.00E-04
S(6)	4.7
Se	1.00E-04
Si	24.1
U	7.00E-04

exchange
Y 0.000806
-equilibrate 1

surface
-equilibrate 1
Hfo_	0.0000600	60	0.296
-no_edl

Hao_s	0.00000716	97	3.58
Hao_w	0.000143
Hao_ww	0.000143
-no_edl

QOH	0.000103	0.31	86.8
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

```
#Paleoweathered_NewAq_Minimal_071922.phr
solution
units	mg/L
pH	6.7 charge
pe	14
temperature	7
Al	0.034
As	0.05
C(4)	154
Ca	6.76
Cd	0.00001
Co	0.01
Cl	86.5
Fe	0.49
K	5.6
Mg	3.09
Na	76.1
Ni	0.015
Pb	0.0001
S(6)	4.55
Se	0.0001
Si	9.18
U	0.01239

exchange
Y 0.0483
-equilibrate 1

surface
-equilibrate 1

Hao_s	0.0004293	97	215
Hao_w	0.0086
Hao_ww	0.0086
-no_edl

QOH	7.06E-04	0.31	596
-no_edl

EQUILIBRIUM_PHASES
O2(g) -0.68
Gibbsite 1.2 0
```

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Appendix F Summary of Results from Metallurgical Testing

F.1 Summary of Metallurgical Test Work

This summary of results is focused on the metallurgical test work done to support an understanding of the:

a) mineralogy and hydrogeochemical changes in the ore and barrier zones as a result of the lixiviant (mining solution) injections;

b) the composition of the uranium bearing solution (UBS) at the end of mining and prior to any remediation; and

c) water quality and secondary mineral phases formed during remediation of the ore zone.

Metallurgical testing completed, the objectives and results of the work, and the information carried forward for discussion in this response are summarized in Table F-1.

Further details on the metallurgical testing, including the sample information for cores (e.g., mineralogy, location, U content, depth), test conditions (e.g., duration, # of iterations, column length, flow rate, temperature, pressure, sample frequency, influent/effluent composition) are provided in the sections below. All data presented herein are from the metallurgical test programs used to support the 2018 Prefeasibility Study (Denison 2018) and the Feasibility Study (Denison 2023).

Table F-1: Summary of Metallurgical Testing

Years	Description	Objective	Results	Information informing IR-20, IR-67 and IR-69
2017-2018	Batch leach tests and bottle roll/agitation leach tests	Early testing of leaching with alkaline and acidic based lixiviants	Supported decision for Acid Leaching	No discussion herein; very preliminary testing.
	A column leach test conducted using sulfuric acid followed, which also included simulated groundwater restoration tests.	Initial column test with acid leaching and evaluation of groundwater remediation	Early indication of groundwater remediation needs	Water Quality of UBS at the end of mining and Restoration Phase/flushing solution (groundwater remediation)
2021	Column leach tests on blended crushed ore	Test leach recoveries on a range of feed grades. Determine potential recovery and generate a representative sample for process plant testing.	Operationally, the feed sample for Column 1 is was verified as a reasonable blend to represent ISR wellfield production of UBS. Groundwater remediation with groundwater and alkaline solutions	Water Quality of UBS at the end of mining and Restoration Phase/flushing solution (groundwater remediation). Mineralogy.
2022	Column leach and remediation tests on crushed and screened core from individual hydrogeologic units	•Develop information to support geochemical modelling of the deposit, including leaching and neutralization phases. •Generate a detailed chemical and mineralogical characterization of the dominant hydrogeological units(HGUs) within the ore zone •Evaluate behaviour of different HGUs during ISR and neutralization, in particular those hosting the majority of the resource. •Compare the efficacy of neutralization of different HGUs, with the use of dilute sodium hydroxide	Uranium leachability was found to vary amongst the HGUs. Also, there were some indications of an HGU ("2A") to be avoided during operations to prevent clay mobilization.	Water Quality of UBS at the end of mining.
2018	Static uranium ore dissolution (jar) test on intact core	Room temperature, 1,138 hours (48 days) exposure of drill core to concentrated sulphuric acid (35 g/L) in a very slow-motion shaker.	Provided visual indication that with sufficient soak time, lixiviant will penetrate into intact high grade uranium pieces. The incomplete recoveries at the end of the tests can be attributed largely to requiring longer residence time	No discussion herein; testing limited to visual information.
2018-2022	Coreflood tests on intact core in 2018 to 2022	Simulate the in situ field conditions, to understand and develop the lixiviant conditions necessary for successful full-scale ISR. Objectives were to: evaluate the rate of uraninite dissolution and changes in permeability of the core with leaching; generate laboratory scale test results applicable to planning the 2022 field test; and delineate a life-of-well-pattern production profile.	Results were inconsistent in the early work (Coreflood 1 to 3C) due to highly variable reagent dosages in this pioneering work. Coreflood 4 and 5 (2021-ongoing). In Coreflood 4, as uranium mass gradually leached away, there was a mild trend of increasing flow rate at the same pressure, indicating permeability increase. Lessons learned from past testing, particularly with respect to reagent adjustments, were put into practice with this testing to enable completion of the longest test run to support the feasibility work. In total, 51.8% of the initial dry mass of the sample was removed by leaching; 50% of this was the result of uranium leaching. Feed grade was 26.66% U3O8. In Coreflood 5 is ongoing and is focused on HGU 2B, which has the majority of contained uranium, highest grade and highest natural permeability. The methodology was different from the other coreflood tests in that the flow was directed through a pencil hole in core. Cumulative recovery at end of February 2023 was 33%.	Water Quality of UBS at the end of mining and Restoration Phase/flushing solution (groundwater remediation). Mineralogy.
2022	Feasibility field test (FFT) leaching and remediation in 2022	The FFT was a full-scale proof of concept in an ISR method; to demonstrate injection of lixiviant and recovery of UBS from the CSW test pattern. Injection was into 1 well (GWR-041).	After pH below 3 was achieved in GWR-041, active leaching of uranium began. UBS grade from GWR-041 rose while pH declined. Uranium grade trended upwards to 25 g/L over four days, while injection pressure decreased. This suggests that leaching played a role in reducing resistance to flow. A peak sample grade of 43 g/L U was collected from GWR-041 after a further three days, so the acid injection phase was ended (on October 12). A global leaching recovery curve could be developed using the field testing and coreflood tests.	No discussion included herein.

F.2 2018 Column Leach and Groundwater Restoration Test

In early 2018, a column leach test with acid lixiviant was performed. The core material used for testing came from three drill holes. Select intervals of overlying very low-grade sandstone was blended with very high-grade intervals to create a composite feed grade of 24.2% U. Details on the core material used in the leach tests are provided in Appendix A to this response, in Table F-A1.

A total of 137 pore volumes (PVs) of uranium bearing solution (UBS) was generated at flow rate ranging between 2 to 4 PV/d. A 90% recovery was achieved with a peak individual sample uranium grade of 27.4 g/L and average UBS grade of 8.4 g/L U. Following the leaching, the column was flushed with simulated groundwater to simulate groundwater restoration. Analytical results from the first pore volume of water removed from the column during the restoration phase are incorporated into the range in UBS composition at the end of mining presented in Table F-2.

Flushing of the column with simulated groundwater (Phase 1 of restoration) was continued for 84 pore volumes. Phase 2 (RPV 84-108) circulated simulated ore zone water quality fortified with 1 g/L Bicarbonate [from $NaHCO_3$]. The test simulated the operation of a Reverse Osmosis (RO) water treatment step where solution exiting the column would be treated prior to being re-introduced. Phase 3 (RPV 108-114) re-established injection of simulated groundwater quality. The objective of this phase was to displace the bicarbonate and to ensure ground water stability once the circulation of fluid is halted. Analytical results for groundwater collected during this restoration process are shown in Table F-9 and Table F-10. Information presented in those tables is discussed further in Section F-9.

F.3 Column and Coreflood Tests

The following were common to all column and coreflood tests performed**:**

- The pore volume was determined by pumping water (deionized water, site groundwater) into each column or core until filled.
- Temperature was controlled to 10°C by placing the apparatus in a walk-in cooler.
- An online UBS or Remediation/Flushing Solution sample was taken daily.

Table F-2: UBS Chemistry at end of Leaching (Mining)

