Denison Mines Corp.

Wheeler River Operation

Groundwater Protection and Monitoring Plan

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Approval for Use

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Revision History

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Acronyms and Abbreviations

Term	Definition
AD	Absolute Difference
AHJ	Authority Having Jurisdiction
A&M	Accidents and Malfunctions
CALA	Canadian Association for Laboratory Accreditation
CNSC	Canadian Nuclear Safety Commission
COPC	Contaminants of Potential Concern
CSA	Canadian Standards Association
CSM	Conceptual Site Model
DDP	Detailed Decommissioning Plan
DSZ	Desilicified Zone
DQO	Data Quality Objectives
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EPA	Environmental Protection Act
ERA	Environmental Risk Assessment
ESA	Environmental Site Assessment
GWMP	Groundwater Monitoring Plan
GWPP	Groundwater Protection Plan
GW&MP	Groundwater Protection and Monitoring Plan
HU	Hydrostratigraphic Units
ISR	In-situ Recovery
IWWTP	Industrial Waste Water Treatment Plant
MOE	Ministry of the Environment
LCL	Lower Control Limit
LSA	Local Study Area
ORP	Oxidation-Reduction Potential
PDP	Preliminary Decommissioning Plan
QA	Quality Assurance
QA/QC	Quality Control and Quality Assurance
QC	Quality Control

RPD	Relative Percent Difference
SAT	Systematic Approach to Training
SRC	Saskatchewan Research Council
SSC	Structures, Systems, and Components
UCL	Upper Control Limit
UPB	Upper Limit of Background
USB	Uranium Bearing Solution
VOC	Volatile Organic Compounds
VWP	Vibrating Wire Piezometer
WSA	Water Sustainability Act

1 Introduction

1.1 Background

This *Groundwater Protection and Monitoring Plan* (GWM&MP) supports the *Environmental Management Program* for the Wheeler River Operation (the Operation). Groundwater protection is an element of the overall environmental protection measures for the Operation. The GWP&MP is interrelated with the suite of tools utilized by Denison to assure that adequate provisions have been made to protect human health and the environment from any releases of contaminants of potential concern (COPCs).

Groundwater protection and monitoring is a component of overall environmental protection under the Canadian Nuclear Safety Commission (CNSC) REGDOC -2.9.1 version 1.2. A Groundwater Monitoring Program is a mandatory component of groundwater protection under the Canadian Standards Association (CSA) N288.7-23 standard "*Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*" ("N288.7-23").

For the Operation, Denison's Groundwater Protection Plan (GWPP) and Groundwater Monitoring Plan (GWMP) are combined within this GWP&MP under the *Environmental Management Program*.

The GWPP and GWMP apply to site preparation and construction of the Operation, and while it is intended to apply to subsequent future phases of the Operation it may be subject to change.

The GWMP is informed by the understanding of existing groundwater conditions (Ecometrix 2022a), the reactive transport modelling of chemicals of potential concern (COPC) associated with the decommissioned mining zone (Ecometrix, 2022b), and the commitments made pertaining to Geology and Hydrogeology valued components within the Draft Environmental Impact Statement ("the Draft EIS") for the Phoenix River Project (Denison, 2022). COPC has been defined herein as chemicals of potential concern in following with CSA N288.0-22 standard "*Environmental management of nuclear facilities: Common requirements of the CSA N288 series of Standards*" ("N288.0-22").

The GWP&MP is a "living document" that will be adapted and updated as required for environmental protection, as committed to in the EIS, over the life of the Operation.

1.2 Scope of the GWMP

This version of the GWP&MP focuses on monitoring activities during site preparation and construction, and provides higher-level information on groundwater monitoring during operations, decommissioning, and post-decommissioning. Construction activities include establishment of the construction camp, site preparation and earthworks, and construction of the operational systems including the wellfield, processing plant, water and waste management, access and transportation, power, and support facilities.

The scope of the GWMP includes monitoring of groundwater flow and quality conditions associated with surface facilities and subsurface mining activities over the life of the Operation. The spatial boundary of the GWMP is the area over which there is a reasonable potential for the Operation and its associated activities to interact with and potentially adversely affect groundwater conditions. This area is shown in

Figure 1-1: Wheeler River Operation Location and Spatial Boundary of the GWMPFigure 1-1 and corresponds to the Local Study Area (LSA) defined for the Geology and Groundwater Assessment in the Draft Environmental Impact Study (EIS).

The GWMP documented here is designed for application during routine conditions. In Clause 1.3 of N288.7-23, the definition given for normal operations notes that “nuclear and hazardous substances might be released to groundwater during normal operations over the lifecycle of a nuclear facility” and that under normal operations there are “reasonably foreseeable upset events, also known as anticipated operational occurrences, including leaks and spills”. Such reasonably foreseeable upset events are mitigated against with engineering controls, as described in this document, the *Spill Management Plan*, and the *Environmental Management Program*.

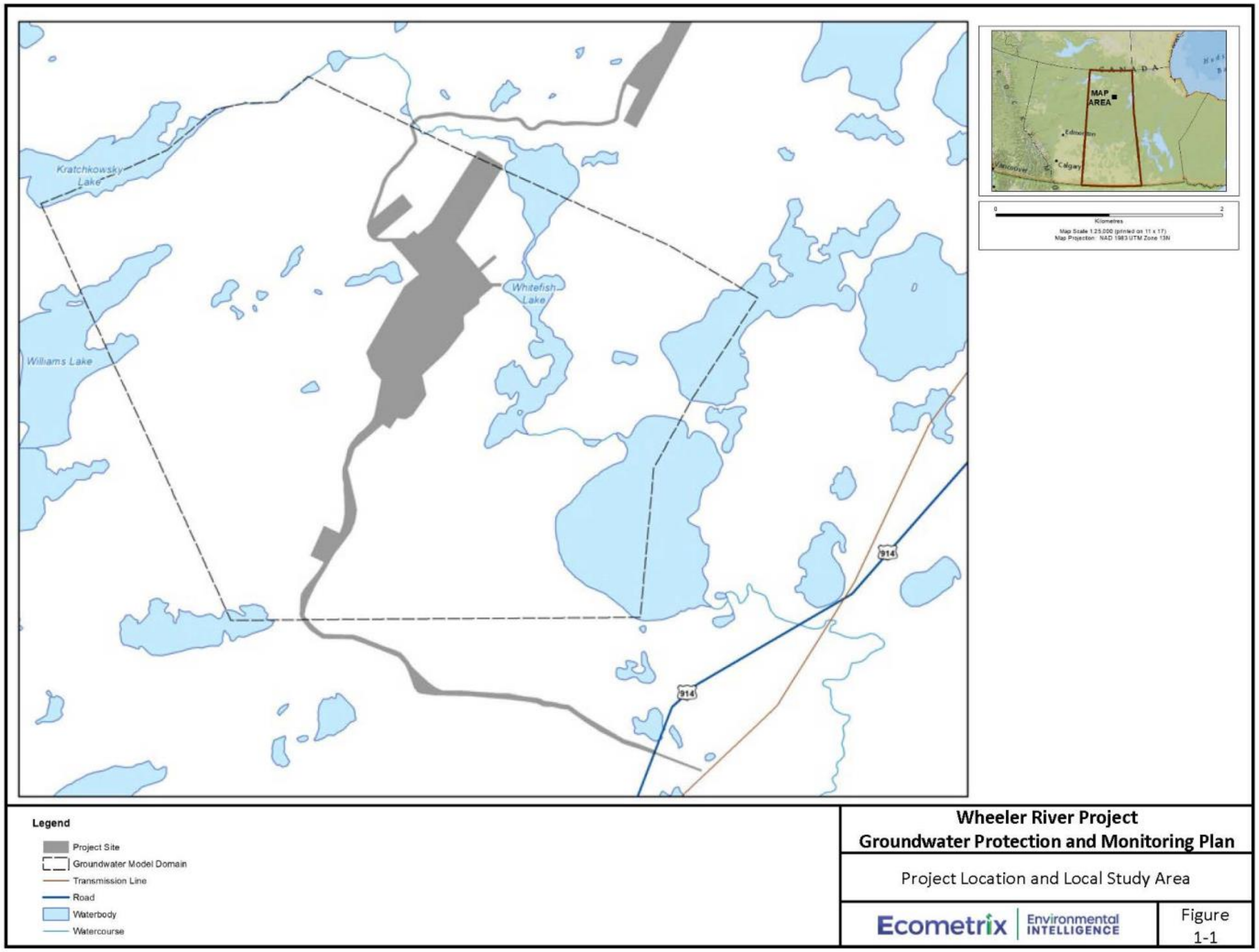
In addition, not included as part of the GWMP are:

- Routine monitoring carried out for occupational health and safety;
- Process control monitoring;
- Groundwater that is intercepted, mixed with an effluent stream, and subsequently discharged; and
- Accidents and Malfunctions (A&M) related to the various projects and components and the effect of these events, which have been outlined in detail within the “Assessment of Accidents and Malfunctions – Technical Support Document for the Wheeler River Project”, which is Section 14 of the Draft EIS.

The A&M report addressed potential releases of various chemicals used or produced in operations at ground surface. Such events would trigger an emergency and spill response, in accordance with Denison procedures. Following the response, should there be a need to incorporate monitoring into longer-term groundwater monitoring, the GWMP would be modified accordingly.

Detailed monitoring during site preparation and Construction is the focus of this version of the GWP&MP. It is reasonable to assume that as part of preparations for Operation, and subsequently for Decommissioning and Post-Decommissioning, the design of the GWP&MP will be reviewed according to the requirements for Periodic Review in Clause 8 of N288.0-22 to determine if there are changes that could alter the risks to groundwater and groundwater pathways. The GWMP addresses how the needs for risk management or remediation are identified based on the collected groundwater information. However, recommendations for the methods or approaches used for risk management and remediation are outside the scope of this document. Dose assessment methods are also not within the scope of this document. However, dose assessment methods are anticipated to be used to define evaluation criteria for the program.

Figure 1-1: Wheeler River Operation Location and Spatial Boundary of the GWMP



2 Groundwater Protection Plan

2.1 Rationale for Implementing the GWPP

The purpose of implementing a GWPP is defined in Clause 0.2.2.1 of N288.7-23. It is to:

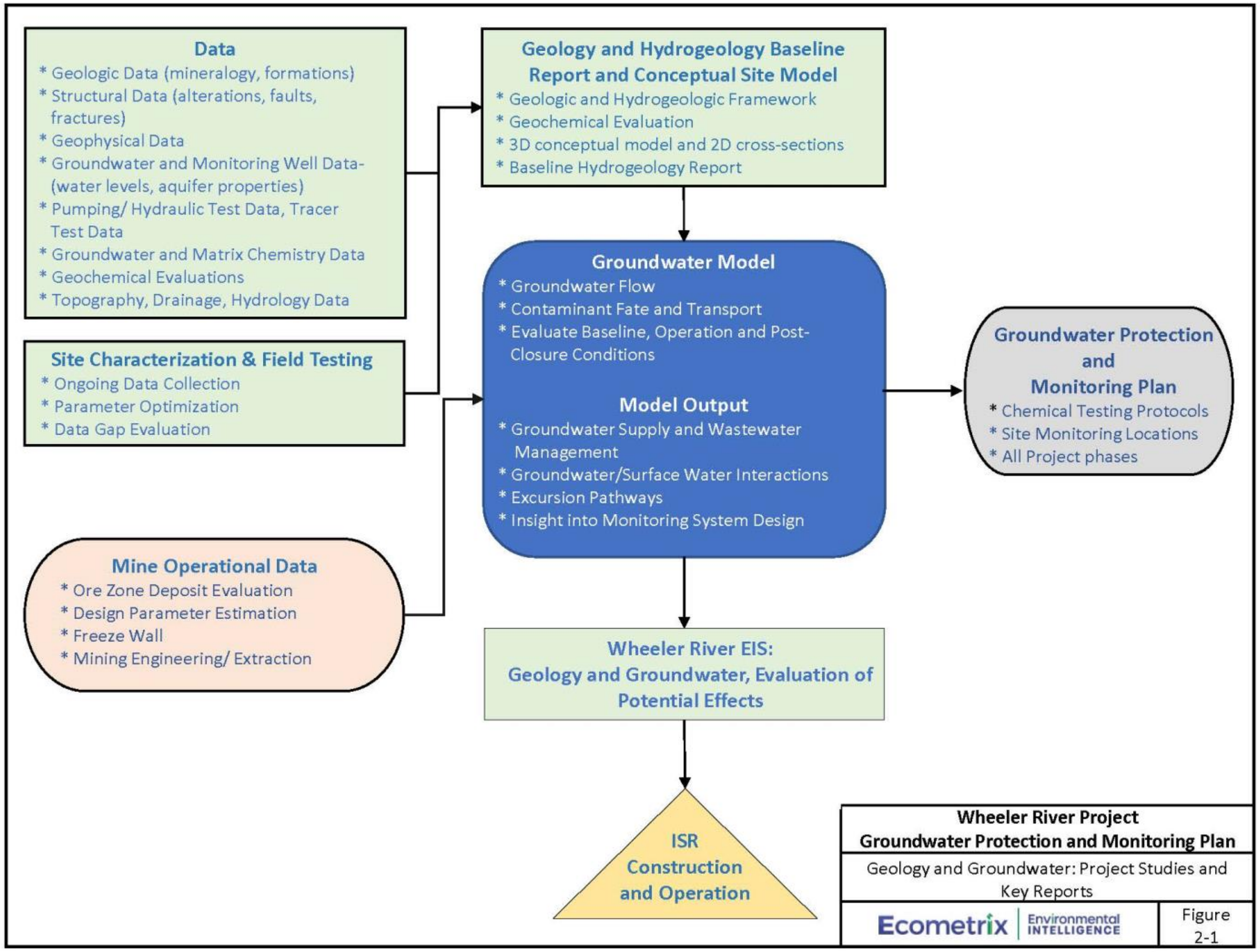
- Prevent or minimize releases of nuclear or hazardous substances to groundwater;
- Prevent or minimize the effects of physical stressors on groundwater end uses; and
- Confirm that adequate measures are in place to stop, contain, control, and monitor any releases to and physical stressors on groundwater that can occur under normal operation.

A GWPP is specific to site conditions. The basis for this GWPP is:

- The Project Description section (Section 2) of the Draft EIS (herein referred to as “the Project Description in the Draft EIS”);
- The Geology and Groundwater section (Section 7) of the Draft EIS;
- The associated baseline understanding of geology and groundwater (herein referred to as “the Baseline Report”; Ecometrix 2022a; Appendix 7A of the Draft EIS); and
- The reactive transport modelling of groundwater constituents associated with the decommissioned mining zone (herein referred to as the “the Modelling Report”; Ecometrix 2022b; Appendix C to Section 7C of the Draft EIS).

The relationship of these reports to each other and to the GWP&MP is shown in **Figure 2-1**. The groundwater protection goals developed are specific to the Wheeler River site conditions.

Figure 2-1: Geology and Groundwater: Project Studies and Key Reports



2.1.1 Conceptual Site Model (CSM) for the GWPP

The CSM is the basis for the GWPP and includes the following elements:

- Potential contamination sources and COPCs, contamination risks and high-priority structures, systems and components (SSCs);
- Groundwater flow system and contaminant fate and transport; and
- Groundwater end-use and potential human and ecological receptors.

