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Supplementary Information

Written Submission from Ontario Power Generation Inc. in response to undertaking #2 to provide clarification or additional information

In the matter of

Ontario Power Generation Inc.

Application to refurbish Pickering Nuclear Generating Station and to renew licences for the Pickering Nuclear Generating Station and Waste Management Facility

Commission Public Hearing
Part 2

October 6-9, 2026

Renseignements supplémentaires

Mémoire d'Ontario Power Generation Inc. en réponse à l'engagement no 2 de fournir des précisions ou des renseignements supplémentaires

À l'égard de

Ontario Power Generation Inc.

Demande concernant la réfection de la centrale nucléaire de Pickering et le renouvellement de ses permis pour la centrale et l'installation de gestion des déchets

Audience publique de la Commission
Partie 2

6-9 octobre 2026

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ONTARIO POWER GENERATION

Report

Public Information	
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Title:
Predictive Environmental Risk Assessment for Pickering Refurbishment, Decommissioning, and Continued Operations

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Predictive Environmental Risk Assessment for Pickering Refurbishment, Decommissioning, and Continued Operations

P-REP-07701-00014 R001

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PREDICTIVE ENVIRONMENTAL RISK ASSESSMENT FOR PICKERING REFURBISHMENT, DECOMMISSIONING, AND CONTINUED OPERATIONS

P-REP-07701-00014 R001

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PREDICTIVE ENVIRONMENTAL RISK ASSESSMENT FOR PICKERING REFURBISHMENT, DECOMMISSIONING, AND CONTINUED OPERATIONS

P-REP-07701-00014 R001



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Revision Number	Date	Comments
R000	07 April 2025	Initial Issue of report.
R001	29 May 2026	Updated to address Indigenous Nations' comments. Updated to address regulatory comments. Updated to include additional data collected since R000 for existing conditions including: • Integration of results from the ongoing monitoring programs and associated reports, including: ○ 2024 Pickering Nuclear Environmental Monitoring Program ○ 2023-2025 Pickering Nuclear Biodiversity Monitoring Program ○ 2024 Pickering Nuclear Generating Station Acoustic Assessment ○ 2024 Pickering Nuclear Generating Station Impingement Monitoring Program ○ 2024 Pickering Nuclear Emissions Summary and Dispersion Modelling ○ 2024 Pickering Nuclear Environmental Compliance Approval Annual Performance ○ 2024 Pickering Thermal Emission Environmental Protection Report ○ 2024 Pickering Waste Management Facility - Safety Report Addendum for Minimum Six-Year Cooled Fuel • Completion of 1-year of air quality monitoring data • Follow-up hydrazine sampling in surface water during 3 sampling events in 2025 • Sediment sampling in the Cutoff Wall Study Area, and in the Mid-Depth Study Area (previously proposed dredged channel) • Benthic macroinvertebrate community sampling in the proposed DWI area, proposed cutoff wall area, and the mid-depth area (previously proposed dredged channel) • Fish community sampling program in the DWI Study area, Mid-Depth Study Area, and Cutoff Wall Study Area • Larval fish and eggs assessment • Fall spawning assessment • Fish species at risk assessment • Aquatic habitat assessment in the Mid-Depth Study Area and Cutoff Wall Study Area

LAND ACKNOWLEDGEMENT

The lands and waters on which the Pickering Nuclear Generating Station (PNGS) is situated are the treaty and traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations.

The PNGS is within the territory of the Johnson-Butler Purchase/Gunshot Treaty (1787-1788) and the Williams Treaties of 1923. These Treaty Rights were reaffirmed in 2018 in a settlement with Canada and the Province of Ontario.

To acknowledge the Treaty and traditional territory, is to recognize the rights of the First Nations. It is to recognize the history of the land, predating the establishment of the earliest European colonies. It is also to acknowledge the significance for the Indigenous peoples who lived and continue to live upon it, to acknowledge the people whose practices and spiritualties are tied to the land and water and continue to develop in relation to the territory and its other inhabitants today.



EXECUTIVE SUMMARY

Ontario Power Generation (OPG) plans to pursue refurbishment and continued operation of Pickering Nuclear Generating Station (PNGS) Units 5 to 8, as well as decommissioning of PNGS Units 1 to 4, herein referred to as the Project. This report presents the Predictive Environmental Risk Assessment (PERA) for the Project. The PERA supports the renewal of the existing licence for PNGS, to include refurbishment activities for PNGS Units 5-8 and decommissioning of PNGS Units 1-4, as well as the Nuclear Sustainability Services – Pickering Waste Management Facility (NSS-PWMF) waste licence.

Refurbishment and continued operation of PNGS Units 5-8 will help OPG meet its mission to build a sustainable future powered by our electricity, our ideas, and our people. This supports OPG's vision to electrify life in one generation.

The focus of the PERA is on the activities that will potentially occur up to and including the re-licensing period from January 1, 2027 to December 31, 2036; activities and Project phases that will occur after the end of 2036 are discussed at a more general level of detail. The Project includes the following phases:

PNGS Units 1-4

- **Stabilization Phase:** Initiated in October 2024, a Stabilization Phase for Unit 1 and Unit 4 includes the arrangements and activities that ensure a safe and efficient transition from the end of commercial operation to the Storage with Surveillance (SWS) state for the transitioning units. PNGS Unit 2 and Unit 3 are not included in the assessment of this phase as the Stabilization Phase of Unit 2 and Unit 3 is complete and the units have been in SWS since 2010.

- **Storage with Surveillance:** Starting in 2028, and projected to end by approximately 2090, a 50 to 70-year Storage with Surveillance Phase will be initiated (for Unit 1 and Unit 4) to allow for natural decay of radioactivity. Unit 2 and Unit 3 have been in SWS since 2010 and will continue in SWS until approximately 2090 as well. Activities occurring during the requested 2027-2036 licence period include the ongoing operation of the Irradiated Fuel Bays (IFBs) and the continued transfer of spent fuel to dry storage containers (DSCs). Consistent with CNSC REGDOC-2.11.2 "Decommissioning" (CNSC, 2021), risk reduction activities will also be initiated during this time period to remove and remediate non-nuclear equipment and buildings/facilities.

- **Dismantle and Demolish:** From 2034 to approximately 2100, the Dismantle and Demolish Phase will be undertaken for Units 1-4, with details to be provided in subsequent Detailed Decommissioning Plan (DDP) updates.

PNGS Units 5-8

- **Refurbishment:** Starting in 2026 (pending approvals) preparation for refurbishment of PNGS Units 5-8 will be initiated, including defueling and dewatering of reactors, relocation and/or removal of structures and equipment, and construction of buildings and temporary laydown areas. Starting in 2027, the first unit will enter refurbishment, which involves replacing reactor components including: fuel channels and calandria tubes, inlet and outlet feeders from end fittings to the reactor inlet/outlet headers, replacement of steam generators, refurbishment of various systems including reactor auxiliary systems and feedwater systems, and normal upgrade and maintenance activities. The unit will then be refuelled and restarted.

- **Continued Operations:** At the end of refurbishment, all units at PNGS Units 5-8 will be returned to service and operation will then continue for at least another 30 years.

- **Decommissioning:** At the end of commercial operation for PNGS Units 5-8 the facility will enter a Stabilization Phase, followed by SWS, and Dismantle and Demolish phases. At this stage, decommissioning of PNGS Units 5-8 is only conceptually developed, and is consistent with its preliminary decommissioning plan (PDP) (OPG, 2025a).

Objectives

This PERA was conducted to meet the requirements of CSA N288.6:22 "Environmental Risk Assessments at Nuclear Facilities and Uranium Mines and Mills" (CSA, 2022) and also meets the requirements for an Environmental Risk Assessment (ERA) outlined in Section 4.1 of REGDOC-2.9.1 "Environmental Protection: Environmental Principles, Assessments and Protection Measures" (CNSC, 2020). The objectives of the PERA are to:

- Identify whether any proposed Project activities are likely to result in environmental emissions or other stressors potentially exceeding those in previous assessments;

- Predict and assess the risk of effect to representative human and ecological receptors resulting from exposure to radiological and non-radiological substances and physical stressors expected to be released during refurbishment, decommissioning, and continued operations of PNGS;

- Inform prioritization of monitoring and mitigation measures.

OPG is committed to open and transparent communication on our operations and projects and adheres to the guidance outlined in CNSC REGDOC 3.2.1, Public Information and Disclosure, and CNSC REGDOC 3.2.2, Indigenous Engagement, in accordance with the PNGS Licence Condition Handbook (CNSC, 2018, 2022).

Methodology

The general approach to this PERA included the following key steps:

1. Review and update existing conditions. This is primarily conducted through review of the 2022 Pickering Nuclear ERA and additional data collected to support an update to existing conditions.

2. Identify proposed PNGS Units 1-4 decommissioning activities and PNGS Units 5-8 refurbishment activities.

3. Perform a qualitative assessment to identify future activities that are not bound by existing conditions or assumptions in previous assessments (Tier 1 assessment). For those interactions bound by existing conditions or previous assessments, no further action is required other than documenting the rationale.

4. Conduct quantitative assessment (Tier 2) for those interactions not bound by existing conditions or assumptions in previous assessments. This is primarily a quantitative risk assessment with estimation of dose and hazard quotients (HQs; as applicable).

5. Identify mitigation measures and recommendations for monitoring programs.

The evaluation of Project-environment interactions also utilizes the previous assessments referred to above, which include the 2022 PN ERA (Ecometrix, 2023a), the 2017 Safe Storage Predictive Effects Assessment (PEA) and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017), and the Pickering Component Storage Structure (PCSS) PERA (Ecometrix, 2024).

Tier 1 Assessment

PNGS Units 1-4 Decommissioning and PNGS Units 5-8 Refurbishment proposed activities were evaluated for interactions with environmental pathways and receptors in the Tier 1 assessment. In general, interactions associated with project activities during the Stabilization and SWS phases of PNGS Units 1-4 are considered sufficiently bounded by the findings of the 2017 Safe Storage PEA and the 2022 PEA Addendum, or the 2022 PN ERA, and do not warrant further evaluation. Although PNGS Units 1-4 risk reduction and removal activities were not evaluated in previous assessments, these activities are not anticipated to result in significant environmental effects as construction best practices and applicable mitigation plans will be implemented to ensure impacts are minimized. Environmental effects of future dismantle and demolish activities planned to start in 2034 will be detailed in subsequent DDP updates and PERA updates when more detailed work packages are defined.

Refurbishment activities for PNGS Units 5-8, including islanding the unit, refurbishment of reactor auxiliary systems, and other upgrades are determined in the Tier 1 assessment to have negligible interaction with the environment. Some activities, such as the construction of the PCSS, are evaluated as part of a separate PERA. Other activities, such as defueling and dewatering the units, are bounded by the 2017 Safe Storage PEA and the 2022 PEA Addendum, while still others, such as management of tritium emissions, are bounded by the 2022 PN ERA. These activities bounded by other assessments do not warrant further evaluation in the Tier 2 assessment.

One of the major design modifications/activities not previously evaluated is the potential construction of an offshore deep water intake structure for PNGS Units 5-8 that will replace the current shoreline surface water intake. The proposed deep water intake (DWI) will draw deeper cooler water from Lake Ontario, and is expected to significantly reduce fish impingement and entrainment as well as reduce potential biofouling events with attached algae. The construction of the intake structure may also involve construction of an intake cap, bridge, cutoff wall to the forebay, and material disposal. The Tier 1 screening identified that aquatic habitat impacts from the DWI construction and thermal effects, when considered with climate change projections, require further assessment. As such, these project-environment interactions are comprehensively evaluated in the Tier 2 quantitative assessment to characterize the potential for adverse impacts.

To support this PERA, predictive air quality and noise modelling was completed to assess potential impacts to human and ecological receptors resulting from the planned PNGS Units 1-4 Decommissioning and PNGS Units 5-8 Refurbishment. The modelling was developed as a conservative "worst-case" bounding scenario for the planned Project activities.

No long-term human health effects are expected to occur as a result of the predicted ambient air quality or noise conditions for the bounding scenario. Exceedances of the ambient air quality criteria were predicted; however, no health risks are anticipated for the bounding scenario since air quality criteria exceedances are predicted to occur infrequently (i.e., only a few days to a few weeks in the year), or at receptor locations where people stay for short periods of time (i.e., the Sport Fisher). For noise, predicted exceedances of human health noise guidelines are modelled to only occur at locations where people stay for short periods of time (i.e., the Sport Fisher, Industrial/Commercial Worker), limiting the overall exposure to elevated noise levels.

No long-term ecological health effects are expected to occur as a result of the predicted ambient air quality for the bounding scenario. Some exceedances of the selected ambient air quality criteria were predicted; however, no effects are expected since exceedances are largely localized to the PN site where mitigation measures (e.g., dust suppression measures) will be utilized to further minimize dust and particulate emissions. Project-related exceedances of short-term 24-hr total suspended particulates (TSP) and PM_{10} criteria off-site at Frenchman's Bay are predicted to occur relatively infrequently (i.e., exceedances on a few days up to a few weeks in a year). It is expected that Frenchman's Bay will continue to provide suitable habitat for local terrestrial and riparian biota over the course of the Project.

No noise impacts to receptors at Hydro Marsh and Frenchman's Bay are expected since predicted noise levels are less than the 10 dB guideline for incremental change above existing conditions. Exceedances of noise guideline are localized to the PN site. It is presumed that wildlife currently inhabiting the PN site are well adjusted to noise levels characteristic of an urban/semi-urban environment and are relatively tolerant of human activity. Increased noise levels above the 10 dB guideline are predicted at the Bank Swallow Fixed Face Earthen Embankment. As such, mitigation measures should be considered to reduce noise levels during the breeding season (approximately April 1st to August 31st). Additionally, the "worst-case" assumptions in the noise model may not

actually occur during the breeding season and the model can be re-evaluated once Project planning is further underway to provide more realistic predictions.

While air quality and noise were not assessed further for any human or ecological receptors in the Tier 2 assessment, recommendations are included to protect breeding birds on-site, including SAR, from elevated noise levels (see recommendations section below). Barn Swallow, Bank Swallow, and Peregrine Falcon are known to breed on the PN site.

Based on feedback from the Williams Treaties First Nations (WTFNs) on previous PERAs, OPG understands the importance of including a Harvester receptor in the PERA to more specifically reflect Indigenous people who may live and work near the facility and consume traditional foods harvested near the facility. As such, assessment of a Harvester is considered in the Tier 2 quantitative assessment.

Following refurbishment, PNGS Units 5-8 will operate in a manner consistent with existing operations (4 operating units). Consequently, the potential effects of the Continued Operation Phase on most environmental components are bounded by those previously assessed in the 2022 PN ERA for 6 operating units and comparable to current conditions with 4 units (PNGS Units 5-8) operating.

In summary, the following potential effects are evaluated in the Tier 2 assessment:

- Inclusion of a Harvester in the Predictive Human Health Risk Assessment (HHRA) to assess radiation dose from exposure to releases of tritium, carbon-14, and beta/gamma to the atmospheric and surface water environment.
- Evaluation of aquatic habitat loss and potential changes to habitat quality in the Predictive Ecological Risk Assessment (EcoRA) from construction of the proposed DWI and associated lake cutoff wall.
- Evaluation of changes to thermal effects on indicator fish species in the Predictive EcoRA due to operation of the DWI, with consideration of long-term climate change projections.

Tier 2 Quantitative Assessment

Predictive HHRA

The Tier 1 assessment concluded that the radiological emissions to air and water assessed in the 2017 Safe Storage PEA remain conservative estimates of radiological emissions for current Project planning for PNGS Units 1-4 Stabilization and SWS, as well as for PNGS Units 5-8 Refurbishment.

Using the conservative estimates for emissions, the predictive HHRA provides the predicted radiation dose for the Harvester, and also provides an updated dose prediction for the other human receptors evaluated in the 2017 Safe Storage PEA based on more recent meteorological data from PN (2020 to 2024).

The incremental radiation dose from the Project to all human receptors evaluated is predicted to be well below the regulatory public dose limit of 1,000 µSv/a. The predicted dose to the Harvester is 1.37 µSv/a which is 0.14% of the regulatory public dose limit (1,000 µSv/a). The predicted doses to all human receptors are well below the public dose limit and a small fraction of the natural background dose of 1,400 µSv/a; therefore, no health effects are anticipated due to exposure of potential critical groups to radiological releases from the PN Site during the Project phases.

Predictive EcoRA

While primary benefits of the DWI include substantial reduction of impingement and entrainment and provision of a more robust system for future operations under changing climate conditions, construction of the DWI intake infrastructure and associated shoreline works will result in localized disturbance and some loss of aquatic habitat. The predictive EcoRA evaluated the potential impacts of the construction and operation of the DWI on aquatic habitat loss and thermal effects.

Initial evaluations in revision 0 of this PERA were based on the previous project footprint estimate that approximately 25 ha of fish habitat could be affected by the proposed DWI and associated works. A study area was therefore established to assess the effects of constructing the DWI, including the intake cap, cutoff wall, bridge, and the previously proposed lake infill and dock-related navigational dredging. In this updated PERA (revision 1), the footprints and associated impacts of the proposed DWI and related works have been significantly reduced. The intake cap and cutoff wall are now expected to affect approximately 1 ha and 5 ha of aquatic habitat, respectively. The bridge design has been modified to minimize any in-water footprint or habitat loss within the PNGS Units 5-8 discharge channel. Several components from earlier design concepts have also been removed from the project scope, including the lake infill, navigational dredging and associated new dock installation, reducing the projected aquatic habitat impact from approximately 25 ha to 6 ha. An analysis of options for the disposal of spoils, which include open water disposal, is being undertaken for a volume of up to 40,000 m^3.

Aquatic habitat studies of existing conditions undertaken from 2024 and 2025 indicate that construction of the DWI and intake cap is expected to cause localized habitat alteration, disruption, or loss in areas used by fish for foraging, movement, spawning, and seasonal staging. Similarly, associated nearshore modifications are anticipated to impact areas used for foraging, movement, potential spawning, and overwintering habitat. However, the habitat features within the proposed construction areas are not unique and are widely distributed throughout Lake Ontario. Therefore, construction of the DWI is not expected to result in population-level effects for any fish species. Furthermore, the DWI area and nearshore aquatic environment lack unique habitat features, as they are typical of other areas found throughout Lake Ontario. Therefore, while construction activities will result in some habitat loss, no rare or unique habitats will be lost.

The thermal impact of the PNGS Units 5-8 discharge during operation of the DWI was evaluated. It is anticipated that once the DWI is in operation, the discharge temperature will be the same or lower than the existing PNGS Units 5-8 discharge temperatures. Thus, the PNGS Refurbishment activities are not expected to add any additional thermal load to the aquatic environment and may even

result in an improvement relative to current thermal conditions. Due to the influence of climate change, lake water temperatures are expected to increase over the long-term. This increase is not expected to occur uniformly across the water column, with surface waters warming at a faster rate than deeper layers. The effects of lake warming due to climate change are anticipated to impact all fish in varying degrees. Some fish species may have to shift to different habitats to remain within their optimal temperature range or acclimate as climate change continues to progress. To reduce uncertainty related to the potential impacts of climate change on aquatic habitat and species, future monitoring of lake bottom temperatures is recommended once the DWI is operational.

Cumulative Site Effects

The PERA encompasses all existing and known future activities on the PN site including evaluation of: PNGS operations (for the previous 6 operating units), PNGS Units 1 and 4 Stabilization, PNGS Units 1-4 SWS and early dismantle/demolish activities, PNGS Units 5-8 Refurbishment (including construction and operation of the DWI), PNGS Units 5-8 Continued Operations, and NSS-PWMF operations including construction of an additional Storage Building 5, the PCSS, and construction of other planned buildings such as the Retube and Feeder Replacement Service Island Support Annex (RFRISA).

The air, noise, and surface water modelling performed to support the PERA conservatively evaluate bounding scenarios where Project activities are assumed to occur during the same timeframe. As such, cumulative effects on the PN site have been considered in this PERA.

While cumulative effects from other OPG projects near the PN site are considered negligible, environmental monitoring at PN would include any contributions from other OPG nuclear sites including Darlington Nuclear Generating Station (DNGS), and in the future, Darlington New Nuclear Project (DNNP).

Overall Conclusions

The PERA aims to quantify and characterize the risk to representative human and ecological receptors posed by proposed activities. The PERA uses the predictions of risk to draw conclusions on potential effects.

Based on the predictions of risk in the PERA, most activities associated with PNGS Units 1-4 Decommissioning, PNGS Units 5-8 Refurbishment, and Continued Operations are not likely to result in adverse effects to human and/or ecological receptor groups evaluated. Some aquatic habitat will be disturbed or removed due to DWI construction – OPG will meet all Fisheries and Oceans Canada (DFO) authorization requirements including implementation of fish habitat compensation measures to offset the loss of habitat and associated productivity. As such, the effect of aquatic habitat loss should be minimal with implementation of mitigation measures. While some individual exceedances of air quality or noise guidelines were identified, mitigation measures identified below will be implemented and monitoring will confirm that there are no adverse effects.

Recommendations for Monitoring and Mitigation

Based on the results of this PERA, recommendations and/or mitigation measures are identified in **Table ES-1** below.

Table ES-1: Recommendations for Monitoring and Mitigation

Environmental Component	Recommendation for Monitoring and Mitigation
Atmospheric Environment	• Air Quality: Air monitoring of existing conditions (TSP, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, VOCs, and PAHs) was conducted to provide sufficient data to characterize the existing environment. The air monitoring data from January to December 2025 are included in the current R001 version of the PERA which captures seasonal variability of existing conditions. Follow up air monitoring is recommended for one year during refurbishment to verify predictions and confirm the effectiveness of mitigation measures. Final constituent selection will be established during future program design and in consultation with regulators. • Air Quality: Implementation of a dust management plan, if required could involve mitigative measures such as the application of dust suppressants, stabilization of completed soil surfaces, and suspension of dust-generating activities during periods of inclement weather. This is expected to reduce dust and particulate emissions and deposition on to vegetation surfaces, limiting pollution of local wildlife habitat. • Noise: The development and implementation of a Noise Management Plan will outline best construction practices and available mitigation measures for controlling noise generation. • Noise: OPG plans to review its noise assessment for the period of bird breeding season for the peak noise level year. If noise is predicted to potentially impact species at risk (SAR) during the breeding season (April 1 to August 31), including Bank Swallow, Barn Swallow, and Peregrine Falcon (known to nest on the PN site), mitigation measures should be explored to reduce noise impacts to. Mitigation measures could include • A work buffer between high-noise equipment and active Bank Swallow nesting habitat where feasible • Appropriately sized equipment for the required tasks and avoiding clustering of equipment near Bank Swallow nesting areas where practical • Stationary equipment with built-in or accessory noise controls (e.g., enclosures, silencers) where feasible that are maintained in good working order

Environmental Component	Recommendation for Monitoring and Mitigation
	• Mobile equipment with effective mufflers that are maintained in good working order • Minimizing drop heights during loading/unloading and material handling where feasible • Avoiding tailgate banging and adhering to posted speed limits for trucks. • A no-idling policy to limit unnecessary noise where practical • Temporary noise barriers as needed on a case-by-case basis, considering the duration of the work, type of equipment involved, proximity to Bank Swallow habitat, and observed nesting sensitivity.
Surface Water Environment	• No additional recommendations beyond continuing to implement existing surface water quality monitoring through OPG's ongoing EMP. • OPG will employ best practices for stormwater management that would meet Ontario Ministry of Environment, Conservation and Parks (MECP) requirements and industrial sewage works rules.
Aquatic Environment	• Aquatic monitoring studies were completed in 2024 to support the PERA R000 based on Project planning for the DWI at the time. As the design of the DWI evolved, so did the study area size and location. As such, further data (fish community, benthic macroinvertebrate community, macrozooplankton community) were collected in 2025 (between R000 and R001 of the PERA) for the aquatic environment to reflect changes to DWI planning since the Project was initiated. The additional aquatic environment data are included in the current R001 version of the PERA. • Aquatic Habitat: To mitigate impacts of habitat loss from DWI construction, measures should be taken to limit the spread of aquatic invasive species, such as cleaning, draining, and drying any equipment used in the water, and avoiding the transfer of organisms or water between bodies of water. Additionally, OPG will replace and restore disturbed habitat features, as well as remediate any impacted areas, in accordance with DFO authorization requirements, as applicable. • Aquatic Habitat: An Erosion and Sediment Control Plan should be developed to minimize the mobilization of suspended materials into the water during DWI construction. Mitigation measures may include conducting in-water works in isolation of open or flowing water to reduce sediment introduction into the watercourse, regular inspection and maintenance of erosion controls, monitoring for signs of sedimentation, and ensuring the proper disposal of dredged

Environmental Component	Recommendation for Monitoring and Mitigation
	materials. Similarly, a spill response plan should be implemented to prevent spills of deleterious substances. • Aquatic Habitat: An analysis of options for disposal of spoils from the construction of the DWI is currently being undertaken. Following selection of an option, a comprehensive spoil management plan should be developed to minimize environmental impacts. • Impingement and Entrainment: The FDS should remain in place to minimize impingement and entrainment until the DWI is operational and thereafter until DFO grants approval for its removal. • Impingement and Entrainment: The reduction of impingement and entrainment once the DWI is operational should be confirmed through follow up monitoring programs. • Thermal Effects: OPG should incorporate a staggered and sequential shutdown of Pickering Units 5-8 during refurbishment to allow for fish acclimation, and to reduce the risk of a cold shock event. • Thermal Effects: The assumption that PNGS Units 5-8 discharge temperatures post-DWI implementation will be the same or slightly lower than previous operational conditions (with 6 operating units) should be confirmed through monitoring of discharge temperatures. To reduce uncertainty related to the potential impacts of climate change on aquatic habitat and species, future monitoring of lake bottom temperatures is recommended once the DWI is operational. This evaluation should be summarized in a future PN ERA update.
Geological and Hydrogeological Environment	• OPG and all sub-contractors should utilize construction best practices and follow a construction Environmental Management Plan to ensure that all equipment is well maintained and functioning correctly to limit fuel spills and environmental contamination. • During construction of the PCSS, SB5, and RFRISA, and other planned buildings any dewatering during excavation should be completed with the necessary permissions following MECP regulations intended to be protective against discharge or re-infiltration of collected groundwater. • A geotechnical investigation should be completed to determine if dewatering is required for the RFRISA or any other planned building. A geotechnical investigation has already been completed for the PCSS and is discussed in the PCSS PERA.
Terrestrial Environment	• See atmospheric environment row for recommendations on reducing noise levels for SAR.

Environmental Component	Recommendation for Monitoring and Mitigation
	• As much as it's possible to do so, consider adjusting construction activities to minimize impacts, such as modifying work schedules or implementing noise and activity restrictions near nesting sites. To further reduce disturbance, heavy construction activity should be avoided during key breeding periods, to the extend possible. Furthermore, work could be planned to occur during daytime hours to minimize disruption of nocturnal wildlife. • OPG will comply with the species and habitat protection provisions of the Species Conservation Act, Species at Risk Act, and Migratory Birds Convention Act during all project activities. • OPG will continue to monitor breeding birds and conduct broader biodiversity monitoring on an annual basis to support conservation efforts and regulatory compliance. • Best safe driving practices should be implemented to minimize the likelihood of wildlife strikes during construction activities associated with refurbishment.
Radiation and Radioactivity (Gamma Radiation)	• Future iterations of the PN ERA (based on the time period they encompass) should consider the new NSS-PWMF layout with inclusion of the transferred DSMs from the Phase I to the Phase II NSS-PWMF site. TLDs will be installed to monitor gamma radiation fields around the DSMs transferred to NSS-PWMF Phase II site. Data from TLDs surrounding the DSMs as well as quarterly catch basin stormwater monitoring can be used to verify the conclusion that doses remain acceptable.
Climate change considerations	• The DWI and cutoff wall should be designed using engineering best practices to withstand extreme weather conditions such as storms, droughts, floods, and blizzards. • OPG should also continue utilizing the AAWS, a predictive tool developed in 2019, to forecast and monitor algae events, and adjust operations accordingly to mitigate the effects.

While the PERA provides a comprehensive assessment of environmental impacts from a Western science perspective, OPG has and will continue to seek additional perspectives from Indigenous Nations and communities on the potential impact of the Project on established and/or asserted Aboriginal and/or Treaty Rights. In particular, OPG recognizes the importance of the 2018 settlement agreement between the seven members of the WTFN with the Governments of Canada and Ontario. The Settlement (Government of Canada, 2018) pertains to the lands of the PN site and reaffirms the rights of WTFN citizens, which has fundamentally shifted how WTFN is engaged and consulted on site development. OPG recognizes the importance of furthering our knowledge and understanding,

in ongoing meaningful engagement with the WTFN. To this end, OPG shared an earlier version of this PERA (R000) with the WTFN for review, with responses collected and incorporated from Curve Lake First Nation (CLFN) and Mississaugas of Scugog Island First Nation (MSIFN), and has shared a draft of R001. OPG maintains our commitment to incorporating Michi Saagiig and Chippewa knowledge and perspectives shared for this purpose into OPG's assessments.

OPG endeavors to continue to work with Indigenous Nations and communities with established and/or asserted Aboriginal and/or Treaty Rights to appropriately understand their perspectives with respect to the potential impacts by the Project on those rights, and to identify avoidance, mitigation measures and/or accommodation measures as may be appropriate in the circumstances.

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LIST OF ACRONYMS AND SYMBOLS

Acronyms

AAQC	Ambient Air Quality Criteria
AAWS	Advanced Algae Warning System
AAR	Acoustic Assessment Report
ACB	Air Contaminants Benchmarks
AFN	Alderville First Nations
AIFB	Auxiliary Irradiated Fuel Bay
AIM	Abnormal Incident Manual
ALARA	As Low as Reasonably Achievable
ALW	Active Liquid Waste
AQM	Air Quality Monitoring
ASB	Auxiliary Security Building
BaP	Benzo(a)pyrene
BATEA	Best Available Techniques and Technology Economically Achievable
BOD	Biochemical Oxygen Demand
BPUE	Biomass Per Unit Effort
BSM	Broadscale Monitoring
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAAQS	Canadian Ambient Air Quality Standards
CANDU	CANada Deuterium Uranium
CCME	Canadian Council of Ministers of the Environment
CCW	Condenser Cooling Water
CDEM	Canadian Digital Elevation Model
CLFN	Curve Lake First Nation
CNSC	Canadian Nuclear Safety Commission
CO	Carbon monoxide
COD	Chemical Oxygen Demand
COG	CANDU Owners Group
COPC	Contaminant of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CPUE	Catch Per Unit Effort
CSA	Canadian Standards Association
CSB	Common Services Building
CSM	Conceptual Site Model
CTU	Combustion Turbine Unit
CWQG	Canadian Water Quality Guidelines
D_2O	Heavy Water (Deuterium oxide)
DDP	Detailed Decommissioning Plan

DFO	Fisheries and Oceans Canada
DN	Darlington Nuclear
DNGS	Darlington Nuclear Generating Station
DNNP	Darlington New Nuclear Project
DOC	Dissolved Organic Carbon
DRL	Derived Release Limit
DSC	Dry Storage Container
DSM	Dry Storage Module
dw	Dry weight
DWI	Deep Water Intake
EA	Environmental Assessment
EC	Environment Canada
ECA	Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
Eco CV	Ecological Component Value
EcoRA	Ecological Risk Assessment
EMEAF	Environmental Monitoring and Environmental Assessment Follow-up
EMP	Environmental Monitoring Program
EPG	Emergency Power Generator
EPRI	Electric Power Research Institute
ERA	Environmental Risk Assessment
ERT	Emergency Response Team
ESA	Endangered Species Act
ESDM	Emissions Summary and Dispersion Modelling
ESG	Environmental, Social, and Governance
EXP	Experimental
FAA	Fisheries Act Authorization
FDS	Fish Diversion System
FEQG	Federal Environmental Quality Guideline
FFEE	Fixed Face Earthen Embankment
FNFNES	First Nations Food, Nutrition and Environment Study
GHG	Greenhouse Gas
GLM	Generalized Linear Model
GTA	Greater Toronto Area
GWMP	Groundwater Monitoring Program
GWPP	Groundwater Protection Program
%HA	Percent Highly Annoyed
HADD	Harmful Alteration, Destruction, and Disruption
HC	Health Canada
HHRA	Human Health Risk Assessment
HPECI	High Pressure Emergency Coolant Injection
HQ	Hazard Quotient
HTO	Tritium Oxide

HU	Hydrostratigraphic Unit
IAD	Inactive Drainage
IAEA	International Atomic Energy Agency
IARC	International Agency for Research on Cancer
IBI	Indices of Biological Integrity
IEP	Indigenous Engagement Plan
IFB	Irradiated Fuel Bay
ILCR	Incremental Lifetime Cancer Risk
ILW	Intermediate Level Waste
ISO	International Organization for Standardization
ISQG	Interim Sediment Quality Guidelines
IX	Ion Exchange
LAeq	Equivalent sound levels (A-weighted)
LCV	Lowest Chronic Value
L&ILW	Low and Intermediate Level Waste
LEL	Lowest Effect Level
LLW	Low Level Waste
LOE	Lines of Evidence
LPL	Lowest Practical Level
MAXGLC	Maximum Ground Level Concentration
MECP	Ministry of Environment, Conservation and Parks
MNA	Monitored Natural Attenuation
MNRF	Ontario Ministry of Natural Resources and Forestry
MOE	Ontario Ministry of Environment
MOECC	Ontario Ministry of Environment and Climate Change
MOEE	Ontario Ministry of Environment and Energy
MSB	Main Security Building
MSIFN	Mississaugas of Scugog Island First Nation
MWAT	Maximum Weekly Average Temperature
NEW	Nuclear Energy Worker
NAPS	National Air Pollution Surveillance
NO_2	Nitrogen Dioxide
NO_x	Nitrogen oxides
NPC-300	Environmental Noise Guideline
NSCA	Nuclear Safety and Control Act
NSS-PWMF	Nuclear Sustainability Services – Pickering Waste Management Facility
NSS-WWMF	Nuclear Sustainability Services – Western Waste Management Facility
NWTP	New Water Treatment Plant
NYDEC	New York State Department of Environmental Conservation
OBT	Organically Bound Tritium
OPEX	Operating Experience
OPG	Ontario Power Generation
PAH	Polycyclic Aromatic Hydrocarbon

PCB	Polychlorinated Biphenyl
PCSS	Pickering Component Storage Structure
PDP	Preliminary Decommissioning Plan
PE	Planning Envelope
PEA	Predictive Effects Assessment
PERA	Predictive Environmental Risk Assessment
PEL	Probable Effects Level
PHC	Petroleum Hydrocarbons
PM_{10}	Inhalable particulates
$PM_{2.5}$	Respirable particulates
PN	Pickering Nuclear
PNGS	Pickering Nuclear Generating Station
PNEC	Predicted No Effect Concentration
PNIC	Pickering Nuclear Information Centre
POI	Point of Impingement
POW	Plane of Window
PSQG	Provincial Sediment Quality Guideline
PWQO	Provincial Water Quality Objective
Q25	First Quartile
Q75	Third Quartile
QA	Quality Assurance
RAB	Reactor Auxiliary Bay
RB	Reactor Building
RBSW	Reactor Building Service Water
RCM	Regional Climate Model
RCP	Representative Concentration Pathway
RCS	Retube Component Storage
RCSF	Retube Component Storage Facility
RFRISA	Retube and Feeder Replacement Service Island Support Annex
RLWMS	Radioactive Liquid Waste Management System
RMA10	Hydrodynamic surface water model
RSL	Reginal Screening levels
SAR	Species at Risk
SARA	Species at Rick Act
SARO	Species at Risk in Ontario
SB	Storage Building
SCA	Species Conservation Act
SCS	Site Condition Standards
SDSE	Shutdown System Enhancement
SEL	Severe Effects Level
SG	Standby Gas Generator
SHA	Safe Harbour Stewardship Agreement
SLM	Sound level meters

SO_2	Sulfur dioxide
SPM	Suspended Particulate Matter
SQG	Soil Quality Guideline
SSC	Structures, Systems, and Components
STDM	Short Term Daily Maximum
SWS	Storage with Surveillance
TAB	Turbine Auxiliary Bay
TH	Turbine Hall
THQ	Target Hazard Quotient
TKN	Total Kjeldahl Nitrogen
TLD	Thermoluminescent dosimeter
TOC	Total Organic Carbon
TRC	Total Residual Chlorine
TRV	Toxicity Reference Value
TSD	Technical Support Document
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
U.S. EPA	United States Environmental Protection Agency
UCLM	Upper Confidence Limit of the Mean
UPP	Upgrading Plant Pickering
VBRS	Vacuum Building Ramp Sump
VOC	Volatile Organic Compound
WHO	World Health Organization
WNW	West-North-West
WSP	Water Supply Plant
WTFNs	Williams Treaties First Nations
ww	Wet weight

1.0 Introduction

The Pickering Nuclear (PN) site is located on the treaty and traditional territory of the Williams Treaties First Nations (WTFNs) and in the City of Pickering on the north shore of Lake Ontario at Moore Point, about 32 km east of downtown Toronto and 21 km west of Oshawa (**Figure 1-1**). The PN site is comprised of the PN Generating Station (PNGS), with four operating CANada Deuterium Uranium (CANDU) pressurized heavy water reactors, two units in Stabilization, and two units in Storage with Surveillance (SWS). The Nuclear Sustainability Services – Pickering Waste Management Facility (NSS-PWMF) is also located on the PN site and is comprised of two sites. The NSS-PWMF Phase I site is located southeast of PNGS Unit 8, adjacent to the east side of the station security fence, and the NSS-PWMF Phase II site is located approximately 500 m north-east of the power generating facilities in the East Complex.

By the late 1700s, the Indigenous peoples in southeastern Ontario were compelled to cede their lands along the northern shore of Lake Ontario to the Crown. Two Treaties and agreements between the Crown and First Nations have historically been related to the lands comprising the PN site: the Johnson/Butler Purchase (1787-1788) (also known as the Gunshot Treaty), and the Williams Treaties (1923). Presently, the PN site remains within the territory of the 1923 Williams Treaties.

Ontario Power Generation (OPG) plans to pursue refurbishment and continued operation of PNGS Units 5-8, as well as decommissioning of PNGS Units 1-4, herein referred to as the Project. Refurbishment and continued operation of PNGS Units 5-8 will help OPG meet its mission to build a sustainable future powered by our electricity, our ideas, and our people. This is in support of OPG's vision to electrify life in one generation.

The existing PNGS licence allows for continued operation of PNGS Units 5-8 until the end of 2026. PNGS Units 1 and 4 were shutdown in 2024 and PNGS Units 2 and 3 have been in SWS since 2010. The existing licence is being renewed early to include refurbishment activities for PNGS Units 5-8, decommissioning of PNGS Units 1 to 4, as well as incorporating the NSS-PWMF waste licence.

To support the licence renewal, this predictive environmental risk assessment (PERA) was prepared. This PERA evaluates the proposed Project activities to ensure there will not be any significant risks to people or the environment, and to determine any areas requiring additional mitigation, monitoring, or study. This PERA complies with Canadian Standards Association (CSA) N288.6:22, Environmental Risk Assessment at Nuclear Facilities and Uranium Mines and Mills (CSA, 2022) and Canadian Nuclear Safety Commission (CNSC) REGDOC-2.9.1, Environmental Protection: Environmental Principles, Assessments and Protection Measures (CNSC, 2020). OPG is committed to open and transparent communication on our operations and projects and adheres to the guidance outlined in CNSC REGDOC 3.2.1, Public Information and Disclosure, and CNSC REGDOC 3.2.2, Indigenous Engagement, in accordance with the PNGS Licence Condition Handbook (CNSC, 2018, 2022).

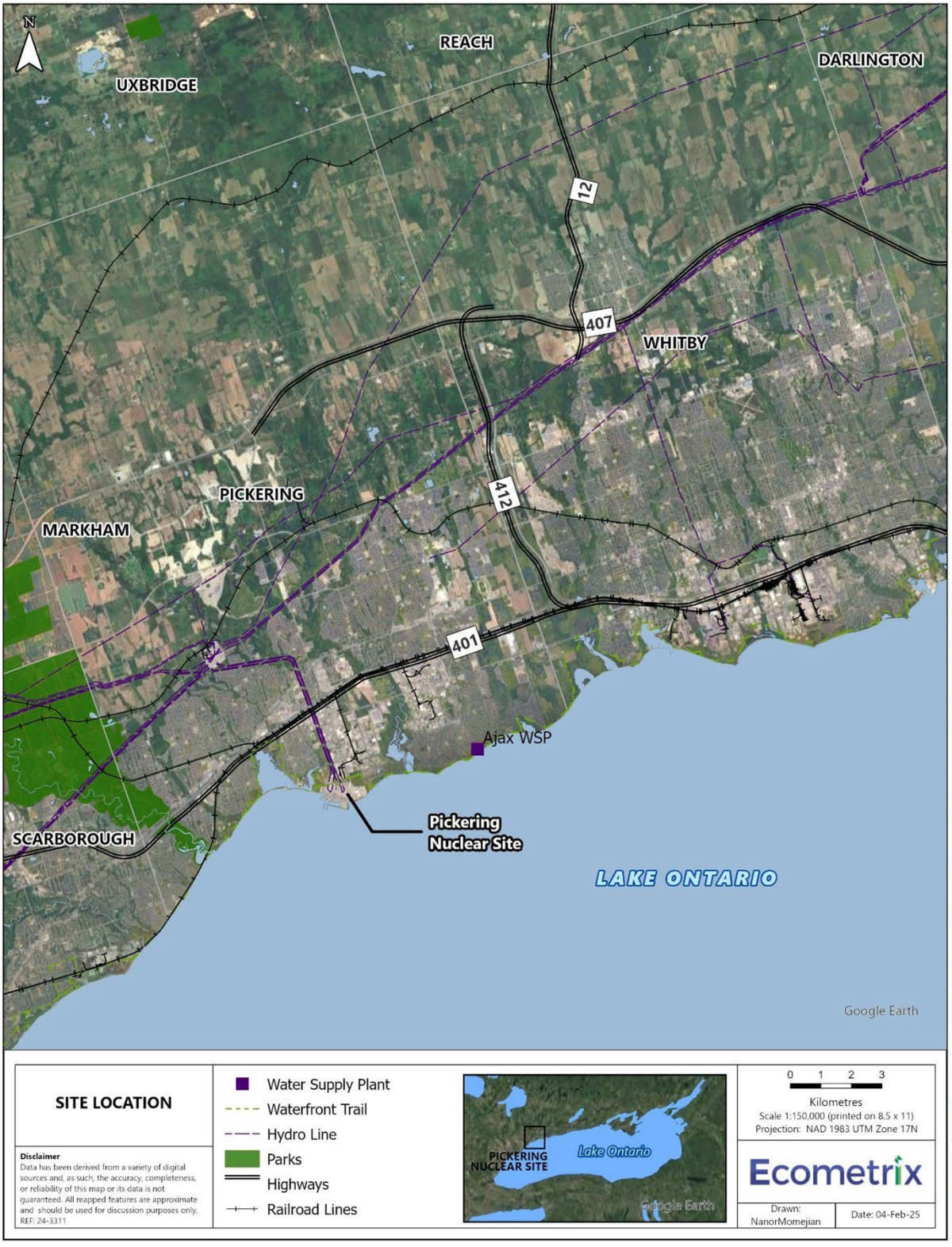


Figure 1-1: PN Site Location and Vicinity

1.1 Project Overview and Schedule

This section provides a brief overview of the Project and associated timelines based on current planning at the time of preparing this PERA. As the Project progresses, the timelines may shift; however, conceptual timelines are provided here for planning purposes, and are shown in **Figure 1-2**. The assumptions considered in the PERA are specific to activities which are expected to occur during the Project phases considered and are generally independent of exact timelines unless otherwise noted within the assessment.

The focus of the PERA is on the activities that will occur up to and including the re-licensing period from January 1, 2027 to December 31, 2036; however, activities and Project phases that will occur after the end of 2036 are discussed at a more general level of detail.

PNGS Unit 1 was permanently shut down on October 1, 2024 and Unit 4 was permanently shut down on December 31, 2024. PNGS Units 2 and 3 were previously shut down in 1997 and were declared to be in SWS in 2010 (Note: for the purposes of this PERA, the term Safe Storage is equivalent to SWS). Stabilization activities were initiated in 2024 for PNGS Unit 1 and in early 2025 for PNGS Unit 4 and are expected to be completed by 2028. SWS Activities (Start of Decommissioning [1]) for Unit 1 and Unit 4 will begin in 2028.

- **Stabilization Phase:** Initiated in October 2024, a Stabilization Phase for Units 1 and 4 includes the arrangements and activities that ensure a safe and efficient transition from the end of commercial operation to the SWS state for the transitioning units. Stabilization activities include defueling and dewatering reactor Units 1 and 4. PNGS Units 2 and 3 are not included in assessment of this phase as the Stabilization Phase of Units 2 and 3 is complete and the units have been in a SWS state since 2010. The stabilization activities are captured in the PNGS Stabilization Activity Plan (OPG, 2024a), and were previously assessed from an environmental impact perspective in the 2017 Safe Storage Predictive Effects Assessment (PEA) and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017).

- **Storage with Surveillance (SWS):** Starting in 2028 to approximately 2090, a 50 to 70-year SWS Phase for Units 1 and 4 will begin to allow for natural decay of radioactivity. Units 2 and 3 have been in SWS phase since 2010. Activities during the requested 2027-2036 licence period include the ongoing operation of the Irradiated Fuel Bays (IFBs) and the continued transfer of spent fuel to dry storage containers (DSCs). Current planning anticipates that used fuel transfer to DSCs will be completed within 10 years of PNGS Units 1 and 4 transitioning to SWS. Monitoring the natural decay of radioactivity within the remaining reactor systems will continue to approximately 2050. Risk reduction and removal activities will be initiated to remove and remediate non-nuclear equipment and

[1] Decommissioning actions are the procedures, processes and work activities (e.g., storage with surveillance, decontamination, dismantling or cleanup) that are taken to retire a facility, location or site from service with due regard for the health and safety of people and the environment.

buildings/facilities. These risk reduction and removal activities are distinct from the dismantle and demolish activities of nuclear structures, systems, and components (SSCs), which are planned to commence in approximately 2040. Risk reduction and removal activities will only occur for SSCs that have been end-stated and are no longer required to support SWS activities. This is consistent with CNSC REGDOC-2.11.2 "Decommissioning" (CNSC, 2021). SWS activities were previously assessed from an environmental impact perspective in the 2017 Safe Storage PEA and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017) – the SWS period was 25 to 30 years in previous assessments; with the focus on the first 10 years as bounding for the rest of the phase. While the duration of SWS is now longer, the bounding assumption for the first 10 years of SWS is still valid. Risk reduction and removal activities were not considered in the 2017 Safe Storage PEA or 2022 PEA Addendum, but are assessed in this PERA.

- **Dismantle and Demolish:** From 2034 to approximately 2100, the Dismantle and Demolish Phase will be initiated for PNGS Units 1-4. The specific Dismantle and Demolish activities, along with their associated work packages, will be detailed in subsequent Detailed Decommissioning Plan (DDP) updates. As per the DDP schedule, initial dismantling and demolition activities will focus on non-nuclear planning envelopes, with nuclear dismantling planned to start in approximately 2040.

For PNGS Units 5-8, refurbishment licensed activities are planned to start in 2027; however, prerequisites will start earlier. The units are planned for shutdown in 2026. The first unit from PNGS Units 5-8 is expected to come back online in 2031 and the last of the four units is expected to come back online by the end of 2034. The PNGS Units 5-8 Project phases are described below, and the conceptual timeline is shown in **Figure 1-2**.

- **Refurbishment:** Starting in 2026 (pending approvals), preparation for refurbishment of PNGS Units 5-8 will be initiated, including defueling and dewatering of reactors, relocation and/or removal of structures and equipment, construction of buildings and temporary laydown areas. Starting in 2027, the first unit will enter refurbishment which includes replacing reactor components including: fuel channels and calandria tubes, inlet and outlet feeders from end fittings to the reactor inlet/outlet headers, replacement of steam generators, refurbishment of various systems including reactor auxiliary systems and feedwater systems, and normal upgrade and maintenance activities. The unit will then be refuelled and restarted. Each unit will undergo refurbishment in a staged manner.

- **Continued Operations:** At the end of Refurbishment all units at PNGS Units 5-8 will be returned to service where operation will then continue for at least another 30 years. Continued Operations of the refurbished reactors will be very similar to current operations for PNGS Units 5-8 and will include ongoing maintenance until end of life of the reactors.

- **Decommissioning:** At the end of commercial operation for PNGS Units 5-8 (approximately 2070), the facility will enter a Stabilization Phase, followed by SWS, and Dismantle and Demolish phases. At this stage, decommissioning of PNGS Units 5-8 is only conceptually developed, and is consistent with its preliminary decommissioning plan (PDP) (OPG, 2025a). Prior to the transition of PNGS Units 5-8 to SWS, the PDP will be further developed into one or more DDPs that include details of decommissioning and storage with surveillance, and the associated environmental effects will be evaluated. It is assumed, based on international decommissioning experience and the protection strategies outlined in the PDP, that decommissioning can be implemented in a manner that is protective of health, safety, and the environment. Stabilization and SWS activities for PNGS Units 5-8 were previously assessed from an environmental impact perspective in the 2017 Safe Storage PEA and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017), as these documents assessed both PNGS Units 1-4 and PNGS Units 5-8.

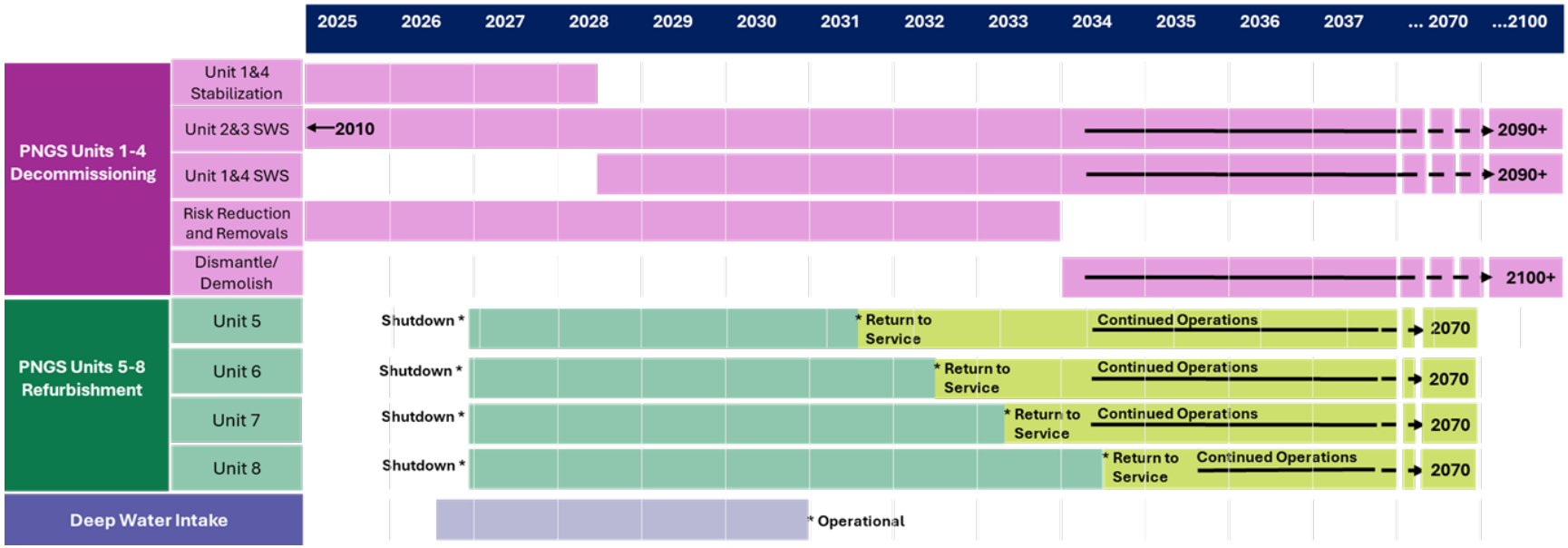


Figure 1-2: Pickering NGS Timeline Overview

1.2 Regulatory Context

The *Nuclear Safety and Control Act* (NSCA) mandates the CNSC to regulate the nuclear industry in a manner that prevents unreasonable risk to the environment and makes adequate provision for environmental protection, in conformity with international obligations. This mandate is reflected in the General Nuclear Safety and Control Regulations under the NSCA, and in the CNSC Regulatory Document REGDOC-2.9.1 "Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2" (CNSC, 2020).

REGDOC-2.9.1 outlines the CNSC's environmental protection framework, including the environmental protection measures a licensee would take for a given project or licence application. The refurbishment of PNGS Units 5-8 and the decommissioning of PNGS Units 1-4 is not a designated project under the *Impact Assessment Act* (2019). However, the Project does have potential for interactions with the environment, which requires the CNSC to conduct an Environmental Protection Review under the NSCA. This PERA will become part of the supporting technical documentation to be submitted to the CNSC in support of the licence application for these activities, which will help inform the CNSC's Environmental Protection Review.

This PERA has been prepared following the guidance of CSA N288.6:22 (CSA, 2022) and CNSC REGDOC-2.9.1 (CNSC, 2020).

OPG is committed to open and transparent communication on our operations and projects and adheres to the guidance outlined in CNSC REGDOC 3.2.1, Public Information and Disclosure, and CNSC REGDOC 3.2.2, Indigenous Engagement, in accordance with the PNGS Licence Condition Handbook (CNSC, 2018, 2022).

1.3 Objectives

The objectives of this PERA are to:

- Identify whether any proposed Project activities are likely to result in environmental emissions or other stressors potentially exceeding those in previous assessments;
- Predict and assess the risk of effect to representative human and ecological receptors resulting from exposure to radiological and non-radiological substances and physical stressors expected to be released during refurbishment, decommissioning, and continued operations of PNGS;
- Inform prioritization of monitoring and mitigation measures.

The most recent ecological risk assessment (ERA) for PN was completed in 2022 and focused on the five-year period from 2016 to 2020 (Ecometrix, 2023a). The 2022 PN ERA should be consulted for detailed information on prior operational conditions on the PN Site (for 6 operating units); as well as the systems and structures in operation at PNGS. Additionally, the 2017 Safe Storage PEA and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix,

2017) should be consulted for assessment of the environmental risks from stabilization and SWS activities.

To support this PERA, additional field data were collected on existing conditions in 2024 and 2025. These data supplement the ongoing annual environmental monitoring program (EMP), effluent and emissions monitoring programs, biodiversity monitoring programs, and any supplementary environmental field studies previously conducted. Existing conditions are described at a summary level in **Section 4.0**.

1.4 Scope

1.4.1 Spatial Boundaries

For the predictive human health risk assessment (HHRA), the spatial scale is consistent with that in the 2022 PN ERA, the 2017 PN PEA, 2022 PN PEA Addendum, and EMP, and includes identified human receptors (including a Harvester receptor not considered in previous assessments, see **Section 6.1.1.2**) within 10 km of the PN site, as shown on **Figure 1-3**. This area includes lands within the city of Pickering, the town of Ajax, and the eastern part of the city of Toronto (Scarborough).

For the predictive ERA, the spatial scale is consistent with that in the 2022 PN ERA, the 2017 PN PEA and 2022 PN PEA Addendum and includes those ecological receptors identified on the PN site and within the immediate PNGS boundary, as well as within the near-field receiving waters, including Frenchman's Bay. However, for this assessment, the nearshore Lake Ontario has been expanded to include the area of the proposed Deep Water Intake (DWI), as shown on **Figure 1-4**.

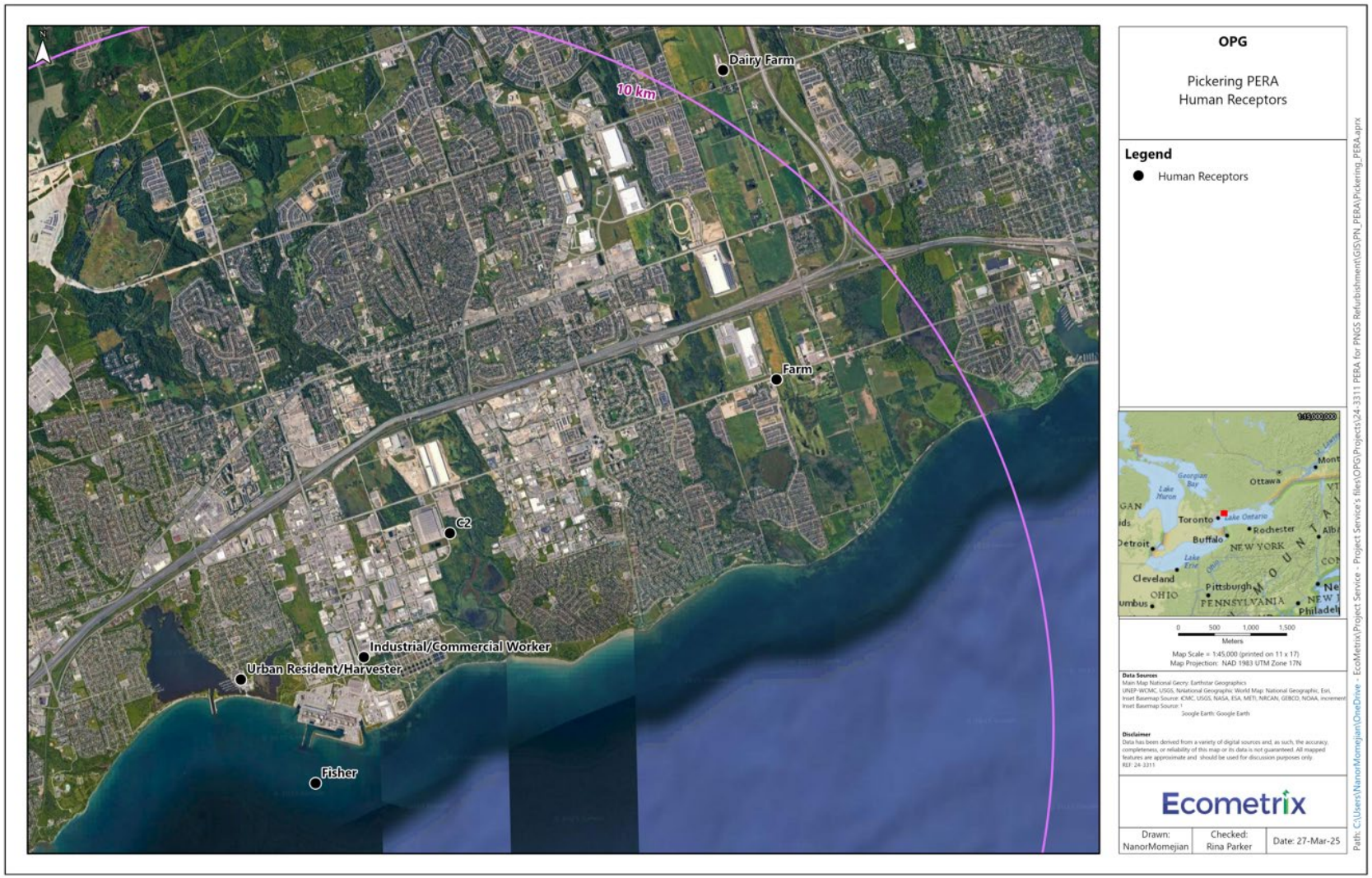


Figure 1-3: Area of Assessment for Human Receptors



Figure 1-4: Areas of Assessment for Ecological Receptors

1.4.2 Temporal Boundaries

The temporal boundaries of the Pickering PERA include the existing licence period which expires at the end of August 2028, as well as the re-licensing period (up to the end of 2036) to align with the start of refurbishment activities. This includes PNGS Units 1 and 4 Stabilization (3 years), PNGS Units 1-4 SWS (including risk reduction and removal activities that will occur up to the end of 2036), as well as PNGS Units 5-8 refurbishment and the start of continued operations (see **Figure 1-2**). This Pickering PERA covers the timeframe of 2025 to 2036.

At this stage, future Dismantle and Demolish activities for PNGS Units 1-4 are in the planning stages. The specific Dismantle and Demolish activities, along with their associated work packages, will be detailed in subsequent DDP updates.

At the end of commercial operation of PNGS Units 5-8, the facility will enter a Stabilization Phase, followed by SWS, and Dismantle and Demolish. At this stage, decommissioning of PNGS Units 5-8 is only conceptually developed, and is consistent with its PDP (OPG, 2025a). Prior to the transition of PNGS Units 5-8 to SWS, the PDP will be further developed into one or more DDPs that include details of decommissioning, and the associated environmental effects will be evaluated. It is assumed, based on international decommissioning experience and the protection strategies outlined in the PDP, that decommissioning can be implemented in a manner that is protective of health, safety, and the environment.

1.5 Summary of Past Assessments

This section provides a summary of past assessments that were relied on to support the assessment of PNGS Units 1-4 decommissioning and PNGS Units 5-8 refurbishment and continued operations in this PERA. The 2022 PN ERA provides the most up to date assessment of previous conditions at the PN site for 6 operating units. It is important to understand these existing and previous conditions in order to assess future conditions during PNGS Units 1-4 decommissioning and PNGS Units 5-8 refurbishment and continued operations. This section also provides a summary of predictive assessments that have been completed including the 2017 Safe Storage PEA and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017), as well as the 2007 environmental assessment (EA) for the refurbishment and continued operations of PNGS Units 5-8.

1.5.1 Environmental Risk Assessment for Pickering Nuclear

The most recent ERA for PN (i.e., the 2022 PN ERA) (Ecometrix, 2023a) was completed in accordance with CSA N288.6:22 (CSA, 2022) and REGDOC-2.9.1. It assesses the conditions at the PN site focused on the five-year period from 2016 to 2020. The scope looked at the potential effects of nuclear and hazardous substances released from the PN site on the human and ecological environment, as well as potential effects from physical stressors.

Potential risks to human receptors were characterized quantitatively in the HHRA, which concluded that there was limited risk to human receptors from inhalation of nitrogen oxides

(NO_X) and ingestion of hydrazine via drinking water. While the Incremental Lifetime Cancer Risk (ILCR) to sport fishers from ingesting fish containing hydrazine exceeded the acceptable risk level, this estimate was based on the highly conservative assumption that 100% of the fish consumed were collected within 500 meters of the Condenser Cooling Water (CCW) discharge. During the 2016 to 2020 period, the annual radiological dose to the critical group (Urban Resident) ranged from 1.2 to 2.1 µSv/a, which is approximately three orders of magnitude lower than the regulatory public dose limit of 1,000 µSv/a. Since the critical group is the receptor that receives the highest dose from PN, their protection implies that other receptor groups near PN are also protected.

The ERA suggested that there were minimal effects of the PN site on aquatic or terrestrial ecosystems near the site, in Frenchman's Bay, and surrounding areas.

At the outfall, Upper Confidence Limit of the Mean (UCLM) concentrations of morpholine, hydrazine, copper, and total residual chlorine (TRC) were below benchmark levels for aquatic receptors.

At Frenchman's Bay, measured water concentrations of hydrazine, morpholine, TRC, and sodium did not indicate potential for adverse effects to the ecological receptors evaluated. Since sediment concentrations of iron were below relevant benchmarks for benthic invertebrates, adverse effects are not expected because benthic invertebrates live in the sediment.

While the Hazard Quotients (HQs) of aluminum and iron exceeded the acceptable level of 1 for certain riparian mammals and birds in Frenchman's Bay, many of these species are unlikely to be impacted at a population-level as they do not reside exclusively in the area.

In general, soils on the PN site that exceeded benchmark concentrations are localized, suggesting the influence of past industrial operations rather than deposition from atmospheric sources or accumulation of contaminants of potential concern (COPC) in soil over time.

Although localized effects to individual earthworms/plants may occur, the earthworm community and terrestrial plant population on the site as a whole are not expected to be affected. Risks to mammals and birds on the PN site are considered unlikely. Residency at the PN site has been conservatively assumed to be 1, even though soil is inaccessible at most areas of the site due to the existing infrastructure. Any effects to individual mammals or birds on the PN site are localized, and the populations on the site as a whole are not expected to be affected.

The impacts of physical stressors, such as temperature, entrainment, and impingement, were also assessed for fish at the PN site. It was found that the thermal plume released from PNGS does not adversely affect the development of Round Whitefish (*Prosopium cylindraceum*) embryos. Additionally, biomass lost to impingement in 2016 was reduced by 88% relative to conditions prior to the installation of the fish diversion system (FDS) in 2009, surpassing the 80% impingement reduction target set by the CNSC in 2009.

In terms of radiological impacts, there were no exceedances of the radiation dose benchmarks for aquatic, riparian, and terrestrial biota at any locations for the ecological receptors assessed.

1.5.2 Predictive Effects Assessment for Pickering Nuclear Safe Storage

A PEA for PN Safe Storage was completed in 2017 to identify changes from the years 2011 to 2015 (identified as existing conditions at the time of the assessment) environmental and human health conditions that would result from activities associated with the Stabilization Phase and the SWS Phase of PNGS Units 1-4 and PNGS Units 5-8 (Golder and Ecometrix, 2017). Based on the screening assessment, further quantitative assessment of air quality (radiological and non-radiological), and surface water flow and quality were conducted. The conclusion of the 2017 Safe Storage PEA was that there were no predicted potential adverse effects to humans nor to ecological receptors from the activities proposed to take place during the Stabilization and the SWS Phases.

To support the mid-term operating licence review that occurred in 2023, a PEA Addendum Report was prepared to document and demonstrate that human health and the environment would continue to be protected during PNGS Units 1 and 4, and PNGS Units 5-8 shutdown, based on updated existing environmental conditions and current operational assumptions for the Stabilization and SWS Phases (Ecometrix, 2023b). The 2017 Safe Storage PEA assumed continued operations of PNGS until 2024; whereas in the PEA Addendum Report, continued operations of PNGS Units 5-8 was assumed until 2026. Based on changes to assumptions for Safe Storage (equivalent to SWS) at the time when the PEA Addendum Report was being prepared, the PEA Addendum Report re-assessed predicted effects to future ecological receptors in the PN forebay as well as potential entrainment and impingement effects due to increased flows through the intake, compared to the 2017 Safe Storage PEA. The conclusion of the 2022 PEA Addendum was consistent with 2017 in that there were no predicted potential adverse effects to humans nor to ecological receptors from the activities proposed to take place during the Stabilization and the SWS Phases. No further mitigation measures were identified.

Based on current planning, the 2017 Safe Storage PEA and 2022 PEA Addendum are still valid for PNGS Units 1-4 for the Stabilization and SWS Phases. Note the SWS period in the 2017 Safe Storage PEA and 2022 PEA Addendum was 25 to 30 years; with the focus on the first 10 years as bounding for the rest of the phase. While the duration of SWS is now longer, the assessment of the bounding assumption for SWS is still valid. For PNGS Units 5-8, OPG now plans to pursue refurbishment.

1.5.3 Pickering B Refurbishment Environmental Assessment

In 2007 OPG conducted an EA study for the refurbishment of one or more of the PNGS Units 5-8 reactors. The scope of the EA included the construction and operation of additional waste storage structures to accommodate wastes resulting from reactor refurbishment activities, and from continued operation of the reactors.

The EA study report and nine technical supporting documents (TSDs) were submitted to the CNSC in December 2007 (OPG, 2007). After considering the screening report, the mitigation measures, and comments filed from the public, the CNSC accepted that the project would not cause significant adverse effects (CNSC, 2009). However, in 2010 OPG announced that it would not be pursuing refurbishment of the PNGS Units 5-8.

In early 2024, to help meet Ontario's growing electricity demand and reduce emissions by supporting the electrification of the province's overall economy, OPG announced plans to pursue refurbishment of PNGS Units 5-8 (OPG, 2024b). The refurbishment of PNGS Units 5-8 is not subject to the current federal Impact Assessment Act, as the project is not a "designated project" under the Physical Activities Regulations (Project List). Accordingly, refurbishment of PNGS Units 5-8 is following the CNSC licensing requirements under the NSCA.

1.6 What OPG has Heard through Indigenous Engagement Feedback

In early 2024, OPG initiated support for the Michi Saagiig Nations of the WTFN to carry out a regional, OPG-wide Indigenous Knowledge study. This work is planned to be scoped by the Michi Saagiig Nations, and when completed, the Nations will determine if and what portions may be shared with OPG, which can help inform future ERAs.

This section describes engagement activities and meetings with Indigenous Nations and communities related to the PERA, relevant discussion and feedback, and how it has been considered in the PERA.

OPG has a site wide Indigenous Engagement Plan (IEP) for the PN site which covers ongoing and proposed initiatives, including the PERA. The IEP distinguishes between established rights holders (WTFNs) and Indigenous Nations and communities that assert Treaty and/or Aboriginal rights or have expressed interest in OPG's PN site.

Currently, OPG is engaging with the Michi Saagiig Nations of the WTFNs on a regular basis on various OPG projects, including activities that are planned at the PN site. OPG also continues to share information and provide opportunities for engagement with the Chippewa Nations of the WTFN, as well as with Indigenous communities with respect to asserted rights. With respect to Indigenous Nations and communities who have expressed interest in PNGS, OPG conducts outreach and engages at the request of those Nations and communities. Engagement on the PERA has primarily focused on the WTFNs. The list below summarizes feedback received and topics discussed related to the Pickering PERA through various engagements with the Michi Saagiig Nations.

- In 2023, OPG received comments from the Mississaugas of Scugog Island First Nation (MSIFN) on the 2022 PN ERA and 2022 PEA Addendum. A number of issues were raised related to terminology, questions on environmental monitoring data, and explanation of ERA results. OPG has addressed those comments that are also applicable to this PERA.

  - Moved away from using the term "baseline" to describe the current environmental conditions. Have preferred the term "existing conditions", "current operational conditions", "existing operational conditions", or "previous operational conditions" if referring to 6 operating units.

  - Inclusion of text to describe how adaptive management is considered (Section 2.0).

  - Initiated collection of environmental monitoring data in 2024 and 2025, addressing concerns that existing conditions at PNGS were relying on old data. Environmental data collected included air quality data, noise levels, surface water and sediment quality, soil quality, fish tissue, and aquatic habitat characterization.

- In May 2024, OPG met with the Nations to present an overview of the PERA, including plans for field studies and opportunities to participate.

- In June 2024, sampling plans were shared with the Nations as well as dates for upcoming monitoring as opportunities for participation.

- In Fall 2024, a Michi Saagiig representative of MSIFN participated in the fish community studies in the Deep Water Intake study area. On that day a Lake Sturgeon was captured and released back into the lake. Follow up discussions with the Michi Saagiig Nations identified lessons learned regarding communications between OPG and the Michi Saagiig Nations when a notable event occurs.

- In November and December 2024 OPG received comments on the Darlington New Nuclear Project (DNNP) PERA from Curve Lake First Nation (CLFN) and MSIFN, respectively. Comments from CLFN on the DNNP PERA that may be relevant to this PERA are related to assessment of the thermal plume and its impact on aquatic biota, as well as the accuracy of the Harvester receptor characterized in the DNNP PERA. OPG is making efforts to seek additional information to update the characteristics of the new Harvester receptor over time, and engaging with the Michi Saagig Nations along the way. Comments from MSIFN on the DNNP PERA that are relevant to this PN PERA include: ensuring direct input from the WTFNs into the PERA, formalizing a plan to incorporate input from the WTFNs into the ERA process and ensuring characteristics are accurately represented in exposure models, pprioritizing monitoring and validation of emissions, addressing cumulative effects, consideration of adaptive management, and clarifying waste management, among others.

- In early 2025, OPG received comments from CLFN on the PCSS PERA, requesting a Harvester receptor be added to the assessment. The Harvester has been added to this PERA (see Section 6.0). Subsequently, in April 2025, OPG received comments from MSIFN on the PCSS PERA and responded to these in May 2025. OPG has taken action to address a few comments in this PERA, including:

  - Removing the word "discernable" from "no discernable health effects" and removing the word "adverse" from "no adverse radiological effects to ecological receptors" when presenting the results of the Pickering Component Storage Structure (PCSS) PERA;

  - Adding reference to CNSC REGDOC 3.2.1, Public Information and Disclosure, and CNSC REGDOC 3.2.2, Indigenous Engagement (CNSC, 2018, 2022).

- In March 2025, OPG met with the Nations to provide an overview of the PERA's timelines, to understand engagement opportunities leading up to its submission to the CNSC.

- In April 2025, OPG shared a draft copy of the PERA with the Michi Saagiig Nations. In June 2025, OPG received feedback from the MSIFN, via third party review, and CLFN. OPG reviewed this feedback and in response, prepared and shared comment disposition tables in August 2025. Based on feedback received to date from the Michi Saagiig Nations, in addition to sharing further information and clarifications, and inviting next steps, there were proposed changes to be included within the next iteration of the PERA. These changes are described below, in general terms:

  - Extended the monitoring of existing conditions for air quality until mid-December 2025 (resulting in approximately 12 months of ambient air quality data);

  - Proposed inclusion of a new section in the Introduction (Section 1.0) where the Michi Saagiig Nations are invited to further outline the history of the local area to supplement the existing information. OPG invites the Michi Saagiig Nations to contribute to the drafting of this text to better incorporate Indigenous Knowledge and describe the unique history of the communities from pre-colonization to the present day;

  - Proposed additions to **Section 4.3.1.1** (and subsections as appropriate) to provide further details about Atlantic Salmon (*Salmo salar*), Lake Sturgeon (*Acipenser fulvescens*), and American Eel (*Anguilla rostrata*).

- In July and August 2025, OPG shared a list of topics and questions that are applicable across nuclear generating stations in the context of engagement on current and future ERAs and PERAs. The Harvester is one of the main topics included (specifically, related to naming, location, characterization, and site-specific knowledge). OPG looks forward to further discussion and feedback on this topic as well as others.

- In January 2026, at a monthly engagement meeting, MSIFN expressed interest in being more involved in project decision making, and a desire for OPG to go above and beyond regulatory requirements for environmental initiatives, such as biodiversity initiatives. Alderville First Nations (AFN) expressed appreciation for the kind of surface water information presented in the 2007 EA study report (see **Section 5.2.1.1.1**).

- In March 2026, OPG shared a draft copy of the PERA R001 with the Michi Saagiig Nations. OPG received feedback from CLFN in May 2026 and incorporated changes in PERA R001 where required.

OPG will continue to facilitate engagement on this and other PERAs and ERAs, to broaden OPG's understanding of surrounding land use and receptor selection. OPG endeavors to continue working with Indigenous Nations and communities to strengthen ongoing engagement around ERAs and PERAs. OPG will continue to engage with the Michi Saagiig Nations via regularly scheduled meetings and maintain efforts to engage with Chippewa Nations as part of the WTFNs as well as with Indigenous communities that assert Treaty and/or Aboriginal rights to discuss Pickering Nuclear.

1.7 Quality Assurance and Quality Control

This PERA made use of environmental monitoring data. These data are derived from chemical and radiochemical analyses of samples collected from effluent streams and environmental media around the PN site. The environmental data provided by OPG were collected by qualified staff and analyzed by qualified laboratories under the EMP, such as the station chemistry laboratory and the Whitby Health Physics Laboratory. The EMP has its own quality assurance (QA) program that encompasses activities such as sample collection, laboratory analysis, laboratory quality control, and external laboratory comparison (OPG, 2025b).

Environmental samples collected in 2024 and 2025 to characterize existing conditions at the PN site, such as water, sediment, soil, fish tissue, air and noise were collected and analyzed in accordance with CSA N288.4:19. Samples collected were analyzed for non-radiological constituents by Bureau Veritas Laboratories and radiological constituents by Kinectrics, which are both accredited by the Standards Council of Canada as conforming to the quality assurance requirements of International Organization for Standardization (ISO) Standard 17025. In order to achieve desired detection limits, hydrazine analysis was performed by Eurofins Lancaster Laboratories Environmental in Lancaster, Pennsylvania, which is accredited to the ISO Standard 17025 as well as the United States National Environmental Laboratory Accreditation Program Standard.

Throughout the planning and preparation of the PERA, all staff worked under an ISO 9001:2015 certified Quality Management System. All work was internally reviewed and verified. Reviews included verification of data and calculations, as well as review of report content and formatting. Comments have been dispositioned and addressed as appropriate by report revisions. The review process has been documented through an electronic paper trail of review comments and dispositions.