Test	Units	Coreflood 2B (2021)	Coreflood 3C	Number of Samples	Range of Values of UBS constituent concentrations across Metallurgical tests from 2018-2021 representative of End of mining conditions		Baseline Ore Zone Groundwater Chemistry
Sample Name		**D-CF2B-57**	**D-CF3C-142**		**Minimum**	**Maximum**	**GWR-032 (2021-06-04)**
Acidity	mg/L			5	65000	87000	
Bicarbonate	mg/L	-	-	6	0	<1	118
Carbonate	mg/L			5	<1	<1	<1
Chloride	mg/L			1	<10	1220	220
Hydroxide	mg/L			0	<1	<1	<1
P. alkalinity	mg/L			0	<1	<1	<1
pH	pH units	2.1	1.1	13	0.63	2.10	6.83
Specific Conductance	uS/cm			9	52100	303000	860
Eh	mV			10	580	870	
Sum of ions	mg/L			5	52700	70100	504
Total alkalinity	mg/L			5	<1	<1	97
Total hardness	mg/L			5	202	1480	182
Nitrate	mg/L			5	<4	<40	<0.04
Fluoride	mg/L			5	1	34	0.23
Total dissolved solids	mg/L			5	8970	47900	599
Calcium	mg/L	557	723	13	58	723	55
Magnesium	mg/L	47	<63	13	<10	240	11
Potassium	mg/L	148.8	<86	13	6.2	149	4.6
Sodium	mg/L	17.9	<77	13	6.0	12300	81
Aluminum, dissolved	mg/L	1738	71	13	69	4609	0.0006
Antimony, dissolved	mg/L			5	0.040	1	<0.0002
Arsenic, dissolved	mg/L	<0.1	<1	13	<0.1	21	0.2
Barium, dissolved	mg/L	<0.1	<1	13	<0.05	<0.5	0.063
Beryllium, dissolved	mg/L			5	0.07	0.4	<0.0001
Boron, dissolved	mg/L			1	<1	<10	0.43
Cadmium, dissolved	mg/L	<0.1	<1	13	0.018	1.809	<0.00001
Chromium, dissolved	mg/L	9.1403	<1	13	<0.1	9.140	<0.0005
Cobalt, dissolved	mg/L	5.41	<1	12	0.5	15	<0.0001
Copper, dissolved	mg/L	5.16	10.23	13	5.2	964	<0.0002
Iron, dissolved	mg/L	3309	4094	13	820	4094	4.2
Lead, dissolved	mg/L	0.97	19.45	13	0.20	19	<0.0001
Manganese, dissolved	mg/L	16.35	<81	13	2.70	41	0.22
Molybdenum, dissolved	mg/L	1.65	59.57	13	1.65	60	0.0038
Nickel, dissolved	mg/L	15.7	<1	13	<1	27	0.001
Selenium, dissolved	mg/L	18.4	<1	13	<0.025	26	<0.0001
Silver, dissolved	mg/L			5	<0.005	<0.05	<0.00005
Strontium, dissolved	mg/L	5.2	<1	7	0.60	5	1.66
Thallium, dissolved	mg/L	-	-	5	0.05	<0.2	<0.0002
Tin, dissolved	mg/L	-	-	5	0.07	0.30	-
Titanium, dissolved	mg/L			5	2.80	32	<0.0002
Uranium, dissolved	mg/L	7.45E+03	3.88E+04	13	7.70E+02	3.88E+04	1.10E-02
Vanadium, dissolved	mg/L	160.88	62.57	13	6.16	161	<0.0001
Zinc, dissolved	mg/L	134.37	4.03	13	2.30	331	2.62
Sulfur	mg/L	9,263	22,877	13	5211	209411	4.3
Phosphorous	mg/L	-	75.4	13	2	75	<0.01
Silica, soluble, dissolved	mg/L	-	-	6	31	192	13.3
Radium-226*	Bq/L	-	-	4	230	3000	180
Radium-228*	Bq/L	-	-	1	5	5	-
Lead-210*	Bq/L	-	-	4	600	1700	2200
Polonium-210*	Bq/L	-	-	4	290	2000	110
Thorium-230*	Bq/L	-	-	4	21000	220000	7
Thorium-232*	Bq/L	-	-	4	2	12	-
Radium-226*	mg/L	-	-	4	6.29E-06	8.21E-05	4.92E-06
Thorium-230*	mg/L	-	-	4	2.75E-02	2.88E-01	9.17E-06

Notes

* Analytical results for radionuclides are limited. The ranges of radionuclide concentrations (Bq/L) provided are considered conservative because they reflect composite samples collected over the ISR leaching period in the 2021 column samples, not UBS at the end of mining

Analytical results for Coreflood 2B and 3C are provided (in addition to the range of UBS Constituent Concentrations) because results from the remediation portion of these tests was used for development of the Restored Solutions modelled in the draft EIS (Appendix 7-C)

Used to highlight baseline groundwater quality in the ore zone for comparison with UBS Composition at end of mining.

F.4 2021 UBS Column Tests

The objective of the 2021 column tests was to test leach recoveries on a range of feed grades. Four samples were generated from nine drill holes, all proximal to the WS Shear where most of the resource lies. The samples contain varying amounts of uraninite, sulphides, clay and iron and represent blends of the various hydrogeologic units within the deposit (HGUs). Samples were crushed to -10 mm. Columns with a diameter of ~100 mm were packed with the samples. Four column tests were conducted, with details for each sample listed in Table F-3.

The 2021 column tests used the full-size distribution of crushed core and achieved relatively high mineral liberation in contact with lixiviant. This results in relatively rapid leach kinetics compared to intact core. The initial flow rate was calculated based on a retention time of eight hours (3 column pore volumes per day (PV/d)).

Table F-3: Summary of Samples for Column Test 1 to 4

Column No.	Sample ID	Mass (g)	Feed U_3O_8 (wt%)[a]	HGUs in Blend[b]	Hole IDs	Number of PVs - Leaching	Number of PVs - Remediation
1	Sample A	27,338	48.1	2A/B/C/D	GWR-10, 16, 19, 21	116	6.7 (D.I. Water)
2	Sample B	18,619	46.1	2B	GWR-10, 19, 23, 26	120.4	16.5 (Site GW, 10g/L NaOH Solution)
3	Sample D	9,180	1.8	2A/C/D/E	GWR-15, 16, 19, 26	14.7	15.5 (Site GW, 10g/L NaOH Solution)
4	Samples C&E	8,742	26.9	2A/C/D/E	GWR-01, 19, 22	29.7	11.2 (Site Water, 1.5g/L NaHCO3)

Notes

[a] Back Calculated

[b] HGUs = Hydrogeological Units in the Ore Zone

A single pass flow of dilute sulfuric acid and hydrogen peroxide lixiviant was run between 22 to 38 days. Lixiviant strength was generally decreased over the course of each run. UBS composition from each of the column leach tests at the end of leaching is shown in Table F-2.

On completion of the leaching tests, each column was flushed with water (de-ionized water or groundwater) and for columns #2, #3 and #4, neutralization of groundwater was evaluated using alkaline solutions. Solutions used and porewater volumes flushed are summarized in Table F-3. Analytical results for solution composition during the remediation phase are included in Table F-9 and Table F-10.

Mineralogy of the column samples pre-testing were analyzed by XRD and QEMSCAN; the mineral assemblages aligned with the overall understanding of the ore zone mineralogy as presented in Table 3-1. XRD results for the fine particles are provided as Table F-4. These results show the formation of secondary sulphate minerals during the uranium ore leaching process. The other mineral phases are associated with the (pre-mining) ore zone mineralogy (Table 3-1).

Table F-4: XRD Results for Fine Particles in UBS, Column Experiments #1 to #4 (2021)

Mineral Phase	Column #1	Column # 2	Column #3	Column #4
Anglesite	18.1	9.8	-	6.6
Anhydrite	7	-	-	-
Biotite	-	38	24.2	8.3
Chlinochlore	62.6	21.2	20.3	20.1
Gypsum	-	4.4	-	-
Kaolinite	-	22	41.1	57
Quartz	-	-	5.4	-
Pyrite	12.3	4.6	8.9	7.1

Notes

Secondary Minerals

F.5 2022 Column Leaching and Remediation Tests

A suite of 5 column leaching tests was undertaken to support remediation planning. Whereas core flood testing may more realistically represent the ISR conditions with respect to operational conditions (i.e., using intact core and pressure applied), this phase of column testing used crushed material to accelerate the testing process and, thus, provide key information on the remediation phase and prepare for the (2022) field feasibility study.

The 2022 column testing program consisted of five 100mm diameter columns loaded with samples from different HGUs providing characterization of ore variability. The samples were selected from a blend of assay sample splits of fresh core from GWR-054 through GWR-061, supplemented by preserved core from GWR-016, GWR-022 and GWR-024 stored frozen by Denison. The hole locations are shown Figure F-1 ranging along the length of the deposit. Intervals from five to eight different drill holes were composited to meet required sample mass and/or to meet representativeness for each HGU.

The samples were hand crushed to minimize fines generation, to a maximum size of 30 mm. Minimum size fraction was +0.212 mm by wet screening out fines. This was designed to promote flow through the column and minimize exposed mineral surface area. Overall procedures were like 2021 column tests. The lixiviant was a mixture of sulphuric acid and hydrogen peroxide and was prepared using Wheeler River groundwater. Lixiviant was injected upwards in essentially flooded plug flow conditions. The flow rate was calculated based on ~0.67 measured column

PV/d. Test parameter variables were minimized, so the differences between HGUs could be distinguished.

Initially, all five columns were fed lixiviant from a common tank. The low-grade columns 2A and 2E were run until fully leached. From that point forward, 2A and 2E were fed from a separate tank to perform groundwater flush and neutralization. A summary of details of the column tests including pore volumes during leaching, during post-leaching flushing with groundwater, and during neutralization are provided in Table F-5.

UBS composition at the end of the leaching period is provided in Table F-2, and groundwater quality following the groundwater flushing and neutralization is provided in Table F-9 and Table F-10.

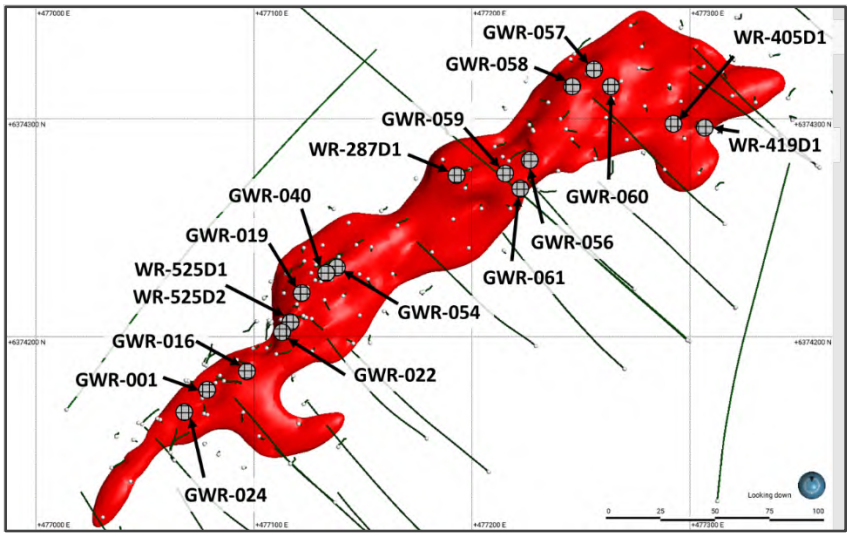

Figure F-1: Metallurgical Hole Locations for 2022 Column Leach Testing

Table F-5: 2022 Column Leach Testing Details

Columns	2a	2b	2c	2d	2e
Estimated Grade (wt % U3O8)	5.0%	58.3%	41.3%	46.1%	1.6%
	Numbers of Pore Volumes				
Phase 1: Groundwater equilibration	2.9	3.1	3.0	2.8	3.1
Phase 2: In-Situ Recovery (ISR)	20.8	66.7	64.1	62.4	19.4
Phase 3: Groundwater Flushing	15.0	16.2	15.1	11.6	14.9
Phase 4: Neutralization	4.4	4.2	11.0	2.6	3.7
Total Pore Volumes	43.1	90.3	93.1	79.4	41.1
pH at end of Phase 2	0.93	0.95	0.91	0.91	0.95
pH at end of Phase 4	9.53	7.1	3.8	7.22	7.87

QEMSCAN was done on the column pre-testing and at the end of the flushing period. The results are presented as Table F-6. Mineral phases that reflect basement-derived materials in the ore zone residuals include biotite, spodumene, petalite and garnet.