A summary of each of these elements is provided in the sections below.

2.1.2 Potential Contamination Sources and COPCs

Potential contamination sources are the surface facilities and the In-situ leach mining process. For each of these, contamination risks and high priority structures are evaluated in more detail in Section 3. Structures Systems and Components (SSCs) are elements of the surface facilities and mining process and are defined in Clause 3.1 of N288.7-23 as:

- Structures: passive elements such as building and shielding;
- Systems: an assembly of components in such ways as to perform a specific function; and
- Components: discrete elements in a system such as wires, integrated circuits, motors, solenoids, pipes, fittings, pumps, vessels, tanks and valves.

Chemicals of Potential Concern (COPCs) include, as per Clause 1.5 of N288.7-23):

- Hazardous substances such as toxic, corrosive of deleterious substances;
- Nuclear substances; and
- Geochemical (e.g., groundwater quality) and physical characteristics of groundwater (e.g., groundwater quantity and temperature).

2.1.2.1 Surface Facilities

During normal operating conditions, potential interactions between surface facilities and groundwater will be mitigated through appropriate design. For example, lining and leak detection capabilities are included in the design of the pads, ponds and landfills, and hazardous substances will be stored in approved storage areas with secondary containment, as required. Denison has developed a *Waste Management Program* (Denison 2023d). Waste management (e.g., material sorting for items destined for onsite landfill, hazardous waste handling and storage) will be appropriately designed and will follow the requirements of the *Waste Management Program*. Denison's *Facilities and Equipment Management Program* ensures that maintenance of site facilities and equipment are carried out in a controlled, optimized, and consistent manner. Response to environmental spills will follow actions identified in the *Spill Management Plan* under the *Environmental Management Program*.

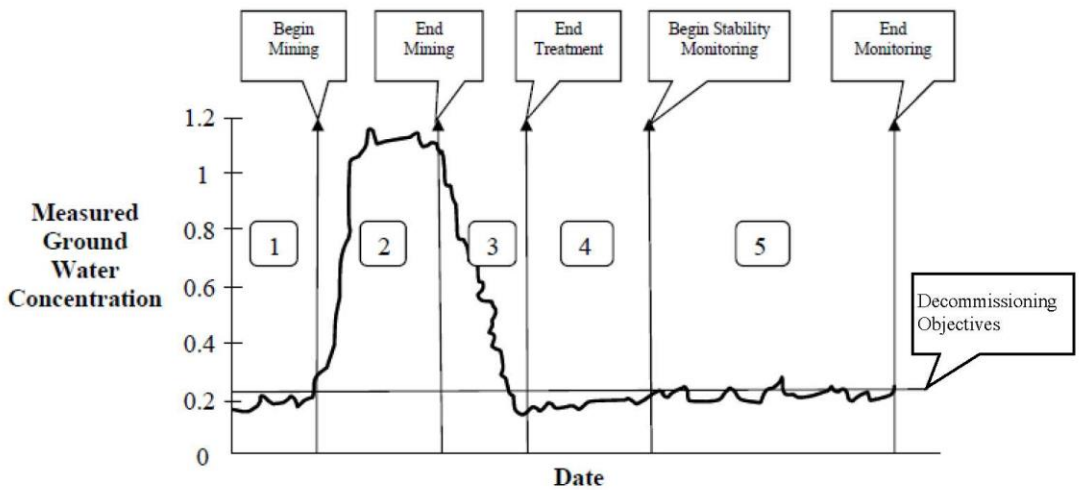
Groundwater conditions surrounding and downgradient of surface facilities will be monitored as part of the GWMP. Excursions associated with surface facilities are changes in groundwater flow conditions or groundwater quality that represent design failure. Such failures include spills, leaks, or uncontrolled leachate from ponds and landfills that may cause changes to the shallow groundwater flow conditions and/or groundwater quality.

2.1.2.2 The ISR Mining Area

The uranium deposit at the Wheeler River Operation occurs at a depth of approximately 400 m below the ground surface and has a length and width of approximately 750 m and 40 m, respectively. During ISR mining, acidic mining solution is injected from surface pumphouses via a series of injection wells and enters the mining area – defined below - from well screens located at the base of the injection wells. Uranium is dissolved in place (i.e., in situ) as the mining solution travels from an injection well towards a recovery well. The mining solution now contains uranium and is referred to as uranium bearing solution (UBS). The UBS is pumped to surface by a recovery well.

Groundwater modelling and flow path analysis calibrated to field conditions have evaluated upward solution migration and demonstrated that the maximum height that injected fluids will migrate upwards from the ore zone during active mining is likely between 11 to 13 m. For conservatism, a 50-m vertical zone above the deposit was included in the assessment of potential environmental effects in the Draft EIS as potentially disturbed by mining activities. This entire area is referred to as the mining area, although the active mining area is expected to be a smaller area within the broader mining area and is the area immediately within the ore zone. The ore zone has an average thickness is 5 m, with a range of 2 to 17 m.

Figure 2-2: Mining Phases and Temporal Changes in Concentration of Groundwater Constituents



Stage 1 – Measure baseline groundwater concentrations and establish agreed-upon decommissioning objectives
Stage 2 – Conduct in-situ mining. Detect excursions of injected fluids outside of the mining area if they occur
Stage 3 – Conduct wellfield decommissioning. Monitor the progress towards agreed-upon decommissioning objectives through groundwater sampling.
Stage 4 – Establish compliance with agreed-upon decommissioning objectives.
Stage 5 – Conduct long-term stability monitoring.

Modified from: U.S. EPA (2011)

Wheeler River Project **Groundwater Protection and Monitoring Plan**	
Mining Phases and Temporal Changes in Concentration of Groundwater Constituents	
Ecometrix Environmental INTELLIGENCE	Figure 2-2

During the mining and decommissioning phases of Wheeler River Operation (represented by stages 2 through 4 in **Figure 2-2**) there will be three engineered means of containing mining solutions and mitigating excursions (being accidental releases of mining solution or uranium bearing solution (UBS) outside of the mining area). These are described within the Project Description in the Draft EIS and summarized as:

i. **Primary means: Well Design.** Each injection and recovery well will have secondary containment. Mining solution will travel inside a casing which is cemented in place to provide secondary containment for the mining fluids. Wells will be constructed of materials resistant to the mining solution that meet well design specifications. Wells will be pressure grouted from the ore zone to surface and tested for mechanical integrity prior to commissioning to confirm an adequate seal from surface to the well screen at the mining area.

ii. **Secondary Means: Pumping**. Hydrogeological studies and models completed show that mining solution within the mining area can primarily be controlled by maintaining an inward hydraulic gradient. The inward hydraulic gradient will be created by recovering more solution than is being injected. Perimeter pumping wells will be installed vertically, horizontally, and laterally surrounding the mining area both inside and outside the freeze wall with the ability to capture fluids by pumping when required and recycle solutions should the primary containment system not perform as expected.

iii. **Tertiary Containment: Freeze Wall**. It is currently assumed that a freeze wall will encircle/surround the uranium deposit, and extend from the surface to the basement rock, isolating the mining area from regional groundwater. Current plans are for the freeze wall to be installed 20 to 25 m away from the uranium deposit and extend 30 m into the basement rock. The need for tertiary containment of mining solution is an important area of technical study that Denison will advance through Project design and into Operation.

The influence of in-situ recovery (ISR) mining on groundwater quality over the life of an ISR project is shown generically in **Figure 2-2** (taken, with modification, from U.S. EPA, 2011). Several stages of groundwater monitoring are identified. Groundwater monitoring will be carried out in keeping with this general schematic over the life of the Operation.

The decommissioning objectives referred to in **Figure 2-2** are project specific. They define the concentrations of groundwater COPCs that must be met and the subsurface extent (volume) over which they apply. Chemical concentrations or values that represent the mining area Decommissioning Objectives are presented within the Project Description in the Draft EIS. Although not indicated specifically, decommissioning objectives also address and describe post-decommissioning groundwater flow conditions to be achieved.

A commitment was made in the Draft EIS to remediate groundwater quality within the mining area to acceptable levels. Acceptable levels are the Decommissioning Objectives and are based on the protection of receptors at groundwater discharge locations to surface water bodies (Denison, 2022).

2.1.2.3 Chemicals of Potential Concern (COPCs) and Physical Stressors

The chemical and physical constituents to be monitored in groundwater were established in the Baseline Report, Modelling Report, and from review of the Project Description in the Draft EIS. They include:

- pH;
- Oxidation-Reduction Potential (ORP);
- Electrical Conductivity (EC);
- Sulfate;
- Other Major Ions (total alkalinity, bicarbonate, carbonate, chloride, sodium, magnesium, potassium, calcium);
- Uranium, iron, aluminum, and heavy metals/trace elements;
- Radionuclides (^{226}Ra, ^{230}Th, ^{210}Pb and ^{210}Po); and
- Temperature.

Additional COPCs identified in association with surface facilities are nitrogen species (ammonium, nitrate, nitrite) and volatile organic compounds (VOCs). These COPCs will be monitored in association with a small number of surface facilities.

In addition to the above parameters, tritium concentrations will be also be measured in groundwater to further analyze the potential to age groundwater in the subsurface.

Not all the above parameters will need to be measured in groundwater at all sampling locations, or during each sampling event. Higher priority will be given to some parameters that are key indicators of site activity-related changes in water quality. Parameters being analyzed at any given location and time are rationalized in Section 4.0.

2.1.3 Groundwater Flow Conditions

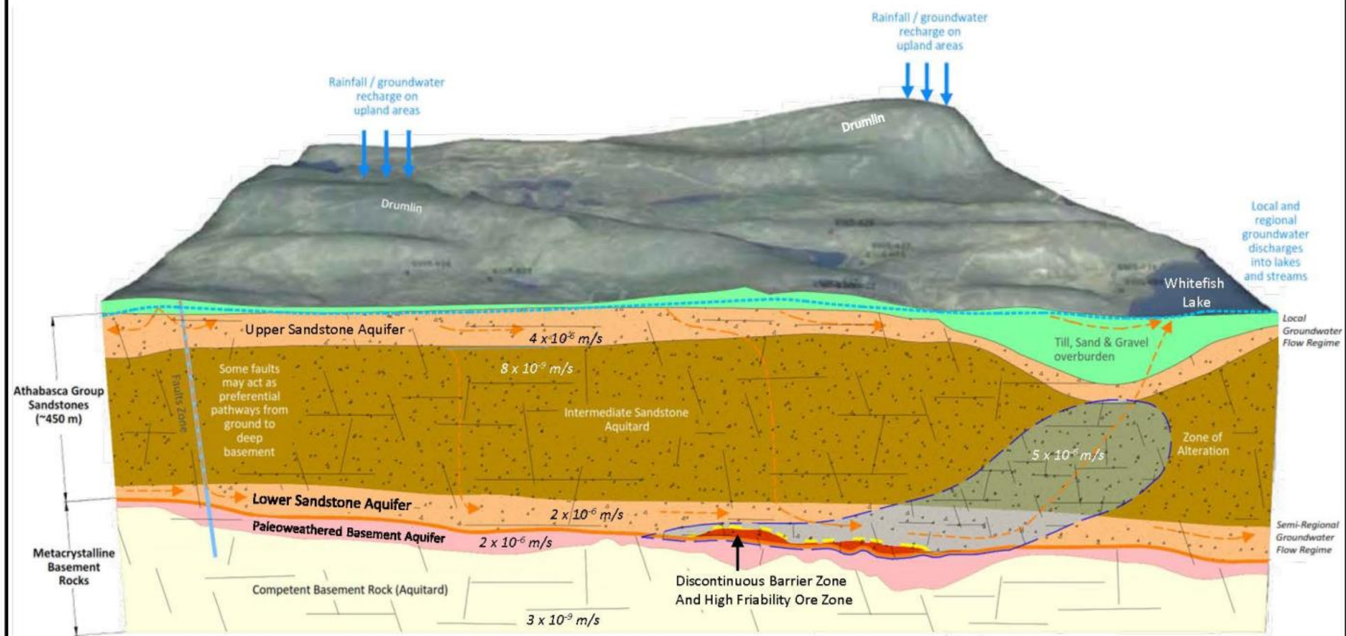
A hydrogeological CSM was prepared as part of the Baseline Report to present the geology and hydrogeology of the subsurface surrounding the Operation, surface water features and baseline hydrochemical distributions. The CSM is a descriptive summary and is accompanied by a graphical representation of the hydrogeological framework that describes our current understanding of components of the groundwater flow system within the boundaries of the GWMP. Details of the lithologic and hydrostratigraphic units within the boundary of the GWMP are summarized in **Table 2-1**, and the graphical representation of the hydrogeological framework is provided in **Figure 2-3**.

Groundwater flow conditions in the spatial boundary of the GWMP have been evaluated through 3-D hydrogeological modelling in the Modelling Report in the Draft EIS. Groundwater flow observed, and simulated in the calibrated groundwater model, travels eastward from the mining zone within the Lower Sandstone Aquifer before moving upward through the Desilicified Zone and overlying overburden deposits toward Whitefish Lake. The trajectory of flow paths resulting from the model simulations are from the Ore Zone to Whitefish Lake as shown in **Figure 2-4**.