2.0 Methodology

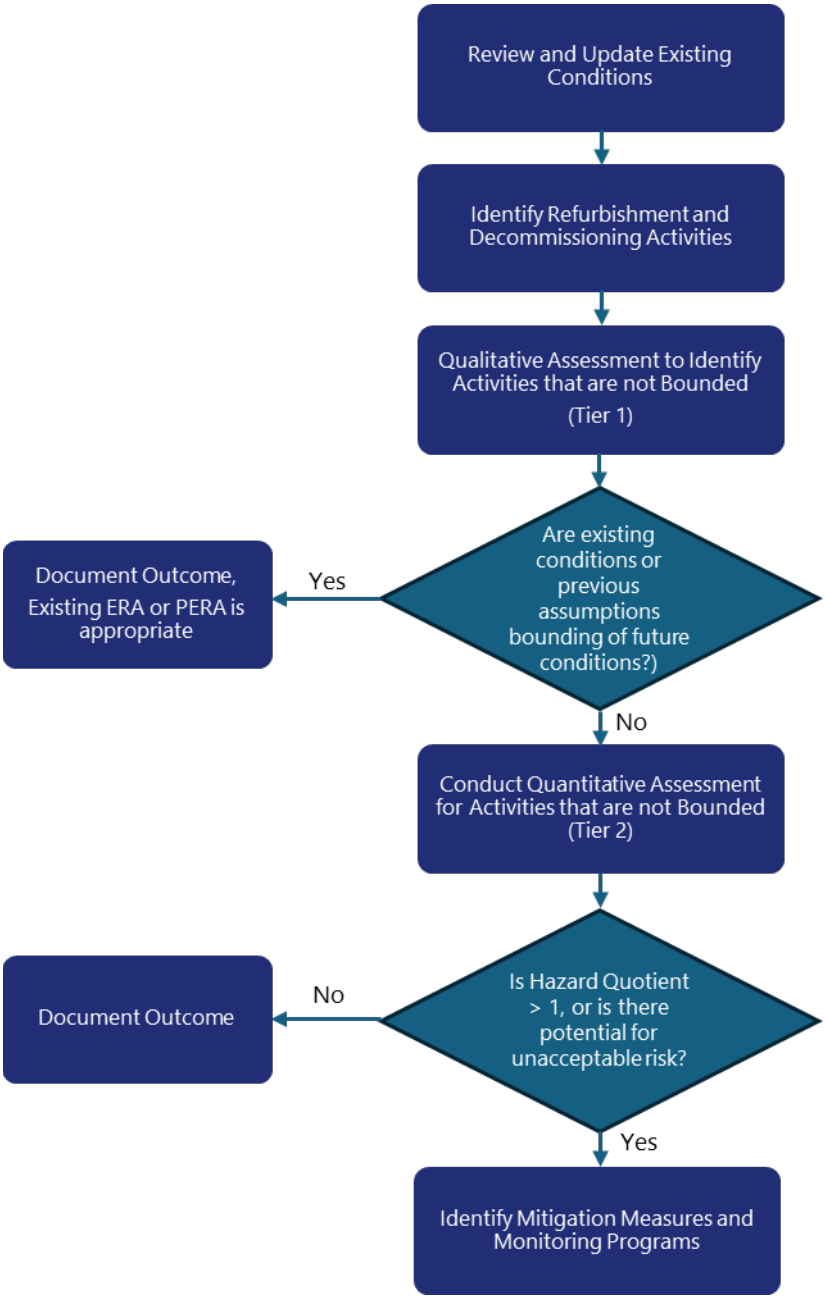
The methodology for the PERA is based on general guidance from CSA N288.6:22 (CSA, 2022). Specific guidance on predictive ERAs is not provided in the CSA guidance; therefore, ERA guidance was modified from Figure 5.1 in CSA N288.6:22 to apply to this assessment. This methodology is generally consistent with that identified in the 2017 Safe Storage PEA and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017) and is shown on **Figure 2-1**.

The PERA focuses on identifying and assessing decommissioning and refurbishment activities that were not previously considered and found acceptable in other assessments (the 2017 Safe Storage PEA and 2022 PEA Addendum) and are not bounded by previous conditions at the PN site as described in the 2022 PN ERA (for 6 operating units) and updated existing conditions (**Section 4.0**). Those activities that are not bounded by existing or previous conditions are those that may potentially increase environmental emissions or other stressors, and would therefore warrant further assessment of human health or ecological risk.

A qualitative assessment (Tier 1 assessment) is performed to identify which project activities are not bounded by existing conditions and previous assessments. A quantitative assessment (Tier 2 assessment) is performed for those environmental interactions and project activities that are not bounded. The outcome of the quantitative assessment will inform if additional monitoring or mitigation measures are recommended.

OPG integrates adaptive management into its environmental management system. Specifically, adaptive management is fundamental to the EMP to ensure that the monitoring activities remain valid, and to enable OPG to appropriately identify and address any adverse findings or areas of risk. EMP design reviews, self-assessments and audits are regularly conducted to confirm effectiveness of environmental monitoring activities and to practice continual improvement. The ERA process is also a means for adaptive management as it is undertaken every 5 years and considers changes to site activities and environmental conditions to identify any areas where changes in mitigation or monitoring may be needed. Through the existing processes, if a risk to the environment is identified or predicted through the ERA, it can trigger changes to the EMP, supplementary studies and/or mitigation measures, as required.

As the Project is in its planning phase, the PERA has been conducted as a bounding conservative assessment to ensure that potential environmental effects are adequately characterized. As part of adaptive management, an updated PERA may be prepared, if warranted based on CSA N288.6:22 to incorporate future Project changes.



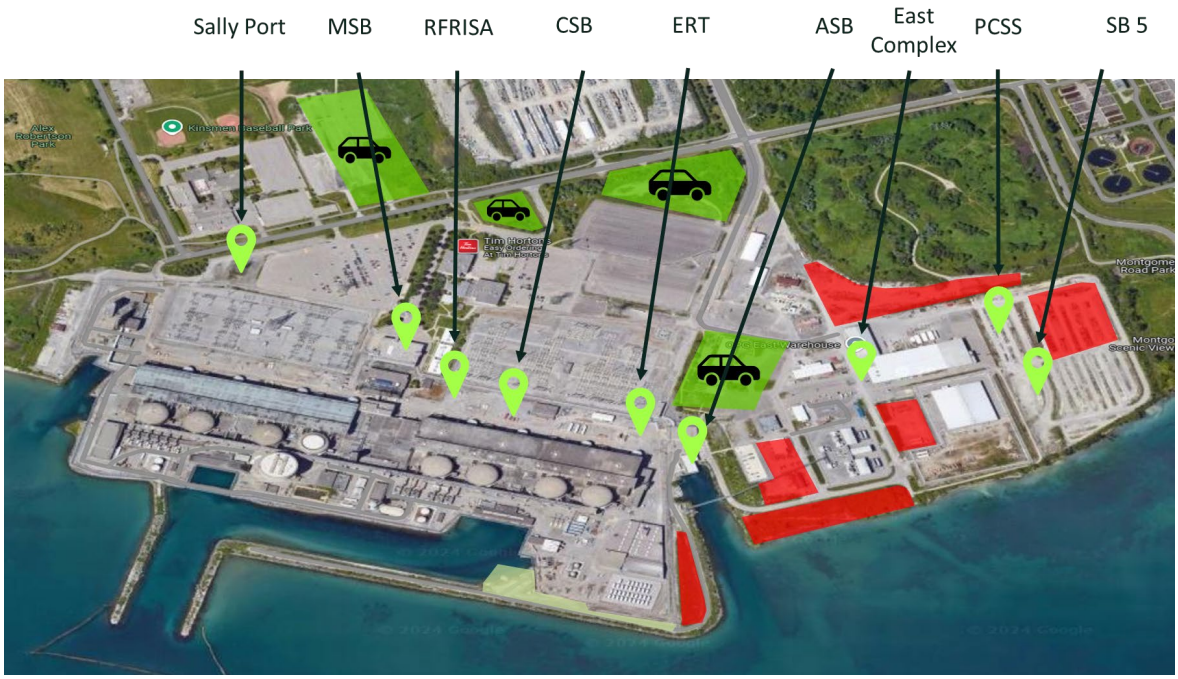
Note: A hazard quotient is a numerical representation of a potential for effects due to exposure to constituents. A hazard quotient greater than 1 indicates that there is potential for adverse effects and there is a need for further, more detailed assessment. In some situations (i.e., physical stressors) a hazard quotient may not be applicable, but the overall tiered approach still applies.

Figure 2-1: Methodology for the PNGS PERA

3.0 Project Activities

This section provides the current understanding (at the time of preparing this PERA) of the overall activities for the Decommissioning of PNGS Units 1-4 and the Refurbishment and Continued Operation of PNGS Units 5-8. As identified in **Section 1.1**, permanent shutdown of PNGS Units 1 and 4 occurred in Q4 2024, Stabilization Activities for Units 1 and 4 were initiated in 2025 and SWS Activities (Start of Decommissioning) for Units 1-4 will start in 2028. PNGS Units 5-8 refurbishment licensed activities will start in 2027; however, other prerequisites will begin earlier. The first unit is expected to come back online from PNGS Units 5-8 in 2031 and the last of the four units in 2034. Operation of PNGS Units 5-8 will then continue for at least another 30 years.

The PN site is shown on **Figure 3-1**, which includes existing and planned buildings, laydown areas, and parking areas. A summary of assumptions for the Project is provided in **Table 3-1** by SSC, with further detailed discussion provided by Project phase below. A background description of each SSC is provided in the 2022 PN ERA (Ecometrix, 2023a).



Note: Red shaded areas represent planned laydown areas, green shaded areas represent parking.
Existing Facilities: MSB = Main Security Building; ERT = Emergency Response Team; ASB = Auxiliary Security Building;
Proposed New Facilities: RFRISA = Retube and Feeder Replacement Service Island Support Annex; CSB = Common Services Building; PCSS = Pickering Component Storage Structure; SB = Storage Building

Figure 3-1: Pickering Nuclear Site Plan

Table 3-1: Summary of Project Assumptions for Pickering Refurbishment and Decommissioning

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
Reactor Building (RB) Systems	• The Reactor Building systems will cease operation for nuclear fission and heat generation. Fuel will be removed, heavy water systems drained, moderator system flushed, and all other liquids, wastes and potentially hazardous transient materials will be removed. • Building ventilation and stack monitoring will remain operational. • The RB active drainage sumps will remain operational. • 1,500 Mg of heavy water (D_2O) that will be drained from the units will be transferred to the Darlington Heavy Water Management Building – West Annex, following the Darlington Unit 1 refurbishment per D_2O (Deuterium oxide; Heavy water) Management Plan for Pickering Safe Storage.	• Surveillance will commence to ensure RB systems are maintained in a safe state. • Operation of ventilation may be reduced and run only as required for occupational safety and building integrity. • Sumps will be isolated from the active drainage system. • D_2O storage on-site will continue, with periodic transfers off-site as required.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• The RB systems will cease operation for nuclear fission and heat generation. Fuel will be removed, heavy water systems drained, moderator system flushed, and all other liquids, wastes and potentially hazardous transient materials will be removed. • D_2O transfers from PNGS Units 5-8 dewater to Darlington Heavy Water Management Building West Annex – 150 Mg will be Low Curie, 160 Mg will be High Curie. • Units will be drained – 2017 Safe Storage PEA assumptions would be bounding. • Removal of Fuel Bundles using existing fuel handling equipment. • Initial dewatering may result in some increase in radiological emissions from RLWMS and RB ventilation. • D_2O will be drained from moderator and heat transport systems and auxiliaries. • Systems will be dried and maybe rinsed to remove remaining D_2O, minimizing tritium emissions later during the outage. • Dewatering moderator and heat transport involves removal of ~ 242 m^3 and 139 m^3 of heavy water, respectively. • D_2O will be reused once refurbishment is complete.
Reactor Auxiliary Bay (RAB), Irradiated Fuel Bays (IFB-A, IFB-B) and Auxiliary Irradiated Fuel Bay (AIFB*)	• The RAB systems will remain in operation to accommodate the shutdown of the reactor units, the defueling, and the removal of other equipment. • Systems no longer required will be taken out of service and left in a safe state, with the equipment remaining in place. • IFB-A and AIFB will remain in normal operation.	• SWS will commence to ensure RAB is maintained in a safe state. • IFB-A and AIFB will remain in normal operation until all contents can be transferred to dry storage. • Selected monitoring equipment will remain operational. • Fuel will be transferred to DSCs and transportation to the NSS-PWMF will continue.	• In the 2025– 2036 timeframe baskets and associated frames from the IFB-A and AIFB would be removed and transferred to the NSS-PWMF (See Nuclear Sustainability Services - Pickering Waste Management Facility (NSS-PWMF) row for more details).	• Used fuel will be transferred to the IFB-B for wet storage. • Used fuel will remain in IFB-B for at least 10 years; however, OPG is authorized to process and store a maximum of 100 DSCs with used fuel that has been cooled in wet storage for a minimum of 6 years. Commissioning tests on DSCs have been performed and submitted to

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		• Once IFB-A is not required, it can be drained. Once AIFB is not required, it can be drained.		the CNSC for review. OPG is approved to process and store minimum 6-year cooled fuel once CNSC staff conclude the results are acceptable. • Abnormal Incident Manual (AIM) inspection platform will require removal for inspection of fuel bundles to meet International Atomic Energy Agency (IAEA) inspection timeline requirements.
Turbine Hall (TH) and Turbine Auxiliary Bay (TAB)	• Electricity generating equipment (e.g., turbines and generators) associated with each reactor unit will cease operation as units are shut down. • As equipment within the PNGS Units 1-4 TAB is no longer required, it will be taken out of service and left in a safe state with equipment remaining in place (some exceptions may be made for equipment that can be resold). • PNGS Units 1-4 TAB basement sump pumps will remain in operation.	• Current steam emissions from PNGS Units 1 and 4 will continue long-term. • Surveillance will commence to ensure PNGS Units 1-4 TAB is maintained in a safe state. • Heating and ventilation will be provided, to the extent required. • Operation of the PNGS Units 1-4 TAB basement sumps will continue to maintain the groundwater level below the basement floor.	• Within the 2025-2036 timeframe, select Non-Nuclear Components such as turbine and generator in the TH (PE-B-1 in Section 3.3.4.2) will be partially removed, but TH structures remain. • Removal of electrical supply and controls In the PNGS Units 1-4 TAB (PE-B-2) will occur within the 2025 - 2036 timeline in parallel with Units 1&4 Stabilization activities. PNGS Units 1-4 TAB structure will remain intact.	• Planned modifications will be installed. • Turbine and generator controls will be upgraded. • Turbine and generator will be commissioned.
Service Wing*	• No Changes to 2017 Safe Storage PEA.	• No Changes to 2017 Safe Storage PEA.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• No Changes from existing conditions for PNGS Units 5-8.
Standby Generators and Emergency Power	• The generators will continue to be tested and relied on to supply back-up power and water to PN Generating Station systems while fuel remains in the reactor units. • End State Report has mandated removal of all energy sources (i.e., fuel and lube oil) and abandon in place after no longer required.	• PNGS Units 1-4 Standby Generators will be in operation until dewatering is completed at PNGS Units 5-8 by 2027.	• Removal of the PNGS Units 1-4 Standby Generators (PE-A-1, see Section 3.3.4.1).	• PNGS Units 5-6 Standy Generators will be in operation throughout refurbishment except for maintenance windows during planned outages. They will be replaced post refurbishment. • PNGS Units 7-8 Standby Generators will be shutdown and replaced by the time Unit 7 returns to service.
Building Heating and Ventilation	• Adequate building heating and ventilation will continue to be supplied. • An alternative heating source will be required when the operating units are shutdown. Four electrode boilers are being installed to provide the primary source	• Building heating and ventilation will be supplied to the extent necessary to satisfy occupational safety and maintain system and building integrity. • Less heat (i.e., less heating boiler use) will be required than in the Stabilization Phase.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• The electrode boilers will continue to be utilized as the primary source of building heating steam supplemented by the Standby Boiler, until PNGS Units 5-8 are returned to service. At that point, the operational units will be the primary source of steam for site.

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
	of building heating steam, supplemented by the existing standby boiler. As end stating is conducted, there will be opportunities to reduce building heating steam demand on Units 1-4.	• The electrode boilers will continue to be utilized as the primary source of building heating steam supplemented by the Standby Boiler, until PNGS Units 5-8 are returned to service. At that point, the operational units will be the primary source of steam for site.		
Condenser Cooling Water (CCW) and Reactor Building Service Water (RBSW) Systems	• CCW pumps will be taken out of service in stages as reactor units are shut down. • A minimum of two CCW pumps will continue to operate following the shutdown of reactor units to facilitate Stabilization activities.	• The increased CCW flow between the 2017 Safe Storage PEA and the 2022 Safe Storage PEA Addendum will further reduce the temperature difference between the discharged water temperature from the outfall and the water intake temperature (i.e., ΔT) because of greater dilution of warm water. The increased CCW flow may change predicted sediment deposition patterns. • Unit 1 CCW Pumps will be made available as contingency. • For PNGS Units 5-8, the expected CCW flow rate through the PNGS-B side is 2,899 L/s (250,500 m^3/day) during the SWS Phase, higher than the assumed flow rate of 578 L/s (50,000 m^3/day) in the 2017 Safe Storage PEA. With regards to water quality, the updated CCW flows are bounded by the conditions assumed for the 2017 Safe Storage PEA, because the higher flow rate will provide greater dilution, resulting in reduced discharge concentrations at the outfall. This was addressed in the 2022 Safe Storage PEA Addendum.	• Cooling water lines will be removed from the CCW supply system. CCW lines will be isolated, and segmented. • Remove CCW pipework to access points and cap per the interim end state. • Cutting and capping the CCW pipework during the 2025-2036 timeframe.	• When all units on the PNGS Units 5-8 side are shut down for refurbishment, 2 CCW pumps on the PNGS Units 1-4 side or the PNGS Units 5-8 side will be operating. RBSW will be released to either the PNGS Units 1-4 or PNGS Units 5-8 discharge channels. • When one unit has completed refurbishment and the DWI is operational, water will flow into PNGS Units 5-8 through the deep water intake (DWI). All CCW pumps will be shutdown on PNGS Units 1-4 side, except during any draining of systems to support decommissioning. These are expected to be short duration runs. • At the end of refurbishment all units on PNGS Units 5-8 will be operational and water balance will return to existing conditions for the PNGS Units 5-8 side.
Electrical Transmission Facilities*	• Main output transformers and generating system transformers associated with each unit will be taken out of service and placed into a safe state following the shutdown of the reactor units. • Select station service transformers and switchyard equipment will remain in operation to supply power to the facility.	• Select station service transformers and switchyard equipment will remain in operation to supply power to the facility.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• Replacement of the Main Power Output Transformers will occur as well as partial upgrade of the standby generators. • The Auxiliary Power Supply will be used to support DWI construction power.

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
	Any transformers no longer required would be placed in SWS.			
Oil and Chemical Storage Building (SB)*	• Waste consolidation activities and transportation off-site will increase.	• Operations will continue, though waste consolidation and transportation activities will be reduced.	• Selected oil tank and gas cylinders to be completely removed or partially removed throughout the 2025– 2036 timeframe. Those activities units include: ○ Remove Oil Tank Farm A (PE-A-1, see Section 3.3.4.1): This unit is already emptied and will be removed off-site along with concrete pad, and associated piping, instrumentation, and electrical connections. Pipework will need to be removed, capped, material and equipment surveyed, hoisted for transportation and off-site disposal. ○ Complete removal of internal components and structures for Gas Bottle Storage Enclose A (PE-A-2): Gas bottles would be removed before the start of decommissioning activities in 2034. During decommissioning phase, the remaining structure/building will be dismantled and removed. ○ Complete removal of internal components and structures of Standby Generator oil tanks PNGS Units 1-4 (PE-A-2): The standby generator oil tanks will be emptied in the Stabilization phase. During SWS, the remaining structure/building will be dismantled and removed.	• Waste consolidation activities and transportation off-site will increase.
Administration, Engineering Services, Security Buildings and Pickering Nuclear Information Centre (PNIC)*	• The Administration building will be maintained to support the decommissioning project and to house key decommissioning staff. • The assumption of the 2017 Safe Storage PEA remains bounding.	• The Administration building will be maintained to support the decommissioning project and to house key decommissioning staff. • The 2017 Safe Storage PEA assumption that buildings will be leased to future	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• Construction of RFRISA, a three-storey office building. • Based on Project planning for refurbishment leasing of buildings is no longer planned; therefore, the on-site

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
		industrial/commercial workers is bounding, because the future industrial/industrial worker was assessed as the nearest receptor to the plant (refer to Section 4.1.3 of the 2017 Safe Storage PEA). This receptor would be bounding of exposure and dose from any on-site building leased out. Therefore, no further assessment is required. (Note: based on Project planning for refurbishment leasing of buildings is no longer planned).		future industrial/commercial worker is no longer applicable.
High Pressure Emergency Coolant Injection (HPECI) Facilities*	• No changes while fuel remains in the reactor units. • Once the reactor units are all defueled, the HPECI will be drained, and all associated equipment placed in an inactive safe state. • HPECI water will be discharged via an approved pathway.	• HPECI facilities will no longer be in operation and will be in an inactive safe state. • PNGS-A Pipework will be drained, but PNGS-B will remain in service.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• No changes are planned to the HPECI system.
New Water Treatment Plant (NWTP)*	• A mobile water treatment system may be used or demineralized water will be brought from off-site, and stored in tanks at the PN site. New pumps and controls will be added to hook up with the existing network to supply active loads during SWS. • The 2017 Safe Storage PEA evaluated. use of a mobile water treatment system • If demineralized water brought from off-site no discharges are anticipated to be associated with water treatment to meet demineralized water requirements, and the 2017 Safe Storage PEA assumptions are bounding.	• A mobile water treatment system is no longer planned during the SWS Phase. The 2017 Safe Storage PEA considered non-radiological discharges from a mobile water treatment system during the SWS Phase and found that predicted concentrations of contaminants from water treatment are below screening levels (refer to Section 4.2.3.2.1.1 of the 2017 Safe Storage PEA). Considering that no water treatment is currently planned, the assessment of non-radiological discharges from a mobile water treatment system in the 2017 Safe Storage PEA is bounding for lake water quality. No further assessment is needed.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• A NWTP will be built and commissioned. • During refurbishment a mobile water treatment plant may be used for 2.5 years (approximately October 2026 to 2029. • A temporary mobile water treatment plant may be used to support DWI construction activities such as tunnel boring and muck management (approximately 2027-2030).
Nuclear Sustainability Services - Pickering Waste Management Facility (NSS-PWMF)*	• A Licence Amendment for PWMF was received from CNSC to load 6- to 10-year fuel to the DSCs (from previous 10-year minimum), to free up bay space for the defueling of PNGS Units 5-8. Up to 100 DSCs with minimum 6-year old fuel can be stored in Storage Building 3	• No changes, the NSS-PWMF will continue in full operation to receive, process and store DSCs until all the fuel has been removed from the IFBs and they have been decommissioned.	• Used fuel that has been stored in the IFBs for the required minimum cooling period will continue to be loaded into DSCs and transported to the NSS-PWMF using the existing programs and procedures for the management of used fuel.	• Used fuel that has been stored in the IFBs for the required minimum cooling period will continue to be loaded into DSCs and transported to the NSS-PWMF using the existing programs and procedures for the management of used fuel.

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
	(SB3). A dose rate assessment was completed for OPG considering the higher activity (lower aged) fuel for SB3.		• Work will continue to be executed with existing operational procedures, leveraging established practices from previous fuel handling operations. • As fuel is removed, empty baskets/modules and associated frames will be removed from the IFBs and disposed of using existing waste routes.	• Used fuel will be transferred to NSS-PWMF for storage. No additional SBs after SB5 are planned. • Pickering Component Storage Structure (PCSS) will be constructed in the East Complex for storage of Low and Intermediate Level Waste (L&ILW). • Refurbishment waste, including fuel channel assembly waste and steam generator waste, will be stored in PCSS. • Refurbishment of fuel channel assemblies, calandria tubes and feeder piping will generate Intermediate Level Waste (ILW) and Low Level Waste (LLW) and will be contained in radioactive waste containers. • Volume reductions such as cutting and crushing in the RB vault will be used for pressure tubes and calandria tubes. • Feeder pipes cut into lengths to fit in standardized waste containers, and transported off site as per routine LLW generated at PNGS Units 5-8. • Total estimated volume of miscellaneous routine LLW is 4,000 m^3 (1,000 m^3 per unit). • Miscellaneous LLW and feeder pipes will be transported to Nuclear Sustainability Services – Western Waste Management Facility (NSS-WWMF). • Relocation of Dry Storage Modules (DSMs).
Waste Management (non-radiological)*	• Non-radiological solid and liquid wastes will continue to be generated and managed as they are during normal operations.	• There will be a reduction in wastes produced. • Waste will continue to be managed in accordance with accepted procedures and licence requirements.	• Waste management will continue to be managed in accordance with accepted procedures and licence requirements.	• Waste management will continue to be managed in accordance with accepted procedures and licence requirements.
Site Drainage and Waterborne Emissions	• Drainage systems, including stormwater runoff, sewage, active and inactive drainage (IAD) systems will remain operational. • Draining of systems may result in additional flow to the radioactive liquid waste management system (RLWMS,	• All types of waterborne emissions will be reduced. • Stormwater volumes will remain the same. • All drainage systems, including stormwater runoff, sewer, and active and IAD systems will remain operational to	• All types of waterborne emissions will be reduced. • Stormwater volumes will remain the same. • All drainage systems, including stormwater runoff, sewer, and active and IAD systems will remain operational to	• During refurbishment waterborne emissions will be similar to that assessed in 2017 Safe Storage PEA. • A minimum of two CCW pumps will remain in service on PNGS Units 1-4 side or Units 5-8 side, while all units on PNGS Units 5-8 side are shutdown for

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
	e.g., upgraders), but it will be discharged as in previous operations (6 operating units). • Additional materials may be generated for discharge via the IAD; however, approval will be obtained for the disposal options. • The volumes of active and inactive liquid emissions generated will be gradually reduced as operations are terminated. • A minimum of two CCW pumps (from Units 1-4) will remain available for service.	the extent necessary to meet operational and regulatory requirement. • IAD will not be re-routed to RLWMS, RBSW or the PNGS Units 5-8 discharge channel. The revised strategy for IAD in the 2022 Safe Storage PEA Addendum was to discharge to the respective PNGS-A or PNGS Units 5-8 CCW intake duct. As a result, less active discharges will be diverted to the RLWMS, and the 2017 Safe Storage PEA assessment of lake water quality remains bounding. • IAD discharge to the PNGS Units 5-8 CCW intake duct will be drawn back into the station along with the cooling water intake. Any potential impacted water will be diluted prior to discharge, as was the case in the 2017 Safe Storage PEA. This change does not affect the 2017 Safe Storage PEA bounding condition and the increased CCW flow between the 2017 PEA (50,000 m^3/day) and the 2022 PEA Addendum (250,500 m^3/day) will reduce predicted discharge concentrations since there is greater CCW flow available for dilution. Therefore, no further assessment is needed for IAD to the PNGS Units 5-8 side. • IAD discharge to the PNGS Units 1-4 CCW intake duct will eventually be a source of tritium to the forebay because there is expected to be no intake flow through the PNGS Units 1-4-A intake duct. This was assessed in the 2022 Safe Storage PEA Addendum.	the extent necessary to meet operational and regulatory requirement.	refurbishment. RLWMS will discharge out the PNGS Units 1-4 side or Units 5-8 side. • Drainage systems, including stormwater runoff, sewage, active and IAD systems will remain operational.
Screenhouses, Forebay, Intake Channel, and Intake and Discharge Ducts	• All these SSCs will remain operational and continue to operate as in the current operations. • The CCW duct may not be used when the CCW pumps cease operations at the end of the Stabilization Phase.	• The forebay will continue to be an operating intake that is reduced from operational conditions but will be increased from the 2017 Safe Storage PEA assumption as discussed in the CCW and RBSW systems row (i.e. Section 3.7 of the 2017 Safe Storage PEA). Once the deepwater intake is	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• DWI to be constructed will draw deeper cooler water from Lake Ontario which is expected to significantly reduce fish impingement and entrainment as well as reduce potential biofouling events with attached algae (see Section 3.1.1.7). • Construction of the DWI will also involve construction of a cutoff wall to separate

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
		operational the forebay will no longer be an operating intake and a cutoff wall will be constructed that allows for minimal flow to pass into the forebay and direct the operational flows through the DWI and into the forebay. • The 2017 Safe Storage PEA predicted that the forebay would become a sediment depositional area (refer to Section 4.3.2 of the 2017 Safe Storage PEA). Less sedimentation in the forebay is expected to occur due to the higher expected intake flow rate. This change is considered bounded in the assessment in the 2017 PEA. No further assessment is needed. • The IAD system will continue to discharge to the common PNGS Unit 1-4 or PNGS Unit 5-8 line that leads to the old water treatment plant and then directed to the sediment pond and to the common intake channel, discharge to the respective PNGS Until 1-4 or PNGS Unit 5-8 CCW intake duct after unit shut-down. However, for PNGS Unit 1-4, with no CCW flow, IAD will report eventually to the forebay. See discussion in the previous row. This was assessed in the 2022 Safe Storage PEA Addendum.		the forebay from the lake, and disposal of construction and dredged material (see Section 3.1.1.7). • Once the DWI is in use, a cutoff wall will be installed in the intake channel, as it will no longer be needed to supply water to the station. The cutoff wall will be designed to allow for minimal flow through the wall into the forebay. • DWI and its associated cutoff wall are pending final design, construction and approvals.
Fish Diversion System (FDS)*	• The FDS will continue to be installed seasonally as necessary while any number of CCW pumps remain in operation.	• The FDS will not be removed without prior approval and discussions between OPG and Fisheries and Oceans Canada (DFO).	• The FDS will not be removed without prior approval and discussions between OPG and DFO.	• The FDS will not be removed without prior approval and discussions between OPG and DFO.
Tempering Water Duct*	• No Changes.	• No Changes.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• No changes.
Standby Boiler (Existing steam boiler, fueled with fuel oil, which provides back-up heating steam supply for the PN site during commercial operations)*	• The existing Standby Boiler will be upgraded and modified to supply steam for building heating and process steam (as a backup to meet peak demand if required) during the Stabilization Phase. The upgrades to the Standby Boiler include installation of a new air dryer,	• Planned operation of the Standby Boiler will be limited to during Peak Loads, until the PNGS Units 5-8 begin to return to service, at which time the Standby Boiler will remain poised for emergency use.	• No risk reduction and removal or dismantle/demolish activities in the 2025 – 2036 timeframe associated with this SSC.	• Planned operation of the Standby Boiler will be limited to during Peak Loads, until the PNGS Units 5-8 begin to return to service, at which time, the Standby Boiler will remain poised for emergency use.

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
	replacement of the feed water pump, and a new oxygen sensor; these upgrades will not increase the air emission rate from the Standby Boiler. • Operation of the Standby Boiler during the Stabilization Phase is bounded by the 2017 Safe Storage PEA and previous operational conditions assessed for the 2022 PN ERA, both of which consider full-time operation of the Standby Boiler.			
Other Supporting Structures and Services*	• The East and West Annex will be used for PN Site activities and will remain. • The East Complex will continue to be used for PN Site activities. • Upgraders will continue to be used to upgrade D_2O. Necessary process steam may be supplied by the building heating boilers.	• The East Complex, East and West Annex will be required. • The East Complex will be maintained for PN Site activities. • Upgraders will be in service as required.	• The Helium Trailers x4 and Hydrogen (H_2) Skids (PE-A-1, see Section 3.3.4.1) will be completely removed, with the removal of internal components and structures. • Select equipment within the Off Gas Management System Building will be removed in the 2025– 2033 timeframe, while keeping the structures. The Off Gas Management System includes the Activated Carbon Tank, ducts, instrumentation, pump system, connected piping and electrical systems. • Complete removal of internal components of Sulzer-A while keeping the structure (PE-A-1). • Selected structures will be partially or completely removed including: ○ Scaffolding Sheds (PE-A-1): These sheds will be dismantled to be removed, transported and disposed. ○ Shutdown System Enhancement (SDSE) Instrument Rooms (PE-A-2): The outer structure of the instrument rooms will be dismantled, removed and transported for disposal. ○ Some or all of the SSCs within UPP-A and UPP-B (PE-A-3). ○ Gas Bottle SB (PE-A-1): the building will be dismantled to	• The East and West Annex will be used for PN Site activities and will remain. • The East Complex will continue to be used for PN Site activities. • Upgraders will continue to be used to upgrade D_2O. Necessary process steam may be supplied by the building heating boilers.

Structure, System or Component	Units 1 & 4 Stabilization Phase (Defueling/Dewatering and End Stating) (2024-2028)	Units 1-4 Storage with Surveillance Phase (Wet and Dry) (2028-2070+)	Units 1-4 Risk Reduction and Removal and Dismantle/Demolish Activities (2025-2036)	Units 5-8 Refurbishment (2026-2034)
			be removed, transported, and disposed of. ○ Other oil tanks and systems included in PE-A may be removed as part of risk reduction or early decommissioning activities.	

Note:
* Indicates that the SSC provides a common service to all PNGS units.

3.1 Refurbishment of PNGS Units 5-8

Refurbishment of PNGS Units 5-8 consists of three sub-phases: preparation for refurbishment, refurbishment, and refuelling and restarting. These sub-phases are described in more detail below. Additional activities such as, construction and operation of DWI are described based on current Project planning.

3.1.1 Preparation for Refurbishment

Starting in 2026, preparation for refurbishment will be initiated including procurement and mobilization of equipment and components, relocation/removal/construction of buildings, structures and equipment and temporary laydown areas, defueling and dewatering of reactors, islanding the unit, management of heavy water (D_2O), and DWI construction.

3.1.1.1 Procurement and Mobilization of Equipment and Components

The major system components to be procured for refurbishment include steam generators, feeder piping, fuel channel assemblies and calandria tubes.

Additionally, a large amount of heavy machinery will be mobilized. This includes diesel-powered transportation equipment, including a large multi-wheeled ground transporter, forklifts, tractor trailers, and other construction equipment such as cranes, earthmovers, electrical generators, etc. A large crane will be required for hoisting of the steam generators into and out of the reactor buildings (RBs), through specially prepared and approved openings in the RB domes. This crane will be situated on the south side of the PNGS Units 5-8 RB.

3.1.1.2 Relocation/Removal/Construction of Buildings, Structures, and Equipment

To make room for the large crane, some structures and equipment within the PNGS Protected Area will be temporarily relocated or removed. This will include fire hydrants, an equipment storage building (SB), the gas bottle storage enclosure and the chlorine building, since they are located south of the RBs. Other structures and equipment may have to be temporarily relocated or removed to facilitate the movement of refurbishment equipment, components and wastes through the station.

The majority of the temporary construction facilities and laydown areas will be located in the East Complex (**Figure 3-1**). Construction-related facilities, such as change rooms, shop facilities, construction offices, and laydown areas for equipment and machinery will be required. These land uses are similar to the existing land use in the East Complex area. Depending on the exact timing, some existing buildings and structures within the East Complex will be converted to these uses or replaced as required.

Some additional service buildings or structures may be required within the PNGS Protected Area Boundary. There may be a need for service buildings to accommodate additional personnel or additional equipment storage, which may include the Retube and Feeder Replacement Service Island Support Annex (RFRISA), Sally Port, and the Common Services Building (CSB) (**Figure 3-1**).

The RFRISA will be constructed within the PNGS Protected Area during the same timeframe as the PCSS (**Figure 3-2**). The RFRISA is expected to have an area of approximately 48,000 to 50,000 ft^2, and will be a three-storey office building with offices and conference rooms. Underground services will be connected to existing site services. It is expected that construction of the RFRISA will be complete by mid to late 2026.

Any new buildings will be designed and constructed following OPG's engineering change control process.

3.1.1.3 Construction of Pickering Component Storage Structure (PCSS) and SB 5

The NSS-PWMF Waste Facility Operating Licence amendment for PCSS construction and operation was approved by the CNSC in July 2025. The PCSS will be constructed adjacent to the northern boundary of the NSS-PWMF Phase II site within the Pickering Site East Complex (**Figure 3-2**). The PCSS will be used for the storage of low and intermediate level waste (L&ILW), including PNGS Units 1-4 and PNGS Units 5-8 components such as steam generators, pressure and calandria tubes, calandria tube inserts, and end fittings, and concrete low level waste (LLW). Based on the expected waste streams that will be produced, the PCSS is expected to have an area of approximately 41,000 ft^2. The structure will be shielded with concrete walls and enclosed with a roof. It is expected that construction of the PCSS will be complete by mid-2027. Evaluation of the environmental effects of the PCSS was part of a separate PERA (Ecometrix, 2024) to reflect the plan to incorporate the PCSS into the existing NSS-PWMF operating policies and procedures and operate it under an amended Waste Facility Operating Licence.

The Pickering B Refurbishment EA included the construction and operation of two additional DSC SBs (SB5 and SB6) in the PWMF Phase II Site, east of SB4 (SENES, 2007). At this time, only SB5 is planned, as an amalgamation of both buildings, with an in-service date of Q3 2027 (see **Figure 3-1**). SB5 will be designed to accommodate up to 1040 loaded DSCs with minimum 10-year-old cooled fuel.

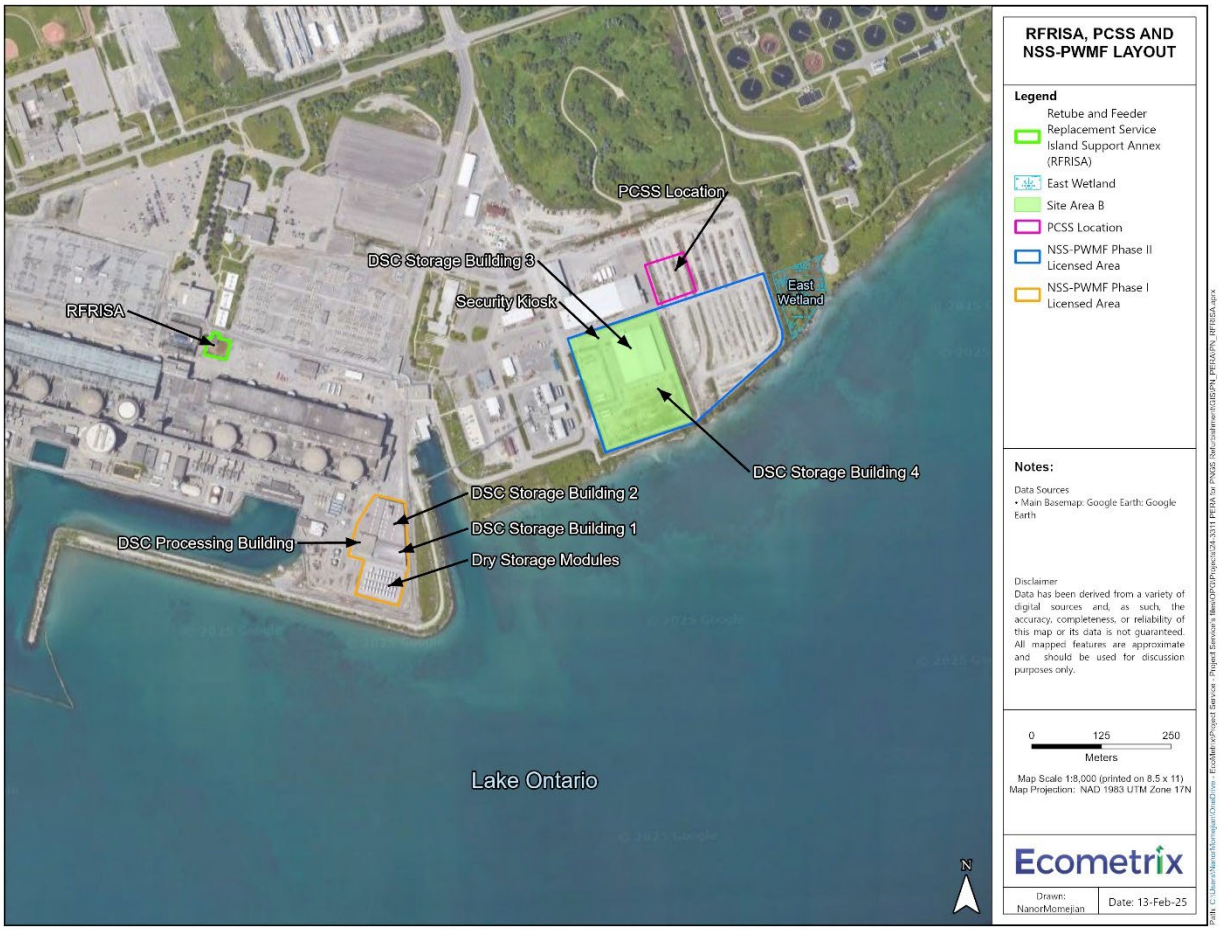


Figure 3-2: Planned Locations for the PCSS and RFRISA

3.1.1.4 Defuel and Dewater

The RB systems for Units 5-8 will cease operation for nuclear fission and heat generation. Used fuel will be removed from the fuel channels of those reactors, using fuelling machines and transferred using the existing irradiated fuel transfer and conveyor systems, to the Unit 5-8 IFB for wet storage. Currently, the used fuel will remain in the IFB-B for at least ten years prior to transfer to dry storage at the NSS-PWMF. OPG is authorized to process and store a maximum of 100 DSCs in SB3 with used fuel that has been cooled in wet storage for a minimum of 6 years. OPG performed commissioning tests on DSCs, submitted dose results to the CNSC for review and has proceeded with processing of minimum 6-year cooled fuel.

D_2O will be drained from the moderator and heat transport systems and auxiliaries. Initial dewatering may result in some increase in radiological emissions from Radioactive Liquid Waste Management System (RLWMS) and RB ventilation exhaust. The units (Units 5-8) will be drained.

The moderator and heat transport systems will be dried and may be rinsed to remove the remaining D_2O to minimize tritium emissions later in the refurbishment process.

3.1.1.5 Islanding the Unit

The unit undergoing refurbishment will be isolated from the other operating units, to facilitate the refurbishment work and create a safe working environment for reactor activities. This is referred to as "islanding the unit", and involves physical separation of the unit to be refurbished from the common negative pressure containment system by sealing the transition duct between the boiler room and the containment pressure relief duct. It will also involve isolation of the unit's portion of some shared systems and potentially involve equipment logic or operational changes to support the needs of the remainder of the station. Operationally, the islanded unit will be supported separately from the remainder of the station and in a manner that benefits safe and efficient access for construction staff.

3.1.1.6 Management of Heavy Water

D_2O removed will be collected, upgraded and stored in accordance with existing plans. D_2O will be stored on-site, with some transferred to the Darlington Heavy Water Management Building – West Annex. D_2O will be reused once refurbishment is complete.

If the **heavy water** is to be de-tritiated prior to reuse, it will be shipped to the Darlington Tritium Removal Facility in specially designed containers called Tritiated Heavy Water Transportation Packages, as per current practice. OPG has D_2O storage facilities on the PN site, and storage of D_2O is within PNGS Units 5-8's current operating licence (PROL 48.03/2028).

D_2O is reusable and interchangeable between units. However, D_2O used for moderator and heat transport systems is kept separated as the isotopic composition and chemical characteristics of the D_2O in the two systems are slightly different.

3.1.1.7 Construction of Deep Water Intake

One of the major design modifications/activities related to the Project is the construction of an offshore deep water intake structure for PNGS Units 5-8 that will replace the current shoreline surface water intake. The proposed DWI will draw deeper cooler water from Lake Ontario which is expected to significantly reduce fish impingement and entrainment as well as reduce potential biofouling events with attached algae.

This proposed modification would include the installation of a porous veneer intake structure, and the excavation of a tunnel. In support of the modification to an offshore DWI, the construction of a cutoff wall to greatly reduce the connection of the existing forebay to the lake is also being proposed. The cutoff wall is expected to be constructed using a combination of concrete, steel reinforcement, and various fill types. This structure will serve two primary functions: to separate the lake from the forebay and to provide an emergency service water supply to the station. The cutoff wall will have small holes to allow for minimal flow through the wall into the forebay. The specific flow mechanism through the structure, such as a pipe or sluice

gate will be determined based on safety case and environmental requirements. The cutoff wall will be designed with environmental considerations such as minimizing risk of fish impingement/entrainment and biofouling.

Other works that were previously proposed, which have since been excluded from the construction plan, included nearshore infilling and associated seawall, a new dock, dredging of a channel out to approximately 9 m depth to facilitate dock access, and the shoreline protection (armoring) of the eastern shoreline for erosion mitigation purposes.

The site modifications to support the DWI tunneling encompass several key activities being considered. Infrastructure enhancements may include constructing a bridge over the outfall and road widening on Dike Road. Preparatory activities include clearing/grubbing and leveling/laydown area preparation. The new intake cap will be located approximately 1.5 km offshore out from the east end of the existing forebay at approximately 11.5 - 15 m depth (**Figure 3-3**). An alternate location was previously under consideration for the intake cap, sited at 1.25 km offshore at approximately 12 m depth. Construction of the DWI and associated modifications will begin in 2027 and will include tunnel boring. The DWI will be operational by 2030.

During tunneling activities, a large volume of spoils (up to 40,000 m^3) will be excavated. OPG is currently evaluating spoil management options, including: open aquatic disposal, onsite landfill or offsite disposal facility. Based on preliminary planning it is anticipated that much of the rock and soil could potentially be disposed of offsite and overburden materials may be sent for open aquatic disposal. OPG is working with the Indigenous Nations and communities to seek input and feedback on identifying the best option and mitigation measures. A comprehensive soil and spoil management plan has been prepared in accordance with regulatory requirements during the site preparation phase for the DWI.

The total estimated project footprint and associated impacts on aquatic habitat are outlined in **Section 6.2.2.1** based on the current concept design. Briefly, the completed intake cap is projected to cover approximately 1 ha, based on current design specifications of a 50 m radius intake cap. However, to accommodate the temporary disruption caused by dredging and construction activities associated with the intake cap, approximately 120 m x 120 m (approximately 1.5 ha) is being considered for total shifting/gradient requirements for the intake cap area. As the intake tunnel spanning from PNGS to the intake cap is expected to be a boring tunnel that is drilled below the lakebed, it is not expected to result in a measurable footprint on the aquatic environment. The cutoff wall is currently conceptualized to be approximately 2,132 m^2 (0.213 ha). Temporary cutoff wall construction platform piles may additionally be required to create temporary work areas above the water, but will be removed following construction completion. Once the DWI and cutoff wall are in full operation, approximately 5 ha of existing forebay is expected to be separated from Lake Ontario. In addition, a potential bridge over the PNGS Units 5–8 CCW outfall is being considered; however, its design has been modified to minimize any in-water footprint or habitat loss within the PNGS Units 5–8 discharge channel.

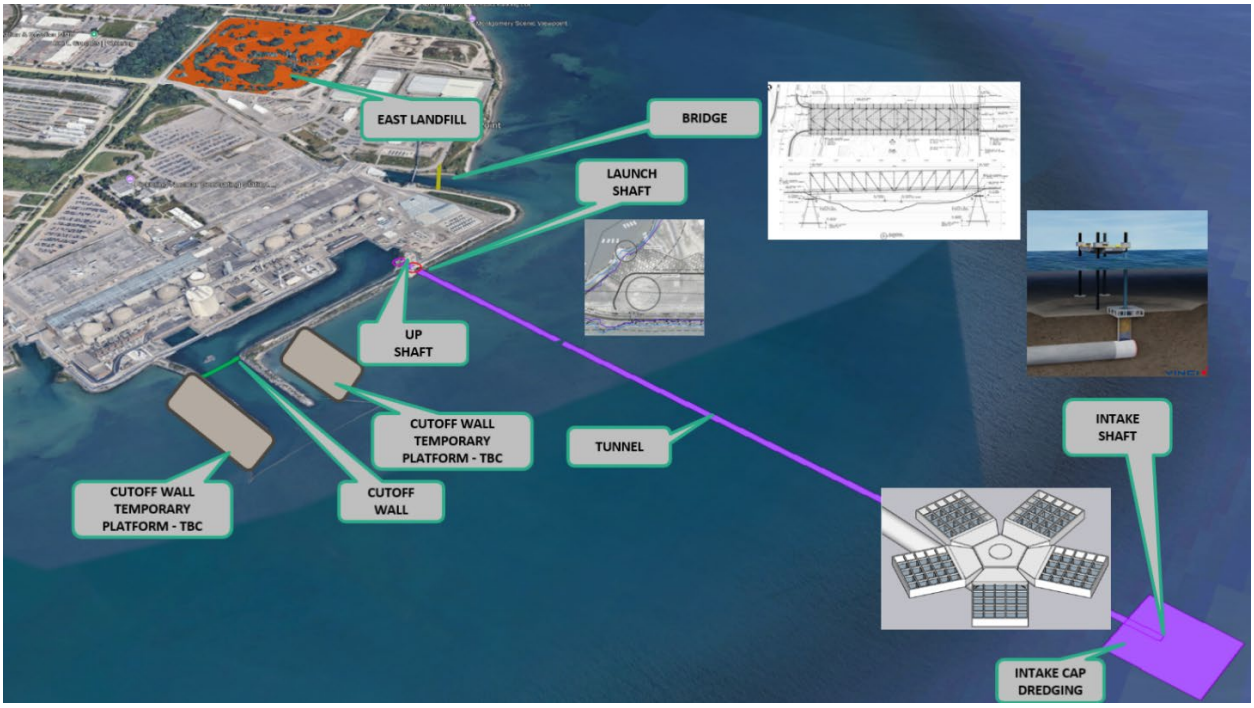


Figure 3-3: DWI and Associated Site Preparation Modifications

To accommodate equipment, space allocation, and construction activities for the DWI, OPG plans to relocate a portion of the Protected Area security fence northwards from Dike Road. Security fence relocation will be completed by Q4 2026. This also required relocation in Q1 2026 of the Dry Storage Modules (DSMs) which contain intermediate level waste from PNGS Units 1 to 4 Refurbishment that occurred in the mid-1980s and early-1990s and is located in the Retube Component Storage (RCS) Facility (approximately 36 DSMs). The DSMs are categorized as Intermediate Level Waste (ILW) and have been moved to an alternative location onsite within the NSS-PWMF Phase II site. New concrete pads were constructed near DSC SB 4 to store the relocated DSMs, and the old concrete pads where the DSMs are currently stored will be removed.

OPG also plans to relocate the NSS-PWMF fence to allow for road widening that will be used to reduce traffic on-site and connect the construction site to the East Complex.

3.1.2 Refurbishment

Starting in 2027 the first unit will enter refurbishment which includes replacing reactor components, replacement of steam generators, refurbishment of various systems including reactor auxiliary systems and feedwater systems, and normal upgrade and maintenance activities.

3.1.2.1 Replacement of Reactor Components

The following components will be replaced during refurbishment: pressure tubes, fuel channels, calandria tubes, end fittings, shield plugs, closure plugs, spacers, feeder coupling hardware, feeder tubes (up to the headers), feeder tube supports, feeder cabinet insulation, and positioning assemblies. The work will include the following activities:

- **Vault Preparation**: removal of feeder cabinet and reactor face insulation, installation of shielding, and installation of additional services to support the work.
- **Removal of Fuel Channels, Calandria Tubes and Feeders**: feeder pipes will be removed. Shielding and automated tooling will be used where feasible to reduce worker dose. All components of the fuel channel assemblies (including pressure tubes) and calandria tubes will be removed.
- **Installation of New Fuel Channels, Calandria Tubes and Feeders**: New fuel channel assemblies and calandria tubes will be installed in the reactor core. New feeder piping will be installed. The reactor vaults will be returned to operational status through removal of all the temporary services, removal of temporary shielding and tooling, and reinstallation of feeder cabinet and reactor face insulation.
- **Waste Handling**: Refurbishment of fuel channel assemblies, calandria tubes and feeder piping is expected to generate L&ILW. ILW resulting from refurbishment will primarily include fuel channel assembly wastes (i.e., pressure tubes, calandria tubes and related components collectively referred to as "retube waste"). Pressure and calandria tubes, calandria tube inserts, and end fittings will be processed (e.g. volume reduced, packaged, etc.) before transfer to the PCSS for secure storage. Feeder pipes will be cut into lengths to fit in standardized waste containers, and transported off site as per routine LLW generated at PNGS Units 5-8. The total estimated volume of miscellaneous routine LLW is 4,000 m^3 (1,000 m^3 per unit). The estimated volume of ILW from fuel channel assembly waste is approximately 3,000 m^3.

3.1.2.2 Removal and Replacement of Steam Generators

During refurbishment, all of the steam generators (also referred to as boilers) will be replaced. Each PNGS Units 5-8 unit has 12 steam generators, each approximately 14 m in length and 2 m wide, weighing approximately 90,000 kg per steam generator. Replacement of the steam generators will include the following activities:

- **Building and Equipment Preparation**: Specially prepared and approved openings will be created in the Rb dome to provide crane access. A wet-cutting technique will be used to minimize dust. The holes will be temporarily covered to prevent precipitation from entering the RB. A large heavy lift crane will be placed on the south side of the RB that will be used to remove the steam generators. The crane will meet stringent safety

requirements such as being seismically qualified and having a significant safety factor in terms of lifting capacity.

- **Removal of Steam Generators**: Steam generator removal includes removal of insulation, cutting or disconnecting all piping and equipment attached to the steam generators, capping of all openings to prevent release of loose radioactive contamination. The exterior of steam generators will be shielded and coated to fix loose contamination.

- **Installation of Steam Generators**: New steam generators will be shipped to site. Steam generator installation will be carried out by reversing the procedure for removal. Connections to process piping and instrumentation will be made and insulation installed. When all new steam generators are installed, equipment will be returned to operational status by removing temporary services and lifting rigs and reinstalling any temporarily removed equipment. The holes in the RB dome will be restored to meet design requirements. Appropriate testing will be performed to confirm containment system integrity.

- **Waste Handling**: Steam generator replacement will generate liquid waste, LLW and ILW, including the steam generators themselves, insulation materials and miscellaneous components.

    - The liquid waste (i.e., light water) from the secondary heat transport system will be drained from the steam generators. The water will be monitored to ensure it is within Environmental Compliance Approval (ECA) limits for non-radionuclides before being released to the lake. Water will also be monitored for radionuclides. If contamination is detected during the monitoring, the water will be sent to the RLWMS for processing.

    - The removed steam generators will be shielded, sealed and loose contamination on the exterior surfaces will be coated and fixed prior to removal from the RB. This will ensure that neither loose contamination nor radioactivity releases will be present during loading onto and unloading from the transfer vehicle. The steam generators may be placed temporarily in a laydown area prior to being transferred to the PCSS for storage. The estimated volume of the 48 steam generators is 2,500 m^3.

    - The concrete and dry solids from the cutting slurry used to cut the reactor dome would be checked to confirm that they are not radioactive and then disposed of as landfill waste or sent for recycling. If radioactive, the concrete and dry solids would be handled as LLW in a similar manner to other LLW. The water inventory from the cutting slurry is not expected to be categorized as Low Level Active Waste; however, when hydro-demolition is completed, the water inventory will be sampled and analyzed to verify that it does not exceed the Low Level Active

Waste threshold. Once verified, it will be discharged in batches into the Unit 5 Pickering Incoming/Outgoing Transfer System Low Level Active Sump and processed in accordance with applicable OPG procedures.

3.1.2.3 Refurbishment of Other Plant Systems

Refurbishment/upgrades of the reactor auxiliary systems and feedwater systems includes normal maintenance and repair to be undertaken during each refurbishment outage, and normal maintenance activities required for the refuelling and restart of any reactor unit.

During refurbishment outages of PNGS Units 5-8, there may be opportunities to undertake normal repair, maintenance and upgrades of components. While these activities are undertaken as part of normal operations and maintenance during typical unit outages, they are noted here to indicate the likelihood that ongoing repair and maintenance may also occur during the major refurbishment outages. This work may generate small volumes of LLW and non-radioactive waste. The wastes will be managed in a manner similar to current practice.

Replacement, upgrades, maintenance and commissioning of the majority of Turbine and Generator drive train and auxiliary equipment will be performed.

- A total of 12 low pressure turbine spindles (3 per unit), and 2 high pressure turbine spindles (Unit 6 and 8) will be replaced.
- The generator stator cores and windings will be replaced.
- The generator rotors will be refurbished and the windings will be replaced.
- The majority of the large turbine valves will undergo major maintenance with some components of the assembly being replaced.
- Moisture separator & Re-heater internals will be replaced.
- Turbine/Generator auxiliary equipment (stator cooling water, seal oil, hydrogen, lubrication oil, fire resistant fluid, glands) will undergo significant upgrades.
- The turbine/generator controls system will undergo a significant upgrade.

Replacement of the Main Power Output Transformers will also occur as well as partial upgrade of the standby generators.

3.1.3 Refuelling and Restarting

Following completion of major component refurbishment activities, the reactor fuel channels will be loaded with new fuel bundles. Each reactor requires 4,560 bundles (385 tonnes of fuel for all 4 units). New fuel will be brought into the RB to a fuel receiving area. New fuel will likely be loaded into new fuel channels manually as per past practice for initial fuel load.

The moderator and heat transport systems will be filled with D_2O. Refilling the moderator and primary heat transport systems involves the transfer from storage of 242 m^3 and 139 m^3, respectively, of D_2O into the reactor systems.

Restarting reactors consists of system start up and testing, raising power and generating electricity for the electrical grid. The refurbished unit will be connected to the electrical grid and the reactor will be brought up to full power in a series of steps, meeting certain condition and performance criteria.

Refuelling and restarting is expected to generate LLW and ILW typical of maintenance outages. Returning the reactors to full power will produce used nuclear fuel and purification wastes, such as filters and ion exchange (IX) resins, as well as other LLW. At the end of the Refurbishment Phase, all four reactors will be operational.

3.2 Continued Operations of PNGS Units 5-8

At the end of Refurbishment PNGS Units 5-8 will be returned to service and enter the Continued Operations phase. Continued Operations of the refurbished reactors will be similar to previous operations (6 operating units) and will include ongoing maintenance until end of life (at least another 30 years) of the reactors. More specifically, it is expected that three general areas of maintenance will be performed: preventative maintenance, corrective maintenance, and improvement or upgrade activities. Additionally, during Continued Operations, radiological and non-radiological waste will be transported similar to previous operations (6 operating units).

During Continued Operations, used fuel will continue to be stored in the NSS-PWMF. Based on current planning, there are no future waste SBs planned beyond SB5 for used fuel. DSCs currently stored at the NSS-PWMF will be transferred to a future deep geological repository for the safe, long-term management of used nuclear fuel.

3.3 Decommissioning of PNGS Units 1-4

Stabilization and SWS activities were previously assessed from an environmental impact perspective in the 2017 Safe Storage PEA and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017). As such, the detailed activities for Stabilization and SWS are not presented below.

The focus below is on additional activities that were not previously considered in the 2017 Safe Storage PEA or 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017).

One of the major changes in assumptions since the 2017 Safe Storage PEA and 2022 PEA Addendum is that a portion of dismantling of non-nuclear systems and outbuildings [2] to ground level will occur during the SWS Phase. This is done through the allowance given in REGDOC-2.11.2 to implement such risk reduction and removal activities during SWS. Previously, it was assumed that outbuildings would remain in place and demolition and dismantling would occur following completion of the SWS Phase. Additionally, in alignment with OPG's risk reduction strategy, OPG will initiate some dismantling activities in the IFB (IFB-A and AIFB) during the SWS Phase.

3.3.1 Decommissioning Timeline

The Pickering PERA covers the re-licensing timeframe up to the end of 2036; however, the full PNGS Units 1-4 decommissioning timeline is identified below based on the DDP Overview document:

- Since 2010: Unit 2 and Unit 3 are currently in SWS.
- 2024-2028: Unit 1 and Unit 4 cease operations (defueled and dewatered) and Stabilization activities begin. IFB (IFB-A) and Auxiliary Irradiated Fuel Bay (AIFB) remain in service.
- 2025-2034: Initiate Risk Reduction and removal strategy and transition Unit 1 and 4 to SWS.
- 2030s: Post Refurbishment separation between PNGS Units 1-4 and PNGS Units 5-8 complete.
- 2034: PNGS Units 1-4 IFB-A fuel removal and transport to NSS-PWMF complete by 2034 (see Sections 3.3.3.1 and 5.6.1.1).
- 2034 to 2040: Dismantling and demolition of Non-Nuclear SSCs.

[2] Outbuildings refers to SSCs within the PNGS Units 1-4 protected area, but not part of the main Powerhouse structure.

- 2039: Fuel removed from AIFB.
- 2040 to 2058: Major Decontamination, Dismantling and Demolition of all Nuclear SSCs except RBs.
- Post 2070: RB Structure removal and Site Restoration. This can be completed after PNGS Units 5-8 has reached the end of its commercial operations.

3.3.2 Separation of PNGS Units 1-4 and PNGS Units 5-8

Since PNGS Units 1-4 and PNGS Units 5-8 will be in different lifecycle phases, there will be a need to separate the two facilities to differentiate between the decommissioning side and the operational side. The separation of PNGS Units 1-4 and PNGS Units 5-8 is established by the AB Gate [3] (**Figure 3-4**) which is defined based on the following criteria:

- Systems on the PNGS Units 1-4 side are to support SWS activities, while the systems on the PNGS Units 5-8 side are to support refurbishment and continued operations of PNGS Units 5-8.
- Terminal points to be established if required for energy sources crossing the AB gate barrier.
- At the appropriate point in decommissioning, the PNGS AB Gate may become a physical barrier to separate the operating island (PNGS Units 5-8) from the active decommissioning island (PNGS Units 1-4).

[3] A conceptual and physical boundary established to separate the operational and decommissioning areas of a nuclear power plant site during concurrent activities.

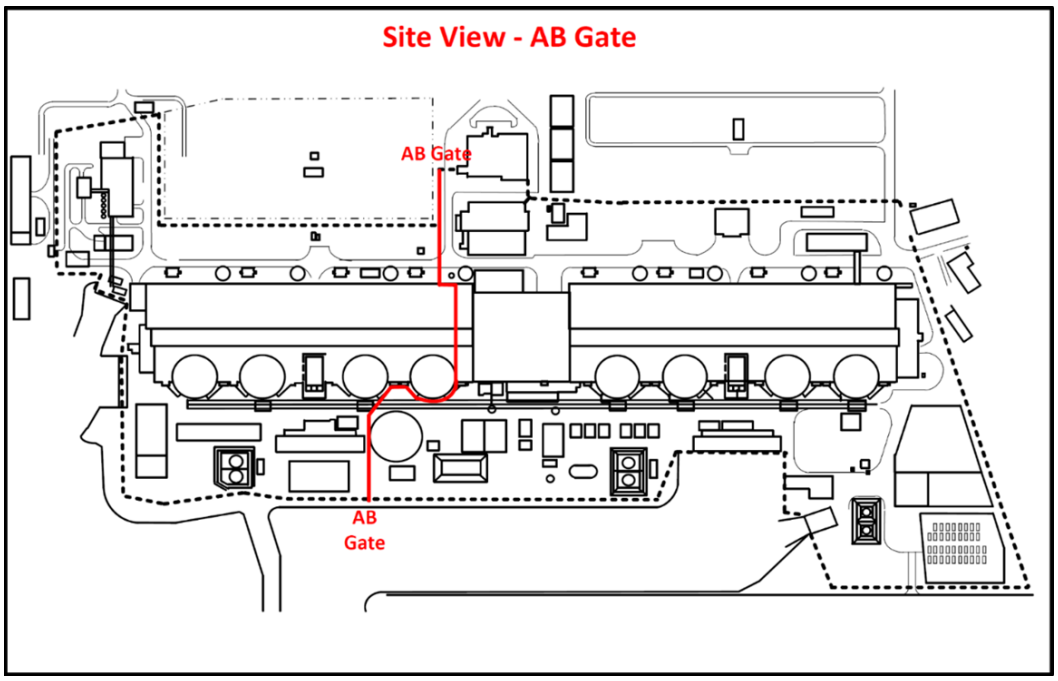


Figure 3-4: PNGS AB Gate

3.3.3 Stabilization and Storage with Surveillance Activities

Stabilization is the period following end of commercial operation where activities are performed to transition the unit from permanent shutdown to SWS (commencement of decommissioning). The Stabilization activities are captured in the PNGS Stabilization Activity Plan (OPG, 2024a), and were previously assessed from an environmental impact perspective in the 2017 Safe Storage PEA and 2022 PEA Addendum (Ecometrix, 2023b; Golder and Ecometrix, 2017).

The Stabilization Activity Plan encompasses:

- Identification of critical SSCs that must be kept available (i.e. not end-stated) for future use in Decommissioning activities.
- Steps taken to progress from permanent shutdown of a unit to SWS.
- Stabilization for Units 1 and 4 will be complete by the end of 2028, and Units 1 and 4 will transition to SWS.

The SWS Plan details systems that are expected to remain active or partially active post Stabilization, and are necessary for the SWS period, planned continued operation of PNGS Units 5-8, or anticipated to be required for decontamination and dismantling activities at PNGS.

3.3.3.1 Irradiated Fuel Bays

Following shutdown of Units 1 and 4, used fuel was transferred to the IFB-A and AIFB for a cooling period. Fuel in the AIFB is stored in modules and fuel in the IFB-A is stored in baskets.

The modules and baskets are stacked in the bays using frames. Used fuel that has been stored in the AIFB or IFB-A for the required minimum cooling period will continue to be loaded into DSCs and transported to the NSS-PWMF using the existing programs and procedures for the management of used fuel; the removal of used fuel from the AIFB and IFB-A was most recently assessed in the 2022 PEA Addendum (Ecometrix, 2023b). As fuel is removed, empty baskets and associated frames will be removed from the AIFB and IFB-A and disposed of using existing waste routes. Fuel removal from IFB-A and transport to the NSS-PWMF will be completed by 2034. This work is being done to create space for installing equipment necessary for inspecting damaged fuel.

The sorting, segregation, and canning of damaged and defective fuel is a first-of-its-kind operation for OPG, expected to commence in 2029. OPG will notify CNSC before proceeding with these activities to ensure compliance with regulatory requirements and safety standards.

The IFB-A will be drained by 2034 and the AIFB will be drained by 2041. The draining of the bays is the final steps in preparing the AIFB and IFB-A for subsequent decommissioning and dismantling phases. Water drained from the AIFB and IFB-A will be released to Lake Ontario in a controlled manner that keeps tritium concentrations at the Water Supply Plants (WSPs) within existing tritium levels and well below regulatory limits.

3.3.4 Risk Reduction and Removal Activities

In parallel with the Stabilization Phase of Unit 1 and Unit 4, the station will commence limited risk reduction and removal activities focused on PNGS Units 1-4. These activities began in 2025 and include dismantling of non-nuclear systems and outbuildings. This approach is consistent with Section 8.1 of REGDOC-2.11.2 (CNSC, 2021), which allows OPG to initiate risk reduction and removal activities during the SWS phase in accordance with its licence and consultation with the CNSC. These risk reduction and removal activities from REGDOC-2.11.2 may include:

- reduction or removal of combustibles;
- removal and recycling of non-contaminated or slightly contaminated equipment;
- reduction or isolation of asbestos;
- demolition of non-nuclear buildings or facilities, provided that there are no safety impacts to the remainder of the site;
- removal of accumulated radioactive waste to an offsite licensed storage or disposal facility, location or site;
- reduction or removal of hazardous wastes.

The scope of the dismantling and demolishing activities is organized into planning envelopes (PEs) [4] which are identified in detail in the DDP. The PEs that are considered in this PERA are execution of elements of PE-A (mostly non-nuclear buildings or facilities on site that are no

[4] A definable part or area of a facility that is sufficiently removed from, or otherwise independent of, other parts or areas such that the strategic approach to decommissioning that part or area can be planned in a relatively independent manner

longer required to support PNGS Units 1-4 operations or SWS) as well as PE-B (non-nuclear components and systems located within the turbine hall (TH) and turbine auxiliary bay (TAB)). Removal scope from PE-A and PE-B make up the risk reduction activities that commenced in 2025 and will continue through 2036, and only occur on SSCs which have completed the Stabilization Phase and are end-stated.

The PEs are structured to facilitate sequencing of PNGS Units 1-4 decommissioning beginning with demolition of outbuildings and removal of non-nuclear systems, followed by dismantling and demolition of nuclear systems and reactor components, and finally removal of building structures and subsequent site remediation.

3.3.4.1 Activities Associated with Planning Envelope A

Activities associated with PE-A include the dismantling and removal of end-stated, abandoned, or retired structures within the PNGS Units 1-4 protected area, excluding the main powerhouse structure. The PE-A is categorized into three groups and each includes SSCs that will no longer be required to support PNGS Units 1-4 (OPG, 2024c).

- Group A-1: Post PNGS Units 1 and 4 shutdown, Outbuildings and SSCs not required after shutdown **(Figure 3-5**).
    - Scaffolding Shed Buildings,
    - Oil Tank Farm A,
    - Off Gas Management System Building,
    - Old Water Treatment Plant,
    - Helium Trailers,
    - Hydrogen Skids,
    - Sulzer-A.
- Group A-2: Post separation of PNGS Units 1-4 and PNGS Units 5-8, Outbuildings and SSCs not required after common systems are separated along the AB Gate (**Figure 3-6**).
    - Gas Bottle Storage Enclosure 'A',
    - Shutdown System Enhancement (SDSE) Instrument Rooms 1-2, SDSE Instrument Rooms 3-4,
    - PNGS Units 1-4 Standby Generator,
    - Standby Generator oil tanks PNGS Units 1-4,
    - Standby Generator Pumphouse PNGS Units 1-4
- Group A-3: Post IFB Empty, Outbuildings and SSCs not required after IFB-A and AIFB are emptied, drained, and dried (IFB-A will be drained by 2034 and the AIFB will be drained by 2041) (**Figure 3-7**). Group A-3 is planned to start in 2034 as part of Dismantling and Demolition. Activities are in the preliminary planning stage and will be developed further through future DDPs.
    - Heavy Water Upgrading Plant,
    - Heavy Water Upgrading Plant Pickering (UPP-A) Upgrading Towers,
    - UPP Expansion Feed Storage Area,

- UPP Expansion Area, UPP Area,
- PNGS-A Screenhouse,
- Demineralized Water Tanks.

As part of PE-A, select SSCs will undergo complete removal of the internal components and the structures, including gas trailers, a standby generator, oil tanks and gas cylinders. Meanwhile, other selected SSCs will undergo partial removal of internal components leaving only the structures such as the off-gas system buildings, and the old water treatment plant. There are other non-operational components such as sheds and instrument rooms that will be removed completely which includes the internal components as well and the outbuilding structures.

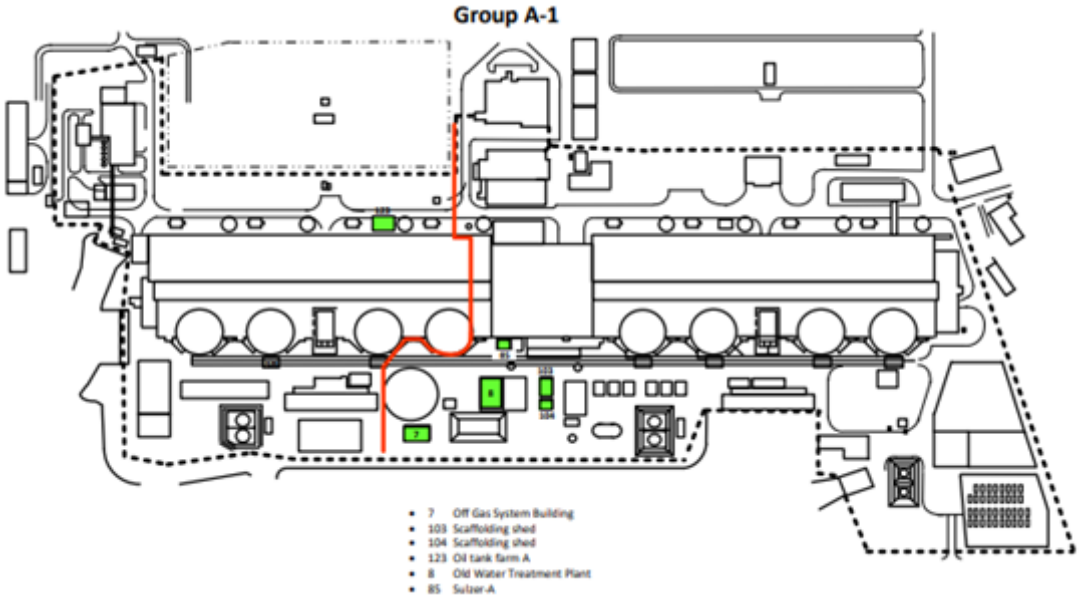


Figure 3-5: Planning Envelope A-1 – Outbuildings in Green

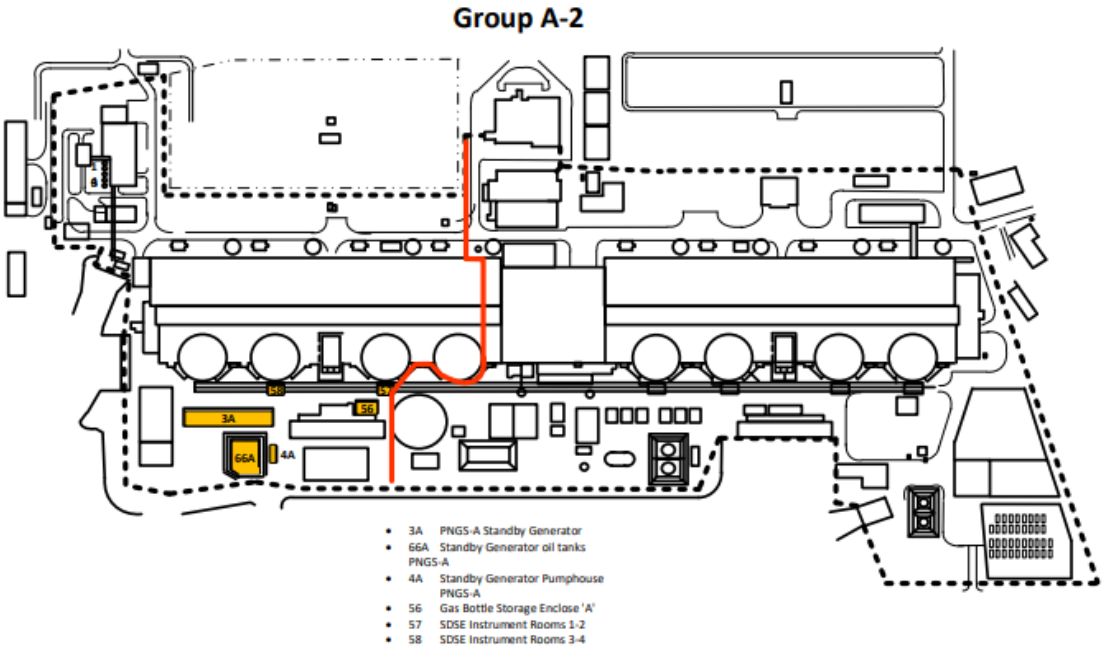


Figure 3-6: Planning Envelope A-2 – Outbuildings in Orange

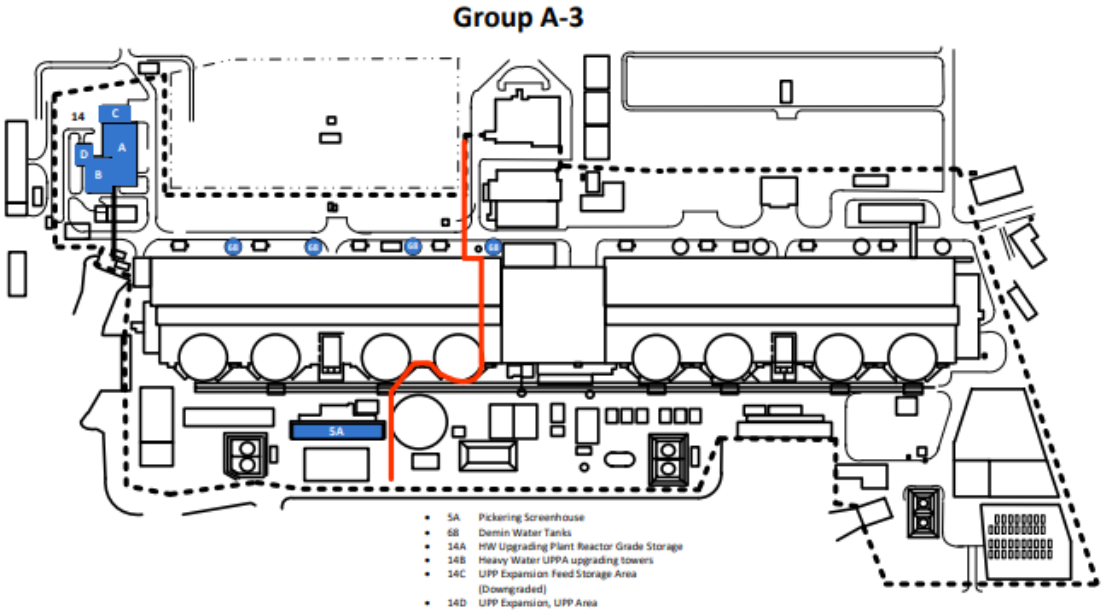


Figure 3-7: Planning Envelope A-3 – Outbuildings in Blue

3.3.4.2 Activities Associated with Planning Envelope B

The decommissioning process of PE-B includes the dismantling and removal of SSCs considered to be non-nuclear that are located within the TH and TAB. Components included in PE-B have

been end-stated, abandoned or retired, and do not support PNGS Units 1-4 SWS, PNGS Units 5-8 refurbishment, or continued operations of PNGS Units 5-8. The PE-B is categorized into two groups based on location and the type of systems to be decommissioned and is described in detail in the DDP Program Volume 2:

- Group B-1: SSCs such as the turbine and generators located within the TH of PNGS Units 1-4 (**Figure 3-8**).
- Group B-2: SSCs such as the electrical supply and controls, located within the TAB of PNGS Units 1-4 (**Figure 3-9**).