Table F-6: 2022 Column Leach Test QEMSCAN results

QEMSCAN	Column 2a		Column 2b		Column 2c		Column 2d		Column 2e	
	Pre-Test (Feed)	Post-Test (Residuals)	Pre-Test (Feed)	Post-Test (Residuals)	Pre-Test (Feed)	Post-Test (Residuals)	Pre-Test (Feed)	Post-Test (Residuals)	Pre-Test (Feed)	Post-Test (Residuals)
Mineral	**2A-BATCH-1**	**DCL-2a-R**	**2B-BATCH-1**	**DCL-2b-R**	**2C-BATCH-1**	**DCL-2c-R**	**2D-BATCH-1**	**DCL-2d-R**	**2E-BATCH-1**	**DCL-2e-R**
Anglesite		3.84		3.28		3.99		14.18		1.15
Biotite	4.84	1.38	0.25	0.44	4.26	0.83	1.16	1.41	2.96	1.98
Bornite	0.36	0.07					0.70	1.15	0.43	0.20
Calcite			0.42	0.69		0.14				
Chalcocite (CuS)			1.54		0.28		0.31		1.28	
Chalcopyrite	12.37	13.03	0.71	2.27	0.11	0.16		0.25	8.76	3.48
Chlorite				3.15						
Clinochlore-(Fe)		11.34				0.8		9.39		52.26
Covellite (CuS)	0.35	0.38	0.19	2.61	0.39	1.34	0.06	0.18	0.10	0.20
Fe-oxide		0.03				1.15		0.53		0.03
Galena	0.63	0.40	0.43	1.23	0.25	0.3	0.53	3.06	0.10	0.02
Garnet	0.25				2.52		1.47		0.43	
Goethite-Clay mix	4.31	0.03	0.35	0.10	7.37	16.78	10.95	1.66	1.52	0.41
Illite	0.21	0.52		0.05					0.32	0.67
Ilmenite		0.08				0.09				0.47
Kaolinite	42.04	40.41	1.52	3.28	7.12	11.67	0.75	2.09	62.20	28.63
Muscovite	9.46	6.09	0.79	3.35	0.81	1.2	0.15	2.06	13.69	8.79
Petalite		0.15		0.05				0.03		0.02
Pyrite	8.48	10.44	1.49	3.38	0.98	1.58	0.12	0.09		0.84
Quartz	4.40	9.11		1.05	0.05	0.42		1.74	1.01	0.12
Rutile	0.61	0.58	0.07	0.04	0.04	0.04			0.44	0.32
Sphalerite	0.56	0.41		0.04	0.03			0.02		
Spodumene		0.17		0.05		0.16				0.05
Uraninite	10.70	1.07	92.10	74.89	75.74	58.72	83.73	61.93	6.67	0.29
Zircon	0.36	0.45	0.06	0.02		0.04				
Siderite						0.54				

F.6 2018-2022 Coreflood Tests

Core testing machines (CTM) were typically used to study in situ oil recovery processes, for flooding uranium deposit drill core with lixiviant to simulate ISR conditions on a micro scale which are referred to as coreflood tests. All drill cores tested were from vertically oriented drill holes allowing the flow from end to end of the coreholder to simulate flow in the vertical direction of the deposit. This is tangential to the intended predominantly horizontal flow path between wells in situ.

From late 2019 to mid-2021, coreflood tests numbered 1, 2A, 2B, 3A, and 3C were performed. The main objective was to simulate the in situ field conditions, to understand and develop the lixiviant conditions necessary for successful full-scale ISR. Priority was placed on testing a large number of samples over short durations. Tests were ended early, so, uranium recoveries were low relative to later testing (generally < 10%). Results for Coreflood 2B and 3C are discussed further herein.

Coreflood 2B and 3C

Details for the testing of Coreflood 2B and 3C are provided in Table F-7.

Table F-7: 2021 Coreflood Test Details

Coreflood	**2B**		**3C**	
Corehole	GWR-024		GWR-019	
Core Dimensions (average diameter, average length), in mm	60 x100		78*70	
Core Pore volume (mL)	36.9		53.1	
Estimated Grade (wt % U3O8)	24		70.7	
	Number of Pore Volume	pH (at end of Leaching or Remediation Phase)	Number of Pore Volume	pH (at end of Leaching or Remediation Phase)
In-Situ Recovery (ISR)	34.4	2.1	82.7	0.98
Groundwater Flushing	22.7	1.91	91.6	2.83
Neutralization with NaOH	55.6	11.92	-	-
Neutralization with $NaHCO_3$	-	-	62.4	6.87
Post-Neutralization Groundwater Flush	9.3	11.47	17.2	6.43
Total Pore Volumes	122	-	253.9	-

The UBS composition at the end of leaching for Coreflood 2B and 3C is provided in Table F-2. The analytical results for these samples were provided in Table F-2 because Corefloods 2B and 3C were the primary basis for the development of the restored solutions. UBS composition during

flushing for these coreflood tests is discussed further in Section F-9 and is summarized in Table F-9 and Table F-10.

At the end of testing, the core from Coreflood 2B was frozen. The frozen core was cut in the middle into two sides. XRD, QEMSCAN and SEM was done on one half of the sample, on the inside cut. The XRD results indicated:

- 19.5 wt% Kaolinite
- 26.7 wt % Montmorillonite
- 45.3 wt % Dickite
- 2.9 % Fluorite
- 5.6 % Pyrite

The cumulative uranium recovery for core 2B was low, and thus the sample (post-leaching) has a mineralogical composition comparable to that of the unmined ore zone. The portion of the sample that underwent mineralogical analysis was also rich in clay minerals. The QEMSCAN results are shown in Figure F-2. The SEM image (not shown) shows the presence of uraninite, pyrite, and sphalerite.

The QEMScan shows a minor amount of mineral phase suggestive of a small amount of jarosite ("Fe-Al-Si-S") closely associated with pyrite. This suggests formation of oxidation products/secondary minerals in the core with exposure to lixiviant.

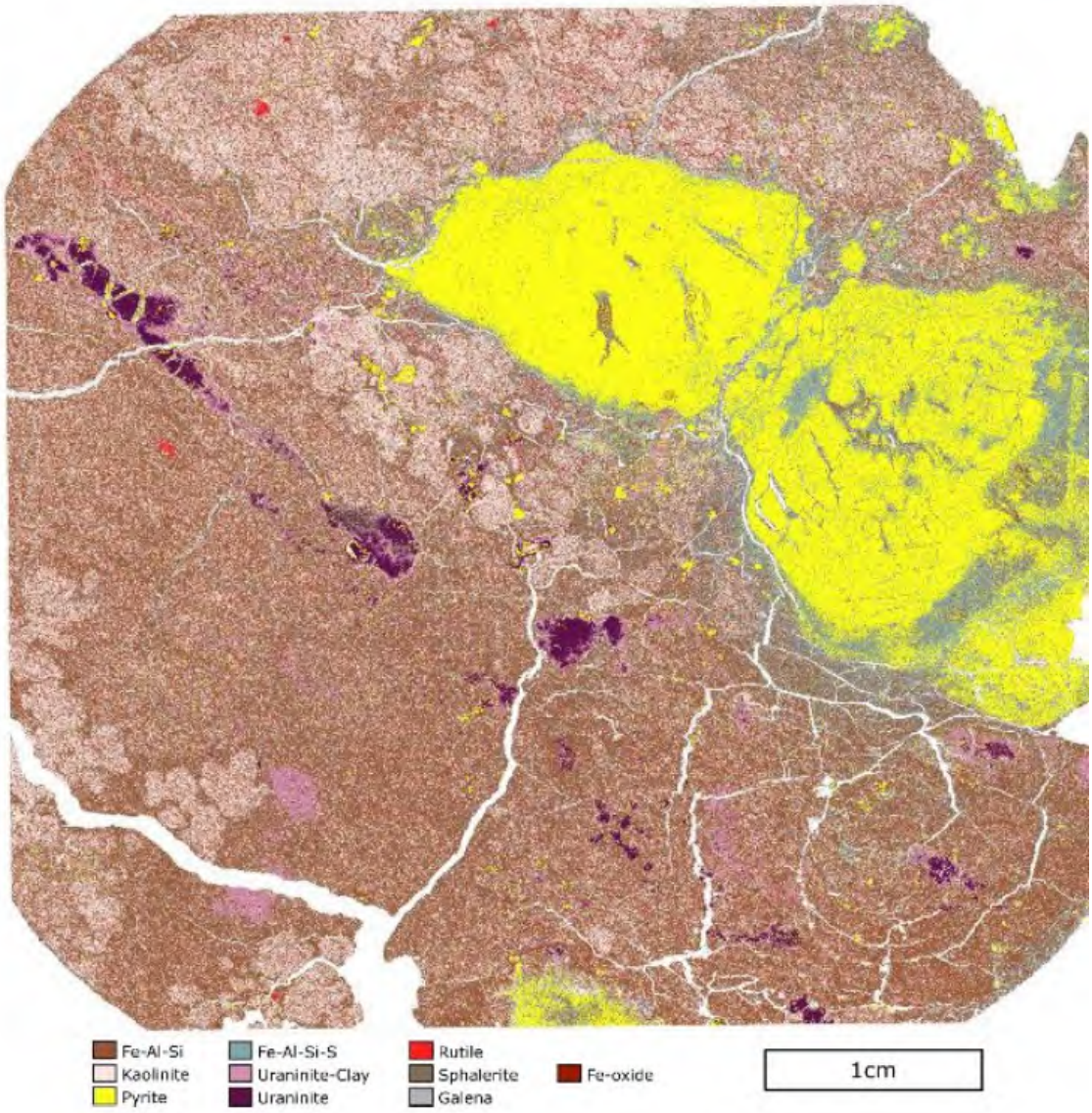

Figure F-2: Coreflood 2, QEMSCAN

Coreflood 4

The Coreflood 4 sample was taken from a high-grade segment of HGU 2C from hole GWR-040, which is the middle CSW in the planned field feasibility test (FFT) well pattern. Thus, it was an excellent candidate to correlate with subsequent FFT results.