Table 2-1: Summary of Lithologic Units and Hydrostratigraphic Units

<table>
<tr><th colspan="2">Lithologic Unit</th><th colspan="2">Hydrostratigraphic Unit (Aquifer/ Aquitard)</th></tr>
<tr><td colspan="2">Overburden</td><td colspan="2">Overburden Aquifer</td></tr>
<tr><td rowspan="6">Athabasca Supergroup/Manitou Falls Group</td><td>Dunlop Formation - MFd</td><td colspan="2" rowspan="2">Upper Sandstone Aquifer</td></tr>
<tr><td rowspan="2">Collins Formation - MFc</td></tr>
<tr><td rowspan="3">Intermediate Sandstone Aquitard</td><td rowspan="4">Desilicified Zone Aquifer</td></tr>
<tr><td>Bird Formation - MFb</td></tr>
<tr><td rowspan="2">Read Fm (MFa)</td></tr>
<tr><td>Lower Sandstone</td></tr>
<tr><td colspan="2">Upper Barrier Zone (Clay zone and sulphide-cemented rock zone)</td><td colspan="2">Aquitard (overlying the ore zone)</td></tr>
<tr><td colspan="2">Ore Zone (high grade friable zone)</td><td colspan="2">Ore Zone Aquifer</td></tr>
<tr><td colspan="2">Lower Barrier Zone (Clay zone and sulphide-cemented rock zone)</td><td colspan="2">Aquitard (underlying the ore zone)</td></tr>
<tr><td colspan="2">Paleoweathered and Competent Basement</td><td colspan="2">Basement Aquitard</td></tr>
</table>

Figure 2-3: Summary Conceptual Site Model for the Phoenix Area



LEGEND

- Groundwater Flow
- Fractures
- Fault
- Unconformity
- Clay Cap
- High Friability Ore Zone
- Water Table
- 2×10^{-7} m/s Geomean of Field Based Hydraulic Conductivity Values

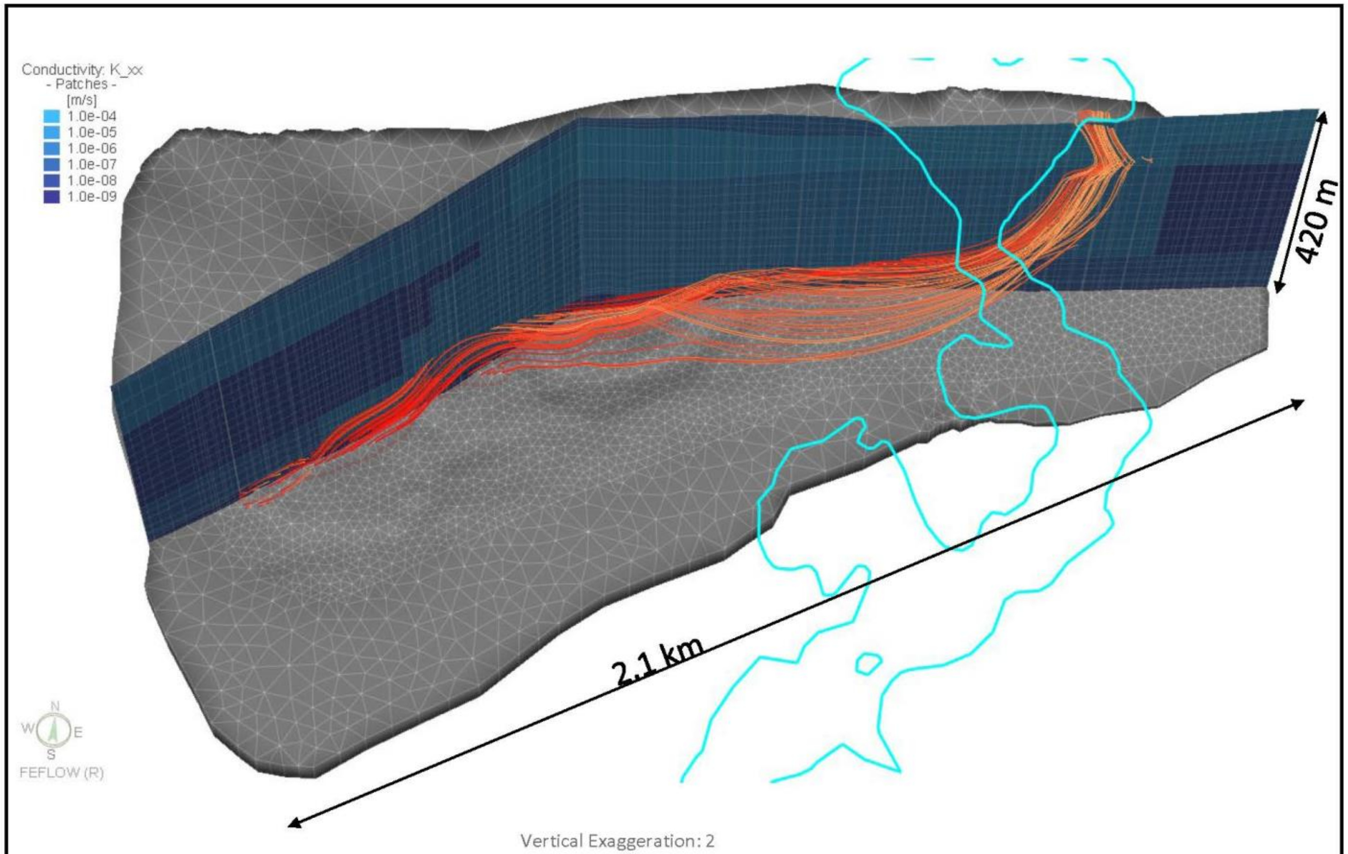
Wheeler River Project
Groundwater Protection and Monitoring Plan

Summary Conceptual Site Model for the Phoenix Area

Ecometrix | Environmental Intelligence

Figure 2-3

Figure 2-4: Cross-Section Following Flow Path from the Ore Zone to Whitefish Lake



Wheeler River Project **Groundwater Protection and Monitoring Plan**	
Cross-Section Following Flow Path from the Ore Zone to Whitefish Lake	
Ecometrix Environmental Intelligence	Figure 2-4

2.1.4 Groundwater End Uses and Receptors

The groundwater flow model developed for the Operation and presented in the Modelling Report in the Draft EIS was designed to encompass the end use of discharge to surface water bodies and potential associated ecological receptors. The groundwater end use specified within the Draft EIS was the potential for groundwater to reach and affect surface water quality, with Whitefish Lake as the primary receiving water body. Receptors in Whitefish Lake were defined in the Draft EIS to include aquatic life receptors and a future permanent human resident.

2.2 GWPP Goals

2.2.1 General Goals

During the Site Preparation and Construction, and Operation, the General GWPP goals are to:

i. Have in place a GWMP to provide timely data collection and analysis to ensure that uncontrolled releases are not occurring and, if uncontrolled releases do occur, to signal when and where; and

ii. Protect the identified groundwater end-uses that are potentially affected by releases to groundwater.

During Decommissioning and Post-Decommissioning, there is the additional general GWPP goal of:

i. Demonstrate compliance with requirements of the agreed-upon groundwater quality Mining Area Decommissioning Objectives.

2.2.2 Specific Goals

2.2.2.1 Compliance Goals

The goal is to comply with the requirements of the CNSC and the Saskatchewan Ministry of Environment (MOE). The GWP&MP was designed to be compliant with CSA N288.7-23. Compliance is demonstrated through developing and implementing a GWP&MP, and reporting on the GWMP results, as per N288.7-23 requirements.

The GWP&MP is also to comply with the *Water Security Act* and the *Ground Water Regulations* administered under that *Act* for construction and operation of wells and other groundwater works and the right to use groundwater.

2.2.2.2 Control Measure Goals

The goal is for the Operation to have in place control measures to prevent or minimize the release of nuclear or hazardous substances directly or indirectly to groundwater by the design and operation of SSCs. The Operation has in place several programs to meet this goal. Specific programs implemented for the Operation to meet the goal of having control measured in place include the *Facility and Equipment Management Program* and the *Management System Program* These programs serve to maintain and test equipment, prevent spills, detect leaks, and provide secondary containment to ensure human and environmental protection.

2.2.2.3 Monitoring Goals

The monitoring goals are the basis for the GWMP and define monitoring activities, over all stages of the life of the mine:

- Stage 1: Development of a robust understanding of existing (pre-mining) baseline groundwater conditions for the Operation, including the conceptual groundwater flow path from ore zone to receiving environment. Baseline groundwater conditions require characterization to the level that allows spatial and temporal changes to groundwater quality and quantity to be quantifiable over the life of the mine;
- Stage 2a: Monitoring over the operational phases (i.e., "Begin Mining to End Mining in Figure 2-2) that is focused on the surface infrastructure of the mine (ponds and landfills);
- Stage 2b: Monitoring over the operational phases (i.e., "Begin Mining to End Mining in Figure 2-2) that is focused within and immediately surrounding the freeze wall;
- Stage 3: Monitoring over the decommissioning phase that focuses within and immediately surrounding the freeze wall and near any remaining surface infrastructure (i.e., "End Mining through End Monitoring" in Figure 2-2); and
- Stage 4: Monitoring over the post-decommissioning phase that focuses on the wells immediately surrounding the freeze wall (now unfrozen) and further downgradient (i.e., monitoring outside of the remediated mining area, beyond "End of Monitoring" in Figure 2-2).

The requirements of the GWMP are to be able to demonstrate, at each stage, that:

- Excursions are not occurring and, if excursions do occur, to provide early warning (a timely signal) of when and where they are occurring, such that appropriate further evaluation and actions can be undertaken if warranted;
- Commitments made in the EIS have been achieved; and
- Protection of groundwater end use/receiving environment is achieved.

3 Groundwater Monitoring Program

The GWMP has been developed using a systematic planning process, as per Clause 7.2.2. of CSA N288.7-23. The basis of the GWMP is a set of defined monitoring objectives. These objectives are related to the specific groundwater protection goals, defined in Section 2.2.

The GWMP is developed in this document in three stages. In the first stage (this Section), the objectives of the GWMP are defined. For each objective, the information needed to meet the objective is identified, and how the information will be collected and used to achieve the objective is outlined. This comprises the GWMP design.

In the second stage (Section 4) a preliminary procedure to be followed when a potentially emerging condition (excursion) has been identified is provided.

Also provided, as Section 5 is an outline of the content of the detailed Groundwater Sampling Work Package that will be prepared to execute groundwater the GWMP. This includes procedures such as the sampling and analysis procedures, Quality Control and Quality Assurance (QA/QC), data management, well installation and maintenance procedures, waste management, reporting, program review, etc.

3.1 GWMP Objectives

An objective is defined in Clause 3.1 of N288.7-23 as "[a] specific action or purpose that supports the attainment of an associated goal". The intent is that objectives are to be stated with sufficient clarity to guide monitoring actions to obtain the required data, and with sufficient clarity to allow measurement of progress toward achieving the objective.

In accordance with Clause 4.2 of N288.7-23, there are several objectives that fall under "shall consider" clauses, meaning that reasons for including or excluding the objective shall be documented. Each of these objectives are considered in **Table 3-1**, and rationale is provided with respect to the decision to include or exclude the objectives in the GWMP objectives for the Wheeler River Operation.

Table 3-1: Regional (GWR-series) Groundwater Monitoring Well

Objectives in Clause 4.2 of N288.7-23	Included (I) or Excluded (E)	Rationale
Support the Overall, General and Specific goals of the GWPP	I	Each Objective in the GWMP ties into the GWPP goals
Demonstrate compliance with requirements of the authority having jurisdiction (AHJ) concerning the release of nuclear and hazardous substances from the source	I	The GWMP provides the data to demonstrate compliance with AHJ requirements
Provide data to verify the predictions made and models used in the EA or ERA, or reduce the uncertainty in predictions	I	The GWMP provides the data to verify and/or reduce the uncertainty in the predictions made and the models used in the EA.
Characterize groundwater flow and baseline groundwater quality conditions at a site	I	Baseline water quality and groundwater flow conditions have been provided in the Baseline Report. However, supplemental monitoring

		of existing (Pre-Mining) conditions during Construction is proposed in the GWMP.
Characterize groundwater flow and groundwater quality during other phases of a project's life cycle.	I	The GWMP serves to monitor conditions under Construction, Operation, Decommissioning, and Post-decommissioning.
Provide information to assess risks from site-affected groundwater to human health and the environment	I	The GWMP provides groundwater flow and quality information relevant to assessment of risks to humans and ecological users of water in Whitefish Lake, being the identified groundwater end uses.
Evaluate monitoring data against groundwater evaluation criteria related to nuclear and hazardous substances in groundwater	I	Groundwater evaluation criteria are defined for COPCs (nuclear and hazardous substances) for groundwater at the point of discharge to Whitefish Lake.
Provide an indication of unusual or unforeseen conditions that might require corrective action or additional monitoring.	I	The GWMP is designed to detect where and when excursions are occurring, in conjunction with other existing Denison programs.
To the extent possible, monitor for releases from high risk SSCs associated with a given facility	I	In the GWMP, groundwater monitoring is designed to monitor releases from SSCs associated with surface facilities and the mining area.
Other objectives identified by the facility operator (e.g., demonstrate due diligence, meet a stakeholder commitment, or other business reasons)	E	No other objectives have been identified by the facility operator for inclusion in the GWMP.

3.2 GWMP Specific Objectives and Detailed Design

The GWMP has been designed using professional judgement along with a thorough knowledge of the Operation including site hydrogeology and the local environment. As the GWMP is executed, any changes made to the monitoring outlined here should be based on sound professional judgement and are to be documented.

For each stage of the Operation, the following subsection below outline/identify:

- the location of monitoring wells, spatially and target hydrostratigraphic units (HUs);
- chemical and physical parameters to be measured; and
- sampling frequency.

The groundwater well monitoring network and sampling plan will be flexible and adapted at each stage to ensure that changes in groundwater quality and quantity associated with mining activities are identified in a timely fashion. The spatial pattern of monitoring wells (i.e., well locations and density) and the sampling schedule will reflect the spatial and temporal distribution of COPCs, guided by anticipated operational conditions and by the range of constituent behaviours identified in the site-specific fate and transport modelling, detailed in the Modelling Report in the Draft EIS. The monitoring system will be designed at each stage such that there is adequate coverage of all HUs.

3.2.1 Monitoring During Site Preparation and Construction: Supplemental Monitoring of Existing (Pre-Mining) Groundwater Conditions

The understanding of pre-mining groundwater flow conditions and quality in the LSA are described in the Baseline Report. Existing groundwater conditions are well understood for the Operation. The existing network of groundwater wells at the Site is show in **Figure 3-1**. The groundwater wells sampled as part of the Baseline Report and a description of each well in terms of the HUs in which they installed are summarized in [redacted] Groundwater monitoring wells that can no longer be sampled due to well integrity are indicated in [redacted]

In relation to the groundwater monitoring at the site to date, groundwater monitored fits within two zones, with the language being used aligning with that used for other ISR projects (e.g., U.S. EPA, 2020). Specifically, groundwater being sampled is zoned as follows:

i. Background
ii. Baseline

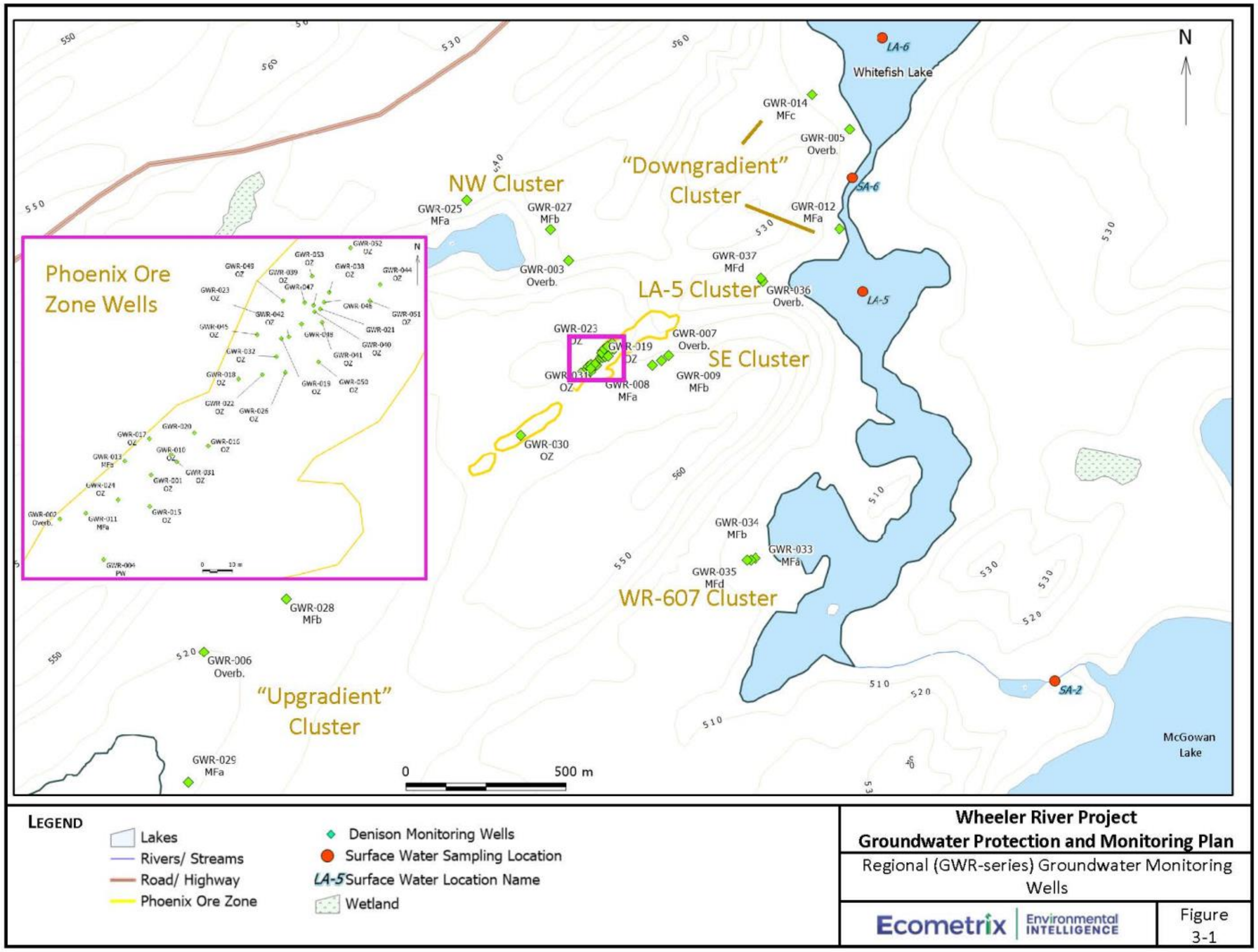
The "Baseline" groundwater zone is defined herein by two sub-zones:

i. Ore Zone: groundwater within the ore zone; and
ii. Downgradient: groundwater along the anticipated groundwater flow path from the ore zone to the receiving environment.