The components included in this envelope are not anticipated to be radiologically contaminated. The decommissioning process in PE-B also includes removal of all equipment from the work area, such as tanks, valves, pumps, motors, heat exchangers, instrumentations and pipework. Selected SSCs in PE-B will undergo risk reduction and removal activities following these steps for both Groups B-1 and B-2:

- Clear work area to access the target equipment (e.g. pumps, heat exchangers, pipework).
- Dismantle/segment larger tanks/containers/gas cylinders/pipes.
- Disconnect electrical connections from the remaining instrumentation and removed to terminal points.
- Cap and seal the remaining pipework (for those that are partially removed). Underground metal and concrete piping will be excavated for survey and removed, if necessary. Non-contaminated materials beyond one meter will be left in place. Any contaminated materials exceeding clearance levels will be removed and disposed of appropriately.
- Characterize, survey, classify, and transport material/equipment to an approved offsite disposal facility.
- Clear up work area and make safe.

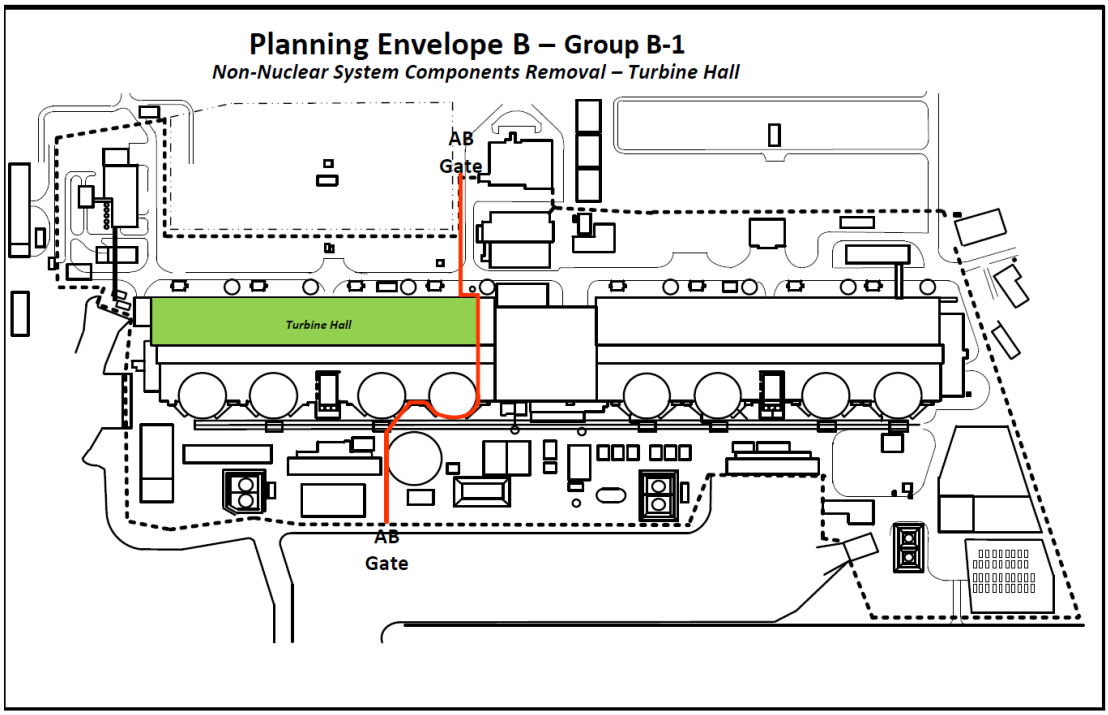


Figure 3-8: Planning Envelope B-1 – Turbine Hall

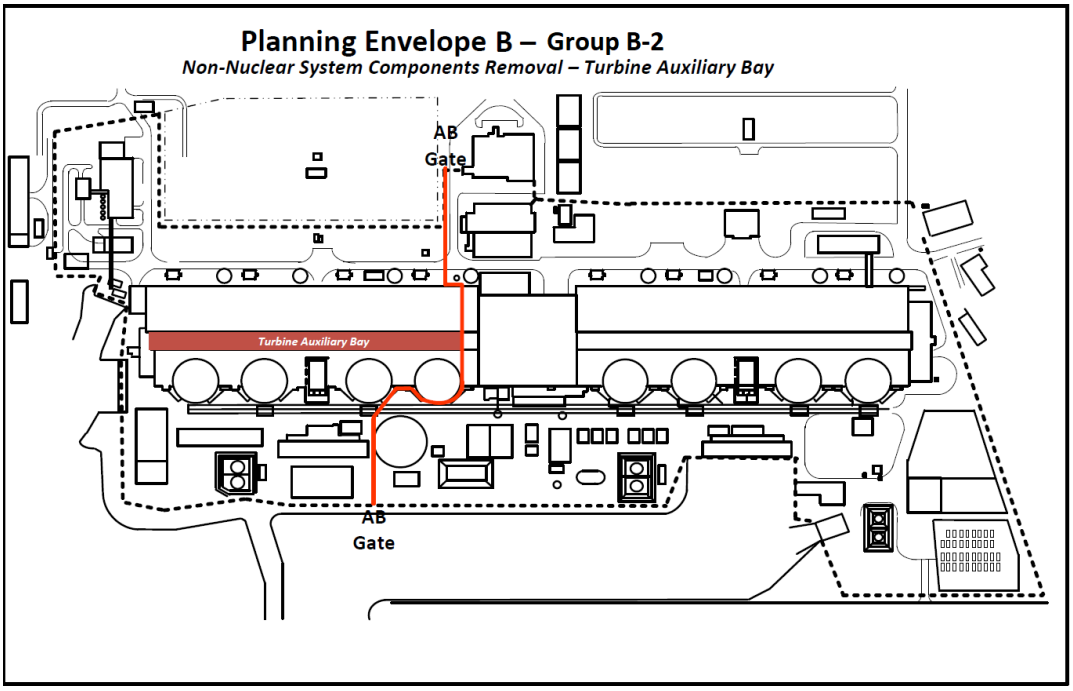


Figure 3-9: Planning Envelope B-2 – Turbine Auxiliary Bay

3.3.4.3 Waste Management

As the outbuildings in PE Group A-1 and Group A-2 are mostly considered non-nuclear, it is assumed that all waste generated will be non-radioactive. The exception is for the Sulzer-A building which will generate LLW.

For PE Group B-1 and Group B-2, all waste generated are expected to be non-radioactive except for the head tanks in Group B-2 which may be potentially contaminated. Characterization and surveying of SSCs in Group B-1 and Group B-2 will be completed to verify waste classifications.

Although the PE-A and PE-B are non-nuclear envelopes, there is potential for contamination, which will be managed utilizing existing OPG processes and procedures.

4.0 Summary of Existing Conditions

A concise summary of existing and previous conditions is provided in this section based on the data presented in the 2022 Pickering ERA (Ecometrix, 2023a), which focused on the five-year period from 2016 to 2020. Updated information on existing conditions is also provided based on any new data collected since the 2022 Pickering ERA through ongoing annual EMPs, as well as the supplementary environmental field studies conducted in 2024 and 2025 that were completed to support this PERA. A summary of the 2024 and 2025 environmental field studies is presented in **Table 4-1**, with a brief description of each program provided in the sections below. Additional supplementary information regarding existing and previous conditions is provided in **Appendix A**.

Table 4-1: Summary of 2024-2025 Environmental Field Studies conducted in support of the PERA

Sampling/Monitoring program	Data collected	Locations sampled	Parameters Analyzed	Sampling Frequency
Air quality and noise monitoring program	Continuous air measurements Noise levels including A-weighted energy-equivalent sound levels (Leq), statistical sound-level measurements (e.g., Ln values including L10 and L90), and octave band sound levels	Air: PN site (1 location; **Figure 4-1**) Noise: PN site (4 locations; **Figure 4-1**)	Air samples: Suspended particulate matter (SPM), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), volatile organic compounds (VOC) as represented by acrolein) and polycyclic aromatic hydrocarbons (PAH; as represented by benzo[a]pyrene).	One continuous sampling event each for Air Quality and Noise: Air quality: One year (January 6 to December 15, 2025) Noise: Winter (2-week event in October 2024)
Surface water sampling program	Surface water samples In-situ water quality measurements (Conductivity, dissolved oxygen, pH, temperature, turbidity)	Lake Ontario (4 locations in nearshore and 4 locations in the Deepwater Study Area; **Figure 4-3**) Frenchman's Bay (6 locations; **Figure 4-3**)	General chemistry parameters, metals, petroleum hydrocarbons (PHC) fractions F1 to F4, hydrazine, morpholine, radionuclides microbiological parameters, volatile organics, and PHC.	Three sampling events for all parameters: Spring (May 2024), Summer (July 2024), Fall (October 2024) Three sampling events for follow-up hydrazine sampling: Spring (June 2025), Summer (August 2025), and Fall (September 2025)
Sediment sampling program	Sediment samples	Infill and Shoreline Erosion Mitigation Study Areas (7 locations; **Figure 4-4)** Frenchman's Bay (16 locations; **Figure 4-4**) Mid-depth Study Area (previously proposed dredged channel; 5 locations; **Figure 4-4**) Cutoff Wall Study Area (2 locations; **Figure 4-4**)	General chemistry and physical parameters, metals, methylmercury, radionuclides, polychlorinated Biphenyls (PCBs), pesticides, herbicides, PAHs and PHC. Additional particle size analysis for samples from the Mid-depth and Cutoff Wall Study Areas.	One sampling event each: Frenchman's Bay: Summer (August 2024) Infill and Shoreline Erosion Mitigation Study Areas: Fall (October 2024) Mid-depth Study Area: Fall (November 2025) Cutoff Wall Study Area: Fall (September - November 2025)
Soil sampling program	Soil samples	PN site (8 locations; **Figure 4-11**)	General chemistry and physical parameters, metals, PHC, volatile organics, and radionuclides.	One sampling event: Fall (September 2024)
Benthic Macroinvertebrate Community sampling program	Benthic macroinvertebrates samples In-situ water quality measurements (Conductivity, dissolved oxygen, pH, temperature, turbidity)	Deepwater Study Area (Samples collected from lake bottom at 10-19 m depths; 10 locations; **Figure 4-8**) Infill and Shoreline Erosion Mitigation Study Areas (1.2-3 m depth; **Figure 4-8**) Mid-depth Study Area (Samples collected from lake bottom at 3.2-3.5 m depths; 5 locations; **Figure 4-5**)	Total macroinvertebrate density, Invertebrate taxonomic richness (lowest practical level; LPL), Simpson's Evenness, Simpson's Diversity, Density of major taxonomic groups, Relative density of major taxonomic groups.	Two sampling events: Deepwater Study Area: Fall (November 2024, September 2025) One sampling event each: Infill and Shoreline Erosion Mitigation Study Areas: Fall (October 2024) Mid-depth Study Area (previously proposed Dredged channel): Fall (September 2025) Cutoff Wall Study Area: Fall (September 2025)

Sampling/Monitoring program	Data collected	Locations sampled	Parameters Analyzed	Sampling Frequency
		Cutoff Wall Study Area (Samples collected from lake bottom at 1.5-3.5 m depths; 5 locations; **Figure 4-5**)		
Macrozooplankton community sampling program	Macrozooplankton samples In-situ water quality parameters (e.g., Conductivity, dissolved oxygen, pH, temperature, turbidity) at the bottom, mid-depth, and 0.5 m below the surface Temperature profiles before and after each net set (Water temperature in °C at 1 m intervals)	Deepwater Study Area (12-14, 14-16 and 16-18 m depths; 6 locations; **Figure 4-5**)	Identification and enumeration of all microzooplankton, Biovolume calculations for dominant microzooplankton species.	Three sampling events: Spring (May 2024), Summer (July 2024), and Fall (October 2024)
Deepwater Fish Community sampling program	Species and number of fish caught In-situ water quality measurements (Conductivity, dissolved oxygen, pH, temperature, turbidity) Temperature profile before and after each net set (Water temperature in °C at 1 m intervals) Fish tissue from up to eight individuals from up to three species in each of the spring and fall season	Initial Deepwater Study Area (12-20 m depth; 9 grids S1-9; **Figure 4-5**) Expanded Deepwater Study Area (9-12 m depths; 3 grids S10-12; **Figure 4-5**)	Species composition and species richness, Catch per unit effort (CPUE; # fish/24h) by species and combined, Biomass per unit effort (BPUE; grams/24h) by species and combined, Morphometric summary (lengths and weights) of fish captured. Fish tissue was analyzed for metals and radionuclides.	Three sampling events: Initial Deepwater Study Area (S1-S9): Spring (May 2024), Summer (July 2024), and Fall (October 2024) Expanded Deepwater Study Area (S10-12): Spring (May 2025), Summer (July 2025), and Fall (September 2025)
Mid-depth Fish Community sampling program	Species and number of fish caught In-situ water quality measurements (Conductivity, dissolved oxygen, pH, temperature, turbidity) Temperature profile before and after each net set (Water temperature in °C at 1 m intervals)	Mid-depth Study Area (at depths of 2 – 7.9 m; **Figure 4-5**)	Species composition and species richness, CPUE (# fish/24h) by species and combined, BPUE (grams/24h) by species and combined, Morphometric summary (lengths and weights) of fish captured.	Three sampling events: Spring (April 2025), Summer (July-August 2025), and Fall (September-October 2025)
Nearshore Fish Community sampling program	Species and number of fish caught In-situ water quality measurements (Conductivity, dissolved oxygen, pH, temperature, turbidity)	Infill and Shoreline Erosion Mitigation Study Areas (1.2-3 m depths depending on lake depth; 3 locations; **Figure 4-5**) Cutoff Wall Study Area (3 – 5.2 m depths depending on lake depth; 2 locations; **Figure 4-5**)	Species composition and species richness, CPUE (# fish/24h) by species and combined, Morphometric summary (lengths and weights) of fish captured. Fish tissue was analyzed for metals and radionuclides.	Three sampling events: Infill and Shoreline Erosion Mitigation Study Areas: Spring (May 2024), Summer (July 2024), and Fall (October 2024)

Sampling/Monitoring program	Data collected	Locations sampled	Parameters Analyzed	Sampling Frequency
	Fish tissue from up to eight individuals from up to three species in each of the spring and fall season			Cutoff Wall Study Area: Spring (April 2025), Summer (July-August 2025), and Fall (September-October 2025)
Larval Fish and Eggs (Ichthyoplankton) Assessment	Species and number of larval fish and eggs Flow-meter measurements	Deepwater Study Area: Twelve grids (S1-12; **Figure 4-7**) Mid-depth Study Area (previously proposed Dredged channel): Six grids (S13-18; **Figure 4-7**)	Species composition and species richness, CPUE (# larval fish/tow and # eggs/tow).	Three sampling events each: Spring (April 2025), Summer (July 2025), and Fall (September-November 2025)
Fall Spawning Assessment	Species and number of fish caught Spawning condition of fish caught In-situ water quality measurements (Conductivity, dissolved oxygen, pH, temperature, turbidity) Temperature profile before and after each net set (Water temperature in °C at 1 m intervals)	Deepwater Study Area: 6 locations; **Figure 4-5** Shoreline Erosion Mitigation Study Area: 2 locations; **Figure 4-5** Cutoff Wall Study Area: One location: **Figure 4-5**	CPUE (# fish/24h) and BPUE (grams/24h). For first 25 Lake Trout, Round Whiteish and Lake Whitefish morphometrics (length and weight), gonad classification, gonad weight (females only), scales (whitefish only), otoliths, and external condition assessment. Following 25 samples, full suite of data only collected on dead fish and non-intrusive measures (i.e., morphometrics and external condition assessment) on live target species individuals.	5 weekly net sets between when water temperatures were <10ºC (November 14, 2025) and were set each week until spawning was complete for all fish species of interest (December 9, 2025)
Fish Species at Risk Assessment	Species and number of fish caught In-situ water quality measurements (Conductivity, dissolved oxygen, pH, temperature, turbidity) Temperature profile before and after each net set (Water temperature in °C at 1 m intervals)	**Figure 4-5:** Gillnets (for Lake Sturgeon) Deepwater Study Area/Mid-depth Study Area: 8 locations Cutoff Wall Study area: 2 locations Shoreline Erosion Mitigation Study Area: 2 locations Trapnets (for American Eel) Infill Study Area: 1 location Shoreline Erosion Mitigation Study Area: 1 location	For both targeted species at risk (SAR), individual fish health determined in the field. If fish appeared in adequate health then length in mm or cm, weight in grams, sex if possible, and external condition (qualitative assessment) collected.	Three sampling events: Spring (May 2025), Summer (July 2025), and Fall (October-November 2025)
Aquatic Habitat Assessment program	Deepwater Study Area, Mid-depth Study Area, and Cutoff Wall Study Area: Sidescan sonar Infill and Shoreline Erosion Mitigation Study Areas: Underwater Transect video collection	Deepwater Study Area: 14 transects; **Figure 4-9**) Infill and Shoreline Erosion Mitigation Study Area (5 transects **Figure 4-9**) Mid-depth Study Area (15 transects; **Figure 4-9**) Cutoff Wall Study Area (4 transects; **Figure 4-9**)	Substrate information including substrate type and coverage, macrophyte presence, algae coverage, dreissenid mussel coverage, and fish observations.	One sampling event: Deepwater Study Area: Summer (July 2024), Fall (September 2025) Infill and Shoreline Erosion Mitigation Study Areas: Spring (May 2024) Mid-depth and Cutoff Wall Study Areas: (September 2025)

4.1 Atmospheric Environment

4.1.1 Air Quality

The atmospheric environment at the PN site is typical of a southern Ontario airshed within the Windsor-Québec corridor, with local air quality being dominated by traffic and industrial emissions released throughout the Greater Toronto Area (GTA) and the long-range transport of airborne pollutants from neighbouring Canadian provinces and the United States. Substances that dominate air quality impacts include carbon monoxide (CO), NO_X, sulfur dioxide (SO_2), total suspended particulates (TSP), inhalable particulates (PM_{10}) and respirable particulates ($PM_{2.5}$). Environment and Climate Change Canada (ECCC) and the Ministry of the Environment, Conservation and Parks (MECP) measure air quality at several locations between Toronto and Oshawa, though there are no ambient air quality stations located in close proximity to PNGS. The nearest ECCC/MECP Air Quality Monitoring (AQM) stations to the west and east of the PN site are the Oshawa (ID# 061703) and Toronto East (ID# 060410) stations, respectively (see **Figure 4-1**). The PNGS emits relatively low quantities of chemical and radiological constituents to the atmosphere during the course of normal operations. Overall, the PN site does not significantly contribute to air quality emissions at a regional level (OPG, 2003).

4.1.1.1 Radiological Air Emissions

OPG maintains an EMP in the vicinity of PN in accordance with operating licence requirements. The program scope encompasses protection of both the public and the environment from nuclear materials, hazardous substances, and physical stressors resulting from PN site operations, including on-site waste management activities. Routinely monitored radiological parameters in air include tritium oxide (HTO), iodine-131 (I-131), carbon-14 (C-14), and radioactive noble gases and particulates.

Between 2020 and 2024, emissions of HTO have gradually decreased following a previously noted increase in 2020. Atmospheric C-14 emissions gradually increased between 2020 and 2024, but were lower than the emissions recorded in 2018 which represent the 10-year high (OPG, 2025c). Radioactive noble gas stack emissions are often measured below instrument detection limits; thus, measurements taken from environmental noble gas monitors located outside of PNGS are used to trend PN noble gas emissions. Argon-41 (Ar-41) is the predominant radiological noble gas for the PN site and is associated with operation of PNGS Units 1 and 4. Trend analyses indicate no statistically significant trends in Ar-41 emissions over the last 10 years. Xenon-133 (Xe-133) is occasionally detected at PN, though this radionuclide comprises a relatively small percentage of noble gas emissions compared with Ar-41. Xe-135 and Iridium-192 (Ir-192) were not detected in noble gas emissions at the PN site between 2021 and 2024 (OPG, 2025c).

Overall, radiological air emissions from the PN site (**Table 4-2**) remain at a very small fraction of the site Derived Release Limits (DRLs) (OPG, 2024d). The DRLs represent radionuclide release rates that correspond to an exposure at the legal public dose limit of 1,000 µSv/a for the most affected critical group.

Table 4-2: Radiological Air Emissions from PN (2021-2024)

Parameter	Units	Average[1] (2016-2020)	Year[2]				Average (2021-2024)	Average (2021-2024) as % of DRL[3]
			2021	2022	2023	2024		
Tritium Oxide	Bq/a	6.40E+14	5.20E+14	4.90E+14	4.80E+14	4.00E+14	4.73E+14	0.46%
Noble Gas	γBq-MeV/a	1.14E+14	1.40E+14	1.00E+14	1.20E+14	9.90E+13	1.15E+14	0.43%
Iodine-131	Bq/a	1.27E+07	9.70E+06	1.10E+07	1.00E+07	9.40E+06	1.00E+07	0.0004%
Particulate	Bq/a	5.11E+07	1.10E+07	1.10E+07	1.20E+07	1.10E+07	1.13E+07	0.003%
Carbon-14	Bq/a	2.72E+12	2.60E+12	2.40E+12	3.20E+12	2.40E+12	2.65E+12	0.10%

Note:

[1] Average from the 2022 PN ERA (Ecometrix, 2023a) is the average of emissions from 2016 to 2020.

[2] Data for 2021, 2022, 2023, and 2024 obtained from the 2021, 2022, 2023, and 2024 PN EMP reports, respectively (OPG, 2023a, 2023b, 2024e, 2025c)

[3] The DRL used for comparison to 2021-2024 average emissions is obtained from the 2017 PN DRL report (OPG, 2017a).

4.1.1.2 Non-Radiological (Chemical) Air Emissions

The PN site emits low levels of chemical contaminants to the atmosphere during normal operations. The main sources of atmospheric emissions result from boiler chemical emissions and fossil fuel combustion associated with the testing of on-site standby generators. Chemicals associated with the treatment of boilers include hydrazine, morpholine and other degradation products (e.g., ammonia), which are used within the feedwater system to prevent corrosion of the boilers. These chemicals are released to the atmosphere through controlled boiler venting. Combustion emissions occur during testing of the standby generators and other minor sources, such as the on-site use of vehicles or motorized equipment. These sources can release CO, NO_X, and trace amounts of volatile organic compounds (VOCs), metals, and polycyclic aromatic hydrocarbons (PAHs). Emissions of SO_2 and TSP are relatively minor compared with other atmospheric emissions due to the use of low-sulphur diesel during testing of the standby generators.

4.1.1.2.1 Emission Summary and Dispersion Modelling Reports

The Emissions Summary and Dispersion Modelling (ESDM) process uses dispersion modelling to predict the maximum air concentration at the property line (Point of Impingement; POI) for each chemical constituent under the worst-case emissions scenario.

Between 2020 and 2024, the ESDM reports indicated that the PN site was operating in compliance with s. 19 of O. Reg. 419/05. All contaminants with MECP POI standards that are emitted from the PN site were found to have POI concentrations less than their respective MECP POI limits. Since 2020, modelled emissions of NO_X were routinely found to result in the highest maximum POI concentrations relative to the MECP standard, though no exceedances of the standard were modelled. As part of the ESDM reporting, hydrazine is the subject of a site-specific Maximum Ground Level Concentration (MAXGLC) approval. Between 2020 and 2024, hydrazine was found to have POI concentrations below the approved MAXGLC value.

4.1.1.2.2 Updated 2025 Air Quality Monitoring

As part of the supplementary environmental field studies completed to support this PERA, a year-long AQM program was initiated in January 2025 to characterize existing atmospheric site conditions at the PN site. Overall, the program was designed and implemented following regulatory and guidance documents from federal and provincial agencies including the Canadian Council of Ministers of the Environment (CCME), ECCC, Health Canada (HC), and the Ontario MECP. Additionally, as is common practice for Canadian ambient air monitoring programs, the selection of monitoring instrumentation relied upon guidance provided by the U.S. Environmental Protection Agency (EPA).

One monitoring station, named AQ1, was established for the air quality program as shown in **Figure 4-1** below. The COPCs of interest measured at AQ1 included TSP, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2 and PAH (conservatively assumed to be benzo[a]pyrene [BaP]). COPC concentrations were compared against applicable Ambient Air Quality Criteria (AAQC), namely the Canadian Ambient

Air Quality Standards (CAAQS) provided by the CCME (ECCC, 2023a) and the AAQC provided by the Ontario MECP (MECP, 2023). Air sampling commenced in January 2025 and continued until December 15, 2025. Summary statistics of the air quality data collected during the 2025 monitoring program at the AQ1 station are provided in **Table 4-3**.

Understanding existing conditions is an important element of the air quality modelling to support this PERA (see **Section 5.1.1**), since modelled future project-related concentrations are combined with the existing conditions data to determine the total air concentrations at locations of interest. As such, a review of existing conditions with respect to air quality was conducted to determine the suitability of available data for characterizing existing conditions. On-site monitoring data were compared with regional background concentrations for constituents of interest (**Table 4-4)**. Regional atmospheric concentrations were taken from the Darlington Nuclear (DN) West Station (for SO_2 and BaP) or the MECP's Oshawa air monitoring station (for $PM_{2.5}$ and NO_2). As CO is not measured at the DN and Oshawa MECP monitoring stations, available CO concentrations measured at the PN site from the first two months of the 2025 AQM program were used to characterize existing conditions.

The comparison of on-site data to the regional data set indicates that particulate matter concentrations measured on site during 2025 were substantially higher than regional values, primarily due to pre-construction activities that occurred in close proximity to the monitoring station. PM_{10}, and $PM_{2.5}$ were respectively two and three times higher than the regional dataset values. Pre-construction activities include, but are not limited to, site grading and excavation, concrete pad removal, and road resurfacing. Such activities would generate particulate matter emissions from surface disturbances, material handling, on site vehicle/equipment movements, and wind-driven resuspension of dust.

Although combustion-related equipment was also present near the air monitoring station during such activities, concentrations of gaseous COPCs (i.e., NO_2, SO_2, CO) did not exhibit increases proportional to those observed for particulate matter. Specifically, comparisons for non-particulate COPCs exhibited expected near-field variability, with some parameters showing moderately higher on-site concentrations (e.g., NO_2, CO) and others showing lower values (e.g., SO_2, BaP). This observation indicates that the elevated particulate concentrations were likely driven by mechanical disturbances and resuspension processes rather than combustion emissions alone, supporting the conclusion that the particulate measurements reflect localized activity-related effects rather than background levels.

As such, existing conditions are characterized as follows:

- Regional monitoring datasets of particulate matter (TSP, PM_{10}, $PM_{2.5}$) were used for air quality modelling in **Section 5.1.1** to represent ambient background conditions independent of localized disturbance effects, and;

- On-site monitoring data collected in 2025 were applied as background data for all other COPCs, since these measurements were considered reasonably representative of existing conditions.

Table 4-3: Summary of PN Air Quality Monitoring Data (Jan. 6 to Dec. 15, 2025)

COPC	Averaging Period	Min Conc. (µg/m^3)	Max Conc. (µg/m^3)	Average (µg/m^3)	Standard Deviation (µg/m^3)	90th Percentile (µg/m^3)	98/99th Percentile
TSP	24-hr	8.3	85.4	32.1	18.7	55.1	NA
PM_{10}	24-hr	19.6	94.4	31.6	10.4	44.0	NA
$PM_{2.5}$	24-hr	15.1	84.8	21.3	7.0	27.2	41.6
NO_2	1-hr	<0.1	84.2	9.9	10.9	23.8	44.0
	24-hr	0.9	33.4	9.9	6.3	18.7	NA
SO_2	1-hr	<0.1	12.9	2.1	1.8	4.4	9.1
CO	1-hr	7.6	208.0	60.4	25.0	88.3	NA
	8-hr	<0.1	122.4	44.5	19.8	67.9	NA
BaP[1]	24-hr	5.40E-06	5.99E-05	2.04E-05	1.43E-05	4.18E-05	NA

Note: [1] Measured as total PAH, and conservatively assumed to be BaP.

Table 4-4: Comparison of Existing Conditions Air Concentrations from 2025 Monitoring Program with Regional Monitoring Sources and Selection of Air Concentrations Used In AQ Modelling

COPC	Averaging Period	Summary Statistics of Regional Monitoring Concentrations (µg/m³)	Regional Monitoring Source	2025 PN Monitoring Program Results	Comparison	Application
TSP	24-hr (90th percentile)	44.2	Estimated from MECP Oshawa $PM_{2.5}$ data	55.1	Higher on site	Regional dataset used – On site data affected by localized activity.
	Annual (average)	25.5	Estimated from MECP Oshawa $PM_{2.5}$ data	32.1	Higher on site	Regional dataset used – On site data affected by localized activity.
PM_{10}	24-hr (90th percentile)	22.1	Estimated from MECP Oshawa $PM_{2.5}$ data	44	~2× higher on site	Regional dataset used – On site data affected by localized activity.
$PM_{2.5}$	Annual (average)	6.7	MECP Oshawa AQ Monitoring Station	21.3	~3× higher on site	Regional dataset used – On site data affected by localized activity.
NO_2	1-hr (98th percentile)	25.6	MECP Oshawa AQ Monitoring Station	44.1	Higher on site	On site dataset used – Data representative of site conditions.
	Annual (average)	6.7	MECP Oshawa AQ Monitoring Station	9.9	Higher on site	On site dataset used – Data representative of site conditions.
SO_2	1-hr (99th percentile)	51.5	Darlington New Nuclear Pre-Site Preparation Program (2021-2022)	9.1	Lower on site	On site dataset used – Data representative of site conditions.
	Annual (average)	4.2	Darlington New Nuclear Pre-Site Preparation Program (2021-2022)	2.1	Lower on site	On site dataset used – Data representative of site conditions.

COPC	Averaging Period	Summary Statistics of Regional Monitoring Concentrations (µg/m^3)	Regional Monitoring Source	2025 PN Monitoring Program Results	Comparison	Application
CO	1-hr (90th percentile)	753.4	PN On-site AQ Data (Jan-Feb 2025)*	922.8	Higher on site	On site dataset used – Data representative of site conditions.
BaP[1]	Annual (average)	3.58E-05	Darlington New Nuclear Pre-Site Preparation Program (2021-2022)	2.04E-05	Lower on site	On site dataset used – Data representative of site conditions.

Note:
* CO is not measured at the DN or Oshawa MECP monitoring stations, so on-site data collected during the first two months of the 2025 monitoring program, before construction activities began, was used to characterize CO concentrations.
[1] Measured as total PAH, and conservatively assumed to be BaP.

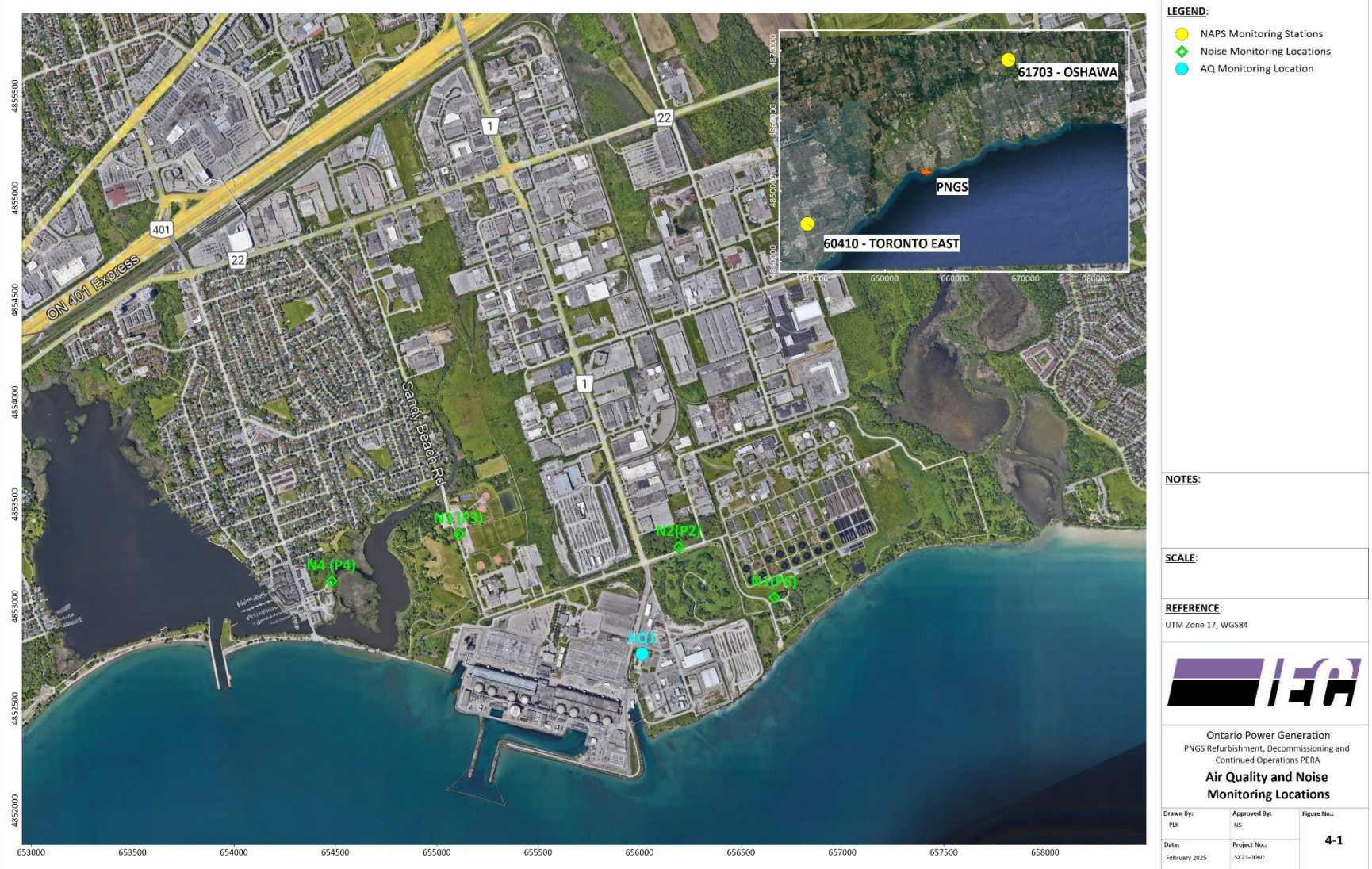


Figure 4-1: Monitoring Locations for the 2025 Air Quality and 2024 Noise Monitoring Program

4.1.2 Noise

Noise emissions from the PNGS originate from a wide variety of on-site sources. During the 2016-2020 period, the PN site operated under amended ECA No. 4766-A3YMB9, issued on December 2, 2015. This was replaced in 2019 by amended ECA No. 2372-BESHSC, issued October 17, 2019. The ECA application includes an assessment of on-site noise sources.

Prior acoustic assessments, including those conducted annually since 2018 at receptor locations within the vicinity of the PN site, concluded that overall noise levels were compliant with applicable MECP Noise & Vibration Guideline (NPC-300 & NPC-207) sound level limits (OPG, 2011, 2019a, 2020a, 2021a, 2022a, 2023c, 2024f, 2025d).

Although there are times when recorded maximum sound levels periodically exceed the MECP Class 1 (i.e., urban) and Class 2 (i.e., suburban) sound level limits (MECP, 2013b), on-site monitoring has indicated that these exceedances are unlikely to be the result of PNGS activities and are more likely the result of localized events consistent with the surrounding populated urban environment (e.g., road traffic). Overall, the PNGS is compliant with noise limits and does not significantly contribute to noise levels experienced by local human and ecological receptors, which tend to be dominated by other sources consistent with an urbanized environment.

4.1.2.1 Updated September 2024 Noise Monitoring

As part of the supplementary environmental field studies completed to support this PERA, a noise monitoring program was conducted in September 2024 to characterize existing atmospheric site conditions at the PN site. As part of this program, various noise measurements, including A-weighted energy-equivalent sound levels[5] (LAeq) and statistical sound-level measurements (e.g., Ln values[6] including L10 and L90) were recorded at four monitoring locations (N1, N2, N3 and N4) around the PN site, shown in **Figure 4-1**.

The MECP Publication *NPC-300 Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning* (MECP, 2013b) outlines sound level limits for outdoor and plane of window (POW) points of reception. These are the default limits that are applied in the absence of any other information regarding the actual background sound environment (i.e., without any contribution from the Project). If it can be demonstrated that the minimum 1-hr background noise level in each of the set periods (i.e., day, evening, night) are higher than the exclusionary limits, then the site-specific background levels may be applied as the sound level limits for future assessment purposes.

[5] LAeq represents the equivalent continuous sound level, measured in A-weighted decibels (dBA)
[6] Ln values are statistical noise measurements used to assess noise levels from fluctuating noise sources over time. L10 is the noise level exceeded for 10% of the measurement period; for 10% of the time, the sound pressure level is above this value. Similarly, L90 is the noise level exceeded for 90% of the measurement period; for 90% of the time, the sound pressure level is above this value. For this reason, the L90 is used to represent background or ambient noise levels of an environment.

Noise monitoring was completed over a 2-week period in September 2024 using an averaging period of 1-hour for the collection of sound level measurements. A summary of the noise monitoring data and a comparison against the Class 1 and Class 2 sound level limits is provided in **Table 4-5**.

Consistent with previously completed noise monitoring programs, existing conditions at the PN site continue to be dominated by sound sources typical of a developed, urban environment. Although there are periodic exceedances of the MECP Class 1 (i.e., urban) and Class 2 (i.e., suburban) sound level limits (MECP, 2013b), it is understood that these exceedances are not the result of PN site activities. In populated urban areas, it is common for sound level limits to be occasionally exceeded due to localized events, such as traffic (e.g., car alarm) or other human activity near the area of monitoring. Periodic exposure to sound levels in excess of the MECP sound level limits are not associated with human health effects and are considered a common occurrence in urban and semi-urban areas.

Table 4-5: PN Existing Conditions Noise Data Summary (September 2024)

Location ID	LAeq		LA90		Full Day		Min 1-hr LAeq		Data Count (Hours)		
	Day	Night	Day	Night	LAeq	LA90	Day	Night	Day	Night	Total
Class 1	**50**	**50**	**50**	**50**	**50**	**50**	**50**	**50**	-	-	-
Class 2	**50**	**45**	**50**	**45**	**50**	**45**	**50**	**45**	-	-	-
P2	**60.1**	**57.2**	47.7	46.9	**59.5**	47.5	49.4	45.3	97	40	137
P3	**61.0**	**53.5**	48.4	46.9	**59.8**	48.0	47.3	44.5	119	49	168
P4	49.1	**50.9**	47.3	50.0	49.7	48.4	44.0	47.7	121	54	175
P6	**50.8**	**50.8**	48.7	49.5	**50.8**	49.0	47.1	47.9	121	50	171

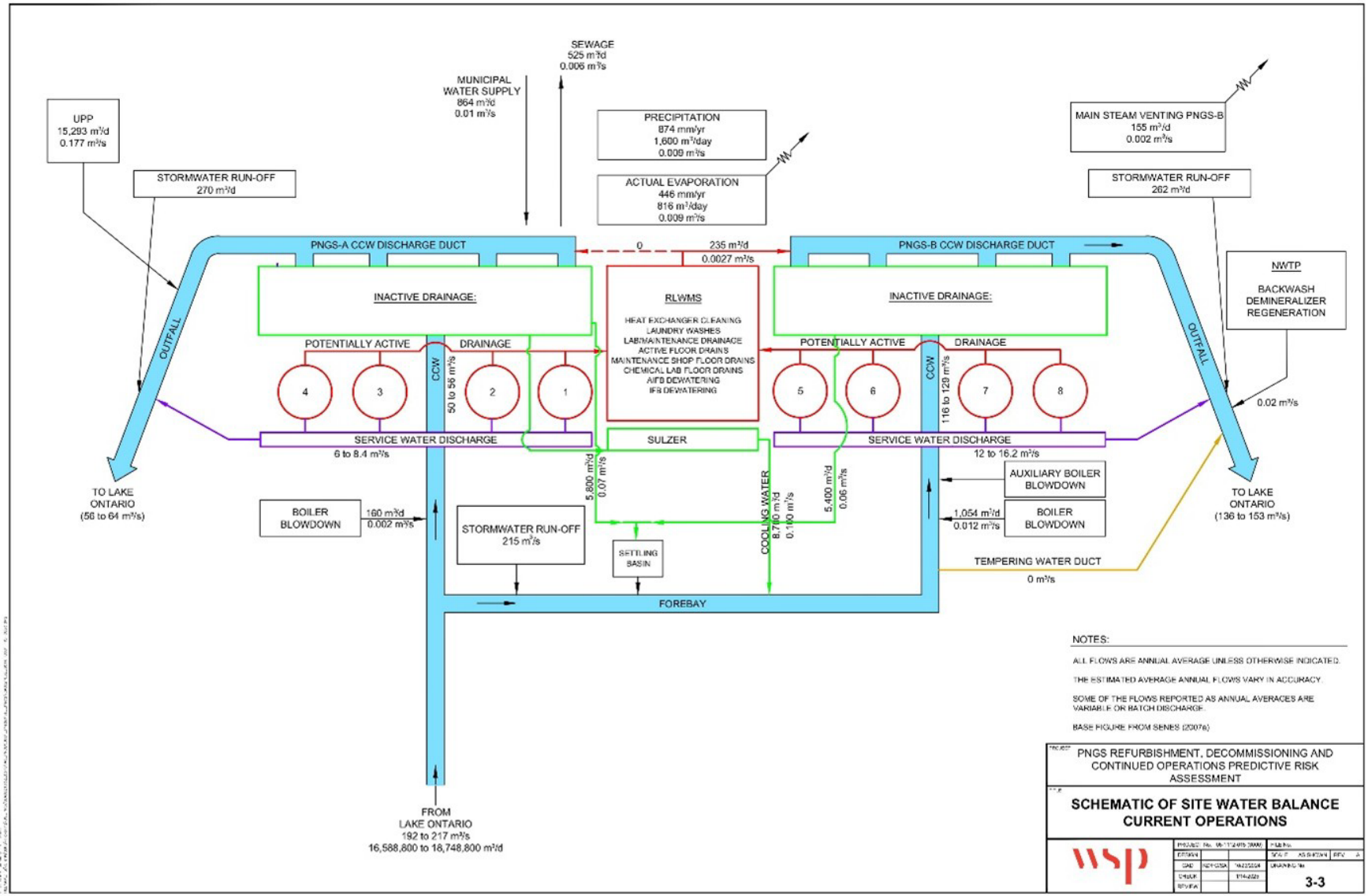
Note:
Values are presented as A-weighted decibels (dBA).
"Class 1" and "Class 2" refer to the 1-hour sound level limits for outdoor points of reception in Table B-1 of the NPC-300 noise guidance document (MECP, 2013b). Consistent with the guidance, "Day" refers to the hours of 7:00 a.m. to 7:00 p.m. and "Night" refers to the hours of 7:00 p.m. to 7:00 a.m.
Bold indicates an exceedance of the Class 1 sound limit; underline indicates an exceedance of the Class 2 sound limit.

4.2 Surface Water Environment

4.2.1 Flow and Hydrology

The PN Site is situated on the north shore of Lake Ontario. Lake-wide circulation is primarily driven by wind and by seasonal temperature effects. The frequency of lake current flowing toward each direction and the maximum speed that occurred in each direction has been documented from 2011 to 2020; Ecometrix, 2023c). The average easterly and westerly current speeds were approximately 24 cm/s and 17 cm/s respectively.

Nearshore lake currents are affected by the PNGS operations via the CCW discharge. The water balance at the PN site, reflecting six functional units as assessed in the 2022 PN ERA (i.e., prior to the permanent shutdown of PNGS Units 1 and 4 at the end of 2024 and the pre-refurbishment state of PNGS Units 5-8), is depicted in **Figure 4-2**. The flow from the PNGS Units 1-4 CCW discharge duct was estimated at approximately 56-64 m^3/s, and the flow from the PNGS Units 5-8 CCW discharge duct was 136-163 m^3/s. Thus, localized effects were observed near these discharge points. Similarly, localized changes in flow can also be seen in the vicinity of intake groynes that are directed toward the plants and a zone of in-flowing water can be seen around the intake. Under the previous operational conditions (with 6 operating units), typical water withdrawal between the intake groynes and into the plant via the intake channel was estimated at 192-217 m^3/s based on rated condenser CCW pump capacities and service water demand.



Note: Figure reflects previous operational conditions as presented in the 2022 PN ERA with 6 operating units.

Figure 4-2: Water Balance at PNGS under Previous Operational Conditions in 2022 PN ERA

4.2.2 Water and Sediment Quality

4.2.2.1 Water Quality

PNGS currently interacts with the surface water quality of Lake Ontario as all liquid effluent (except for sewage, which goes to into the Regional Municipality of Durham sewage mains) and some stormwater drainage is discharged into the CCW discharge duct, the outfall structures or the forebay. All effluent collected through drainage systems and released through the CCW discharge duct is analyzed by OPG (and treated if necessary) to ensure it meets radiological and non-radiological limits prior to discharge to Lake Ontario. Frenchman's Bay is a provincially significant wetland west of PNGS connected to Lake Ontario through the Frenchman's Bay Harbour Entrance.

To characterize conditions around the PN site in Frenchman's Bay, an environmental sampling program was conducted in the summer of 2015 in support of the 2017 ERA (Ecometrix and Golder, 2018). Surface water samples were collected from Lake Ontario and Frenchman's Bay to evaluate water quality in these areas. Samples were analyzed for general chemistry parameters, metals, petroleum hydrocarbons (PHC) fractions F1 to F4, morpholine, radionuclides including tritium, carbon-14 (C-14), and cobalt-60 (Co-60), cesium-134 (Cs-134), and cesium-137 (Cs-137). The ERA also utilized hydrazine concentration determined from a supplementary EMP study conducted in 2014 (Ecometrix, 2015).

In 2024, water samples were collected from Lake Ontario and Frenchman's Bay to update the current understanding of existing conditions and to support this PERA. Samples were collected in the spring, summer, and fall to capture seasonal variability. The sampling stations are depicted in **Figure 4-3** and included five locations sampled in 2015. These stations included the PNGS Units 1-4 outfall (LW10), the PNGS Units 5-8 outfall (LW21), the forebay intake (LW9), the entrance to Frenchman's Bay (FB-1), and the reference station in Cobourg (LWC1). In addition to these stations, four locations (LW2401, LW2402, LW2403, and LW2404) in offshore Lake Ontario were sampled to consider the location of the planned DWI. LW2401 is located at the centre of the initially proposed intake cap (1.5 km offshore) whereas LW2402, LW2403 and LW2404 are located 300 m west, east, and south of LW2401, respectively. An alternate intake cap location, at 1.25 km offshore, was previously under consideration. Given the close proximity of the two locations, water quality conditions at the sampled locations are considered representative of those expected at the alternate intake cap location.

A summary of the surface water screening is presented in the report sections below; further details regarding the screening assessment methodology and results are provided in **Section A.2.1.1**.

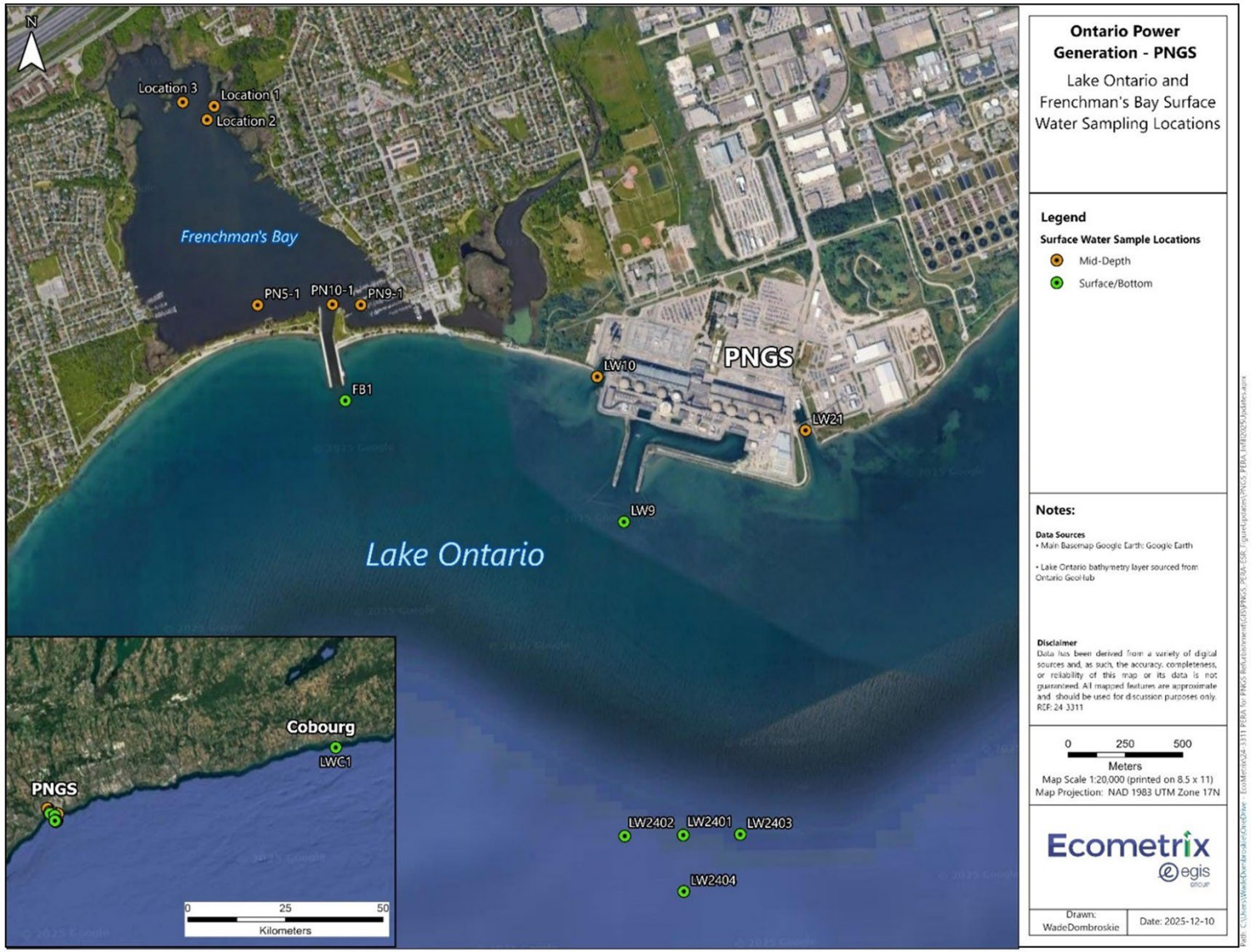


Figure 4-3: Lake Ontario and Frenchman's Bay Surface Water Sampling Locations, 2024-2025

4.2.2.1.1 Lake Ontario

Of the non-radiological parameters evaluated in the 2015 program, hydrazine and morpholine exceeded their respective water quality guidelines in Lake Ontario (Ecometrix and Golder, 2018). However, quantitative assessment of the associated risk to human receptors from exposure to these COPCs indicated no threat to public health, based on the conclusions of the 2022 PN ERA.

Across the spring, summer, and fall sampling events in the 2024 surface water sampling program, the following parameters exceeded the selected ecological and/or human health screening criteria in Lake Ontario: pH, ammonia (total and un-ionized), total suspended solids (TSS), calcium (dissolved and total), magnesium (dissolved and total), total hexavalent chromium cobalt (total), copper (dissolved and total), silver (total), total coliforms, *Escherichia coli* (*E. coli*), and hydrazine (**Table A-2**, **Table A-3**, **Table A-4**).

The noted exceedances are not expected to result in adverse effects to human or ecological receptors. Some COPC exceedances are noted to occur in only a limited number of samples, or are not expected to be associated with PNGS operations. Surface waters with higher pH may be less productive, however Lake Ontario is a well-documented productive habitat for aquatic biota; furthermore, the maximum pH measurement does not exceed the CCME Canadian Water Quality Guidelines (CWQG) for pH (which ranges from 6.5 to 9.0) for the protection of freshwater biota. While ammonia can sometimes be a toxicant, it is also a key component of the nitrogen cycle and a source of bioavailable nitrogen, and is readily metabolized in humans and mammals/birds. Metals such as calcium and magnesium are also important nutrients and are ubiquitous metals in the environment. The noted exceedances of total hexavalent chromium, cobalt, copper, and silver were not associated with samples collected at the PN outfall, and likely reflect natural variability in lake water quality rather than impacts from PNGS operations. Both total coliforms and *E. coli* are naturally-occurring in the environment and are not associated with normal operations at PNGS.

Hydrazine exceeded the CCME screening guideline of 2.6 µg/L at the sampling station near the PNGS Units 5-8 outfall (LW21) in the spring sampling event with a concentration of 4.2 µg/L. Monitoring data indicated that during the week of the spring 2024 sampling event, the concentration of hydrazine in the CCW discharge from PNGS Units 5-8 was above the detection limit of 2 µg/L, measuring at 3 µg/L. However, concentrations fell below the detection limit in the following week. Overall, 85% of hydrazine samples were non-detect during the 2024 monitoring period. Considering this, elevated concentrations of hydrazine are likely transient and infrequent, with no sustained risk to humans or wildlife.

Although there is no HC drinking water guideline for hydrazine, the US EPA estimated that a hydrazine concentration of 0.00001 mg/L corresponds to a cancer risk level of one in one million ($1x10^{-6}$) (EC and HC, 2011; US EPA, 1988), based on a drinking water intake rate of 2 L/day and no exposure amortization. The concentration at LW21 in the spring 2024 sampling event exceeds the drinking water value of 0.00001 mg/L. However, the exceedance at LW21 is unlikely

to pose a risk to the public, as hydrazine has a short chemical half-life and degrades rapidly, and water treatment conditions at nearby WSPs further promote its degradation.

Follow-up hydrazine monitoring was conducted in 2025 to better characterize hydrazine concentrations in the lake water near PNGS and to provide additional information to understand the previous exceedance at LW21 (**Table A-5**). All samples showed that hydrazine concentrations were non-detectable. Overall, these results, together with the 2024 monitoring study and weekly ECA monitoring data from 2024 suggest that the hydrazine exceedance observed in spring 2024 was temporary, with no sustained risk to human and ecological receptors from PNGS operations.

4.2.2.1.2 Frenchman's Bay

Results from the 2015 study showed that aluminum, copper, iron, and sodium in Frenchman's Bay exceeded screening criteria. While concentrations of these metals exceeded toxicity benchmarks for some ecological receptors, such exceedances are expected as the bay receives a substantial amount of urban runoff. Modelling performed to estimate PNGS's contribution to these concentrations indicated that PNGS only accounted for 0.3-22% of COPC levels at Frenchman's Bay (Ecometrix and Golder, 2018).

In comparison, the 2024 sampling program at Frenchman's Bay found exceedances of relevant ecological and/or human health water quality screening criteria for pH, ammonia (total and un-ionized), total phosphorus, TSS, aluminum (dissolved and total), calcium (dissolved and total), copper (dissolved and total), total hexavalent chromium, magnesium (dissolved and total), iron (total), zirconium (total), total coliforms, and *E. coli* (**Table A-2**, **Table A-3**, **Table A-4**).

Exceedances are not expected to result in risk to human or ecological receptors. As with Lake Ontario, the maximum pH detected across all sampling locations and events at Frenchman's Bay was slightly above the PWQO guideline (1% above in this case), but does not exceed the CCME guideline, which is protective of aquatic receptors. Additionally, the exceedance of the total phosphorus guideline in surface water samples from 2024 likely does not pose a risk to ecological receptors, as it presents in the aquatic environment as phosphate which acts as a nutrient rather than a toxicant. Ammonia (un-ionized and total) also exceeded the associated CCME guidelines in samples from the summer and fall sampling event. As such, it is evident that Frenchman's Bay is nutrient-enriched. However, similar to the metal and microbial exceedances, the elevated levels of ammonia and phosphorus are likely attributable to agricultural and urban runoff rather than operations at the PN site. TSS also exceeded the CCME guideline in some samples across all three sampling events, likely driven by localized sediment resuspension due to depositional conditions and limited water exchange in the area. Collectively, these observations indicate that Frenchman's Bay is nutrient-enriched and exhibits characteristics typical of a wetland.

While exceedances of heavy metals (total hexavalent chromium and zirconium) and microbial parameters (total coliform and *E. coli*) were noted, it is likely that the elevated concentrations

observed in water samples from Frenchman's Bay are representative of inputs from urban and agricultural runoff, respectively, rather than PNGS operations.

4.2.2.1.3 Waterborne Emissions

4.2.2.1.3.1 Non-radiological Emissions

Aqueous liquid effluent from PN, except for domestic sewage and some stormwater drainage, is discharged into the CCW discharge duct, the outfall structures, or the forebay. The majority of stormwater drainage is directed to Lake Ontario, and domestic sewage is directed to the York-Durham Water Pollution Control Plant. Non-radioactive liquid emissions are controlled in accordance with the provincial ECA requirements.

To meet these regulatory requirements, OPG monitors and reports the concentrations of ammonia, hydrazine, morpholine, pH, and TRC in the final station discharge. Reports from 2016-2020 were consulted to aid in the selection of non-radiological waterborne COPCs in the 2022 PN ERA (Ecometrix, 2023a) and the 2022 PEA Addendum for PN Safe Storage (Ecometrix, 2023b). This PERA considers the most recent reports prepared for 2021-2024 (OPG, 2022b, 2023d, 2024g, 2025e) to characterize previous operational conditions (with 6 operating units) relating to waterborne chemical emissions from PNGS. There were no regulatory non-compliances associated with the measured concentrations of hydrazine, morpholine, pH, or TRC in the effluent from PN during this time period (2021 to 2024; **Table 4-6**). An exceedance of the ECA ammonia limit (0.02 mg/L) at PNGS Units 1-4 was observed in October 2022 with a measured concentration of 0.07 mg/L. This event was reported to the MECP and investigated. The investigation concluded that the exceedance was not related to station operations, and the apparent cause was interference in the sample due to the presence of organics or amines.

Table 4-6: Final Station Discharge Concentrations and Limits Summary (2021-2024)

Parameter	Unit	ECA Limits	Units 1-4 Maximum Measured Concentration				Units 5-8 Maximum Measured Concentration			
			2021	2022	2023	2024	2021	2022	2023	2024
Un-ionized Ammonia	mg/L	0.02	<0.02	**0.07**	0.02	0.02	0.01	0.01	0.02	0.004
Hydrazine	mg/L	0.1	0.008	0.003	<0.002	0.003	0.003	0.003	0.005	0.003
Morpholine	mg/L	0.5	0.003	0.002	<0.38	0.38	0.001	0.005	<0.38	0.38
pH	pH units	6.0 - 9.5	6.8 - 8.4	7.8 - 8.4	7.7 - 8.3	7.7 - 8.5	7.3 - 8.4	7.7 – 8.4	7.8 - 8.3	7.9-8.2
TRC*	mg/L	0.01	< 0.002	<0.002	<0.002	<0.0002	0.008	<0.002	0.001	<0.003

Note:
* Calculated concentration in the PNGS Units 1-4 or PNGS Units 5-8 outfall after mixing RBSW with CCW water at ratio of 1:10.
Bolded values indicate exceedances of ECA Limits.

4.2.2.1.3.2 Radiological Emissions

During normal operations, the PN site releases small amounts of radiological contaminants into Lake Ontario. As a part of its annual effluent monitoring program, OPG monitors the total waterborne emissions of HTO, C-14, and gross beta/gamma.

HTO emissions from the PN site were slightly elevated between 2018 and 2020 compared to historical emissions due to increased processing of Active Liquid Waste (ALW (OPG, 2024e). These elevated levels persisted in 2021, and could be attributed to the installation of a microscrubber designed to reduce airborne tritium emissions. The microscrubber converts a portion of the tritium into waterborne effluent, which is then directed to the ALW tanks for controlled release within acceptable limits. Emissions of HTO decreased in 2023 and 2024, following the peak in 2022. Overall, waterborne HTO emissions from 2020 to 2024 showed no significant deviation from the last 10 years of emissions data.

The gross beta-gamma water emissions peaked from 2016 and in 2020 due to spontaneous releases of concentrated, entrained active lake sediment materials from the Reactor Building Service Water (RBSW) system. The shallow surface intake for station cooling water allows suspended particulates from the lake to enter the station. Cs-137 is strongly attracted to clay minerals, which are easily suspended in the water column and can subsequently deposit on internal surfaces of station systems (e.g. in pipe work of the systems). As Cs-137 in the sediment originates from past nuclear weapons testing, the peak in gamma emissions in 2016 and 2020, does not represent a station generated source of activity. The results were also biased high in 2021 due to residue in the sampler. Gross beta-gamma emissions were reduced back to pre-2016 levels in 2022 and 2023. Similar to 2020, higher than normal gross beta/gamma values in April 2024 were determined not to be representative of PNGS operational effluent. The likely cause of the elevated activity was entrained sediment from Lake Ontario that entered PNGS through the Unit 1-4 service water. These events, while infrequent in nature, occur due to PN's unique shallow intake and nearby discharge outfalls. This design can result in lake sediment becoming entrained and accumulating within the piping systems over time.

Waterborne carbon-14 emissions contribute minimally to the overall public dose, and the 2020 to 2024 emissions remained consistent with historical levels based on 10 years of longitudinal data. Overall, radiological water emissions from the PN site represent a very small fraction of the site's DRLs.

Radiological emissions to water are shown in **Table 4-7** below.

Table 4-7: Radiological Water Emissions from PN (2021-2024)

Parameter	Units	Average [1] (2016-2020)	Year				Average (2021-2024)	Average (2021-2024) as % of DRL [2]
			2021	2022	2023	2024		
Tritium Oxide	Bq/a	3.96E+14	4.80E+14	5.00E+14	3.80E+14	3.70E+14	4.33E+14	0.05%
Gross Beta-Gamma	Bq/a	1.05E+11	1.20E+11	2.00E+10	2.20E+10	3.40E+11	1.26E+11	6.71%
Carbon-14	Bq/a	2.60E+09	4.60E+09	1.40E+09	3.30E+09	3.50E+09	3.20E+09	0.009%

Note:
[1] Average from the 2022 PN ERA (Ecometrix, 2023a) is the average of emissions from 2016 to 2020.
[2] The DRL used for comparison to 2021-2024 average emissions is obtained from the 2017 PN DRL report (OPG, 2017a). The DRL for gross-beta gamma assumes conservatively that all of the gross beta-gamma is comprised of the most radiotoxic beta-gamma emitter.

4.2.2.1.4 Radionuclide Concentrations in Lake Water

In the 2015 surface water sampling program, the concentrations of radionuclides of interest, including tritium, C-14, Co-60, Cs-134, and Cs-137, were measured in lake water samples. The same radionuclides, along with potassium-40 (K-40), iodine-131 (I-131), Thorium-series, and Uranium-series radionuclides were analyzed in lake water samples on a quarterly basis in 2024 (**Table A-2**, **Table A-3**, **Table A-4**) consistent with the locations identified in **Figure 4-3**. Across both years, the concentrations of C-14, Co-60, Cs-134, and Cs-137 were below detection limits in most samples. Tritium was detected in some samples with levels ranging from 20 to 40 Bq/kg, which were comparable to those observed in 2015. K-40, which is environmentally abundant and is not associated with station operations, was also detected at levels ranging from 0 to 22.3 Bq/kg. Finally, Lake water for recreational use is sampled from three beaches in the vicinity of PN on a monthly basis and analysed for HTO. This data is used as an input to estimate public dose. In 2024, the average HTO concentration in lake water samples collected from beaches near the PN area was 21 Bq/L. Though no statistically significant trend was observed over the last 10 years, in 2023, a decrease in waterborne HTO emissions was observed relative to the peak in 2022, which was reflected in lower HTO concentrations in lake water compared to 2022 levels.

4.2.2.2 Sediment Quality

Current available data indicates that substrate in nearshore Lake Ontario is comprised of coarse sand which is transient and non-depositional due to high wave energy. As a result, appropriate material (i.e., fine-grained sediments, which are targeted for their ability to sorb metals) required for analysis of sediment quality is scarce in this area (Hart and Peterson, 2013). Additionally, the invertebrate community in this area is primarily epifaunal, i.e., residing on the surface of the substrate rather than within it. As such, invertebrates in the area have limited exposure to contaminants in the sediment, further restricting the applicability of sediment assessments here. Therefore, Frenchman's Bay, which is characterized by the presence of fine-grained sediments and relatively high concentrations of total organic carbon (TOC) is the nearest depositional area for sediment that is suitable for analysis.

As a part of the sediment sampling program conducted in 2015, sediment samples were collected from the north and south areas of Frenchman's Bay and were analyzed for metals and radionuclides. Water-to-sediment partitioning coefficients were used to estimate concentrations of parameters in the sediment near the PN outfall area of Lake Ontario (Ecometrix and Golder, 2018).

In the 2024 sediment sampling program, sediment was collected in the fall from locations used in the current PN EMP and in the 2015 sediment sampling program in support of the 2017 ERA (**Figure 4-4**). This included 8 north locations (i.e., in the interior of the bay) and 8 south locations (near the entrance of the bay). The chosen number of samples is considered appropriate for the assessment and quantification of sediment spatial heterogeneity. The range of parameters analyzed was expanded to include Polychlorinated Biphenyls (PCBs), pesticides, herbicides, PAHs, and PHC. Seven locations in nearshore Lake Ontario were also sampled to assess the areas for the construction of the previously proposed infill and Shoreline Erosion Mitigation Area

(**Figure 4-4**), with analyses focused solely on particle size and metals. Radionuclides, PCBs, PAHs, PHCs, and pesticides and herbicides were not analyzed, as the sediments present in these areas (primarily coarse sand) are not appropriate for the accumulation of contaminants (Hart and Peterson, 2013). Though these structures have since been excluded from the project scope, the results have been provided to assist in the interpretation of other field investigations (i.e., aquatic habitat assessment for fish and macroinvertebrates) and provide an understanding of the existing conditions in the nearshore areas prior to construction.

In 2025, a total of seven additional sediment samples were collected from Lake Ontario, including two from the Cutoff Wall Study Area and five from the Mid-Depth (Dredged Channel) Study Area (**Figure 4-4**) to establish existing conditions in areas that may be affected by the proposed structures. While these shoreline areas of Lake Ontario are primarily comprised of sandy sediments, which are not appropriate for all analyses (i.e. radiological) due to their low TOC, the examination of sediment quality in these areas provides characterization applicable to current nearshore aquatic habitat conditions, prior to any construction and overprinting (i.e., the physical covering or destruction of existing fish habitat by structures).

A summary of the sediment screening is presented in the report sections below; further details regarding the screening assessment methodology and results are provided in **Section A.2.1.2**.

The only parameter to exceed its associated screening criterion from the 2024 sediment samples collected in the Infill and Shoreline Erosion Mitigation Study Areas was total phosphorous (**Table A-6**). However, exceedances most likely do not indicate facility-related impacts and are not associated with adverse impacts on aquatic invertebrates. No exceedances of applicable screening criteria were found in the samples collected from the Cutoff Wall Study Area in 2025 (**Table A-7**).

In Frenchman's Bay, aluminum, cadmium, chromium, copper, manganese, nickel, thallium, and tin in sediment samples from 2015 were found to exceed the established screening levels. In 2024, the list of metals that exceeded their screening criteria (**Table A-7**) and the degree of exceedance of these criteria is comparable to the results from 2015, except for aluminum, thallium, and tin, which did not screen in as sediment COPCs in the 2024 monitoring period. Furthermore, some PAHs, PHCs, and Aroclor 1260 exceeded their respective sediment quality guidelines. Overall, sediment in Frenchman's Bay is likely influenced by urban and agricultural inputs, rather than PNGS operations, and is not expected to result in risk to non-human biota.

Some petroleum hydrocarbon fractions exceeded their respective sediment quality guidelines in two samples from the Mid-depth Study Area. However, as these exceedances were limited to a small number of samples and are not expected to be associated with PNGS operations, they are not anticipated to pose a sustained risk to wildlife in the area. These exceedances will be further evaluated as part of the 2027 PN ERA.

Sediment samples collected from Frenchman's Bay during the 2015 sampling program were analyzed for radionuclides, including C-14, Co-60, Cs-134, and Cs-137 (Ecometrix and Golder, 2018). Sediment samples collected as a part of the 2024 sediment monitoring program in support of this PERA were also analyzed for the same radionuclides as the 2015 program, with the addition of tritium, K-40, I-131, Thorium-series, and Uranium-series radionuclides. Overall, concentrations in samples collected in 2024 (**Table A-7**) were low and comparable to those measured in 2015.

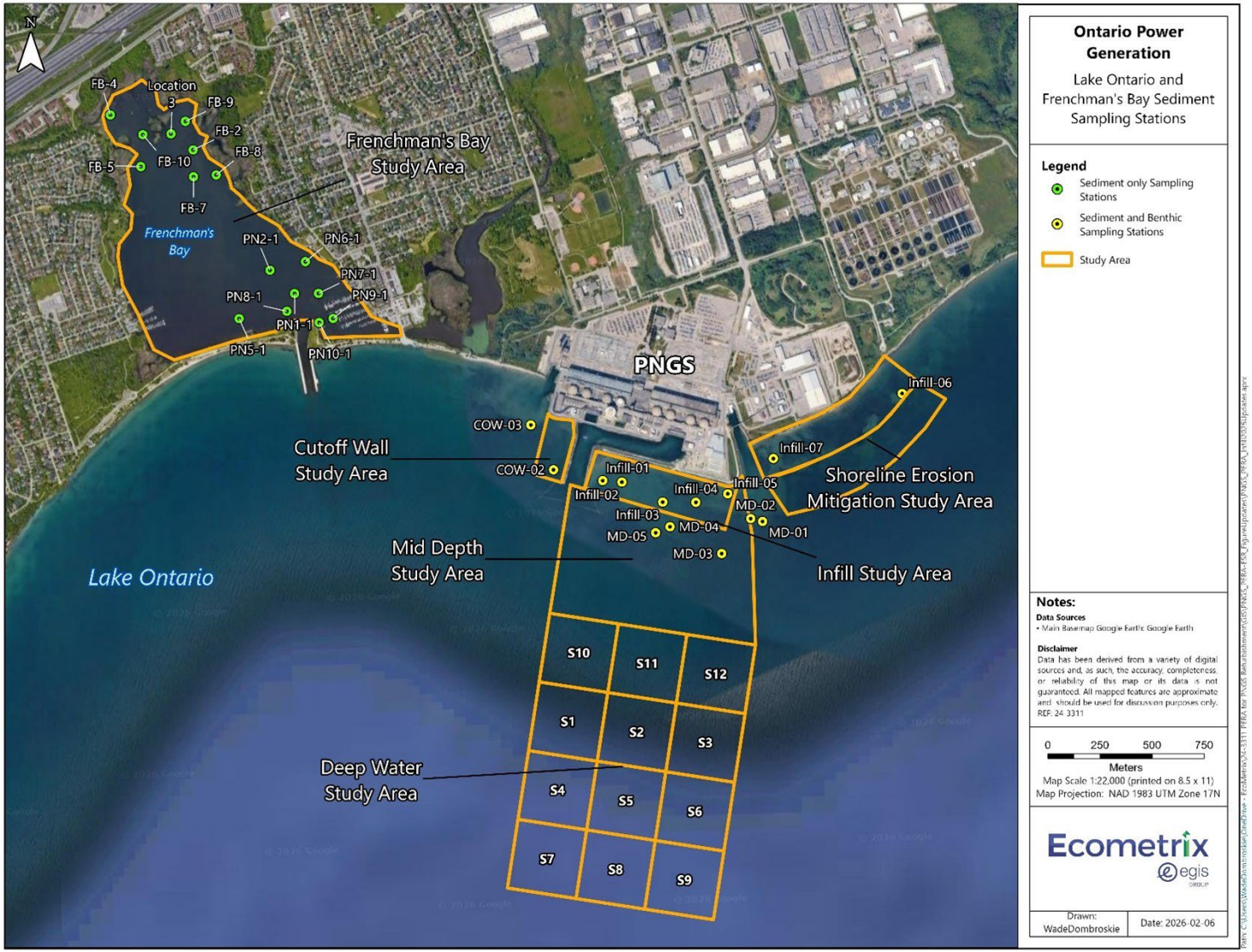


Figure 4-4: Frenchman's Bay and Lake Ontario Sediment Sampling Stations, 2024-2025

4.2.3 Stormwater Runoff

Stormwater runoff from the PN site is collected by a drainage system and directed south to Lake Ontario. Runoff entering the discharge channels is estimated at 270 m^3/day for PNGS Units 1-4 and 262 m^3/day for PNGS Units 5-8, based on an annual precipitation of 872 mm. The 2017 ERA (Ecometrix and Golder, 2018) included results from a 2015–2016 stormwater sampling campaign to characterize the quality of stormwater. Final concentrations in the discharge channels and in Lake Ontario were compared to relevant water quality guidelines, and no exceedances of the selected benchmarks were identified.

Consistent with the requirements of CSA N288.6:22 clause 11.1 to periodically review changes to the facility, the expansion of NSS-PWMF Phase II will likely result in changes to the stormwater catchments in the East Complex. The appropriate stormwater outfalls in the East Complex should be reviewed and sampled accordingly to be representative of the catchment areas after the completion of the NSS-PWMF Phase II expansion. Gross beta-gamma in stormwater was monitored and reported quarterly over the 2016-2020 period; however, in 2021 OPG determined that no routine monitoring is required given the robust design of the used fuel DSCs and absence of liquid inside the DSCs during dry storage (OPG, 2021b). Following their review of the 2017 ERA, CNSC and ECCC recommended that a stormwater sampling plan be included in future ERA submissions. OPG plans to carry out this recommendation after the completion of the NSS-PWMF Phase II expansion and results from the stormwater sampling will be included in the subsequent routine updates of the ERA.

4.3 Aquatic Environment

4.3.1 Fish

4.3.1.1 Fish Community

More than 90 species of migratory and resident fish species are known to inhabit Lake Ontario (see Ecometrix, 2023b for a complete list), with most of them utilizing nearshore waters for spawning, rearing, feeding, and migration. The three fish species at risk (SAR) that have been identified at the PN site, along with their federal and provincial ranking is presented in **Table 4-8**.

Atlantic Salmon are considered to be extinct from Lake Ontario, as the historic population was extinguished through habitat destruction and through over-exploitation by recreational and commercial fisheries (COSEWIC, 2006a). Atlantic Salmon that currently occur in Lake Ontario are a result of Ontario's restoration program and New York State's put-grow-take program and are not assigned either a Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or a Species At Risk in Ontario (SARO) conservation status. Recently, during the PERA summer aquatic sampling program, several (5) Atlantic Salmon were captured near PNGS from July 7th – July 30th, 2025. These individuals lacked signs typical of stocked fish, such as fin clips or damaged dorsal fins. While this observation may suggest that restoration efforts are beginning to show results (i.e. these are offspring of the stocking program), these captures do not confirm natural reproduction by themselves. Nevertheless, Atlantic Salmon are not considered a "Species At Risk" at this time as evidence of natural reproduction alone does not indicate that a native population has taken hold in Lake Ontario that would persist for multiple generations without continued stocking.

American Eel has been consistently recorded in annual impingement monitoring from 2016 to 2024 (OPG, 2016, 2016, 2017b, 2017b, 2018a, 2019b, 2021c, 2021d, 2022c, 2023e, 2024h, 2025f). OPG has an Ontario ESA Waterpower Agreement for the operation of the Saunders Generating Station on the St. Lawrence River, and as part of the former ESA (Endangered Species Act) agreement, from 2006 – 2010, OPG stocked 4 million young eels (elvers) in the upper St. Lawrence and Lake Ontario.

Lake Sturgeon are rarely encountered at the PN site. Prior to the specimen caught and released in Fall of 2024 during the deepwater fish community study, Lake Sturgeon had not been observed or encountered at the PN site since 2005 (OPG, 2012a; TRCA, 2022). The Great Lakes – Upper St. Lawrence population of Lake Sturgeon experienced significant decline following the establishment of an extensive commercial fishery in the Great Lakes region between the mid-19th and early 20th centuries, and has struggled to recover since then due to the direct and indirect effects of dams, chemical pollutants, and competition with invasive species (COSEWIC, 2006b). According to stocking records from the New York State Department of Environmental Conservation (NYDEC), Lake Sturgeon were stocked on the US side of Lake Ontario from 1993 to 2016 in variable numbers at a number of locations (Great Lakes Fishery Commission, 2023;

Stewart et al., 2012; Welsh et al., 2020). At present, intense stocking has ceased, except for limited numbers in the St. Lawrence River. The NYDEC is now monitoring to determine the effect of stocking on the recovery of the species as well as their movements throughout Lake Ontario.