Coreflood 4 feed sample side view is shown in Figure F-3Figure. Near-horizontal mineral banding is evident.

Figure F-3: Coreflood 4 Feed Sample Side View, Prior to Placement in Coreflood Machine

Coreflood 4 ran for a total of 113 PVs over 391 days, with life-of-test average UBS grade of 18.7 g/L U and reagent consumptions of 2.78 kg H_2SO_4 and 0.35 kg H_2O_2 per kg U. Part of the difficulty of production ramp-up of Coreflood 4 was due to the flow constraint of low micro scale permeability through the intact core, particularly with generally lower permeability in the vertical flow direction of coreflood samples. As uranium mass gradually leached away, there was a mild trend of increasing flow rate at the same pressure, indicating permeability increase.

In total, 51.8% of the initial dry mass of the sample was removed by leaching. Just over half of the mass loss is accounted for by uranium leaching, and the remainder is accounted for by gangue mineralization leaching. The feed grade was back calculated from measurements of the total uranium in UBS collected throughout the test plus leach residue sections. Feed grade was 26.66% U_3O_8, and final recovery was 97.1%. Coreflood 4 is the most comprehensive simulation of ISR for the Phoenix FS, with the highest recovery demonstrated from an intact core to date.

Coreflood 4 provides the most information about the mineralogical and hydrogeochemical changes that are occurring in the ore zone during mining. Post-leaching, the core leached in Coreflood 4 was cut into segments, as shown in Figure F-4, assayed and visually examined (photographed) for changes to the core due to leaching. The mineralogy of each section was determined.

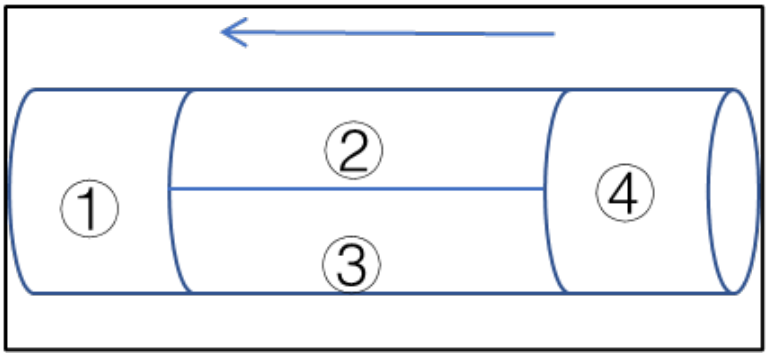

Figure F-4: Coreflood 4 Cut Sections and Direction of Flow

Coreflood 4 feed side puck (Section 4), inlet face view is shown in Figure F-5. The feed end was deeply eroded, nearly through to the discharge side of the section.

Figure F-5: Coreflood 4 Feed Side Puck (Section 4), Inlet Face View

Coreflood 4 middle (Section 2), centre longitudinal cut face view is shown in Figure F-6. It was strongly bleached throughout, with cracks that appeared after drying.

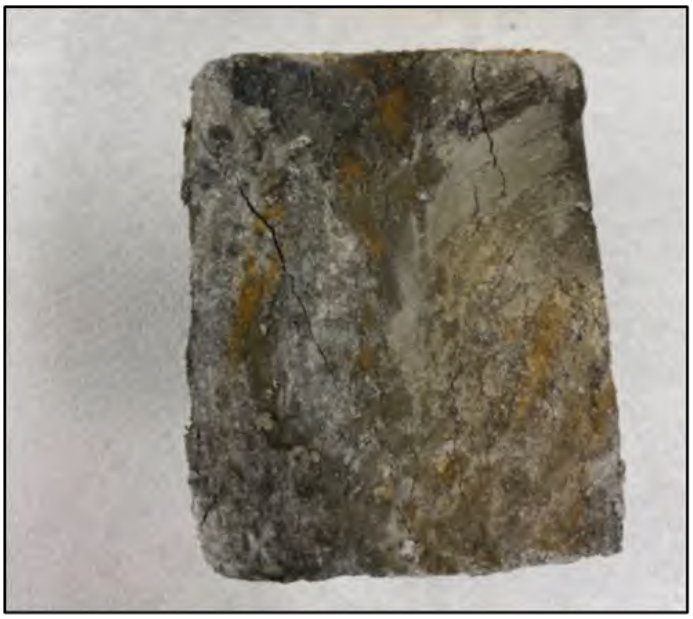

Figure F-6: Coreflood 4 Middle (Section 2), Centre Longitudinal Cut Face View

Coreflood 4 discharge end puck (Section 1), inlet face view, dried, is shown in Figure H-7. It was strongly bleached across the entire cross-section.

Figure F-7: Coreflood 4 Discharge End Puck (Section 1), Inlet Face View, Dried

XRD for each of the sections is given in Table F-8. Mineral phases that reflect basement-derived materials in the ore zone residuals include anorthite.

Table F-8: XRD Results for Coreflood 4 Core Sections

Mineralogical Composition Post-Extraction	D-CF4A-1	D-CF4A-2	D-CF4A-3	D-CF4A-4
Location/section in the coreflood column	Discharge End	Midsection	Midsection	Feed End
Kaolinite (Al2Si2O9H4)	74.7	22.1	38.3	43.8
Pyrite (FeS2)	17.9	20	12.4	16
Chamosite (Mg2.518Fe2.482)Al1.2Si3.8O18H10) (Chlorite Group)	7.3	5.8	1.4	--
Gypsum (CaSO6H4)	--	7.5	4.5	4.8
Barite (BaSO4)	--	1.6	0.7	--
Anorthite (CaSiAl2O8)	--	30.7	31.8	--
Goethite (FeO2H)	--	12.4	10.9	4.3
Anglesite (PbSO4)	--	--	--	31.1

F.7 Composition of the UBS remaining in the Ore Zone at the end of Mining

The analytical results for the UBS composition in Coreflood 2B and 3C are shown in Table F-2, along with a range of UBS composition that was developed from the relevant analytical results for a total of 13 samples from across the column and coreflood tests. The ranges of values for constituents of potential concern (COPCs), as defined in Appendix 7-C of the draft EIS, are provided in Table F-2. Uranium and other COPC concentrations generally vary by 2-3 orders of magnitude. There is expected variability in the UBS composition because of the nature of the deposit, which has been captured in the conditions of the metallurgical testing, and the nature of the testing (e.g., core vs. crushed rock, test duction, lixiviant composition, etc.,). The analytical results were given explicitly for Coreflood 2B and 3C because of the use of results from these coreflood tests to develop the restored solutions, which is discussed further in Section F-9.

F.8 Mineralogical and Hydrogeochemical Changes to the Ore Zone with Mining

Understanding of changes in the mineralogy of the ore zone with mining are informed by the XRD results from Coreflood 4, as this test was terminated at the completion of the ISR process, and QEMSCAN results for the 2022 columns, because these tests provide quantitative information on the mineral assemblage following mining and with remediation. The following conclusions are made with respect to changes in the mineralogy in the ore zone with mining:

- The mining process is effective as leaching uraninite from the ore zone and also results in partial dissolution of sulphide minerals (pyrite, sphalerite, galena, etc.,);

- Secondary sulphate minerals are formed as a result of the mining process. The associated equations are shown in Appendix A. Jarosite minerals were suggested surrounding pyrite particles in the QEMSCAN of Coreflood 2, but were not detected in any of the other post-mining residuals. Gypsum and barite were detected in XRD but not present at quantifiable levels in association with the 2022 column residuals. Formation of anglesite is shown by XRD and QEMSCAN in post-mining residuals.

- The elevated concentration of aluminum in solution evidences clay mineral dissolution, but overall the relative abundance of clays in the ore zone increases with ISR mining, as would be expected with ore dissolution.

The hydrochemistry of the ore zone post-mining is presented in Appendix F, Table F-2. Consistent with the dissolution of parent minerals and the pH of the UBS, most COPCs concentrations in the UBS at the end of mining are elevated with respect to baseline groundwater conditions in the ore zone.

F.9 Composition of the Restored Solutions

The restored solutions were developed using the metallurgical data that were available when conditions in Post-Decommissioning were being conceptualized in 2020-2021 for numerical modelling (presented herein) and effects assessment. This included the early results on acid leaching of the core (2018) and Coreflood 2B and 3C results. At that time, the coreflood tests provided the most detailed information from which to develop the chemistry of the Restored Solutions #1 and #2, using the remediation portion of the tests. From the results of that testing, "Restored Solution #1" and "Restored Solution #2" (Table 3-5) were developed to represent the bounding scenarios for groundwater quality considered in the reactive transport model to evaluate the potential for environmental effects following remediation of the mining area. As is discussed further below, these solution compositions were developed to reflect remediation of the ore zone through flushing and neutralization, without over-neutralization – meaning, base addition past circumneutral conditions to alkaline conditions.

Since that time, more information from the column and coreflood tests has become available that supports the composition of the Restored Solutions put forward in the draft EIS as being representative of porewater within the mining zone with remediation.