"Background" groundwater quality refers to groundwater that is likely to have negligible influence from ISR activities.

The level of certainty of groundwater flow conditions and groundwater quality required in association with these two groundwater zones is different. A higher level of certainty is required for baseline, in anticipation that groundwater in this zone is that which will be influenced by ISR activities. A high level of certainty of groundwater conditions in this zone provides a robust and timely measure of any influence of mining activities on groundwater quality.

Figure 3-1: Regional (GWR-series) Groundwater Monitoring



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3.2.1.1 Pumping Tests

To address uncertainty in the hydraulic conductivity in the DSZ, minimally 48-hour pumping tests are recommended in the new freeze wall perimeter well (P1) cluster in the Lower Sandstone Aquifer and Intermediate Sandstone Aquitard. At this location, both wells will be screened in desilicified sediments.

[redacted]

3.2.2 Monitoring During Site Preparation and Construction: Testing for Projected Groundwater Supply

Mining operations will include the use of groundwater for several purposes, including supply make-up water to the ISR plant, support freeze wall development, wash bay requirements, and drilling activities (pre-development). Three groundwater wells for water supply are planned and their proposed locations are shown in **Figure 3-2** as “freshwater wells” A, B, and C. The wells are anticipated and were simulated in the Modelling Report (Appendix 7-C of the Draft EIS) to pump water from the Upper Sandstone Aquifer.

The groundwater wells installed for water supply require a Water Rights Licence under *The Water Security Agency Act*, and a Permit to Conduct Ground Water Investigation and Approvals to Construct and Operate. The investigation objective is to demonstrate that the groundwater source can sustain the proposed development, and not cause any adverse impacts on the source or existing groundwater users. (https://www.wsask.ca/permits-approvals/regulatory-information/ground-water-approval-process/)

The following are required:

- At least two permanent observation wells (piezometer) completed and sealed in the target aquifer;
- An estimate of the maximum pumping rate and annual quantity required;
    - Related to the maximum pumping rate, required monitoring/data include:
        - A minimum 24-hour constant rate pumping test showing;
            - casing elevation of pumping well and observation wells;
            - depth to static water level in pumping and observation wells;
            - draw downs in pumping and observation wells;
            - time and pumping rate; and
            - water level recovery measurements in pumping and observation wells after pumping has stopped; the recovery period shall be of the same duration as the pump test or until the aquifer has recovered to pre-pumping level.
        - Original borehole geophysical logs and descriptive logs of all test holes; and
        - Copies of well and observation well completion records.

3.2.2.1 Approach

In the early stage of Construction, pumping wells A and C will be installed in the approximate locations shown in **Figure 3-2**. Nearby is monitoring well GWR-003, as is shown in

Figure 3-3, which is screened in the overburden. Water will be drawn out of well A and wells C and GWR-003 will be used as observations wells for a minimum of a 24-hour constant rate pumping test. Once conditions have re-equilibrated after that test, a (at least) minimum of a 24-hour constant rate pumping test will be done completed in Well C, with wells A and GWR-003 acting as the observation wells.

Results will be reported to the Water Sustainability Act (WSA) in support of a Water Rights Licence.

Figure 3-2: Groundwater Monitoring Network: Surface Facilities

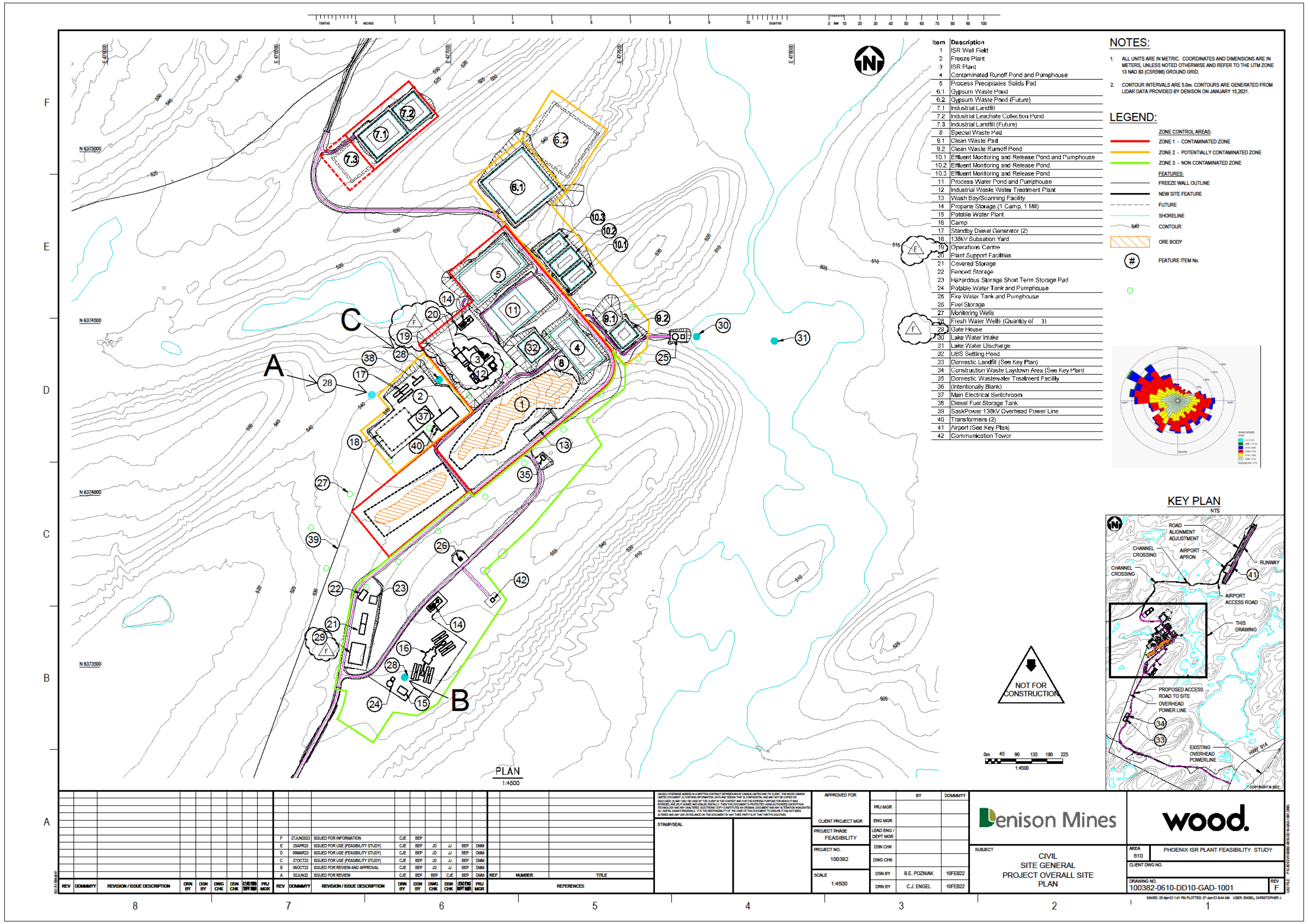
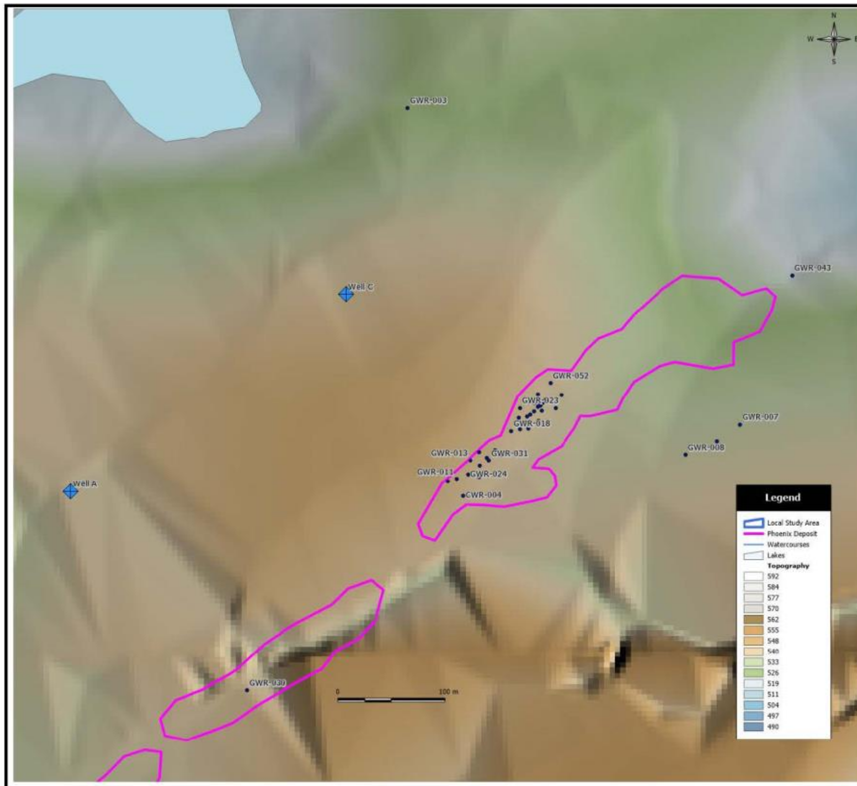


Figure 3-3: Water Supply Wells A and C and GWR-003



Wheeler River Project
Groundwater Protection and Monitoring Plan
Water Supply Wells A and C and GWR-003

Ecometrix | Environmental Intelligence

Figure 3-3

3.2.3 Operation

3.2.3.1 Surface Facilities

Surface facilities are shown in **Figure 3-2** and include ponds, landfills, laydown, and wash areas. The facilities – including liner systems – do not extend more than approximately 4 metres below ground surface (mbgs); 4.5m is the typical distance from the floor of a pond to the top of the safety berm.

Excursions associated with surface facilities are changes in groundwater flow conditions or groundwater quality that represent departures from the Operation design. Such departures include spills, leaks, or uncontrolled leachate from the surface facilities that cause changes to the shallow groundwater flow conditions and/or groundwater quality. Because the facilities extend to a relatively shallow depth into the subsurface, interactions of the surface facilities with groundwater are expected to be limited primarily to the overburden aquifer.

The monitoring plan for the surface facilities and rationale for monitoring locations is provided in **Table 3-4**. Unless otherwise indicated, the groundwater wells are water table wells, meaning they will be screened across the water table, in the overburden materials. Based on available data, the depth of the water table is anticipated to be approximately 20-30 mbgs across the area over which the surface facilities extend.

Monitoring wells will be installed around the perimeter or immediately downgradient of each surface facility. Upgradient wells are existing GWR-series wells installed in the overburden aquifer: GWR-003, GWR-006 and GWR-035. Upgradient wells are sampled to identify any changes from baseline conditions in the overburden aquifer that occur over the operational stage of the mine life.

A total of 13 or 14 new wells will be installed to monitor shallow groundwater conditions during operations of the surface facilities (**Table 3-4**). GWR-036 and GWR-037 will also be sampled as per **Table 3-4** to monitor downgradient locations at the Site, close to Whitefish Lake, and any excursions associated with the effluent discharge lines.

The monitoring well network can be built up over time in alignment with the mining phases. If this approach is taken, groundwater sample collection will begin prior to mining. Pre-operations samples in the surface facilities wells should be collected on two occasions, and preferably in two seasons.

Groundwater quality objectives are discussed further in Section 5.