While Round Whitefish is not considered a SAR, they were considered a species of interest by regulators (OPG, 2013) as they are cold-water fish native to Lake Ontario, and because early embryonic stages are considered sensitive to thermal stressors (Eme et al., 2015; Griffiths, 1980; Petrudev, 2022). As such, this species has been the focus of several studies investigating the environmental impacts of PNGS (see **Section 4.3.1.3** and **Section A.3.1.3** for details). It was felt that absence of an effect observed for Round Whitefish embryo development would also be protective to other Great Lake fish species.

Table 4-8: Fish Species at Risk Observed in the PN Area

Scientific Name	Common Name	Federal Species at Risk Status (SARA)[1]	COSEWIC Status	Provincial Status (SCA)[2]	Most Recent Year Observed
Salmo salar	Atlantic salmon	No status	Extinct	Not listed	2025
Anguilla rostrata	American Eel	No status	Threatened	Endangered	2024
Acipenser fulvescens	Lake Sturgeon	No status	Threatened	Endangered	2024

Note:
Statuses are up to date as of May 13, 2026.
The Provincial Species at Risk in Ontario List, Federal List of Wildlife Species at Risk (Schedule 1 of the Species at Risk Act (SARA)), and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists are frequently revised.
(1) SARA Schedule 1 ranks species at risk as Extirpated, Endangered, Threatened Species and Special Concern. Prohibitions of the Act do not apply to species of Special Concern.
(2) The provincial Endangered Species Act has been replaced by the Species Conservation Act and supporting regulations which came into effect on March 30, 2026. The status is based on those listed in Ontario Regulation 60/26 Protected Species in Ontario List.
Source: (OPG, 2012a, 2016, 2023e; TRCA, 2022).

Fish community studies were conducted in 2024 and 2025 in the planned DWI region of Lake Ontario (i.e., the Deepwater Study Area), the Mid-depth Study Area (associated with the previously proposed dredged channel), the nearshore Infill Study Area (linked to the previously proposed infill), the Shoreline Erosion Mitigation Study Area, and the currently proposed Cutoff Wall Study Area (**Figure 4-5**). Although the Infill and Shoreline Erosion Mitigation study areas have since been excluded from the construction plan, the results of the aquatic studies in these study areas are presented to provide a comprehensive understanding of the nearshore aquatic community under pre-construction conditions. The methods used and the results are discussed in detail in **Section A.3.1**, with a summary provided below.

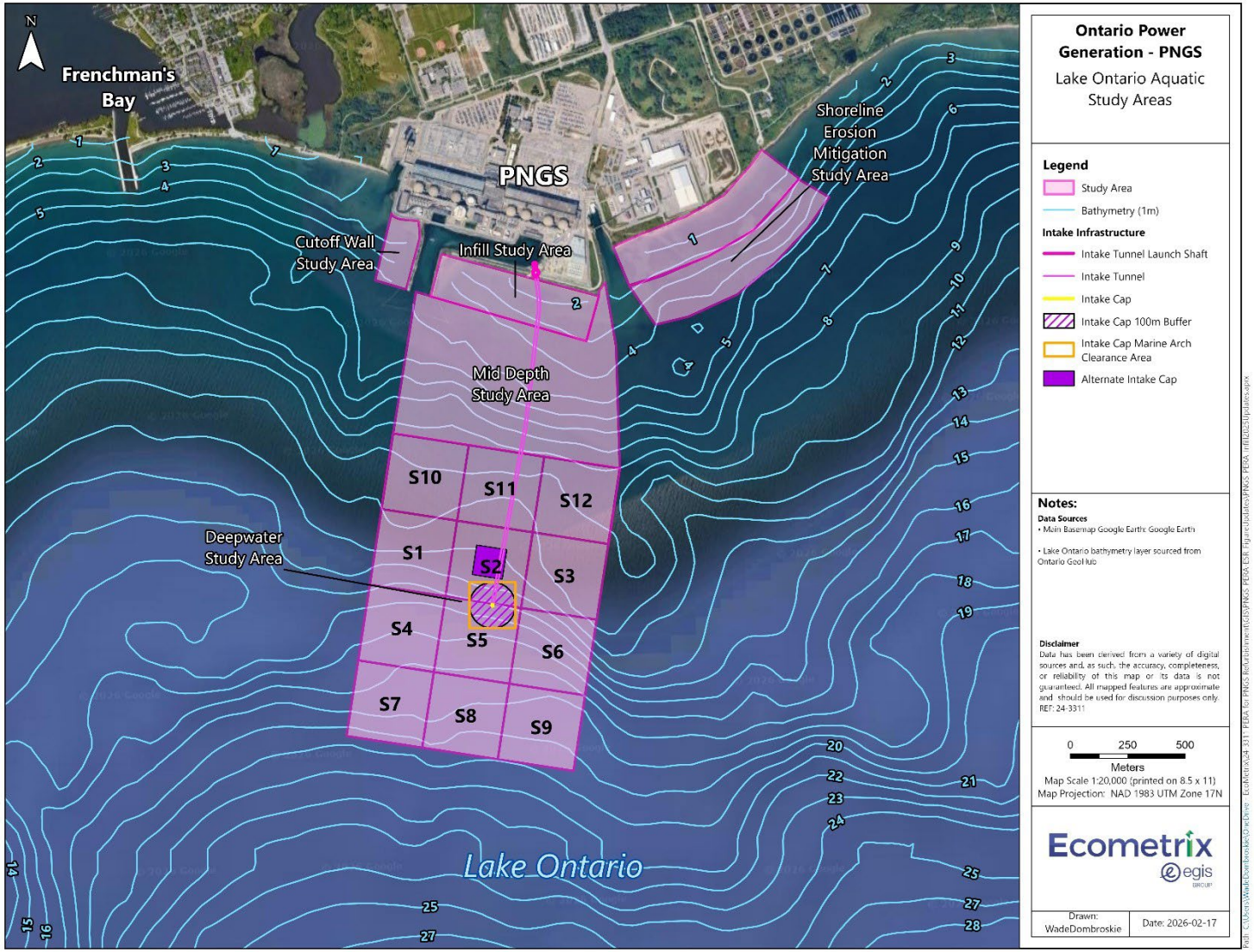


Figure 4-5: Lake Ontario Aquatic Study Area, 2024-2025 Studies

4.3.1.1.1 Fall Spawning Assessment

A fall spawning assessment was conducted to evaluate the presence and potential spawning activity of Lake Whitefish, Round Whitefish, and Lake Trout (*Salvelinus namaycush*), in order to inform selection of the final DWI location and minimize potential impacts to the aquatic community, including through impingement, entrainment, or disturbance of known spawning areas.

The preferred spawning habitats of these species overlap, with preferences for shallow (1-10m) rocky (gravel/cobble/boulder) shoals where prevailing winds are perpendicular to the shoreline (DFO, 2025a, 2025b; Lane et al., 1996). Accordingly, gillnets were set for 18-24 hours in water depths ranging from 3m to 20 m, following a partial randomized, partial fixed design, where one net was set in a random grid square within each row of the Deepwater and Mid-Depth Study Areas (a total of 6 nets), two nets were set in the Shoreline Erosion Mitigation Study Area, and one net in the Cutoff Wall Study Area, for a total of 9 nets.

Lake Trout, Round Whitefish and Lake Whitefish spawn at water temperatures from 9°C to 14°C, 2°C to 4.5°C, and 1°C to 8°C, respectively (DFO, 2025a, 2025b; Lane et al., 1996). Therefore, netting began when water temperatures were <10ºC, which occurred on November 14th, 2025. Nets were set each week, with 6 nets set the first week and 9 nets being set each week thereafter until the week of December 2nd, 2025.

All captured Lake Trout, Round Whitefish and Lake Whitefish were weighed, measured, sexed, and had their gonads weighed, and aging structures collected (scale and/or otoliths). The external condition of each fish was also assessed. Gonads of the captured fish were classified according to maturity stages ranging from immature to spent, which indicate whether fish were not capable of spawning that season, preparing to spawn, actively spawning, or had recently spawned.

The total catch, CPUE, and gonad classification per grid, or netting location, is summarized in **Table 4-9**, and the meristics of fish caught are presented in **Table A-16**. The location and gonad classification of each fish captured from three target species as part of this spawning assessment program is presented in **Figure 4-6** and is discussed in **Section A.3.1**.

<u>Lake Trout</u>

A total of 8 male Lake Trout were caught in the Deepwater Study Area over this assessment program. Despite being caught towards the end of their expected spawning window (September – November), the gonads of the fish caught were generally ripe, or running, indicating that they were in the location they were caught to undergo spawning activities. Most individuals were caught in waters 10 m or deeper, over top of substrates that generally match their preferred spawning substrates (gravel/cobble). While these depths are generally outside of the preferred spawning depths expected for Lake Trout (DFO, 2025b), it is possible that this species is using these areas for spawning grounds due to the presence of preferred substrate and the prevailing

northeast wind direction orientation, which would provide favourable conditions for egg deposition, and protection for developing larval fish.

Lake Whitefish

A total of 32 Lake Whitefish were caught over the course of this assessment program, of which 28 were male and 4 were female. Of all the Lake Whitefish caught in this program, 30 were caught in the Deepwater Study Area and 2 were caught in the Cutoff wall Study Area. The relatively high number of Lake Whitefish, compared to the other two species, suggests that the program occurred during the prime spawning period for this species, which is triggered by water temperatures dropping below 8 ºC (DFO, 2025a). Individuals were caught in all stages of spawning, including fish that were mature, ripe, running, and spent. This representation in gonad classification is indicative of Lake Whitefish using this area for spawning activities. The majority of these fish were caught in the eastern section of the Mid-Depth and Deepwater Study Areas 6 m to 15 m deep, over gravel/cobble, to cobble/boulder substrates. While much of the Deepwater study area is outside of the preferred spawning depths for Lake Whitefish (2-10m), it is possible that this species is using these areas for spawning grounds due to the presence of preferred substrate and prevailing northeast wind direction orientation as detailed earlier. However, it should also be noted that 2 running Lake Whitefish were caught in the Cutoff Wall study area, indicating that while a large number of fish were caught in deeper waters, individuals may be staging in deeper areas, then continuing onto shallower depths when they are ready to actively spawn. Alternatively, spawning may be occurring in deeper water over preferred substrates due to the high abundance of quagga mussels, siltation and general habitat degradation in shallower nearshore habitats, which can significantly reduce the survival of eggs and newly hatched larvae (Great Lakes Fishery Commission, 2021).

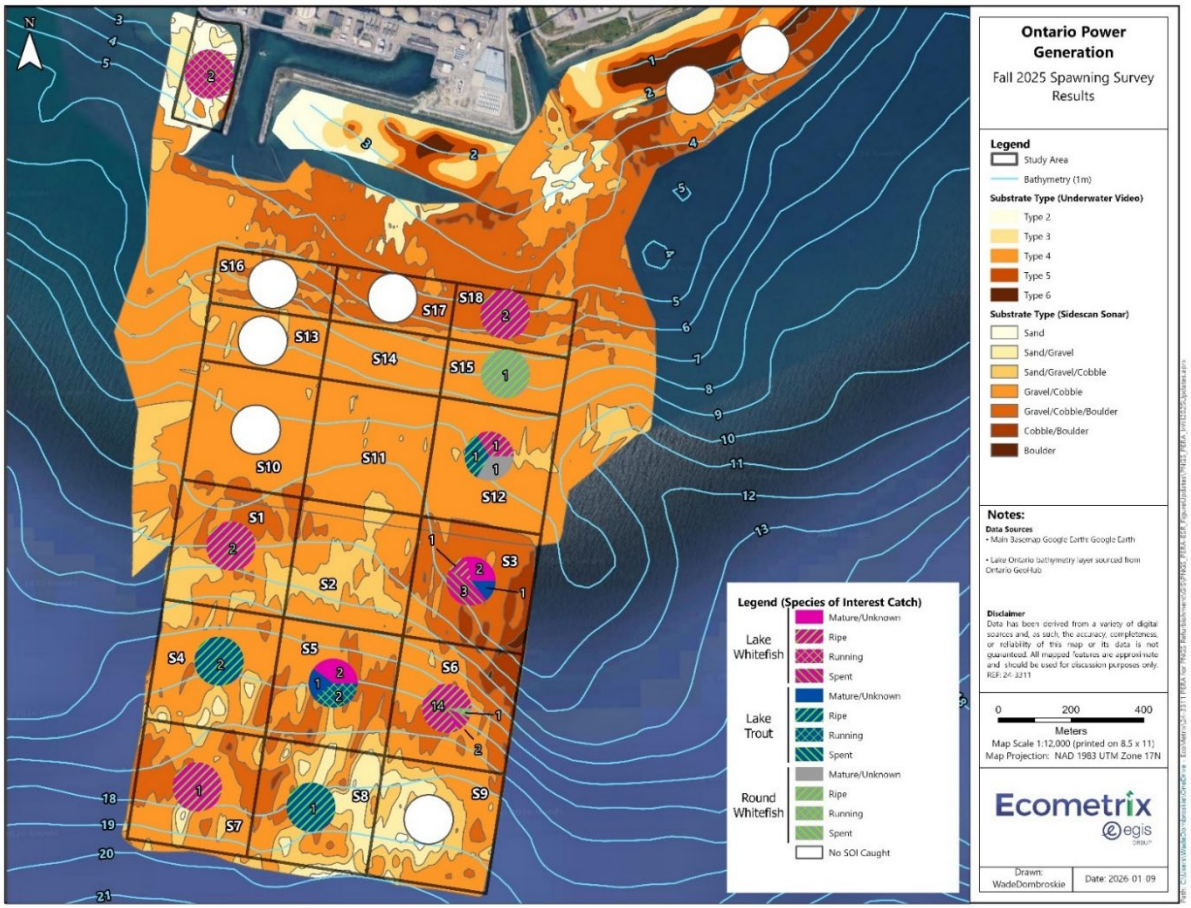
Round Whitefish

A total of 3 Round Whitefish were caught, of which 2 were male and 1 was female. All fish were caught in the Deepwater Study Area. The occurrence of low numbers of Round Whitefish only during the last two weeks of the assessment program may be indicative of sampling efforts overlapping with only the beginning of the Round Whitefish spawning period, as active spawning generally occurs into mid-December, dependent on water temperatures reaching 2-4.5ºC. With only 3 individuals caught, and weather conditions preventing sampling further into December, meaningful conclusions regarding Round Whitefish spawning throughout the study area cannot be made.

Table 4-9: Catch and Gonad Classification of Lake Trout, Lake Whitefish and Round Whitefish Caught as Part of the Fall Spawning Assessment at PNGS, 2025.

Set Location	Sets per location	Lake Trout		Lake Whitefish		Round Whitefish		Total Catch
		Catch	Gonad Class	Catch	Gonad Class	Catch	Gonad Class	
S1	2	0	-	2	1 Mature Male 1 Ripe Male	0	-	2
S3	2	1	1 Unknown	6	1 Mature Female 1 Mature Male 1 Ripe Male 3 Spent Male	0	-	7
S4	2	2	2 Ripe Male	0	-	0	-	2
S5 (Original proposed intake option location)	1	3	1 Unknown 2 Running Male	2	2 Mature Male	0	-	5
S6	1	0	-	16	2 Spent Male 14 Ripe Male	1	1 Ripe Male	17
S7	2	0	-	1	1 Ripe Male	0	-	1
S8	1	1	1 Ripe Male	0	-	0	-	1
S9	1	0	-	0	-	0	-	0
S10	2	0	-	0	-	0	-	0
S12	2	1	1 Ripe Male	1	1 Ripe Male	1	1 Mature Male	3
S13	2	0	-	0	-	0	-	0
S15	1	0	-	0	-	1	1 Ripe Female	1
S16	1	0	-	0	-	0	-	0
S17	1	0	-	0	-	0	-	0
S18	2	0	-	2	1 Ripe Male 1 Ripe Female	0	-	2
COWSA	3	0	-	2	2 Running Females	0	-	2
SEMSA	7	0	-	0	-	0	-	0
Total	**33**	**8**	**2 Unknown 4 Ripe 2 Running**	**32**	**4 Mature 21 Ripe 2 Running 5 Spent**	**3**	**1 Mature 1 Ripe 1 Spent**	**43**

Note:
S1-S12 indicate that the fish was caught in a net set in the Deepwater Study Area, S13-16 in the Mid-depth Study Area, COWSA – Cutoff Wall Study Area, SEMSA – Shoreline Erosion Mitigation Study Area.



Note:
Circles indicate locations where nets were set

Figure 4-6: Catch, and Gonad Classification of Lake Trout, Lake Whitefish and Round Whitefish Throughout the PNGS Study Area, Fall Spawning Assessment, 2025

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4.3.1.1.2 Larval Fish and Eggs

The presence, abundance, and diversity of ichthyoplankton (larval fish and eggs) were assessed in the Deepwater and Mid-Depth Study Areas as these early life stages are particularly vulnerable to entrainment. This characterization of existing ichthyoplankton conditions near the PNGS was completed in accordance with CSA N288.6:22 (CSA, 2022) and REGDOC 2.9.1 (CNSC, 2020b).

Ichthyoplankton sampling was conducted at night (2000–0530 hrs) using both horizontal and vertical plankton tows in the Deepwater and Mid-Depth Study Areas (**Figure 4-7**). Horizontal tows were used to assess the near-bottom larval fish and eggs that would be susceptible to entrainment, while vertical tows were used to characterize the presence and abundance of free-floating larval fish and eggs. Sampling was completed during three seasonal events (spring, summer, and fall) at 12 locations for both the horizontal and vertical tows, resulting in a total of 36 horizontal tow samples and 36 vertical tow samples collected in 2025. For horizontal tows, eight samples were collected from randomly selected locations in the Deepwater Study Area and four samples were collected in the Mid-Depth Study Area. As with the Deepwater Fish Community Study, the study design for the horizontal tows was designed with a focus on variation in depth. Thus, while specific grids pertaining to the DWI structure (grid S5 and S2) may not have been sampled in some events, the broader results for the various depths and substrates are considered representative of the community within that depth stratum throughout the study area. In addition, a statistical analysis of the variation in the ichthyoplankton catch by depth and substrate was conducted.

Vertical tows were conducted at 12 locations corresponding approximately to the midpoints of grids S1–S12 in the Deepwater Study Area and encompassed four depth strata (9–11 m, 11–14 m, 14–17 m, and 17–20 m). Larval fish and eggs in each sample were sent to taxonomists for identification to the lowest practical level (LPL). A summary of results is presented below and detailed results are presented in **Section A.3.1**.

Horizontal Tow Results

The number of larval fish and eggs caught in horizontal tows are presented in **Table A-17,** with supporting information, including habitat descriptions and summary statistics, provided in **Table A-19**. In the spring of 2025, only one larval fish was caught across all 12 horizontal tows. This was identified by a taxonomist as a Lake Whitefish. In the summer sampling event, In the summer sampling event, 3 larval fish were caught, all of which were identified as Round Goby (*Neogobius melanostomus*). Two larvae were caught in grids S3 and S4, and one fish was caught in S18 in the Mid-depth Study Area. In addition, a total of 1,155 eggs were caught across all 12 tows, with eggs being caught across all sampled Deepwater and Mid-depth grids with the exception of S6. These were only able to be conclusively identified as Actinopterygii (spiny-rayed fishes) although taxonomist notes suspect they might belong to the Clupeidae family, which is generally comprised of Shads and Herring (likely Alewife or Gizzard Shad; *Alosa pseudoharengus*

and *Dorosoma cepedianum*). As the spawning time for Alewife, a dominant species in the Deepwater and Mid-depth fish communities as per the 2024-2025 fish community studies, generally occurs throughout the summer, from June through July, it is likely that these larval fish and eggs belong to this species.

In the fall, 18 larval fish were caught in the horizontal tows through the Deepwater and Mid-depth Study Areas, all of which were identified as Burbot. In the fall, 18 larval fish were caught in the horizontal tows through the Deepwater and Mid-depth Study Areas, all of which were identified as Burbot. The presence of the larval Burbot in the study area at this time of year is not likely the result of spawning occurring within the study area but rather the result of summer spawning in deeper water and larval drift towards shore (Jude et al., 2013). Recent studies in Lake Michigan have confirmed these findings, and have shown that some Burbot spawn in the summer period at deeper depths more than 15 km offshore (Robinson, 2022).

To determine if and how the ichthyoplankton communities collected in the horizontal tows varied by depth, season, and substrate, GLMs were used. Detailed results of the GLMs are provided in **Section A.3.1**. Due to the low species richness, it was decided that only the metric of CPUE could be used for statistical comparisons. A statistically significant relationship was considered if the p-value was below 0.1 and if McFadden's pseudo R^2 value was greater than 0.2

For larval fish, the GLM models comparing CPUE across depth, season, and substrate, had a pseudo R^2 value less than 0.2 (R^2=0.012, 0.073, 0.002 respectively). There was a significant effect of season on larval fish CPUE ($p<0.001$), with fall having significantly higher larval fish CPUE than in the spring or summer. There was no statistically significant relationship between larval fish CPUE and depth ($p=0.138$), or larval fish CPUE and substrate ($p=0.548$).

Fish eggs were only captured during the summer sampling period, which did not allow for comparisons of egg CPUE across season. Fish eggs are not typically present in constant numbers, rather, their presence or absence is related to species-specific spawning windows. Given that a substantial number of eggs were collected during the summer sample period, and no eggs were found in the spring or fall, it is likely the summer sampling program happened to coincide with the spawning window of a warmwater fish species while the spring and fall programs did not. As such, only the summer fish egg data was used in the GLM to more accurately portray spawning location preferences. CPUE (density in eggs/1,000m^3) was compared across depth and substrate.

In both cases, the GLM models comparing CPUE across depth and substrate had a pseudo R^2 value less than 0.2 (R^2=0.023, 0.004 respectively). There was a significant effect of depth on fish egg densities ($p=0.061$), where the number of eggs tended to decrease with increasing depth. There was no statistically significant relationship between fish egg density and substrate.

Vertical Tow Results

The number of larval fish and eggs caught in horizontal tows are presented in **Table A-18,** with supporting information, including habitat descriptions and summary statistics, provided in **Table A-20**. No larval fish or eggs were collected during the spring or fall vertical tow events. During the summer event, three larval fish and one egg were collected. Three yolk-sac stage Clupeidae larvae were identified in grid S2, and one Clupeidae egg was collected in grid S7. As Alewife typically spawn from June through July, it is likely that these larvae and egg belong to this species.

Summary and Discussion

Larval fish and eggs were generally found in low abundance in the Aquatic Study Area. The majority of eggs were identified as Alewife, or Round Goby, while species representation for larval fish included Lake Whitefish (spring), Round Goby (summer), and Burbot (fall). Even though eggs for these species were not found during the horizontal and vertical tows, this is likely due to differences in spawning windows as compared to when the samples were taken.

Though S5 (the grid associated with one of the proposed intake cap locations) was not sampled directly during the spring horizontal ichthyoplankton tows, its similar substrate composition and shared depth band with grid S6 suggest a comparable level of habitat quality for Lake Whitefish larvae. The collection of a Lake Whitefish larva further supports observations during the Fall Spawning Assessment (**Section 4.3.1.1.1**), indicating that spawning may occur in the vicinity of the PN site. Lake Whitefish larval fish densities that are greater than 3 fish per 1,000m^3 are generally indicative that spawning is taking place near the area of collection (Brown et al., 2023). Given that only a single larva of this species was collected, the results suggest that the sampled area may not provide suitable nursery habitat or optimal spawning habitat for this species. Collections of larval Burbot in the fall is considered abnormal based on conventional knowledge about the spawning window for this species. As mentioned above, deepwater summer spawning of Burbot has been documented in Lake Michigan during the summer months (Jude et al., 2013; Robinson, 2022). In these instances, the larval Burbot from these deepwater spawning events become mobile after hatch and drift with the current before settling to the bottom. The results of the ichthyoplankton tows conducted in 2024–2025 suggest that similar larval drift may also be occurring in Lake Ontario, rather than Burbot spawning within the study area, given the timing of the collections and the size of the larvae captured.

Together, with the results from the Fall Spawning Assessment (**Section 4.3.1.1.1**), these results suggest that the habitat within and around the Deepwater and Mid-depth Study Areas are being utilized for spawning grounds of several fish species, including but not limited to Burbot, Lake Trout, Lake Whitefish, Round Goby, and possibly Round Whitefish.

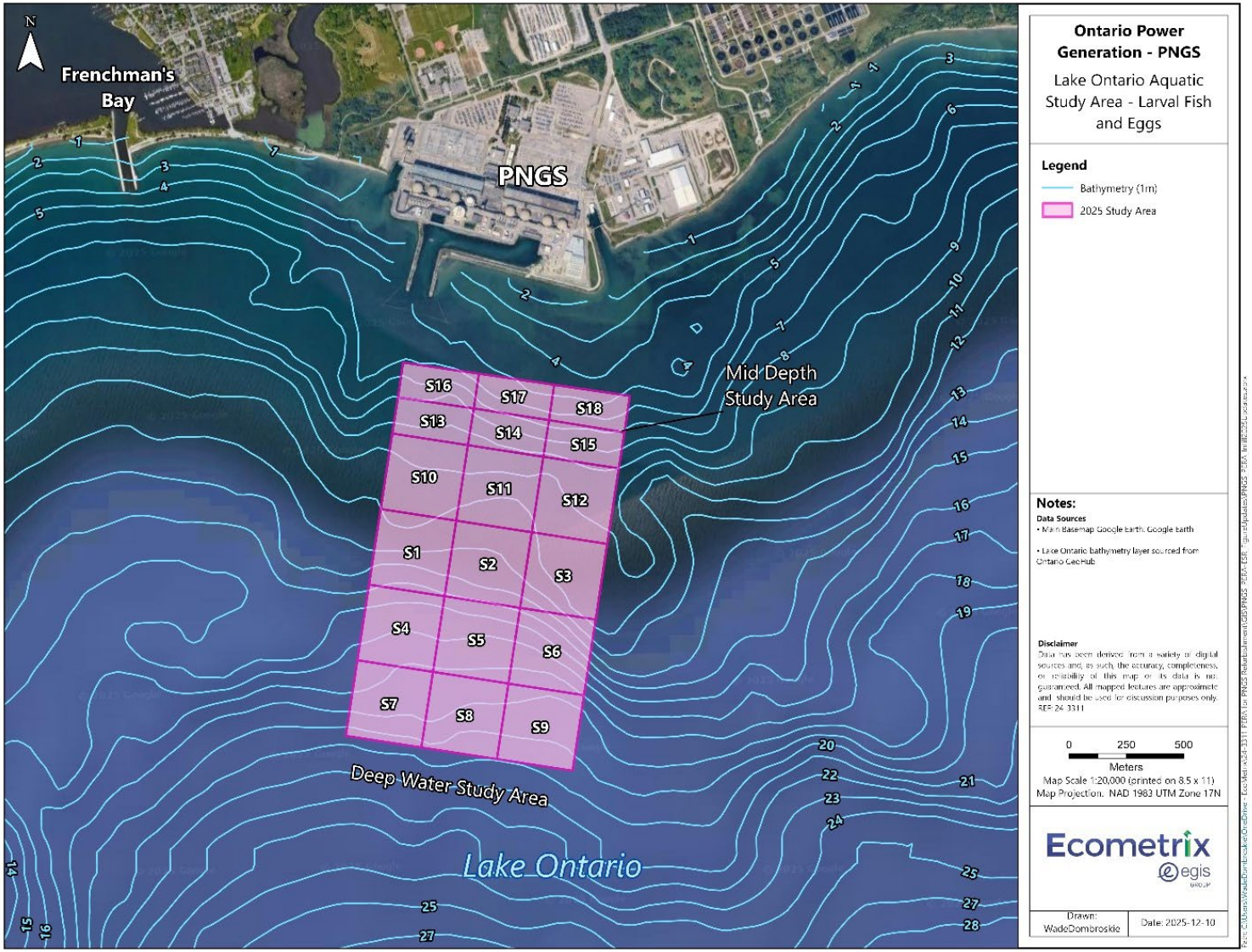


Figure 4-7: Larval Fish and Eggs Sampling Area, 2025

4.3.1.1.3 Species At Risk Assessment

After the catch of an adult Lake Sturgeon during the Fall 2024 Deepwater Fish Community Study, it was determined that a more targeted study to assess SAR within the PN Study Area was essential for the proper understanding of the fish community near the PN site. Consequently, two additional SAR studies were conducted in 2025 to specifically target American Eel and Lake Sturgeon throughout the PNGS study area.

Eight extra-large mesh gillnets were set during spring, summer, and fall in the Deepwater and Mid-Depth Study Areas, for a total of 24 net sets in 2025. Nets were deployed at depths ranging from approximately 5 m at the edge of the Infill Study Area to 19 m at the offshore extent of the Deepwater Study Area. In addition, two nets were set immediately outside the Shoreline Erosion Mitigation Study Area and two nets were set in the Cutoff Wall Study Area during each sampling event, resulting in a total of 12 net sets over the course of the program. For American Eel, a single trap net was set in both the Infill and the Shoreline Erosion Mitigation Study Areas.

Neither the sturgeon gillnetting nor the American Eel trap net surveys resulted in the capture of the target SAR. Lake bottom water temperatures during the spring and summer sampling events were within the preferred range for Lake Sturgeon (10-20ºC; Kerr et al., 2010). During the fall season, two distinct sampling events were conducted on October 2–3 and November 13–14. Lake bottom temperatures during the first round of Lake Sturgeon netting were within the preferred range, whereas temperatures during the second round were below this range. When water temperatures reach these lower levels, Lake Sturgeon generally exhibit increased movement toward overwintering grounds in deep, thermally stable areas with soft substrates near potential spawning areas (Moore et al., 2021). The results of this study suggest that the Lake Sturgeon observed during the fall 2024 sampling event represents a rare or transient occurrence within the study area rather than evidence of regular use or residency.

Although no American Eel were captured in the nets, some slime potentially from this species was observed on a gillnet during the Fall Spawning Assessment. American Eel are not easily captured in gill nets but often leave a distinctive circular ring of slime where they have temporarily struggled when encountering the gillnet. This slime cannot be definitively determined to be from an eel but was noted as such based on the indication encountered in the net and the field staff's experience. Furthermore, American Eel have been consistently recorded in annual impingement monitoring from 2016 to 2024, confirming their presence in the area.

4.3.1.2 Fish Tissue

As part of the 2024 environmental sampling program in support of the PERA, tissue samples from recreational species targeted and consumed by anglers and First Nations communities were collected during the fish community studies. Based on this, in the spring and fall sampling events of the 2024 Fish Community Study, samples were collected from Alewife and Lake Trout caught in the Deepwater Study Area (S1-S9 grids; **Figure 4-5**), and Rainbow Trout, Atlantic Salmon, and Walleye (*Sander vitreus*). caught in the Infill and the Shoreline Erosion Mitigation Study Areas (**Figure 4-5**). The tissues were analyzed for metals and radionuclides (**Table A-22**).

Overall, there was a lot of variability in the concentrations of different parameters amongst the species, with no single species or location exhibiting a consistently higher affinity for metals or radionuclides compared to others. The results and associated screening of these parameters to support the protection of human health are discussed below.

4.3.1.2.1 Metal Concentrations and Screening

Tissue burdens of metals were screened against available federal guidelines for concentrations in fish tissue (CCME, 2000; ECCC, 2021; HC, 2024). Where applicable, to compare directly to laboratory results, guidelines in dry weight (dw) were converted to wet weight (ww) based on average moisture concentrations in the samples. For metals where federal guidelines were not available, screening values were developed based on the fish ingestion rate of high consumers of traditional foods in First Nations Food Nutrition and Environment Study, Ecozone 4 (Chan et al., 2014) using Toxicity Reference Values (TRVs) from available sources. TRVs were sourced, ranked in order of priority, from HC (Health Canada, 2025), Ontario Ministry of Conservation and Parks (MECP, 2025), the United States Environmental Protection Agency Integrated Risk Information System (US EPA, 2025a), and the United States Agency for Toxic Substances and Disease Registry (US EPA, 2025b).

Concentrations of arsenic and selenium in the tissue of each species were well below the HC arsenic guideline for fish protein consumption (3.5 mg/kg dw; 0.88 mg/kg ww) and the federal environmental quality guideline (FEQG) for whole-body tissue burdens of selenium for the protection of fish (6.7 mg/kg dw; 1.7 mg/kg ww).

Concentrations of mercury in two Walleye samples exceeded the applicable screening criteria. Similarly, methylmercury in the tissues of all Lake Trout and Walleye, and 2 Lake Whitefish tissue samples exceeded the CCME guideline for protection of wildlife consumers of aquatic biota (33 ng/g ww; Additionally, concentrations of thallium exceeded the screening guideline in an Atlantic Salmon tissue sample, one Walleye sample, and all Lake Trout tissue samples.

Neither mercury nor thallium are produced during operations or discharged from PNGS; therefore, the observed exceedances in fish tissue are unlikely to be associated with this station.

Mercury pollution is recognized as a concern throughout the entire Great Lakes system due to legacy industrial inputs. Historical sources of mercury into the lakes include gold and silver mining in the late 19th to early 20th centuries, as well as atmospheric emissions from North American smelters, incinerators, landfills, and fossil fuel combustion from the early 1900s through to 1970s (Pirrone et al., 1998) . Additionally, liquid effluents, such as those from chlor-alkali plants and sewage treatment facilities, have contributed significant mercury inputs (French et al., 2006; Pirrone et al., 1998; Trip et al., 2004).

As a result of methylation of inorganic mercury in water and sediment from these industrial sources, methylmercury contamination has occurred in freshwater fish from Lake Ontario (Lepak et al., 2015; Sandheinrich et al., 2011; Zhou et al., 2017). This contamination is especially notable in piscivorous species such as Walleye and Lake Trout, due to biomagnification. Notably, the

concentrations of methylmercury observed in Walleye and Lake Trout near the PN site during the 2024 sampling are consistent with recently reported ranges from sites in Lake Ontario spatially removed from PN (Sandheinrich et al., 2011).

Similarly, thallium is recognized as a legacy contaminant in the Great Lakes, with atmospheric deposition from industrial activities including coal mining, coal-fired power generation, cement manufacturing, fertilizer production, and metal smelting identified as primary sources (Cheam et al., 2000; Couture et al., 2011; Peter and Viraraghavan, 2005). Some studies have reported thallium concentrations in Great Lakes waters that exceed those of other well-known legacy metals such as cadmium and lead (Cheam et al., 1995). Thallium has been shown to bioaccumulate in fish tissue, particularly in Lake Trout. Reported maximum thallium concentrations in Lake Trout from Lake Michigan reached 0.496 mg/kg ww (Lin et al., 2001), substantially higher than the maximum concentration observed in Lake Trout tissue collected near PNGS in the 2024 Fish Community Study (0.0389 mg/kg ww). Elevated thallium concentrations have also been documented in Arctic Char from Lake Hazen, Nunavut, an area minimally influenced by direct human activity, suggesting that long-range atmospheric deposition represents an important source of thallium to aquatic ecosystems (Gantner et al., 2009).

Based on the available evidence, the observed mercury, methylmercury, and thallium concentrations in fish tissue represent legacy contamination within the Great Lakes rather than inputs associated with PNGS operations.

4.3.1.2.2 Radionuclide Concentrations and Screening

For radionuclides, the screening level for each radionuclide represents the activity which, if consumed as part of the high consumer's diet year-round, would result in 10% of the public dose limit of 1,000 µSv/year, following the methodology outlined in CNSC (2023). This approach is appropriate because the public dose limit accounts for contributions from all radionuclides. For metals, each element was assessed individually so its full TRV dose limit was used. No exceedances of radionuclide screening levels were identified in the tissue samples collected during the 2024 Fish Community Study (**Table A-22**).

As part of the annual EMP, White Sucker (*Catostomus commersonii*) muscle tissue is analyzed for radionuclides to support in the calculation of annual radiological dose to the public (OPG, 2017c, 2018b, 2019c, 2020b, 2023b, 2023a, 2024e, 2025c). Radionuclide concentrations measured in the most recent 2024 samples were below the applicable screening levels.

With respect to temporal trends, as described in the 2024 EMP report (OPG, 2025c), the average HTO concentration in the tissue of fish from the PN outfall was 7.4 Bq/L of tissue water, with no significant trend observed over the last decade. In contrast, C-14 levels in these fish averaged 296 Bq/kg-C, showing a small upward trend but remaining low. The majority of the gamma activity in fish from the PN outfall comes from naturally occurring K-40. This is followed by Cs-137, with an average concentration of 0.2 Bq/kg fw, which is consistent with data seen in the last

10 years. Cs-137 is typically present at low levels due to nuclear weapons testing in the early 1960s, and is not associated with reactor operations. Cs-134 and Co-60, which are indicative of reactor operations, were not detected in any fish samples over the last 10 years.

The radionuclide concentrations in the samples from the 2024 Fish Community Study are comparable with the past 10 years of EMP results. As with the EMP, naturally occurring K-40 accounts for the majority of radionuclide activity in fish from both areas (i.e. nearshore regions and deepwater intake areas), while Cs-134 and Co-60 values were below detection limits.

4.3.1.3 Thermal Effects

Potential thermal effects of the PNGS thermal plume on fish near the station have been assessed across various studies considering species type (warm water vs. coldwater), life stage (i.e. spawning, embryo, larval, juvenile or adult), and effect type (i.e. chronic or acute). The findings of these investigations are detailed extensively in the 2022 PN ERA. **Section A.3.1.3** in this PERA summarizes key results from these studies, and integrates the most recent temperature data to provide an updated characterization.

4.3.1.4 Entrainment and Impingement

In 2009, in response to an order by the CNSC to reduce impingement by 80%, OPG installed a fish diversion barrier net, which has demonstrated effectiveness in reducing fish impingement at PNGS (Patrick et al. 2014). A Fisheries Act Authorization (FAA) for PNGS operational activities was issued to OPG by DFO in 2018, requiring OPG to submit an annual impingement monitoring report to the DFO. The authorization also stipulates that consultation is required if the combined biomass of all species and ages impinged exceeds 3,619 kg/yr for two consecutive years (OPG, 2021c). In 2016, biomass lost to impingement was 88% lower than the levels recorded prior to the installation of the FDS. Exceedances of the two-year threshold were found in 2018-2019, prompting notification to DFO. However, these exceedances were likely not caused by PNGS operation but rather a cold shock event. Low temperature stress (cold shock/stress) is an often-overlooked challenge that many fish face as a result of both natural events and anthropogenic activities (Reid et al. 2022). The high impingement rate in 2018-2019 was primarily attributed to a polar vortex in January which caused water temperatures to plunge below 2°C and led to the formation of frazzle ice in the intake forebay. Primarily, Gizzard Shad were impinged during this period, and this species is known to be susceptible to "cold shock" at or below 2°C (Patrick, 2020). From 2021 to 2024, impingement estimates were below the threshold (OPG, 2022c, 2023e, 2024h, 2025f). Alewife, Round Goby, Gizzard Shad, and Common Carp were the most commonly impinged species, consistent with prior years.

The CNSC also mandated OPG to reduce entrainment by 60% (OPG, 2012b). There is no feasible retrofit solution to achieve this; however, the proposed offshore intake location and further mitigation measures (described in **Section 5.3.2.1.2**) should reduce fish entrainment. Estimated ichthyoplankton entrainment losses at PNGS between 1975 and 2006 were summarized by (OPG, 2012c). During the most recent entrainment monitoring study at PNGS (undertaken in 2006), Alewife, Common Carp, and Freshwater Drum eggs and larvae; and Round Goby larvae

were reported. All the species are invasive to Lake Ontario, with exception of Freshwater Drum (Morrison, 2019). It is acknowledged that Alewife and Common Carp entered Lake Ontario many decades ago and have since naturalized. Round Goby, however, remain a Regulated Species, and are excluded from the 2018 FAA value for the PNGS.

An updated entrainment monitoring program was initiated in October 2024 to meet Condition 3.2.3 of the 2018 FAA. The objective of the program was to quantify the impact of entrainment at PNGS with the existing shoreline intake. The 12-month program adheres to the guidelines recommended by Electric Power Research Institute (EPRI) (EPRI, 2014) and CSA for entrainment sampling at nuclear facilities in Canada including DNGS (CSA, 2018, 2024, Patrick et al. 2021). The program is comprised of 60 sampling events with both daytime and nighttime collections conducted in a 24-hour period once a week from October 2024 to April 2025. From April to August 2025, sampling occurred twice weekly from April to August 2025 to target peak entrainment periods identified from previous studies (Golder, 2005, 2007a). Entrained eggs, larvae, and fish are identified to the lowest practical taxonomic level using taxonomic keys and/or genetic barcoding. An analysis of the results from this program is currently underway, and results will be provided in subsequent ERAs once available.

As detailed in **Section 4.3.1.1.2,** horizontal and vertical plankton tows were conducted in 2025 to characterize the ichthyoplankton community and other potentially entrainable organisms throughout the water column in the proposed Deepwater and Mid-Depth Study Areas. In total, there were 4 species of larval fish captured during the 2025 horizontal ichthyoplankton tows, including larval Lake Whitefish in the spring, Round Goby in the summer and Burbot in the fall. An additional larval fish caught during the summer vertical tows was identified as belonging to the Clupeidae family (i.e., Alewife), but further genus or species identification was not possible. Fish eggs could only be identified to the group Actinopterygii (shads/herring) but are likely all the same species in the Clupeidae family (i.e., Alewife). These species therefore represent the most likely ichthyoplankton components susceptible to entrainment within the offshore area. However, overall ichthyoplankton diversity and abundance are expected to be relatively low compared to nearshore areas, where spawning and nursery habitats are more prevalent.

Losses from entrainment are currently being offset by measures approved in the FAA. These measures include allocation of a portion of the OPG Big Island Wetland habitat bank, stocking of Atlantic Salmon in Duffins Creek, and the construction and monitoring of the Simcoe Point Wetland.

4.3.2 Benthic Macroinvertebrates

As highlighted in the 2022 PN ERA, the benthic community along Lake Ontario's north shore reflects the severe conditions of an exposed coast, and is dominated by oligochaetes and chironomids (Golder, 2007a). These taxa had higher abundances at sites within or close to the PNGS Units 1-4 thermal plume than at reference sites. Additionally, species diversity at depths of 6–10 m was lower in the plume than at reference sites. Historically, gastropods and bivalves were scarce in the nearshore due to wave abrasion and/or unsuitable substrates, but invasive

species such as zebra mussels and quagga mussels have colonized these areas in the last few decades (Golder, 2007a). The aquatic macroinvertebrate communities in wetlands near PNGS were studied as part of a wetland monitoring project from 2002 to 2007 (EC, 2009a). The study used Indices of Biological Integrity (IBI) to assess and compare wetland conditions. The IBI values for macroinvertebrate communities were derived using measures of species richness and relative abundance. Durham Region's aquatic macroinvertebrate communities in wetlands were in poorer condition compared to some other Lake Ontario wetlands. Around the PN site in particular, aquatic macroinvertebrate communities at the Hydro Marsh, Frenchman's Bay and Duffins Creek Marsh were rated "poor", ''fair", and "good" respectively (EC, 2009b).

To obtain an updated characterization of the benthic macroinvertebrate community near the PN site for this PERA, benthic samples were collected as part of the 2024 and 2025 aquatic studies using ponar grabs and/or benthic sled tows. Benthic samples were collected from the Deepwater, Mid-depth, Cutoff Wall, Infill, and Shoreline Erosion Mitigation Study Areas. The location of each benthic macroinvertebrate grab station and benthic sled tow line is presented in **Figure 4-8**. Benthic tow lines were derived based on the archeological study of the area conducted prior to the benthic macroinvertebrate community studies in 2025.

Benthic macroinvertebrate LPL densities from samples collected in 2024 and 2025 are provided in **Table B-12** and **Table B-13**, respectively. Various metrics, including total invertebrate density, taxonomic richness, Simpson's Evenness, Simpson's Diversity, and relative density that were computed using the samples to provide a comprehensive assessment of the community's structure and diversity are discussed in **Section A.3.2**.

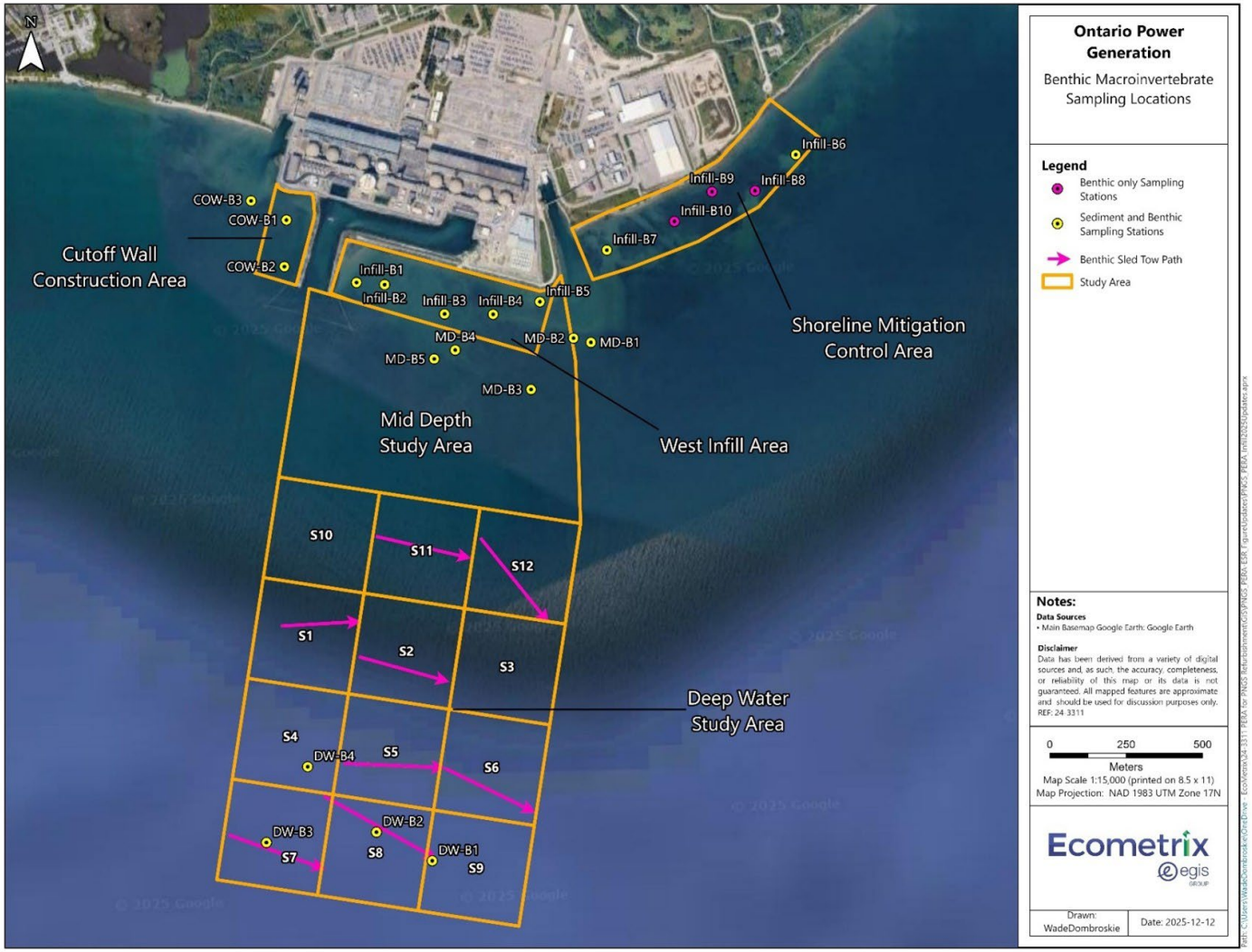


Figure 4-8: Benthic Macroinvertebrate Community Sampling Locations, 2024-2025

4.3.3 Plankton Communities

As discussed in the 2022 PN ERA, plankton communities in Lake Ontario near the PN site have undergone significant changes over the past 30 years due to factors unrelated to PNGS operations (EC, 1998; Ecometrix, 2023a). Since the 1970s, phytoplankton biomass has declined considerably, presumably due to phosphorus reduction programs and the colonization of zebra mussels. Similarly, an overall decrease in algal density has been observed (Winter et al., 2012), with diatoms currently dominating the community. Zooplankton community composition has remained stable since the 1960s, and is primarily comprised of the cladocerans *Bosmina* and *Daphnia* (Barbiero et al., 2001; Barbiero and Tuchman, 2001; Lampman and Makarewicz, 1999).

As a part of the macrozooplankton community study conducted in 2024 plankton tow nets were used to collect macroinvertebrate samples from sampling grids S1-S9 in the Deepwater Study Area depicted in **Figure 4-5** to get an updated characterization of the existing free-floating invertebrate community in the area and identify potentially entrainable organisms (besides ichthyoplankton). The sampling program comprised of a spring, summer, and fall event, with six locations sampled per event. These six locations comprised three depth strata (12-14, 14-16 and 16-18 m), with two locations sampled at each.

Detailed results of the microzooplankton community study are presented in **Section A.3.3**. Of the major groups identified, Cladocera were the most abundant in the spring and summer samples (>82% of total community composition), which is consistent with the findings from previous studies of zooplankton communities in the area (EC, 1998; Barbiero et al., 2001). This was followed by Calanoida, and Cyclopoida. Mysida were the least abundant group in the spring (<1% of total composition) and were not recorded in any of the summer samples. Unlike spring and summer, Calanoida made up the majority of the community in the five out of six samples (56-79% of total community composition) in the fall. The most common cladoceran species in the samples included *Daphnia sp*., *Leptodora sp. Bythotrephes* sp., and *Cercopagis sp*., and the most common calanoidan species included *Skistodiaptomus sp., Leptodiaptomus sicilis* and *Epischura sp.* Overall, species diversity was found to be influenced primarily by seasonal variation rather than depth, except when algal mats were present.

4.3.4 Aquatic Habitat

The aquatic habitat surrounding PNGS was discussed extensively in the Aquatic Environment TSD for the EA for the refurbishment and continued operation of the PNGS Units 5-8 (Golder, 2007a) and the 2022 PN ERA (Ecometrix, 2023a). This section integrates findings from the 2024 and 2025 environmental studies to characterize existing fish habitat within the Deepwater Study Area, Mid-depth Study Area, and the nearshore regions including the Infill, Shoreline Erosion Mitigation, and Cutoff Wall Study Areas, informing the assessment of potential project-related impacts in Section 5. Key environmental components evaluated include water and sediment quality, substrate type, aquatic vegetation/productivity, and fish community composition. The results of the substrate analysis using sidescan sonar, underwater video, and confirmatory

sediment sampling and confirmatory grain size sampling are presented in **Figure 4-10**, and discussed for each study area below.

Sidescan data was imported into ReefMaster v 2.2.57 (Reefmaster, 2024), where the bottom classification tool was used to characterize the substrate based on hardness estimations. These classifications were then compared to the sidescan imagery and the Aquaview substrate checks to assign representative substrate types across the area. Substrate was classified as Sand, Sand/Gravel, Sand/Gravel/Cobble, Gravel/Cobble, Gravel/Cobble/Boulder, Cobble/Boulder, or Boulder throughout the study area. Though mussel and algal/vegetation coverage was not quantified, general observations were recorded. Substrate analysis using underwater videos was conducted in a manner consistent with methodologies used in previous assessments (Golder and SENES, 2009; SENES, 2011a, 2011b). Videos of each transect were split into still images, and observations regarding sediment composition (base and surficial sediment size and substrate type), macrophyte and algal coverage, dreissenid mussel coverage, and fish counts were recorded. Based on sediment classifications, substrates were categorized into six types: fine sediments over bedrock with patches of exposed bedrock (Type 1), Finer sediments usually with distinct ridges and or ripple (Type 2), Finer sediments with scattered gravel and cobble (Type 3), Gravel and cobble in a base of fine sediments (Type 4), Rocks ranging in size from gravel to boulders in a base of finer sediments (Type 5), and Rocks ranging in size from gravel to boulders in a base of finer sediments (Type 6). When classifying mussel and algae coverage, the terms sparse (0-25% coverage), moderate (25-75% coverage) and dense (75-100% coverage) were utilized. If fish were seen within a transect, fish presence was noted.

Details on water quality (**Section 4.2.2.1**) and sediment quality (**Section 4.2.2.2**) are presented elsewhere in the PERA, and will be summarized below in the context of fish habitat quality in the proposed areas.

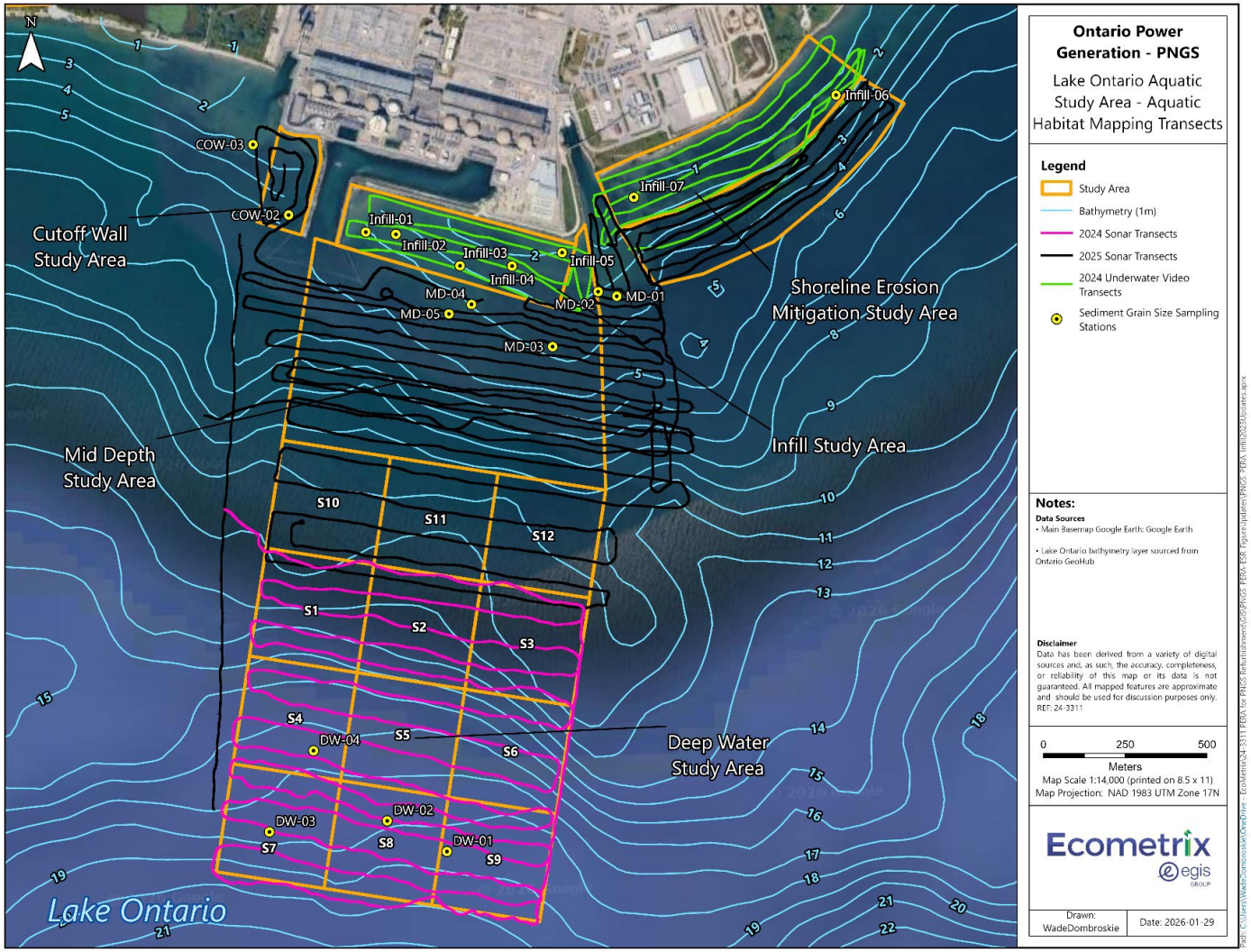


Figure 4-9: Lake Ontario Habitat Mapping Study Area Transects for Sonar and Underwater Video (GoPro), and Substrate Confirmatory Sediment Grain Size Locations, 2024 and 2025.

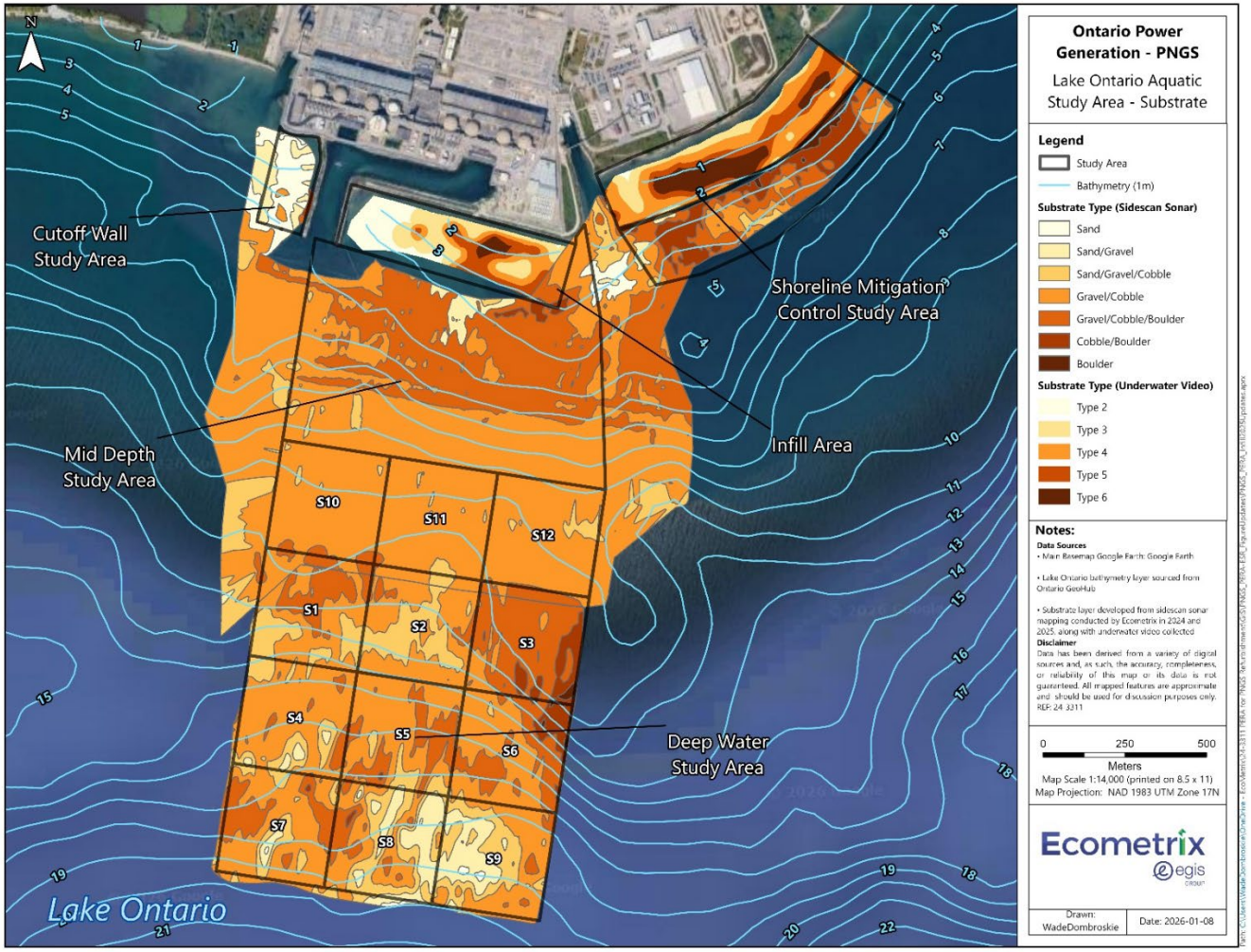


Figure 4-10: Lake Ontario Habitat Mapping Results from Sidescan Sonar, Underwater Video (GoPro), and Substrate Confirmatory Sediment Grain Size Locations, 2024 and 2025.

4.3.4.1 Deepwater Study Area

4.3.4.1.1 Water Quality

Concentrations of metals, PHC fractions F1 to F4, morpholine, radionuclides, and volatile organics in water samples from the Deepwater Study Area (i.e., LW2401, LW2402, LW2403, LW2404) were either below associated screening guidelines, below detection limits, or consistent with historical Lake Ontario levels. Exceedances of calcium, magnesium, and hexavalent chromium screening criteria in a small number of samples were considered reflective of natural background conditions or episodic variability rather than operational inputs. General chemistry parameters such as turbidity, conductivity, dissolved oxygen, and pH conditions in these samples were comparable to other habitats/environments found along the northern shore of Lake Ontario (Stephenson and Mackie, 1988; Stephenson, 1990). While two locations in the Deepwater Study Area exceeded the PWQO guideline for pH during the summer sampling event, these values remained within the CCME CWQG range of 6.5 to 9.0 for the protection of freshwater biota. Overall, the water quality in the Deepwater Study Area is considered suitable for fish habitat.

4.3.4.1.2 Sediment Quality

As sediment in Lake Ontario is transient and sparse in offshore areas, its quality in the Deepwater Study Area could not be assessed. However, based on the water quality conditions in the area, there is no indication that sediment quality in the area would pose a risk to aquatic biota.

4.3.4.1.3 Physical Habitat Features

As a part of the 2024 and 2025 aquatic habitat assessment studies conducted in support of this PERA, sidescan sonar was taken in 14 transects within the 9 sampling grids of the Deepwater Study Area (**Figure 4-9**). In 2025, the aquatic habitat assessment was expanded to include the shallower proposed intake option (sampling grids S10-S12) using the same methodology.

Overall, substrate throughout the initial and expanded Deepwater Study Area was composed of gravel/cobble, with a tendency for coarser substrates (gravel/cobble/boulder, cobble/boulder, and boulder) to the northeast and finer substrates (sand, sand/gravel) to the south and southwest of the DWI. Areas with cobble and boulder substrate exhibited high mussel densities. Periphyton (benthic algal material) coverage was generally sparse on gravel and fine sediments, but more abundant on cobble and boulder substrates. No macrophytes were observed. Additionally, there did not appear to be any unique habitat features (e.g., rocky shoals or steep drop-offs) that would serve to concentrate fish, with the habitat likely similar to other surrounding areas of Lake Ontario. Substrate types within each sampling grid are detailed in **Table A-32** and are mapped in **Figure 4-10**.

Overall, the substrate habitat assessments indicate that substrate composition varies across the study areas, roughly following a depth related pattern. Within the Deepwater study area (9 m-20

m) the occurrence and variety of substrate types tended to increase in a southeasterly direction. The proposed intake locations in grids S2 and S5 are both comprised of substrates that are generally common throughout the study area, suggesting that these grids do not provide unique aquatic habitat. The deepest grids, S8 and S9, tended to have the highest diversity of substrate types and were two of the grid squares with substantial portions of sand and gravel/sand. Shallower grids (S10, S11, and S12) were dominated by larger substrates (gravel/cobble) with little diversity. This is due to the increase in the effects of wave action and weather as the water depth decreases.

Results of the confirmatory grain size analyses aligned with the findings from sidescan sonar and are presented in **Section A.3.4**.

4.3.4.2 Mid-depth Study Area

4.3.4.2.1 Water Quality

Although water samples were not collected directly from the Mid-depth Study Area during the 2024 surface water sampling program, samples from the PN Units 1-4 Outfall (LW10), PN Units 5–8 Outfall (LW21), and Intake Channel (LW9) provide a conservative assessment of water quality. Due to natural dilution and dispersion, conditions in the Mid-depth Area are expected to be less impacted. Concentrations of PHC (F1–F4), morpholine, volatile organics, and radionuclides were below screening guidelines or detection limits, while occasional exceedances of pH, ammonia, metals (copper, hexavalent chromium, cobalt, and silver), and hydrazine were considered transient, naturally variable, or not attributable to PNGS operations and are not expected to pose a risk to aquatic biota. General chemistry parameters, including turbidity, conductivity, dissolved oxygen, and pH, were also within ranges typical of northern Lake Ontario habitats. Thus, water quality is considered suitable to support fish habitat in this area.

4.3.4.2.2 Sediment Quality

Concentrations of metals, PCBs, PAHs, and pesticides and herbicides in sediment samples from the Mid-depth Study Area in 2025 were below applicable screening guidelines or detection limits. Some petroleum hydrocarbon fractions exceeded their respective sediment quality guidelines in two samples from the study area. However, as these exceedances were limited to a small number of samples and are not expected to be associated with PNGS operations, they are not anticipated to pose a sustained risk to wildlife in the area. Overall, sediment quality in this area is considered suitable for fish habitat.

4.3.4.2.3 Physical Habitat Features

Sidescan sonar was taken in 15 transects in the Mid-depth Study Area in 2025 to assess the physical habitat features in the area. Based on the results, the Mid-Depth Study Area ranges from depths of 2 m in the far north-east corner to 10 m in the south-east corner. The substrate is primarily composed of sand/gravel/cobble within the southern deeper sections, between the 6 m and 10 m depth contours. The substrate generally becomes coarser within the shallower northern sections of the study area, dominated by gravel/cobble.

In addition, 5 sediment samples (MD-01 to MD-05; **Figure 4-9)** were collected using Ponar grabs and analyzed for grain size within the Mid-Depth Study Area to compare with the sonar-derived substrate classification map. All of the sediment samples were collected in areas classified as sand or sand/gravel, which is reflected in the grain size results (**Section A.3.4**), indicating that the substrate was mostly composed of sand, with some coarser substrates present.

4.3.4.3 Cutoff Wall Study Area

4.3.4.3.1 Water Quality

Although water samples were not collected directly from the nearshore region associated with the proposed Cutoff Wall Study Area during the 2024 surface water sampling program, samples from the PN Units 1-4 Outfall (LW10) and Intake channel (LW9) can be used to provide a conservative assessment of the water quality in these areas. As highlighted in the sections above, based on the concentrations at LW10 and LW9, the water quality in the Cutoff Wall Study Area is considered suitable for fish habitat.

4.3.4.3.2 Sediment Quality

Sediment samples collected from this area in 2025 were analyzed for grain size, general chemistry parameters, metals, PCBs, PHCs, Pesticides and Herbicides. The concentrations of all measured parameters were either below associated screening guidelines or below detection limits, indicating that sediment quality in this area is considered suitable for fish habitat.

4.3.4.3.3 Physical Habitat Features

Sidescan sonar was taken in 4 transects in the Cutoff Wall Study Area in 2025 to assess the physical habitat features in the area. Based on the results, the Cutoff Wall study area ranges from 2 m to 5 m in depth. The study area is mostly composed of fine substrates within the sand and sand/gravel classifications. There are coarser substrates, boulder and cobble/boulder, right along the break wall in the east of the study area, along with two small sections of gravel/cobble substrate within the southern section of the study area.

In addition, two sediment samples (COW-02 and COW-03: **Figure 4-9)** were collected and analyzed for grain size within the Cutoff Wall study area to compare with the sonar-derived substrate map. Both the sediment samples were collected in areas classified as sand or sand/gravel (**Section A.3.4**). Both samples indicate substrates dominated by sand, with some coarser sediment in COW-02, further to the south of the study area.

4.3.4.4 Infill and Shoreline Erosion Mitigation Areas

4.3.4.4.1 Water Quality

Although water samples were not collected directly from the nearshore region associated with the Infill and Shoreline Erosion Mitigation Study Areas during the 2024 surface water sampling program, samples from the PN Outfalls (LW10, LW21) and Intake channel (LW9) can be used to provide a conservative assessment of the water quality in these areas. As highlighted in the sections above, based on the concentrations at LW10, LW21, and LW9, the water quality in these nearshore areas is considered suitable for fish habitat.

4.3.4.4.2 Sediment Quality

Sediment samples collected from these nearshore study areas in 2024 were analyzed for sediment size, general chemistry parameters, and metals. Due to the highly energetic nature of the infill area and the overall lack of deposition that occurs there, additional parameters including radionuclides, PCBs, PAHs, PHCs, and pesticides and herbicides were not analyzed as these parameters adhere to sand associated with more stable depositional areas (i.e., Frenchman's Bay; Hart and Peterson, 2013). No exceedances of metal screening guidelines were observed. While phosphorus exceeded the guideline at one location in each nearshore area, this threshold reflects potential nutrient enrichment effects on benthic community composition rather than toxicity to ecological receptors. Overall, sediment quality in the Shoreline Erosion Mitigation and Infill Study Areas is considered suitable for fish habitat.

4.3.4.4.3 Physical Habitat Features

As a part of the 2024 aquatic habitat assessment conducted in support of this PERA, underwater video was collected from five transects in the Infill and Shoreline Erosion Mitigation Study Areas each to characterize the available habitat. The transect coverage is outlined in **Figure 4-9**.

Substrate classification results for each transect in the Infill and Shoreline Erosion Mitigation Study Areas are presented in **Table A-33**. Substrates in the Infill Study Area consisted of three substrate types; these were Type 2, Type 5, and Type 6. The finer Type 2 substrates represented the majority of the area, especially concentrated on the west side of the area. The prevalence of sand with distinct ridges and ripples suggest poor fish habitat based on it being a high energy area. Aquatic vegetation was not observed in most of the infill area. The east section of the study area had high levels of vegetation coverage (>90%), which tended to coincide with coarser substrates. Very few mussels were observed throughout transects 1, 2, 4, and 5, and there were no mussels observed throughout transect 3. Though infrequent, areas of sparse to moderate mussel density tended to be observed coincident with areas containing larger substrates (cobble/boulder). No fish were observed along any of the transects conducted within the infill area.

In general, substrates in the Shoreline Erosion Mitigation Study Area consisted of five substrate types; these were Type 2, Type 3, Type 4, Type 5, and Type 6. Type 2 substrates (finer sediments usually with distinct ridges and or ripples) were the most common and Type 3 (finer sediments with scattered gravel and cobble) were the least common. Finer substrates were seen closer to shore and to the west, with coarser substrates found further from shore. Overall, the dominant substrates indicate that the area is energetic and provides limited high quality fish habitat. Aquatic vegetation (including macrophytes and algae) was observed throughout most of every transect, with only six of the 55 images containing no aquatic vegetation. Nearly 100 % coverage was seen in 13 of 55 images. The majority of images within transects 2, 3 and 5 also had no observable mussels and no mussels were observed in transect 1 or 4, with mostly sparse and some moderate amounts observed occasionally. Mussel density tended to increase with substrate particle size. No fish were observed along any of the transects conducted within the Shoreline Erosion Mitigation Study Area. The 2 sediment samples within the study area (Infill-06

and Infill-07), to compare against the derived substate map, were collected on the far southeast edge and west edges of the study area and were composed of >95% sand (**Figure A-25**).

4.4 Geological and Hydrogeological Environment

4.4.1 Surficial Geology and Soil

The PN site is situated between the Oak Ridges Moraine to the north and Lake Ontario to the south. The moraine is composed of thick deposits of glacial till and sand and gravel that are associated with hummocky terrain at the surface (Golder, 2007b). South of the moraine, the north shore of Lake Ontario is largely underlain by glacial till and glaciolacustrine deposits of clayey silt to silty clay composition. The underlying soil sequence at PN can be subdivided into three main layers generally comprised of construction fill materials, a recent Upper Till Complex and an older Lower Till Complex directly overlying the local bedrock (Golder, 2007b).

Historical operations at the PN site have resulted in isolated areas of chemical contamination in soil in locations that may result in a pathway to receptors. The 2017 ERA (Ecometrix and Golder, 2018) determined that risks posed by soil contaminants to human and ecological receptors were low. No additional soil samples were collected for evaluation in the 2022 PN ERA (Ecometrix, 2023a). Details of the 2015 sampling program are presented in **Section A.4.1**.

4.4.1.1 2024 Soil Monitoring Program

4.4.1.1.1 Chemical Soil COPCs

In mid-2024, a soil monitoring program was initiated to characterize existing soil conditions at the PN site. Soil samples from the top 15 cm of soil were collected from a variety of different sampling locations (see **Figure 4-11**), consisting of locations assessed in previous soil sampling programs and/or known areas of concern at the PN site. Consistent with previous soil monitoring programs, soil samples were analyzed for PAHs, VOCs, PHC fractions F1 to F4, metals and inorganics, and radiological parameters including tritium, gamma emitters and carbon-14.

Based on the recent soil monitoring program, measurements of zinc, electrical conductivity and sodium adsorption ratio were found to exceed their respective soil screening criteria (**Table A-34**). Overall, soil quality at the PN site has remained consistent compared with previously completed soil monitoring programs. Concentrations of historical soil COPCs (i.e., arsenic, copper, lead, PHC F4, and cyanide) have improved such that these parameters no longer screen in as soil COPCs based on the results of the 2024 soil monitoring program.

4.4.1.1.2 PN ERA Radiological Soil COPCs

As part of its normal operations, the PN site contributes small amounts of radiological materials to the environment. Atmospheric deposition represents the primary transport pathway of radiological COPCs to soils within and near the PN site. Historically, radiological parameters including tritium, gamma emitters (i.e., Cs-137, Cs-134, Co-60), I-131 and C-14 have been monitored in soil at the PN site.

The 2024 soil monitoring program results indicate increases of C-14 and H-3 in soil compared to the 2015 study. However, concentrations of radiological COPCS in soil remain low, with most samples containing radionuclides at concentrations below or slightly above detection limits.



Figure 4-11: Monitoring Locations for the 2024 Soil Monitoring Program

4.4.2 Groundwater

4.4.2.1 Groundwater Flow

At a regional scale, the sand and gravel layers buried within and between low permeability till deposits under the PN site constitute aquifers that support groundwater flow. The tills and lower bedrock deposits of shale and limestone that underlie the surficial deposits typically have low permeability and behave as aquitards, restricting infiltration and the recharge of water to more permeable layers, weathered zones and areas with open fractures.

Historical site investigations and groundwater monitoring programs (GWMPs) have provided an understanding of the groundwater flow system below the PN site. A hydrogeological conceptual site model (CSM) for the PN site (Ecometrix, 2023c) was presented as part of developing the 2020 Groundwater Protection Plan for the PN Site (Ecometrix, 2023d). Groundwater flow south of the Oak Ridges Moraine, including the area where the PN site is situated, is southward toward Lake Ontario.

Continued monitoring has revealed that the predominant groundwater flow direction and water table elevation have not significantly changed over time and do not experience any meaningful seasonal variability. In general, vertical flow is downward in the overburden and upward in the bedrock, consistent with regional groundwater discharge to Lake Ontario.

4.4.2.2 Groundwater Quality

Numerous hydrogeological investigations have been conducted at the PN site, primarily in relation to known elevated tritium concentrations in groundwater, but also relating to other chemical COPCs such as PHC, chloride and metals (iron) in areas of the site that represent potential sources of these contaminants.

Since December 2020, the PN site has maintained a robust groundwater protection program (GWPP) and GWMP compliant with CSA N288.7-15, "*Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*" (Ecometrix, 2023d). The GWPP is a comprehensive document that defines groundwater protection goals for the PN site based on site-specific hydrogeological conditions and groundwater end uses that are presented in a CSM (Ecometrix, 2023c). Groundwater monitoring and reporting, beginning in 2021, follows the design provided in the GWMP. Prior to 2021, groundwater monitoring had been ongoing for many decades at the PN site, most recently under the GWMP Design (Ecometrix, 2012). This PERA relies on OPG's annual GWMP reports from 2021 to 2023 (OPG, 2022d, 2023f, 2024i).

In the groundwater CSM, SSCs were identified in order to identify high priority SSCs (i.e., those which act as potential sources of chemicals to groundwater). Chemicals associated with the SSCs were screened as COPCs for monitoring in the GWMP on the basis of recent (primarily, 2012-2018) groundwater concentrations of those chemicals at the PN site. Tritium was identified as a COPC in groundwater at the PN site; though there are no published standards for tritium in

groundwater, tritium was retained as a COPC for the GWMP because of its presence in groundwater and association with SSCs.

4.4.2.2.1 Chemical COPCs in Groundwater

Non-radiological COPCs monitored during the 2021-2023 period (OPG, 2022d, 2023f, 2024i) focused on PHC F1-F4, benzene, toluene, ethylbenzene, and xylenes (BTEX), and dissolved iron; these parameters are monitored based on the screening assessment of past monitoring events.

Although there were exceedances reported for PHCs and dissolved iron during the specified time period, these chemical constituents are not expected to pose adverse effects to human health and the environment. As noted in the 2022 PN ERA, continued monitoring has shown that PHCs are not migrating from groundwater to the intake channel or Lake Ontario. Human receptors are restricted from accessing the intake channel and recreational activities would occur further out into the lake, away from any potential groundwater inputs to Lake Ontario. Furthermore, the nearest WSP is situated approximately 7 km east of the PN site in Ajax, Ontario; concentrations of any COPCs in groundwater would thus be subject to considerable dilution before they could migrate to a point of water intake for human consumption. With respect to dissolved iron, no health risks are expected based on the same assumptions provided above. Furthermore, the Ontario PWQO from which the dissolved iron screening criteria is derived is based on the protection of freshwater aquatic life and is considered extremely conservative for assessing risk to humans.