When developing the restored solutions for the draft EIS, the approach was generally to select concentrations for any given element/parameter that represented a low to mid-range value for the COPC from the metallurgical testing solutions, to be conservative with respect to evaluating potential effect, but also to reflect the goal of the remediation (to align with ALARA, as is discussed below). For dissolved uranium, the concentration in Restored Solutions #1 and #2 were set to upper bounds of 100 mg/L and 30 mg/L, respectively. In some cases, like Co and Ni, the values selected for modelling were identified to be on the high end upon subsequent metallurgical testing. Thus, the concentrations for these elements modelled are conservative with respect to anticipated pore water concentrations of these elements post-remediation. The basis of the selected concentrations for Restored Solution #1, which was the solution modelled in this report, is provided below in Table F-9. As Restoration Solution #1 contains the higher remaining concentrations, and lower pH (i.e., differs more from baseline conditions in the ore zone), this solution was carried forward for geochemical reactive transport modelling to evaluate environmental effects.

Table F-9: Groundwater Chemistry basis for Restored Solution #1

Metallurgical Test		2018 Pre-Feasibility; Restoration Phase Data	Coreflood 2B	Coreflood 2B	Coreflood 2B	Coreflood 3C	2021 Column, 2	2021 Column, 3	2021 Column, 4	2022 Column, 2a	2022 Column, 2c	2022 Column, 2d	2022 Column, 2e	2022 Column, 2e	Restored Solution #1	Notes on Value Carried Forward in Restored Solution for Model
Sample Name		RPV30-23	D-CF2B-121-143	D-CF2B-134-144,146	D-CF2B-COMBINED-1 (D-CF2B-134-144,146)	D-CF3C-225-237	D-CL2-FW-2	D-CL3-FW-2	D-CL4-FW-2	D-CL2A-68	D-CL2C-114	D-CL2D-111	D-CL2E-63	D-CL2E-68		
Statistic		-	Average Value[a]	Average Value[a]	-	Average Value[a]				-	-	-	-	-		
Remediation Method		GW Flush	NaOH Neutralization	NaOH Neutralization	NaOH Neutralization	Bicarbonate Neutralization	Groundwater	Groundwater	NaOH Neutralization	NaOH Neutratlization	GW Flush	GW Flush	GW Flush	NaOH Neutratlization		
pH	pH units	3.87	4.4	4.42	Same as adjacent (D-CF3C-238-256)	2.97	2.6	2.44	2.66	3.80	2.58	2.46	2.48	4.05	4.3	High end of observed
Eh	mV		520	525		598					570	542	426	648	-	Set in model to reflect oxidized conditions
Pore Volumes of remediation	-	30-32	59-74	69-76		109-130				19.4	15.1	11.6	14.9	18.6	-	
Aluminum, dissolved	mg/L	5.6	9.7	10.3	7.0	<5	5.4	26	9.1	9.0	9.9	12	32.8	15.6	7	Low end of observed
Arsenic, dissolved	mg/L	<0.010	0.17	0.22	0.03	0.48	0.15	0.31	0.1	0.02	0.14	0.06	0.4	0.012	0.06	Low end of observed
Barium, dissolved	mg/L	<0.05	0.10	<0.1	<0.05	<0.1	<0.005	<0.05	<0.05	<0.05	<0.05	<0.05	0.006	0.018	0.05	Mid range of observed
Total Inorganic Carbon (C(4))	mg/L		-	-	-										58	Assumed to be approximately equivalent to GW values and considers some bicabonate
Calcium	mg/L	109	228	210	-	81.7	11	43	23	21	22	380	20	35	110	Mid range of observed
Cadmium, dissolved	mg/L	<0.001	<0.1	<0.1	0.015	<0.1	0.061	0.033	0.020	0.051	0.001	0.004	0.0004	0.0003	0.015	Mid range of observed
Chloride	mg/L	37			-		1	<1	1	33	<1	6	3	9	200	Very limited information available. Set to a higher value to consider potential for values closer to baseline ore zone water quality
Cobalt, dissolved	mg/L		2.8	2.1	2.0	<0.1				0.15	0.03	0.16	0.53	0.42	2	High end of observed
Chromium, dissolved	mg/L	0.04	0.22	0.14	<0.05	<0.1	0.18	0.76	0.16	<0.05	<0.05	<0.05	0.17	0.013	0.05	Mid range of observed
Copper, dissolved	mg/L	2.23	0.21	0.24	0.17	<0.1	6.2	5.8	9.2	25	3.1	3.2	20.1	4.7	0.17	Low end of observed
Fluoride	mg/L	NA	-	-	-		2.4	0.32	1.6	3	6.0	4.2	2	3		No data available at time of developing Restored Solution
Iron, dissolved	mg/L	54.1	378	334	324	13.0	23.2	92	40	124	33	75	74	57	100	Mid range of observed
Potassium	mg/L	<1	10.1	9.5	-	<8	3.5	4.7	1.5	3.7	1.5	5.6	1.9	1.4	9	High end of observed
Magnesium	mg/L	3.7	-	-	-	<6	0.6	11	0.2	3.0	0.4	4.4	38	43	6	Mid range of observed
Manganese, dissolved	mg/L	0.68	9.3	-	3.4	<8	0.57	0.63	0.85	2.0	0.98	4.1	0.31	0.30	3.4	Mid range of observed
Molybdenum, dissolved	mg/L	0.05	0.22	0.22	0.10	<0.1	0.16	2.1	0.10	0.05	0.05	0.03	0.58	0.019	0.1	Mid range of observed
Sodium	mg/L	221	283.2	351.0	-	120	3.1	4.1	2.8	760	3.0	4.3	3.7	378	190	Mid range of observed
Nickel, dissolved	mg/L	0.20	12.8	10.0	9.7	<0.1	0.56	3.2	0.75	0.55	0.06	0.35	1.04	0.92	9.7	High end of observed
Lead, dissolved	mg/L	3.08	2.9	3.41	3.1	1.8	4.97	0.68	0.96	1.3	0.22	0.10	2.64	0.50	3.1	Mid-high range of observed
Sulfate	mg/L	860	2700	2724	-	679	300	750	480	2180	470	1460	690	1220	620	Mid range of observed
Selenium, dissolved	mg/L	<0.025	0.31	0.23	0.08	<0.1	0.39	0.10	0.13	0.01	0.02	0.05	0.042	0.098	0.08	Mid range of observed
Si	mg/L	71.9	-	-	-										40	limited information available; value similar to available data assumed
Strontium, dissolved	mg/L		4.5	4.4	4.4	3.2	0.32	0.70	0.22	0.62	0.43	0.58	0.67	0.76	4.4	Upper range of observed
Zinc, dissolved	mg/L	1.48	1.6	1.4	1.4	0.14	1.7	3.6	3.0	10	0.14		0.20	0.13	1.4	Mid-range of observed
P	mg/L		-	-		<4									4	applied limited information
Uranium	mg/L	105	586	334	338	45.2	92	217	579	145	288	328	38.1	30.8	100	Mid-low end of observed; value set as upper bound in the EIS
Vanadium, dissolved	mg/L	0.09	2.9	0.8	0.51	0.32	0.35	2.8	1.1	0.13	0.70	0.51	1.8	0.006	0.51	Low end of observed
Polonium-210	Bq/L	6.3+/-0.5	-	-	1600	-	-	-	-	-	-	-	-	-		Not modelled (lack of thermodynamic constants)
Radium-228	Bq/L	-	-	-	<10	-	-	-	-	-	-	-	-	-		Not modelled
Thorium-228	Bq/L	-	-	-	<3	-	-	-	-	-	-	-	-	-		Not modelled
Thorium-230	Bq/L	105+/-9.6	-	-	<500	-	-	-	-	-	-	-	-	-		See Below for values in mg/L
Radium-226	Bq/L	65.8+/-0.3	-	-	<200	-	-	-	-	-	-	-	-	-		See Below for values in mg/L
Lead-210	Bq/L	530+/-1.3	-	-	2400	-	-	-	-	-	-	-	-	-		Not modelled (transport behaviour taken into account with Pb
Thorium-232	Bq/L	0.2+/-0.04	-	-	0.05	-	-	-	-	-	-	-	-	-		Not modelled
Radium-226	mg/L	1.80E-06	-	-	<5.47E-06	-	-	-	-	-	-	-	-	-	5.47E-06	Limited data, high end value[b]
Thorium-230	mg/L	1.38E-04	-	-	<6.55E-04	-	-	-	-	-	-	-	-	-	3.93E-06	Limited data set[b]

Notes

Data Available when developing the Restored Solutions for the modelling in Appendix 7-C of the EIS

[a] Arithmetic average values, calculated using detected measurements or where all values were non-detect, assumed the detection limit. pH value is the median, not the arithmetic average.