Table 3-4: Surface Facilities Groundwater Monitoring Plan

Structure	Function	Construction	Well Network (Proposed New Wells)	Key Indicator Parameters	Sampling Frequency
Process Water Pond	Captures water from a variety of areas, including the process precipitate storage pad and special waste pad	Double composite liner systems with leak detection	1 Downgradient Well	Water Level, pH, temperature, EC, Cl, Dissolved U	Semi-Annually (Spring, Fall/Winter)
Contaminated Runoff Pond	Captures runoff from the wellfield and the special waste pad	Double composite liner systems with leak detection	1 Downgradient Perimeter Well	Water Level, pH, Temperature, EC, Cl Dissolved Uranium	Semi-Annually (Spring, Fall/Winter)
Clean Waste Runoff Pond	May be constructed beside the clean waste rock pad to collect runoff, as required	Single geomembrane liner, with protection	None required	N/A	N/A
Domestic Wastewater Treatment Facility (and Pond)	Pond receives water from the Domestic Wastewater Treatment Plant	Composite liner system	1 downgradient well	Water level, pH, temperature, EC, Cl, Nitrate	Seasonal (Spring, Summer, Fall/Winter)
Effluent Monitoring and Release Ponds and Treated Effluent Discharge Line	Receive treated water primarily from the DWWTP and the IWWTP. Option to recycle water from these ponds back into the processing plant via the process water pond. The treated effluent discharge line runs from the effluent monitoring and release ponds into Whitefish Lake.	Composite liner system. Discharge Line double walled with heat tracing. Trail along length of discharge line allowing visual inspection.	1 Downgradient well. Wells GWR-036 and GWR-037 provide monitoring of discharge line.	Water level, pH, temperature, EC and Cl	Continuous water level, temperature and EC measurements. Manual sample collection seasonally (Spring, Summer, Fall/Winter)
Domestic Waste Landfill with Leachate Collection Pond	Accepts materials including wood, non-recyclable plastics, broken furniture, textiles, and non-recyclable items from the camp and operations centre.	Composite liner system with leachate collection. Pond is double composite liner system with leak detection.	2 Downgradient Wells	Water level, pH, temperature, EC, Cl, Nitrate	Seasonal (Spring, Summer, Fall/Winter)
Construction Waste Laydown Area	Next to the future domestic landfill to temporary store construction and construction leftover materials	Not lined. Base soil compacted. Bermed to prevent run-on and run-off	Monitoring included with the Domestic Waste Landfill and Leachate Collection Pond	N/A	N/A
Industrial Waste Landfill with leachate collection pond and industrial laydown area	Accepts industrial wastes generated at site including waste with chemical and/or low-level (as defined by CNSC) radiological waste contamination.	Double composite liner system with leak detection between the composite liners and leachate collection system above the primary, or upper composite liner. Leachage pond has double liner system with leak detection.	3-4 Perimeter Wells	Water Level, pH, Temperature, EC, Major Ions (Na, Ca, Mg, K, Cl, SO4, Inorganic Carbon Species), radionuclides (includind dissolved U)	Seasonal (Spring, Summer, Fall/Winter)
Hazardous Waste Storage Pad	Denison identified a need to have a small (250 m^2) pad designated for temporary storage of hazardous waste such as paints, solvents, hydrocarbons, and used oil.	Composite liner system	1 downgradient well	Water level, pH, temperature, EC, Cl, Volatile organic constituents (VOCs)	Semi-Annually (Spring, Fall/Winter)
Process Precipitate Pond	Receives radioactive process precipitates	Double liner system with leak detection capabilities	1 downgradient well (1 other downgradient well shared with Process Water Pond)	Water Level, pH, Temperature, EC, Cl Dissolved Uranium	Seasonal (Spring, Summer, Fall/Winter)
Industrial wastewater treatment plant precipitate pond	Receives Non-radioactive IWWPT Precipitates	Composite liner system	1 downgradient well	Water Level, pH, Temperature, EC, Major Ions	Semi-Annually (Spring, Fall/Winter)
Special Waste Pad	Expected to contain primarily mineralized core and cuttings from wellfield development	Double composite liner system with leak detection capabilities	1 downgradient well	Water Level, pH, Temperature, EC, Major Ions, Dissolved U	Semi-Annually (Spring, Fall/Winter)
Clean Waste Pad	Receives clean waste rock, generated as sandstone cuttings and core from drilling activitie	Single geomembrane liner with protection	None required	N/A	N/A
Wash Bay and Scanning facility	Area to clean items, equipment, and vehicles that may have been in contact with potential contaminants	May have a single geomembrane liner with protection. Perimeter berms and a lined sump for collection.	No additional wells required. Downgradient water quality in OB aquifer monitored as part of Freeze-Wall perimeter wells	(Being meausured in freeze wall perimeters wells is: pH, EC, ORP, Cl, Sulphate, Dissolved U)	N/A
Upgradient Wells	Monitors Upradient Conditions in Overburden Aquifer	N/A	Includes GWR-003, GWR-006 and GWR-035. No new wells required	Water Level, pH, Temperature, EC, Major Ions, Dissolved U	Continuous water level, and temperature (transducer). Manual sample collection annually (to confirm baseline conditions).
Total of Proposed new shallow (OB aquifer) groundwater monitoring wells to monitor surface facilities: 13-14.					
Sampling frequency and other program parameters will undergo continuous evaluation and will be adjusted, as needed, to meet GWP&MP goals.					

3.2.3.2 Mining Area

During Operation, the freeze wall and other engineering controls (e.g., well field design, injection and recovery pattern and pressures, etc.,) mitigate against lateral and vertical transport of mining-related constituents away from the ore zone in groundwater.

Groundwater monitoring at this Stage has been developed with two specific objectives:

i. **Within the freeze wall:** demonstrate that groundwater quality at elevations above the mining area (i.e., positioned at elevations 50 m or more from the mining horizon) do not show a change from baseline levels; and

ii. **Outer perimeter of freeze wall:** demonstrate that groundwater quality outside the freeze wall is not changing in a manner as to signal excursions, and if occurring, to detect the excursion and location where it is occurring, in a timely fashion.

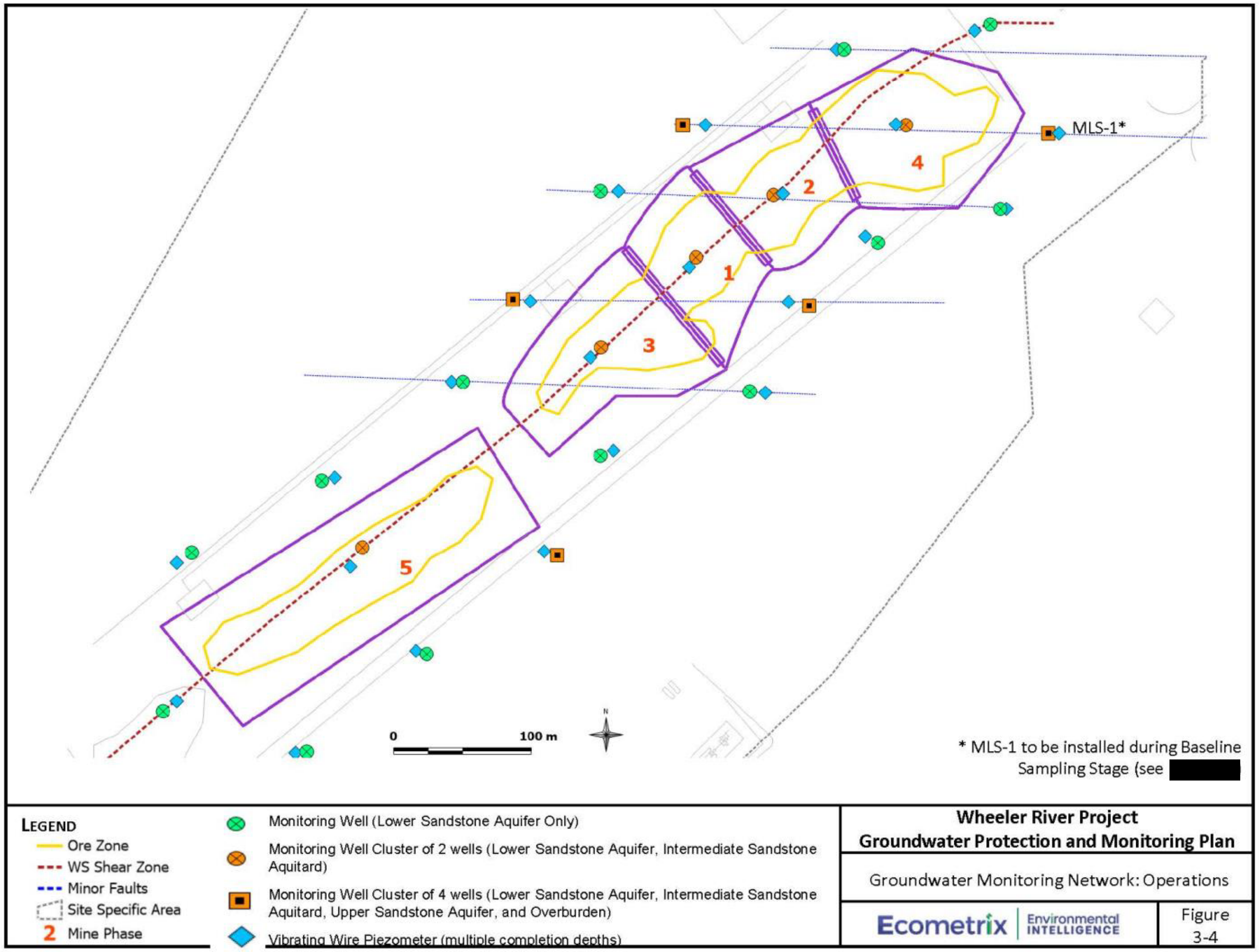
The recommended monitoring well network to achieve these objectives is shown in **Figure 3-4**, and details are provided in [redacted] Well names have not been assigned at this time. The exception to this is monitoring location MLS-1, which is a multilevel or well cluster on the freeze wall perimeter that will be installed to establish baseline conditions in the desilicified zone. Existing GWR-series monitoring wells will be used where possible to meet the monitoring needs at this stage. New monitoring wells will be installed as required.

The ore zone will be mined in five (5) phases, beginning with Phase 1 (**Figure 3-4**). The freeze wall will first encircle Phase 1, and then will be expanded to include Phase 2, Phase 3, and Phase 4, respectively, by thawing of the frozen cross wall sections between adjacent Phases. A separate freeze wall will also encircle Phase 5. Thus, the freeze wall "perimeter" will change and expand over time as mining phases come online. The monitoring network shown in **Figure 3-4** is the conceptual configuration expected when mining activities are occurring across all phases.

The monitoring well network can be built up over time in alignment with the mining schedule. If this approach is taken, sufficient time must be given prior to starting mining to characterize pre-mining conditions at each location. Pre-mining (baseline) samples in each well (again, except for MLS-1) should be collected on two occasions, and preferably in two seasons.

With respect to monitoring around the perimeter of the freeze wall: the groundwater monitoring program presented here provides the monitoring framework to evaluate changes in groundwater quality surrounding the freeze wall and detect excursions from potential loss of freezing capacity. However, the loss of freezing is expected to be signaled much earlier by operational monitoring.

Figure 3-4: Groundwater Monitoring Network: Operations



Types of Monitoring Installations

The proposed monitoring well network within and surrounding the freeze wall consists of four types of installations.

i. Vibrating Wire Piezometers;

ii. Multi-Level Wells or Clusters of four Groundwater Monitoring wells;

iii. Multi-Level Wells or Clusters of two Groundwater Monitoring wells; and

iv. Single Interval Groundwater Monitoring Wells.

Around the perimeter of the freeze wall, monitoring wells generally target the Lower Sandstone Aquifer (single interval groundwater monitoring wells) as this is the most likely unit through which mobilized COPCs may migrate laterally. At all locations, monitoring/sampling wells will be paired with adjacent vibrating wire piezometers. The vibrating wire piezometer (VWP)s are intended to provide early warning of potential excursions by signaling pressure changes outside the freeze wall. Adjacent to each mining Phase, the monitoring well plan also includes a cluster of four monitoring wells, wherein multiple elevations would be discreetly monitored to observe any changes vertically above or below the mining horizon.

Within the footprint of each mining phase, vertical sets of wells (I.e., well clusters) and VWPs will be utilized to monitor vertical pressure changes and potential upward COPC migration. VWPs will be designed to have multiple completions with depth to monitor pressure variability between the ISR mining horizon and the overlying strata.

Details on each type of installation are summarized in [redacted]

Well Placement

The ISR projects in the United States monitor vertical excursions across the freeze wall in the overlying and underlying aquifers with 1 well per 1.2 to 2 hectares (1 hectare = 10,000 m^2) (NRC, 1997, 1998, 2006; Mackin et al., 2001). The frequency of one well per mining Phase for the Operation is aligned with, and results in a greater number of wells than, the precedent at operations in the USA.

The wells around the perimeter of the freeze wall are positioned 20 m from the expected outside perimeter of the freeze wall. This distance was selected because:

- A measurable change in water quality in these wells associated with water quality changes in the mining area in the perimeter wells will be dependent on the effective porosity but would be reasonably expected to occur within 8-10 years. This estimation reflects geomean hydraulic conductivity of the Lower Sandstone Aquifer and Desilicified Zone, are 2.2×10^{-6} m/s and 6.0×10^{-6} m/s, respectively (Ecometrix, 2022b); and

- It is as close to the freeze wall as is considered advisable to represent undisturbed/ambient conditions.

The maximum spacing between monitoring wells around the freeze wall perimeter is no more than 125 m, as proposed, and should not exceed 150 m.

The proposed monitoring network does not include wells installed in the ore zone within the basement aquitard, including the upper paleoweathered zone. The underlying basement rock has very low hydraulic conductivity (Ecometrix, 2022b) that will act to limit the downward vertical migration, but severely limits the capacity of the rock to yield water for sampling. Despite the low hydraulic conductivity, the fluids injected during mining are characterized by a high density and specific gravity (greater than sea water) and have the potential to migrate downward to the base of the paleoweathered zone. Vibrating wire piezometers will delineate the pressure front in the aquitard. Should the potential for an excursion be identified through monitoring of the pressures, the process for excursion management (Section 4) will be followed.

The monitoring wells and VWP proposed in the mining zone and the freeze wall perimeter are, for the most part located along the WS Shear or minor faults. The placement of these wells along these features ensures that changes in groundwater flow conditions and water quality along possible preferential pathways is being monitored.

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3.2.3.3 Key Performance Indicators

A subset of COPCs have been identified as high priority/key performance indicators during the mining stage, as outlined in [redacted] A number of these parameters can be measured in the field (pH, ORP, temperature and EC), and some have been selected for continuous measurement, including hydraulic response (pressure), temperature, and EC. The key performance indicators selected, and the rationale for their selection, are:

Hydraulic Response: The mining fluids are injected at operating pressure that exceed ambient subsurface pressures. Changes in hydraulic head – or the hydraulic response – is a very sensitive measure to changes in pressure. A hydraulic response would be interpreted to indicate a pressure gradient and the potential for fluid movement between the mining chamber and the observation point and may indicate that an excursion has taken place. The volume of the excursion indicated will depend upon the local specific storage and effective porosity (i.e., responses in fractured rock of the paleoweathered zone may require very little volume), and as such storage and porosity conditions will be accounted for when evaluating pressure responses. The importance of hydraulic response as a key indicator is demonstrated by the proposal for continuous monitoring of this parameter; hydraulic response is considered a leading or early warning indicator of potential flow changes, and thus is an important part of the monitoring program.

Temperature: Ambient groundwater temperatures in the Lower Sandstone Aquifer are expected to be <10°C. The temperature of the mining fluids are expected to be exceed these temperatures to some extent (on the order of 10 °C) due to reactions between the ore and the fluids. An increase in temperature may indicate that an excursion has taken place. The importance of temperature as a key indicator is demonstrated by the proposal for continuous monitoring of this parameter as part of the monitoring program.

pH: The mining fluids have a pH < 2. Groundwater pH values are circumneutral (pH ranges from 6.3 to 7.5). A change in pH to more acidic values (<6) may indicate that an excursion has taken place.

ORP: The mining fluids will have an ORP that is oxidizing (>400 mV). The groundwater is anoxic and has ORP values that are typically <150 mV. An increase in ORP may indicate an excursion has taken place.

Electrical Conductivity (EC): The mining fluids have high total dissolved solids (TDS), and associated EC. The specific conductivity of the mining fluids will exceed 15,000 µS/cm whereas the maximum specific conductivity in groundwater in the overlying Lower Sandstone Aquifer are approximately 1000 µS/cm (Ecometrix 2022a). An increase in EC may indicate an excursion has taken place. The importance of EC as a key indicator is demonstrated by the proposal for continuous monitoring of this parameter as part of the monitoring program.