Similarly, groundwater COPCs are not expected to pose any risks to ecological receptors at the PN site. Most terrestrial ecological receptors are unlikely to be exposed to groundwater as there is no reasonable complete exposure pathway. Continued monitoring has shown that aquatic receptors most at-risk of potentially contacting discharged groundwater (e.g., benthic invertebrates, bottom-feeding and pelagic fish in Lake Ontario) are not at risk as any groundwater COPCs discharging into the lake are sufficiently diluted and COPC concentrations within sampled lake water are consistently measured below screening guidelines protective of ecological health.

4.4.2.2.2 Radiological COPCs in Groundwater

Tritium is the only radiological parameter currently measured as part of the PN GWMP consistent with the PN CSM (Ecometrix, 2023c). There is potential for tritiated groundwater to migrate to surface water (i.e., Lake Ontario); however, groundwater flux from the site into Lake Ontario is likely to be small based on the estimated groundwater velocity and influence of site infrastructure (CH2M, 2000). Therefore, any COPCs in groundwater that reach the lake are subject to considerable dilution before they can migrate to a point of water intake for human consumption. Tritium concentrations in all boundary and shoreline wells at the PN site perimeter remain substantively below groundwater evaluation criteria, demonstrating no potential for off-site impacts from tritium in groundwater at PNGS.

A groundwater evaluation criterion for tritium has been developed as part of the N288.7-compliant GWPP for the PN site that would be protective of the drinking water pathway from the Ajax WSP intake. A tritium concentration of 6.19×10^9 Bq/L in groundwater was derived to be protective of human receptors (Ecometrix, 2023e). Over the past four years of groundwater monitoring, measured tritium groundwater concentrations have remained well below the evaluation criterion (OPG, 2022d, 2023f, 2024i).

The on-site groundwater is not considered potable. There are no groundwater supply wells downgradient of potential source areas on-site. Off-site drinking water wells may be influenced by the atmospheric tritium and this is taken into account in the public dose calculations conducted as part of OPG's annual EMP reporting. Overall, groundwater quality results from groundwater monitoring conducted from 2021 to 2023 are consistent with previous groundwater assessments.

4.5 Terrestrial Environment

The PN site spans 105 ha and encompasses limited areas of naturalization in a generally urban setting which provides habitat for many terrestrial plant and animal species. The PN Study Area is an additional 100 ha in area and includes some of the surrounding adjacent natural and park areas as shown in **Figure 4-12**. Biodiversity monitoring has been conducted within the PN Study Area since 2009 and continues on an annual basis (TRCA, 2009, 2013, 2015a). Specifically, the transects monitored outside the site include Hydro Marsh, Alex Robertson Park, Bay Ridges Park, PN East Landfill. A standardized program was developed in 2016 (Beacon, 2017a) and was implemented annually until 2019 (Beacon, 2017b, 2018), followed by a three-year compilation from 2019 to 2021 (Beacon, 2022), an annual report in 2022 (Beacon, 2023), and a three-year program from 2023 to 2025 (Beacon, 2025). The program includes monitoring of amphibians, breeding birds, and bats, as well as identification of SAR. Vegetation communities within and in the vicinity of the PN site were initially characterized in 2004 and 2006 (Golder, 2007c), further studied from 2009 to 2015 (TRCA, 2015a, 2015b), and remapped in 2018 and 2023 (Beacon, 2018, 2025).

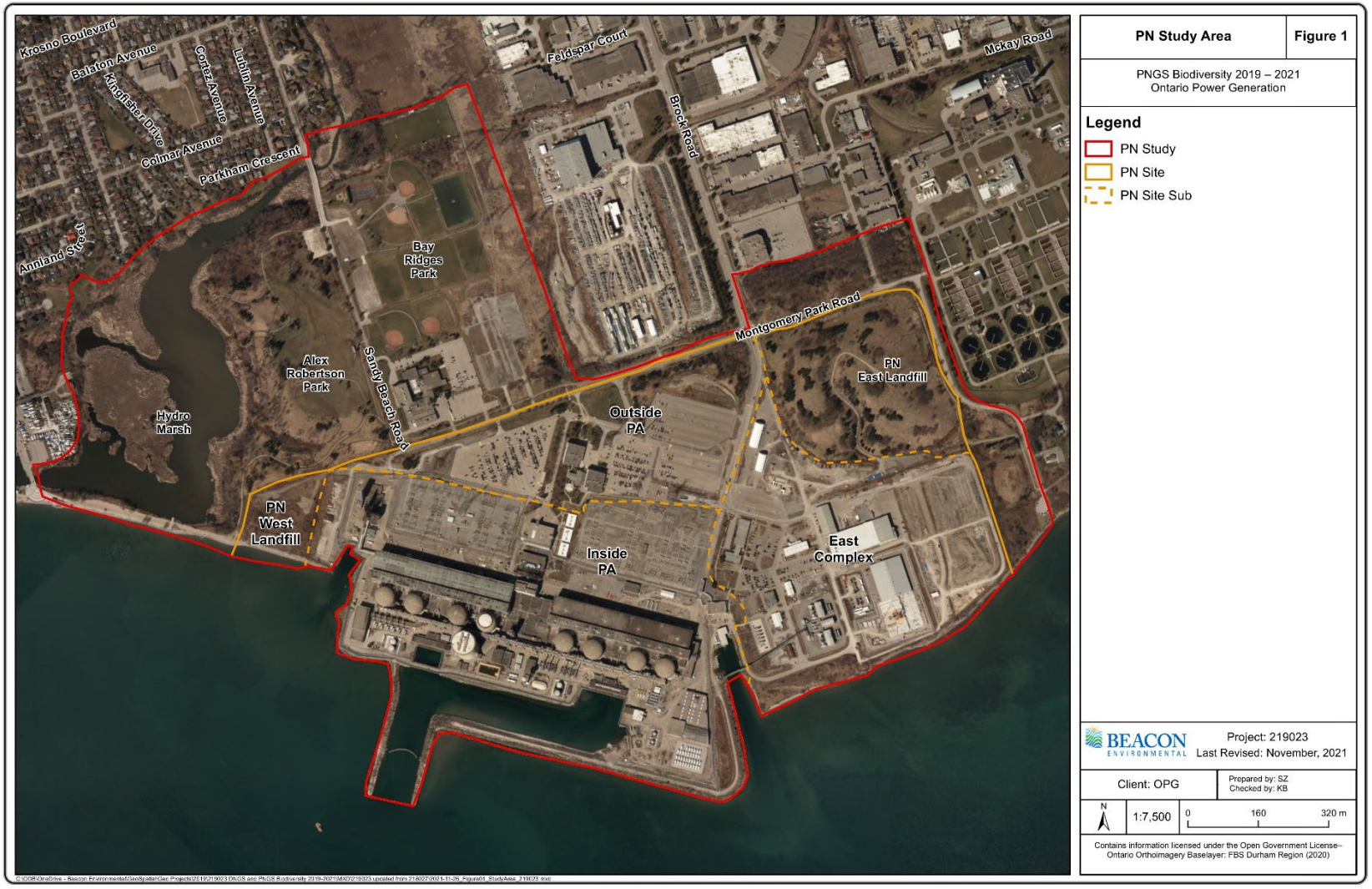


Figure 4-12: Terrestrial Monitoring Study Area (Beacon, 2022)

4.5.1 Vegetation

The vegetation around the PN site comprises a mix of terrestrial, wetland, and cultural communities. Vegetation within the site is sparse, and characterized by weeds, grasses, and small shrubs. The forested lots outside the site boundaries contain 2 ha of forested areas with a mix of native and non-native trees and shrubs (Golder, 2007c). Notably, a Butternut (*Juglans cinerea*) tree, classified as endangered according to the Protected Species in Ontario List under the Species Conservation Act (SCA) and by the Committee on the Status of Species at Risk in Ontario (COSSARO), is present outside the PN site boundary in Alex Robertson Park (Beacon, 2022, 2025). There is also another off-site Butternut located on the east side of Sandy Beach Road, approximately 5 m north of the Study Area boundary (Beacon, 2025). Regenerating shrublands and open fields along the Lake Ontario shoreline serve as transitional ecosystems and support a diverse range of riparian species.

The wetland communities surrounding the PN site are diverse, including swamp thickets, meadow marshes, and shallow marshes (TRCA, 2013). Key areas such as Hydro Marsh, Frenchman's Bay, and Krosno Creek feature vegetation dominated by emergent species like cattails (*Typha angustifolia*) and speckled alder (*Alnus incana*), with native species providing the majority of ground cover and species richness. Although non-native species like Common Reed (*Phragmites australis*) are present in some regions, the overall floristic quality and species diversity have remained stable (Golder, 2007c; Ecometrix, 2023a). In addition to Butternut, other SAR recorded within the PN Study Area include Kentucky Coffee-tree (*Gymnocladus dioicus*), Red Mulberry (*Morus rubra*), and Slender Bush-clover (*Morus rubra*). However, these species have not been observed since 2000 (Beacon, 2022; OPG, 2016; TRCA, 2015a), and the Kentucky coffee-tree is thus no longer considered part of the PN Species list (Beacon, 2020).

4.5.2 Wildlife

The most recent species lists for the PN Study Area, up to and including 2025 (Beacon, 2025), document a total of 732 species of flora and fauna, categorized into the following wildlife groups: 27 mammals, 10 reptiles and amphibians, 257 birds, 26 butterflies and moths, 18 dragonflies and damselflies, 64 fish, and 320 species of vascular plants.

The PN Study Area supports a variety of bird species, most of which are considered secure in the urban landscape of the greater Toronto region. Influenced by its location on Lake Ontario and the surrounding habitat, the area provides valuable stopover sites for migratory birds including waterfowl. As of 2025, 76 bird species were recorded as breeding within the site. Though there has been some fluctuation in the number of breeding bird species over last decade, the bird community is considered robust. Five new bird species were observed between 2023 and 2025, including the American Bittern, Eastern Whip-poor-will, Red-headed Woodpecker, Yellow-throated Vireo, and Glossy Ibis.

Bats were most recently surveyed in 2020, 2022, and 2024 (Beacon, 2025). Species recorded during the most recent surveys included the Big Brown Bat (*Eptesicus fuscus*) and the Eastern

Red Bat (*Lasiurus borealis*) (Beacon, 2025). The Big Brown Bat has been the most frequently recorded bat species in the PN Study Area, and has been observed consistently in Alex Robertson Park since 2016, with the exception of 2022 when no bats were detected. Eastern Red Bat has been recorded intermittently on the Montgomery Road transect (2020 and 2024) and was also detected in Alex Robertson Park in 2020. This species is currently listed as endangered provincially, does not currently have a status under SARA, and was determined to be endangered by COSEWIC in 2023. While not detected during the most recent monitoring program, Silver-haired Bat (*Lasionycteris noctivagans*) was recorded in the PN Study Area in 2020.

The limited and sporadic use of the PN Study Area by bats could be attributed to high levels of anthropogenic activity occurring there throughout the day, evening, and overnight, likely discouraging bat use of the area.

Terrestrial animal protected species/SAR that have been recorded in the PN Study Area (Beacon, 2017a, 2017b, 2018, 2022, 2023, 2025; OPG, 2016), along with their federal and provincial status are presented in **Table 4-10**. Since OPG inventories include incidental observations and migrants, the species listed in **Table 4-10** are not necessarily breeding within the PN site.

Most of the listed species were observed in the parklands, wetlands, and woodlands beyond the PN Site boundaries, with a few exceptions. In 2023, one Midland Painted Turtle was found in a screenhouse collection bin, and one Eastern Whip-poor-will was found in the Screenhouse, likely as migrants from nearby areas. The Chimney Swift, last recorded as a group of four flying over the PN site in 2020, is not regularly observed on-site. While suitable nesting habitat may exist within site structures, this species forages widely and without additional evidence of breeding on site, these observations are considered only possible breeding records. Peregrine Falcon and Barn Swallow pairs have been confirmed to be breeding inside the Protected Area. OPG continues to monitor the presence, distribution, and breeding of species within and around the PN site and ensures compliance with federal and provincial legislation.

In 2021, the MECP issued OPG a Safe Harbour Stewardship Agreement (SHA) under Section 16(1) of the ESA. The SHA allows OPG to test the performance and feasibility of an artificial nesting structure design for Bank Swallows. The design selected for the structure was a Fixed Face Earthen Embankment (FFEE) and was constructed to the east of the East Complex on the PN site in 2021. In accordance with the conditions of the SHA, OPG is required to undertake effectiveness monitoring of the FFEE for the duration of the conservation period, which is seven breeding seasons (i.e., 2021 – 2027). In 2023, during the third year of monitoring, Bank Swallows successfully colonized the artificial embankment for the first time. Since 2023, the embankment has supported near-full occupancy by nesting Bank Swallows and high rates of nesting success each year. Playback was used to encourage colony establishment in 2023 and 2024; however, in 2025, the swallows returned to the colony without the use of call broadcast. In March of 2026, the ESA was replaced with the Species Conservation Act (SCA). This act allows for existing permits, agreements or registrations under the ESA (procured prior to the SCA coming into effect) to continue under O.Reg 62/26 Transitional Matters. The Bank Swallow was removed

from the list of Protected Species under the SCA through provisions of the Migratory Bird Conventions Act and federal SARA legislation. The provisions of this regulation require that all existing agreement conditions be followed. While proponents have the option to terminate the agreement if desired, this requires approval by the minister.

Table 4-10: Terrestrial Animal Species at Risk Observed within the PN Study Area

Scientific Name	Common Name	Federal Species at Risk Status (SARA)[1]	COSEWIC Status	Provincial Status (SCA)[2]	Most Recent Year Observed
Amphibians and Reptiles					
Emydoidea blandingii	Blanding's Turtle	Endangered	Endangered	Threatened	2006
Chrysemys picta marginata	Midland Painted Turtle	Special Concern	Special Concern	No Status	2025
Birds					
Chaetura pelagica	Chimney Swift	Threatened	Threatened	No Status	2024
Contopus virens	Eastern Wood-Pewee	Special Concern	Special Concern	No Status	2025
Ixobrychus exilis	Least Bittern	Threatened	Special Concern	No Status	2023
Antrostomus vociferus	Eastern Whip-poor-will	Threatened	Special Concern	No Status	2023
Falco peregrinus	Peregrine Falcon	NAR	No Status	No Status	2023
Melanerpes Erythrocephalus	Red-headed Woodpecker	Endangered	Endangered	No Status	2023
Hirundo rustica	Barn Swallow	Threatened	Special Concern	No Status	2025
Chordeiles minor	Common Nighthawk	Special Concern	Special Concern	No Status	2010
Dolichonyx oryzivorus	Bobolink	Threatened	Special Concern	No Status	2006
Riparia riparia	Bank Swallow	Threatened	Threatened	No Status	2025
Butterflies and Moths					
Danaus plexippus	Monarch	Endangered	Endangered	No Status	2025

Scientific Name	Common Name	Federal Species at Risk Status (SARA)(1)	COSEWIC Status	Provincial Status (SCA)(2)	Most Recent Year Observed
Mammals					
Lasiurus borealis	Eastern Red Bat	No Status	Endangered	Endangered	2024

Note:
Statuses are up to date as of May 13th, 2026. Observations were included up to 2025.
The Provincial Species at Risk in Ontario List, Federal List of Wildlife Species at Risk (Schedule 1 of the Species at Risk Act (SARA)), and Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists are frequently revised.
(1) SARA Schedule 1 ranks species at risk as Extirpated, Endangered, Threatened Species and Special Concern. Prohibitions of the Act do not apply to species of Special Concern.
(2) The provincial Endangered Species Act has been replaced by the Species Conservation Act and supporting regulations which came into effect on March 30, 2026. The status is based on those listed in Ontario Regulation 60/26 Protected Species in Ontario List.
Sources: (Beacon, 2017b, 2018, 2022, 2023, 2025; OPG, 2016).

4.6 Radiation and Radioactivity

During normal operations, the PN site releases radiation fields into the surrounding environment. It is also a source of radionuclide emissions to air and water, as discussed in **Section 4.1.1.1** and **Section 4.2.2.1.3**, respectively. Radiation doses arising from these sources are discussed in the following sections.

4.6.1 Human Dose

In 2013, the annual Radiological Environmental Monitoring Program report was changed to the annual EMP report entitled "Results of Environmental Monitoring Programs". During this time, the EMP was redesigned to meet the requirements of CSA N288.4-10 (CSA, 2010) and expanded to include conventional contaminants, physical stressors and non-human biota, in addition to the radiological contaminants and human receptors. More recently, the EMP is now compliant with CSA N288.4-19 (CSA, 2019).

For the radiological exposure assessment, exposure point concentrations are either based on measured data from the annual EMP or modelled from emissions data, as described in the EMP report (OPG, 2025c). Additionally, when measurement averages or other calculations are performed, they are calculated using all results obtained, including detection limit values if the results are below the critical level for detection (OPG, 2025c).

Table 4-11 below presents a summary of the annual doses reported for the potential critical groups from 2021 to 2024. Although the current PN EMP design currently focuses on the Urban Resident, Dairy Farm, Sport Fisher, and Industrial Worker, the dose for receptors at the correctional institution is also reported to show variation in dose. **Table 4-12** presents a summary of the maximum dose to each limiting critical group from 2021 to 2024. The annual dose during the four-year period of interest (2021 to 2024) ranged from 0.15 to 1.99 µSv. The limiting critical group for all years was the Urban Resident (adult). The dominant pathways and radionuclides that contribute significantly to the total dose are inhalation of tritium and external exposure to noble gases. Overall, the reported annual doses between 2021 and 2024 are comparable with those presented in the recent 2022 PN ERA, which assessed annual doses from 2016 to 2020.

Table 4-11: Summary of Dose to Potential Critical Groups from 2021-2024

Year	Age Class	Radiological Dose (µSv/a)				
		Dairy Farm	Urban Resident	Sport Fisher	Correctional Institution	Industrial Worker
2021	Adult	0.30	1.99	0.38	1.00	1.56
	Child	0.35	1.74	0.43	1.03	-

Year	Age Class	Radiological Dose (µSv/a)				
		Dairy Farm	Urban Resident	Sport Fisher	Correctional Institution	Industrial Worker
	Infant	0.43	1.97	0.38	-	-
2022	Adult	0.35	1.94	0.17	0.98	1.45
	Child	0.40	1.76	0.19	1.04	-
	Infant	0.50	1.90	0.15	-	-
2023	Adult	0.38	1.54	0.19	0.94	1.42
	Child	0.47	1.31	0.20	0.98	-
	Infant	0.63	1.44	0.17	-	-
2024	Adult	0.28	1.4	0.29	0.60	0.83
	Child	0.34	1.1	0.31	0.58	-
	Infant	0.47	1.4	0.27	-	-

Source: (OPG, 2023b, 2023a, 2024e, 2025c)

Table 4-12: Summary of Dose to Limiting Critical Group from 2021 to 2024

Year	Limiting Receptor Group	Effective Dose (µSv)	Percentage of Regulatory Limit (%)	Percentage of Dose from Canadian Background Radiation (%)
2021	Urban Resident (Adult)	1.99	0.20%	0.14%
2022	Urban Resident (Adult)	1.94	0.19%	0.14%
2023	Urban Resident (Adult)	1.54	0.15%	0.11%
2024	Urban Resident (Adult)	1.40	0.14%	0.1%

Source: (OPG, 2023b, 2023a, 2024e, 2025c)

4.6.1.1 Radiological Dose from the NSS-PWMF

Radiation fields outside the NSS-PWMF are due primarily to contributions from direct gamma radiation and secondarily from gamma skyshine. Given that radiation intensity decreases as distance from the source increases, the Sport Fisher is the only critical group for which gamma radiation would likely be measurable due to its relatively close proximity to the PN site compared to the other critical groups. Based on a study from 2017 (OPG, 2024e), at a distance of 400 m from the NSS-PWMF, the measured air kerma rate was below the detection limit of 0.33 nGy/h. At a distance of 1 km from the NSS-PWMF, the air kerma rate was estimated to be negligible.

When the NSS-PWMF DSC Buildings #1 to #4 are filled to capacity, the calculated dose rate at the eastern lakeside exclusion zone boundary is $1.64x10^{-3}$ µSv/hr, or 1.64 µSv per year based on 1,000 hours occupancy. This is conservative for the Sport Fisher who is assumed to have 1% occupancy at the outfall, or 87.6 hours per year. By adjusting the occupancy to 1%, the predicted total annual dose to the Sport Fisher from the NSS-PWMF when DSC Buildings #1 to #4 are at capacity is 0.144 µSv (**Table 4-13**).

Table 4-13: Dose Rate at the NSS-PWMF Exclusion Zone Boundary

Occupancy	Dose Rate – Full Capacity (µSv/h)	Annual Dose – Full Capacity (µSv)
1,000 hrs/yr (11%)	$1.64x10^{-3}$	1.64
87.6 hrs/yr (1%)	$1.64x10^{-3}$	0.144

4.6.2 Ecological Dose

Ecological receptors are exposed to radiation fields and radionuclides released by the PN site during normal operations.

In the 2022 PN ERA, radiation dose benchmarks of 400 µGy/h (9.6 mGy/d) and 100 µGy/h (2.4 mGy/d) (UNSCEAR, 2008) were selected for the assessment of radiological effects on aquatic biota and terrestrial biota, respectively, as recommended in the CSA N288.6 standard. This is a total dose benchmark, therefore the dose to biota due to each radionuclide of concern is summed to compare against this benchmark. Further information as to the selection of these benchmarks is provided in Section 4.3.2 of the 2022 PN ERA (Ecometrix, 2023a).

A summary of estimated radiological doses for ecological receptors from the 2022 PN ERA is provided in **Table 4-14** below.

No exceedances of the selected radiation dose benchmarks were reported for any terrestrial and aquatic receptors assessed in the 2022 PN ERA, a conclusion shared with the prior 2017 PN ERA

report. The most recent maximum terrestrial dose was estimated to be $2.79x10^{-2}$ mGy/d for the Ring-billed Gull assessed at the Outfall. This dose represents 1.2% of the radiological dose benchmark of 100 µGy/h (2.4 mGy/d) for terrestrial ecological receptors. The maximum aquatic dose was estimated to be $3.82x10^{-2}$ mGy/d for benthic invertebrates in the Outfall. This dose represents 0.4% of the radiological dose benchmark of 400 µGy/h (9.6 mGy/d) for aquatic ecological receptors.

The above results represent an improvement in the existing radiological conditions at the PN site from the earlier 2014 PN ERA, where it was estimated that the terrestrial radiological dose benchmark of 100 µGy/h (2.4 mGy/d) was exceeded for the Earthworm and Red-winged Blackbird receptors at the PN Site. It was noted at the time that the areas of high radiological exposure are highly localized near the RBs and do not present a risk to populations of earthworms and other soil-dwelling organisms across the overall PN site. The exceedance of the terrestrial benchmark for the Red-winged Blackbird was determined to be driven by the assumed ingestion of maximally exposed earthworms; however, since the blackbird is a mobile receptor and is unlikely to be ingesting maximally exposed earthworms at all times, the calculated mean dose was considered a more representative dose for the blackbird, which did not exceed the dose benchmark.

Overall, ecological receptors are not expected to be at risk of radiological effects from current environmental conditions at the PN site.

4.6.2.1 Radiological Dose from the NSS-PWMF

The dose rate for ecological receptors within the immediate vicinity of the NSS-PWMF could be up to 0.5 µGy/h (0.012 mGy/d), assuming full capacity of the NSS-PWMF (OPG, 2024j). The dose rate to any ecological receptors at the closest PN property boundary would be lower than 0.5 µGy/h (0.012 mGy/d). As noted in the 2022 PN ERA (Ecometrix, 2023a), the above assumption is conservative as it assumes the receptor is always located at the NSS-PWMF and does not incorporate an occupancy factor based on the fraction of time a receptor is likely to be in close proximity to the NSS-PWMF.

As noted above, the maximum dose rate to any ecological receptor residing in close proximity to the NSS-PWMF could be up to 0.012 mGy/d, which is lower than the 2.4 mGy/d radiation benchmark for terrestrial biota. When considering the maximum dose from the NSS-PWMF ($1.20x10^{-2}$ mGy/d) together with the maximum dose to any ecological receptor ($2.79x10^{-2}$ mGy/d for the Ring-Billed Gull) from being exposed to radionuclides through other existing PN operations (see **Table 4-14**), the total combined dose of $3.99x10^{-2}$ mGy/d remains below the 2.4 mGy/d radiation benchmark for terrestrial biota.

Table 4-14: Summary of Radiation Dose Estimates for Biota at the Pickering Site

Location	Receptor	Units	C-14		Cs-134		Cs-137		Co-60		Tritium (HTO+OBT)		I-131		Ar-41		Total Dose	
			Max	UCLM	Max	UCLM	Max	UCLM	Max	UCLM	Max	UCLM	Max	UCLM	Max	UCLM	Max	UCLM
Outfall	Benthic Fish	mGy/d	3.96E-05	2.18E-05	2.37E-02	1.47E-03	1.28E-06	6.78E-07	7.75E-07	5.58E-07	2.74E-05	2.43E-06	-	-	-	-	2.38E-02	1.49E-03
	Pelagic Fish	mGy/d	1.43E-05	3.11E-06	1.56E-02	9.61E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.57E-05	1.17E-05	-	-	-	-	1.56E-02	9.76E-04
	Benthic Invertebrate	mGy/d	1.40E-05	3.04E-06	3.82E-02	2.36E-03	0.00E+00	0.00E+00	3.36E-06	2.42E-06	2.58E-05	1.17E-05	-	-	-	-	3.82E-02	2.38E-03
	Ring-Billed Gull	mGy/d	4.43E-03	2.03E-03	2.29E-02	1.44E-03	2.37E-05	2.37E-05	3.97E-05	3.93E-05	5.17E-04	2.16E-04	1.01E-11	1.76E-12	7.05E-05	9.82E-06	2.79E-02	3.76E-03
PN Site	Earthworm	mGy/d	1.81E-04	3.63E-05	2.00E-05	2.00E-05	7.35E-06	7.35E-06	3.14E-05	3.10E-05	5.96E-04	2.47E-04	1.06E-08	1.84E-09	7.05E-05	9.82E-06	9.07E-04	3.52E-04
	Grass/Shrub	mGy/d	2.16E-04	4.33E-05	7.54E-05	7.54E-05	2.86E-05	2.86E-05	1.16E-04	1.12E-04	5.74E-04	2.38E-04	1.02E-07	1.77E-08	7.05E-05	9.82E-06	1.08E-03	5.07E-04
	Pine	mGy/d	2.16E-04	4.33E-05	2.25E-05	2.25E-05	8.14E-06	8.14E-06	3.54E-05	3.40E-05	5.74E-04	2.38E-04	5.77E-09	1.00E-09	7.05E-05	9.82E-06	9.26E-04	3.55E-04
	Red-winged Blackbird	mGy/d	3.68E-04	7.39E-05	3.30E-05	3.16E-05	1.14E-05	1.14E-05	4.78E-05	4.69E-05	3.25E-04	1.35E-04	8.19E-11	1.42E-11	7.05E-05	9.82E-06	8.56E-04	3.08E-04
	Red-tailed Hawk	mGy/d	4.84E-04	9.70E-05	3.34E-05	3.15E-05	1.13E-05	1.13E-05	4.69E-05	4.68E-05	1.85E-04	7.69E-05	2.84E-11	4.92E-12	7.05E-05	9.82E-06	8.30E-04	2.73E-04
	Red Fox	mGy/d	2.95E-03	1.33E-03	3.54E-05	3.41E-05	2.85E-05	2.83E-05	4.54E-05	4.54E-05	3.27E-04	1.36E-04	2.35E-09	4.07E-10	7.05E-05	9.82E-06	3.46E-03	1.58E-03
	Meadow Vole	mGy/d	4.34E-04	8.69E-05	3.18E-05	3.13E-05	1.17E-05	1.17E-05	4.95E-05	4.94E-05	2.51E-04	1.05E-04	1.27E-08	2.20E-09	7.05E-05	9.82E-06	8.48E-04	2.94E-04
	White-tailed Deer	mGy/d	4.34E-04	8.69E-05	2.30E-05	1.66E-05	5.87E-06	5.87E-06	2.63E-05	2.52E-05	2.83E-04	1.18E-04	8.22E-08	1.42E-08	7.05E-05	9.82E-06	8.42E-04	2.62E-04
Frenchman's Bay	White Sucker	mGy/d	1.74E-03	9.15E-04	1.72E-03	1.72E-03	1.55E-03	1.54E-03	3.92E-05	3.23E-05	6.16E-06	4.10E-06	-	-	-	-	5.05E-03	4.21E-03
	Lake Trout	mGy/d	1.74E-03	9.15E-04	1.72E-03	1.72E-03	1.54E-03	1.54E-03	3.06E-05	3.06E-05	6.16E-06	4.10E-06	-	-	-	-	5.03E-03	4.21E-03
	Frog	mGy/d	1.74E-03	9.15E-04	8.10E-04	8.10E-04	1.13E-03	1.12E-03	2.09E-05	1.33E-05	6.16E-06	4.10E-06	-	-	-	-	3.70E-03	2.87E-03
	Aquatic Plant	mGy/d	1.80E-03	9.47E-04	6.44E-05	6.43E-05	8.19E-05	7.59E-05	1.79E-04	1.71E-04	5.95E-06	3.96E-06	-	-	-	-	2.13E-03	1.26E-03
	Benthic Invertebrate	mGy/d	1.70E-03	8.93E-04	3.17E-05	3.10E-05	6.24E-05	3.56E-05	5.40E-05	2.42E-05	6.18E-06	4.11E-06	-	-	-	-	1.85E-03	9.88E-04
	Bufflehead	mGy/d	7.28E-03	3.83E-03	8.87E-05	8.85E-05	8.45E-05	7.55E-05	6.34E-05	5.50E-05	1.11E-05	6.50E-06	1.28E-14	2.23E-15	9.84E-06	3.71E-06	7.54E-03	4.06E-03
	Common Tern	mGy/d	3.51E-03	1.85E-03	2.17E-03	2.17E-03	1.85E-03	1.85E-03	2.68E-05	1.87E-05	7.94E-06	4.41E-06	1.21E-14	2.10E-15	9.84E-06	3.71E-06	7.58E-03	5.90E-03
	Trumpeter Swan	mGy/d	3.51E-03	1.85E-03	1.26E-04	1.26E-04	1.14E-04	1.06E-04	1.80E-04	1.71E-04	7.78E-06	4.30E-06	1.37E-14	2.37E-15	9.84E-06	3.71E-06	3.94E-03	2.26E-03
	Ring-billed Gull	mGy/d	1.05E-02	5.55E-03	1.34E-03	1.34E-03	1.15E-03	1.14E-03	5.90E-05	5.10E-05	1.55E-05	9.06E-06	1.33E-14	2.31E-15	9.84E-06	3.71E-06	1.31E-02	8.09E-03
	Muskrat	mGy/d	2.89E-03	1.52E-03	7.94E-05	7.92E-05	8.59E-05	7.87E-05	1.66E-05	8.12E-06	7.33E-06	4.19E-06	8.86E-13	1.53E-13	9.84E-06	3.71E-06	3.09E-03	1.70E-03

Source: (Ecometrix, 2023a)
Note:
Dashed line indicates radionuclide not assessed for the specified receptor.
Bold and shaded values exceed the aquatic benchmark of 9.6 mGy/d or the terrestrial benchmark of 2.4 mGy/d.
Max and mean dose for Cobalt-60, Cesium-134, and Cesium-137 are generally equivalent for most receptors since their concentrations in surface water, sediment, and soil were generally measured below the detection limit. Iodine-131 and Argon-41 are only applicable to terrestrial and riparian biota.
HTO – tritiated water; OBT – organically bound tritium.

4.7 Uncertainty in the Existing Conditions

Considering the effort spent in 2024 and 2025 to collect additional data on existing conditions at the PN site, including supplementary studies for air quality data, noise levels, surface water and sediment quality, soil quality, fish tissue, and aquatic habitat characterization; along with OPG's routine annual EMP and GWMP, the PN Site is well-characterized.

Components that were only sampled during one season were based on standard methodologies and biological considerations of those individual components of the environment. Rationale for why a single sampling campaign was considered adequate are outlined in further detail below.

Soil samples were collected during a single event because it is not anticipated that the concentrations of parameters will have seasonal variability. This rationale was also applied to sediment samples collected from Frenchman's Bay, which were collected in the summer. Fall sediment samples were, however, added to the 2024 and 2025 sampling plans to obtain data from additional areas that could potentially be affected by activities associated particularly with the development of the Deep Water Intake and previously proposed structures such as the Infill and Shoreline Erosion Mitigation Areas.

Another example was continuous noise monitoring, which was completed over a 10-day period in September 2024 at four locations representing the nearest sensitive areas to the PNGS. This monitoring was carried out in accordance with the MECP Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning (NPC-300) (MECP, 2013a). This guideline only requires a minimum monitoring duration of 48 hours, which was greatly exceeded during this program to ensure a more comprehensive assessment of current noise conditions on site. Seasonal variation in ambient sound levels in the vicinity of the PNGS is expected to be minimal, as the dominant contributors to the acoustic environment (i.e., the highway and local road traffic, ongoing facility operations, and other surrounding industrial activities) are mostly continuous and steady-state in nature. As such, the single campaign conducted in September 2024 was considered adequately representative of typical acoustic conditions, and completion of additional seasonal monitoring campaigns was not warranted.

Aquatic habitat surveys were conducted in 2024 and 2025 to determine substrate type and distribution throughout the study area. At the depths sampled, substrates are not expected to change seasonally, and therefore a single season survey for each portion of the Aquatic Study Area is adequate to determine substrate types throughout the study area. However, an underwater camera was routinely used during biological surveys (which are conducted across multiple seasons) to provide information on algal growth in the sampling areas, and to confirm that the substrate type is suitable for sampling (i.e., fine substates are targeted during benthic invertebrate sampling), thus providing sufficient opportunity to verify documented substate types.

Within freshwater systems, aquatic benthic invertebrates are typically collected during the fall season as it is the time of year when benthic invertebrate communities reach their peak in biomass and diversity. Many species have completed their life cycles and are present in their most identifiable and mature forms, making taxonomic identification easier and more accurate.

Sampling uncertainty related to sampling location in the 2024-2025 aquatic studies was minimized through the use of industry best practices. The sampling design incorporated randomized site selection for the ichthyoplankton tows and the deepwater fish community study to ensure representative coverage of the study area. As a result of this randomized approach, some grids were not sampled during certain sampling events. For example, specific grids associated with the preferred intake locations (S2 and S5) were not sampled in some instances. Although these grids were not sampled directly, nearby sampled grids (S1, S3, S4, S6, and, to a lesser extent, S8 and S14) share comparable substrate composition and occur within similar depth bands where fish were observed. This similarity suggests that these unsampled grids likely provide comparable habitat quality capable of supporting multiple life stages, including eggs, larval fish, and adults. Therefore, the overall aquatic study design is considered robust and associated with a low level of sampling uncertainty.

Several steps were taken to reduce uncertainty in 2025 Air Quality and 2024 Noise Monitoring Program as well. This included the selection of proven instrumentation referenced by the U.S. EPA and endorsed by the Ontario MECP and ECCC; careful siting of instruments in accordance with Ontario MECP and ECCC guidelines (e.g., inlet height, distance to obstructions) and prevailing meteorological conditions; and use of accredited laboratories. Despite these measures, there are inherent uncertainties when using fixed monitoring locations to represent air concentrations or noise levels over a large area. Influencing factors such as wind direction, speed, and localized emissions (e.g., highways, rail corridors, industrial operations, smog events) can vary widely in space and time. However, the objective of these monitoring programs was to characterize average existing conditions and incorporate these data into air quality and noise modelling in support of this PERA. The rigorous siting process and quality protocols, established in line with ECCC and MECP requirements, are expected to mitigate uncertainty to the extent possible.

Existing conditions of locally harvested foods, other than fish, have not been characterized in the PERA. OPG will continue to engage with Indigenous Nations and communities on this PERA via regularly scheduled meetings to develop guidance around how to identify and incorporate Harvester information and locally harvested foods into the PERA. Feedback received on these topics can help refine future ERAs, PERAs, and EMPs. Modelling environmental concentrations in mammals and birds is usually preferred over sampling/analysis unless there are opportunistic samples available (i.e., through roadkill).

The sampling plan was designed following industry standards, which indicate that components sampled for a single season were appropriately timed and did not require seasonal sampling. The level of uncertainty in the information used to characterize existing site conditions is

considered low and appropriate for the assessment of potential risk. No other residual uncertainties in the existing environment site characterization have been identified.

Furthermore, it is important to note that there was no significant data gap between 2020 and 2024, as environmental monitoring continued during this period through the annual EMP. The EMP routinely evaluates multiple environmental media and terrestrial biota, including air, sediment, water, soil, fruits, vegetables, animal feed, milk, eggs, and poultry for radionuclides associated with PN site operations. These monitoring results support public dose assessments and provide ongoing characterization of environmental conditions at the site and surrounding areas, which were used to support the PERA.

5.0 Tier 1 Qualitative Assessment

This section presents the qualitative Tier 1 assessment to identify Project interactions that are not bounded by existing conditions or previous assessments. The qualitative assessment utilizes the description of activities identified in **Section 3.0** that are planned to occur during PNGS Units 1-4 decommissioning and PNGS Units 5-8 refurbishment and continued operations, and the understanding of existing conditions identified in **Section 4.0** to identify potentially increasing interactions with environmental components during the Project phases.

Where Project-environment interactions are bounded by previous operational conditions as assessed in the 2022 PN ERA for 6 operating units (Ecometrix, 2023a), or other assessments such as the 2017 Safe Storage PEA and 2022 PEA Addendum, they are considered to be adequately assessed and are not considered further in this PERA. While additional environmental data have been collected since the 2022 PN ERA, no material change in emissions or receiving environment conditions has occurred as described in **Section 4.0**.

The existing operating licence for PNGS allows for OPG to operate PNGS Units 1 and 4 until the end of 2024, operate PNGS Units 5-8 until the end of 2026, and perform Stabilization and SWS activities.

As shown in the conceptual timeline for the Project in **Figure 1-2**, there will be activities occurring in one phase that occur at the same time as another phase. For example, while PNGS Units 1 and 4 are in the Stabilization Phase, and PNGS Units 2 and 3 are in SWS phase, risk reduction and removal activities will also occur, along with PNGS Units 5-8 refurbishment activities, and construction of the DWI. The assessment by environmental component considers activities that are occurring at the same time, where relevant.

Those Project-environment interactions not readily bounded by previous operational conditions in the 2022 PN ERA (for 6 operating units), or by previous assessment in the 2017 Safe Storage PEA and 2022 PEA Addendum, are considered in this PERA to identify whether predicted effects could exceed accepted screening values for the protection of human health and the environment. If screening values are predicted to be exceeded, the interactions are evaluated further in the Tier 2 quantitative assessment (**Section 6.0**).

The results of the qualitative assessment of Project-environment interactions are shown in **Table 5-1** and described in the subsections below by environmental component: atmospheric environment (air, noise), surface water environment (surface water flow, surface water and sediment quality), geological and hydrogeological environment (soil, groundwater), radiation and radioactivity, aquatic environment (fish and fish habitat, benthic invertebrates), and terrestrial environment (vegetation, wildlife).

The main constituents of potential concern, their sources, and exposure pathways are identified for relevant environmental components at the end of each subsection.

Table 5-1: Identification of Project-Environment Interactions

Project Activities	Atmospheric Environment (Air/Noise)	Surface Water Environment - Flow	Surface Water Environment - Quality	Hydrogeological and Geological Environment – Groundwater Flow	Hydrogeological and Geological Environment – Groundwater Quality	Hydrogeological and Geological Environment - Soils	Radiation and Radioactivity (Gamma Radiation Field)	Terrestrial Environment	Aquatic Environment
PNGS Units 1-4 Decommissioning									
PNGS Units 1 and 4 Stabilization	✓	✓	✓	✓	✓	✓	✓	✓	✓
PNGS Units 1-4 Storage with Surveillance	✓	✓	✓	✓	✓	✓	✓	✓	✓
Risk Reduction and Removal Activities	✓	-	-	✓	✓	✓	-	✓	-
Dismantle/Demolish	✓	-	-	✓	✓	✓	✓	✓	-
PNGS Units 5-8 Refurbishment									
Preparation for Refurbishment									
• Procurement and Mobilization of Equipment and Components	✓	-	-	-	-	-	-	✓	✓
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	✓	-	-	✓	-	✓	-	✓	-
• Construction of PCSS and SB5	✓	-	-	✓	-	✓	-	✓	-
• Defuel and Dewater	✓	✓	✓	-	-	-	-	-	-
• Islanding the Unit	-	-	-	-	-	-	-	-	-
• Management of Heavy Water	✓	-	-	-	-	-	-	-	-
• Construction of DWI	✓	✓	✓	✓	-	-	-	✓	✓
Refurbishment									
• Replacement of Reactor Components	✓	-	-	-	-	-	-	-	-
• Removal and Replacement of Steam Generators	✓	-	-	-	-	-	-	-	-
• Operation of DWI	-	✓	✓	-	-	-	-	-	✓
• Refurbishment of Other Plant Systems	✓	-	-	✓	-	-	-	-	-
• Waste Management and Transportation	✓	-	-	-	-	-	✓	✓	-
• Refuelling and Restarting	✓	✓	✓	-	-	-	-	-	-

Project Activities	Atmospheric Environment (Air/Noise)	Surface Water Environment - Flow	Surface Water Environment - Quality	Hydrogeological and Geological Environment – Groundwater Flow	Hydrogeological and Geological Environment – Groundwater Quality	Hydrogeological and Geological Environment - Soils	Radiation and Radioactivity (Gamma Radiation Field)	Terrestrial Environment	Aquatic Environment
Continued Operations									
• Operation and Maintenance of PNGS Units 5-8	✓	✓	✓	✓	✓	✓	✓	✓	✓
• Waste Management and Transportation	✓	-	-	-	-	-	✓	✓	-

Note:

✓: Indicates an interaction between the Project activity and the environmental component. The Tier 1 assessment determines if this interaction is negligible and/or bounded by another previous assessment (2017 Safe Storage PEA and 2022 PEA Addendum, the PCSS PERA, or 2022 PN ERA), or if further quantitative evaluation in the Tier 2 assessment is warranted.

- : Indicates no interaction between the Project activity and the environmental component.

5.1 Atmospheric Environment

5.1.1 Air Quality

5.1.1.1 PNGS Units 1-4 Decommissioning

5.1.1.1.1 Stabilization and Storage with Surveillance

Non-Radiological Emissions

As stated in the 2017 Safe Storage PEA and updated in the 2022 PEA Addendum, non-radiological emissions will gradually decrease during the Stabilization Phase compared to previous operations (6 operating units). Steam generating boilers for electricity production are the only emission sources with the potential to change emissions notably. Starting in 2026, emissions will be reduced, as 4 electrode boilers will be used to provide steam for building heating. The Standby Boiler will be only used if required to meet peak load. As detailed in **Table 4-3** of the 2017 Safe Storage PEA, combustion emissions associated with the Standby Boiler include NOx, CO, SO_2, and particulate matter (PM_{10} and $PM_{2.5}$). No other substantial changes to non-radiological atmospheric emission sources are anticipated. These findings from the 2017 Safe Storage PEA and updated in the 2022 PEA Addendum continue to remain valid for Stabilization and SWS; therefore, no further assessment is conducted in this PERA.

Radiological Emissions

As indicated in the 2017 Safe Storage PEA and 2022 PEA Addendum, tritium is released to the environment during reactor dewatering and draining during the Stabilization Phase. It was concluded that previous operational conditions (for 6 operating units) are bounding of tritium emissions to air during the Stabilization Phase. Additionally, tritium and C-14 emissions during SWS will be even lower and remain below existing emissions assessed in the 2022 PN ERA (for 6 operating units). Even though tritium and C-14 emissions are expected to be lower than existing emissions (for 6 operating units), the 2017 Safe Storage PEA evaluated the resulting radiation dose to human receptors in the vicinity of PN and it was determined to be a small fraction of the public dose limit. These findings from the 2017 Safe Storage PEA and updated in the 2022 PEA Addendum continue to remain valid for Stabilization and SWS; therefore, no further assessment is conducted in this PERA.

While no specific radiological COPCs were identified for the atmospheric environment during Stabilization and SWS, general feedback from the WTFNs during engagement on other PERAs has indicated that it would be beneficial to include a Harvester receptor, to account for Indigenous people who may live and work near the facility and consume traditional foods harvested near the facility. As such, assessment of a Harvester for atmospheric radiological emissions is considered in the Tier 2 quantitative assessment.

The 2022 PEA Addendum identified that approximately 1,500 Mg of D_2O will be transported to the DN site for storage towards the end of the Stabilization Phase at the DN Heavy Water

Management Building – West Annex. The movement of D_2O to the DN site may result in some additional releases of tritium to air during the Stabilization Phase due to venting. However, PN currently transports D_2O to Darlington on a routine basis to modulate tritium concentration in the D_2O inventory. OPG will continue to use existing processes and practices of transporting D_2O and the frequency for transporting D_2O will be bounded by previous operational conditions (for 6 operating units). Additionally, OPG will manage D_2O in accordance with the D_2O Management Plan for Pickering Safe Storage. These findings from the 2022 PEA Addendum continue to remain valid for Stabilization and SWS; therefore, no further assessment is conducted in this PERA.

One activity not assessed in the 2017 Safe Storage PEA and 2022 PEA Addendum is removal of modules and baskets from the AIFB and IFB-A. Fuel baskets filled with fuel are moved from the IFB-A and taken to the AIFB for storage and fuel removal into DSCs. As fuel is removed, empty baskets and associated frames will be removed from the AIFB and IFB-A and disposed of using existing waste routes (see **Section 3.3.3.1**). The empty baskets are returned to the IFB-A. The modules and baskets will have some radiological contamination. Handling of this waste falls within the Radiation Protection Procedures and Waste Management Procedures used to safely and routinely handle LLW of this type at the station. If waste is identified that does not meet clearance criteria, OPG has procedures in place to appropriately handle radioactive waste before and during transportation.

The removal of modules and baskets does not result in any increase in emissions to the environment above normal operational levels and thus does not introduce any new pathway impacting ecological or human health.

5.1.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities. As identified in **Section 3.3.4**, during the 2025 to 2033 timeframe OPG plans to initiate risk reduction and removal activities, which will include dismantling of non-nuclear systems and outbuildings. More specifically, PE-A (Groups A-1 and A-2) includes dismantling and removal of end-stated and abandoned/retired structures within the PNGS Units 1-4 protected area, excluding the main powerhouse structure; and PE-B (Groups B-1 and B-2) includes the dismantling and removal of SSCs considered to be non-nuclear that are located within the TH and TAB.

From 2034 to 2036, OPG plans to execute PE-A (Group A-3) which includes complete removal of non-nuclear outbuildings, as identified in **Figure 3-7**.

Non-Radiological Emissions

During dismantling of non-nuclear systems and outbuildings, air emissions may result from general activities such as clearing of the work area and accessing the structure, which involve vehicle movement, and lifting and removing structures. Dismantling and/or segmenting larger tanks and water lines may emit particles or fumes from the grinding work. It is expected that all

grinding and segmentation work would be carried out indoors in a ventilated environment. Work related to CCW lines may include hazards from asbestos in gaskets, tiles and insulation. These hazards will be mitigated by complying with OPG's Asbestos management procedures. OPG will follow typical construction best practices including implementation of an Environmental Management Plan. The decommissioning phase work plan will include protocols for dust suppression to reduce the release of particulates and dust into the atmosphere. Other hazardous materials (e.g., mercury, lead, PCBs, etc.) that are identified will be mitigated by following OPG-PROC-0125 (Management of Substances other than Asbestos). Vehicle traffic associated with transporting dismantled material off-site will be similar to or slightly higher than the traffic associated with current PN operations; thus, the slight increase of traffic volumes would overall be considered negligible. OPG's implementation of an Environmental Management Plan is sufficient to mitigate the expected negligible impacts.

Radiological Emissions

No radiological atmospheric emissions to the environment are expected during the dismantling and demolition activities. Other than removal of frames and baskets from IFB-A and AIFB, none of the dismantled equipment are from radiological systems or systems that are likely to be radiologically contaminated. All waste being transported will be radiologically surveyed before transportation and disposal, as part of best practices and in accordance with existing procedures of waste removal.

Execution of PE-A-3 (dismantle/demolish activities from 2034 to 2036) involves complete removal of non-nuclear outbuildings shown in **Figure 3-7**. Complete removal for these specific non-nuclear outbuildings may have residual radiological contamination. The specific plans for environmental risk mitigation and strategy to execute any radiological work safely will be determined via the completion of a Decommissioning Safety Assessment, which is planned for the next DDP update. All SSCs will be characterized prior to dismantling and demolishing in accordance with OPG's Characterization Implementation Strategy which follows industry best practices (OPG, 2024k).

Overall, air emissions during risk reduction and dismantle/demolish activities during this licensing period will be similar to that assessed in the 2022 PN ERA with 6 operating units; therefore, no further assessment is warranted in the PERA.

5.1.1.2 PNGS Units 5-8 Refurbishment

Non-Radiological Emissions

During routine operations at the PN site, there are emissions to air from boiler chemicals, ventilation and chemical use, combustion equipment, and vehicular movement. During preparation for refurbishment, releases to the atmospheric environment are expected from construction activities as well as activities during refurbishment such as replacement of reactor components, removal and replacement of steam generators, waste management, and refuelling

and restarting. Similar to SWS, during Refurbishment, in 2026 the heating source will transition to electrode boilers and the Standby Boiler will be available on standby.

To support this PERA, a maximum bounding emission scenario was developed to assess the effects of refurbishment and decommissioning activities. The bounding scenario considered was the combined emissions from activities that will occur on the PN site in 2027 for both PNGS Units 5-8 refurbishment as well as PNGS Units 1-4 decommissioning activities. A screening activity was performed to identify all activities that will occur during all Project phases, and the year 2027 was identified as the bounding case where maximum emissions from equipment and vehicular traffic are expected.

Potential effects associated with site and facility preparation for refurbishment, management of D_2O, transfer of low and intermediate level refurbishment waste, transportation of low and intermediate level refurbishment waste, and the management of non-nuclear waste were not considered for the bounding scenario as they are only a small fraction of the potential effects from the bounding emission scenario.

Construction equipment, such as cranes, forklifts, excavators and loaders, will be used during the site preparation earthworks and the removal and replacement of steam generators. Emissions will be dominated by diesel combustion and mechanically generated dust and will result in the release of constituents such as particulate matter (TSP, $PM_{2.5}$, and PM_{10}), CO, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), PAHs, and VOCs.

During preparation for refurbishment, the PCSS, RFRISA, and other buildings needed to support refurbishment will be constructed. Activities associated with the construction of the PCSS for the storage of low and intermediate-level refurbishment waste were assessed as part of the PCSS PERA (Ecometrix, 2024). The activities associated with construction of the RFRISA are expected to be similar to the PCSS. While construction of these buildings is not explicitly included in the updated air model for this PERA, the results of the air model are considered bounding of building construction.

Additionally, construction is planned for SB5 in the NSS-PWMF Phase II Site for future storage of used fuel, with an in-service date of Q3 2027. Assessment of the construction of SB5 was completed as part of the approved Pickering B Refurbishment EA.

The source term for the maximum bounding emission scenario was developed from a comprehensive inventory of major project activities and sources, with emission estimates based on maximum design capacities, bounding operating conditions, and conservative emission factors. Further conservatism was built into the modelling by applying upper-bound emission rates and background concentrations, worst-case meteorological conditions, and the assumption of simultaneous operations, even where co-occurrence is unlikely. A broad range of significant equipment and activities were explicitly included, such as cranes, excavators, trucks, pile drivers, harbour tugs, and diesel generators, ensuring that the emissions inventory is comprehensive and precautionary. Given this worst-case bounding approach, it was not

necessary to separately model construction of the RFRISA, PCSS, SB5, and other auxiliary structures.

During refurbishment, the steam generators (also known as boilers) will be physically removed and replaced. A temporary construction opening will be created in the roof of the RBs to allow for extraction of the large steam generators. It is assumed that any concrete cutting will be done with wet methods (i.e., hydrojet cutting) and will have spray drift covers, thus ensuring that dust emissions are minimal.

Refurbishment activities will also involve metal cutting and welding within the RBs to remove and replace reactor components. The RBs will generally remain sealed; therefore, emissions from this activity would be contained within the building. Given that these activities would still occur within the building and would likely be minimized during these complicated lift operations, emissions released from the building are considered to be insignificant and are not considered further.

The maximum bounding emission scenario also considered on-site vehicular traffic (approximately 2,200 vehicles per day), specifically haul trucks for movement of material associated with refurbishment activities (i.e., hauling of excavated materials, concrete trucks supporting construction), as well as employee and delivery traffic from previous conditions (with 6 operating units) and additional refurbishment contract employee and delivery traffic.

Sources of emissions considered in the model included combustion emissions from construction equipment, activity in the harbour (tugboats), tailpipe emissions and re-suspended road dust generated by vehicle movements, wind-blown dust from construction sites, and dust generated from material handling (e.g., fugitive dust from transferring excavated materials to trucks). With regard to combustion emissions, it was assumed that diesel fuel would be used to run construction equipment. With regard to fugitive dust emissions (i.e., from road dust, wind erosion and material handling), it was assumed that watering methods would be utilized as a dust control measure, and this was accounted for in the modelling. The constituents that were modelled included: NO_2, sulphur dioxide, CO, TSP, $PM_{2.5}$, PM_{10}, benzo(a)pyrene (surrogate for total PAHs), and acrolein (representative of VOCs).

5.1.1.2.1 Model Methodology and Assumptions

Air dispersion modelling for this project was conducted using AERMOD (version 19191), an MECP-approved model under Ontario Regulation 419/05: Air Pollution – Local Air Quality. To ensure consistency, the corresponding AERMET (version 19191) was used to process meteorological inputs. The meteorological dataset (2013–2017) was prepared by the MECP, which represented the most recent MECP-approved dataset available for the project at the time.

The modelling incorporated local terrain features from the Canadian Digital Elevation Model (CDEM) in GeoTIFF format and included existing site and building layouts to account for building downwash and site geometry. Work area locations and emission source information

were supplied by OPG and its contractors to ensure the model accurately reflected site-specific conditions.

The inventory of construction equipment included equipment type, estimated rated power, fuel type, usage parameters (e.g., hours per day, days per year), load factors, and fuel consumption rates. These data, combined with published emission factors, were used to estimate emission rates for atmospheric releases. Emission estimates assumed high equipment utilization, representative upper-bound load factors, and published emission factors without adjustment for operational variability. Emission factors were obtained from well recognized sources including the US EPA and manufacturer specifications.

Emission sources considered in the model include:

- Tailpipe emissions for mobile equipment;
- Combustion emissions from diesel generators and tugboats operating in the harbour,
- Re-suspended road dust from vehicle movements,
- Wind-driven re-suspension of surface dust, and
- Fugitive dust from material handling (e.g., loading/unloading excavated material).

Fugitive dust emissions from material handling and road dust sources were estimated using control efficiencies consistent with active dust suppression practices. Specifically, a control efficiency of 61% was applied to reflect the use of watering as a dust control measure. This approach is consistent with guidance provided in the WRAP Fugitive Dust Handbook for estimating emissions from fugitive dust sources subject to active water application controls (Countess Environmental, 2006).

5.1.1.2.2 Screening of Atmospheric Non-Radiological Constituents of Potential Concern

The changes to the air model between R00 and R01 of the PERA are from application of the updated existing concentrations for NO_2, SO_2, CO, and BaP from the on-site air monitoring station (see **Table 4-4**). Re-modelling was completed using the refined background values to ensure that predicted total concentrations reflect the most appropriate estimate of cumulative air quality conditions.

While the revised existing concentrations resulted in numerical adjustments to the model results, the updates did not materially alter:

- Dominant emission source identification,
- Spatial distribution of predicted effects,
- Compliance interpretations, or
- Overall assessment conclusions.

The modelled concentrations of non-radiological COPCs in air were compared against provincial and federal ambient air quality standards, including the MECP AAQCs (MECP, 2023) and CAAQS from the CCME (CCME, 2019) to determine whether modelled concentrations of atmospheric COPCs could pose a risk to human and ecological receptors. Modelled concentrations were directly compared to guidelines with the same averaging periods. The air quality criteria with averaging times of 24 hours or longer are considered protective of chronic health effects, while air quality criteria with averaging times of 1-hr and 8-hr are considered protective of short-term health effects. The air quality guidelines used as part of this risk assessment are shown in **Table 5-2**. The human and ecological receptor locations retained for the air quality modelling assessment are shown in **Figure 5-1** and **Figure 5-2**, respectively.

The human receptor locations are generally consistent with existing receptor locations considered in OPG's existing annual EMP (OPG, 2024e) and the 2022 PN ERA (Ecometrix, 2023a), except for the new Harvester and three Local Harvesting Area locations. The Harvester is assumed to live close to the PN site (at the Urban Resident) and also hunts and gathers traditional foods at Hydro Marsh (R1-R3, three assumed local harvesting areas). The ecological receptor locations were chosen from a larger list of locations used in the air quality and noise modelling for the PERA. Some locations overlap with those in the 2022 PN ERA, and an additional location (R3) was included to represent ecological receptors in Hydro Marsh.

A summary of the predicted exceedances of applicable AAQC are shown in **Table 5-3**. Detailed results of the air modelling and comparison with applicable AAQC are presented from **Table 5-4** to **Table 5-11**. To put these concentrations into context, screening level HQs for all human receptors have been calculated using the applicable AAQC as the TRVs for the air quality parameters that exceeded the applicable criteria (**Appendix B**). Screening level HQs above 1 require further discussion. Discussion of AAQC and HQ exceedances, and a summary of the non-radiological emission screening, are provided in **Section 5.1.1.2.2.1** and **Section 5.1.1.2.2.2** for human and ecological receptors, respectively.

Table 5-2: Ambient Air Quality Screening Criteria

Constituent	Units	Averaging Period	Value	Basis	Reference	Notes
Total suspended particulates (TSP)	µg/m^3	24-hr	120	Visibility	(MECP, 2023)	-
	µg/m^3	Annual	60	Visibility	(MECP, 2023)	-
Particulate matter <10 µm (PM_{10})	µg/m^3	24-hr	50	Health	(MECP, 2023)	-
Particulate matter <2.5 µm ($PM_{2.5}$)	µg/m^3	24-hr	27	Health / Environment	(CCME, 2019; MECP, 2023)	-
	µg/m^3	Annual	8.8	Health / Environment	(CCME, 2019; MECP, 2023)	-
Sulphur dioxide (SO_2)	µg/m^3	1-hr	170	Health / Environment	(CCME, 2019)	Converted from 65 ppb, where 1 ppb of SO_2 is equal to 2.62 µg/m^3 at 20°C and 1 atm.
	µg/m^3	1-hr	105	Health	(MECP, 2023)	Converted from 40 ppb, where 1 ppb of SO_2 is equal to 2.62 µg/m^3 at 20°C and 1 atm.
	µg/m^3	Annual	11	Vegetation	(CCME, 2019; MECP, 2023)	Converted from 4 ppb, where 1 ppb of SO_2 is equal to 2.62 µg/m^3 at 20°C and 1 atm.
Nitrogen dioxides (as NO_2)	µg/m^3	1-hr	79	Health / Environment	(CCME, 2019)	Converted from 42 ppb, where 1 ppb of NO_2 is equal to 1.88 µg/m^3 at 20°C and 1 atm.
	µg/m^3	1-hr	400	Health	(MECP, 2023)	-
	µg/m^3	24-hr	200	Health	(MECP, 2023)	-

Constituent	Units	Averaging Period	Value	Basis	Reference	Notes
	µg/m^3	Annual	23	Health / Environment	(CCME, 2019)	Converted from 12 ppb, where 1 ppb of NO_2 is equal to 1.88 µg/m^3 at 20°C and 1 atm.
Carbon monoxide (CO)	µg/m^3	1-hr	36,200	Health	(MECP, 2023)	-
	µg/m^3	8-hr	15,700	Health	(MECP, 2023)	-
Acrolein	µg/m^3	1-hr	4.5	Health	(MECP, 2023)	Surrogate for Volatile Organic Compounds (VOCs) without separate AAQC.
	µg/m^3	24-hr	0.4	Health	(MECP, 2023)	
Benzo(a)pyrene (BaP)	µg/m^3	24-hr	0.00005	Health	(MECP, 2023)	Surrogate for total Polycyclic Aromatic Hydrocarbons (PAHs) without separate AAQC.
	µg/m^3	Annual	0.00001	Health	(MECP, 2023)	

Note:
µg/m^3 – micrograms per cubic meter.
ppb – parts per billion.
atm – standard atmosphere of pressure.
MECP, 2023 – Ontario's Ambient Air Quality Criteria (AAQC).
CCME, 2019 – CCME's Canadian Ambient Air Quality Standards (CAAQS).

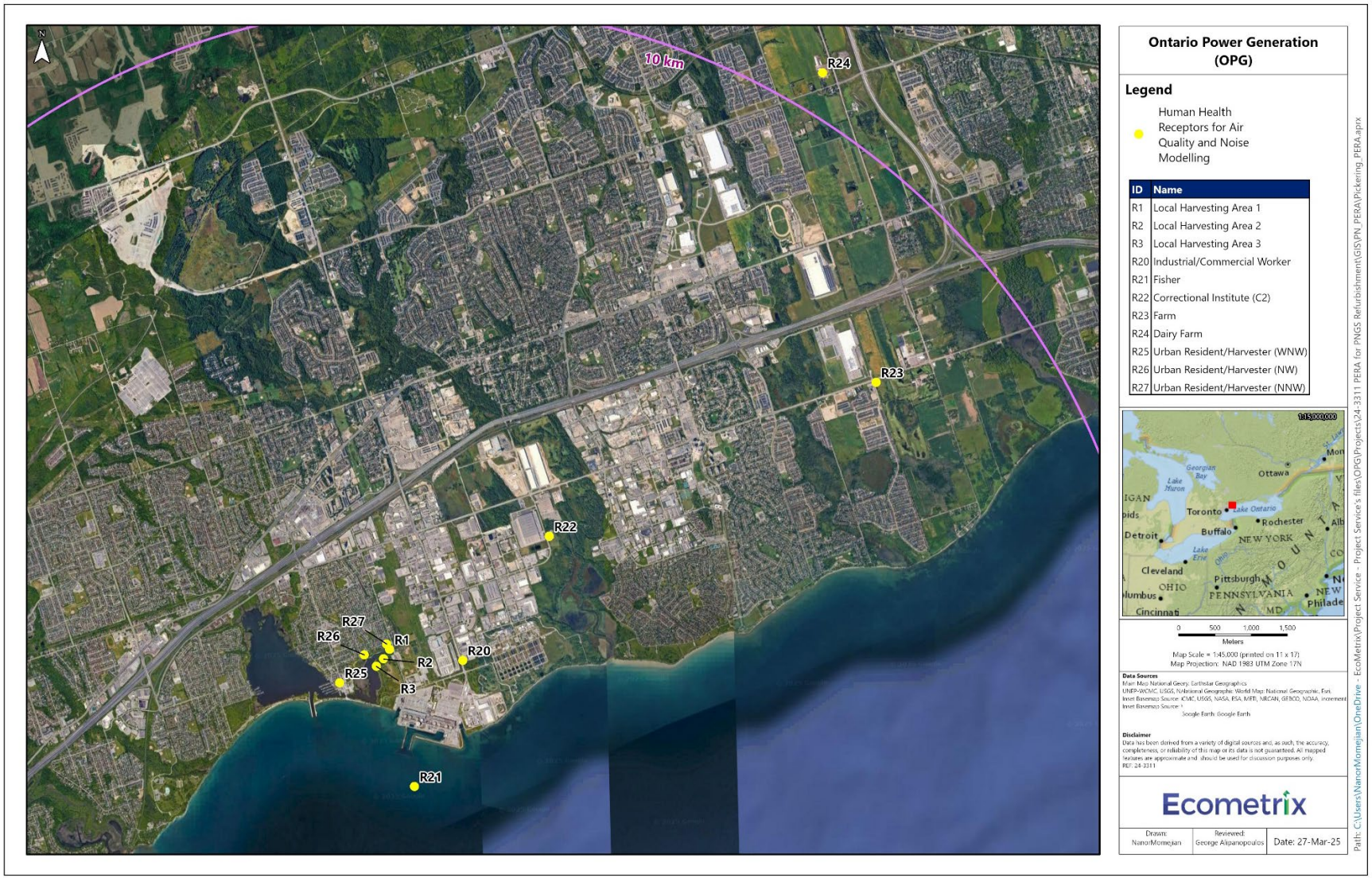


Figure 5-1: Human Health Receptors for Air Quality and Noise Modelling



Figure 5-2: Ecological Receptor Locations for the Air Quality and Noise Modelling

Table 5-3: Summary of Exceedances of Ambient Air Quality Guidelines during PNGS Units 5-8 Refurbishment

Constituent	Averaging Period	Existing Conditions	Refurbishment
Total suspended particulates (TSP)	24-hr	-	✓
	Annual	-	-
Particulate matter <10 µm (PM_{10})	24-hr	-	✓
Particulate matter <2.5 µm ($PM_{2.5}$)	24-hr	-	✓
	Annual	-	-
Sulphur dioxide (SO_2)	1-hr (CCME)	-	-
	1-hr (AAQC)	-	-
	Annual	-	-
Nitrogen dioxides (as NO_2)	1-hr (CAAQS)	-	✓
	1-hr (AAQC)	-	✓ (on-site)
	24-hr	-	-
	Annual	-	✓ (on-site)
Carbon monoxide (CO)	1-hr	-	-
	8-hr	-	-
Acrolein	1-hr	-	-
	24-hr	-	-
Benzo(a)pyrene (BaP)	24-hr	-	-
	Annual	✓	✓

Note:
✓ = exceedance of ambient air quality criteria at both human and ecological receptor locations.
✓ (on-site) = exceedance of ambient air quality criteria at on-site ecological receptor locations only.
- = no exceedance of ambient air quality criteria.

5.1.1.2.3 Discussion of Air Quality Modelling Results

5.1.1.2.3.1 Human Health

Ambient air concentrations at the human receptor locations shown in **Figure 5-1** were predicted for different averaging periods for TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, acrolein, and BaP. It is acknowledged that there are exceedances of the selected air quality criteria for some constituents at a number of the human receptor locations. The specific predicted exceedances are discussed below:

- TSP (**Table 5-4**): There are no exceedances of the annual TSP criterion of 60 µg/m^3 at any of the human receptor locations. There are predicted exceedances of the 24-hr TSP criterion of 120 µg/m^3 at a number of receptor locations, including the three local harvesting areas, the industrial/commercial worker, the correctional institute (C2), and the three urban resident/harvester locations. Except for the industrial/commercial worker, exceedances of the 24-hr criterion for TSP at the other receptor locations tend to be relatively infrequent (<45 days per year, representing approximately 12% of the year).

- PM_{10} (**Table 5-5**): There are predicted exceedances of the 24-hr PM_{10} criterion of 50 µg/m^3 at a number of receptor locations, including the three local harvesting areas, the industrial/commercial worker, and the three urban resident/harvester locations. Except for the industrial/commercial worker, exceedances of the 24-hr criterion for PM_{10} at the other receptor locations tend to be relatively infrequent (<8 days per year, representing approximately 2% of the year).

- $PM_{2.5}$ (**Table 5-6**): There are no exceedances of the annual $PM_{2.5}$ criterion of 8.8 µg/m^3 at any of the human receptor locations. There are predicted exceedances of the 24-hr $PM_{2.5}$ criterion of 27 µg/m^3 at one receptor location, specifically the industrial/commercial worker. Exceedances at the industrial/commercial worker are predicted to occur 249 days of the year.

- NO_2 (**Table 5-7**): There are no predicted exceedances of the maximum 1-hr (400 µg/m^3), 24-hr (200 µg/m^3) and annual (23 µg/m^3) air quality criteria for NO_2 at any of the human receptor locations. The 1-hr 98th percentile criterion of 79 µg/m^3 is predicted to be exceeded at the industrial/commercial worker and sport fisher receptor locations.

- SO_2, and CO (**Table 5-8** and **Table 5-9**): Predicted air concentrations for all averaging periods for SO_2 and CO are predicted to remain below air quality criteria at all human receptor locations.

- BaP (**Table 5-10**): There are no predicted exceedances of the 24-hr Benzo(a)pyrene (BaP) criterion of 5.00E-05 µg/m^3. Predicted BaP concentrations exceed the annual criterion of 1.00E-05 µg/m^3 at all human receptor locations. It should be noted that the existing annual concentration of BaP (2.04E-05 µg/m^3) is already above its respective criterion

without the addition of BaP from PN site activities. The maximum predicted annual incremental increase in BaP concentration resulting from planned Project activities represents a 5.61×10^{-11} % change from existing annual conditions. The incremental value for BaP was determined from the AERMOD air quality model developed for the bounding condition based on combustion sources including trucks, mobile construction equipment, and stationary combustion equipment such as diesel generators.

- Acrolein (**Table 5-11**): 24-hr and annual acrolein concentrations are predicted to be below their respective air quality criteria at all human receptor locations.

Total suspended particulates (TSP) and inhalable/respirable particulates (PM_{10}/$PM_{2.5}$)

The 24-hr TSP criterion of 120 µg/m^3 is from the Ontario MECP, which identifies visibility as the sensitive endpoint for the TSP criterion rather than human or ecological health. Elevated TSP concentrations are generally not considered to pose significant health risks because these particles are too large (50 – 100 µm) to be inhaled deep into the lungs; therefore, TSP is not considered for further assessment for human receptors in this PERA.

Occasional exceedances of the 24-hr PM_{10} criterion are predicted at various human receptor locations. To put these PM_{10} exceedances into context, HQs for all human receptors were calculated using the 24-hr AAQC as the TRV (**Table B-2**). HQs were greater than 1 for PM_{10} at the three local harvesting areas considered, for the industrial/commercial worker, and at the three urban resident/harvester receptor locations. Exposures to elevated concentrations of PM_{10} are associated with various adverse respiratory and cardiovascular effects in humans. When inhaled, PM_{10} can deposit onto surfaces of the upper region of the lungs. However, finer particles that can be inhaled deeply into the lungs (i.e., $PM_{2.5}$) are associated with greater risk because they are more chemically active, and have more complex characteristics than larger particles (HC, 2016a). If individuals are present during short periods of elevated PM_{10} they may experience short-term respiratory symptoms such as coughing, difficulty breathing, asthma symptoms and/or chronic bronchitis; however, effects should be reversible and subside after exposure. Excluding the industrial/commercial worker, exceedances of the 24-hr criterion for PM_{10} at the receptor locations further away from the PN site tend to be relatively infrequent (<8 days per year), suggesting that any short-term effects would be temporary and expected to subside after the exposure ends. Considering $PM_{2.5}$, and again excluding the industrial/commercial worker, no exceedances of the 24-hr criterion for $PM_{2.5}$, and consequently, no HQs greater than 1 (**Table B-3**), are predicted to occur at any of the other human receptor locations.

Considering the industrial/commercial worker, there are numerous predicted exceedances of both 24-hr criteria for PM_{10} and $PM_{2.5}$. The annual $PM_{2.5}$ criterion is not predicted to be exceeded at any human receptor locations, which is an indication that long-term, chronic health effects associated with $PM_{2.5}$ exposure are not expected to occur. However, daily exceedances of the 24-hr criteria can result in temporary respiratory symptoms. It is expected that OPG will develop and implement a dust management plan and utilize construction best practices to mitigate dust

and particulate generation during planned Project activities. Potential mitigation options to manage dust generation include the application of dust suppressants, stabilization of completed soil surfaces, and the suspension of dust-generating activities during periods of inclement weather. It is expected that dust mitigation measures would also reduce concentrations of smaller particulates (PM_{10} and $PM_{2.5}$), further limiting exposures to nearby human receptors. It should also be noted that the air quality modelling conducted for the PERA is extremely conservative in its assumptions, and is intended to represent a worst-case scenario for potential air quality impacts. The predicted concentrations were calculated assuming maximum equipment use, fuel consumption, and emission factors, without accounting for any significant variability in operational practices. As such, real-world emissions during the Units 5-8 refurbishment and Units 1-4 decommissioning activities are expected to be lower than those estimated in the modelled scenario.

Nitrogen oxides (NO_X)

HQs calculated using the 24-hr and annual screening criteria as TRVs are below 1 for all the human receptor locations **(Table 5-7**); therefore, no long-term effects are expected.

HQs calculated using the 1-hr screening criterion provided by the CCME are greater than 1 for the industrial/commercial worker and sport fisher receptors (**Table B-4**). Potential adverse health effects that are attributed to short-term exposures to ambient NO_2 include asthma exacerbations and possibly increased risk of cardiopulmonary effects, and to a lesser extent cardiovascular and respiratory mortality (HC, 2016b). Individuals with certain pre-existing diseases such as asthma appear to be sensitive to exposure to ambient NO_2. Although it has been suggested that there may not be a threshold for the health effects of NO_2, even considering short-term (1-hour) exposures (CCME, 2020), at least some reviews (Hesterberg et al., 2009) do not support this assertion and rather support a 1-hour threshold. Hesterberg et al. (2009) completed a critical review of over 50 human clinical studies in which human volunteers (including sensitive sub-populations: the elderly, children, and asthmatics) were exposed to NO_2 at concentrations ranging from 0.1 to 3.5 ppm (equivalent to 188 to 6,580 µg/m^3 [1 ppm = 1,880 µg/m^3) for periods of 30 minutes to 6 hours, often combined with exercise and co-pollutants. Their findings indicated that there is evidence of no-effect at low concentrations, and that a threshold of approximately 0.2 ppm (or 376 µg/m^3) is supported. Additionally, as reported in HC (2016b), both the World Health Organization (WHO) and United States Environmental Protection Agency (US EPA) concluded that healthy individuals do not experience any adverse effects at concentrations up to 1 ppm (or 1,880 µg/m^3).

The highest 98th percentile 1-hr NO_2 concentration, which represents a more realistic real-world exposure concentration than the 1-hr maximum concentration, was predicted to be 133.6 µg/m^3 at the sport fisher receptor location. This concentration represents 9% of the concentration protective for short-term exposures in asthmatics per Hesterberg et al. (2009). Similarly, the 98th percentile 1-hr NO_2 concentration at the industrial/commercial worker location was 88.0 µg/m^3, which is 4.7% of the concentration protective for short-term exposures in asthmatics.

Considering the above discussion, NO_X (as NO_2) is not considered for further assessment for any human receptors in the PERA.

Benzo(a)pyrene (BaP)

HQs calculated using the 24-hr criterion were below 1 across all receptors. HQs calculated using the annual BaP air quality criterion were above 1 for all human receptors (**Table B-5**). Exceedances of the annual air quality criterion are exclusively associated with elevated existing concentrations of BaP in air at the PN site. The contribution of BaP from the PN site to the atmospheric environment (represented as the "increment" values in **Table 5-10**) is noted to be many orders of magnitude less than both the 24-hr and annual BaP air quality criteria. Thus, BaP is not assessed further in this PERA.

5.1.1.2.3.2 Ecological Health

Similar to the assessment of human health receptors, ambient air concentrations at the ecological receptor locations shown in **Figure 5-2** were predicted for different averaging periods for TSP, PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, acrolein, and BaP. It is acknowledged that there are exceedances of the selected air quality criteria for some constituents at a number of the ecological receptor locations. The specific predicted exceedances are discussed below:

- TSP (**Table 5-4**): There are no exceedances of the annual TSP criterion of 60 µg/m^3 at any of the ecological receptor locations. There are predicted exceedances of the 24-hr TSP criterion of 120 µg/m^3 at all receptor locations. At the receptor locations representative of Frenchman's Bay (R6, R8, R15, R16, R19, R25, P8) and the nearby Hydro Marsh (R3), exceedances of the 24-hr criterion for TSP tend to be less frequent (<49 days per year, representing approximately 13% of the year) compared with receptor locations representing the PN site and nearshore area of Lake Ontario at the PN southern property boundary (predicted exceedances range from 115 to 364 days per year).

- PM_{10} (**Table 5-5**): There are predicted exceedances of the 24-hr PM_{10} criterion of 50 µg/m^3 at a number of ecological receptor locations, excluding the three furthest receptor locations within Frenchman's Bay (R15, R16 and P8). Predicted exceedances of the 24-hr criterion for PM_{10} at the other receptor locations representative of Frenchman's Bay (R6, R8, R19, R25) and the Hydro Marsh (R3) tend to be relatively infrequent (<9 days per year, representing approximately 2.5% of the year). Predicted PM_{10} concentrations at receptors within the PN site and nearshore Lake Ontario area are modelled to exceed the 24-hr criterion between 56 and 353 days per year.

- $PM_{2.5}$ (**Table 5-6**): There are no exceedances of the annual $PM_{2.5}$ criterion of 8.8 µg/m^3 at any of the ecological receptor locations. There are predicted exceedances of the 24-hr $PM_{2.5}$ criterion of 27 µg/m^3 at all ecological receptor locations within the PN site and nearshore Lake Ontario area. The noted exceedances are predicted to occur between 4 and 296 days per year. There are no exceedances of the 24-hr $PM_{2.5}$ criterion for any of the receptor locations representing Frenchman's Bay and the Hydro Marsh.