[b] Limited data set meant that PFS groundwater flushing data at pH 5.8 was also considered in setting this value, with a Th-230 concentration of 2.62E-07 mg/L and a Ra-226 value of 1E-05 mg/L (see Table IR-67-10)

Table F-10: Groundwater Chemistry basis for Restored Solution #2

Metallurgical Test		2018 Pre-Feasibility; Restoration Phase Data			Coreflood 3C	Coreflood 3C	2021 Column, 4	2022 Column, 2b	Restored Solution #2	Notes on Value Carried Forward in Restored Solution for Model
Sample Name		RPV 38-42	RPV 42-53	RPV 54-57	D-CF3C-238-256	D-CF3C-COMBINED-1 (D-CF3C-238-256)	D-CL4-FW-3	D-CL2b-116		
Statistic		-	-	-	Average[a]	-		-		
Remediation Method		GW Flush	Neutralization ($NaHCO_3$)	GW Flush	Bicarbonate Neutralization	Bicarbonate Neutralization	Distilled Water Flush Post NaOH Neutralization	NaOH Neutratlization		
pH	pH units	5.8	8.5	8.3	6.51	Same as adjacent (D-CF3C-238-256)	7.48	6.51	6.1	Low end of Observed
Eh	mV				402		-	387	-	Set in model to reflect oxidized conditions
Pore Volumes of remediation	-	76-84	82-108	-	131-162		-	18.70	-	
Aluminum, dissolved	mg/L	0.27	1.32	4.4	<5	0.56	0.70	10	0.56	Low end of observed
Arsenic, dissolved	mg/L	0.10	0.04	0.06	0.25	0.1	<0.01	0.000259	0.1	Upper end of observed
Barium, dissolved	mg/L	<0.05	0.05	0.04	<0.1	0.05	<0.05	0.2	0.05	Mid range of observed
Total Inorganic Carbon (C(4))	mg/L	-	-	-	-				105	Assumed to be approximately equivalent to GW values and considers some bicabonate neutralization
Calcium	mg/L	28	13	5	48.1		16	127	10	Low end of observed
Cadmium, dissolved	mg/L	0.002	<0.001	<0.001	<0.1	0.004	0.004	<0.1	0.004	Mid range of observed
Chloride	mg/L	15	2	12			6	-	50	Set to a higher value to consider potential for values closer to baseline ore zone water quality
Cobalt, dissolved	mg/L				0.11	<0.01		<0.1	0.01	Low end of observed
Chromium, dissolved	mg/L	<0.01	<0.01	<0.01	<0.1	<0.05	0.05	<0.1	0.05	Mid range of observed
Copper, dissolved	mg/L	0.04	<0.01	<0.01	0.12	<0.02	0.33	0.2	0.02	Low end of observed
Fluoride	mg/L	0.5	1.2	0.8			1.4	-	0.8	Mid range of observed
Iron, dissolved	mg/L	6.13	0.44	1.23	9.1	4.7	1.7	10	4.7	Mid range of observed
Potassium	mg/L	<1	<1	2	<8		1.2	<8	3.5	Mid range of observed
Magnesium	mg/L	<1	<1	<1	6.7		1.2	<6	3	Mid range of observed
Manganese, dissolved	mg/L	0.07	0.02	0.05	<8	0.48	0.28	<8	0.48	Mid range of observed
Molybdenum, dissolved	mg/L	0.03	0.05	<0.005	0.47	0.13	<0.01	0.4	0.13	Mid range of observed
Sodium	mg/L	36	235	87	251		351	887	90	Low range of observed
Nickel, dissolved	mg/L	0.03	<0.01	<0.01	0.10	<0.01	0.21	0.1	0.01	Low end of observed
Lead, dissolved	mg/L	2.13	0.36	0.39	0.20	0.32	0.25	10.0	0.32	Mid range of observed
Sulfate	mg/L	174	117	100	718.7		440	2480	136	Low end of observed
Selenium, dissolved	mg/L	<0.025	<0.025	0.026	0.86	<0.01	0.09	<0.1	0.01	Low end of observed
Si	mg/L	43.7	43.8	44.4				132.6	40	Mid range of observed
Strontium, dissolved	mg/L				2.0	2.4	0.20	0.7	2.4	Upper end of observed
Zinc, dissolved	mg/L	0.08	<0.01	<0.01	0.10	<0.05	0.46	0.1	0.05	Mid-range of observed
P	mg/L				<4			<5	4	applied limited information available
Uranium (mg/L)	mg/L	3.5	4.1	0.5	19.3	26.4	187	38.7	30	Upper End of Observed
Vanadium, dissolved	mg/L	<0.01	0.007	0.03	0.13	0.16	0.03	0.2	0.16	Upper end of observed
Polonium-210	Bq/L	14.9+/-0.3	1.9+/-0.1	2.7+/-0.1	-	280	-	-		Not modelled (lack of thermodynamic constants)
Radium-228	Bq/L	-	-	-	-	<2	-	-		Not modelled
Thorium-228	Bq/L	-	-	-	-	<1	-	-		Not modelled
Thorium-230	Bq/L	0.2+/-0.03	1.36+/-0.14	3.2+/-0.4	-	<100	-	-		See Below for values in mg/L
Radium-226	Bq/L	389+/-0.7	262+/-0.5	129+/-0.4	-	370	-	-		See Below for values in mg/L
Lead-210	Bq/L	301+/-0.7	40+/-0.3	22+/-0.2	-	660	-	-		Not modelled (transport behaviour taken into account with Pb modelled)
Thorium-232	Bq/L	<0.01	<0.01	<0.01	-	0.007	-	-		Not modelled
Radium-226	mg/L	1.06E-05	7.17E-06	3.53E-06	-	1.01E-05	-	-	1.01E-05	Limited data, high end value
Thorium-230	mg/L	2.62E-07	1.78E-06	4.19E-06	-	<1.31E-04	-	-	1.31E-06	Limited data set ; Low end of observed

Notes

Data Available when developing the Restored Solutions for the modelling in Appendix 7-C of the EIS

Data Available when developing the Restored Solutions for the modelling in Appendix 7-C of the EIS, but not considered in the development of Restored Solution #2 as pH was alkaline

[a] Arithmetic average values, calculated using detected measurements or where all values were non-detect, assumed the detection limit. pH value is the median, not the arithmetic average.

F.10 _Remediation of Mining Area within the context of ALARA

Decommissioning of the mining area will continue until recovered water reaches and is demonstrated to be stabilized (maintained) at acceptable mining area decommissioning objectives (Section 2.3.3.1.1 of the Revised Draft EIS). Such decommissioning objectives consider protection of plausible downgradient water uses. For the purpose of the assessment "plausible use" has been determined to be the protection of aquatic life in Whitefish Lake, since the numeric 3D groundwater modelling presented herein has indicated that Whitefish Lake is where groundwater associated with the remediated mining area will discharge to. It is within this frame of reference therefore that the ALARA concept should be considered. That is, ALARA can be defined for the purpose of the remediation of the mining area to the extent that subsequent discharge of groundwater to Whitefish Lake does not adversely affect aquatic biota in the lake.

The metallurgical testing done to date evidences an amelioration of UBS quality post-mining with flushing using groundwater and base (hydroxide or bicarbonate) to a restored solution of pH in the range of 4.5-5.5. The intent of the remediation approach is to raise the pH consistently but incrementally, so as to avoid over-neutralizing and yielding an alkaline solution. Alkaline pH conditions favour the formation of precipitates that are not desired from a physical (clogging) or chemical standpoint (secondary solids formed in place of removal of COPCs in the dissolved-phase from the subsurface). Potential environmental effects were thus evaluated based on plausible use, as defined above, at a pH and groundwater conditions that were shown to be achievable through groundwater flushing and addition of base without the risk of over-neutralization. Restored Solution #1 contains the higher remaining concentrations, and lower pH (i.e., differs more from baseline conditions in the ore zone) and was carried forward for geochemical reactive transport modelling to evaluate environmental effects.

It is noted that the freeze wall will remain in place during mining area remediation (Section 2.3.3.1.1 of the Revised Draft EIS), until decommissioning objectives are achieved to ensure there is no loss of tertiary control of the mining fluid (even in a diluted state). Refinement of the mining area decommissioning objectives and associated modelling will be done as the Project progresses through updates to the Decommissioning Plan; nevertheless, the objectives as they may evolve will be bound by the objectives evaluated in the EIS, which as shown are protective of aquatic biota in Whitefish Lake. The final acceptable mining area decommissioning objectives will be developed prior to initiation of groundwater remediation, as part of the Detailed Decommissioning Plan (DDP).

F.11 References

Denison (Denison Mines Corp), 2018. Prefeasibility Study Report for the Wheeler River Uranium Project, Saskatchewan, Canada. Report dated: September 24, 2018.

Denison (Denison Mines), 2023. Feasibility Study.

Appendix A

2018 Column Leach Testing

Table F-A1: Sample Inventory for 2018 ISR Column Leach Test

Original Sample Purpose	Sample I.D.	WR Hole No.	Lithology	Est. U%	Mass (g)	Mass U (g)
Porosity/Perm.	S066906	419D1	BSMT	0.22	320	0.61
Porosity/Perm.	S066907	525D2	SDST	0.06	323	0.17
Porosity/Perm.	S066908	405D1	SDST	0.06	270	0.14
Porosity/Perm.	S066909	405D1	BSMT	0.08	299	0.21
Porosity/Perm.	S066910	525D1	BSMT	51.72	843	375
Leach Testing	S066911	525D1	SDST	0.06	282	0.17
Leach Testing Composite Sample	S066912-S066916	525D1 525D2	SDST & BSMT	29.4	1,090	276
Leach Testing Total Composite Sample	S066906-S066916	405D1 419D1 525D1 525D2	SDST & BSMT	19.03 (wet)	3,427 (wet)	652.3

Reactions forming secondary sulphate minerals

K-Jarosite

$KFe_3(SO_4)_2(OH)_6 + 6H^+ = K^+ + 3Fe^{+3} + 2SO_4^{-2} + 6H_2O$

Barite

$BaSO_4 = Ba^{+2} + SO_4^{-2}$

Anglesite

$PbSO_4 = Pb^{+2} + SO_4^{-2}$

Gypsum

$CaSO_4{:}2H_2O = Ca^{+2} + SO_4^{-2} + 2H_2O$

Denison Mines

Wheeler River Project

Final Environmental Impact Statement

November 2024

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Section 8: Engagement Database Summary Table – Surface Water Quantity