Sulphate: The primary chemical in the injected fluids is sulfuric acid (H_2SO_4). In metallurgical testing completed for the project to date, sulphate concentrations in the leachate can exceed 40,000 mg/L. Concentrations of sulphate in groundwater may be influenced by interactions with other groundwater/mining fluid constituents, however, elevated concentrations of sulphate may indicate an excursion has taken place.

Dissolved Uranium: Mobilized uranium in the injected fluids reach concentrations that are orders of magnitude higher than those in groundwater. Should an excursion be taking place, it is important to understand the associated dissolved uranium concentration.

One additional parameter, **chloride**, has been included as a key parameter. It is possible that mobilized chloride concentrations are higher in the injected fluids than in groundwater; however, this is not the primary intent of including this parameter in the routine monitoring. Rather, calcium chloride brine makes up fluids that maintain the freeze wall. Thus, a change in the concentration of chloride - and EC - may indicate that a loss of freezing capacity has occurred in the freeze wall and delineate the extent of brine migration. However, loss of freezing is considered as an accident and malfunction, and loss of freezing is expected to be signaled much earlier by operational monitoring (e.g., pressure changes in the cooling circuit) than through monitoring of water quality. Should other parameters be identified through monitoring as being Key Parameters, they will be added to this list.

How changes in concentrations/values of these parameters may signal an excursion is discussed Section 4. Groundwater quality objectives during Operation are discussed in Section 5.

3.3 Decommissioning and Post-Decommissioning

Groundwater monitoring during the Decommissioning and Post-Decommissioning stages of the Operation is provided at a conceptual level in this version of the GWMP, in support of the environmental assessment. A groundwater monitoring plan during decommissioning will be further developed as part of the detailed closure and decommissioning plan, which will be developed with input from local land users, Indigenous peoples, and the general public and submitted to regulators as part of licensing and permitting. Prior to executing decommissioning activities, details of the groundwater monitoring needs during decommissioning will be developed and submitted as part of a Detailed Decommissioning Plan (DDP) to regulators for acceptance. The DDP builds on the PDP.

The primary objective during Decommissioning is to demonstrate that water quality is remediated in the mining area to meet acceptable Decommissioning Objectives. There will also be a small number of decommissioned surface facilities for which downgradient groundwater conditions will be monitored to verify chemical stability.

The primary objective at the Post-Decommissioning stage is to demonstrate re-establishment of the pre-operational groundwater flow regime and that chemical stability of groundwater quality will continue into the future. Chemical stability will be demonstrated by verifying groundwater reactive transport of COPCs in remediated groundwater is aligned with that predicted through modelling and testing in the years immediately following the thawing of the freeze wall. The Post-Decommissioning GWMP will be designed in detail and conducted in accordance with the provincial and federal regulations and license conditions.

3.3.1 Surface Facilities

During decommissioning of the surface facilities there will be decontamination, asset removal, and demolition and disposal activities, as outlined in the EIS (Denison, 2022).

Ponds will be decommissioned once they are no longer required for water management. Any contaminated liners will be removed and hauled to an approved disposal facility. Shallow groundwater wells associated with decommissioned facilities will be abandoned in accordance with Provincial well abandonment legislation.

Facilities retained on site, and their decommissioned configurations, include:

- The industrial landfill, containing low-level (as defined by the CSNC) radiological waste contamination, will have an engineered cover installed to limit water infiltration into the industrial wastes; and
- The material (primarily gypsum) in the industrial waste water treatment plant precipitate pond will be covered and decommissioned in place.

During Operation, there are 3 or 4 wells planned to monitor conditions around the perimeter of the industrial landfill, and 1 well planned to monitor downgradient of the industrial waste water treatment plant precipitate pond. The monitoring wells will be retained to demonstrate chemical stability of groundwater surrounding and downgradient of these facilities after the covers have been placed.

The monitoring wells associated with these facilities will have been sampled extensively during Operations (in accordance with **Table 3-4**). Thus, there will be a good understanding of the chemical stability prior to cover placement. It is expected that long-term chemical stability, post cover placement, will be demonstrated in 2 to 3 years with seasonal sampling. Monitoring of these wells may extend into the early Post-Decommissioning period.

To demonstrate chemical stability, it is recommended that monitoring include the full suite of inorganic and radiological groundwater constituents listed in Section 2.1.2. Organic constituents are not expected to be COPCs associated with the decommissioned industrial landfill or industrial waste water treatment plant precipitate pond but will be added for analysis as deemed necessary. Upgradient conditions will continue to be monitored during the decommissioning phase in one or more of the GWR-series wells completed in the overburden aquifer.

3.3.2 Mining Area

3.3.2.1 Within Freeze Wall

Remediation of water quality within the mining area will occur during the Decommissioning stage. The mining area will be contained by the freeze wall and is controlled through engineering means to extend upwards 50 m vertically from the ore zone, as shown conceptually in **Figure 3-5**. The freeze wall will remain in place until the mining area decommissioning objectives are met within this zone.

Remediation of the mining area will involve injection of water into the mining horizon via injection wells and withdrawal from recovery wells. Neutralizing reagents such as sodium bicarbonate and sodium hydroxide may be added to the injected water to accelerate groundwater quality recovery. Produced water will be processed through the processing plant until non-economic uranium concentrations are observed. Non-economic produced waters will be treated in the industrial waste water treatment plant. The effluent will either be discharged or recycled and mixed with fresh water and/or neutralizing agents for continued circulation in the mining horizon. This will continue until recovered water reaches and is demonstrated to be stabilized (maintained) at the mining area Decommissioning Objectives.

The mining area Decommissioning Objectives prepared in support of Environmental Assessment were developed through metallurgical testing as being reasonably achievable (Denison, 2022) and to not pose a risk to groundwater end use through reactive transport modelling (Modelling Report in the Draft EIS) and the environmental risk assessment (ERA). In the modelling simulations, it was assumed that within the mining area, water quality will meet two sets of decommissioning objectives. These are shown conceptually in **Figure 3-5**.

The mining area Decommissioning Objectives (as presented in the Draft EIS) apply to the mining horizon and the 15 m of immediately overlying strata. The second set of water quality objectives, in concentrations of COPCs were set at 50% of their values in the Decommissioning Objectives, applies to groundwater within the 35 m thickness of Athabasca Sandstone Supergroup materials that overly the mining horizon by 15-50 metres. The water quality objectives set for this “Upper Mining Zone”, reflect that groundwater quality is assumed to be influenced by mining-associated COPCs, but not to the same extent as in the mining horizon. Thus, water quality in the Upper Mining Zone will need to meet more stringent water quality objectives, based on this assumption.

The Decommissioning Objectives developed are comprehensive for the inorganic and radionuclide COPCs listed in Section 2.1.2.3. Refinement of these Decommissioning Objectives will continue as the Operation progresses and (final) acceptable Decommissioning Objectives will be developed prior to initiation of groundwater remediation.

Well Placement and Sampling Approach

The conceptual basis for a network of groundwater monitoring clusters (or multilevel wells) during Decommissioning is shown in **Figure 3-5**. Two wells will be positioned within the mining horizon to monitor conditions towards the base (well “E”) and towards the upper extent of this horizon (well “D”). Two wells will be positioned within the Upper Mining Zone, again towards the base (well “C”) and towards the upper extent of this zone (well “B”). A well will also be positioned immediately above the Upper Mining Zone (well “A”) to confirm baseline water quality above the mining area.

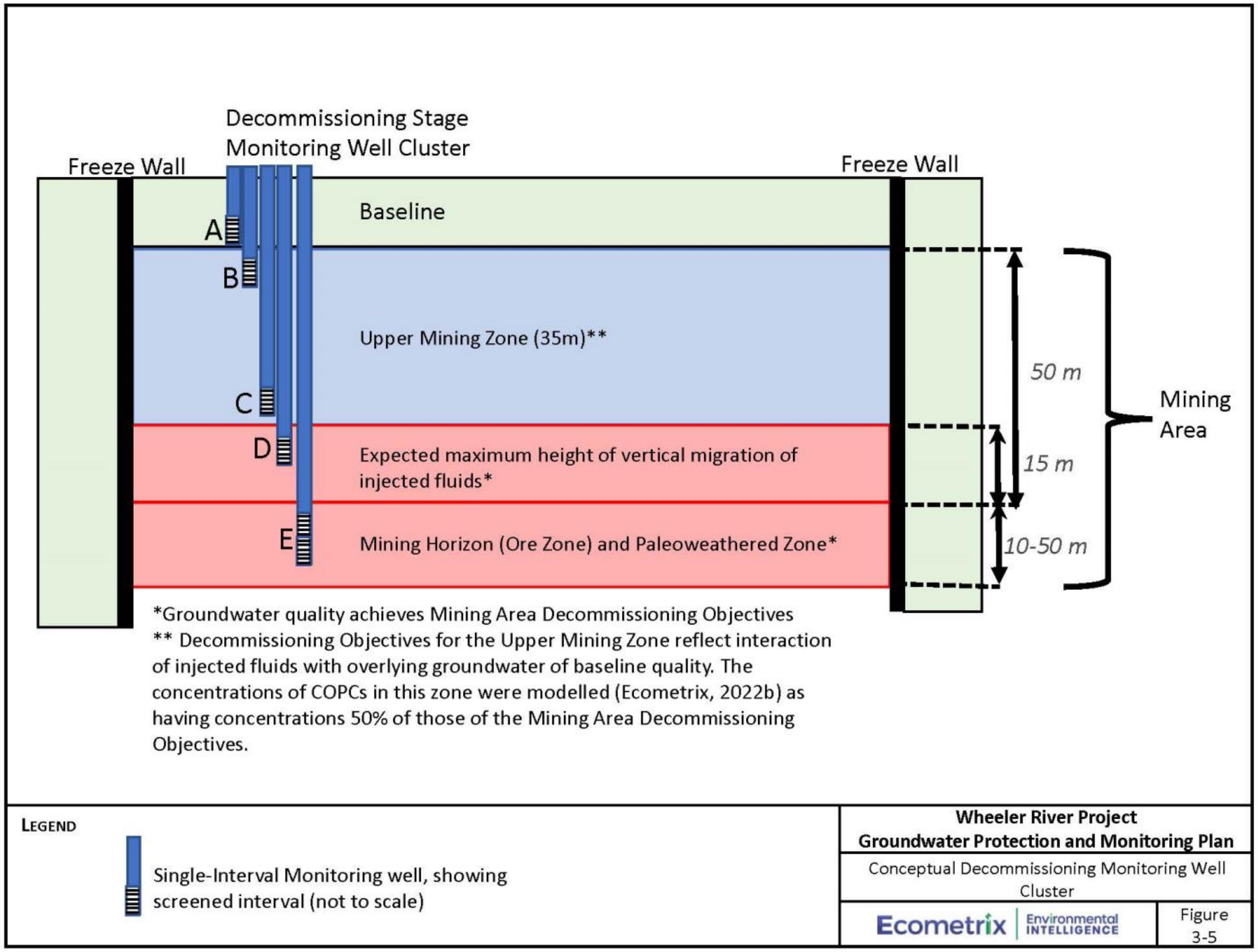
At least five to seven (5-7) of these clusters are proposed across the mined area; four to six (4-6) spanning mining Phases 1 to 4, and 1 to 2 spanning the mining Phase 5 zone. Sampling will include the full suite of COPCs defined in Section 2.1.2.3, and other COPCs that may be identified during Operation.

Sampling of water produced in the mining horizon over the entire remediation process will be frequent (at least weekly), to allow the remedial approach to be adapted as required on a spatial-temporal basis. Suggested sampling frequency of the wells in the Upper Mining Zone and overlying Athabasca Sandstones will be seasonally in the first three (3) years of decommissioning, and potentially more frequent in the later two (2) years of decommissioning, to demonstrate chemical stability. However, the frequency of monitoring will be re-evaluated and modified, as appropriate, during decommissioning.

Groundwater quality is not expected to be uniform across the monitoring wells installed in the same horizon; for example, groundwater quality in “D” wells across the mining zone will not be uniform. As such, meeting the acceptable Decommissioning Objectives will be based on statistically demonstrating that the water quality in each zone meets acceptable target values with associated level of uncertainty (i.e., central tendency and 95% confidence interval) and is stable over sufficient time for there to be confidence that conditions will not change.

Where possible, groundwater monitoring wells installed during Operation for groundwater monitoring above the mining area will be used for monitoring during Decommissioning. New wells will be installed as needed.

Figure 3-5: Conceptual Decommissioning Monitoring Well Cluster



*Groundwater quality achieves Mining Area Decommissioning Objectives
** Decommissioning Objectives for the Upper Mining Zone reflect interaction of injected fluids with overlying groundwater of baseline quality. The concentrations of COPCs in this zone were modelled (Ecometrix, 2022b) as having concentrations 50% of those of the Mining Area Decommissioning Objectives.

3.3.2.2 Outside of Freeze Wall

During the Decommissioning, monitoring will continue in the freeze wall perimeter wells. The objective of this monitoring is, as during Operation, to demonstrate that excursions are not occurring, and if occurring, to detect the excursion and location in a timely fashion. The key indicator parameters and sampling frequency are anticipated to follow those provided during Operation ([redacted] but will be adapted as necessary.

3.3.3 Post Decommissioning

After remediation has been completed, the freeze wall will be allowed to thaw. This will allow the eventual re-establishment of the pre-operational groundwater flow regime in the former mining area. The post-decommissioning period will extend from the end of physical decommissioning until transfer of the site into the provincial Institutional Control Program (Government of Saskatchewan 2009) or direct release of the land back to the Crown.

The primary objectives at the Post-Decommissioning stage are to demonstrate that:

- the pre-operational flow conditions are re-established; and
- chemical stability is verified in the years following the thawing of the freeze wall.