- NO_2 (**Table 5-7**): There are no predicted exceedances of the maximum 24-hr (200 µg/m^3) air quality criterion for NO_2 at any of the ecological receptor locations. The annual NO_2 air quality criterion (23 µg/m^3) is predicted to be exceeded at two receptor locations within the PN site and along the southern property boundary in the nearshore Lake Ontario area. The 1-hr 98th percentile criterion of 79 µg/m^3 is modelled to be exceeded at two receptor locations in Frenchman's Bay (R16 and R19), at every ecological location within the PN site (R9, R10, R11, R13, R14, and R28), at the maximum of the western, eastern, and southern fenceline property boundary of the PN site, and again along the southern property boundary representative of the nearshore Lake Ontario area. The 1-hr maximum criterion of 400 µg/m^3 is predicted to be exceeded at two ecological receptor locations within the PN site (R11 and R28) and again along the southern property boundary in the nearshore Lake Ontario area.

- SO_2, and CO (**Table 5-8** and **Table 5-9**): Predicted air concentrations for all averaging periods for SO_2 and CO are predicted to remain below air quality criteria at all ecological receptor locations.

- BaP (**Table 5-10**): Predicted BaP concentrations exceed the annual criterion of 1.00E-05 µg/m^3 at all ecological receptor locations, but not the 24-hr criterion of 5.00E-05 µg/m^3. It should be noted that the existing annual concentration of BaP is already above its criterion without the addition of BaP from PN site activities. The maximum predicted annual incremental increases in BaP concentrations resulting from planned Project activities represent 5.61x10^{-11} % changes from existing annual conditions.

- Acrolein (**Table 5-11**): 24-hr and annual acrolein concentrations are predicted to be below their respective air quality criteria at all ecological receptor locations.

Total suspended particulates (TSP) and inhalable/respirable particulates (PM_{10}/$PM_{2.5}$)

Dust (TSP), including particulates (PM_{10}, $PM_{2.5}$), could be generated from Project activities including mobilization, clearing, grubbing, on-land earthmoving, grading, and excavation. Dust deposition onto vegetation could impact growth and function. It should be noted that the air quality modelling assumptions are considered conservative and represent a "worst-case" scenario that is unlikely to occur. Furthermore, a dust management plan will be implemented that could involve mitigative measures such as the application of dust suppressants, stabilization of completed soil surfaces, and suspension of dust-generating activities during periods of inclement weather. It is expected that dust mitigation measures would also reduce concentrations of smaller particulates (PM_{10} and $PM_{2.5}$). As such, no adverse effects to vegetation and terrestrial/riparian habitat associated with vegetation are expected.

Mammals and birds are mobile receptors; thus, it is unlikely that these receptors would be continuously exposed to maximum concentrations of TSP, PM_{10} or $PM_{2.5}$. These receptors are presumed to be able to limit their exposure to TSP, PM_{10} and $PM_{2.5}$ by moving away from areas of elevated dust and particulate deposition and returning once the dust-generating activities

have concluded. Mammals and birds are also expected to be protected through the implementation and adherence with a dust management plan. Additionally, it should be noted again that the 24-hr TSP criterion of 120 µg/m^3 is derived with visibility as the sensitive endpoint rather than ecological (or human) health. Thus, exceedance of this criterion does not necessarily indicate a potential for ecological health risks. Exceedances of the 24-hr $PM_{2.5}$ criterion of 27 µg/m^3 are localized to the PN site, with no exceedances predicted at nearby Frenchman's Bay. While exceedances of the 24-hr PM_{10} criterion of 50 µg/m^3 are predicted to occur at receptor locations in Frenchman's Bay, the exceedances are modelled to occur, at most, for 9 days out of the year, representing approximately 2.5% of a calendar year. For this reason, exceedances of the 24-hr PM_{10} criterion at Frenchman's Bay are considered largely negligible, and the area is expected to remain an important habitat for local terrestrial and riparian receptors.

Considering the above, elevated TSP, PM_{10} and $PM_{2.5}$ concentrations are generally not considered to pose significant ecological health risks and are expected to be sufficiently mitigated through the implementation of a dust management plan. Thus, TSP, PM_{10} and $PM_{2.5}$ are not assessed further for any ecological receptors in this PERA.

Benzo(a)pyrene (BaP)

The annual BaP air quality criteria is predicted to be exceeded at all ecological receptor locations. However, exceedances are exclusively associated with elevated existing concentrations of BaP in air at the PN site. As noted in the bulleted list earlier in this section, the contribution of BaP from the PN site to the atmospheric environment (represented as the "increment" values in **Table 5-10**) is noted to be many orders of magnitude less than both the 24-hr and annual BaP air quality criteria. Thus, BaP is not assessed further in this PERA.

Nitrogen oxides (NO_X), sulphur dioxide (SO_2), carbon monoxide (CO), and acrolein

Substances that do not partition to soil include gases such as NO_X, SO_2, CO, and acrolein. No exceedances of any air quality criteria were identified for predicted concentrations of SO_2, CO, and acrolein at all ecological receptor locations; thus, these air quality parameters are not assessed further for any ecological receptors in the PERA.

As previously noted, modelled concentrations of NO_2 are predicted to exceed the 1-hr criteria from both CCME (79 µg/m^3, based on 98th percentile concentrations) and MECP (400 µg/m^3, based on maximum concentrations), in addition to the CCME annual criterion of 23 µg/m^3. There is no annual MECP AAQC and the CCME CAAQS are not appropriate for ecological receptors, thus, exceedance of the annual criterion does not suggest any potential risk to ecological receptors. Adverse effect levels for NO_X under short-term exposure are not expected below 5 ppm (9,000 µg/m^3) for dogs (Kleinman and Mautz, 1991), and below 3.5 ppm (6,300 µg/m^3) for plants (Heck, 1964). Predicted NO_2 concentrations are well below these adverse effect levels and are not considered to pose any potential short-term risk to ecological receptors. For these reasons, NO_X (as NO_2) is not assessed further for any ecological receptors in the PERA.

Table 5-4: Total Suspended Particulate Matter (TSP) Air Modelling Results

Receptor ID	Receptor Name	24-hr Averaging Period					Annual Averaging Period			
		24-hr 90th TSP (Existing Conditions)	Max 24-hr TSP (Increment)	Max 24-hr TSP (Total)	% of Criteria	# of Exceedances	Average Annual TSP (Existing Conditions)	Annual TSP (Increment)	Annual TSP (Total)	% of Criteria
		(µg/m³)	(µg/m³)	(µg/m³)	(%)	DAYS/YR	(µg/m³)	(µg/m³)	(µg/m³)	(%)
Criteria (µg/m³)		**120**					**60**			
Human Receptors										
R1	Local Harvesting Area 1 [a]	44.2	266.1	310.3	258.5%	30	25.5	1.1	26.6	44.4%
R2	Local Harvesting Area 2 [a]	44.2	247.2	291.4	242.9%	42	25.5	1.3	26.8	44.7%
R3	Local Harvesting Area 3 [a]	44.2	255.8	300.0	250.0%	44	25.5	1.3	26.8	44.7%
R20	Industrial/Commercial Worker	44.2	1605.8	1650.0	1375.0%	361	25.5	20.5	46.0	76.6%
R21	Sport Fisher	44.2	57.5	101.7	84.7%	0	25.5	0.7	26.2	43.6%
R22	Correctional Institute (C2)	44.2	80.6	124.8	104.0%	1	25.5	0.3	25.8	43.0%
R23	Farm	44.2	38.0	82.2	68.5%	0	25.5	0.1	25.6	42.6%
R24	Dairy Farm	44.2	15.7	59.9	49.9%	0	25.5	0.0	25.5	42.6%
R25	Urban Resident/Harvester [b] (WNW)	44.2	201.2	245.4	204.5%	38	25.5	1.2	26.7	44.4%
R26	Urban Resident/Harvester [b] (NW)	44.2	214.6	258.8	215.7%	22	25.5	1.0	26.5	44.1%
R27	Urban Resident/Harvester [b] (NNW)	44.2	250.1	294.3	245.2%	22	25.5	1.0	26.5	44.1%
Ecological Receptors										
R3	Hydro Marsh	44.2	255.8	300.0	250.0%	44	25.5	1.3	26.8	44.7%
R6	Frenchman's Bay	44.2	193.5	237.7	198.0%	36	25.5	1.1	26.6	44.4%
R8	Frenchman's Bay	44.2	213.7	257.9	214.9%	29	25.5	1.1	26.6	44.3%
R15	Frenchman's Bay	44.2	140.0	184.2	153.5%	5	25.5	0.6	26.1	43.5%
R16	Frenchman's Bay	44.2	134.6	178.8	149.0%	13	25.5	0.7	26.2	43.7%
R19	Frenchman's Bay	44.2	249.4	293.6	244.6%	48	25.5	1.4	26.9	44.8%
R25	Frenchman's Bay	44.2	201.2	245.4	204.5%	38	25.5	1.2	26.7	44.4%
P8	Frenchman's Bay	44.2	135.1	179.3	149.4%	20	25.5	0.9	26.4	44.0%
R9	PN Site	44.2	1131.6	1175.8	979.8%	282	25.5	11.6	37.1	61.8%
R10	PN Site	44.2	967.6	1011.8	843.2%	245	25.5	8.8	34.3	57.2%
R11	PN Site	44.2	488.4	532.6	443.8%	182	25.5	4.6	30.1	50.2%
R13	PN Site	44.2	1739.8	1784.0	1486.7%	364	25.5	24.6	50.1	83.5%
R14	PN Site	44.2	496.7	540.9	450.8%	115	25.5	2.7	28.2	47.0%
R28	PN Site	44.2	579.6	623.8	519.9%	214	25.5	5.1	30.6	51.0%
FL_WEN_1-394	PN Site [c]	44.2	2144.1	2188.3	1823.6%	348	25.5	30.8	56.3	93.8%
FL_S_1-144	Nearshore Lake Ontario [d]	44.2	1184.7	1228.9	1024.1%	326	25.5	19.3	44.8	74.7%

Note:
µg/m³ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.

Table 5-5: Inhalable Particulates (PM_{10}) Air Modelling Results

Receptor ID	Receptor Name	24-hr Averaging Period				
		90th PM_{10} (Existing Conditions)	Max 24-hr PM_{10} (Increment)	Max 24-hr PM_{10} (Total)	% of Criteria	# of Exceedances
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)	DAYS/YR
Criteria ($\mu g/m^3$)		**50**				
Human Receptors						
R1	Local Harvesting Area 1 [a]	22.1	51.4	73.5	146.9%	6
R2	Local Harvesting Area 2 [a]	22.1	48.0	70.1	140.1%	5
R3	Local Harvesting Area 3 [a]	22.1	49.7	71.8	143.6%	7
R20	Industrial/Commercial Worker	22.1	309.3	331.4	662.9%	346
R21	Sport Fisher	22.1	11.5	33.6	67.1%	0
R22	Correctional Institute (C2)	22.1	15.6	37.7	75.5%	0
R23	Farm	22.1	7.4	29.5	59.1%	0
R24	Dairy Farm	22.1	3.1	25.2	50.4%	0
R25	Urban Resident/Harvester [b] (WNW)	22.1	39.4	61.5	123.0%	4
R26	Urban Resident/Harvester [b] (NW)	22.1	41.6	63.7	127.5%	2
R27	Urban Resident/Harvester [b] (NNW)	22.1	48.2	70.3	140.7%	5
Ecological Receptors						
R3	Hydro Marsh	22.1	49.7	71.8	143.6%	7
R6	Frenchman's Bay	22.1	38.2	60.3	120.5%	5
R8	Frenchman's Bay	22.1	42.2	64.3	128.6%	3
R15	Frenchman's Bay	22.1	27.6	49.7	99.5%	0
R16	Frenchman's Bay	22.1	26.2	48.3	96.5%	0
R19	Frenchman's Bay	22.1	48.9	71.0	142.0%	9
R25	Frenchman's Bay	22.1	39.4	61.5	123.0%	4
P8	Frenchman's Bay	22.1	26.7	48.8	97.6%	0
R9	PN Site	22.1	219.9	242.0	484.0%	226
R10	PN Site	22.1	190.6	212.7	425.5%	155
R11	PN Site	22.1	95.9	118.0	236.0%	101
R13	PN Site	22.1	335.0	357.1	714.2%	353
R14	PN Site	22.1	98.4	120.5	241.1%	56
R28	PN Site	22.1	113.3	135.4	270.8%	130
FL_WEN_1-394	PN Site [c]	22.1	413.0	435.1	870.1%	316
FL_S_1-144	Nearshore Lake Ontario [d]	22.1	231.0	253.1	506.2%	297

Note:
$\mu g/m^3$ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.

Table 5-6: Respirable Particulates ($PM_{2.5}$) Air Modelling Results

Receptor ID	Receptor Name	24-hr Averaging Period					Annual Averaging Period			
		90th 24-hr $PM_{2.5}$ (Existing Conditions)	Max 24-hr $PM_{2.5}$ (Increment)	Max 24-hr $PM_{2.5}$ (Total)	% of Criteria	Exceedance	Mean Annual $PM_{2.5}$ (Existing Conditions)	Annual $PM_{2.5}$ (Increment)	Annual $PM_{2.5}$ (Total)	% of Criteria
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)	DAYS/YR	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)
Criteria ($\mu g/m^3$)		**27**					**8.8**			
Human Receptors										
R1	Local Harvesting Area 1 [a]	11.1	12.6	23.7	87.7%	0	6.70	0.08	6.78	77.0%
R2	Local Harvesting Area 2 [a]	11.1	11.8	22.9	84.7%	0	6.70	0.09	6.79	77.1%
R3	Local Harvesting Area 3 [a]	11.1	12.3	23.4	86.6%	0	6.70	0.09	6.79	77.2%
R20	Industrial/Commercial Worker	11.1	75.8	86.9	322.0%	249	6.70	0.99	7.69	87.4%
R21	Sport Fisher	11.1	2.9	14.0	51.9%	0	6.70	0.10	6.80	77.3%
R22	Correctional Institute (C2)	11.1	3.8	14.9	55.3%	0	6.70	0.02	6.72	76.4%
R23	Farm	11.1	1.9	13.0	48.1%	0	6.70	0.01	6.71	76.2%
R24	Dairy Farm	11.1	0.8	11.9	43.9%	0	6.70	0.00	6.70	76.2%
R25	Urban Resident/Harvester [b] (WNW)	11.1	9.8	20.9	77.5%	0	6.70	0.09	6.79	77.2%
R26	Urban Resident/Harvester [b] (NW)	11.1	10.3	21.4	79.1%	0	6.70	0.07	6.77	76.9%
R27	Urban Resident/Harvester [b] (NNW)	11.1	11.8	22.9	84.9%	0	6.70	0.07	6.77	76.9%
Ecological Receptors										
R3	Hydro Marsh	11.1	12.3	23.4	86.6%	0	6.70	0.09	6.79	77.2%
R6	Frenchman's Bay	11.1	9.7	20.8	77.1%	0	6.70	0.09	6.79	77.1%
R8	Frenchman's Bay	11.1	10.7	21.8	80.9%	0	6.70	0.09	6.79	77.1%
R15	Frenchman's Bay	11.1	7.0	18.1	67.2%	0	6.70	0.05	6.75	76.7%
R16	Frenchman's Bay	11.1	6.5	17.6	65.4%	0	6.70	0.07	6.77	76.9%
R19	Frenchman's Bay	11.1	12.4	23.5	87.0%	0	6.70	0.12	6.82	77.5%
R25	Frenchman's Bay	11.1	9.8	20.9	77.5%	0	6.70	0.09	6.79	77.2%
P8	Frenchman's Bay	11.1	6.9	18.0	66.5%	0	6.70	0.08	6.78	77.0%
R9	PN Site	11.1	54.1	65.2	241.6%	87	6.70	0.66	7.36	83.6%
R10	PN Site	11.1	48.1	59.2	219.3%	48	6.70	1.05	7.75	88.0%
R11	PN Site	11.1	24.1	35.2	130.2%	16	6.70	0.42	7.12	80.9%
R13	PN Site	11.1	82.0	93.1	344.8%	296	6.70	1.19	7.89	89.7%
R14	PN Site	11.1	25.0	36.1	133.7%	4	6.70	0.27	6.97	79.2%
R28	PN Site	11.1	27.8	38.9	144.2%	23	6.70	0.40	7.10	80.7%
FL_WEN_1-394	PN Site [c]	11.1	100.9	112.0	414.9%	222	6.70	1.48	8.18	92.9%
FL_S_1-144	Nearshore Lake Ontario [d]	11.1	57.0	68.1	252.2%	180	6.70	1.30	8.00	90.9%

Note:
$\mu g/m^3$ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.

Table 5-7: Nitrogen Oxides (as NO_2) Air Modelling Results

Receptor ID	Receptor Name	1-hr 98th Percentile				1-hr Averaging Period					24-hr Averaging Period					Annual Averaging Period			
		98th 1-hr NO_2 (Existing Conditions)	98th 1-hr NO_2 (Increment)	98th 1-hr NO_2 (Total)	% of Criteria	90th 1-hr NO_2 (Existing Conditions)	Max 1-hr NO_2 (Increment)	Max 1-hr NO_2 (Total)	% of Criteria	# of Exceedances	90th 24-hr NO_2 (Existing Conditions)	24-hr NO_2 (Increment)	Max 24-hr NO_2 (Total)	% of Criteria	# of Exceedances	Mean Annual NO_2 (Existing Conditions)	Annual NO_2 (Increment)	Annual NO_2 (Total)	% of Criteria
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)	HRS/YR	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)	DAYS/YR	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)
Criteria ($\mu g/m^3$)		**79**				**400**					**200**					**23**			
Human Receptors																			
R1	Local Harvesting Area 1 [a]	44.1	19.5	63.6	80.5%	23.8	259.9	283.7	70.9%	0	18.7	37.2	55.9	27.9%	N/A	9.9	1.5	11.4	49.4%
R2	Local Harvesting Area 2 [a]	44.1	21.9	66.0	83.5%	23.8	267.0	290.8	72.7%	0	18.7	37.7	56.4	28.2%	N/A	9.9	1.6	11.5	49.9%
R3	Local Harvesting Area 3 [a]	44.1	22.9	66.9	84.7%	23.8	235.1	258.9	64.7%	0	18.7	37.4	56.1	28.0%	N/A	9.9	1.7	11.5	50.2%
R20	Industrial/Commercial Worker	44.1	43.9	88.0	111.4%	23.8	251.3	275.0	68.8%	0	18.7	47.1	65.8	32.9%	N/A	9.9	1.6	11.5	49.8%
R21	Sport Fisher	44.1	89.5	133.6	169.1%	23.8	142.9	166.6	41.7%	0	18.7	58.5	77.2	38.6%	N/A	9.9	3.9	13.8	59.8%
R22	Correctional Institute (C2)	44.1	4.3	48.3	61.2%	23.8	141.4	165.1	41.3%	0	18.7	11.4	30.1	15.0%	N/A	9.9	0.4	10.2	44.6%
R23	Farm	44.1	1.3	45.4	57.4%	23.8	60.5	84.3	21.1%	0	18.7	5.6	24.3	12.2%	N/A	9.9	0.2	10.0	43.7%
R24	Dairy Farm	44.1	0.3	44.4	56.2%	23.8	62.3	86.1	21.5%	0	18.7	2.6	21.3	10.7%	N/A	9.9	0.1	10.0	43.3%
R25	Urban Resident/Harvester [b] (WNW)	44.1	24.3	68.3	86.5%	23.8	199.2	223.0	55.7%	0	18.7	45.0	63.7	31.9%	N/A	9.9	1.8	11.7	50.7%
R26	Urban Resident/Harvester [b] (NW)	44.1	17.5	61.5	77.9%	23.8	207.7	231.5	57.9%	0	18.7	29.2	47.9	23.9%	N/A	9.9	1.3	11.2	48.6%
R27	Urban Resident/Harvester [b] (NNW)	44.1	18.4	62.4	79.1%	23.8	252.7	276.5	69.1%	0	18.7	35.2	53.9	27.0%	N/A	9.9	1.3	11.2	48.8%
Ecological Receptors																			
R3	Hydro Marsh	44.1	22.9	67.0	84.8%	23.8	197.2	221.0	55.3%	0	18.7	44.3	63.0	31.5%	N/A	9.9	1.7	11.5	50.2%
R6	Frenchman's Bay	44.1	28.8	72.9	92.3%	23.8	184.3	208.1	52.0%	0	18.7	41.7	60.3	30.2%	N/A	9.9	1.9	11.8	51.3%
R8	Frenchman's Bay	44.1	18.7	62.7	79.4%	23.8	145.3	169.1	42.3%	0	18.7	26.4	45.1	22.6%	N/A	9.9	1.2	11.1	48.1%
R15	Frenchman's Bay	44.1	36.8	80.9	102.4%	23.8	125.9	149.7	37.4%	0	18.7	31.5	50.2	25.1%	N/A	9.9	1.7	11.6	50.5%
R16	Frenchman's Bay	44.1	47.8	91.8	116.2%	23.8	172.0	195.8	48.9%	0	18.7	47.8	66.5	33.2%	N/A	9.9	2.7	12.6	54.9%
R19	Frenchman's Bay	44.1	24.3	68.3	86.5%	23.8	199.2	223.0	55.7%	0	18.7	45.0	63.7	31.9%	N/A	9.9	1.8	11.7	50.7%
R25	Frenchman's Bay	44.1	35.0	79.0	100.0%	23.8	142.0	165.8	41.5%	0	18.7	33.5	52.2	26.1%	N/A	9.9	1.8	11.7	50.8%
P8	Frenchman's Bay	44.1	70.5	114.6	145.0%	23.8	297.3	321.1	80.3%	0	18.7	76.0	94.7	47.3%	N/A	9.9	5.5	15.4	66.8%
R9	PN Site	44.1	206.4	250.5	317.1%	23.8	350.8	374.6	93.7%	0	18.7	115.3	134.0	67.0%	N/A	9.9	31.8	41.7	181.3%
R10	PN Site	44.1	107.4	151.4	191.7%	23.8	516.8	540.6	135.1%	16	18.7	94.4	113.1	56.5%	N/A	9.9	10.0	19.8	86.3%
R11	PN Site	44.1	52.3	96.4	122.0%	23.8	293.8	317.5	79.4%	0	18.7	48.7	67.4	33.7%	N/A	9.9	1.9	11.8	51.1%
R13	PN Site	44.1	94.6	138.7	175.5%	23.8	343.0	366.8	91.7%	0	18.7	89.9	108.6	54.3%	N/A	9.9	7.0	16.9	73.3%
R14	PN Site	44.1	91.3	135.3	171.3%	23.8	417.2	441.0	110.2%	3	18.7	78.2	96.8	48.4%	N/A	9.9	7.8	17.6	76.7%
R28	PN Site	44.1	80.4	124.4	157.5%	23.8	334.2	358.0	89.5%	0	18.7	80.0	98.7	49.3%	N/A	9.9	6.2	16.1	69.8%
FL_WEN_1-394	PN Site [c]	44.1	235.5	279.6	353.9%	23.8	402.4	426.2	106.6%	18	18.7	128.6	147.2	73.6%	N/A	9.9	20.3	30.2	131.4%
FL_S_1-144	Nearshore Lake Ontario [d]	44.1	22.9	67.0	84.8%	23.8	197.2	221.0	55.3%	0	18.7	44.3	63.0	31.5%	N/A	9.9	1.7	11.5	50.2%

Note:
$\mu g/m^3$ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.

Table 5-8: Sulphur Dioxide (SO_2) Air Modelling Results

Receptor ID	Receptor Name	1-hr 99th Percentile				1-hr Averaging Period					Annual Averaging Period			
		99th 1-hr SO_2 (Existing Conditions)	99th 1-hr SO_2 (Increment)	99th 1-hr SO_2 (Total)	% of Criteria	90th 1-hr SO_2 (Existing Conditions)	Max 1-hr SO_2 (Increment)	Max 1-hr SO_2 (Total)	% of Criteria	# of Exceedances	Annual SO_2 (Existing Conditions)	Annual SO_2 (Increment)	Annual SO_2 (Total)	% of Criteria
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)	DAYS/YR	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(%)
Criteria ($\mu g/m^3$)		**170**				**105**					**11**			
Human Receptors														
R1	Local Harvesting Area 1 [a]	9.05	0.04	9.09	5.3%	4.39	0.36	4.75	4.4%	NA	2.13	0.0006	2.13	21.3%
R2	Local Harvesting Area 2 [a]	9.05	0.04	9.09	5.3%	4.39	0.35	4.74	4.4%	NA	2.13	0.0007	2.13	21.3%
R3	Local Harvesting Area 3 [a]	9.05	0.03	9.08	5.3%	4.39	0.29	4.68	4.4%	NA	2.13	0.0007	2.13	21.3%
R20	Industrial/Commercial Worker	9.05	0.12	9.17	5.4%	4.39	0.42	4.81	4.5%	NA	2.13	0.0014	2.13	21.3%
R21	Sport Fisher	9.05	0.10	9.15	5.4%	4.39	0.17	4.57	4.3%	NA	2.13	0.0020	2.13	21.3%
R22	Correctional Institute (C2)	9.05	0.01	9.06	5.3%	4.39	0.17	4.56	4.3%	NA	2.13	0.0002	2.13	21.3%
R23	Farm	9.05	0.004	9.05	5.3%	4.39	0.05	4.44	4.1%	NA	2.13	0.0001	2.13	21.3%
R24	Dairy Farm	9.05	0.002	9.05	5.3%	4.39	0.05	4.44	4.2%	NA	2.13	0.0001	2.13	21.3%
R25	Urban Resident/Harvester [b] (WNW)	9.05	0.03	9.08	5.3%	4.39	0.20	4.60	4.3%	NA	2.13	0.0007	2.13	21.3%
R26	Urban Resident/Harvester [b] (NW)	9.05	0.03	9.08	5.3%	4.39	0.26	4.65	4.3%	NA	2.13	0.0006	2.13	21.3%
R27	Urban Resident/Harvester [b] (NNW)	9.05	0.04	9.09	5.3%	4.39	0.35	4.74	4.4%	NA	2.13	0.0006	2.13	21.3%
Ecological Receptors														
R3	Hydro Marsh	9.05	0.03	9.08	5.3%	4.39	0.22	4.61	4.3%	NA	2.13	0.001	2.13	21.3%
R6	Frenchman's Bay	9.05	0.04	9.09	5.3%	4.39	0.19	4.58	4.3%	NA	2.13	0.001	2.13	21.3%
R8	Frenchman's Bay	9.05	0.03	9.08	5.3%	4.39	0.16	4.55	4.3%	NA	2.13	0.001	2.13	21.3%
R15	Frenchman's Bay	9.05	0.05	9.10	5.4%	4.39	0.13	4.52	4.2%	NA	2.13	0.001	2.13	21.3%
R16	Frenchman's Bay	9.05	0.07	9.12	5.4%	4.39	0.19	4.58	4.3%	NA	2.13	0.001	2.13	21.3%
R19	Frenchman's Bay	9.05	0.03	9.08	5.3%	4.39	0.20	4.60	4.3%	NA	2.13	0.001	2.13	21.3%
R25	Frenchman's Bay	9.05	0.05	9.10	5.4%	4.39	0.14	4.53	4.2%	NA	2.13	0.001	2.13	21.3%
P8	Frenchman's Bay	9.05	0.13	9.18	5.4%	4.39	0.48	4.87	4.6%	NA	2.13	0.002	2.13	21.3%
R9	PN Site	9.05	0.12	9.17	5.4%	4.39	0.42	4.81	4.5%	NA	2.13	0.005	2.13	21.3%
R10	PN Site	9.05	0.12	9.17	5.4%	4.39	0.83	5.22	4.9%	NA	2.13	0.002	2.13	21.3%
R11	PN Site	9.05	0.14	9.19	5.4%	4.39	0.48	4.87	4.6%	NA	2.13	0.002	2.13	21.3%
R13	PN Site	9.05	0.09	9.14	5.4%	4.39	0.38	4.77	4.5%	NA	2.13	0.002	2.13	21.3%
R14	PN Site	9.05	0.10	9.15	5.4%	4.39	0.70	5.09	4.8%	NA	2.13	0.002	2.13	21.3%
R28	PN Site	9.05	0.16	9.21	5.4%	4.39	0.55	4.94	4.6%	NA	2.13	0.002	2.13	21.3%
FL_WEN_1-394	PN Site [c]	9.05	0.38	9.43	5.5%	4.39	0.54	4.93	4.6%	NA	2.13	0.007	2.14	21.4%
FL_S_1-144	Nearshore Lake Ontario [d]	9.05	0.03	9.08	5.3%	4.39	0.22	4.61	4.3%	NA	2.13	0.001	2.13	21.3%

Note:
$\mu g/m^3$ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.

Table 5-9: Carbon Monoxide (CO) Air Modelling Results

Receptor ID	Receptor Name	1-hr Averaging Period				8-hr Averaging Period			
		90th 1-hr CO (Existing Conditions)	Max 1-hr CO (Increment)	Max 1-hr CO (Total)	% of Criteria	90th 8-hr CO (Existing Conditions)	Max 8-hr CO (Increment)	Max 8-hr CO (Total)	% of Criteria
		(µg/m³)	(µg/m³)	(µg/m³)	(%)	(µg/m³)	(µg/m³)	(µg/m³)	(%)
Criteria (µg/m³)		**36,200**				**15,700**			
Human Receptors									
R1	Local Harvesting Area 1 [a]	923	1,476	2,399	6.6%	883	713	1,596	10.2%
R2	Local Harvesting Area 2 [a]	923	1,573	2,496	6.9%	883	616	1,499	9.5%
R3	Local Harvesting Area 3 [a]	923	1,445	2,368	6.5%	883	673	1,556	9.9%
R20	Industrial/Commercial Worker	923	11,381	12,304	34.0%	883	3,766	4,649	29.6%
R21	Sport Fisher	923	397	1,320	3.6%	883	111	993	6.3%
R22	Correctional Institute (C2)	923	1,643	2,566	7.1%	883	223	1,105	7.0%
R23	Farm	923	588	1,511	4.2%	883	131	1,014	6.5%
R24	Dairy Farm	923	394	1,317	3.6%	883	50	933	5.9%
R25	Urban Resident/Harvester [b] (WNW)	923	1,420	2,343	6.5%	883	533	1,415	9.0%
R26	Urban Resident/Harvester [b] (NW)	923	1,191	2,114	5.8%	883	546	1,429	9.1%
R27	Urban Resident/Harvester [b] (NNW)	923	1,422	2,345	6.5%	883	646	1,529	9.7%
Ecological Receptors									
R3	Hydro Marsh	923	1,342	2,265	6.3%	883	499	1,382	8.8%
R6	Frenchman's Bay	923	1,322	2,245	6.2%	883	581	1,463	9.3%
R8	Frenchman's Bay	923	961	1,884	5.2%	883	359	1,242	7.9%
R15	Frenchman's Bay	923	699	1,622	4.5%	883	313	1,196	7.6%
R16	Frenchman's Bay	923	1,223	2,146	5.9%	883	698	1,581	10.1%
R19	Frenchman's Bay	923	1,420	2,343	6.5%	883	533	1,415	9.0%
R25	Frenchman's Bay	923	883	1,806	5.0%	883	396	1,279	8.1%
P8	Frenchman's Bay	923	6,708	7,631	21.1%	883	2,366	3,248	20.7%
R9	PN Site	923	6,342	7,265	20.1%	883	2,739	3,621	23.1%
R10	PN Site	923	3,022	3,945	10.9%	883	1,434	2,317	14.8%
R11	PN Site	923	5,066	5,988	16.5%	883	3,215	4,098	26.1%
R13	PN Site	923	2,935	3,858	10.7%	883	1,321	2,203	14.0%
R14	PN Site	923	2,820	3,743	10.3%	883	1,606	2,488	15.9%
R28	PN Site	923	15,410	16,333	45.1%	883	5,019	5,902	37.6%
FL_WEN_1-394	PN Site [c]	923	4,537	5,460	15.1%	883	2,448	3,330	21.2%
FL_S_1-144	Nearshore Lake Ontario [d]	923	1,342	2,265	6.3%	883	499	1,382	8.8%

Note:
µg/m³ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.

Table 5-10: Benzo(a)pyrene (BaP) Air Modelling Results

Receptor ID	Receptor Name	24-hr Averaging Period				Annual Averaging Period			
		24-hr Avg BaP (Existing Conditions)	Max 24-hr BaP (Increment)	Max 24-hr BaP (Total)	% of Criteria	Annual Average BaP (Existing Conditions)	Annual BaP (Increment)	Annual BaP (Total)	% of Criteria
		(µg/m³)	(µg/m³)	(µg/m³)	(%)	(µg/m³)	(µg/m³)	(µg/m³)	(%)
Criteria (µg/m³)		**5.00E-05**				**1.00E-05**			
Human Receptors									
R1	Local Harvesting Area 1 [a]	4.18E-05	7.05E-17	4.18E-05	84%	2.04E-05	3.17E-19	2.04E-05	204%
R2	Local Harvesting Area 2 [a]	4.18E-05	6.71E-17	4.18E-05	84%	2.04E-05	3.58E-19	2.04E-05	204%
R3	Local Harvesting Area 3 [a]	4.18E-05	7.23E-17	4.18E-05	84%	2.04E-05	3.74E-19	2.04E-05	204%
R20	Industrial/Commercial Worker	4.18E-05	4.53E-16	4.18E-05	84%	2.04E-05	5.61E-18	2.04E-05	204%
R21	Sport Fisher	4.18E-05	1.52E-17	4.18E-05	84%	2.04E-05	2.84E-19	2.04E-05	204%
R22	Correctional Institute (C2)	4.18E-05	1.86E-17	4.18E-05	84%	2.04E-05	8.13E-20	2.04E-05	204%
R23	Farm	4.18E-05	1.09E-17	4.18E-05	84%	2.04E-05	1.99E-20	2.04E-05	204%
R24	Dairy Farm	4.18E-05	4.05E-18	4.18E-05	84%	2.04E-05	9.88E-21	2.04E-05	204%
R25	Urban Resident/Harvester [b] (WNW)	4.18E-05	5.82E-17	4.18E-05	84%	2.04E-05	3.29E-19	2.04E-05	204%
R26	Urban Resident/Harvester [b] (NW)	4.18E-05	5.96E-17	4.18E-05	84%	2.04E-05	2.70E-19	2.04E-05	204%
R27	Urban Resident/Harvester [b] (NNW)	4.18E-05	6.58E-17	4.18E-05	84%	2.04E-05	2.76E-19	2.04E-05	204%
Ecological Receptors									
R3	Hydro Marsh	4.18E-05	5.68E-17	4.18E-05	84%	2.04E-05	3.22E-19	2.04E-05	204%
R6	Frenchman's Bay	4.18E-05	6.33E-17	4.18E-05	84%	2.04E-05	3.16E-19	2.04E-05	204%
R8	Frenchman's Bay	4.18E-05	4.16E-17	4.18E-05	84%	2.04E-05	1.90E-19	2.04E-05	204%
R15	Frenchman's Bay	4.18E-05	3.73E-17	4.18E-05	84%	2.04E-05	2.42E-19	2.04E-05	204%
R16	Frenchman's Bay	4.18E-05	7.14E-17	4.18E-05	84%	2.04E-05	4.28E-19	2.04E-05	204%
R19	Frenchman's Bay	4.18E-05	5.82E-17	4.18E-05	84%	2.04E-05	3.29E-19	2.04E-05	204%
R25	Frenchman's Bay	4.18E-05	4.03E-17	4.18E-05	84%	2.04E-05	2.76E-19	2.04E-05	204%
P8	Frenchman's Bay	4.18E-05	2.85E-16	4.18E-05	84%	2.04E-05	3.10E-18	2.04E-05	204%
R9	PN Site	4.18E-05	3.22E-16	4.18E-05	84%	2.04E-05	2.68E-18	2.04E-05	204%
R10	PN Site	4.18E-05	1.52E-16	4.18E-05	84%	2.04E-05	1.33E-18	2.04E-05	204%
R11	PN Site	4.18E-05	4.63E-16	4.18E-05	84%	2.04E-05	6.85E-18	2.04E-05	204%
R13	PN Site	4.18E-05	1.40E-16	4.18E-05	84%	2.04E-05	8.09E-19	2.04E-05	204%
R14	PN Site	4.18E-05	1.78E-16	4.18E-05	84%	2.04E-05	1.48E-18	2.04E-05	204%
R28	PN Site	4.18E-05	5.63E-16	4.18E-05	84%	2.04E-05	8.45E-18	2.04E-05	204%
FL_WEN_1-394	PN Site [c]	4.18E-05	3.17E-16	4.18E-05	84%	2.04E-05	5.26E-18	2.04E-05	204%
FL_S_1-144	Nearshore Lake Ontario [d]	4.18E-05	5.68E-17	4.18E-05	84%	2.04E-05	3.22E-19	2.04E-05	204%

Note:
µg/m³ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.

Table 5-11: Acrolein Air Modelling Results

Receptor ID	Receptor Name	1-hr Averaging Period				24-hr Averaging Period			
		90th 1-hr Acrolein (Existing Conditions)	Max 1-hr Acrolein (Increment)	Max 1-hr Acrolein (Total)	% of Criteria	90th 24-hr Acrolein (Existing Conditions)	Max 24-hr Acrolein (Increment)	Max 24-hr Acrolein (Total)	% of Criteria
		(µg/m³)	(µg/m³)	(µg/m³)	(%)	(µg/m³)	(µg/m³)	(µg/m³)	(%)
Criteria (µg/m³)		**4.50E+00**				**4.00E-01**			
Human Receptors									
R1	Local Harvesting Area 1 [a]	NA [e]	6.12E-14	6.12E-14	<0.01%	NA [e]	1.04E-14	1.04E-14	<0.01%
R2	Local Harvesting Area 2 [a]	NA [e]	6.38E-14	6.38E-14	<0.01%	NA [e]	1.02E-14	1.02E-14	<0.01%
R3	Local Harvesting Area 3 [a]	NA [e]	6.10E-14	6.10E-14	<0.01%	NA [e]	1.11E-14	1.11E-14	<0.01%
R20	Industrial/Commercial Worker	NA [e]	3.97E-13	3.97E-13	<0.01%	NA [e]	6.55E-14	6.55E-14	<0.01%
R21	Sport Fisher	NA [e]	1.69E-14	1.69E-14	<0.01%	NA [e]	2.85E-15	2.85E-15	<0.01%
R22	Correctional Institute (C2)	NA [e]	6.03E-14	6.03E-14	<0.01%	NA [e]	2.90E-15	2.90E-15	<0.01%
R23	Farm	NA [e]	2.25E-14	2.25E-14	<0.01%	NA [e]	1.78E-15	1.78E-15	<0.01%
R24	Dairy Farm	NA [e]	1.52E-14	1.52E-14	<0.01%	NA [e]	6.53E-16	6.53E-16	<0.01%
R25	Urban Resident/Harvester [b] (WNW)	NA [e]	6.77E-14	6.77E-14	<0.01%	NA [e]	1.01E-14	1.01E-14	<0.01%
R26	Urban Resident/Harvester [b] (NW)	NA [e]	5.07E-14	5.07E-14	<0.01%	NA [e]	8.97E-15	8.97E-15	<0.01%
R27	Urban Resident/Harvester [b] (NNW)	NA [e]	5.59E-14	5.59E-14	<0.01%	NA [e]	9.61E-15	9.61E-15	<0.01%
Ecological Receptors									
R3	Hydro Marsh	NA [e]	6.10E-14	6.10E-14	<0.01%	NA [e]	1.11E-14	1.11E-14	<0.01%
R6	Frenchman's Bay	NA [e]	6.50E-14	6.50E-14	<0.01%	NA [e]	1.04E-14	1.04E-14	<0.01%
R8	Frenchman's Bay	NA [e]	6.18E-14	6.18E-14	<0.01%	NA [e]	1.15E-14	1.15E-14	<0.01%
R15	Frenchman's Bay	NA [e]	4.42E-14	4.42E-14	<0.01%	NA [e]	7.29E-15	7.29E-15	<0.01%
R16	Frenchman's Bay	NA [e]	2.98E-14	2.98E-14	<0.01%	NA [e]	5.95E-15	5.95E-15	<0.01%
R19	Frenchman's Bay	NA [e]	5.69E-14	5.69E-14	<0.01%	NA [e]	1.16E-14	1.16E-14	<0.01%
R25	Frenchman's Bay	NA [e]	6.77E-14	6.77E-14	<0.01%	NA [e]	1.01E-14	1.01E-14	<0.01%
P8	Frenchman's Bay	NA [e]	4.06E-14	4.06E-14	<0.01%	NA [e]	6.92E-15	6.92E-15	<0.01%
R9	PN Site	NA [e]	2.49E-13	2.49E-13	<0.01%	NA [e]	4.43E-14	4.43E-14	<0.01%
R10	PN Site	NA [e]	2.62E-13	2.62E-13	<0.01%	NA [e]	6.01E-14	6.01E-14	<0.01%
R11	PN Site	NA [e]	1.70E-13	1.70E-13	<0.01%	NA [e]	2.67E-14	2.67E-14	<0.01%
R13	PN Site	NA [e]	1.74E-13	1.74E-13	<0.01%	NA [e]	6.69E-14	6.69E-14	<0.01%
R14	PN Site	NA [e]	1.50E-13	1.50E-13	<0.01%	NA [e]	2.92E-14	2.92E-14	<0.01%
R28	PN Site	NA [e]	1.52E-13	1.52E-13	<0.01%	NA [e]	2.91E-14	2.91E-14	<0.01%
FL_WEN_1-394	PN Site [c]	NA [e]	5.32E-13	5.32E-13	<0.01%	NA [e]	8.14E-14	8.14E-14	<0.01%
FL_S_1-144	Nearshore Lake Ontario [d]	NA [e]	1.83E-13	1.83E-13	<0.01%	NA [e]	5.36E-14	5.36E-14	<0.01%

Note:
µg/m³ – micrograms per cubic meter.
Highlighted cell indicates an exceedance of the applicable ambient air quality criteria.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.
[c] Represents the maximum concentration modelled along the western, eastern and northern fenceline property boundaries of the PN site.
[d] Represents the maximum concentration modelled along the southern fenceline property boundary of the PN site.
[e] No reliable concentration of acrolein is available for characterizing existing conditions.

Radiological Emissions

As described in **Section 3.1.1**, during preparation for refurbishment, the reactor will be defueled and dewatered. During reactor dewatering there may be emissions of radionuclides; however, emissions are expected to remain below previous operational conditions assessed in the 2022 PN ERA for 6 operating units. This reduction in emissions is shown in the 2017 Safe Storage PEA, which presented airborne tritium emissions data collected from PNGS Unit 2 and Unit 3 during draining, flushing, and drying, that were several times less than operational conditions. Draining, flushing, and drying activities are the first step for both the Stabilization Phase and the Refurbishment Phase.

Since the data demonstrates that tritium emissions from PNGS Unit 2 and Unit 3 during dewatering and drying activities were substantially lower compared to operational units, a similar decrease in other radionuclides such as noble gases, particulates, radioiodines, and carbon-14 is expected. During refurbishment, OPG will use lessons learned from the PNGS Unit 1 and Unit 4 Stabilization Phase, as well as the Darlington refurbishment, to ensure emissions are minimized and maintained As Low as Reasonably Achievable (ALARA).

During the times when there will be openings in containment (i.e., specially prepared and approved openings in the RB dome for steam generator removal and replacement, and/or open airlocks), procedures will be in place to control radioactive releases to the environment and keep within previous levels (as evaluated in the 2022 PN ERA for 6 operating units). Prior to creating an opening in the dome, the unit will be isolated from the other operating units. Additionally, the heat transport and moderator system components will be dried to reduce potential for tritium emissions to the atmosphere through the opening. The specific control measures will be determined through an assessment of work that will be in progress and system/equipment availability (e.g. status of vapour barriers between boiler room and reactor vaults, status of RB ventilation and filter systems, status of monitoring systems). The controls will take into account allowed parallel work activities, directing air flow towards the inside of the RBs, maintaining negative pressure in the RBs, radioactivity monitoring, decontamination, and contingency actions should an abnormal event or condition occur.

Overall, radiological emissions to the atmospheric environment are expected to be similar to that evaluated in the 2017 Safe Storage PEA and overall bounded by that evaluated in the 2022 PN ERA for 6 operating units. As such, no further assessment is conducted in this PERA of radiological emissions to air during refurbishment.

5.1.1.3 PNGS Units 5-8 Continued Operations

Following refurbishment, PNGS Units 5-8 will operate in the same manner as current PNGS Units 5-8 operations; therefore, assessment of the potential effects from the Continued Operation Phase on the environment is similar to the assessment of effects under the 2022 PN ERA with 6 operating units; therefore, no further assessment is warranted in the PERA for continued operations.

During Continued Operations of PNGS Units 5-8, activities associated with PNGS Units 1-4 SWS and dismantle/demolish will be occurring, which could result in increased air emissions. It is expected that air predictions would be within the bounding air quality assessment presented in **Section 5.1.1.2**. This bounding air quality assessment includes both existing conditions and the incremental Project contributions. During continued operations, emissions will be similar to those during existing conditions. During continued operations, PNGS Units 5-8 will be operating, and PNGS Units 1-4 will undergo dismantle/demolish activities (2034 onwards). During dismantle/demolish activities, air emissions are expected to be negligible and mitigated by an Environmental Management Plan (see **Section 5.1.1.1.2)**. The bounding air quality assessment assumes emissions during refurbishment include building construction and combustion emissions which are bounding of emissions during dismantle/demolish activities for PNGS Units 1-4.

5.1.2 Noise

5.1.2.1 PNGS Units 1-4 Decommissioning

5.1.2.1.1 Stabilization and Storage with Surveillance

As stated in the 2017 Safe Storage PEA and the 2022 PEA Addendum, noise levels will be reduced during Stabilization and SWS as reactor units (including Units 1 and 4) are shutdown and facilities are transitioned to a SWS state. These findings from the 2017 Safe Storage PEA and updated in the 2022 PEA Addendum continue to remain valid for Units 1 and 4; therefore, no further assessment is conducted in this PERA.

5.1.2.1.2 Risk Reduction/Removal activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities, which will include dismantling and demolishing of buildings and structures. Dismantling activities (either under risk reduction and removal activities in 2025-2033 or dismantle/demolish activities in 2034-2036) will require equipment that may generate noise. These noise emissions would be coming from various sources such as road traffic and hauling machineries. Some SSCs require segmentation of the unit, which will generate additional noise as part of the process, which is temporary until the completion of the segmentation. Additional temporary noise would also be emitted from lifting the material on carts/buggies to transport to off-site waste disposal. Generally, it is anticipated that noise emitting activities will be associated with clearing work, segmentation/dismantling activities, hoisting and transporting the equipment.

OPG will implement a Noise Management Plan to mitigate noise generation at the site, maintain equipment in proper mechanical condition, and comply with applicable noise standards and regulations.

Overall, noise levels during risk reduction and removal activities and dismantle/demolish activities during this licensing period will be similar to noise levels assessed in the 2022 PN ERA with 6 operating units; therefore, no further assessment is warranted in the PERA.

5.1.2.2 PNGS Units 5-8 Refurbishment

During ongoing operations at the PN site, on-site continuous noise sources are primarily from building ventilation systems. Intermittent noise sources are primarily from the standby turbine generator set, steam relief valves, switchyard, emergency power supply generator, auxiliary steam boiler, and the auxiliary power supply.

No blasting is expected as part of the refurbishment and DWI construction activities; therefore, noise and vibration from blasting, including underwater, is not considered to be of concern and is not discussed further in the PERA.

During refurbishment additional noise will be emitted from operation of all construction-related equipment, operating outside of the building envelope, including additional on-site vehicle movements (e.g., haul trucks, additional workforce traffic).

To support this PERA, a maximum bounding scenario was developed to evaluate the effects of refurbishment and decommissioning on noise levels. The noise assessment focused on noise from construction equipment such as diesel generators, cranes, excavators, loaders, drilling, tugboats for DWI construction, and use of a multi-wheeled ground transporter for moving construction equipment. The maximum bounding emission scenario also considered on-site vehicular traffic (approximately 2,200 vehicles per day), specifically haul trucks for movement of material associated with refurbishment activities (i.e., hauling of excavated materials, concrete trucks supporting construction), as well as employee and delivery traffic from existing conditions and additional refurbishment contract employee and delivery traffic.

Noise levels were previously evaluated as part of the Pickering B Refurbishment EA; however, an updated noise model was developed in 2025 which took into account current Project planning as well as activities not considered in the Pickering B Refurbishment EA, including construction of the DWI.

5.1.2.2.1 Noise Screening Guidelines

Human Health

The measurement used to assess sound levels is the day-night sound level (Ldn). This value represents a 24-hour energy equivalent sound level that includes a 10 dB penalty for sounds that occur during night-time hours (22:00-07:00). The intention is to account for the heightened sensitivity to noise during night-time hours and capture a higher potential for annoyance during common sleeping hours. To assess the impact of noise on human receptors, noise guidelines were retained from HCs *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise* (HC, 2017). This document provides a novel method for estimating the

percentage of people that would be "highly annoyed" (%HA) by exposure to different noise levels and types. A dose-response curve is used to identify the %HA by sounds at the calculated levels. HC suggests that a noise impact requiring further evaluation and noise control measures occurs when an activity causes a change in %HA of +6.5%.

In addition to the %HA guidance, HC considers Project-associated noise levels greater than 75 dBA to potentially result in adverse effects such as sleep impairment and disturbance to vulnerable populations. Additional noise control measures are required when Project-associated Ldn values exceed 75 dBA (HC, 2017).

Ecological Health

There are minimal regulatory noise limits for the protection of ecological receptors. N288.6:22 (CSA, 2022) points to Environment and ECCC guidelines established to avoid causing harm to migratory birds and their nests (ECCC, 2023b). According to ECCC (2023b), birds can be potentially impacted by noise when:

- noise levels exceed 10 decibels (dB) above ambient noise levels in the natural environment (i.e., existing conditions pre-project); and,
- noises greater than about 50 dB are produced.

While ECCC caveats these guidelines as advice rather than regulatory limits, the ECCC values have been retained as the screening guidelines for assessing potential noise impacts to ecological receptors for the PERA.

5.1.2.2.2 Noise Modelling Results and Discussion

The human and ecological receptor locations retained for the noise modelling assessment are shown in **Figure 5-1** and **Figure 5-2**, respectively. Results of the noise modelling and comparisons with human health and ecological noise guidelines are presented in **Table 5-12** below.

Human Health

Predicted noise levels at the industrial/commercial worker receptor location are predicted to exceed the 75 dBA guideline provided by HC. Modelled noise levels at the industrial/commercial receptor location, in addition to the sport fisher, are predicted to exceed the +6.5 %HA guideline from HC.

Despite some noted exceedances of the HC noise guidelines, human receptors are not expected to be impacted by Project-associated noise levels. The industrial/commercial worker represents an off-site worker that would be acclimated to elevated noise levels through exposure to other industrial activities. Noise impacts tend to be more disruptive during nighttime hours when sounds can be perceived as being louder than during the daytime and sleep can potentially be

interrupted. Sleep disturbance is not considered a relevant health endpoint for this receptor location. Additionally, noise impacts tend to be more disruptive for certain sensitive receptors, such as residential areas, schools and daycares, hospitals, and places of worship. The industrial/commercial worker location is representative of a mix of various industrial and commercial operations and businesses and do not represent an area with receptors sensitive to noise impacts.

The sport fisher receptor represents a location where humans may be temporarily exposed to elevated noise levels resulting from Project activities. As described in **Section 6.1.1.2**, the sport fisher receptor is assumed to spend 1% of their time at the outfall location where atmospheric exposure occurs. This equates to approximately 87.6 hours in a full calendar year. Similar to the industrial/commercial worker, the sport fisher receptor does not represent a location where sleep disturbance is a relevant health endpoint, nor is it representative of an area with elevated sensitivity to noise impacts.

Considering the above, noise impacts are not assessed further for human receptors in this PERA.

Ecological Health

When considering existing conditions characterized by the recent noise monitoring program conducted at the PN site in October 2024, no background noise levels exceeded the ECCC's 50 dB guideline. When the influence of Project-related activities are considered together with existing noise levels, the 50 dB guideline was exceeded at all ecological receptor locations. Predicted sound levels at all ecological receptor locations within the PN site (including the Bank Swallow artificial habitat) and along the southern fenceline (representative of the nearshore Lake Ontario area) exceeded current noise levels by more than 10 dB, with the exclusion of receptor location R9, which met the ECCC guideline by demonstrating a predicted 9.7 dB increase from current noise conditions.

Although the ECCC noise guidelines are predicted to be exceeded at many of the ecological receptor locations assessed, these guidelines are interpreted to be provided by ECCC as recommended reference values and are not representative of strict regulatory limits. Nonetheless, mitigation measures are expected to be implemented to minimize Project-related noise disturbances to local terrestrial and riparian biota. As much as it is feasible to do so, work should be planned to occur during daytime hours when background sound levels are higher than nighttime hours to minimize disruption of nocturnal wildlife. The development and implementation of a Noise Management Plan will outline best construction practices and available mitigation measures for controlling noise generation. Noise levels at the PN site are characteristic of a typical urban and semi-urban environment; thus, it is likely that many on-site ecological receptors are accustomed to living near human developments and are well adjusted to sound levels consistent with local human activities.

Predicted noise levels at the receptor locations representative of Frenchman's Bay (an important local habitat for terrestrial and riparian biota) are considerably lower than the predicted noise

levels within the PN site and, in many cases, only slightly exceed the ECCC's 50 dB guideline. It is thus anticipated that noise impacts to Frenchman's Bay will be less severe relative to the PN site, allowing the area to continue to provide important refuge to local wildlife. This notion is further supported by the fact that predicted noise levels at the ecological receptor locations for Frenchman's Bay meet the ECCC recommendation that Project noise levels do not exceed background (i.e., pre-project) noise levels by more that 10 dB.

Predicted noise levels at the Bank Swallow artificial habitat location (receptor BSH) exceeded both noise guidelines provided by ECCC. This location corresponds to the site of the FFEE, a pilot artificial nesting test structure designed for Bank Swallow, a SAR. It should be noted that, without the pilot FFEE structure, the PN does not provide suitable breeding habitat for the Bank Swallow. In addition to monitoring of the FFEE currently undertaken as part of the SHA, OPG maintains an annual biodiversity monitoring program that documents and monitors wildlife populations at the PN site, including for breeding birds.

Mitigation measures should be explored to reduce noise levels to SAR during the breeding season including Bank Swallow. However, it should be noted that the noise modelling conducted for this PERA was developed with highly conservative assumptions relating to the planned Project activities, including maximum equipment use, without accounting for any significant variability in operational practices. The results represent a "worst-case" bounding scenario for potential noise impacts and may not actually occur during the breeding season. It is expected that under real-world conditions, noise impacts to ecological receptors would be less severe than the predicted modelling values.

Considering the above discussion, noise impacts are not assessed further for any ecological receptors for this PERA; however, recommendations are provided for noise levels associated with SAR such as the Bank Swallow.

Table 5-12: Human Health and Ecological Noise Modelling Results

Receptor ID	Receptor Name	Existing Conditions					PNGS Sources Only			Existing Conditions + PNGS Sources								
										Day		Night		24-hr		%HA Analysis		
		Day	Night	24-hr	Ldn	%HA	Day	Night	24-hr	Total	Increment	Total	Increment	Total	Increment	Total Ldn	Total %HA	Δ%HA
Noise Guidelines - Human Health (HC, 2017)																**75**		**+6.5**
Human Receptors																		
R1	Local Harvesting Area 1 [a]	48.4	46.9	48.0	53.6	3.5	49.0	49.0	49.0	51.7	3.3	51.1	4.2	51.6	3.5	57.6	5.8	2.3
R2	Local Harvesting Area 2 [a]	48.4	46.9	48.0	53.6	3.5	49.4	49.4	49.4	51.9	3.5	51.4	4.4	51.8	3.7	57.9	5.9	2.5
R3	Local Harvesting Area 3 [a]	48.4	46.9	48.0	53.6	3.5	49.1	49.1	49.1	51.8	3.4	51.2	4.2	51.6	3.6	57.7	5.8	2.3
R20	Industrial/Commercial Worker	47.7	46.9	47.5	53.4	3.4	70.3	70.3	70.3	70.3	22.7	70.3	23.4	70.3	22.9	76.7	43.3	39.9
R21	Sport Fisher	47.3	50.0	48.4	56.2	4.8	63.0	63.0	63.0	63.1	15.8	63.2	13.2	63.1	14.8	69.6	22.9	18.1
R22	Correctional Institute (C2)	47.7	46.9	47.5	53.4	3.4	42.5	42.5	42.5	48.8	1.2	48.2	1.3	48.7	1.2	54.7	4.0	0.6
R23	Farm	48.7	49.5	49.0	55.8	4.6	28.8	28.8	28.8	48.8	0.0	49.6	0.0	49.0	0.0	55.9	4.6	0.0
R24	Dairy Farm	48.7	49.5	49.0	55.8	4.6	16.9	16.9	16.9	48.7	0.0	49.5	0.0	49.0	0.0	55.8	4.6	0.0
R25	Urban Resident/Harvester [b] (WNW)	47.3	50.0	48.4	56.2	4.8	52.5	52.5	52.5	53.7	6.3	54.5	4.4	53.9	5.6	60.8	8.5	3.7
R26	Urban Resident/Harvester [b] (NW)	47.3	50.0	48.4	56.2	4.8	46.9	46.9	46.9	50.1	2.8	51.8	1.7	50.7	2.3	58.0	6.0	1.2
R27	Urban Resident/Harvester [b] (NNW)	48.4	46.9	48.0	53.6	3.5	48.3	48.3	48.3	51.4	2.9	50.7	3.7	51.2	3.1	57.2	5.5	2.0
Noise Guidelines - Ecological (ECCC, 2023)				**50**					**50**					**50**	**+10**			
Ecological Receptors																		
R3	Hydro Marsh	48.4	46.9	48.0	53.6	3.5	49.1	49.1	49.1	51.8	3.4	51.2	4.2	51.6	3.6	57.7	5.8	2.3
R6	Frenchman's Bay	47.3	50.0	48.4	56.2	4.8	52.0	52.0	52.0	53.3	5.9	54.1	4.1	53.6	5.2	60.4	8.2	3.3
R8	Frenchman's Bay	47.3	50.0	48.4	56.2	4.8	51.3	51.3	51.3	52.8	5.4	53.7	3.7	53.1	4.7	60.0	7.7	2.9
R15	Frenchman's Bay	47.3	50.0	48.4	56.2	4.8	47.7	47.7	47.7	50.5	3.2	52.0	2.0	51.1	2.7	58.3	6.2	1.4
R16	Frenchman's Bay	47.3	50.0	48.4	56.2	4.8	48.1	48.1	48.1	50.7	3.4	52.2	2.1	51.2	2.9	58.4	6.4	1.6
R19	Frenchman's Bay	47.3	50.0	48.4	56.2	4.8	53.5	53.5	53.5	54.4	7.1	55.1	5.1	54.7	6.3	61.4	9.2	4.4
R25	Frenchman's Bay	47.3	50.0	48.4	56.2	4.8	52.5	52.5	52.5	53.7	6.3	54.5	4.4	53.9	5.6	60.8	8.5	3.7
P8	Frenchman's Bay	47.3	50.0	48.4	56.2	4.8	50.5	50.5	50.5	52.2	4.9	53.3	3.2	52.6	4.2	59.6	7.3	2.5
R9	PN Site	48.7	49.5	49.0	55.8	4.6	58.2	58.2	58.2	58.7	9.9	58.8	9.2	58.7	9.7	65.1	14.2	9.6
R10	PN Site	48.4	46.9	48.0	53.6	3.5	73.5	73.5	73.5	73.5	25.1	73.5	26.6	73.5	25.5	79.9	53.7	50.3
R11	PN Site	48.4	46.9	48.0	53.6	3.5	70.0	70.0	70.0	70.0	21.6	70.0	23.1	70.0	22.0	76.4	42.3	38.8
R13	PN Site	47.7	46.9	47.5	53.4	3.4	65.0	65.0	65.0	65.1	17.4	65.1	18.2	65.1	17.6	71.5	27.6	24.2
R14	PN Site	48.4	46.9	48.0	53.6	3.5	58.8	58.8	58.8	59.2	10.8	59.1	12.1	59.2	11.1	65.5	14.8	11.3
R28	PN Site	47.7	46.9	47.5	53.4	3.4	70.3	70.3	70.3	70.3	22.7	70.3	23.4	70.3	22.9	76.7	43.3	39.9
BSH	Bank Swallow Habitat	48.7	49.5	49.0	55.8	4.6	63.2	63.2	63.2	63.4	14.6	63.4	13.9	63.4	14.4	69.8	23.4	18.8

Note:
Shaded cells indicate exceedance of the specified noise guideline.
Background noise levels are L90 measurements presented in dBA.
"PNGS Sources Only" and "Existing Conditions + PNGS Sources" presented as Leq values in dBA, unless otherwise specified.
"Existing Conditions": Background (i.e., pre-Project) noise levels characterized during the recent PN noise monitoring study conducted in October 2024.
"PNGS Sources Only": Modelled noise levels associated with the planned Refurbishment and Decommissioning activities.
"Existing Conditions + PNGS Sources": Predicted noise levels calculated by considering the influence of the modelled PNGS Refurbishment and Decommissioning activities together with existing noise levels. "Total" values represent sound levels considering both existing conditions and PNGS activities; "Increment" values represent the contribution to total noise values from PNGS activities only.

5.1.2.3 PNGS Units 5-8 Continued Operations

Following refurbishment, PNGS Units 5-8 will operate in the same manner as current PNGS Units 5-8 operations; therefore, assessment of the potential effects from the Continued Operation Phase on the environment is similar to the assessment in the 2022 PN ERA with 6 operating units; therefore, no further assessment is warranted in the PERA for continued operations.

During Continued Operations of PNGS Units 5-8, activities associated with PNGS Units 1-4 SWS and dismantle/demolish will be occurring, which could result in increased noise levels. It is expected that noise predictions would be within the bounding noise assessment presented in **Section 5.1.2.2**.

5.1.3 Summary of Tier 1 Assessment

The initial screening of potential effects of Project activities on the atmospheric environment included consideration of both air quality and noise levels. The predicted interactions between the atmospheric environment and Project activities are summarized in **Table 5-13**.

Table 5-14 below summarizes the constituents of interest considered, their sources, and associated exposure pathways for the atmospheric environmental component considered in the Tier 1 assessment. The table differentiates among the different phases of the Project including: PNGS Units 1-4 Stabilization and SWS, Risk Reduction/Removal Activities, PNGS Units 5-8 Refurbishment, and PNGS Units 5-8 Continued Operations. It also identifies the outcome of the Tier 1 assessment and if a Tier 2 analysis was needed.

As shown in **Table 5-14**, no Tier 2 assessment was identified based on the outcomes of the air and noise model. A Tier 2 assessment was identified for inclusion of a Harvester for the bounding radiological emissions.

Table 5-13: Summary of Interactions between Project Activities and Atmospheric Environment

Project Activities	Air	Noise
PNGS Units 1-4 Decommissioning		
PNGS Units 1 and 4 Stabilization	2017 Safe Storage PEA and 2022 PEA Addendum is bounding.	2017 Safe Storage PEA and 2022 PEA Addendum is bounding.
PNGS Units 1-4 Storage with Surveillance	2017 Safe Storage PEA and 2022 PEA Addendum is bounding for all activities with the exception of the following: • Activities associated with removal of modules and baskets from IFB-A and AIFB not previously assessed.	2017 Safe Storage PEA and 2022 PEA Addendum is bounding for all activities with the exception of the following: • Activities associated with removal of modules and baskets from IFB-A and AIFB not previously assessed.

Project Activities	Air	Noise
	Included in air model completed to support this PERA. • Harvester receptor not previously considered. Harvester receptor exposed to radiological COPCs in atmospheric environment considered further in Tier 2 assessment.	Included in noise model completed to support this PERA.
Risk Reduction and Removal Activities (2025-2033) Dismantle/Demolish (2034-2036)	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum. The Tier 1 assessment in this PERA concludes that: • Non-Radiological Emissions – negligible and mitigated by Environmental Management Plan. • Radiological Emissions – All SSCs will be characterized prior to dismantle/demolish. Decommissioning Safety Assessment will be completed.	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum. The Tier 1 assessment in this PERA concludes that noise levels would be mitigated by Noise Management Plan. Noise levels would be similar to or bounded by the 2022 PN ERA for 6 operating units.
PNGS Units 5-8 Refurbishment		
Preparation for Refurbishment		
• Procurement and Mobilization of Equipment and Components	This activity is bounded by the activities assessed in the air model completed to support this PERA. Not a significant air source.	The activity is bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source.
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	This activity is bounded by the activities assessed in the air model completed to support this PERA. Not a significant air source.	The activity is bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source.
• Construction of PCSS and SB5	This activity is bounded by the activities assessed in the air model completed to support this PERA. Not a significant air source.	The activity is bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source.
• Defuel and Dewater	• This activity is bounded by the activities assessed in the air model completed to support this PERA. Not a significant air source. • Radiological emissions bounded by existing conditions assessed in the 2022 PN ERA for 6 operating units.	The activity is bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source.

Project Activities	Air	Noise
• Islanding the Unit	No interaction.	No interaction.
• Management of Heavy Water	This activity is bounded by activities assessed in the air model completed to support this PERA. Not a significant air source.	The activity is bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source.
• Construction of DWI	Included in air model completed to support this PERA. Emissions associated with DWI construction such as launch shaft and tunnel construction, construction equipment, etc. considered, as well as DSM moves.	Included in noise model completed to support this PERA. Noise associated with DWI construction such as launch shaft and tunnel construction, construction equipment, etc. considered, as well as DSM moves.
Refurbishment		
• Replacement of Reactor Components	Equipment used to perform activity included in air model completed to support this PERA.	Equipment used to perform activity included in noise model completed to support this PERA.
• Removal and Replacement of Steam Generators	Equipment used to perform activity included in air model completed to support this PERA.	Equipment used to perform activity included in noise model completed to support this PERA.
• Operation of DWI	No interaction.	No interaction.
• Refurbishment of Other Plant Systems	Included in air model completed to support this PERA.	Included in noise model completed to support this PERA.
• Waste Management and Transportation	On-site transportation included in air model completed to support this PERA.	On-site transportation included in noise model completed to support this PERA.
• Refuelling and Restarting	Equipment used to perform activity included in air model completed to support this PERA.	Equipment used to perform activity included in noise model completed to support this PERA.
Continued Operations		
• Operation and Maintenance of PNGS Units 5-8	2022 PN ERA is bounding.	2022 PN ERA is bounding.
• Waste Management and Transportation	2022 PN ERA is bounding.	2022 PN ERA is bounding.

Table 5-14: Constituents, Sources and Pathways – Atmospheric Environment

Phase	Constituents of Interest	Sources	Potential Exposure Pathways	Tier 1 Outcome
Stabilization and SWS	Radionuclides: HTO, C-14 Non-radionuclides: combustion emissions - NOx, SO_2, CO, particulate matter Noise	• Building ventilation exhaust during reactor defueling, dewatering, (short-term peaks). • Emissions reduced since 4 electrode boilers will be used – Standby boiler used if required. • Ventilation reduced during SWS but still functional for safety.	Inhalation Noise exposure	Radiological emissions remain within historical bounds. However, based on engagement, Harvester evaluated in Tier 2 with exposure to bounding radiological emissions of HTO, C-14.
Risk Reduction and Removal	Radionuclides: None Non-radionuclides: Dust (TSP, PM_{10}, $PM_{2.5}$); diesel emissions; low-level residual contamination in dismantled components (generally non-nuclear). Noise	• Demolition of outbuildings. • Removal of generators, tanks, off-gas systems, and miscellaneous structures.	Inhalation Noise exposure	Emissions remain bounded by standard construction practices. No Tier 2.
Refurbishment	Radionuclides: HTO, C-14 Non-radionuclides: nitrogen dioxide, sulphur dioxide, carbon monoxide, TSP, $PM_{2.5}$, PM_{10}, benzo(a)pyrene (representative of total PAHs), and acrolein (representative of VOCs)[a] Noise	• Reactor dewatering and draining. • Steam generator removal (wet cutting). • Major equipment mobilization (cranes, heavy lift).	Inhalation Noise exposure	Radiological emissions remain within historical bounds. However, based on engagement, Harvester evaluated in Tier 2 with exposure to bounding radiological emissions of HTO, C-14. Localized non-radionuclide air quality exceedances possible

Phase	Constituents of Interest	Sources	Potential Exposure Pathways	Tier 1 Outcome
				but infrequent; Noise bounded offsite. No Tier 2.
Continued Operations	Radionuclides: HTO, C-14 at operational levels Non-radionuclides: nitrogen dioxide, sulphur dioxide, carbon monoxide, TSP, $PM_{2.5}$, PM_{10}, benzo(a)pyrene (representative of total PAHs), and acrolein (representative of VOCs)[a] Noise	Normal PNGS Units 5-8 reactor operations post-refurbishment and Units 1-4 SWS and dismantle/demolish.	Inhalation Noise exposure	Bounded by 2022 PN ERA. Bounded by air quality assessment. No Tier 2.

Note:

a. PAHs were modelled and conservatively assumed to be represented by benzo(a)pyrene. Similarly, VOCs were modelled and conservatively assumed to be represented by acrolein.

5.2 Surface Water Environment

5.2.1 Surface Water Flow

5.2.1.1 PNGS Units 1-4 Decommissioning

5.2.1.1.1 Stabilization and Storage with Surveillance

The 2017 Safe Storage PEA and 2022 PEA Addendum assumed that the PN water balance would change in a stepwise manner during the Stabilization Phase, from its previous operational configuration (6 operating units) to its configuration during the SWS Phase (PNGS Units 1 and 4, and PNGS Units 5-8 shut down). PNGS Units 1 and 4 were shut down in Q4 2024, and based on current Project planning, PNGS Units 5-8 will continue to operate until the end of 2026 after which they will enter refurbishment (see **Section 5.2.1.2**). During Units 1 and 4 Stabilization and Units 1-4 SWS, the most significant change from previous operational conditions (for 6 operating units) results from the gradual shutting down of the CCW pumps throughout Stabilization and SWS.

During Stabilization a minimum of 2 CCW pumps (approximately 2,050,000 m^3/day) will continue to operate to support Stabilization activities. The 2022 PEA Addendum assumed that during SWS, the expected CCW intake flow will be 250,500 m^3/day (2,899 L/s). The 2022 PEA Addendum is conservative as it assumed less flow was available for mixing.

Based on current Project planning, during Unit 1 and 4 Stabilization, some or all of PNGS Units 5 to 8 will be shutdown for refurbishment. When all units at PNGS Units 5-8 are shutdown, the RLWMS flow will discharge through either the PNGS Units 1-4 CCW discharge channel or the PNGS Units 5-8 CCW discharge channel. RBSW will be released through either the PNGS Units 1-4 or PNGS Units 5-8 outfall. Consistent with the 2022 PEA Addendum, inactive drainage (IAD) will be discharged to the respective PNGS Units 1-4 or PNGS Units 5-8 CCW intake duct. The water balance in **Figure 5-3** is a representation of 2 CCW pumps running and RLWMS flow discharged through the PNGS Units 1-4 CCW discharge channel.

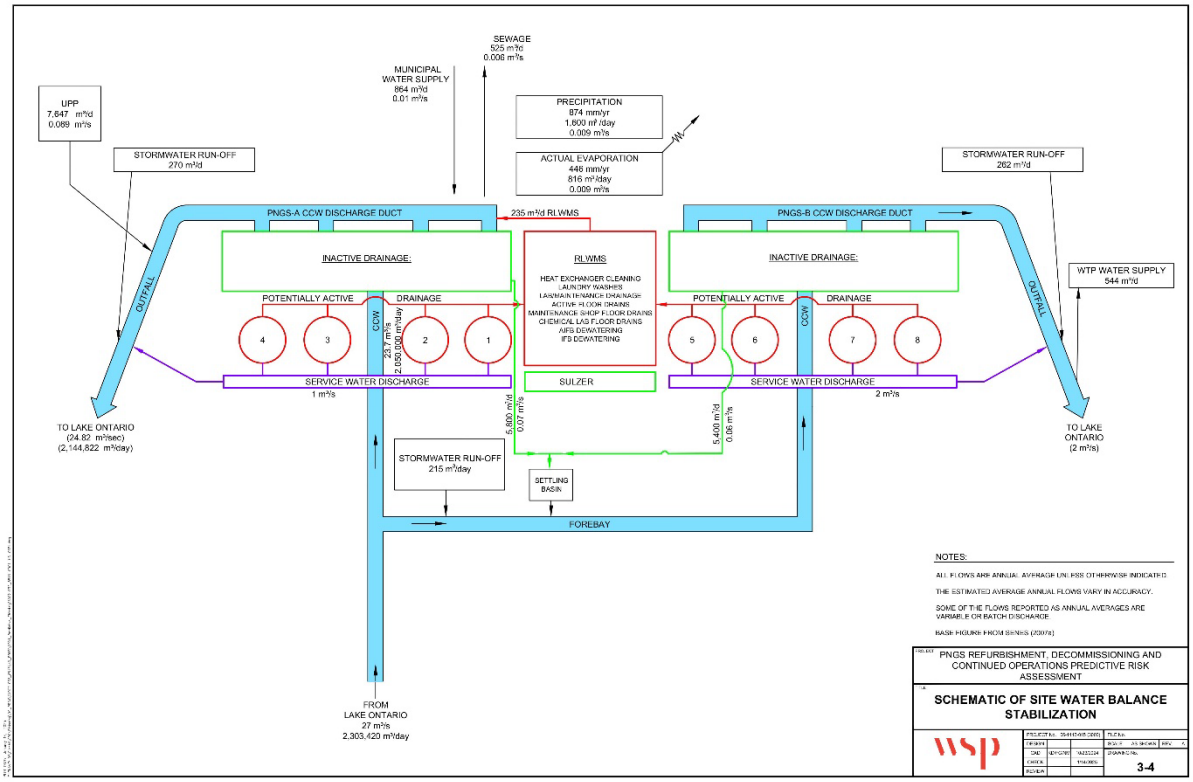
A three-dimensional hydrodynamic surface water model (RMA10) was initially developed to support the 2007 Pickering B Refurbishment EA. The model can be used to determine surface water levels, flow velocities and water temperatures. The model was updated for the 2017 Safe Storage PEA and re-assessed in the 2022 PEA Addendum, to evaluate the changes to the nearshore hydraulic environment resulting from the reduced flow conditions during SWS (SWS in the 2017 Safe Storage PEA and 2022 PEA Addendum was for both PNGS Units 1-4 and Units 5-8). The model grid is shown in **Figure 5-4**. The model was employed to predict changes in lake currents during SWS. The model assumed a much lower flow of 50,000 m^3/day (from RBSW only), compared to current Project planning. The 2022 PEA Addendum concluded that the model used in 2017 provides a reasonable representation of existing lake water physical conditions (water level, water temperature, current speed) and that the concentration factors provided in the 2017 Safe Storage PEA continue to remain valid for PNGS Units 1-4 SWS.

Furthermore, no changes in the amount of stormwater runoff were anticipated during the Stabilization and SWS activities. Overall, the findings from the 2017 Safe Storage PEA and updated in the 2022 PEA Addendum are bounding for PNGS Units 1 and 4 Stabilization and PNGS Units 1-4 SWS; therefore, no further assessment is conducted in this PERA.

A summary of assumptions made for surface water quantity from previous assessments and current Project planning is provided in **Table 5-15**.

Table 5-15: Summary of Surface Water Assumptions during the Project

Project Phase	2017 Safe Storage PEA	2022 PEA Addendum	Current Project Planning (this PERA)
PNGS Units 1 and 4 Stabilization	CCW pumps will be taken out of service as reactor units are shut down.	CCW pumps will be taken out of service as reactor units are shut down.	2 CCW pumps running (2,050,000 m^3/day), RLWMS released to PNGS Units 1-4 or Unit 5-8 discharge channel. PNGS Units 5-8 shutdown in 2026 for initiation of refurbishment – see **Figure 5-3.**
PNGS Units 1 to 4 SWS	50,000 m^3/day cooling water from RBSW only. No CCW pumps operating. Assessed in RMA10 model.	Increased flow of 250,500 m^3/day compared to 2017 Safe Storage PEA.	Same as Stabilization row.
PNGS Units 5-8 Refurbishment	Not assessed; however, considered shutdown of PNGS Units 5-8 which is the first step of refurbishment.	Not assessed; however, considered shutdown of PNGS Units 5-8 which is the first step of refurbishment.	Bounding condition evaluated in additional RMA10 model scenario (**Figure 5-5**) - 1 unit has completed refurbishment and is operational, water drawn in from DWI (approximately 2,050,000 m^3/day) to PNGS Units 5-8, no flow to PNGS Units 1-4. There is also option that flow will occur to PNGS Units 1-4 instead of Units 5-8, but that condition is represented in **Figure 5-3.**



Note: Figure reflects PNGS Units 1 and 4 in Stabilization and PNGS Units 5-8 shutdown for initiation of Refurbishment.