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-EN-MN-SR3-1.2	1	Site Visit	2019-08-23	Denison hosts the MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals at the Project site for a site tour and to discuss the Project, along with representatives from the Canadian Nuclear Safety Commission and the Province of Saskatchewan, Ministry of Environment.	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Are there ponds for waste and waste rock?	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. As part of waste management, Project components include a process precipitate pond, an industrial wastewater treatment plant precipitate pond, a special waste pad, and a clean waste rock pad. Additional detail can be found in the Project Description section of the EIS.
19-EN-ML82-1.3	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Waste water would be treated?	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Wastewater will be treated as part of water management for the Project. See the Project Description section of the EIS for detailed information.
19-EN-MOE-1.4	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	What would you be discharging?	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Treated effluent will be discharged as part of water management for the Project. See the Project Description section of the EIS for detailed information.
18-EN-VILX-3.33, 18-EN-VILX-3.35	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Ile a la Crosse	Need a stormwater management plan and a spill response plan.	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Denison will have in place procedures to effectively respond to spills. The waste management program accounts for retention and treatment of potentially contaminated storm water. See the Project Description section of the EIS for more information.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VILX-3.39	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Monitoring with elders and students should be considered, as part of a guardianship program.	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018.
18-EN-VILX-3.84	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Do you have the environmental statistics? Who did the testing?	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Third party consultants conducted testing, as detailed within EIS appendices in which baseline data are available.
21-EN-VPL-444.3 21-EN-VPL-444.4	444	Virtual Meeting	2021-0211	Denison hosted a virtual meeting for the municipality of Pinehouse Lake. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Pinehouse Lake	Does Denison anticipate that climate change will potentially impact the EA baseline information?	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual from Pinehouse who attended a virtual meeting in the year 2021.
21-EN-BNFN-479.6	479	Email	2021-05-10	Birch Narrows First Nation provided correspondence to the Canadian Nuclear Safety Commission regarding their interest in being consulted by the Crown and by Denison.	Birch Narrows Dene Nation, Canadian Nuclear Safety Commission	Based on the level of detail included in the Project Description it is not possible to fully evaluate BNDN's concerns or the degree of potential impacts associated with the Project. Based on a preliminary review of Denison's Project, we would like to highlight the following areas of interest to BNDN: Impacts to surface water quality/quantity from effluent release and water taking.	Denison considered this in section: Influence of Indigenous Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a member or representative of Birch Narrows Dene Nation who sent an email in 2021. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to surface water quality and quantity. Denison has determined that there will be no significant impacts as a result of Project activities.

Section 8: Engagement Database Summary Table – Surface Water Quality

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-ERFN-5.68	5	Workshop	2018-05-03	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for ERFN at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting had been delayed many times, and was held in the Health Clinic because there was a regional power outage.	English River First Nation	The biggest body of water to be impacted is Russell Lake – "Big Poor Fish Lake" in Dené. A lot of Scandinavians and Norwegians went up there in the 1930s and partnered with First Nations in that territory.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a workshop in the year 2018.
18-EN-VILX-3.33, 18-EN-VILX-3.35	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Ile a la Crosse	Need a stormwater management plan and a spill response plan.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Denison will have in place procedures to effectively respond to spills. The waste management program accounts for retention and treatment of potentially contaminated storm water. See the Project Description section of the EIS for more information.
18-EN-VILX-3.39	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Monitoring with elders and students should be considered, as part of a guardianship program.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018.
18-EN-VILX-3.84	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Do you have the environmental statistics? Who did the testing?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Third party consultants conducted testing, as detailed within EIS appendices in which baseline data are available.
19-EN-ML21-62.34	62	Meeting	2019-11-05	Denison, MN-S representatives, and the Métis Local Presidents meet to discuss process for engagement. Denison requested MN-S provide direction related to rescheduling the community workshops for January 2020.	A La Baie Métis Local #21, Kineepik Métis Local #9, Métis Local #67 (Dore/Sled Lake), Métis Nation - Saskatchewan, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Sipishik Métis Local #74	How many lakes have you tested? Is there mercury?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a Métis Nation – Saskatchewan representative or a Métis Local President who attended a meeting in the year 2019.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-EN-ML82-1.3	1	Site Visit	2019-08-23	Denison hosts the MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals at the Project site for a site tour and to discuss the Project, along with representatives from the Canadian Nuclear Safety Commission and the Province of Saskatchewan, Ministry of Environment.	A La Baie Métis Local #21 , English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Waste water would be treated?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Wastewater will be treated as part of water management for the Project. See the Project Description section of the EIS for detailed information.
19-EN-MN-SR3-1.2	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21 , English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Are there ponds for waste and waste rock?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. As part of waste management, Project components include a process precipitate pond, an industrial wastewater treatment plant precipitate pond, a special waste pad, and a clean waste rock pad. Additional detail can be found in the Project Description section of the EIS.
19-EN-MOE-1.4	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21 , English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	What would you be discharging?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Treated effluent will be discharged as part of water management for the Project. See the Project Description section of the EIS for detailed information.
19-LK-ERFNTrap-134.255	134	Site Visit	2019-10-29	Denison met with local land user and English River First Nation Trapper at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trapper provided his consent to Denison to use the	ERFN Trapper	Russell is one lake where I commercially fish. How will this effluent impact the water quality, fish health? Will I be able to sell fish from here? If there is going to water pollution, I just want to know.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. Water quality in Whitefish Lake and, by extension, downstream of Whitefish Lake will meet appropriate benchmarks for the protection of aquatic life in consideration of a small mixing zone in the lake. Following Decommissioning and the restoration of drainage patterns that are similar to pre-mining conditions, water quality is expected to meet appropriate benchmarks for the protection of aquatic life in Whitefish Lake and downstream. This includes Russell Lake of which the Icelander River system is associated. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, fishing and water quality. Denison additionally completed a human health risk assessment. Denison has determined that there will be no significant impacts as a result of Project activities.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				information he provided in the environmental assessment. He reviewed the notes taken from the meeting, and provided his revisions / modifications to Denison on January 2, 2020.				
21-EN-LLRIB-392.15	392	Meeting	2021-03-05	As a result of their request, Denison provided a presentation on the Wheeler River Project to the Lac La Ronge Indian Band Lands and Resources Subcommittee.	Lac La Ronge Indian Band	How are you going to protect the water quality? We are concerned about mercury in fish, other animals, etc. Is there mercury or arsenic in the uranium solution?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a member of the Lac La Ronge Indian Band who attended a meeting in the year 2021. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to surface and groundwater quality. Denison has determined that there will be no significant impacts as a result of Project activities. Water quality would be protected through various Project design measures, as well as mitigation and monitoring plans. As part of the licensing and permitting process, mitigation and monitoring will be detailed, including environmental monitoring, groundwater monitoring, and liquid effluent monitoring. The uranium at the Project is amenable to the same type of leach solution that is used to leach other Athabasca Basin uranium ore in mills: an acidic (i.e. low pH) solution. A clear understanding of constituents used in the mining solution is an important component of ongoing engagement work.
21-EN-VILX-443.25	443	Virtual Meeting	2021-02-10	Denison hosted a virtual meeting for the municipality of Ile a la Crosse. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Ile a la Crosse	What is the plan for storing and cleaning the water and where does it flow? What is the impact of ISR mining on water quality?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual from Ile a la Crosse who attended a virtual meeting in the year 2021. Wastewater will be treated as part of water management for the Project. Treated water will be released into monitoring and release ponds prior to release to Whitefish Lake. See Project Description for detailed information. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to water quality. Denison has determined that there will be no significant impacts as a result of Project activities.

Section 8: Engagement Database Summary Table – Fish and Fish Habitat

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-EN-ML82-1.3	1	Site Visit	2019-08-23	Denison hosts the MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals at the Project site for a site tour and to discuss the Project, along with representatives from the Canadian Nuclear Safety Commission and the Province of Saskatchewan, Ministry of Environment.	A La Baie Métis Local #21, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Waste water would be treated?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Wastewater will be treated as part of water management for the Project. See the Project Description section of the EIS for detailed information.
19-EN-MN-SR3-1.2	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Are there ponds for waste and waste rock?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. As part of waste management, Project components include a process precipitate pond, an industrial wastewater treatment plant precipitate pond, a special waste pad, and a clean waste rock pad. Additional detail can be found in the Project Description section of the EIS.
19-EN-MOE-1.4	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	What would you be discharging?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Treated effluent will be discharged as part of water management for the Project. See the Project Description section of the EIS for detailed information.
ERFNTrap-134.129	134	Site Visit	2019-10-29	Denison met with local land user and English River First Nation Trapper at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trapper provided his consent to Denison to use the information he provided in the	ERFN Trapper	Northern pike spawning area in creek south of Williams Lake (Figure 4) and in areas identified in Figure 5. Lake whitefish spawn in creeks/rivers. Trout spawning areas in Russell Lake: one south of LAB area (Figure 5); around island and rocky shoals to both north and south of island (Figure 4).	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				environmental assessment. He reviewed the notes taken from the meeting, and provided his revisions / modifications to Denison on January 2, 2020.				
18-EN-VILX-3.33, 18-EN-VILX-3.35	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Need a stormwater management plan and a spill response plan.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Denison will have in place procedures to effectively respond to spills. The waste management program accounts for retention and treatment of potentially contaminated storm water. See the Project Description section of the EIS for more information.
18-EN-VILX-3.39	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Monitoring with elders and students should be considered, as part of a guardianship program.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018.
18-EN-VILX-3.84	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Do you have the environmental statistics? Who did the testing?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Third party consultants conducted testing, as detailed within EIS appendices in which baseline data are available.
18-EN-ERFN-5.68	5	Workshop	2018-05-03	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for ERFN at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting had been delayed many times, and was held in the Health Clinic because there was a regional power outage.	English River First Nation	The biggest body of water to be impacted is Russell Lake – "Big Poor Fish Lake" in Dené. A lot of Scandinavians and Norwegians went up there in the 1930s and partnered with First Nations in that territory.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a workshop in the year 2018.
20-LK-LEASESUR-267.66	267	Survey	2020-02-01	Denison sent all known local cabin and lodge leaseholders a survey in the mail to be completed regarding their interests in Wheeler River. Denison received 6 responses from the survey, which has informed it's understanding of leaseholder uses in the area and interests regarding elements to be assessed as part of the environmental assessment.	Leaseholder, Wheeler River Lodge	Concerns over fishing and hunting pressure [from the mine and people accessing the area].	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a Leaseholder who attended virtual meeting in the year 2020. Denison understands the importance of maintaining access to greatest degree possible for Indigenous people, while respecting the need for safety for all in the area. Access restrictions north of the Key Lake gate mean that use is restricted to lease holders (e.g., cabin owners) and select Indigenous communities. The Project does not propose any changes to the current access to Highway 914 north of Cameco's Key Lake Operation gate. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
								activities, including hunting and fishing. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-VILX-443.25	443	Virtual Meeting	2021-02-10	Denison hosted a virtual meeting for the municipality of Ile a la Crosse. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Ile a la Crosse	What is the plan for storing and cleaning the water and where does it flow? What is the impact of ISR mining on water quality?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual from Ile a la Crosse who attended a virtual meeting in the year 2021. Wastewater will be treated as part of water management for the Project. Treated water will be released into monitoring and release ponds prior to release to Whitefish Lake. See Project Description for detailed information. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to water quality. Denison has determined that there will be no significant impacts as a result of Project activities.