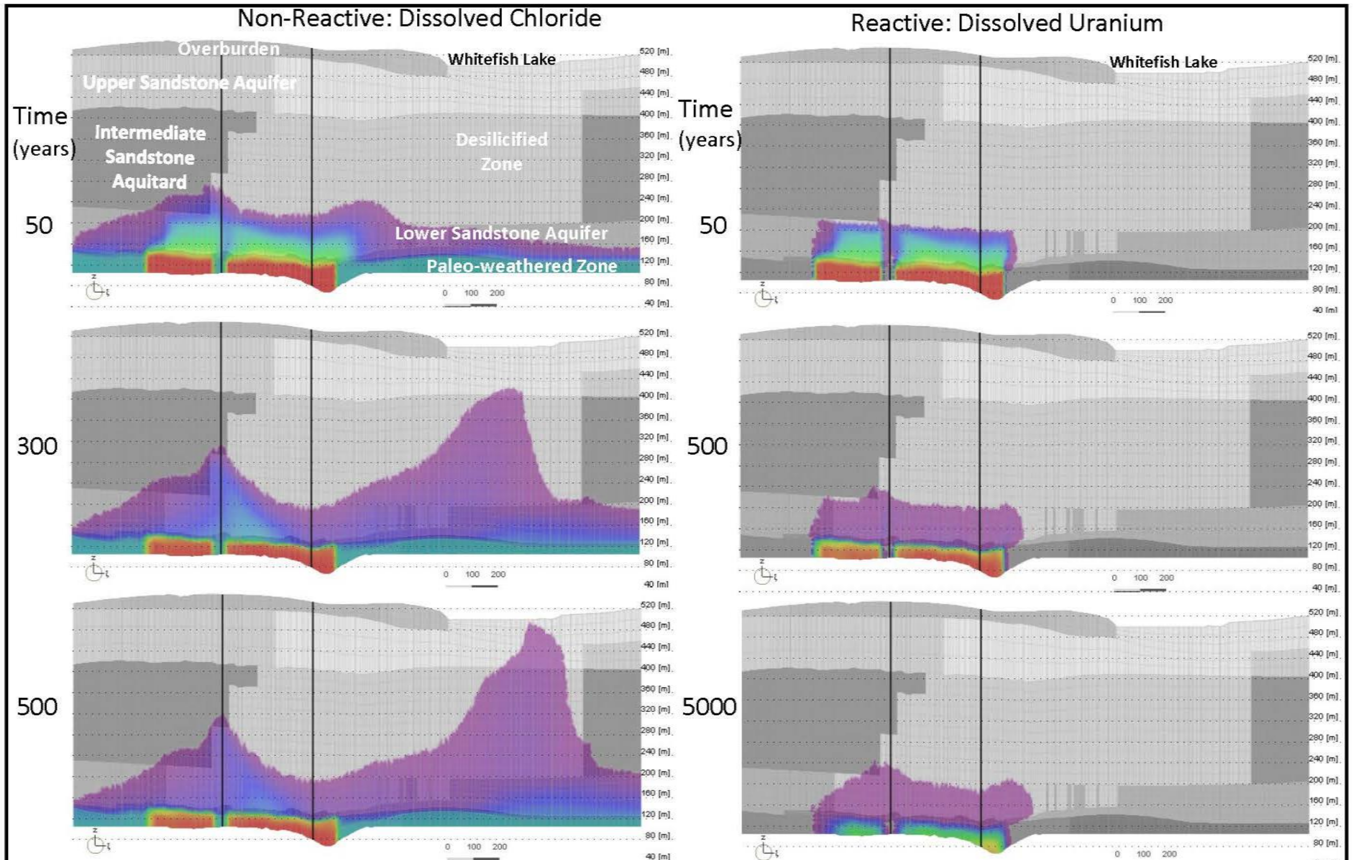
Verification of chemical stability involves a demonstration that measured groundwater flow conditions and quality are aligned with those predicted through reactive transport modelling presented in the Modelling Report in the Draft EIS in the years following thawing the freeze wall and beyond the Operation timeline. Modelling evaluated the assimilative capacity of the groundwater system with respect to COPC concentrations in the remediated ISR Zone, over the “Future Centuries” phase.

The “Future Centuries” is terminology developed in support of the Environmental Assessment. The “Future Centuries” temporal scope was developed to reflect the time period over which the highest COPC concentrations in groundwater are predicted, through reactive transport modelling, to migrate towards and interact with surface water. Modelled transport of dissolved constituents along the groundwater flow path allowed for interactions of the dissolved constituents with the geologic media through which they are flowing. Due to the relatively low groundwater velocities between the mining zone and Whitefish Lake and chemical reactions along the groundwater flow pathway, the “Future Centuries” scenario spans 100s-1000s of years.

Transport of a conservative constituent (chloride) and a reactive constituent (uranium) that shows a strong affinity for interactions with geologic media in the subsurface (i.e., indicates migration in groundwater will be strongly retarded relative to a conservative constituent) in the Future Centuries is shown in **Figure 3-6**. The model predictions show that in the 50-year period following thawing of the freeze wall, monitoring to verify model predictions should be focused primarily in proximity (100 m surrounding, in the Athabasca Sandstones) to the mining area.

Emphasis of monitoring in the Post-Decommissioning phase will be on verifying the predicted reactive transport behaviour of COPCs, such that there is confidence in the longer-term predictions and that commitments made in the EIS of no residual effects will be met. Verification is achieved by demonstrating that water quality is not changing in a manner that is unexpected beyond the outer perimeter of the (former) freeze wall in the Post-Decommissioning period. This will provide confidence that further remediation is not required.

Figure 3-6: Example Transport of Reactive and Non-Reactive Species in the 3-D Hydrogeological Model



Legend

Time (years) is post-restoration

Conductivity: K_xx - Patches - [m/s]	Mass concentration - Cl(f) - Continuous - [mg/l]
1.0e-04	200
1.0e-05	162
1.0e-06	124
1.0e-07	86
1.0e-08	48
1.0e-09	10

Cross-section alignment shown on Figure 5. Vertical lines indicate bends in cross-section to follow plume trajectory.

Wheeler River Project
Groundwater Protection and Monitoring Plan

Example Transport of Reactive and Non-Reactive Species in the 3-D Hydrogeological Model

Ecometrix Environmental Intelligence

Figure 3-6

3.3.3.1 Well Placement and Sampling Approach

Monitoring at the Post-Decommissioning Stage will utilize the existing monitoring network from the Decommissioning stage and will require an augmented well network beyond the outer perimeter of the freeze wall.

A conceptual schematic for Post-Decommissioning monitoring well network is shown in **Figure 3-7** in cross-section and **Figure 3-8** in plan view. The highest density of wells will be in and closely surrounding the mining area. In the high density zone:

- The density of the wells in the mining area during the Decommissioning Phase (5 to 7 Clusters; described in Section 3.3.2.1) is considered likely to be adequate;
- The density of the freeze wall perimeter wells may need to be augmented to increase the number of clusters/multi-levels, such that there is adequate coverage of the Intermediate Sandstone Aquitard; and
- A small number of additional clusters will be required beyond the freeze wall perimeters wells downgradient of the mining Phase four (4) zone. These wells are to be completed primarily in desilicified sediments of the Lower Sandstone Aquifer and Intermediate Sandstone Aquitard.

Upgradient of mining Phase five (5) and further downgradient of mining Phase four (4), there will be a zone of intermediate density wells, where well clusters will be positioned no more than 200 m apart along the predicted plume path and plume delineation wells will be offset from that path, orthogonally, in both directions. 3D simulations suggest that lateral migration will be limited, such that monitoring 100 m beyond the plume path will be sufficient to delineate the plume. In the upgradient direction, well clusters in this intermediate density zone will be completed in the Lower Sandstone Aquifer and Intermediate Sandstone Aquitard. In the downgradient direction, well clusters will have will be completed in desilicified sediments of the Lower Sandstone Aquifer and Intermediate Sandstone Aquitard, and in the Upper Sandstone and Overburden Aquifers.

Further upgradient of mining Phase five (5) and beyond Whitefish Lake in the downgradient direction will be low density (regional) groundwater monitoring zones. Existing regional (GWR-series) wells will be used where possible. Well clusters will monitor the Lower Sandstone Aquifer, Intermediate Sandstone Aquitard, Upper Sandstone Aquifer and Overburden Aquifer. Well clusters will be positioned to delineate any influence of mining activities on water quality.

The groundwater constituents being measured and frequency of sampling of wells in the Post-Decommissioning groundwater network will be identified in future iterations of the GWMP. Over the life of the mine, predictions of the assimilative capacity of the subsurface and associated migration potential for COPCs will be refined through review and potential updated reactive transport modelling. These will guide the specific details of the Post-Decommissioning GWMP.

Any groundwater wells installed as part of the Post-Decommissioning groundwater network should be sampled twice following installation and prior to any anticipated influence from mining activities to establish local baseline conditions.

Figure 3-7: Conceptual Groundwater Monitoring Scheme During Future Centuries Phase, Cross-Section

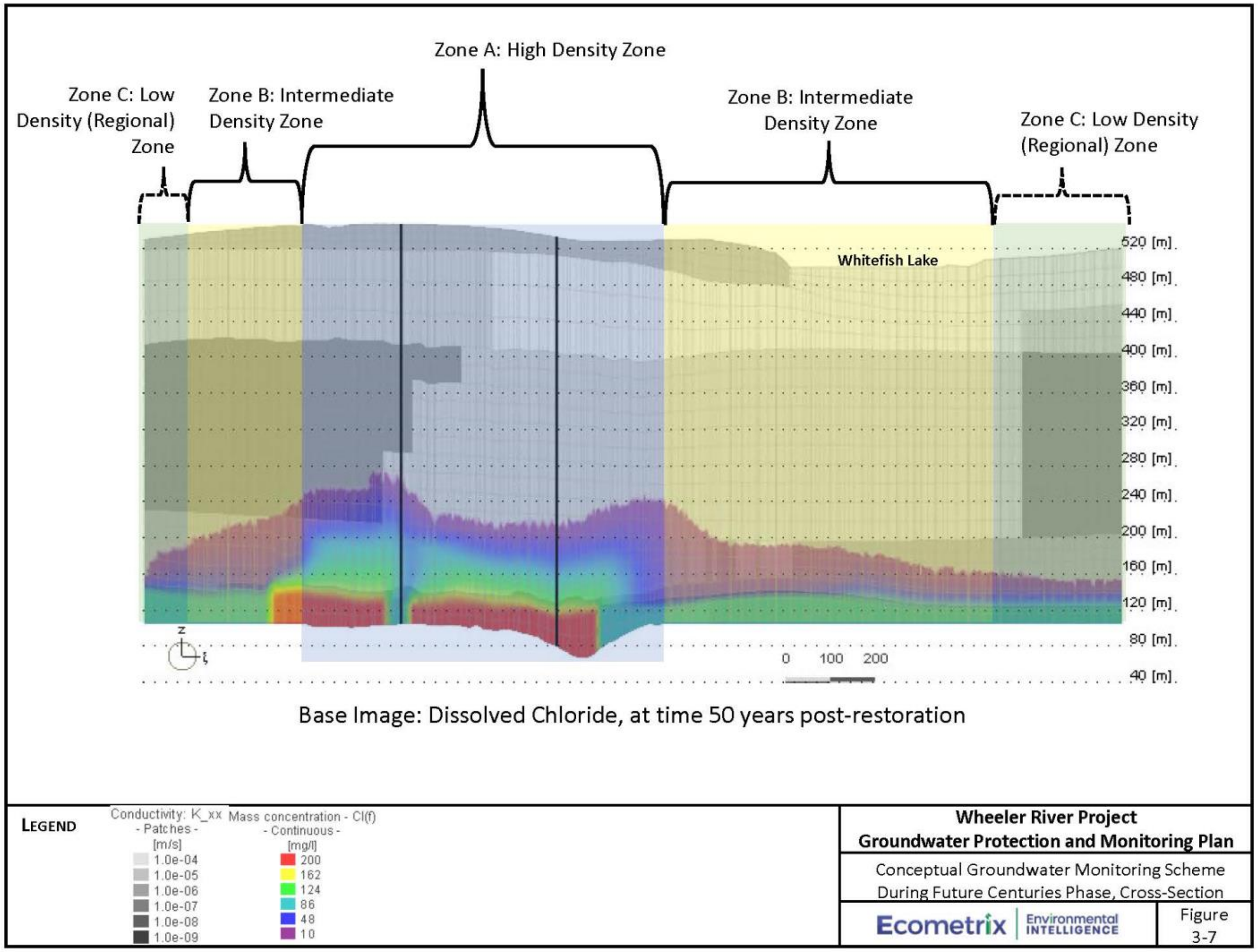
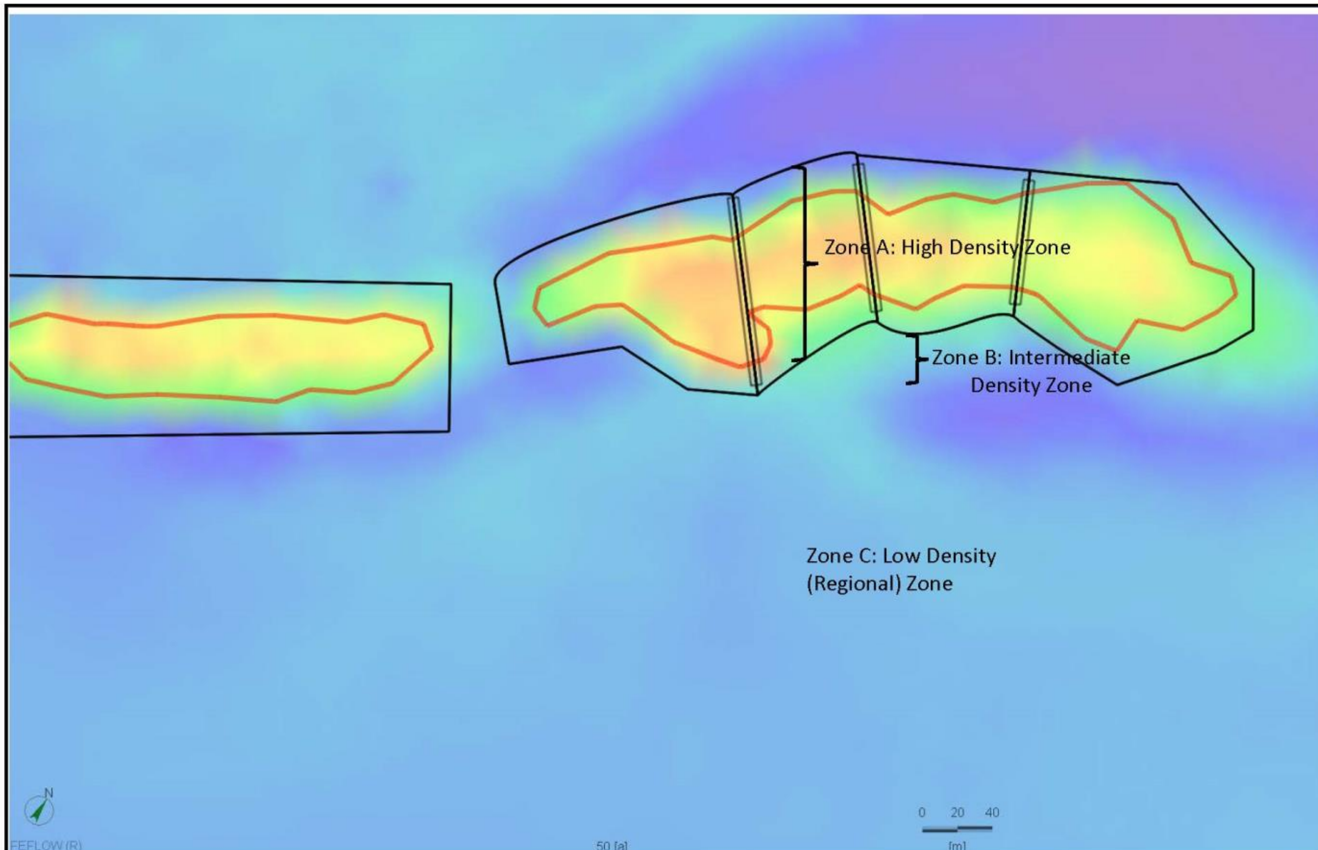


Figure 3-8: Conceptual Groundwater Monitoring Scheme During Future Centuries Phase, Plan View



LEGEND	Mass concentration - Cl(f) - Continuous - [mg/l]: 200, 162, 124, 86, 48, 10	Base Image: Dissolved Chloride, at time 50 years post-restoration	Wheeler River Project Groundwater Protection and Monitoring Plan Conceptual Groundwater Monitoring Scheme During Future Centuries Phase, Plan View Ecometrix Environmental Intelligence — Figure 3-8

4 Excursion Management

4.1 Excursions defined by Operation Stage

The following describes how to manage groundwater excursions, or exceedances (relative to expected behaviour or established criteria). The overall objective of the plan is to facilitate the timely identification of, and response(s) to, potentially emerging conditions (excursions) if routine monitoring results indicate that environmental performance is not meeting expectations.