Figure 5-3: Site Water Balance During PNGS Unit 1 and Unit 4 Stabilization

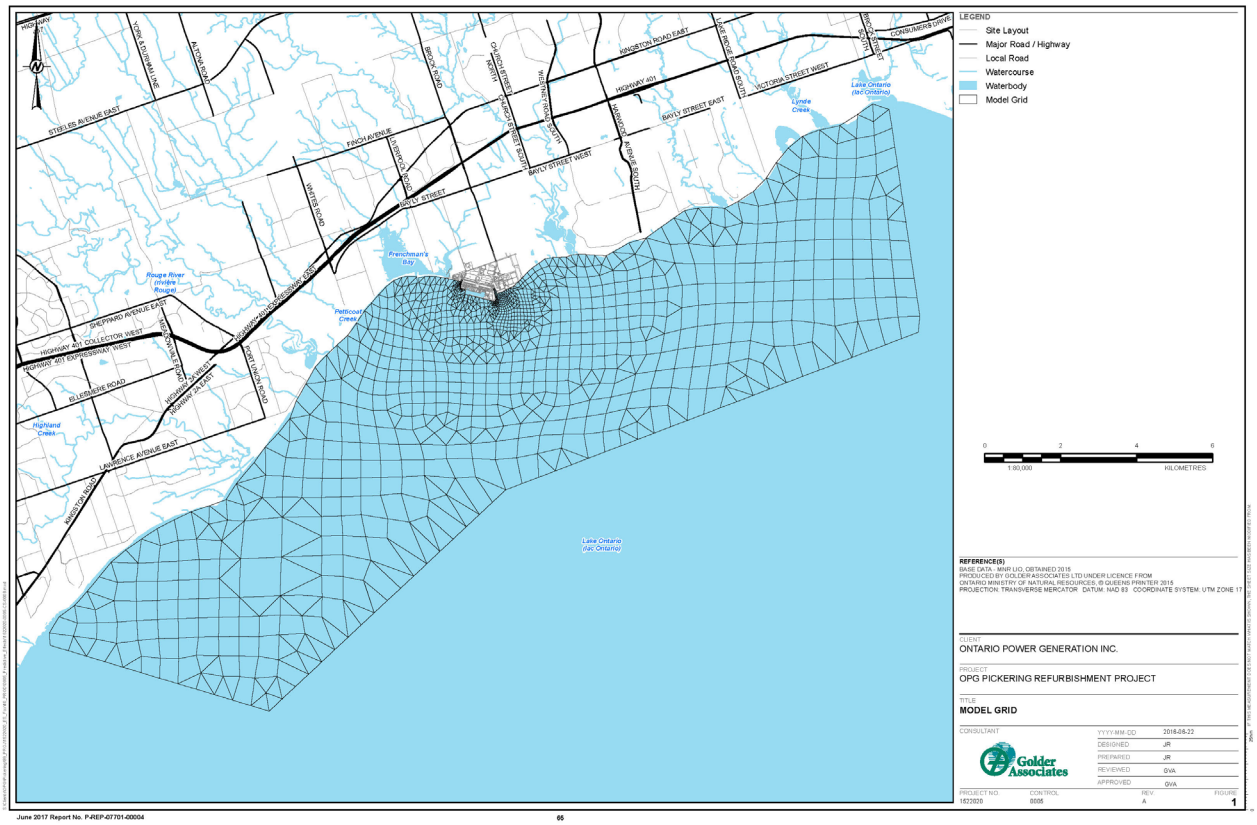


Figure 5-4: RMA10 Model Grid and Extent

5.2.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities that will occur during the 2025 to 2033 timeframe, nor the additional dismantle/demolish activities that will occur from 2034 to 2036.

As outlined in **Section 3.3.4**, OPG intends to dismantle certain non-nuclear systems and outbuildings associated with PNGS Units 1-4. However, these specific SSCs do not interact with the drainage system, forebay, intake channel, and intake and discharge ducts.

Considering risk reduction and removal activities and dismantling/demolition activities of non-nuclear outbuildings, from 2025 to 2036, will have no impact on surface water quantity, no further assessment is warranted.

5.2.1.2 PNGS Units 5-8 Refurbishment

PNGS Units 5-8 will undergo refurbishment and return to operations in a staged manner. While PNGS Units 5-8 are shut down for refurbishment, water will be discharged via PNGS Units 1-4 or PNGS Units 5-8. Once PNGS Units 5-8 return to service, the discharge will be via PNGS Units 5-8 CCW discharge channel. The water balance for the Refurbishment phase is shown in **Figure 5-5**.

Other refurbishment activities associated with the replacement of reactor components, replacement of steam generators, waste management, and refuelling and restarting are not anticipated to result in any major changes to the volume of effluent discharged or to Lake Ontario's hydrology.

Construction activities during the Refurbishment phase may disturb existing surfaces and reduce pervious cover, potentially altering stormwater volumes and flow rates, with an increase in sediment from disturbed areas and storm events. However, all activities during this phase will be conducted in accordance with an Erosion and Sediment Control Plan to ensure there are no measurable effects on stormwater runoff. Additionally, a Stormwater Management Plan will be developed. The assessment of potential modifications to existing stormwater infrastructure (e.g., the development of a new stormwater outfall, or the installation of new drainage ditches and storm sewers) needed to support the Project will be completed by a civil engineer. It is assumed that any modifications or expansions to the stormwater management system will meet water quality protection criteria as per MECP requirements. Additionally, any shoreline work for potential stormwater outfalls, if needed, would be done as per Toronto and Region Conservation Authority approvals. The stormwater management system itself will not represent an adverse effect to surface water quantity

As discussed in **Section 3.1.1.7**, the construction and operation of a DWI is proposed. The DWI is proposed to be located approximately 1.5 km offshore from the east end of the existing forebay and will replace the current shoreline surface water intake. The construction of a cutoff wall to greatly reduce the connection of the existing forebay to the lake is also being proposed.

The RMA10 model developed for the 2017 Safe Storage PEA and re-assessed in the 2022 PEA Addendum did not consider the DWI. As such the RMA10 model was updated by WSP to change the intake location to the proposed location for the DWI and assess changes to lake circulation patterns. This was used to determine if previously used concentration factors at various receptor locations would change based on the new configuration. A bounding condition was evaluated where only 1 unit from PNGS Units 5-8 has completed refurbishment (and the remaining 3 units are not operating); therefore, the flow through the DWI is approximately 23.7 m^3/s. The water balance assumes that all CCW pumps are shutdown on the PNGS Units 1-4 side. The water balance for refurbishment is shown in **Figure 5-5**. Note that CCW pumps on the PNGS Units 1-4 side may still be operational during PNGS Units 5-8 refurbishment.

The RMA10 simulation periods included two modelling periods (September 4, 2011 to December 24, 2011, and March 29, 2012 to July 10. 2012), as used in the 2017 Safe Storage PEA. The 2022 PEA Addendum checked if the model predictions were still accurate using updated lake water data and future climate trends up to 2039. It concluded that the RMA10 model accurately represents current and future conditions. Based on that conclusion, the modelling periods continue to remain valid as simulation periods for the updated model.

The following assumptions in the RMA10 model were made to align with current Project planning:

- The future plant configuration includes a submerged DWI located approximately 1,500 m from the plant. The model was modified to draw intake water from a model element that was centered on the location of the new intake. The existing intake channel was removed from the model.
- The intake flow and CCW flow from PNGS Units 5-8 was assumed to be 23.7 m^3/s based on the latest flow diagram (**Figure 5-5**) for the bounding condition.
- The flow from the PNGS Units 1-4 discharge channel was assumed to be limited to the average stormwater runoff rate of 270 m^3/d (0.0031 m^3/s).
- The RLWMS discharge is to the PNGS Units 5-8 discharge channel and not PNGS Units 1-4 (based on current Project planning discharge could be to either channel).
- The intake temperature was assumed to be equal to the measured lake water temperature at temperature loggers near PNGS, consistent with the 2017 Safe Storage PEA.

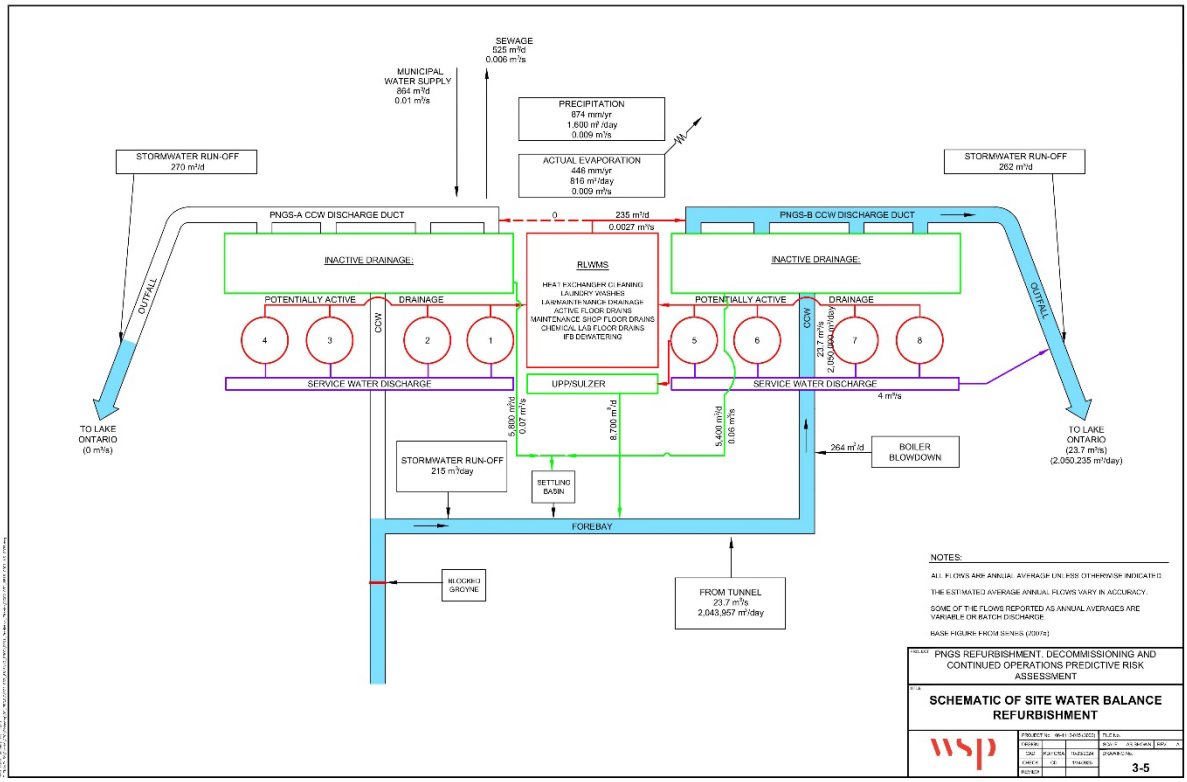
The RMA10 model was used to predict the transport and dispersion of a conservative tracer for the future conditions. Concentration factors were developed for each receptor location based on a constant discharge concentration of 1 g/m^3 (1 mg/L), and are shown on **Table 5-16**. The concentration factors represent the inverse of dilution factors. The concentration factor can be multiplied by a contaminant's outfall concentration to estimate its concentration at different lake locations. The conservative tracer is not intended to represent any specific contaminant, but is intended to provide a consistent method to determine concentrations at various receptors consistent with the 2017 Safe Storage PEA.

For the discussion on surface water quantity, the main differences in the assumptions behind the concentration factors for the 2025 modelling update and those from the 2017 Safe Storage PEA are that the 2025 modelling assumes 2,050,000 m^3/day of cooling water from CCW pumps, released to the PNGS Units 5-8 CCW discharge duct, whereas the 2017 Safe Storage PEA assumed 50,000 m^3/day of cooling water from the RBSW only. As well, addition of the DWI changes the circulation patterns. The concentration factors used in the 2017 Safe Storage PEA, along with those for existing condition (for 6 operating units) and the 2025 bounding condition are shown in **Table 5-16**. The main difference between the concentration factors is that in the 2017 Safe Storage PEA water was planned to be released to the PNGS Units 5-8 outfall from the RBSW only; however, based on current project planning water will be released via the PNGS Units 5-8 discharge duct with a greater flowrate. Interpretation of the concentration factors in terms of predicted concentrations of radionuclides and non-radionuclides is presented in **Section 5.2.2.2**.

Table 5-16: Summary of Predicted Surface Water Concentration Factors for PNGS Units 5-8 Outfall

Location of Interest	Distance from PNGS Units 5-8 Outfall (m)	2017 Safe Storage PEA RBSW Discharge to PNGS Units 5-8[1]	Existing Conditions[2] Discharge to PNGS Units 1-4	Existing Conditions[2] Discharge to PNGS Units 5-8	2025 Modelling Update Discharge to PNGS Units 5-8, during Refurbishment [3]
PNGS Units 1-4 Discharge Channel	939	3.56E-04	9.44E-01	3.84E-03	9.88E-03
PNGS Units 5-8 Discharge Channel	212	6.80E-02	1.05E-04	9.97E-01	8.97E-01
Off PNGS / Sport Fisher	515	1.25E-03	5.72E-02	1.81E-01	5.58E-02
Squires Beach	2,100	7.48E-04	1.26E-02	1.06E-01	2.93E-02
Liverpool Beach	1,485	3.62E-04	1.68E-01	4.54E-02	1.67E-02
Frenchman's Bay Inlet	1,970	3.16E-04	9.67E-02	4.28E-02	1.44E-02
Ajax Intake	5,061	1.01E-04	5.50E-03	1.86E-02	3.08E-03

Note:
Estimated average concentration factors based on constant discharge concentration of 1 g/m^3 (1 mg/L).
(1) Concentration factor applies to RBSW end of pipe concentration where flow is 50,000 m^3/day.
(2) Existing conditions represents PNGS Units 1 and 4 operating and Units 5-8 operating.
(3) Concentration factor applies to PNGS Units 5-8 CCW discharge duct end of pipe where flow is 2,050,00 m^3/day. A bounding condition was evaluated where only 1 unit from PNGS Units 5-8 has completed refurbishment (and the remaining 3 units are not operating), and all of PNGS Units 1-4 are shut down.



Note: Figure reflects a condition where 1 unit is operating for PNGS Units 5-8, DWI tunnel is operating, and PNGS Units 1-4 has no intake or discharge flow.

Figure 5-5: Water Balance for Refurbishment

5.2.1.3 PNGS Units 5-8 Continued Operations

As outlined in the previous section, the construction of the proposed DWI and associated activities will modify surface water flow and hydrology compared to previous conditions (with 6 operating units as assessed in the 2022 PN ERA).

During Continued Operations, the intake flow will come from the DWI, and will be lower than previous operational conditions (with 6 operating units) since there will be no flow to PNGS Units 1-4. The intake flow from the DWI will range from approximately 141 to 172 m^3/s (average of 156.5 m^3/s) with a similar discharge through the PNGS Units 5-8 discharge channel (see **Figure 5-6**). Since there will be no flow out the PNGS Units 1-4 discharge channel, the Continued Operations scenario will be similar to or lower than previous operational conditions (with PNGS Units 1 and 4 operating); therefore, no further assessment is warranted in the PERA for continued operations.

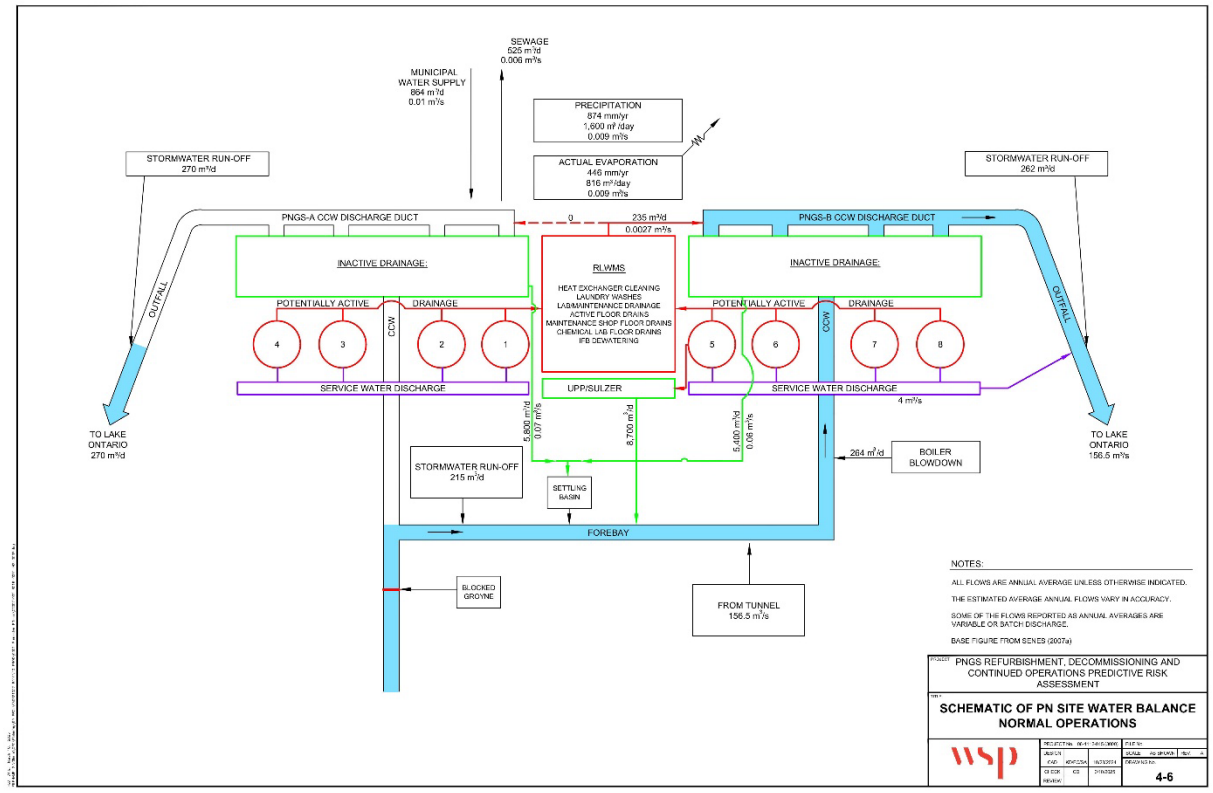


Figure 5-6: Water Balance for PNGS Units 5-8 Continued Operations

5.2.2 Surface Water Quality

5.2.2.1 PNGS Units 1-4 Decommissioning

5.2.2.1.1 Stabilization and Storage with Surveillance

5.2.2.1.1.1 Forebay

Non-Radiological and Radiological Emissions

In the 2017 Safe Storage PEA and 2022 PEA Addendum, the forebay was assessed as a potential aquatic habitat during the SWS Phase following reduced flows and removal of the FDS. In the 2022 PEA Addendum an updated mass balance box model was developed to predict surface water concentrations in the forebay during the SWS Phase based on groundwater contributions from the TAB IAD sumps and the Vacuum Building Ramp Sump (VBRS), as well as stormwater to the forebay. As shown in the 2022 PEA Addendum, predicted concentrations of non-radionuclides in the forebay were below screening criteria. For radionuclides, total doses to ecological receptors in the forebay were calculated using measured concentrations of tritium, C-14, Co-60, Cs-134 and Cs-137. Based on the modelling results, there were no potential adverse effects identified. All doses to the receptors assessed were predicted to be below the aquatic benchmark of 9.6 mGy/d, or the terrestrial benchmark of 2.4 mGy/d, as applicable to each receptor.

Based on current Project planning, a DWI will be used to draw water into the forebay and then into the PNGS Units 5-8 intake duct. The DWI will be used starting in 2030, and the FDS will remain operational as necessary. A cutoff wall will be installed at the entrance to the intake channel and water flowing through the cutoff wall into the forebay may serve as an emergency service water supply to the station. While some small fish may be able to enter the forebay through small holes in the cutoff wall, the forebay would not be considered fish habitat according to the DFO definition as "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration area." The cutoff wall will include fish mitigation measures to minimize the risk of fish entry, including SAR such as American Eel. Since the assessment conducted in the 2022 PEA Addendum assumed that during SWS the forebay would become a potential aquatic habitat and assessed effects of radionuclides and non-radionuclides on ecological receptors, the 2022 PEA Addendum is considered bounding; therefore, no further assessment of water quality in the forebay is conducted in this PERA.

5.2.2.1.1.2 Stormwater

Non-Radiological and Radiological Emissions

Consistent with the 2017 Safe Storage PEA and 2022 PEA Addendum, there are no changes to the stormwater runoff anticipated as a result of the Stabilization and SWS activities. Stormwater is discharged through stormwater runoff outfalls at the shore of Lake Ontario, into the forebay and into the PNGS Units 1-4 and PNGS Units 5-8 discharge channels. Stormwater runoff catchments to Lake Ontario have been assessed in the 2022 PN ERA and that assessment is considered bounding for Stabilization and SWS. The stormwater runoff that drains into the discharge channels is assumed to be 270 m^3/day and 262 m^3/day for PNGS Units 1-4 and PNGS Units 5-8, respectively, based on annual precipitation of 872 mm (see **Figure 5-3**). The 2017 Safe Storage PEA assessed stormwater runoff mixed with cooling water (50,000 m^3/day) in the discharge channel. Using the maximum stormwater quality from the 2015/2016 sampling program, mixed with cooling water, all concentrations were below screening criteria. Based on current Project planning, with 2 CCW pumps running, additional cooling water will be available for dilution instead of 50,000 m^3/day (cooling water needs from RBSW assumed in 2017 Safe Storage PEA); therefore, concentrations in the PNGS Units 1-4 discharge channel are expected to be lower and will be bounded by the 2017 Safe Storage PEA and 2022 PEA Addendum. Additionally, during the end of Stabilization, all PNGS Units 5-8 units will be shutdown for refurbishment, so there will be a period of time where only RBSW and stormwater are discharged to the PNGS Units 5-8 discharge channel (no CCW pumps will be running). Since additional dilution will be available from operation of the CCW pumps, the scenario for PNGS Units 1 and 4 Stabilization and Units 5-8 refurbishment is bounded by the stormwater concentrations predicted in the discharge channels for SWS in the 2017 Safe Storage PEA (Golder and Ecometrix, 2017). Overall, these findings for stormwater quality from the 2017 Safe Storage PEA are bounding for Stabilization and SWS; therefore, no further assessment is conducted in this PERA.

5.2.2.1.1.3 Lake Water Quality

Non-Radiological and Radiological Emissions

As discussed in **Section 5.2.1.1.1**, during Stabilization and SWS, a minimum of 2 CCW pumps will continue to be available.

During the end of PNGS Units 1 and 4 Stabilization, all PNGS Units 5-8 will be shutdown for refurbishment. A minimum of 2 CCW pumps will run from either PNGS Units 1-4 or Units 5-8. There may be a period of no flow (no CCW pumps running for PNGS Units 5-8), where the RLWMS will discharge through the PNGS Units 1-4 CCW discharge channel and only RBSW (and stormwater) will be released through the PNGS Units 5-8 CCW outfall (see **Figure 5-3**). Consistent with the 2022 PEA Addendum, the IAD will be discharged to the respective PNGS Units 1-4 or PNGS Units 5-8 CCW intake duct, and not diverted to the RLWMS or RBSW. In addition, the increase in expected minimum flow rate from 50,000 m^3/day (assumed in the 2017 Safe Storage PEA) to 250,500 m^3/day (assumed in the 2022 PEA Addendum) will improve the dilution of contaminants discharged at the outfall.

The 2017 Safe Storage PEA evaluated lake water quality during SWS based on expected liquid effluent quality for tritium, carbon-14, and gross beta/gamma from the RLWMS and groundwater inputs. In the 2017 Safe Storage PEA, the release from the RLWMS and groundwater was assumed to be mixed with 50,000 m^3/day of RBSW, released to the PNGS Units 5-8 discharge channel. The end of pipe RBSW concentrations were multiplied by the concentration factors from the RMA10 model to calculate concentrations at various receptor locations as reproduced from the 2017 Safe Storage PEA in **Table 5-17**. End of pipe RBSW concentrations for non-radionuclides were compared against screening values in the 2017 Safe Storage PEA and it was determined that further consideration in a Tier 2 assessment was not warranted.

Table 5-17: Predicted Lake Water Concentrations for Radionuclides during SWS

Location of Interest	Tritium (Bq/L)	Carbon-14 (Bq/L)	Beta/Gamma (Bq/L)
RBSW Discharge[(a)]	7.00E+03	3.00E-01	5.00E-01
PNGS Units 1-4 Discharge Channel	2.49E+00	1.07E-04	1.78E-04
PNGS Units 5-8 Discharge Channel	4.76E+02	2.04E-02	3.40E-02
Sport Fisher	8.78E+00	3.76E-04	6.27E-04
Squires Beach	5.24E+00	2.24E-04	3.74E-04
Liverpool Beach	2.53E+00	1.08E-04	1.81E-04
Frenchman's Bay Inlet	2.21E+00	9.47E-05	1.58E-04
Ajax Intake	7.08E-01	3.03E-05	5.06E-05

Note:
(a) The RBSW discharge concentration is from Section 4.2.3.2.1.4 in the 2017 Safe Storage PEA.

Overall, since based on current Project planning more cooling water flow will be available for dilution during Stabilization and SWS than previously assessed, the findings from the 2017 Safe Storage PEA and updated in the 2022 PEA Addendum are bounding for PNGS Unit 1 and 4 Stabilization and PNGS Units 1-4 SWS. Therefore, no further assessment of lake water quality is warranted in this PERA.

While no specific COPCs were identified for the surface water environment during Stabilization and SWS, general feedback from the WTFNs on other PERAs has indicated that it would be beneficial to include a Harvester receptor in the PERA. As such, assessment of a Harvester for surface water radiological emissions is considered in the Tier 2 quantitative assessment.

5.2.2.1.1.4 Irradiated Fuel Bays

During SWS, the IFB-A will be drained by 2034. OPG may flush the IFB-A water directly to the PNGS Units 1-4 outfall using U1 CCW pump for dilution. Water drained from IFB-A will be released to Lake Ontario in a controlled manner that keeps tritium concentrations at the WSPs within existing tritium levels and well below regulatory limits.

5.2.2.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities that will occur during the 2025 to 2033 timeframe, nor the additional dismantle/demolish activities that will occur from 2034 to 2036.

As outlined in **Section 3.3.4**, OPG plans to dismantle certain non-nuclear systems and outbuildings associated with PNGS Units 1-4. As part of the dismantling activities, any potential impacts to surface water quality will be minimized or eliminated by following construction best practices and OPG's spill management protocols, which include the highest precautions to control and contain any potential spill and prevent release to the environment. Considering minimal interaction between surface water quality and risk reduction and removal activities and dismantling/demolition activities of non-nuclear buildings, from 2025-2036, no effects on surface water quality are expected; therefore, no further assessment is warranted.

5.2.2.2 PNGS Units 5-8 Refurbishment

Construction equipment, such as cranes and forklifts, will be used during the site preparation and the removal and replacement of steam generators. Possible effects of increased traffic, clearing operations and sanding/salting of parking and lay-down areas will be mitigated by implementing the procedures outlined in the Erosion and Sediment Control Plan or Stormwater Management Plan. Therefore, measurable changes to stormwater runoff, and consequently, to surface water and sediment quality are unlikely.

Project activities associated with the removal and replacement of reactor components, refurbishment of other plant systems (e.g., reactor auxiliary systems, feedwater systems), general upgrades and maintenance, and refuelling and restarting are not expected to have an increased interaction with surface water and sediment quality from previous operations (with 6 operating

units). Activities associated with the construction of the PCSS for the storage of low and intermediate-level refurbishment waste were assessed as part of the PCSS PERA and were determined to have negligible interactions with surface water (Ecometrix, 2024). Consistent with the PCSS PERA, and applicable for all planned construction of buildings to support the Project, OPG will employ best practices for stormwater management that would meet Ontario MECP requirements and industrial sewage works rules.

The main interactions between Project activities and surface water are likely to occur during PNGS Units 5-8 shutdown, defueling and dewatering since there will be a reduction in cooling water flow which may lead to changes in the surface water quality. This is discussed further below.

Non-Radiological Emissions

The reduction in CCW flow is not expected to result in any measurable changes in the concentrations of non-radiological parameters of interest within the CCW discharge channel compared to previous operational conditions (for 6 operating units). When a unit is shutdown there may be some liquid effluent discharges associated with draining and decontamination of systems and equipment; however, after this initial work there will be a proportional decrease in both liquid effluent and CCW flow.

During reactor shut down for refurbishment, morpholine and hydrazine will continue to be used to protect equipment and piping from corrosion. Hydrazine, a corrosion inhibitor utilized in station water systems and known to produce ammonia as a by-product, will continue to be applied at current levels during refurbishment. Under existing conditions, hydrazine, morpholine, ammonia, pH and TRC concentrations have been maintained below the boiler blowdown ECA limits (OPG, 2018b, 2019c, 2020b, 2021e, 2023b, 2023a, 2024e, 2025e), and are expected to remain well within acceptable thresholds during refurbishment. If necessary, CCW flows can be adjusted to ensure discharges are within ECA limits. As such the assessment of hydrazine and morpholine in the 2022 PN ERA is bounding (for 6 operating units); therefore, no further assessment is conducted in the PERA for lake water quality during refurbishment.

The 2022 PN ERA concluded that there is no risk to human receptors due to hydrazine in drinking water. Considering fish ingestion, the ILCR to the Sport Fisher receptor exceeded the acceptable cancer risk level when estimating lake exposure level by dilution of the UCLM concentration of hydrazine in the CCW discharge, but not when considering lake-measured hydrazine. The 2022 PN ERA concluded that the result was conservative since a fisher's diet would likely include fish harvested from various locations including those unaffected by PN emissions. Additionally, the ERA did not account for hydrazine degradation at the Sport Fisher location – hydrazine is known to degrade rapidly.

Overall, it is expected that the waterborne non-radiological emissions released through the PNGS Units 5-8 CCW discharge channel during this phase would reduce considerably. Based on historical water quality monitoring, this will likely result in either a minor measurable decrease or

no change in concentrations in Lake Ontario compared to previous operational conditions (as assessed in the 2022 PN ERA for 6 operating units). Consistent with the Surface Water TSD in the 2008 Pickering B Refurbishment EA (updated in **Table 5-18**), mixing calculations of inputs to the CCW duct (for those streams including the RLWMS and new water treatment plant (NWTP) that require monitoring prior to mixing in the CCW duct as per the ECA) show concentrations below the PWQO during refurbishment, assuming a CCW flow of 76.5 m^3/s for 2 units operating and 23.7 m^3/s for 1 unit operating (Golder, 2007d). Other constituents (ammonia, hydrazine, morpholine, pH, and TRC) are measured directly in the CCW duct prior to discharge to the outfall and as such evaluation of compliance can be determined based on direct monitoring data, and CCW flows can be adjusted to ensure discharges remain within ECA limits.

Table 5-18: Summary of CCW Mixing Calculations for RLWMS and NWTP

Parameter	Units	Intake Concentration[1]	ECA Limit at Effluent Discharge	Maximum Predicted Concentration in CCW (2 Units Operating)	Maximum Predicted Concentration in CCW (1 Unit Operating)	PWQO
RLWMS						
Phosphorus	mg/L	<0.01	1	<0.01	<0.01	0.02
Total suspended solids	mg/L	<2	73	<2	<2	N/A
Zinc	mg/L	0.01	1	0.010	0.011	0.03
Iron	mg/L	0.025	9	0.026	0.030	0.3
Oil and Grease	mg/L	<1	36	<1	<1	Narrative
NWTP						
Aluminum	mg/L	0.004	13	0.0064	0.0117	0.075
Total suspended solids	mg/L	<2	70	<2	<2	N/A
Iron	mg/L	0.0025	2.5	0.0255	0.0265	0.3

Note:

[1] (Golder, 2007d)

Radiological Emissions

During refurbishment D_2O systems will be drained, moderator system flushed, and all other liquids, wastes and potentially hazardous transient materials will be removed. Initial dewatering may result in some increase in radiological emissions from the RLWMS. However, this activity is bounded by the assumptions in the 2017 Safe Storage PEA and 2022 PEA Addendum.

During the removal and replacement of steam generators, light water will be drained from the steam generators and released to Lake Ontario. This water will be monitored for non-radionuclides to ensure it is within ECA limits before being discharged to the lake. Water will also be monitored for radionuclides. If contamination is detected during the monitoring, the water will be sent to the RLWMS for processing.

OPG is developing a tritium emissions plan for light water to ensure that tritium concentrations at the Ajax WSP remain within the range seen during previous operations (6 operating units), i.e. below roughly 10 Bq/L. Since OPG intends to manage tritium emissions during refurbishment in alignment with previous operations, the 2022 PN ERA (with 6 operating units) is considered bounding and no further assessment of tritium emissions to lake water during refurbishment is warranted.

5.2.2.2.1 Deep Water Intake

The construction and operation of the planned DWI, as well as associated activities including the construction of the cutoff wall to separate the forebay from the lake, and material disposal, have the potential to alter sediment and water quality. Specifically, this includes disturbance of the sediment during dredging and subsequent relocation of dredge spoils, and possible changes in local hydrology during operation with intake flow. It is likely that these activities will only cause a temporary impact, or little-to-no impact, on surface water and sediment in Lake Ontario and Frenchman's Bay. Dredged materials will be sampled prior to disposal based on a sampling plan developed in accordance with regulatory requirements.

As discussed in **Section 5.2.1.2**, an updated RMA10 was used to determine changes to concentration factors at various receptor locations due to the change in configuration with a DWI. A bounding condition was evaluated where only 1 unit from PNGS Units 5-8 has completed refurbishment (and the remaining 3 units are not operating); therefore, the flow through the DWI is approximately 23.7 m^3/s, as per the water balance for the bounding condition shown in **Figure 5-5**.

The expected bounding concentrations in the RLWMS are consistent with the 2017 Safe Storage PEA based on average operational RLWMS emissions from 2011 to 2015 and include:

- Tritium: 1.2E+06 Bq/L;
- Carbon-14: 46 Bq/L; and
- Beta/Gamma: 91 Bq/L.

The flow rate from the RLWMS is approximately 235 m^3/day and approximately 2,050,000 m^3/day of cooling water is being released from the PNGS Units 5-8 discharge channel. Using the concentration factors from the 2025 RMA10 modelling for refurbishment, the predicted concentrations at various receptor locations are shown in **Table 5-19**.

Predicted concentrations of radionuclides in surface water under the refurbishment bounding scenario are expected to be lower than those assessed in the 2017 Safe Storage PEA; therefore, the assessment in the 2017 Safe Storage PEA is bounding and no further assessment of radionuclides in surface water is warranted in the PERA for the Refurbishment Phase. As mentioned in **Section 5.2.2.1.1.3**, while no specific COPCs were identified for the surface water environment, general feedback from the WTFNs on other PERAs has indicated that it would be

beneficial to include a Harvester receptor in the PERA. As such, assessment of a Harvester for surface water radiological emissions is considered in the Tier 2 quantitative assessment.

Table 5-19: Predicted Surface Water Concentrations for Radionuclides Released to PNGS Units 5-8 Outfall During Refurbishment

Location of Interest	Distance from PNGS Units 5-8 Outfall (m)	2017 Safe Storage PEA Concentrations (50,000 m^3/day cooling water from RBSW)			Refurbishment Concentrations (2,050,000 m^3/day CCW cooling water)		
		Tritium (Bq/L)	Carbon-14 (Bq/L)	Beta/Gamma (Bq/L)	Tritium (Bq/L)	Carbon-14 (Bq/L)	Beta/Gamma (Bq/L)
PNGS Units 1-4 Discharge Channel	939	2.49E+00	1.07E-04	1.78E-04	1.36E+00	5.21E-05	1.03E-04
PNGS Units 5-8 Discharge Channel	212	4.76E+02	2.04E-02	3.40E-02	1.23E+02	4.73E-03	9.36E-03
Sport Fisher	515	8.78E+00	3.76E-04	6.27E-04	7.68E+00	2.94E-04	5.82E-04
Squires Beach	2,100	5.24E+00	2.24E-04	3.74E-04	4.03E+00	1.55E-04	3.06E-04
Liverpool Beach	1,485	2.53E+00	1.08E-04	1.81E-04	2.30E+00	8.81E-05	1.74E-04
Frenchman's Bay Inlet	1,970	2.21E+00	9.47E-05	1.58E-04	1.98E+00	7.59E-05	1.50E-04
Ajax Intake	5,061	7.08E-01	3.03E-05	5.06E-05	4.24E-01	1.62E-05	3.21E-05

5.2.2.3 PNGS Units 5-8 Continued Operations

The construction and operation of the proposed DWI and associated activities could modify lake circulation and associated dilution patterns and surface water quality compared to previous operational conditions (with 6 operating units as assessed in the 2022 PN ERA). As described in **Section 5.2.1.3**, during Continued Operations the intake flow will be provided by the DWI, and will be lower than previous operational conditions for 6 operating units, since there will be no flow to PNGS Units 1-4. Concentrations in effluent released from PNGS Units 5-8 should be similar to previous operational conditions (for 6 operating units); however, concentrations in the nearshore Lake Ontario may be different, as water released from the PNGS Unit 5-8 outfall will no longer be drawn into the forebay due to the cutoff wall (while there will be some flow through the cutoff wall, recirculation of water into the forebay will be reduced).

Surface water quality during Continued Operations will be similar to previous operational conditions (with 6 operating units); however, continued monitoring of lake water through the EMP will confirm this assumption over time. No further assessment is warranted in the PERA for continued operations.

Beyond this, no significant changes to surface water are anticipated during this phase as PNGS Units 5-8 is expected to continue operating consistent with current practices.

5.2.3 Summary of Tier 1 Assessment

The initial screening of potential effects of Project activities on the surface water environment included consideration of both surface water flow and quality. The predicted interactions between the surface water environment and Project activities are summarized in **Table 5-20**.

Table 5-21 below summarizes the constituents of interest considered, their sources, and associated exposure pathways for the surface water environmental component considered in the Tier 1 assessment. The table differentiates among the different phases of the Project including: PNGS Units 1-4 Stabilization and SWS, Risk Reduction/Removal Activities, PNGS Units 5-8 Refurbishment, and PNGS Units 5-8 Continued Operations. It also identifies the outcome of the Tier 1 assessment and if a Tier 2 analysis was needed.

As shown in **Table 5-21**, no Tier 2 assessment was identified based on the outcomes of the surface water model. A Tier 2 assessment was identified for inclusion of a Harvester for the bounding radiological emissions.

Table 5-20: Summary of Interactions between Project Activities and Surface Water Environment

Project Activities	Surface Water Flow	Surface Water Quality
PNGS Units 1-4 Decommissioning		
PNGS Units 1 and 4 Stabilization	2017 Safe Storage PEA and 2022 PEA Addendum is bounding. • 2 CCW pumps at PNGS Units 1-4 will continue to operate (bounded by lower flow assessed in 2022 PEA Addendum). • PNGS Units 5-8 will enter refurbishment during PNGS Units 1 and 4 Stabilization – bounding condition when all Units 5-8 is shutdown for refurbishment.	2017 Safe Storage PEA and 2022 PEA Addendum is bounding. • Forebay not considered aquatic habitat (bounded by previous assessments that evaluated the forebay). • Stormwater and Lake water quality predictions bounded by 2017 Safe Storage PEA and 2022 PEA Addendum.
PNGS Units 1-4 Storage with Surveillance	2017 Safe Storage PEA and 2022 PEA Addendum is bounding based on flow assumptions. • Low flow of 50,000 m^3/day assumed in 2017 Safe Storage PEA is bounding since flow will be higher based on current Project planning (less change).	2017 Safe Storage PEA and 2022 PEA Addendum is bounding. • Forebay no longer considered aquatic habitat due to cutoff wall. • Lake water quality assessed in 2017 Safe Storage PEA considered bounding; however, Harvester receptor not previously considered. Harvester receptor exposed to radiological COPCs in surface water considered further in Tier 2 assessment.
Risk Reduction and Removal Activities (2025-2033) Dismantle/Demolish (2034-2036)	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum • No interaction with water quantity.	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum • No interaction with water quality.
PNGS Units 5-8 Refurbishment		
Preparation for Refurbishment		
• Procurement and Mobilization of Equipment and Components	No interaction	No interaction
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	No interaction	No interaction
• Construction of PCSS and SB5	No interaction	No interaction
• Defuel and Dewater	• Reduction in cooling water flow during refurbishment. • The impact of PNGS Units 5-8 on nearshore lake circulation will be reduced.	• Reduction in cooling water flow during refurbishment. • Non-radiological emissions will remain below ECA limits and screening values. 2022 PN ERA is bounding.

Project Activities	Surface Water Flow	Surface Water Quality
		• Radiological emissions from dewatering bounded by 2017 Safe Storage PEA and 2022 PEA Addendum. • Tritium emissions will be managed to ensure tritium concentrations at Ajax WSP are within existing levels – 2022 PN ERA is bounding.
• Islanding the Unit	No interaction	No interaction
• Management of Heavy Water	No interaction	No interaction
• Construction of DWI	• Once construction complete, DWI will be used for water intake instead of the forebay. • Updated hydrodynamic surface water model (RMA10) indicates flow pattern and velocity in the lake will be altered when DWI is operating, and velocities will be reduced during Refurbishment phase.	• Bounding condition assessed with a CCW flow reduction to 23.7 m^3/s representing 1 unit operating on PNGS Units 5-8 side, no CCW flow through PNGS Units 1-4 side, and DWI operational (partial flow). • Updated concentration factors for the RMA10 model for the bounding condition show radiological concentrations in surface water from the 2017 Safe Storage PEA are bounding for the Refurbishment phase. • Harvester receptor not previously considered. Harvester receptor exposed to surface water considered further in Tier 2 assessment.
Refurbishment		
• Replacement of Reactor Components	No interaction	No interaction
• Removal and Replacement of Steam Generators	No interaction	No interaction
• Operation of DWI	• DWI will be used for water intake instead of the forebay. • Updated RMA10 indicates flow pattern and velocity in the lake will be altered when DWI is operating and velocities will be reduced during Refurbishment phase.	• Bounding condition assessed with a CCW flow reduction to 23.7 m^3/s representing 1 unit operating on PNGS Units 5-8 side, no CCW flow through PNGS Units 1-4 side, and DWI operational (partial flow). • Updated concentration factors for the RMA10 model for the bounding condition show radiological concentrations in surface water from the 2017 Safe Storage PEA are

Project Activities	Surface Water Flow	Surface Water Quality
		bounding for the Refurbishment phase.
• Refurbishment of Other Plant Systems	No interaction	No interaction
• Waste Management and Transportation	No interaction	No interaction
• Refuelling and Restarting	• CCW pumps will return to full capacity for PNGS Units 5-8. • 2022 PN ERA is bounding.	• CCW pumps will return to full capacity for PNGS Units 5-8. • 2022 PN ERA is bounding.
Continued Operations		
• Operation and Maintenance of PNGS Units 5-8	2022 PN ERA is bounding.	2022 PN ERA is bounding.
• Waste Management and Transportation	No interaction	No interaction

Table 5-21: Constituents, Sources and Pathways – Surface Water Environment

Phase	Constituents of Interest	Sources	Potential Exposure Pathways	Tier 1 Outcome
Stabilization and SWS	Radionuclides: HTO, C-14, beta/gamma Non-radionuclides: boiler blowdown, metals, sulphate (as per 2017 Safe Storage PEA **Table 4-7**)	• RLWMS and RBSW discharges. • Inactive drainage (IAD).	Discharge to Lake Ontario - ingestion, immersion.	Non-radionuclides below screening guideline. Radiological emissions remain within historical bounds. However, based on engagement, Harvester evaluated in Tier 2 with exposure to bounding radiological emissions of HTO, C-14, beta/gamma.
Risk Reduction and Removal	Radionuclides: None Non-radionuclides: None	• Demolition of non-nuclear systems and outbuildings.	None	Emissions remain bounded by standard construction practices and OPG's spill management protocols. No Tier 2.
Refurbishment	Radionuclides: HTO, C-14, beta/gamma Non-radionuclides: hydrazine, morpholine, ammonia	• PNGS Units 5-8 shutdown. • Defueling and dewatering. • Removal and replacement of steam generators. • PCSS construction (negligible).	Discharge to Lake Ontario - ingestion, immersion.	Non-radionuclides below screening guideline and ECA limits. Radiological emissions remain within historical bounds. No Tier 2.
Continued Operations	Radionuclides: HTO, C-14, beta/gamma at operational levels Non-radionuclides: hydrazine, morpholine, ammonia	Normal PNGS Units 5-8 reactor operations post-refurbishment and Units 1-4 SWS and dismantle/demolish.	Discharge to Lake Ontario - ingestion, immersion.	Bounded by 2022 PN ERA . No Tier 2.

5.3 Aquatic Environment

5.3.1 Fish and Fish Habitat

5.3.1.1.1 PNGS Units 1-4 Decommissioning

5.3.1.1.1.1 Stabilization and Storage with Surveillance

As discussed in **Section 5.2.2.1.1.3**, the 2017 Safe Storage PEA evaluated the effects of lake water quality during Stabilization and SWS activities.

Dose to ecological receptors at the outfall, Frenchman's Bay and forebay were calculated in the 2017 Safe Storage PEA and 2022 PEA Addendum – all doses to aquatic receptors including fish were below the aquatic dose benchmark of 9.6 mGy/d. No non-radiological constituents were identified that exceeded screening levels and required further quantitative assessment. The 2017 Safe Storage PEA and 2022 PEA Addendum remain bounding for Stabilization and SWS and no further assessment of effects on fish and fish habitat is required.

5.3.1.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities. As outlined in **Section 3.3.4**, OPG plans to initiate risk reduction and removal activities, which will include dismantling and demolishing of certain non-nuclear systems and outbuildings associated with PNGS Units 1-4.

The primary concern for aquatic habitats during dismantling activities is the potential release of contaminants into surface water. For example, residue from tanks could leak during the segmenting process. However, OPG's spill management protocols effectively mitigate this risk by ensuring all dismantling activities occur in controlled areas with proper containment systems and implementing practices to prevent any release of contaminants. By adhering to these precautions, OPG expects the impact on fish and their habitats from risk reduction and removal activities and dismantle/demolish activities during this licensing period to be negligible. As such, no further assessment is warranted in the PERA.

5.3.1.1.2 PNGS Units 5-8 Refurbishment

The construction of the intake structure as well as shoreline modifications including a cutoff wall, and disposal of material during the Project are the main activities that will interact with the aquatic environment during refurbishment. Additionally, construction of the DWI will result in removal of lake bottom aquatic habitat within the construction footprint.

The modernized federal Fisheries Act provides two core prohibitions related to fish and fish habitat protection: a prohibition against persons carrying out works, undertakings, or activities that result in the death of fish by means other than fishing (subsection 34.4(1)), and a prohibition against persons carrying out works, undertakings, or activities that result in the harmful alteration, disruption, or destruction (HADD) of fish habitat (subsection 35(1)) (Government of Canada, 2019). The modernized federal Fisheries Act includes a more

comprehensive definition of fish habitat under subsection 2(1): "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes". The types of areas that can directly or indirectly support life processes include, but are not limited to, spawning grounds and nursery, rearing, food supply, and migration areas.

Given that the areas where the DWI and associated nearshore modifications are proposed provide potential fish habitat for certain species in Lake Ontario (refer to **Section 4.3.1** for details), project activities may result in HADD of aquatic habitat in these areas. Although designs are still being developed, preliminary estimates indicate that the DWI intake cap construction area may have a permanent footprint of approximately 1.0 ha (11,000 m^2). Along with the construction of the cutoff wall, the permanent habitat changes are expected to cover roughly 6 ha (6,000 m^2). These values have been conservatively derived based on the maximum potential extent of disruption, and final assessments may yield different estimates as designs are refined.

The modernized federal Fisheries Act also includes a prohibition against the deposit of deleterious substances of any type in water frequented by fish (subsection 36(3)) (Government of Canada 2019), which is administered by ECCC. In accordance with this regulation, an analysis of options for spoils disposal, which includes open water disposal, is being undertaken for a maximum volume of 40,000 m^3. Following selection of an option, a comprehensive spoil management plan will be developed to minimize environmental impacts. OPG is working with Indigenous Nations and communities to gather input and identify the best disposal options and mitigation measures.

To minimize the mobilization of suspended materials into the water, an Erosion and Sediment Control Plan will be developed, focusing on reducing sedimentation during all phases of the project. Measures include conducting in-water works in isolation of open or flowing water to reduce sediment introduction into the watercourse, regular inspection and maintenance of erosion controls, monitoring for signs of sedimentation, and ensuring the proper disposal of dredged materials. Similarly, a spill response plan will also be implemented to prevent spills of deleterious substances. This includes measures such as planning activities to ensure chemicals such as paints, solvents, and fuels do not enter the watercourse. Machinery used will be maintained in a clean condition to avoid fluid leaks, and an emergency spill kit will be on site during operations. Any spills will be contained, cleaned up, and disposed of properly to prevent further impact to the watercourse.

A Fisheries Act Authorization Application will be required for these works as they are affecting potential fish habitat. When death of fish or a HADD of fish habitat cannot be avoided or mitigated, an authorization under subsections 34.4(2) and 35(2), respectively, may be provided by the Minister of Fisheries and Oceans with the provision of appropriate offsetting of residual adverse effects.

Therefore, the habitat type lost, as well as the type of disturbance, and potential changes to habitat quality, resulting from the construction of the proposed DWI and cutoff wall are further evaluated in the Tier 2 Assessment.

5.3.1.1.3 PNGS Units 5-8 Continued Operation

Following refurbishment, continued operation of PNGS Units 5-8 is not expected to result in further loss of aquatic habitat. The DWI will be used to draw water into the station, and all other operations will be bounded by previous operational conditions (with 6 operating units). As such, no further assessment is warranted in the PERA for continued operations.

5.3.2 Impingement and Entrainment

5.3.2.1.1 PNGS Units 1-4 Decommissioning

5.3.2.1.1.1 Stabilization and Storage with Surveillance

The 2017 Safe Storage PEA and 2022 PEA Addendum assumed that the PN water balance will change in a stepwise manner during the Stabilization Phase, from its previous operational configuration (6 operating units) to its configuration during the SWS Phase (PNGS Units 1 and 4, and PNGS Units 5-8 shut down). Based on current Project planning, PNGS Units 1 and 4 were shut down in Q4 2024 and have entered stabilization, and PNGS Units 5-8 will continue to operate until the end of 2026 after which they will enter refurbishment (see **Section 5.2.1.2**). A minimum of 2 CCW pumps (see **Figure 5-3**) will be available to support PNGS Units 1 and 4 Stabilization activities. Given that this is considerably lower than the flow volumes under previous operational conditions (with 6 operating units) and is expected to result in a corresponding decrease in intake velocities, impingement and entrainment is also expected to be reduced accordingly in this phase. As the FDS is expected to remain in place during the Stabilization phase, the assumptions of the 2017 Safe Storage PEA and 2022 PEA Addendum remain bounding, and no further assessment is required.

The 2022 PEA Addendum assumed a CCW intake flow rate of 250,500 m^3/day during the SWS Phase, an update from the 50,000 m^3/day estimate in the 2017 Safe Storage PEA. Current project planning assumes that 2 CCW pumps are running, resulting in an intake flow of 2,050,000 m^3/day. In the 2022 PEA Addendum, it was assumed the FDS would be removed during SWS. Based on current Project planning, the FDS will not be removed until the DWI is operational, and may remain in place even afterward as necessary. This would further reduce impingement and entrainment rates relative to existing conditions. The 2022 PEA Addendum also assumed that PNGS Units 5-8 would be permanently shut down by 2026, while current project planning anticipates the refurbishment of these units beginning in 2026. As a result, there is expected to be some overlap of the SWS phase of PNGS Units 1-4 with the refurbishment/operations phase of PNGS Units 5-8. When PNGS Units 1-4 is in SWS and PNGS Units 5-8 is in the Refurbishment/Operations phase, the previous operational conditions (for 6 operating units) are assumed to be bounding (see **Section 5.3.2.1.2**). Therefore, no further assessment is conducted in this PERA.

5.3.2.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess the dismantling and demolishing of buildings and structures. As outlined in **Section 3.3.4**, OPG plans to dismantle certain non-nuclear systems and outbuildings associated with PNGS Units 1-4. The activities associated with dismantling and demolishing will not impact impingement and entrainment of fish; therefore, no further assessment is conducted in this PERA.

5.3.2.1.2 PNGS Units 5-8 Refurbishment

The main activity to interact with impingement and entrainment is the DWI. The DWI is planned to be operational by 2030.

A preliminary evaluation of the change in overall impingement and entrainment levels resulting from the change in depth and design associated with the proposed DWI was conducted in 2024. The analysis compared impingement and entrainment levels at the existing shoreline intake at PNGS to those at the offshore intake at DNGS, as well as the estimated levels for the proposed DWI intake at PNGS. Initial estimates suggested that entrainment will be reduced by 60% following the change in intake location at PNGS. This value was derived from a similar assessment for the offshore intake at DNGS which estimated an entrainment reduction of 60% relative to the onshore intake because larval tow data from Lake Ontario indicated that larval abundance decreases with increasing depth (OPG, 2013). Given that the DWI at PNGS is expected to be at a similar depth as the one at DNGS, a comparable reduction in total entrainment is expected occur at PNGS. However, there is uncertainty in this estimate, and an entrainment monitoring program was conducted between 2024-2025 to substantiate the value. An analysis of the results from this program is currently underway, and will be used to establish existing entrainment levels for comparison following DWI installation.

Similarly, the DWI is expected to reduce impingement by 80% or more compared to levels prior to the implementation of any mitigation measures such as the FDS. This reduction is primarily due to two factors. First, deeper waters have lower fish productivity and are predominantly inhabited by larger-bodied fish, thereby reducing the number of fish susceptible to impingement. The second reason is due to the adoption of a porous veneer intake structure similar to the intake structure at DNGS. A recent Best Available Techniques and Technology Economically Achievable (BATEA) assessment of different intake technologies and techniques showed that an enhanced porous veneer intake has the potential to significantly reduce I&E compared to other intake designs currently used in the Great Lakes watershed by preventing the entrapment of large fish schools.

Additional design modifications aimed at reducing impingement and entrainment, similar to those incorporated into the DNNP Intake Structure (OPG, 2013) and the existing porous veneer intake at DNGS (Black & Veatch, 2024), are also being considered for the DWI at PNGS. These include modifications to optimize approach velocity and slot spacing to further reduce impingement (>80%) and entrainment. For example, a 15 cm/s approach velocity will not

exclude larval fish based on operating experience (OPEX) and scientific literature, but will serve to reduce impingement. An approach velocity closer to 6-7 cm/s would minimize entrainment, while further reducing impingement. It should be noted that even an approach velocity as low as 6 cm/s would not effectively exclude entrained fish eggs or recently hatched yolk-sac larvae, the latter of which have limited swimming speed capabilities. However, several measures can be implemented to reduce these impacts. These include fine mesh screens (e.g., ≤2 mm) such as cylindrical wedge-wire screen structure, traveling screens, or specialized fish protection systems such as Geiger Multidisc or Hydrolox (Patrick et al., 2018). Narrow slot spacing of wedge-wire screens would result in reduced fish passage. Operational modifications, such as reducing intake flow during periods of peak entrainment, also serve as potential mitigation strategies. Furthermore, the proposed DWI is strategically located at a depth where the presence of eggs and early life stages of key species, such as Round Whitefish and Lake Trout, is unlikely, further minimizing entrainment risks. The specific approach velocity and screen size of the DWI structure, along with the methods to achieve them, are currently being determined.

As indicated by the results of the 2025 Ichthyoplankton tows (**Section 4.3.1.1.2**), larval fish and eggs are generally found in low abundance in the vicinity of the proposed DWI intake cap, which support the estimate. In terms of species composition, the majority of eggs collected in the area were identified as Alewife, or Round Goby, while larval fish caught included Lake Whitefish, Round Goby, and Burbot. The low abundance of Lake Whitefish larval fish and eggs and the absence of Lake Trout larvae or eggs in the tows, combined with high catch of the adults of these species during the Fall Spawning Assessment (**Section 4.3.1.1.1**) suggests that staging rather than spawning may be occurring here. Therefore, there may be a risk of adult fish impingement during the spawning season, however increased entrainment of larval fish and eggs of these species should not be expected. In contrast, Burbot larvae were detected across multiple grids at comparatively higher densities. These results suggest some potential for larval Burbot entrainment at the proposed DWI structure location, likely associated with larval drift through the area.

The proposed intake locations, S2 and S5, were classified as Mixed–Soft and Cobble/Gravel, respectively. While these specific grids were not sampled during all Ichthyoplankton tow events, larval fish CPUE and fish egg density associated with these substrate types did not differ significantly from any other substrate class (see **Section 4.3.1.1.2**). This indicates that the potential exposure of larval fish and eggs to entrainment at the proposed intake locations is comparable to that of the broader study area, with no meaningful ecological differences detected.

While the DWI is under construction, PNGS Units 5-8 will be shut down in preparation for refurbishment. During this time, station requirements for cooling water will be substantially reduced relative to previous operational conditions (with 6 operating units), resulting in lower impingement and entrainment rates. The FDS will also continue to remain in place. As such, existing impingement and entrainment rates, as evaluated in the 2022 PN ERA, remain bounding. Once the DWI is in use a cutoff wall will be installed in the intake-forebay channel, as

it will no longer be needed to supply water to the station; however, the cutoff wall will have small holes to allow for minimal exchange flow through the wall into the forebay. Current estimates suggest that the maximum flow into the forebay will be 5,395 L/s, with the potential to be reduced to 600 L/s, both of which are considerably lower than the current flow rate (192,000-217,000 L/s).

The reduction in intake flow during Refurbishment, as well as a corresponding decrease in intake velocity, is expected to result in a proportional reduction in impingement and entrainment during this phase. Given that the flow is over the wide forebay, the velocity of the water may allow fish to escape the water flow, further reducing impingement counts. Additionally, the cutoff wall estimated flow rates into the forebay are below 5.5 m^3/s (5500 L/s), which is identified as the volume of flow where entrainment may be of concern (US EPA, 2014). However, the flow volumes still exceed 125 L/s, the threshold beyond which facilities require impingement and entrainment monitoring unless mitigation measures consistent with the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (CSA, 2018) are implemented. As such, the FDS will remain operational as necessary. Since the water flowing through the cutoff wall into the forebay may serve as an emergency service water supply to the station, an application for a FAA may be required for its operation following the expiry of the current FAA in 2028 as the flow volumes exceed 125 L/s. OPG may seek approval from the DFO to discontinue the use of the FDS in the future, provided such a decision is deemed feasible and adequately justified.

The intake flow rate through the DWI during the Refurbishment phase (see **Figure 5-5**), is estimated to be approximately 23.7 m^3/s (23,700 L/s). Consequently, the reduction in flow rate and intake velocity due to decreased station requirements for cooling water during Refurbishment is expected to result in lower impingement and entrainment rates.

Overall, given the lower intake flow rate and velocity, optimized intake design features, and lower abundance of ichthyoplankton and fish at deeper depths, impingement and entrainment rates are expected to be substantially reduced following construction of the DWI. Accordingly, no further assessment is conducted in this PERA.

5.3.2.1.3 PNGS Units 5-8 Continued Operations

Following refurbishment, continued operation of PNGS Units 5-8 and the DWI is expected to result in reduced impingement and entrainment compared to previous operational conditions (for 6 operating units) as discussed in **Section 5.3.2.1.2**. The reduction of impingement and entrainment will be confirmed through ongoing monitoring programs. As such no further assessment is warranted in the PERA for continued operations.

5.3.3 Thermal Effects

5.3.3.1.1 PNGS Units 1-4 Decommissioning

5.3.3.1.1.1 Stabilization and Storage with Surveillance

Consistent with the 2017 Safe Storage PEA and 2022 PEA Addendum, during Stabilization and SWS, as CCW pumps are shut down in a step-wise manner, the temperature difference between the water intake temperature and the CCW discharge temperature will be reduced. Units 1 and 4 were permanently shut down in Q4 of 2024, with a three-month interval between them. This phased shutdown strategy mitigated the risk of cold shock, which can result from a sudden and simultaneous reduction in discharge temperatures. In general, the lake near the PNGS Units 1-4 discharge will be returned to a thermal condition that is more normal for the nearshore zone of Lake Ontario. Whereas the warmed waters in the current operating condition have attracted certain fish species to the discharge (e.g., Smallmouth Bass; *Micropterus dolomieu*), and have enhanced aquatic productivity near the discharge, the cooler waters after shutdown will offer thermal habitat more similar to the regional nearshore zone. The findings in the 2017 Safe Storage PEA and 2022 PEA Addendum continue to remain valid; therefore, no further assessment is conducted in this PERA.

5.3.3.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess the dismantling and demolishing of buildings and structures. As outlined in **Section 3.3.4**, OPG plans to dismantle certain non-nuclear systems and outbuildings associated with PNGS Units 1-4 during SWS phase. The activities associated with dismantling and demolishing will not impact the thermal regime in the nearshore of Lake Ontario; therefore, no further assessment is conducted in this PERA.

5.3.3.1.2 PNGS Units 5-8 Refurbishment

In preparation for Refurbishment, PNGS Units 5-8 will be shutdown in 2026.To minimize cold shock-induced stress in fish caused by a sudden drop in discharge temperatures, shutdown of the units is planned to be staggered to facilitate a gradual reduction in thermal discharge temperatures. Each unit requires 48 hours for a complete shutdown. Once PNGS Units 5-8 are shutdown, water temperatures in the lake near the discharge will more closely resemble natural conditions.

During refurbishment, the DWI will be constructed and become operational by 2030. Once the DWI is in use, a cutoff wall will be installed in the intake channel, as it will no longer be needed to supply water to the station. The existing PNGS Units 5-8 CCW discharge channel will still be used. As per initial conceptual designs, the DWI will be situated approximately 1.5 km offshore at an approximate depth of 11.5 - 15 m. Thermal profiles generated from temperature data collected during the macrozooplankton and deepwater fish community studies indicate that the temperature at the depths proposed for the DWI is approximately 3-5°C lower than at the surface water. OPG monitors temperature daily at the intake and discharge. For the past 5 years

of monitoring, intake temperatures ranged from approximately 5°C in winter to greater than 20°C in summer. Since intake temperatures through the DWI are expected to be up to 3-5°C colder (depending on the season) than through the existing intake channel, average water temperature in the discharge channel is expected to be the same or lower than that currently observed.

The potential changes to the thermal plume resulting from the relocation of the intake, and its impacts on indicator fish species, will be quantitatively evaluated in the Tier 2 assessment.

5.3.3.1.3 PNGS Units 5-8 Continued Operations

Following refurbishment, continued operation of PNGS Units 5-8 and the DWI is expected to result in thermal effects that are either comparable to or lower than those observed under previous operational conditions (with 6 operating units as assessed in the 2022 PN ERA) as discussed in **Section 5.3.3.1.2**. Future monitoring of intake and discharge temperatures will confirm any resulting changes in the thermal plume. However, to assess potential future impacts on the thermal plume from PNGS, particularly in the context of climate change, the potential effluent temperatures following DWI construction and implementation will be evaluated in the Tier 2 assessment.

5.3.4 Summary of Tier 1 Assessment

The initial screening of potential effects of Project activities on the aquatic environment included consideration of fish and fish habitat, impingement and entrainment, and thermal effects. The predicted interactions between the surface water environment and Project activities are summarized in **Table 5-22.**

Table 5-23 below summarizes the stressors of interest considered, their sources, and associated exposure pathways for the aquatic environmental component considered in the Tier 1 assessment. The table differentiates among the different phases of the Project including: PNGS Units 1-4 Stabilization and SWS, Risk Reduction/Removal Activities, PNGS Units 5-8 Refurbishment, and PNGS Units 5-8 Continued Operations. It also identifies the outcome of the Tier 1 assessment and if a Tier 2 analysis was needed.

As shown in **Table 5-23**, no Tier 2 assessment was identified for impingement and entrainment since impingement and entrainment will be substantially reduced. A Tier 2 assessment was identified for aquatic habitat loss and thermal effects related to DWI construction and operation.

Table 5-22: Summary of Interactions between Project Activities and Aquatic Environment

Project Activities	Fish and Fish Habitat	Impingement and Entrainment	Thermal Effects
PNGS Units 1-4 Decommissioning			
PNGS Units 1 and 4 Stabilization	2017 Safe Storage PEA and 2022 PEA Addendum is bounding.	2017 Safe Storage PEA and 2022 PEA Addendum is bounding.	2017 Safe Storage PEA and 2022 PEA Addendum is bounding.

Project Activities	Fish and Fish Habitat	Impingement and Entrainment	Thermal Effects
			• PNGS Units 1 and 4 were permanently shut down in Q4 2024, with a three-month interval between them to prevent cold shock.
PNGS Units 1-4 Storage with Surveillance	2017 Safe Storage PEA and 2022 PEA Addendum is bounding.	2022 ERA is bounding. • The continued use of the FDS will further reduce impingement and entrainment.	2017 Safe Storage PEA and 2022 PEA Addendum is bounding.
Risk Reduction and Removal Activities (2025-2033) Dismantle/Demolish (2034-2036)	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum. • No interaction.	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum. • No interaction.	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum. • No interaction
PNGS Units 5-8 Refurbishment			
Preparation for Refurbishment			
• Procurement and Mobilization of Equipment and Components	No interaction	As PNGS Units 5-8 will be shutdown in 2026 in preparation for refurbishment, impingement and entrainment are expected to be lower than previous operational conditions. FDS will remain in place. 2022 PN ERA is bounding.	PNGS Units 5-8 will be shutdown in a staggered manner to gradually reduce the temperature differential between the effluent and ambient waters. This will reduce likelihood of cold shock and return the lake water temperatures to natural conditions.
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	No interaction	No interaction	No interaction
• Construction of PCSS and SB5	No interaction	No interaction	No interaction
• Defuel and Dewater	No interaction	No interaction	No interaction
• Islanding the Unit	No interaction	No interaction	No interaction
• Management of Heavy Water	No interaction	No interaction	No interaction
• Construction of DWI	Construction of DWI and associated modifications (cutoff wall) is expected to result in habitat loss and changes to habitat quality. Potential effects will be quantitatively evaluated in the Tier 2 assessment.	No interaction	No interaction
Refurbishment			
• Replacement of Reactor Components	No interaction	No interaction	No interaction
• Removal and Replacement of Steam Generators	No interaction	No interaction	No interaction

Project Activities	Fish and Fish Habitat	Impingement and Entrainment	Thermal Effects
• Operation of DWI	Once construction is complete, DWI will be used for water intake. No further loss of habitat is expected. 2022 PN ERA is bounding.	Cutoff wall will be installed at the current nearshore intake. Flows and velocity through wall will be considerably lower, resulting in reduced impingement and entrainment. FDS to remain in place as necessary. 2022 PN ERA is bounding. Impingement and entrainment rates are expected to be substantially reduced by the DWI due to lower intake flow rate and velocity, optimized intake design features, and lower abundance of ichthyoplankton and fish at deeper depths.	Once the DWI is operational, discharge temperatures are expected to be similar to or lower than existing discharge temperatures. Potential thermal effects from this change will be quantitatively evaluated in the Tier 2 assessment.
• Refurbishment of Other Plant Systems	No interaction	No interaction	No interaction
• Waste Management and Transportation	No interaction	No interaction	No interaction
• Refuelling and Restarting	No interaction	No interaction	No interaction
Continued Operations			
• Operation and Maintenance of PNGS Units 5-8	The DWI will be used to draw water into the station, and all other operations will be bounded by previous operational conditions.	The continued operation of the DWI is expected to result in reduced impingement and entrainment compared to previous operational conditions (for 6 operating units).	The continued operation of the DWI is expected to result in thermal effects that are lower than or similar to previous operational conditions (for 6 operating units). However, potential impacts of climate change on the thermal plume during continued operations are evaluated in the Tier 2 assessment.
• Waste Management and Transportation	No interaction	No interaction	No interaction

Table 5-23: Stressors, Sources and Pathways – Aquatic Environment

Phase	Stressors of Interest	Sources	Exposure Pathways	Tier 1 Outcome
Stabilization and SWS	Impingement and entrainment (reduced)	• Reduction in CCW flows and corresponding intake velocities.	None	No Tier 2
Risk Reduction and Removal	None	• Demolition of non-nuclear systems and outbuildings.	None	OPG's spill management protocols. No Tier 2.
Refurbishment	Impingement and entrainment (reduced) Thermal effects – cold shock Alteration/destruction of fish habitat	• Shutdown of PNGS Units 5-8. • Construction of DWI and associated structures such as the cutoff wall. • Operation of DWI.	Habitat removal Temperature change	Erosion and Sediment Control Plan to control mobilization of suspended materials. Impingement and entrainment reduced – no Tier 2 for impingement and entrainment. Tier 2 evaluated for habitat loss and thermal effects.
Continued Operations	Impingement and entrainment (reduced) Thermal effects (climate change)	• Normal PNGS Units 5-8 reactor operations post-refurbishment and Units 1-4 SWS and dismantle/demolish.	Temperature change	Tier 2 evaluated for impacts of climate change on thermal effects.

5.4 Geological and Hydrogeological Environment

5.4.1 Soil

5.4.1.1 PNGS Units 1-4 Decommissioning

5.4.1.1.1 Stabilization and Storage with Surveillance

Non-Radiological Constituents

As outlined in the 2017 Safe Storage PEA and 2022 PEA Addendum, soil quality beyond the protected area is expected to remain consistent with previous operational conditions (for 6 operating units). This finding continues to remain valid for Stabilization and SWS; therefore, no further assessment is conducted in this PERA.

Radiological Constituents

As indicated in the 2017 Safe Storage PEA and 2022 PEA Addendum and summarized in **Section 5.1.1.1.1**, tritium will be released to the atmospheric environment during reactor dewatering and draining during the Stabilization Phase. It was concluded that previous operational conditions (for 6 operating units) are bounding of atmospheric tritium emissions during the Stabilization Phase. Additionally, tritium emissions during SWS will be even lower. As atmospheric deposition is the primary transport mechanism by which radionuclides are deposited to soils within and surrounding the PN site, tritium concentrations in soil (pore water) are expected to decrease over time following the reduction of atmospheric emissions and as natural decay of tritium currently present in soil occurs. These findings continue to remain valid for Stabilization and SWS; therefore, no further assessment is conducted in this PERA.

The 2022 PEA Addendum identified that approximately 1,500 Mg of D_2O will be transported to the DN site for storage near the end of the Stabilization Phase. The transfer of D_2O to the DN site may result in additional releases of tritium to air. However, PN currently transports D_2O to Darlington on a routine basis to modulate the concentration of tritium in the D_2O inventory. OPG will continue to use existing processes and practices of transporting D_2O, and the frequency for transporting D_2O will be bounded by previous operational conditions (for 6 operating units). The findings from the 2022 PEA Addendum continue to remain valid for Stabilization and SWS; therefore, no further assessment is conducted in this PERA.

5.4.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities or the dismantling and demolishing of buildings and structures. As identified in **Section 3.3.4**, during the 2025 to 2033 timeframe OPG will initiate some risk reduction and removal activities, which will include dismantling of non-nuclear systems and outbuildings. More specifically PE-A (Groups A-1 and A-2) includes dismantling and removal of end-stated and abandoned/retired structures within the PNGS Units 1-4 protected area, excluding the main

powerhouse structure; and PE-B (Groups B-1 and B-2) includes the dismantling and removal of non-nuclear SSCs that are located within the TH and TAB.

From 2034 to 2036, OPG plans to execute PE-A (Group A-3) which includes complete removal of non-nuclear outbuildings, as identified in **Figure 3-7**.

Most of the waste generated from the dismantled/demolished buildings and structures will be conventional waste, disposed of at approved conventional disposal facilities. Interim storage of conventional waste is not planned; therefore, soil is unlikely to be impacted.

Non-Radiological Constituents

Clearing the work area and accessing the structures involve vehicle movement, lifting and removing structures, which may release non-radiological emissions that could deposit on local soil. Dismantling and/or segmenting larger tanks and water lines may emit particles or fumes from the grinding work, but this work would occur indoors with adequate ventilation.

Spills to soil could potentially occur from ineffective capping of existing pipework, especially the CCW lines, but this risk is expected to be mitigated by planning for containment pre-dismantling. OPG will use existing spill recovery equipment and spill management procedures during decommissioning activities, with appropriate precautions to reduce risk. Overall, the risk of spills is considered negligible due to the presence of paved areas and secondary containment structures that are designed to prevent releases to the environment.

OPG will follow best construction practices and implement an Environmental Management Plan for dismantling and demolition activities. The Decommissioning Phase Work Plan will include protocols for dust suppression to mitigate the release of particulates and dust that could deposit onto nearby soil surfaces. Vehicle traffic for transporting dismantled material off-site is expected to be similar to or marginally higher than current traffic levels at the PN site; overall, any small increase in traffic volume is considered negligible.

Overall, having an Environmental Management Plan in place is considered sufficient to mitigate any potential impacts to soil quality, and no further quantitative assessment is warranted in this PERA.

Radiological Constituents

No radiological atmospheric emissions to the environment are expected during the dismantling and demolition activities during this licensing period. Other than the removal of frames and baskets from IFB-A and AIFB, none of the dismantled equipment will be from radiological systems or systems that are likely to be radiologically contaminated. All waste will be radiologically surveyed before transportation and disposal, utilizing current best practices and operating in accordance with OPG's existing procedures for waste removal. The risk to soil quality from radiological contamination during dismantling/demolition is considered adequately mitigated, and no further quantitative assessment is warranted in this PERA.

5.4.1.2 PNGS Units 5-8 Refurbishment

Refurbishment activities identified as having a potential interaction with soil quality are related to the preparation of the site and facilities for refurbishment.

Non-Radiological Constituents

During preparation for refurbishment there may be interactions with soil quality due to construction of parking and laydown areas, set up of temporary construction facilities, construction of buildings including waste SBs at the NSS-PWMF. These buildings/areas are located in paved or gravel areas, and no change to soil quality is expected due to any site or refurbishment preparation activities. This is consistent with the conclusions of the Pickering B Refurbishment EA (SENES, 2007). Furthermore, the 2003 NSS-PWMF Phase II EA did not identify any soil issues that would require consideration for the redistribution of soil within the NSS-PWMF area (OPG, 2003).

Activities associated with the construction of the PCSS for the storage of low and intermediate-level refurbishment waste were assessed as part of the PCSS PERA (Ecometrix, 2024). The PCSS PERA did not identify any activities that would pose a risk to soil quality that are not sufficiently mitigated by construction best practices, the implementation of an Environmental Management Plan, and/or the adherence to existing OPG policies and procedures for environmental protection and management. The activities associated with construction of the RFRISA or other buildings that will be constructed to support the Project are expected to be similar to those assessed for construction of the PCSS, and soil quality impacts are similarly considered sufficiently mitigated.

Construction is planned for DSC SB5 in the NSS-PWMF Phase II Site for future storage of used fuel, with a planned in-service date of Q3 2027. Assessment of the construction of additional DSC SBs was completed as part of the Pickering B Refurbishment EA.

The Pickering B Refurbishment EA did not assess the construction of the proposed DWI and any associated nearshore modifications, including construction of a cutoff wall, and disposal of generated waste materials. The 2009 DNNP EIS is used for comparison purposes since the construction of a deepwater intake and discharge structures was assessed as part of general excavation and grading activities for the DNNP (SENES & MMM, 2009). Overall, shoreline and marine works were found not to affect soil quality and were not assessed further (SENES & MMM, 2009). The construction of the DWI and associated works for PNGS Units 5-8 Refurbishment are expected to be similar to those assessed in the 2009 DNNP EIS, and are not expected to result in impacts to soil quality at the PN site.

Considering the above, the assessment of soil quality is considered sufficiently mitigated by current construction best practices and OPG's existing environmental protection procedures. Thus, no further quantitative assessment of non-radiological soil quality is required for this PERA.

Radiological Constituents

As described in **Section 3.1.1**, the reactors will be defueled and dewatered during preparation for refurbishment. During reactor dewatering there may be atmospheric emissions of radionuclides; however, emissions at this time are expected to be below those of previous operational conditions (for 6 operating units). This reduction in emissions is described in the 2017 Safe Storage PEA that demonstrates that tritium emissions from PNGS Unit 2 and Unit 3 during dewatering and drying activities were substantially lower compared to operational units. A similar decrease in other radionuclides such as noble gases, particulates, radioiodines, and carbon-14 is expected. The reduction in atmospheric radionuclide emissions is expected to result in a decrease in the deposition of radionuclides to soil. Additionally, soil quality is expected to gradually improve over time as natural decay of deposited radionuclides occurs. Thus, the radiological soil quality condition as assessed in the 2022 PN ERA and the more recent 2024 soil data (see **Section 4.4.1.1**) is considered bounding for PNGS Units 5-8 Refurbishment. Furthermore, during refurbishment, OPG will rely on lessons learned from the PNGS Units 1-4 Stabilization Phase, as well as the refurbishment of DN to ensure that radiological emissions (and their deposition to soil) are minimized and maintained ALARA.