Section 8: Engagement Database Summary Table – Sediment Quality and Benthic Invertebrates

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VILX-3.33, 18-EN-VILX-3.35	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Ile a la Crosse	Need a stormwater management plan and a spill response plan.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Denison will have in place procedures to effectively respond to spills. The waste management program accounts for retention and treatment of potentially contaminated storm water. See the Project Description section of the EIS for more information.
18-EN-VILX-3.39	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Monitoring with elders and students should be considered, as part of a guardianship program.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018.
18-EN-VILX-3.84	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Do you have the environmental statistics? Who did the testing?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Third party consultants conducted testing, as detailed within EIS appendices in which baseline data are available.
19-EN-MN-SR3-1.2	1	Site Visit	2019-08-23	Denison hosts the MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals at the Project site for a site tour and to discuss the Project, along with representatives from the Canadian Nuclear Safety Commission and the Province of Saskatchewan, Ministry of Environment.	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Are there ponds for waste and waste rock?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. As part of waste management, Project components include a process precipitate pond, an industrial wastewater treatment plant precipitate pond, a special waste pad, and a clean waste rock pad. Additional detail can be found in the Project Description section of the EIS.
19-EN-ML82-1.3	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Waste water would be treated?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Wastewater will be treated as part of water management for the Project. See the Project Description section of the EIS for detailed information.
19-EN-MOE-1.4	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation -	What would you be discharging?	Denison considered this in section:	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
					Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake		Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Treated effluent will be discharged as part of water management for the Project. See the Project Description section of the EIS for detailed information.
21-EN-VILX-443.25	443	Virtual Meeting	2021-02-10	Denison hosted a virtual meeting for the municipality of Ile a la Crosse. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Ile a la Crosse	What is the plan for storing and cleaning the water and where does it flow? What is the impact of ISR mining on water quality?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual from Ile a la Crosse who attended a virtual meeting in the year 2021. Wastewater will be treated as part of water management for the Project. Treated water will be released into monitoring and release ponds prior to release to Whitefish Lake. See Project Description for detailed information. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to water quality. Denison has determined that there will be no significant impacts as a result of Project activities.

Section 8: Engagement Database Summary Table – Fish Health

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
19-EN-ML82-1.3	1	Site Visit	2019-08-23	Denison hosts the MN-S President, MN-S Minister of Environment/MN-S Region 3 President, and the Presidents of the Métis Locals at the Project site for a site tour and to discuss the Project, along with representatives from the Canadian Nuclear Safety Commission and the Province of Saskatchewan, Ministry of Environment.	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Waste water would be treated?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Wastewater will be treated as part of water management for the Project. See the Project Description section of the EIS for detailed information.
19-EN-MN-SR3-1.2	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	Are there ponds for waste and waste rock?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. As part of waste management, Project components include a process precipitate pond, an industrial wastewater treatment plant precipitate pond, a special waste pad, and a clean waste rock pad. Additional detail can be found in the Project Description section of the EIS.
19-EN-MOE-1.4	1	Site Visit	2019-08-23	Same as above	A La Baie Métis Local #21, English River First Nation, Kineepik Métis Local #9, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Village of Beauval, Village of Ile a la Crosse, Village of Pinehouse Lake	What would you be discharging?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from the MN-S President, the MN-S Minister of Environment/MN-S Region 3 President, or the Presidents of the Métis Locals representative or a Métis Local President who attended a site visit in the year 2019. Treated effluent will be discharged as part of water management for the Project. See the Project Description section of the EIS for detailed information.
18-EN-VILX-3.33, 18-EN-VILX-3.35	3	Workshop	2018-01-17	As part of the engagement program for the Wheeler River Project, Denison organized a workshop in Ile a la Crosse for community and A La Baie Métis members to attend. The workshop gathered community and student input in relation to road alignment options, treated effluent discharge locations, and mining methods.	Village of Ile a la Crosse	Need a stormwater management plan and a spill response plan.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Denison will have in place procedures to effectively respond to spills. The waste management program accounts for retention and treatment of potentially contaminated storm water. See the Project Description section of the EIS for more information.

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
18-EN-VILX-3.39	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Monitoring with elders and students should be considered, as part of a guardianship program.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018.
18-EN-VILX-3.84	3	Workshop	2018-01-17	Same as above	Village of Ile a la Crosse	Do you have the environmental statistics? Who did the testing?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual who attended a workshop in Ile a la Crosse in the year 2018. Third party consultants conducted testing, as detailed within EIS appendices in which baseline data are available.
18-EN-ERFN-5.68	5	Workshop	2018-05-03	As part of the engagement program for the Wheeler River Project, Denison organized a workshop for ERFN at their Patuanak Reserve location for ERFN and Patuanak members to attend. The workshop aimed to gather community input in relation to road alignment options, treated effluent discharge locations, and mining methods. The meeting had been delayed many times, and was held in the Health Clinic because there was a regional power outage.	English River First Nation	The biggest body of water to be impacted is Russell Lake – "Big Poor Fish Lake" in Dené. A lot of Scandinavians and Norwegians went up there in the 1930s and partnered with First Nations in that territory.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a member of English River First Nation who attended a workshop in the year 2018.
19-EN-ML21-62.34	62	Meeting	2019-11-05	Denison, MN-S representatives, and the Métis Local Presidents meet to discuss process for engagement. Denison requested MN-S provide direction related to rescheduling the community workshops for January 2020.	A La Baie Métis Local #21, Kineepik Métis Local #9, Métis Local #67 (Dore/Sled Lake), Métis Nation - Saskatchewan, Métis Nation - Saskatchewan, Métis Nation - Saskatchewan - Region 3, Patuanak Métis Local 82, Sipishik Métis Local #74	How many lakes have you tested? Is there mercury?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a Métis Nation – Saskatchewan representative or a Métis Local President who attended a meeting in the year 2019.
19-LK-ERFNTrap-134.255	134	Site Visit	2019-10-29	Denison met with local land user and English River First Nation Trapper at the Wheeler River Project site location for a full-day to interview him regarding his knowledge of the area, including providing information and feedback on specifics pertaining to wildlife and wildlife movement patterns, fish and spawning areas, local lakes and lake names, recreational and commercial use, traditional food consumption, and specific aspects of the Wheeler River Project. ERFN Trapper provided his	ERFN Trapper	Russell is one lake where I commercially fish. How will this effluent impact the water quality, fish health? Will I be able to sell fish from here? If there is going to water pollution, I just want to know.	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from ERFN Trapper who attended a site visit in the year 2019. Water quality in Whitefish Lake and, by extension, downstream of Whitefish Lake will meet appropriate benchmarks for the protection of aquatic life in consideration of a small mixing zone in the lake. Following Decommissioning and the restoration of drainage patterns that are similar to pre-mining conditions, water quality is expected to meet appropriate benchmarks for the protection of aquatic life in Whitefish Lake and downstream. This includes Russell Lake of which the Icelander River system is associated. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to traditional and other land use activities, fishing and water quality. Denison additionally

UNIQUE ID	ROC	Event Type	Date	Event Summary	Interested Parties	Comments (From Interested Party)	Response (From Denison)	Denison's Response to Question/Concern (where applicable)
				consent to Denison to use the information he provided in the environmental assessment. He reviewed the notes taken from the meeting, and provided his revisions / modifications to Denison on January 2, 2020.				completed a human health risk assessment. Denison has determined that there will be no significant impacts as a result of Project activities.
21-EN-LLRIB-392.15	392	Meeting	2021-03-05	As a result of their request, Denison provided a presentation on the Wheeler River Project to the Lac La Ronge Indian Band Lands and Resources Subcommittee.	Lac La Ronge Indian Band	How are you going to protect the water quality? We are concerned about mercury in fish, other animals, etc. Is there mercury or arsenic in the uranium solution?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from a member of the Lac La Ronge Indian Band who attended a meeting in the year 2021. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to surface and groundwater quality. Denison has determined that there will be no significant impacts as a result of Project activities. Water quality would be protected through various Project design measures, as well as mitigation and monitoring plans. As part of the licensing and permitting process, mitigation and monitoring will be detailed, including environmental monitoring, groundwater monitoring, and liquid effluent monitoring. The uranium at the Project is amenable to the same type of leach solution that is used to leach other Athabasca Basin uranium ore in mills: an acidic (i.e. low pH) solution. A clear understanding of constituents used in the mining solution is an important component of ongoing engagement work.
21-EN-VILX-443.25	443	Virtual Meeting	2021-02-10	Denison hosted a virtual meeting for the municipality of Ile a la Crosse. The public meetings were focused on the Project generally, and did not seek input or comments on the distinct interests of the Métis in respect of the Project or Métis land use. This was expressly stated at the outset of each of the public meetings. Included in the discussion was an overview on the Valued Components for the Wheeler River Project, with a request to provide feedback to Denison via an online survey with specific questions pertaining to Valued Components.	Village of Ile a la Crosse	What is the plan for storing and cleaning the water and where does it flow? What is the impact of ISR mining on water quality?	Denison considered this in section: Influence of Indigenous Knowledge, Local Knowledge, and Engagement on the Assessment	The context in which this comment was used within the Aquatic section of the EIS serves as a local perspective, documented as coming from an individual from Ile a la Crosse who attended a virtual meeting in the year 2021. Wastewater will be treated as part of water management for the Project. Treated water will be released into monitoring and release ponds prior to release to Whitefish Lake. See Project Description for detailed information. Denison has completed an environment assessment to understand Project impacts on the environment. The assessment considers potential impacts to water quality. Denison has determined that there will be no significant impacts as a result of Project activities.