During each mining stage, excursions signal that performance expectations are not being met.

- Mining and Decommissioning Stages:
    - Excursions are signaled by a change in water quality in specific wells compared to baseline conditions. These include wells on the perimeter and downgradient of surface facilities, the freeze wall perimeter wells and wells within the freeze wall overlying the mining area;
        - A change in water quality is defined as an upward trend in a COPC concentration (or key indicator value) above that statistically established as background or baseline concentrations. The upward trend is identified based on a suitable statistical test such as the Mann Kendall Test;
- Post-Decommissioning Stage:
    - Excursion are signaled by a change in water quality that is outside of that bounded by modelling predictions; and
        - The model predictions indicate spatiotemporally bound COPC concentrations in the subsurface that do not pose a risk to the receiving environment. Water quality that is outside of these bounding conditions is defined as representing a material increase compared to the predicted values either in rate of change or magnitude of change of COPC concentrations.

An excursion, signaled in the manner described above, will trigger a response. The response plan is tiered and involves confirmation (or not) of the excursion, with successive levels of response, including:

- Investigation of cause and risk;
- Investigation of strategies to mitigate risk; and
- Implementation of preferred risk mitigation.

Additional details on environmental performance and the response plan are outlined in Sections 4.3 and 4.4, respectively.

4.2 Establishing Background and Baseline Conditions

A robust understanding of baseline groundwater flow and groundwater quality conditions is the basis for detecting excursions over the life of the Operation. As introduced above (Section 183.2.1), there are background and baseline groundwater zones for the Operation. In each zone, there are several wells in each hydrostratigraphic unit. Baseline and background conditions will be established by:

- Compiling data that meets data quality objectives;

- Identifying and removing outliers; the recommended approach for identifying outliers is that described in U.S. Environmental Protection Act (EPA) (2006).
- Determining the number of hydrochemical groups needed to define unique baseline and background groundwater types for the Operation (Section 4.2.1); and
- Developing appropriate control limits or upper bounding values to background or baseline conditions (Section 4.2.2)

Supplemental sampling of existing conditions will be ongoing up to and potentially into the early years of Operation, as outlined in Sections 3.2.1 and 3.2.3.2. Background and baseline values will be established prior to initiation of mining activities. Baseline or background groundwater quality measured in newly installed wells after that time will be examined against the existing information and incorporated into the dataset, as necessary. This process is defined further in Section 4.2.2.

Sampling at the site, for baseline and background conditions as well as at other stages of the Operation will include continuous (transducers, thermistors, and EC sensors) and periodic (discrete) sampling. The method for establishing baseline and background conditions in groundwater, evaluating environmental performance with respect to groundwater conditions and doing data quality checks (Section 5) will be the same for the two types of sampling.

4.2.1 Hydrochemical Groups

Background and baseline groundwater quality available to date (Ecometrix 2022a) indicate that background and/or baseline groundwater quality can be similar for one or more HU, suggesting that the water quality is influenced by similar processes and would be expected to change in a consistent manner. Further, some uncertainty around whether the Desilicified Zone Aquifer has different/unique water quality remains, and additional data is needed to address this uncertainty. As such, the de-minimis number (or, the number deemed optimal) of hydrochemical "groups" should be identified to establish background and baseline groundwater quality conditions for the Operation.

Methods used to identify hydrochemical groups may include major ion composition, ion ratios, and statistical approaches (e.g., basic statistical distributions, summary statistics, clustering, clustering following principal component analysis, etc.,). In this identification process, higher weighting may be placed on specific groundwater constituents that show the greatest relative differences between the groundwaters being examined and have the greatest potential to signal excursions (i.e., key indicator species).

In the grouping process, monotonic trends in the data from individual wells, seasonality and/or other periodicity in groundwater quality will be evaluated, such that any variability in water quality over time in the existing data are understood before establishing baseline and background water quality groups.

4.2.2 Control Limits or Upper Limits

The objectives in establishing baseline and background conditions for the Operation are to:

- Where influence from mining is not anticipated (i.e., wells that monitor upgradient or regional wells distant from the mining area), confirm that baseline and background water quality is stable over time, or, if not stable, how those changes need to be considered in interpreting results in other monitoring wells; and
- Provide a basis for detecting excursions with confidence.

In both cases, it is important that the established baseline and background conditions are set at values whereby abnormal water quality can be confidently identified without increasing the number of false positives (NUREG, 2009).

Where there is a robust data set for a given groundwater constituent and data analysis has not indicated outliers or changes over time in the concentration/measurement, a numerical (background and) baseline level is to be established as the upper and lower control levels (UCL and LCL, respectively) derived from a Shewhart control chart (Shewhart, 1931; Morrison, 2009). A "robust dataset" includes 11 or more data points collected over the baseline period, where it can be assumed that there are no Site-related nor other anthropogenic sources of that constituent. UCL and LCL are calculated as shown below.

Using a factor of 3 times the standard deviation of the dataset means that 1% of the measurements taken under the same controlled conditions (i.e., no changes in groundwater conditions and sources of the parameter of interest at that location) are expected to be outside of the control range.

$$UCL = M + (3 \times S) \qquad \text{and} \qquad LCL = M - (3 \times S)$$

where,

M = arithmetic mean of the data

S = standard deviation of the data

The advantage of the Shewhart control chart is that UCL and LCL values can be established and used to evaluate all subsequently measured baseline and background concentrations over time as well as to provide an upper limit of baseline concentrations (UCL) to use for evaluation of concentrations in wells downgradient of a potential source of COPCs. New background or baseline control limits do not need to be calculated over time with the collection of new data, and changes in the parameter of interest can be flagged visually, by plotting new downgradient data on the control chart, for re-evaluation where there are values that are consistently outside of the control range.

If the dataset available for background and/or baseline conditions does not meet the recommended number of samples (11), an Upper Limit of Background (ULB) will be calculated numerically in the same way as the UCL, until that time when a control chart can be developed. As new data are measured, they will be incorporated into the ULB calculation, except for any values identified as outliers (U.S. EPA 2006).

4.2.3 Baseline and Background Conditions over Life of Mine

All wells sampled to date (2019-2021, as reported in Ecometrix 2022a) and to be sampled in accordance with [redacted] will represent the data set being used to establish pre-mining baseline/background data for the Operation. Other background and baseline data collected, over the life of mine, will include:

- Baseline conditions at surface facilities network (two sampling events in each well; Section 3.2.3.1);
- Upgradient, background conditions in the overburden aquifer, in wells GWR-003, GWR-006 and GWR-035 (**Table 3-4**). Sampling in these wells began in 2020 and will continue at least through to Decommissioning of the surface facilities, and as deemed optimal, through the Post-Decommissioning period;
- Baseline conditions within the freeze wall (overlying the ore zone) and freeze wall perimeter wells (two sampling events in each well; Section 3.2.3.2);

- Baseline conditions in the wells installed as part of the Post-Decommissioning groundwater monitoring network (two sampling events in each well; Section 3.3.3); and
- Background conditions in regional wells on a frequent enough basis (bi-annually) to allow any changes in background conditions to be identified and included in the interpretation of performance monitoring wells. These wells include GWR-series wells -005, -012, -014, -025, -029, and -035.

4.3 Environmental Performance: Data Analysis and Interpretation

Environmental performance data will include all data pertaining to groundwater conditions collected from the onset of mining activities, and that is not categorized as background or baseline data. Analysis of environmental performance with respect to groundwater for the Site involves looking at the data collected and applying a systematic approach to interpreting the data.

Environmental performance data being collected varies by well and by stage with respect to the constituents being analyzed (i.e., full suite of COPCs or Key Performance Indicators) and frequency of sampling. As discussed above (Section 4.2.1), even when the full suite of COPCs is being analyzed, higher weighting may be placed on specific groundwater constituents to evaluate environmental performance.

Data analysis will primarily involve:

- Identifying data outliers;
- Comparing concentrations/measurements during the sampling event to background or baseline conditions (Section 4.2). Identifying where sampling results are outside of control limits. Control limits for the mining stages will be established as follows:
    - Mining and Decommissioning Stages: Background values as defined by control charts or upper limit of background for wells on the perimeter and downgradient of surface facilities, the freeze wall perimeter wells and wells within the freeze wall overlying the mining area; and
    - Post-Decommissioning: Upper bounds of water quality predictions.
- Plotting the new data along with historical data as a time series and examining the behaviour of parameter concentrations/measurements in that well over time. Performing trend analysis as the basis for detecting excursions.

Appropriate methods will be used to identify trends in the data that are statistically significant, such as the Mann Kendall test. Trends away from control limits will be considered as signaling an excursion if and only if the following conditions are met:

- Control limits are exceeded, and a monotonic trend is confirmed by trend analysis for continuous monitoring of EC or temperature for an appropriate number of routine sampling intervals. The appropriate number will be defined by objective, in further iterations of the GWMP, and is likely to be specific to the mining phase and the area/zone being monitored. Identification of a monotonic trend will trigger further analysis, as described below (Section 4.4),
- Control limits are exceeded and a monotonic trend is confirmed for two or more of the Key Indicator Parameters ([redacted] or other constituents identified as key parameters measured through discrete sampling, over three or more routine sampling intervals.

4.4 Process to Address Potential Excursions

If, on the basis of the above criteria, an excursion is signaled, the investigative or mitigative actions may include the following:

- Confirmation of results;
- Increase sampling frequency;
- Investigate potential source(s);
- Delineate groundwater plume; and
- Investigate mitigation options and implement preferred mitigation.

Some details of a four-level tiered contingency response procedure are provided herein for guidance, although deviations may be appropriate depending upon the specific circumstances of the excursion.

Level 1 – Confirmation of Validity of the Sample Results

In Level 1, the objective is to confirm the validity of the results signaling the excursion. This will be done through review of QA/QC information that was collected coincident with the results signaling the excursion. These data are assessed to determine whether there are issues with the sample result, such that the result is accurate or not. The laboratory would also be consulted to confirm the accuracy of the reporting. The Groundwater Sampling Procedures document (to be implemented before Operations begin, defined in Section 5) will detail how to assess the validity of analytical results.

In instances where sample results are validated, Level 2 actions are implemented; conversely, if the data cannot be validated it may be appropriate to re-sample and increase sampling frequency to confirm the results, or to end the inquiry and return to routine sampling.

For reference, the validation of the results for individual sampling events will be carried out upon receipt of those data, since follow up activities associated with validation may be time sensitive, and also to ensure that implementation of Level 2 actions, when appropriate, is done in a timely manner. Such follow-up activities could include, beyond confirmation of sampling and laboratory QA/QC, the re-analysis of samples by the laboratory or re-sampling.

Level 2 – Investigation of Cause and Risk

An investigation to confirm that the observations signaling an excursion are related to Operational activities and to determine the potential cause will be initiated. The investigation could take many forms but ultimately the investigation should identify a causal mechanism to confirm that the sample results are related to mining activities. In addition, consideration of the results within a temporal context will be given to understand the extent to which future change might be expected. Such an analysis supports the assessment of risk, as described below.

Risk associated with the confirmed cause of the excursion should be described. Risk in this context is risk to surface water quality and to biota. The characterization of risk is meant to contribute to decision making for next steps, with respect to both scope and timing.

The nature of the Level two (2) response is likely to vary depending on the result and level of investigation required; as such, the response times may vary (e.g., one to several months) but will be conducted in a timely manner. By way of example, in the instance that the investigation process identifies that the trigger exceedance is in fact mining-related, follow up would be appropriate (see Level 3). Alternatively, enhanced monitoring or targeted studies could be recommended to reduce uncertainties, or in the case that the trigger exceedance is not Site-related it may be appropriate to return to routine monitoring.

Level 3 – Development of Strategies for Mitigation

Alternatives to mitigate the identified trigger exceedance will be considered. Mitigation measures associated with the protection of groundwater quality and quantity are outlined in Section 2.2.2.2. Other mitigation measures, likely to be primarily focused on reduction of constituent loadings and/or concentrations reporting to the environment, may also be developed and implemented. It is expected that the effectiveness of any mitigation alternative under consideration will be assessed quantitatively (to the extent possible), and that the assessment will include predictions about the degree of risk reduction expected. Criteria should be developed to assist in the selection of the preferred alternative.

The response time for a Level three (3) action will be agreed upon in collaboration with appropriate stakeholders, including all applicable ministries and regulatory authorities.

Level 4 – Implementation of a Preferred Mitigation Strategy

A plan to implement a preferred mitigation strategy would be developed in consultation with regulatory authorities, as well Interested Parties, as appropriate, pending the outcomes of Levels one to three (1-3) of the excursion management procedure. Any regulatory permits/approvals that may be required will be obtained and any stakeholder and/or Indigenous consultation obligations will be fulfilled.

Monitoring plans will be developed to track the environmental response in relation to the implementation of the preferred mitigation strategy. In many cases, the monitoring needed to track environmental response following mitigation will already be in place as part of routine monitoring programs. In some cases, minor revisions to routine monitoring programs may be required whereas in others it may not be possible to adequately assess the success of abatement actions through routine monitoring. In these cases, additional special studies may be needed. The details of these special studies will be documented.

The response time for a Level four (4) action will be agreed upon in collaboration with appropriate stakeholders, including all applicable ministries and regulatory authorities.

5 General Guidance

A Groundwater Sampling Procedure is being developed and will provide detailed procedures and practical guidance for:

- Data Collection: Sampling (Continuous and Discrete) and Analytical Procedures
    - Water Level Measurements
    - Sample Collection
    - Sample Analysis
    - Analytical Laboratories
- Quality Assurance and Quality Control
    - Field and Laboratory QA/QC Samples; and

  - Data Performance Objectives and Acceptance Criteria, including analytical precision criteria for COPCs.
- Data Management
- Monitoring Well Design and Installation
- Monitoring Well Operation, Maintenance, Inspection and Decommissioning
- Waste Management
- Review and Audit Process
- Reporting
- Staff Qualification and Training

6 References

6.1 Internal

Document Number	Document Name
32	Effluent and Emissions Monitoring Plan
	Environmental Management Program
33	Environmental Monitoring Plan
	Facility and Equipment Management Program
	Spill Management Plan
	Training Management Program

6.2 External

CSA (Canadian Standards Association) Standard N286: Management system requirements for nuclear facilities.

CSA (Canadian Standards Association) Standard N288.0-22: Environmental management of nuclear facilities: Common requirements of the CSA N288 series of Standards.

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