During the times when there will be openings in containment (i.e., specially prepared and approved openings in the RB dome for steam generator removal and replacement, or open airlocks), procedures will be in place to control and minimize radioactive releases to the environment. It is assumed that any concrete cutting will be done with wet methods (i.e., hydrojet cutting) and will have spray drift covers, thus ensuring that dust emissions and deposition to soil are minimal. As discussed in **Section 3.1.2.2**, the water inventory from concrete cutting will be tested to confirm that it does not exceed the Low Level Active Waste threshold. Once verified, it will be discharged in batches into the Unit 5 Pickering Incoming/Outgoing Transfer System Low Level Active Sump in accordance with applicable OPG procedures.

No radiological materials are associated with construction of the proposed DWI, and thus no radiological impacts to soil quality are expected.

Overall, any risk to soil quality resulting from potential radiological contamination during PNGS Units 5-8 Refurbishment is bounded by the 2022 PN ERA, and is considered sufficiently mitigated by OPG's existing policies and procedures for environmental protection and management. No further quantitative analysis is warranted in this PERA.

5.4.1.3 PNGS Units 5-8 Continued Operations

Once PNGS Units 5-8 refurbishment activities are complete and the remaining reactors re-enter normal operations, chemical and radiological emissions from the PN site are expected to resume. Since the number of operating units will be reduced to 4, it is anticipated that chemical and radiological emissions post-refurbishment would be similar to or lower than previous operational conditions assessed in the 2022 PN ERA with 6 operating units. Thus, any human

health and ecological impacts resulting from the release and deposition of chemical and radiological materials to soil post-refurbishment would be bounded by the results of the 2022 PN ERA and are not assessed further in this PERA.

During Continued Operations of PNGS Units 5-8, activities associated with PNGS Units 1-4 SWS and dismantle/demolish will be occurring. PNGS Units 1-4 SWS and dismantle/demolish have already been determined to have minimal interaction with soil quality (see **Section 5.4.1.1**), so no further discussion is warranted.

5.4.2 Groundwater

5.4.2.1 Groundwater Quantity and Flow

5.4.2.1.1 PNGS Units 1-4 Decommissioning

5.4.2.1.1.1 Stabilization and Storage with Surveillance

Groundwater flow at PNGS is significantly influenced by the inactive TAB foundation drainage system located beneath the deep building foundations. The drainage system has locally lowered groundwater levels below the level of Lake Ontario, creating a hydraulic sink that captures groundwater beneath and immediately adjacent to the PNGS RBs. Groundwater from the TAB foundation drains and VBRS sumps flows, ultimately discharged to the forebay via pumping.

During Stabilization and SWS, the groundwater flow regime is not expected to change substantially as the existing drainage systems are expected to remain operational. The 2017 Safe Storage PEA assumed that discharges from the TAB foundation drains and the VBRS would be routed to the RLWMS. However, in the 2022 PEA Addendum, this assumption was updated to assess the continued discharge of groundwater from the TAB foundation drains and VBRS to the CCW intake ducts, eventually reaching the forebay. The assumption in the 2022 PEA Addendum is still valid.

The forebay was assessed as a habitat for aquatic and riparian ecological receptors during SWS, with loadings contributing to the forebay from stormwater and the additional tritium contribution from groundwater collected in the TAB foundation IAD sumps on the PNGS Units 1-4 side and the VBRS. Based on the modelling results in the 2022 PEA Addendum, there were no potential adverse effects identified. All doses to the receptors assessed were below the aquatic benchmark of 9.6 mGy/d or the terrestrial benchmark of 2.4 mGy/d (Ecometrix, 2023b).

The 2022 PEA Addendum remains bounding of the planned Stabilization and SWS activities for PNGS Units 1-4, and no further assessment of these activities is warranted in this PERA.

5.4.2.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess the risk reduction and removal activities or the dismantling and demolishment of buildings and structures. However, it is not expected that risk reduction and removal activities and/or dismantling and demolition

activities would disrupt the quantity and flow of groundwater at the PN site. All drainage systems, including stormwater runoff, sewer, and active and IAD systems will remain operational to the extent necessary to meet operational and regulatory requirements. Some excavation of underground piping and utilities may be necessary; it is expected that all excavation activities will follow construction best practices and will adhere to an Environmental Management Plan. Dewatering of groundwater is not expected during excavation activities. However, if dewatering is needed, it will only be done with necessary permissions, intended to be protective against the discharge or re-infiltration of collected groundwater.

In general, the risk of impacts to groundwater flow during the planned risk reduction and removal activities and dismantling and demolition activities is considered negligible, and no further quantitative assessment is warranted in this PERA.

5.4.2.1.2 PNGS Units 5-8 Refurbishment

As noted in **Table 5-1**, certain activities related to PNGS Units 5-8 refurbishment are expected to interact with the groundwater flow component of the PN site. These activities include the relocation, removal, and construction of buildings (i.e., RFRISA), structures, and equipment, in addition to the construction of the PCSS and SB5.

As described in **Section 3.1.1.2**, some structures and equipment within the PNGS Protected Area will need to be temporarily relocated or removed to accommodate the large crane. Additional structures may need to be temporarily relocated or removed to allow for the movement of refurbishment equipment, system components and waste materials through the station. Most of this work is not expected to require excavation at depths that would intersect with the groundwater at the site. In cases where excavation and dewatering are required, it will only be done with necessary permissions, intended to be protective against the discharge or re-infiltration of collected groundwater.

It is likely that site preparation will include the hardening of surfaces by grading, paving and constructing buildings and laydown areas, potentially increasing runoff and reducing infiltration to the underlying Upper Till aquifer. However, paving a relatively small portion of the PN site for any proposed buildings or laydown areas will not measurably affect local shallow groundwater recharge enough to cause any significant change in local groundwater flow (SENES, 2007).

During construction of the DWI, temporary construction dewatering may be required and will be carried out with relevant MECP approvals. OPG will continue to monitor groundwater for the PN site in accordance with the CSA N288.7 compliant GWMP.

As part of preparation for refurbishment, a number of buildings will need to be constructed included the PCSS, SB5, and the RFRISA, among others (see **Section 3.1.1.2** and **3.1.1.3)**.

The PCSS PERA (Ecometrix, 2024) concluded there would be no expected impacts to groundwater quantity and flow from construction and operation of the PCSS. Dewatering during excavation would be completed with the necessary permissions following MECP regulations

intended to be protective against discharge or re-infiltration of collected groundwater. The activities associated with construction of the RFRISA or other planned buildings are expected to be similar to those assessed for construction of the PCSS, and groundwater flow impacts are similarly considered sufficiently mitigated. Similar to the PCSS, any dewatering required during construction of the RFRISA would be completed with the necessary permissions following applicable MECP regulations (i.e., water takings over 50,000 L/d require the project to register under the Environmental Activity and Sector Registry, intended to be protective against the discharge or re-infiltration of collected groundwater). A geotechnical investigation will be completed to determine if dewatering is required for any buildings that will be constructed on the PN site. Overall, building construction is not expected to change the groundwater quantity and flow conditions during the Refurbishment Phase.

PNGS Units 5-8 TAB inactive building effluent sumps receive both groundwater and inactive water from the stations' inactive systems. Groundwater flows into the PNGS Units 5-8 TAB inactive building effluent sumps via the TAB foundation drains are relatively low, but these drains act as groundwater level controls to keep groundwater from entering the lower levels of the powerhouses (SENES, 2007). The 2022 PEA Addendum concluded that groundwater discharges from the TAB foundation drains would continue to be routed to CCW intake ducts, eventually reaching the forebay (Ecometrix, 2023b); this assumption continues to be applicable to reactor shutdown procedures for PNGS Units 5-8 Refurbishment. Overall, the 2022 PEA Addendum concluded there would be no significant changes to groundwater quantity and flow during PNGS Units 5-8 unit shutdowns, and this result remains valid for the planned PNGS Units 5-8 Refurbishment.

5.4.2.1.3 PNGS Units 5-8 Continued Operations

Following refurbishment, PNGS Units 5-8 will operate under conditions similar to previous operations (with 6 operating units). The Continued Operations Phase is not expected to influence groundwater quantity or flow in any way that differs from previous operations at the site. Thus, previous operations (with 6 operating units) remain bounding to PNGS Units 5-8 Continued Operations post-refurbishment and no further assessment of groundwater quantity or flow is required as part of this PERA.

During Continued Operations of PNGS Units 5-8, activities associated with PNGS Units 1-4 SWS and dismantle/demolish will be occurring. During PNGS Units 1-4 SWS and dismantle/demolish groundwater quantity and flow will remain similar to previous operations (with 6 operating units), as discussed in **Section 5.4.2.1**, so no further discussion is warranted.

5.4.2.2 Groundwater Quality

5.4.2.2.1 PNGS Units 1-4 Decommissioning

5.4.2.2.1.1 Stabilization and Storage with Surveillance

As identified in **Section 5.4.2.1.1.1**, during Stabilization and SWS, groundwater from the TAB foundation drains and VBRS sumps will continue to be discharged to the forebay. Assessment of

surface water quality in the forebay due to inputs from PNGS including groundwater was assessed in the 2022 PEA Addendum and is also discussed in **Section 5.2.2.1.1.1**. Based on the modelling results in the forebay, there were no potential adverse effects identified for radionuclides and non-radionuclides. All doses to the receptors assessed were below the aquatic benchmark of 9.6 mGy/d or the terrestrial benchmark of 2.4 mGy/d (Ecometrix, 2023b).

The 2022 PEA Addendum remains valid for PNGS Unit 1 and 4 Stabilization and Units 1-4 SWS; thus, no further assessment of groundwater quality is required as part of this PERA.

5.4.2.2.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities or the dismantling and demolishing of buildings and structures. However, it is not expected that risk reduction and removal activities and dismantling and demolition activities would disrupt groundwater quality at the PN site. During system opening when the risk of spills is highest, precautions will be taken to prevent or minimize the potential for release to the environment. Furthermore, any risk during the planned risk reduction and removal activities and dismantling activities will be mitigated by planning for containment in the event of a spill.

Overall, with respect to radiological groundwater quality, risk reduction and removal activities and dismantling and demolition activities associated with PNGS Units 1-4 Decommissioning are not assessed further in this PERA.

5.4.2.2.2 PNGS Units 5-8 Refurbishment

No refurbishment activities were identified that would impact groundwater quality at the PN site (SENES, 2007). As noted previously, a large portion of the PN site consists of paved and hardened surfaces, limiting infiltration into the underlying groundwater. It is also expected that OPG and all sub-contractors will utilize construction best practices and follow a construction Environmental Management Plan to ensure that all equipment is well maintained and functioning correctly to limit fuel spills and environmental contamination. Spills of any hazardous materials will be sufficiently managed utilizing OPG's existing spill management protocols. Overall, the potential for impacts to groundwater quality resulting from the planned refurbishment activities is considered negligible and is not assessed further in this PERA.

5.4.2.2.3 PNGS Units 5-8 Continued Operations

Consistent with **Section 5.4.1.3**, chemical and radiological emissions from the PN site are expected to resume once PNGS Units 5-8 refurbishment activities are complete and the remaining reactors re-enter normal operations. Since the number of operating units will be reduced to 4, it is anticipated that chemical and radiological emissions post-refurbishment would be similar to or lower than previous operational conditions assessed in the 2022 PN ERA with 6 operating units. Thus, any human health and ecological impacts resulting from the release of chemical and radiological materials to groundwater (via atmospheric deposition) post-refurbishment would be bounded by the results of the 2022 PN ERA and are not assessed further in this PERA.

During Continued Operations of PNGS Units 5-8, activities associated with PNGS Units 1-4 SWS and dismantle/demolish will be occurring. PNGS Units 1-4 SWS and dismantle/demolish have already been determined to have minimal impact on groundwater quality (see **Section 5.4.2.2.1**), so no further discussion is warranted.

5.4.3 Summary of Tier 1 Assessment

The initial screening of potential effects of Project activities on the geological and hydrogeological environment included consideration of soil quality, groundwater flow, and groundwater quality. The predicted interactions between the geological and hydrogeological environment and Project activities are summarized in **Table 5-24**.

Table 5-25 below summarizes the constituents of interest considered, their sources, and associated exposure pathways for the geological and hydrogeological environmental component considered in the Tier 1 assessment. The table differentiates among the different phases of the Project including: PNGS Units 1-4 Stabilization and SWS, Risk Reduction/Removal Activities, PNGS Units 5-8 Refurbishment, and PNGS Units 5-8 Continued Operations. It also identifies the outcome of the Tier 1 assessment and if a Tier 2 analysis was needed.

As shown in **Table 5-25,** no Tier 2 assessment was identified for soil quality, groundwater flow, and groundwater quality.

Table 5-24: Summary of Interactions between Project Activities and Geological and Hydrogeological Environment

Project Activities	Soil Quality	Groundwater Flow	Groundwater Quality
PNGS Units 1-4 Decommissioning			
PNGS Units 1 and 4 Stabilization	2017 Safe Storage PEA and 2022 PEA Addendum are bounding. • Impacts further mitigated by OPG's existing radiological waste handling procedures.	2022 PEA Addendum is bounding.	2022 PEA Addendum is bounding.
PNGS Units 1-4 Storage with Surveillance	2017 Safe Storage PEA and 2022 PEA Addendum are bounding • Impacts further mitigated by OPG's existing radiological waste handling procedures.	2022 PEA Addendum is bounding.	2022 PEA Addendum is bounding.
Risk Reduction and Removal Activities (2025-2033)	Negligible impacts; impacts sufficiently	Negligible impacts; excavation and	Negligible impacts; groundwater quality

Project Activities	Soil Quality	Groundwater Flow	Groundwater Quality
Dismantle/Demolish (2034-2036)	mitigated by OPG's spill management procedures, construction best practices, and implementation of an Environmental Management Plan.	dewatering impacts mitigated by construction best practices and adherence to an Environmental Management Plan.	impacts mitigated by spill prevention and sufficiently planned containment.
PNGS Units 5-8 Refurbishment			
Preparation for Refurbishment			
• Procurement and Mobilization of Equipment and Components	No interaction	No interaction	No interaction
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	• Soil impacts negligible since activity will occur in gravel and paved areas. • Further mitigation through construction best practices and OPG's existing environmental protection procedures.	2022 PEA Addendum is bounding based on: • No significant changes to groundwater flow during PNGS Units 5-8 shutdown and refurbishment.	No interaction
• Construction of PCSS and SB5	PCSS PERA is bounding.	PCSS PERA is bounding.	No interaction
• Defuel and Dewater	No interaction – indirect reduced interaction through reduction in atmospheric radionuclide emissions resulting in decrease in deposition to soil.	No interaction	No interaction
• Islanding the Unit	No interaction	No interaction	No interaction
• Management of Heavy Water	No interaction	No interaction	No interaction
• Construction of DWI	No interaction	Dewatering impacts mitigated by construction best practices.	No interaction
Refurbishment			
• Replacement of Reactor Components	No interaction	No interaction	No interaction
• Removal and Replacement of Steam Generators	No interaction	No interaction	No interaction
• Operation of DWI	No interaction	No interaction	No interaction
• Refurbishment of Other Plant Systems	No interaction	2022 PEA Addendum is bounding based on: • No significant changes to	No interaction

Project Activities	Soil Quality	Groundwater Flow	Groundwater Quality
		groundwater flow during PNGS Units 5-8 shutdown and refurbishment.	
• Waste Management and Transportation	No interaction	No interaction	No interaction
• Refuelling and Restarting	No interaction	No interaction	No interaction
Continued Operations			
Operation and Maintenance of PNGS Units 5-8	2022 PN ERA is bounding.	2022 PN ERA is bounding.	2022 PN ERA is bounding.
Waste Management and Transportation	No interaction	No interaction	No interaction

Table 5-25: Constituents, Sources and Pathways – Geological and Hydrogeological Environment

Phase	Constituents of Interest	Sources	Potential Exposure Pathways	Tier 1 Outcome
Stabilization and SWS	**Soil** Radionuclides: HTO Non-radionuclides: None **Groundwater** Radionuclides: HTO Non-radionuclides: None	• Building ventilation exhaust during reactor defueling, dewatering, (short-term peaks). • Reduced but ongoing – Standby boiler. • Ventilation reduced during SWS but still functional for safety.	Atmospheric deposition – transfer to soil pore water, groundwater.	Remains bounded by 2017 Safe Storage PEA and 2022 PEA Addendum. No Tier 2.
Risk Reduction and Removal	**Soil and Groundwater** Radionuclides: None Non-radionuclides: None	• Demolition of outbuildings. • Removal of generators, tanks, off-gas systems, and miscellaneous structures. • Spills.	None	Remains bounded by standard construction practices. No Tier 2.
Refurbishment	**Soil** Radionuclides: HTO Non-radionuclides: None **Groundwater** Radionuclides: None Non-radionuclides: None	• Reactor dewatering and draining. • Steam generator removal (wet cutting). • Building construction (PCSS, RFRISA, SB 5). • Major equipment mobilization (cranes, heavy lift).	Atmospheric deposition – transfer to soil. Spills to soil.	Remains bounded by standard construction practices. Reduced HTO emissions to air resulting in decreased deposition to soil. No Tier 2.
Continued Operations	**Soil** Radionuclides: Co-60, Cs-134, Cs-137, HTO at operational levels	Normal PNGS Units 5-8 reactor operations post-refurbishment and Units 1-4 SWS and dismantle/demolish.	Atmospheric deposition – transfer to soil. Spills to soil.	Bounded by 2022 PN ERA. No Tier 2.

	Non-radionuclides: similar to 2022 PN ERA **Groundwater** Radionuclides: HTO at operational levels Non-radionuclides: similar to 2022 PN ERA and existing groundwater monitoring program (GWMP)			

5.5 Terrestrial Environment

5.5.1 Vegetation and Wildlife

5.5.1.1 PNGS Units 1-4 Decommissioning

5.5.1.1.1 Stabilization and Storage with Surveillance

As outlined in previous sections, non-radiological airborne and waterborne emissions are expected to decrease gradually during the Stabilization and SWS phases relative to previous operational conditions (for 6 operating units). This reduction is anticipated to either lower or maintain current levels of contaminant loading to the soil, as assessed in the 2022 PN ERA. Consequently, exposures to non-radiological contaminants for terrestrial receptors on or near the PN site are expected to remain within the bounds of previous operational conditions (for 6 operating units) in the 2022 PN ERA. These findings continue to remain valid for Stabilization and SWS; therefore, no further assessment is conducted in this PERA related to impacts of airborne and waterborne emissions on vegetation and wildlife during Stabilization and SWS.

Levels of noise, traffic, and light associated with PNGS Units 1-4 will remain similar to or decrease relative to current conditions during the Stabilization and SWS phases as the units are shut down, further minimizing disturbances to birds and other wildlife relative to current conditions. Thus, the activities during SWS are not expected to significantly affect the terrestrial environment and are considered to be bounded by the 2022 PN ERA. Therefore, they are not assessed further in this PERA.

5.5.1.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The 2017 Safe Storage PEA and 2022 PEA Addendum did not assess risk reduction and removal activities or the dismantling and demolishing of buildings and structures. Activities such as site clearing, structure removal, excavation, and dismantling larger tanks and water lines are expected to have minimal impacts on air, surface water, stormwater, and soil quality due to adherence to best construction practices and an Environmental Management Plan. Consequently, exposures of terrestrial biota to particulates, dust, and non-radiological contaminants from PNGS are expected to remain within the range of previous conditions (with 6 operating units).

Construction activities such as dismantling and removal of structures, as well as land excavation, are expected to occur outdoors and can therefore interact with the terrestrial environment. However, these activities are not expected to result in a measurable change to vegetation communities and species as the type of habitat provided by the disturbed area is common and found in adjacent areas, or is of poor quality due to its fragmented, sparse and disturbed character. No effect on vegetation communities in nearby wetlands (e.g., Frenchman's Bay and Hydro Marsh), woodlands (e.g., Brock Woodlot and Alex Robertson Woodlot), shrubland, shoreline and open water, is likely to occur as a result of project activities. Notably, only one terrestrial plant SAR is currently present within the PN Study Area: a single Butternut tree

located within the Alex Robertson Woodlot (Beacon, 2023, 2025). This tree is not anticipated to be impacted by these activities, as it lies outside the affected area.
Though excavation activities may cause localized impacts on soil organisms inhabiting the subsurface, the affected area represents only a small fraction of the site and does not represent unique habitat for these organisms. Consequently, the overall soil biota on the site is not expected to be significantly impacted.

Noise, odour, and light generated from clearing work, segmentation/dismantling activities, and the utilization and transportation of equipment during this phase can temporarily reduce the attractiveness of the PN site as habitat for wildlife. However, these impacts can be mitigated through application of various management plans and strategies. Activities are not expected to result in elevated vibration levels that would impact wildlife and are not considered. The impact of sound levels is expected to be mitigated through proper equipment maintenance and the implementation of a Noise Management Plan. Odour and emissions produced from diesel or gasoline powered equipment and vehicles will be kept to a minimum by reducing vehicle idling and making use of construction best practices. Additionally, since most wildlife in the area (onsite and offsite) are likely to be accustomed to noise and light levels associated with an urban environment, as PNGS has been fully operational for over three decades (Golder, 2007c), the increase in noise levels is expected to have a negligible effect. While some of the more noise or light sensitive species may display an escape response to the increased disturbance, they may be able to habituate and resume current behaviors over time, as they have done with existing levels of noise, light, and human presence on site (OPG, 2000). If habituation does not occur, species can relocate to adjacent habitats such as Frenchman's Bay, Hydro Marsh, Krosno Creek valley, and other areas on the PN site that are not predicted to be influenced by these activities and are close enough to not require substantial energy expenditures for relocation.

Vehicle traffic associated with transporting dismantled material off-site is expected to be similar to or slightly higher than the traffic levels associated with current PN operations. As a result, the slight increase in traffic volumes would likely have a negligible impact on wildlife road mortality. Safe driving best practices will also be implemented to minimize vehicle collisions with wildlife.

Environmental Management Plans will be developed for the construction activities, such that all project works are carried out in accordance with regulatory requirements to minimize impacts on the terrestrial environment and local wildlife. These plans will outline mitigation measures including best practices for air and water management, noise control, soil management, and wildlife management. As a result, no adverse impacts on terrestrial biota are anticipated during dismantling and demolition activities. Thus, the changes in this phase are considered bounded by previous operational conditions (with 6 operating units) and will not be assessed further in this PERA.

5.5.1.2 PNGS Units 5-8 Refurbishment

The effects of PNGS Units 5-8 refurbishment activities on terrestrial biota, with the exception of the construction of the DWI, have been evaluated in either the Pickering B Refurbishment EA or

the PCSS PERA. In support of this PERA, predictive air quality and noise modelling associated with planned Project activities was completed and is described in further detail in **Section 5.1.1.2** (air quality) and **Section 5.1.2.2** (noise). Discussion of the modelling includes interpretation of predicted exceedances of applicable air quality and noise screening guidelines and a discussion of potential impacts and associated mitigation measures, as necessary.

As noted in **Table 5-1**, the procurement and mobilization of equipment, as well as relocation, removal, and construction of buildings and structures planned for this phase have the potential to interact with the terrestrial environment. These activities are not expected to affect terrestrial plant communities and species as vegetation on site is sparse and consistent with rugged vegetation typical of a highly-disrupted, developed environment (e.g., weeds, grasses, small shrubs). Vegetation communities in nearby wetlands, woodlands, shrubland, open grassland, parkland, and the built environment on the PN site are not expected to be affected as a result of these construction activities. Consequently, the overall effect on vegetation is expected to be negligible.

Disturbances associated with construction activities, including increased human presence, have the potential to startle wildlife in the affected areas through the increase of auditory, olfactory, visual, and mechanical stimuli. Noise levels during Refurbishment were previously estimated in Pickering B Refurbishment EA. However, an updated noise model was developed in 2025 which accounted for the change in vehicles and equipment associated with current Project planning as well as activities not considered in the Pickering B Refurbishment EA, including construction of the DWI.

As described in **Section 5.1.2.2.2**, despite predicted exceedances of ecological noise guidelines, no adverse impacts are expected for local ecological receptors. Since most wildlife species in the affected area are likely acclimatized to urban noise and lighting conditions, the impact of activities in this phase on wildlife is expected to be minimal. Residual impacts from elevated levels of noise are expected to be mitigated through proper maintenance of machinery and vehicles, and the implementation of construction best practices, a Noise Management Plan, and various Environmental Management Plans.

Elevated noise levels on site during refurbishment may impact SAR including Bank Swallow nesting at the FFEE, or Barn Swallow and Peregrine Falcon which have historically nested on the PN site.

As detailed in **Section 4.5.2,** most terrestrial SAR have been observed beyond the PN Site boundaries in adjacent woodlots, parks, and wetlands (Beacon, 2018, 2022, 2023, 2025; OPG, 2016). SAR observed within the site have mostly been recorded occasionally while transiting between nearby areas. Two SAR have been confirmed to breed within the PN site boundaries. These are the Peregrine Falcon and Barn Swallow. Pairs of these species have been observed nesting at the PN site. OPG will comply with the species and habitat protection provisions of the SCA, SARA, and Migratory Birds Convention Act during all project activities. Additionally, to

mitigate potential disturbances from refurbishment activities, various measures are currently being evaluated.

Mitigation measures under consideration include undertaking project activities outside of the sensitive bird nesting period (approximately April 1st to August 31st; after confirming that no nesting is taking place in the areas to be disturbed; or by avoiding nesting areas during project activities). Additionally, other mitigation measures could be explored to reduce noise levels during the breeding season, which may include alternate truck routes or noise barriers.

It should be noted that the PN site does not provide unique breeding habitat for other species observed on-site (i.e., species that are not at risk, non-migratory birds and other birds not covered under the Migratory Birds Convention Act). Thus, individuals, have the potential to temporarily relocate to other nearby areas until construction activities are complete.

The maximum bounding emissions scenario used in the air/noise model considered on-site vehicular traffic (approximately 2,200 vehicles per day), which is inclusive of trucks to support DWI construction, employee and delivery traffic from previous conditions (with 6 operating units) as well as additional refurbishment contract employee and delivery traffic. A small increase in wildlife mortality may occur as a result of increased traffic associated with Refurbishment activities. However, this change is considered to be negligible, and will not affect the overall populations of terrestrial animals. This conclusion is supported by previous analysis of vehicle-wildlife collisions under similar traffic conditions associated with refurbishment activities (OPG, 2007), which found that the increase in wildlife collisions would be negligible.

Additionally, past monitoring data (Golder, 2007c) indicates that no SAR have been involved in vehicle collisions on or near the PN site. This trend is expected to continue due to the absence of significant changes in traffic patterns, habitat use, or species movement corridors in the area. Best safe driving practices will also be implemented to further minimize the likelihood of wildlife strikes.

Nearby wildlife habitats, such as Frenchman's Bay, are not expected to be impacted by Refurbishment activities and offer suitable alternate habitat for displaced mammals and birds if habituation to the elevated levels of noise and light is not possible. As detailed in **Section 5.5.1.1.2**, the only SAR confirmed to breed within the site are Peregrine Falcon, Bank Swallow, and Barn Swallow pairs, which have been observed nesting inside the Protected Area. However, the PN site does not provide unique breeding habitat for these species. Therefore, any disturbances during Refurbishment will likely have only a minor effect on wildlife communities and species.

Activities associated with the construction of the PCSS for the storage of low and intermediate-level refurbishment waste were assessed as part of the PCSS PERA (Ecometrix, 2024). The PCSS PERA did not identify any activities that would pose a risk to terrestrial biota that are not sufficiently mitigated by construction best practices, the implementation of an Environmental

Management Plan, and/or the adherence to existing OPG policies and procedures for environmental protection and management.

The Pickering B Refurbishment EA did not assess the construction of the proposed DWI and any associated nearshore structures such as the cutoff wall. Based on current terrestrial species accounts at the PN site from the ongoing biodiversity monitoring program (Beacon, 2017b, 2018, 2022, 2025; OPG, 2016), the potential areas associated with the cutoff wall are primarily inhabited by riparian birds which forage in the nearshore. Though construction activities in the excavation and grading phase could interfere with riparian bird's use of the inshore lake area, these effects are predicted to be minimized through construction best practices. Marine and shoreline works were also expected to have the potential to affect waterfowl use of the waterfront, as well as shoreline vegetation communities and species. However, since most of the riparian birds that nest and forage along the shoreline can temporarily relocate to other suitable habitats nearby, and shoreline vegetation is sparse and hardy, wildlife and vegetation communities are not expected to be affected.

The Pickering B Refurbishment EA concluded that the effects of refurbishment on air quality, as well as surface water flow, temperature, and quality, were expected to be bounded by effects of operation under previous operational conditions (with 6 operating units). Considering the recent inclusion of DWI construction, updated modeling scenarios were developed to assess the potential influence of DWI construction activities on the aforementioned environmental parameters. As described in **Section 5.1.1.2.1**, despite predicted exceedances of the selected air quality criteria, no adverse impacts to ecological receptors are expected. Air quality impacts resulting from Project activities are expected to be negligible or sufficiently managed by construction best practices and dust reduction measures. For other air quality parameters, the inhalation exposure route is considered a minor pathway relative to food and water ingestion and is considered negligible. As surface water and soil conditions during refurbishment were considered to be bounded by previous operational conditions (with 6 operating units) as discussed in **Sections 5.2.2.2.1** and **5.4.1.2**, the impacts of the quality of these media on terrestrial biota will not be evaluated further.

5.5.1.3 PNGS Units 5-8 Continued Operation

Following refurbishment, PNGS Units 5-8 will operate in the same manner as previous operations. As such, the levels of noise, light, and traffic will return to previous conditions (with 6 operating units). No further changes to the physical habitat features or habitat quality are expected from operations. Therefore, assessment of the potential effects from the Continued Operation Phase on the environment is bounded by the assessment of effects under the 2022 PN ERA with 6 operating units.

During Continued Operations of PNGS Units 5-8, activities associated with PNGS Units 1-4 SWS and dismantle/demolish will be occurring, which could result in increased airborne emissions and noise levels. It is expected that air and noise predictions would be within the bounding air and noise assessment presented in **Sections 5.1.1.2** and **5.1.2.2**, respectively.

5.5.2 Summary of Tier 1 Assessment

The initial screening of potential effects of Project activities on the terrestrial environment included consideration of vegetation and wildlife. The predicted interactions between the terrestrial environment and Project activities are summarized in **Table 5-26.**

No Tier 2 assessment was identified for the terrestrial environment including vegetation and wildlife.

Table 5-26: Summary of Interactions between Project Activities and Terrestrial Environment

Project Activities	Vegetation and Wildlife
PNGS Units 1-4 Decommissioning	
PNGS Units 1 and 4 Stabilization	2022 PN ERA is bounding. Assumptions in 2017 Safe Storage PEA and 2022 PEA Addendum are still valid.
PNGS Units 1-4 Storage with Surveillance	2022 PN ERA is bounding. Exposures to non-radiological contaminants for terrestrial receptors are expected to remain within the bounds of previous operational conditions (with 6 operating units). Noise, light, and traffic levels are expected to be bounded by previous operational conditions (with 6 operating units).
Risk Reduction and Removal Activities (2025-2033) Dismantle/Demolish (2034-2036)	Not assessed in 2017 Safe Storage PEA or 2022 PEA Addendum; however 2022 PN ERA is bounding based on the following. • Exposures of terrestrial biota to particulates, dust, and non-radiological contaminants are expected to remain within the bounds of previous operational conditions (with 6 operating units). • No unique habitat will be affected. • No work is planned in nearby wetlands, woodlots, or parklands. • Residual impacts are expected to be mitigated through proper maintenance, construction best practices, a Noise Management Plan, and various Environmental Management Plans. • Though a slight increase in traffic is expected, population-level impacts to terrestrial biota from vehicle collisions are not expected. There are no significant changes in traffic patterns and routes in this project phase. Best safe driving practices will also be implemented to further minimize the likelihood of wildlife strikes.
PNGS Units 5-8 Refurbishment	
Preparation for Refurbishment	
• Procurement and Mobilization of Equipment and Components	This activity is bounded by results of air/noise modelling conducted in this PERA. • Exposures of terrestrial biota to particulates, dust, and non-radiological contaminants from PNGS are bounded by previous operational conditions (with 6 operating units). • No unique habitat will be affected. • No work is planned in nearby wetlands, woodlots, or parklands.

Project Activities	Vegetation and Wildlife
	• Noise levels are bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source. • Though a slight increase in traffic is expected, population-level impacts to terrestrial biota from vehicle collisions are not expected.
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	This activity is bounded by results of air/noise modelling conducted in this PERA. • Exposures of terrestrial biota to particulates, dust, and non-radiological contaminants from PNGS are bounded by previous operational conditions (with 6 operating units). • No unique habitat will be affected. • No work is planned in nearby wetlands, woodlots, or parklands. • Noise levels are bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source. • Though a slight increase in traffic is expected, population-level impacts to terrestrial biota from vehicle collisions are not expected.
• Construction of PCSS and SB5	This activity is bounded by results of air/noise modelling conducted in this PERA. • Exposures of terrestrial biota to particulates, dust, and non-radiological contaminants from PNGS are bounded by previous operational conditions (with 6 operating units). • No unique habitat will be affected. • No work is planned in nearby wetlands, woodlots, or parklands. • Noise levels are bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source. • Though a slight increase in traffic is expected, population-level impacts to terrestrial biota from vehicle collisions are not expected.
• Defuel and Dewater	No interaction
• Islanding the Unit	No interaction
• Management of Heavy Water	No interaction
• Construction of DWI	This activity is bounded by results of air and noise modelling conducted in this PERA. • Exposures of terrestrial biota to particulates, dust, and non-radiological contaminants from PNGS are bounded by previous operational conditions (with 6 operating units). • Some shoreline vegetation will be removed during nearshore modifications associated with DWI construction. This vegetation is sparse, hardy, and not unique. • No unique habitat will be affected. • No work is planned in nearby wetlands, woodlots, or parklands. • Noise levels are bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source.

Project Activities	Vegetation and Wildlife
	• Though a slight increase in traffic is expected, population-level impacts to terrestrial biota from vehicle collisions are not expected.
Refurbishment	
• Replacement of Reactor Components	No interaction
• Removal and Replacement of Steam Generators	No interaction
• Operation of DWI	No interaction
• Refurbishment of Other Plant Systems	No interaction
• Waste Management and Transportation	This activity is bounded by results of air, and noise modelling conducted in this PERA. • Noise levels are bounded by the activities assessed in the noise model completed to support this PERA. Not a significant noise source. • Though a slight increase in traffic is expected, population-level impacts to terrestrial biota from vehicle collisions are not expected. • Exposures of terrestrial biota to particulates, dust, and non-radiological contaminants from PNGS are bounded by previous operational conditions (with 6 operating units).
• Refuelling and Restarting	No interaction
Continued Operations	
• Operation and Maintenance of PNGS Units 5-8	2022 PN ERA is bounding.
• Waste Management and Transportation	2022 PN ERA is bounding.

5.6 Radiation and Radioactivity (Gamma Radiation Fields)

This section focuses on gamma radiation fields from waste storage structures on the PN site. An assessment of radionuclide emissions to the atmospheric and surface water environments resulting from PNGS Units 1-4 Decommissioning and PNGS Units 5-8 Refurbishment is provided in **Section 5.1.1** and **Section 5.2.2**, respectively.

The NSS-PWMF (**Figure 3-2**) consists of the Phase I site which contains two used fuel dry SBs and a RCS area, and the Phase II site which contains two used dry SBs (SB3 and SB4) with a third dry SB (SB5) planned for Q3 2027, located east of SB3 and SB4.

New to this PERA is the addition of the Harvester receptor. While not specifically assessed in the 2022 PN ERA, the Harvester is not expected to be affected by gamma radiation due to this receptor's relatively far distance from the PN site. The dose received by the Sport Fisher, the closest human receptor to PN site, would be considered conservative for the Harvester for assessment of gamma radiation.

5.6.1 PNGS Units 1-4 Decommissioning

5.6.1.1 Stabilization and Storage with Surveillance

The 2017 Safe Storage PEA and 2022 PEA Addendum assessed a scenario in which 100 DSCs containing 6-year decayed used fuel in SB3, and additional storage in the newly constructed SB4, were considered following the shutdown and transition of all six operational PNGS reactors into Stabilization and SWS. The predicted annual dose at the PN east property boundary was found to be well below the public dose limit for radiation protection, and below the terrestrial and aquatic dose benchmarks for the protection of ecological receptors (Ecometrix, 2023b; Golder and Ecometrix, 2017). The Stabilization and SWS activities assessed as part of the 2017 Safe Storage PEA and 2022 PEA Addendum are generally the same as the planned activities for PNGS Units 1-4 Decommissioning. However, refurbishment is now planned for PNGS Units 5-8 instead of shutdown. Additionally, a change in assumptions since the 2017 Safe Storage PEA and 2022 PEA Addendum would see OPG initiate some dismantling activities in the AIFB and IFB-A, specifically the removal of modules and baskets to aid in the removal of used fuel from the AIFB and IFB-A, an activity not previously assessed as part of Stabilization and SWS. Modules and baskets will be disposed of using existing waste routes.

The planned dismantling activities in the IFBs are described in **Section 3.3.3.1**. To summarize, used fuel stored in the AIFB and IFB-A will continue to be loaded into DSCs and transported to the NSS-PWMF using the existing programs and procedures for the management of used fuel. As fuel is removed, empty baskets and associated frames will be removed from the AIFB and IFB-A and disposed of using existing waste routes. The removal of used fuel from the AIFB and IFB-A and the subsequent transfer of used fuel to the NSS-PWMF is part of OPG's current licensing and was most recently assessed in the 2022 PEA Addendum (Ecometrix, 2023b).

As the transfer of DSCs to the NSS-PWMF falls under current licensing activities for the PN site, the removal of used fuel from the AIFB and IFB-A during Stabilization and SWS is considered bounded by the 2017 Safe Storage PEA and 2022 PEA Addendum. The removal of empty modules and baskets will adhere to OPG's existing waste handling procedures and their disposal will utilize existing waste routes. Overall, the findings of the 2017 Safe Storage PEA and 2022 PEA Addendum remain valid and bounding of the planned Stabilization and SWS. The dismantling activities planned for the AIFB and IFB-A are bounded by current licensed activities and operational conditions. For this reason, no further assessment of Stabilization and SWS for PNGS Units 1-4 is warranted for this PERA.

5.6.1.2 Risk Reduction/Removal Activities and Dismantle/Demolish

The structures selected for dismantlement as part of risk reduction and removal activities would include non-nuclear systems that are non-operational and are not expected to contain radioactivity above procedural or regulatory limits. While these items are not expected to be gamma radiation sources, they will be checked for gamma radiation prior to dismantling. If necessary, they will be decontaminated, and will be checked again after decontamination, to ensure they are suitable for dismantling, with precautionary measures as appropriate. Waste

from dismantling will be managed in accordance with accepted procedures and licence requirements.

PE-A-3 decommissioning activities focus on the removal of outbuildings after IFB-A and AIFB are emptied, drained, and dried. Wastes produced during the dismantlement of the Heavy Water Upgrading Plant and its associated structures are expected to contain some level of radiological contamination due to the historic presence of D_2O within these structures. Consistent with current OPG waste handling procedures, equipment and structures will be surveyed to determine the extent of any radiological hazards prior to dismantlement or demolition. All waste will be managed in accordance with accepted procedures and licence requirements.

Overall, no radiological effects are expected resulting from dismantling and demolition activities, and these activities (with respect to radiation hazards) are not assessed further in this PERA. All risk reduction and removal activities and dismantling/demolition activities will adhere to OPG's existing waste management procedures to mitigate any potential radiological effects to human and ecological receptors.

5.6.2 PNGS Units 5-8 Refurbishment

The refurbishment of PNGS Units 5-8 is expected to involve the handling, repair or replacement of radiologically contaminated SSCs. Further details regarding the planned refurbishment activities are provided in **Section 3.1.2.** Potential interactions between refurbishment activities and releases of radiation and radioactivity to the environment are discussed within their respective environmental component sections on Atmospheric Environment (Section 5.1), Surface Water Environment (Section 5.2), and Geological and Hydrogeological Environment (Section 5.4). This section focuses on activities that result in external gamma radiation fields.

5.6.2.1 Gamma Radiation Fields

During Refurbishment, project works and activities have the potential to interact with the human receptors and the terrestrial environment through gamma radiation fields. External gamma radiation fields are associated with the replacement of reactor components, removal of steam generators, and the management and transfer of radiological waste.

The storage of L&ILW waste is expected to adhere to OPG's existing waste management procedures and is part of current licensing activities for the PN site. Wastes from refurbishment activities will be sent for storage within the planned PCSS; gamma radiation resulting from operation of the PCSS is discussed in **Section 5.6.2.1.2** below.

5.6.2.1.1 Radiological Dose from DSC Storage Buildings Within the NSS-PWMF

Gamma radiation associated with the DSC SBs within the NSS-PWMF is bounded by the 2022 PEA Addendum, which assessed dose rates assuming the storage of 6-year aged fuel (i.e., higher activity than 10-year aged fuel) within the NSS-PWMF. Used fuel is typically stored within the IFBs for 10 years; however, OPG is authorized to process and store up to 100 DSCs with used fuel that has been stored in the IFBs for 6 years to free up space for additional fuel in the IFB.

In the 2022 PEA Addendum (Ecometrix, 2023b), up to 100 DSCs containing 6-year-cooled fuel were assumed to compose 20% of SB3's storage capacity, while SB4 was assumed to contain up to 40% capacity 10-year-cooled fuel with remaining capacity older aged fuel. The highest predicted annual dose of 3.56 µSv/a was modelled to occur at the PNGS eastern boundary fence and is considered to be representative of industrial/commercial workers and members of the public walking by the PN perimeter fenceline. This dose rate is below both the radiation safety requirement for the NSS-PWMF (10 µSv/a) and the public dose limit (1,000 µSv/a). The highest predicted annual dose at the shoreline is 0.14 µSv/a and is representative of the dose to a future Sport Fisher. Once again, this dose rate is below both the radiation safety requirement for the NSS-PWMF (10 µSv/a) and the public dose limit (1,000 µSv/a). As noted earlier in this chapter, the Sport Fisher result is considered conservatively protective of a Harvester receptor.

With respect to ecological receptors, the dose rates at the NSS-PWMF Phase II fence were considered. As indicated in the 2022 PEA Addendum, the tissue absorbed dose for ecological receptors in close proximity to SB3 (assuming storage of up to 100 DSCs containing 6-year aged fuel) and SB4 would be no more than 0.85 µGy/h at the west fence line. This is well below the terrestrial dose benchmark of 100 µGy/h for terrestrial and riparian receptors (Ecometrix, 2023b).

Construction is planned for SB5 in the NSS-PWMF Phase II Site for future storage of used fuel, with an in-service date of Q3 2027. The assessment of the construction of additional DSC SBs was completed as part of the Pickering B Refurbishment EA to ensure the regulatory dose limits and OPG's dose targets for the public and workers at the facility fence and beyond are met.

Considering the storage of used fuel at the NSS-PWMF falls within OPG's current licensing activities for the PN site, and dose rates from the NSS-PWMF are well below the public dose limit, no further assessment of gamma radiation fields from DSCs stored within the NSS-PWMF is warranted in this PERA. A safety assessment was completed in October 2025 for SB5 prior to construction to confirm dose limits and targets will be achieved.

5.6.2.1.2 Construction and Operation of the PCSS

Construction of the PCSS is planned to support refurbishment activities and will be used for the storage of L&ILW from decommissioning and refurbishment, including components such as steam generators, pressure and calandria tubes, calandria tube inserts, and end fittings, and concrete LLW. An evaluation of the environmental effects of the PCSS was part of a separate PERA (Ecometrix, 2024). The PCSS will be incorporated into the existing NSS-PWMF operating policies and procedures.

The PCSS PERA determined that there are no expected radiological risks to human and ecological receptors resulting from the operation of the PCSS (Ecometrix, 2024). The HHRA evaluated the impact on human health of gamma radiation from the PCSS. The estimated dose for the Sport Fisher was 4.89×10^{-3} µSv/a (which includes contributions from PCSS, SB3, SB4, and SB5); considering the other existing facilities on the PN site (including PNGS and NSS-PWMF), the cumulative dose to the Sport Fisher could be up to 0.57 µSv/a. This estimate represents less

than 1% of the regulatory public dose limit of 1,000 µSv/a. Overall, since the dose estimates were found to be a small fraction of the public dose limit and natural background exposure, no human health effects are anticipated due to exposure to gamma radiation from the PCSS (Ecometrix, 2024).

Similarly, the ecological risk assessment evaluated the impact on ecological health due to gamma radiation from the PCSS. For exposure of ecological terrestrial receptors to gamma radiation from the PCSS, the maximum dose rate to any ecological receptors residing in close proximity to the PCSS could be up to 0.057 mGy/d, and lower than 0.057 mGy/d for off-site ecological receptors residing at the PN fenceline. All predicted doses were found to be lower than the 2.4 mGy/d radiation benchmark for terrestrial biota. It was concluded that there are likely no radiological effects to ecological receptors, including in the scenario when the maximum dose from the PCSS is combined with the dose from exposure to radionuclides through other existing PN operations (Ecometrix, 2024).

Overall, the results of the PCSS PERA remain valid for the operation of the PCSS as part of PNGS Units 5-8 Refurbishment, and no further assessment is warranted for this PERA.

5.6.2.1.3 Dry Storage Module Transfer

The Retube Component Storage Facility (RCSF) sits within the NSS-PWMF I licensed site and was the location of a series of 36 DSMs used to contain ILW. Of these, 34 are loaded and two are empty. OPG relocated these DSMs in Q1 2026 to the NSS-PWMF II licensed site to accommodate the spatial requirements related to construction of the DWI (e.g., operation of the tunnel boring machine) and other shoreline works. Additionally, OPG will temporarily relocate the Protected Area fenceline in this area. OPG assessed that the relocation of the DSMs falls within the bounds of permitted activities under existing NSS-PWMF licensing and had notified the CNSC of the intended relocation (OPG, 2024b).

Radiological impacts associated with the relocation of DSMs from the NSS-PWMF I site to the NSS-PWMF II site were assessed in December 2024 (OPG, 2024b). The assessment assumed that the DSMs would be transferred utilizing the same transfer route that existing DSCs use when being transferred to used fuel dry SBs within the NSS-PWMF II site.

Dose measurements from the former NSS-PWMF Phase I DSM storage area (referred to as the RCS area) range from 0.067 µSv/h (south fence) to 1.24 µSv/h (north fence). Dose rates on the north fence have contributions from used fuel dry SBs and represent conservative estimates of DSM dose rates. The assessment concluded that the dose rate acceptance criteria (5.00×10^{-2} µSv/h, equivalent to 10% of the limit for a member of the public when scaled with an occupancy of 2,000 hours per year) is unlikely to be exceeded in the planned DSM storage location within the NSS-PWMF II area, even with the contributions from the existing SB3 and SB4 structures (OPG, 2024b).

The nearest site boundary on land is noted to be approximately 200 m from the new DSM storage location. The worst-case dose rate calculated at the site boundary was found to be

$1.75x10^{-2}$ µSv/h, which includes dose contributions from SB3, SB4, SB5 and the PCSS. The dose rate is below the acceptance criterion of $5.00x10^{-2}$ µSv/h (OPG, 2024b).

Assuming a single DSM results in a maximum dose rate of 1.24 µSv/h at a distance of 8 m (conservatively estimated from the existing highest measurement on the north RCS fence, which again includes contributions from multiple DSMs and existing DSCs), the attenuation at 200 m (NSS-PWMF II to site boundary) was estimated to be a factor of 10,000. Conservatively assuming the 36 relocated DSMs have the same dose rate, the dose rate at the site boundary is $4.50x10^{-3}$ µSv/h. This result assumes a straight line-of-sight to the site boundary and no shielding provided by other DSMs and other structures (e.g., SB3 and SB4), which is considered conservative. Thus, the assessment concluded there is sufficient margin to the dose rate target to accommodate the relocated DSMs on the NSS-PWMF II licensed site (OPG, 2024b). As the findings and assumptions used in this recently completed assessment remain valid, no further assessment is required for this PERA.

The 2024 assessment of radiological impacts associated with the relocation of the DSMs did not specifically address potential impacts to ecological receptors. Ecological receptors may exist closer than the 200 m assumed for the nearest site boundary fenceline. The maximum dose rate of 1.24 µSv/h (measured at 8 m from the DSM, the existing highest measurement on the north RCS fence) can conservatively be assumed as the dose rate at the fenceline for the NSS-PWMF II site. Considering this, the estimated fenceline dose rate would be $2.98x10^{-2}$ mGy/d, which represents approximately 1.2% of the terrestrial radiation dose benchmark. Though ecological receptors may periodically exist closer than 8 m to the DSMs, the maximum dose rate of 1.24 µSv/h includes contributions from multiple DSMs and existing DSCs, making it a conservative estimate of dose from any one DSM. It is also unlikely that ecological receptors would remain in long-term close contact with the DSMs as the areas around the DSMs are paved and devoid of vegetation, and generally do not present suitable foraging or nesting habitat for birds and mammals. Thus, ecological receptors are not considered at risk from the relocation of the DSMs to the NSS-PWMF Phase II licensed site. Current conditions within the NSS-PWMF Phase I site are considered representative and no further assessment is warranted for this PERA.

While this PERA has included an assessment of predicted NSS-PWMF dose rates following the transfer of DSMs to the NSS-PWMF Phase II area, the next iteration of the PN ERA will consider the new NSS-PWMF layout and use updated measured dose rates to evaluate revised doses to human and ecological receptors and ensure that OPG's operational and regulatory limits continue to be met. Following transfer to the NSS-PWMF Phase II area, a series of thermoluminescent dosimeters (TLDs) will be installed to monitor gamma radiation fields surrounding the DSMs. At the current DSM storage location, quarterly catch basin stormwater samples are collected for the analysis of gross beta/gamma; this monitoring is expected to continue at the new DSM storage location within the NSS-PWMF Phase II site.

5.6.3 PNGS Units 5-8 Continued Operations

During normal operations, the PN site emits gamma radiation fields into the surrounding environment, primarily due to the storage of radiological waste within the NSS-PWMF. It is anticipated that gamma radiation fields post-refurbishment would be similar to those assessed in the PCSS PERA since those estimates include contributions from other facilities on the NSS-PWMF Phase II site including SB3, SB4, and SB5 (Ecometrix, 2024)

In general, the Continued Operations Phase of the PNGS Units 5-8 Refurbishment Project is similar to the PCSS PERA; however, future TLD monitoring at the NSS-PWMF Phase II site will confirm gamma radiation fields.

5.6.4 Summary of Tier 1 Assessment

The initial screening of potential effects of Project activities on the radiation and radioactivity included consideration of gamma radiation. The predicted interactions between radiation and radioactivity and Project activities are summarized in **Table 5-27**.

Table 5-28 below summarizes the constituents of interest considered, their sources, and associated exposure pathways for the radiation and radioactivity (gamma radiation) environmental component considered in the Tier 1 assessment. The table differentiates among the different phases of the Project including: PNGS Units 1-4 Stabilization and SWS, Risk Reduction/Removal Activities, PNGS Units 5-8 Refurbishment, and PNGS Units 5-8 Continued Operations. It also identifies the outcome of the Tier 1 assessment and if a Tier 2 analysis was needed.

As shown in **Table 5-28**, no Tier 2 assessment was identified for external gamma radiation.

Table 5-27: Summary of Interactions between Project Activities and Gamma Radiation

Project Activities	Gamma Radiation
PNGS Units 1-4 Decommissioning	
PNGS Units 1 and 4 Stabilization	Bounded by 2017 PEA and 2022 PEA Addendum.
PNGS Units 1-4 Storage with Surveillance	Bounded by 2017 PEA and 2022 PEA Addendum with the exception of the following activity: • Removal of modules and baskets from AIFB and IFB-A not previously assessed, but is bounded by current licensing activities and mitigated by existing waste management procedures.
Risk Reduction and Removal Activities (2025-2033) Dismantle/Demolish (2034-2036)	Radiological effects sufficiently mitigated by adherence to OPG waste management procedures and licence requirements.
PNGS Units 5-8 Refurbishment	
Preparation for Refurbishment	
• Procurement and Mobilization of Equipment and Components	No interaction

Project Activities	Gamma Radiation
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	No interaction
• Construction of PCSS and SB5	No interaction
• Defuel and Dewater	No interaction
• Islanding the Unit	No interaction
• Management of Heavy Water	No interaction
• Construction of DWI	No interaction
Refurbishment	
• Replacement of Reactor Components	No interaction
• Removal and Replacement of Steam Generators	No interaction
• Operation of DWI	No interaction
• Refurbishment of Other Plant Systems	No interaction
• Waste Management and Transportation	• PCSS PERA is valid. • Safety assessment was completed for SB5 in October 2025, prior to construction to confirm dose limits and targets will be achieved. • TLDs will be installed to monitor gamma radiation fields around the DSMs transferred to NSS-PWMF Phase II site.
• Refuelling and Restarting	No interaction
Continued Operations	
• Operation and Maintenance of PNGS Units 5-8	PCSS PERA is valid
• Waste Management and Transportation	PCSS PERA is valid

Table 5-28: Constituents, Sources and Pathways – Radiation and Radioactivity (External Gamma)

Phase	Constituents of Interest	Sources	Exposure Pathways	Tier 1 Outcome
Stabilization and SWS	Gamma radiation fields	• Removal of used fuel and modules/baskets from the AIFB and IFB-A. • Transport of used fuel to NSS-PWMF.	None	Removal and transfer of used fuel part of OPG's current licensed activities and operational conditions. No Tier 2.
Risk Reduction and Removal	None	• None	None	No Tier 2.
Refurbishment	Gamma radiation fields	• Replacement of reactor components. • Removal of steam generators. • Management and transfer of radiological waste. • Storage in PCSS. • DSM move.	External gamma radiation	Dose from external gamma radiation below dose limits and dose benchmarks in PCSS PERA. No Tier 2.
Continued Operations	Gamma radiation fields	• Storage of used fuel in NSS-PWMF. • Storage of L&ILW in PCSS.	External gamma radiation	Dose from external gamma radiation below dose limits and dose benchmarks in PCSS PERA. No Tier 2.

5.7 Climate Change Considerations

OPG is committed to supporting Canada's goals to be net-zero by 2050. Achieving this goal is an organizational priority advanced through initiatives focused on mitigation, energy efficiency, innovation, and leadership. As part of its adaptation commitment, OPG is also dedicated to understanding how climate conditions are changing and ensuring these considerations are integrated into operations and decision-making processes across the organization.

OPG maintains an internal climate atlas that compiles short- and long-term climate projections to support understanding of how climatic variables may evolve over time. This atlas contains data projection maps to aid analyses that assess expected changes in factors such as precipitation and air temperature on annual and seasonal scales. OPG is also in the process developing a climate risk assessment framework that will use information to support consistent evaluation of climate-related risks and enable climate considerations to be fully integrated into existing processes and programs. In addition, OPG reports its greenhouse gas (GHG) emissions annually through its Environmental, Social, and Governance (ESG) Report (OPG, 2025g), which is available on OPG's website (**https://www.opg.com/about-us/who-we-are/commitment-to-esg/**) ensuring transparent disclosure of progress toward its climate objectives.

Furthermore, the PN site continues to be maintained using engineering best practices which account for considerations of extreme weather events. OPG's existing Emergency Management Program addresses actions to be taken to respond to emergencies due to extreme weather events.

OPG acquired local climate change projections and indicators for PNGS in 2023 (AECOM, 2023) which focused on the identification of climate change hazards and their bounding values. OPG is in the process of obtaining CMIP6 (Climate Model Intercomparison Project) climate projections for future analysis.

The bounding analysis considered gradual climate change and extreme weather events under two scenarios: Representative Concentration Pathway (RCP) 4.5, which accounts for intermediate GHG emissions; and RCP 8.5, with accounts for high emissions. The future projections were analyzed for two time periods – 2021-2050 (which covers the licensing period of this PERA) and 2051-2080. The impacts of climate change on Project activities, and potential GHG emissions from these activities, during different phases are summarized below.

5.7.1 PNGS Units 1-4 Decommissioning

5.7.1.1 Stabilization and Storage with Surveillance

The potential influence of climate change on activities during the Stabilization and SWS phase was evaluated in the 2022 PEA Addendum. Regional Climate Models (RCMs) for RCP 4.5 and 8.5 scenarios indicated show slightly increasing water levels in Lake Ontario and greater variability, particularly as temperatures increase by 2050. The RMA10 model developed for the 2017 Safe Storage PEA and the 2022 PEA Addendum utilized elevated water temperatures and levels, as

well as early spring warming conditions, making it representative of future climate change scenarios. Additionally, as the discharges from PNGS Units 1-4 during the SWS Phase are non-thermal and small in volume, the thermal plume is expected to be reduced considerably from previous operational conditions (with 6 operating units). Furthermore, the predicted increase in the frequency and occurrence of extreme weather events (intense precipitation and drought) may increase exchange rates between the forebay and the lake, thus reducing concentrations of any contaminants in the forebay.

The results of the bounding analysis are consistent with the climate projections from the RCP models developed for the 2022 PEA Update. Additional climate hazards not considered in the PEA, such as increased annual ambient air temperatures, higher occurrences of biofouling and algal blooms, and a greater likelihood of heatwaves and storm events, are not expected to impact activities during this phase, as these changes primarily affect operations, which have ceased for PNGS Units 1-4. Consequently, the impacts of climate change on project activities during this phase are considered negligible.

5.7.1.2 Dismantle/Demolish Activities

The impact of climate change on dismantling activities for PNGS Units 1-4 was not evaluated in the 2022 PEA Addendum. As per the results of the bounding analysis, Lake Ontario's annual mean water temperature is projected to increase by 1.7 °C by mid-century under the RCP 8.5 scenario, which aligns with the activities during this phase. This gradual increase in average water temperatures will be minor relative to changes to the receiving environment as a result of reduction of the thermal plume due to minimal releases via the PNGS Units 1-4 discharge channel. Additionally, while increased ambient air temperatures due to climate change could elevate fire risks for certain structures and equipment, the dismantling and removal of non-nuclear SSCs during this phase reduces this risk greatly.

The predicted increase in the frequency and intensity of extreme precipitation events and storms may result in higher runoff. However, existing drainage and stormwater systems will remain operational and are expected to accommodate these changes, with potential adjustments and modifications made to confer additional capacity as needed through adaptive management strategies. In the unlikely event of rainfall exceeding design capacity, localized erosion of ditches or soil cover may occur, but the integrity of site structures and equipment is anticipated to remain unaffected, minimizing risks to the public and environment. This is based on engineering best practices and safety margins at the time they were developed. OPG is currently evaluating the design to determine if it addresses future climatic conditions.

Finally, the utilization of vehicles and equipment for dismantling activities are expected to emit a small amount of GHGs. However, vehicular traffic is not expected to increase significantly compared to previous operational conditions (with 6 operating units), and equipment will be operated intermittently and as efficiently as possible to limit emissions. Therefore, considering the relatively short time frame of project activities, limited project-environmental interactions, and robust mitigation measures (e.g., Emergency Management Program, climate considerations

in infrastructure design at the time they were developed), the impacts of climate change on project activities during the Dismantle and Demolish phase are likely negligible.

5.7.2 PNGS Units 5-8 Refurbishment

An evaluation of the effects of climate change on activities during Refurbishment, except the construction and operation of the proposed DWI, was conducted as a part of the Pickering B Refurbishment EA (SENES, 2007). The conclusions of this evaluation are summarized in this section, integrating the predictions of climate parameters derived from the 2023 bounding analysis and recent climate change literature.

As suggested by the thermal stratification patterns in Lake Ontario (see **Section 1.1.1.1**), the water drawn through the proposed offshore DWI is expected to be 3–5°C cooler than that drawn through the existing nearshore intake channel at the surface, supporting improved thermal management in the future. Compared to surface water, deeper layers in lakes are expected to warm at a slower rate with climate change due to weaker coupling with air temperature (Anderson et al., 2021; Butcher et al., 2015; Pilla et al., 2020). The interactions that result in increasing water temperatures in Lake Ontario are complex and still the subject of ongoing studies. Additionally, preliminary estimates of the discharge temperature following intake relocation account for these climate change-induced increases and indicate that the discharge temperature will remain the same or lower than current conditions. As such, the thermal plume for previous operations (with 6 operating units) remains applicable under climate change conditions.

As water temperatures, particularly maximum temperatures, are expected to rise in the coming decades, an increased frequency and duration of biofouling events and algal blooms during the summer is anticipated. Lake buoyancy, surface winds, and lake currents can concentrate cyanobacteria near the surface. This suggests the projected increase in algal growth is expected to be less pronounced near the DWI. Additionally, increased turbidity in the epilimnion of stratified lakes due to algal blooms is expected to maintain or lower water temperatures in deeper layers. This is because higher turbidity leads to greater light absorption at the surface, limiting heat transfer to subsurface layers (Richardson et al., 2017; Rose et al., 2016). Consequently, this effect would buffer against increased algal growth in deeper layers. Despite this, potential impacts on operations from increased algal growth at depths of 11.5 - 15 m (i.e., the depths between which initial conceptual designs propose the siting of the DWI), including blocking and restrictions of the intake, remain possible. To minimize these risks, OPG will deploy protective screens, prepare systems, and implement design modifications as necessary. OPG will also continue utilizing the Advanced Algae Warning System (AAWS), a predictive tool developed in 2019 (OPG, 2020c), to forecast and monitor algae events, and adjust operations accordingly to mitigate the effects.

The predicted increase in annual precipitation as well as the frequency and intensity of extreme weather events such as storms is expected to result in higher lake water levels in the coming years. Specifically, the bounding analysis projects that annual lake levels could rise to 76.3 m by

the end of 2080 under the RCP 8.5 scenario, a 1 m increase from historical levels. However, as the projected annual level remains below the PN shoreline protection level of 78.6 m, the shoreline is expected to remain adequately protected even in the context of climate-induced changes. Conversely, the findings of the bounding analysis indicate that, despite predicted increases in drought events, a significant decline in annual lake levels is not expected under the RCP 8.5 scenario. Importantly, the International Joint Commission regulates lake levels through controlled outflows and is expected to continue doing so in the future. Thus, given the minor fluctuations in lake levels under climate change, along with the active regulation by the International Joint Commission, lake levels are anticipated to remain relatively stable and below the PNGS shoreline protection level.

OPG's severe weather emergency preparedness procedure (OPG, 2023h) has been effective in managing severe weather events, ensuring that the station operates without risk to the public or the environment. As climate change is expected to increase the frequency and intensity of extreme weather events, this procedure will continue to play a critical role in responding to these challenges and maintaining safe operations. Finally, all project-related structures, i.e., the DWI, cutoff wall, and associated structures, will be designed using engineering best practices to withstand extreme weather conditions such as storms, droughts, floods, and blizzards.

The increased occurrence of extreme weather events such as storms and floods expected to occur with climate change, could result in increased shore erosion due to greater wave intensity, potentially impacting the stability of the nearshore study areas. Erosion is currently an ongoing process along the PN shoreline, and no adverse impacts on nearshore aquatic biota have been observed as a result. Lake acidification due to climate change will also be considered in the design of the DWI intake and associated nearshore modifications.

Activities related to the relocation and removal of buildings, structures, and equipment, and the construction of buildings such as the PCSS and RFRISA, are anticipated to last for a short duration, and are expected to encounter a minimal impact from climate change. As detailed in the PCSS PERA (Ecometrix, 2024), though extreme precipitation events are predicted to increase in the coming decades, the water management infrastructure of the site would be designed to include additional capacity to accommodate this increase as applicable. Additionally, these buildings will be designed according to the National Building Code of Canada and will be constructed using engineering best practices to account for any impacts of extreme weather events. OPG's existing Emergency Management Program and severe weather emergency preparedness procedure are dynamic, and address actions to be taken to respond to emergencies including extreme weather events. Additionally, GHG emissions associated with the construction activities will be minimized by reducing vehicle idling and using energy-efficient systems and equipment.

5.7.3 Continued Operations

Following refurbishment, continued operation of PNGS Units 5-8 with the DWI is expected to result in the discharge temperature remaining the same or lower than current conditions.

Therefore, climate change impacts on the thermal plume are not considered to be significantly different from current conditions based on these preliminary predictions. This will be confirmed through future monitoring of intake and discharge temperatures. As a subsequent step, the Tier 2 assessment evaluates thermal effects further.

Climate change is expected to lead to an increase in ambient air temperatures, with the average annual ambient air temperature in 2080 under the RCP 8.5 scenario projected to reach 16.5°C, increasing 4.3°C from historical observations. Ambient air temperatures are used as one of the inputs to the atmospheric dispersion model used in the 2022 PN ERA. As ambient air temperature increases, there is less difference between the ambient air temperature and the air emissions gas temperature from the PNGS stack. A lower difference between the gas and ambient air temperature results in less buoyancy of the plume and lower atmospheric dispersion. This would likely result in exposure to higher air concentrations for receptors proximal to the site, and lower concentrations for receptors farther from the PN site. The atmospheric dispersion of emissions is also expected to be influenced by higher wind speeds associated with tropical storms in the coming decades. In a 2°C warmer world, wind speeds during storms are projected to increase by 1-10%, with tropical cyclone wind speeds increasing by 0.5 to 5.2 km/h and extra-tropical cyclones increasing by 0.6 to 6.6 km/h compared to historical observations. These stronger winds would result in broader dispersion of emissions, further supporting the conservative nature of this assessment.

Finally, the refurbishment of PNGS Units 5-8 will allow the operational lifespan of the station to increase by at least another 30 years. Given the role of GHG emissions in exacerbating climate change, the continued generation of electricity with minimal carbon emissions will contribute to Canada's efforts to reduce its overall GHG emissions, aligning with broader climate mitigation objectives.

5.8 Uncertainty in the Tier 1 Assessment

The Tier 1 assessment presented a qualitative assessment to identify Project interactions that are not bounded by previous operational conditions (with 6 operating units) or previous assessments. The qualitative assessment utilizes the description of Project activities that are planned to occur during PNGS Units 1-4 decommissioning, and during PNGS Units 5-8 refurbishment until the end of 2036 followed by continued operations. The Tier 1 assessment is based on understanding of Project activities as the Project is defined for the purposes of the PERA. The Project activities may evolve over time as the Project moves forward. As such, where there is uncertainty in the approach for executing activities, conservative or bounding assumptions have been made to capture the range of potential future effects, to ensure that effects are not underestimated.

For the air quality model discussed in **Section 5.1.1.2**, the modelling and assessment approach is intentionally conservative and designed to represent upper-bound exposure conditions. Conservative elements of the assessment include:

- Use of bounding emission scenarios,

- Application of representative worst-case operating assumptions,
- Incorporation of upper-percentile background concentrations, and
- Evaluation of simultaneous source operation.

5.9 Summary of Tier 1 Assessment

PNGS Units 1-4 Decommissioning and PNGS Units 5-8 Refurbishment activities were evaluated for interactions with environmental pathways and receptors in the Tier 1 assessment. **Table 5-29** provides a summary of the interactions and the findings (i.e., screening) from this assessment to determine which interactions require further quantitative assessment in the Tier 2 assessment. In general, interactions associated with project activities during the Stabilization and SWS phases of PNGS Units 1-4 are considered sufficiently bounded by the findings of the 2017 Safe Storage PEA and the 2022 PEA Addendum, or the 2022 PN ERA, and do not warrant further evaluation. Although PNGS Units 1-4 risk reduction and removal activities and dismantling and demolition activities were not evaluated in previous assessments, these activities are not anticipated to result in significant environmental effects as construction best practices and applicable mitigation plans will be implemented to minimize impacts. Environmental effects of future dismantle and demolish activities planned to start in 2050 will be detailed in subsequent DDP updates and PERA updates when more detailed work packages are defined.

Refurbishment activities for PNGS Units 5-8 including islanding the unit, refurbishment of reactor auxiliary systems, and other upgrades were determined in the Tier 1 assessment to have negligible interaction with the environment. Some activities, such as the construction of the PCSS, are evaluated as part of a separate PERA. Other activities, such and defueling and dewatering the units, are bounded by the 2017 Safe Storage PEA and the 2022 PEA Addendum, while still others, such as management of tritium emissions, are bounded by the 2022 PN ERA. These activities bounded by other assessments do not warrant further evaluation in the Tier 2 assessment.

The construction and operation of the DWI, along with associated activities such as the potential construction of the cutoff wall, and material disposal, are major activities that were not part of the project scope at the time of earlier assessments. The Tier 1 screening identified that the impacts resulting from these activities—particularly in relation to the atmospheric environment, and aquatic ecosystems—are not bounded by earlier assessments or previous conditions (with 6 operating units). Specifically, aquatic habitat impacts from the DWI construction and thermal effects, especially as they relate to climate change, require further assessment. As such, these project-environment interactions will be comprehensively evaluated in the Tier 2 quantitative assessment to characterize the potential for adverse impacts.

While no specific COPCs were identified for the atmospheric or surface water environment, general feedback from the WTFNs on other PERAs has indicated that it would be beneficial to include a Harvester receptor in the PERA. As such, assessment of a Harvester is considered in the Tier 2 quantitative assessment including evaluation of tritium and C-14 releases to air, and tritium, C-14, and beta/gamma releases to water.

Following refurbishment, PNGS Units 5-8 will operate in a manner consistent with previous operations (6 operating units). Consequently, the potential effects of the Continued Operation Phase on most environmental components are similar to those previously assessed in the 2022 PN ERA for 6 operating units and comparable to current conditions with 4 units (PNGS Units 5-8) operating.

As shown in the conceptual timeline for the Project in **Figure 1-2**, there will be activities occurring in one phase that occur at the same time as another phase. For example, while PNGS Units 1 and 4 are in the Stabilization Phase and PNGS Units 2 and are in SWS phase, risk reduction and removal activities will also occur, along with PNGS Units 5-8 refurbishment activities, and construction of the DWI. The air and noise modelling, and surface water quality modelling considered a bounding condition when activities are occurring at the same time, where relevant to the assessment.

In summary, the following potential effects are evaluated in the Tier 2 assessment:

- Inclusion of a Harvester in the Predictive HHRA to assess radiation dose from exposure to releases of tritium, carbon-14, and beta/gamma to the atmospheric and surface water environment.
- Evaluation of aquatic habitat loss and potential changes to habitat quality in the Predictive Ecological Risk Assessment (EcoRA) from construction of the proposed DWI and associated nearshore modifications.
- Evaluation of changes to thermal effects on indicator fish species in the Predictive EcoRA due to operation of the DWI, with consideration of long-term climate change.

Table 5-29: Project-Environment Interactions Carried Forward into the Tier 2 Assessment

Project Activities	Atmospheric Environment (Air/Noise)	Surface Water Environment - Flow	Surface Water Environment - Quality	Hydrogeological and Geological Environment – Groundwater Flow	Hydrogeological and Geological Environment – Groundwater Quality	Hydrogeological and Geological Environment - Soils	Radiation and Radioactivity (Gamma Radiation Field)	Terrestrial Environment	Aquatic Environment
PNGS Units 1-4 Decommissioning									
PNGS Units 1 and 4 Stabilization	-	-	-	-	-	-	-	-	-
PNGS Units 1- 4 Storage with Surveillance	✓*	-	✓*	-	-	-	-	-	-
Risk Reduction and Removal Activities	-	-	-	-	-	-	-	-	-
Dismantle/Demolish	-	-	-	-	-	-	-	-	-
PNGS Units 5-8 Refurbishment									
Preparation for Refurbishment									
• Procurement and Mobilization of Equipment and Components	-	-	-	-	-	-	-	-	-
• Relocation/Removal/Construction of Buildings, Structures, and Equipment	-	-	-	-	-	-	-	-	-
• Construction of PCSS and SB5	-	-	-	-	-	-	-	-	-
• Defuel and Dewater	-	-	-	-	-	-	-	-	-
• Islanding the Unit	-	-	-	-	-	-	-	-	-
• Management of Heavy Water	-	-	-	-	-	-	-	-	-
• Construction of DWI	-	-	-	-	-	-	-	-	✓*
Refurbishment									
• Replacement of Reactor Components	-	-	-	-	-	-	-	-	-
• Removal and Replacement of Steam Generators	-	-	-	-	-	-	-	-	-
• Operation of DWI	-	-	-	-	-	-	-	-	✓*
• Refurbishment of Other Plant Systems	-	-	-	-	-	-	-	-	-
• Waste Management and Transportation	-	-	-	-	-	-	-	-	-
• Refuelling and Restarting	-	-	-	-	-	-	-	-	-

Project Activities	Atmospheric Environment (Air/Noise)	Surface Water Environment - Flow	Surface Water Environment - Quality	Hydrogeological and Geological Environment – Groundwater Flow	Hydrogeological and Geological Environment – Groundwater Quality	Hydrogeological and Geological Environment - Soils	Radiation and Radioactivity (Gamma Radiation Field)	Terrestrial Environment	Aquatic Environment
Continued Operations									
• Operation of PNGS Units 5-8	-	-	-	-	-	-	-	-	✓*
• Waste Management and Transportation	-	-	-	-	-	-	-	-	-

Note:

"✓*" Indicates an interaction between the Project activity and the environmental component that is not bounded by previous operational conditions (with 6 operating units) or previous assessments as determined by the Tier 1 assessment. These interactions will be evaluated quantitatively in the Tier 2 assessment.

"-" Indicates conclusions of the Tier 1 assessment show that no Tier 2 assessment is needed.

6.0 Tier 2 Quantitative Assessment

6.1 Predictive Human Health Risk Assessment (HHRA)

The conclusion from the Tier 1 assessment identified that the Harvester receptor should be evaluated in the Tier 2 assessment and that the radiological emissions to air and water assessed in the 2017 Safe Storage PEA continue to remain a conservative estimate of radiological emissions based on current Project planning for PNGS Units 1-4 Stabilization and SWS, as well as for PNGS Units 5-8 Refurbishment. The 2017 Safe Storage PEA and the 2022 PEA Addendum assessed the shutdown of PNGS Units 1 and 4 as well as Units 5-8, followed by Stabilization and SWS for all units. The PERA assesses the shutdown of PNGS Units 1 and 4 and refurbishment of Units 5-8. Refurbishment of Units 5-8 involves many of the same activities as Stabilization and SWS, such as draining and defueling, and shutting down of CCW pumps. As such, the assessment of radiological emissions in the 2017 Safe Storage PEA are applicable to this PERA since the radiological emissions during PNGS Units 5-8 Refurbishment from reactor draining and defueling or CCW pump reduction are expected to be similar to those assessed in the 2017 Safe Storage PEA for Stabilization and SWS. For effluent releases to water, the 2017 Safe Storage PEA is also bounding since substantially reduced CCW flow was assumed during Stabilization and SWS than during Refurbishment (see **Section 5.2.1.1.1** and **Section 5.2.1.2** of the PERA).

Once refurbishment of PNGS Units 5-8 is complete and units are returned to service, the 2022 PN ERA is applicable and conservative since 6 operating units were evaluated. Recognizing that fewer than 6 units will be operating following refurbishment, there is conservatism in the application of the 2022 PN ERA to the continued operations phase.

This predictive HHRA provides the conservative radiation dose for the Harvester, and also an updated dose prediction for the other human receptors evaluated in the 2017 Safe Storage PEA based on more recent meteorological data from PN (2020 to 2024).

6.1.1 Problem Formulation

The problem formulation provides the objectives, goals, framework and methodology for the PERA and consists of identifying the relevant components for the predictive HHRA. These components include the identification of human receptors that may be potentially present in or around the PN Site, the COPCs that may occur in or around the PN Site; and the exposure pathways by which receptors could be exposed to contaminants in the environment. A CSM illustrates all of these relationships, based on the results of the problem formulation.

6.1.1.1 Health and Safety of On-site Workers

On-site workers, contractors, and visitors are potentially exposed to environmental contaminants, both chemical and radiological, but these exposures are considered and controlled through OPG's Health and Safety Management System and the Radiation Protection Program, and are not considered in this HHRA, as discussed below.

OPG's Health and Safety Management System Program is designed to ensure the protection of employees, contractors and visiting members of the public. The program outlines a systems approach used to manage risks associated with activities, products and services of OPG Nuclear operations. Contractors are required to maintain a level of safety equivalent to OPG staff while working at an OPG workplace. Work at OPG is subject to safe work planning requirements where safety hazards are identified and mitigating measures are communicated through Pre-Job Briefings. Routine or planned work is governed by approved procedures and operating instructions.

During PNGS Units 1-4 Decommissioning, PNGS Units 5-8 Refurbishment and Continued Operations, OPG's Radiation Protection Program will be applied. The Radiation Protection Program is designed to ensure that doses for employees, contractors and visiting members of the public are below regulatory limits, and ALARA, social and economic factors being taken into account. Employee radiation doses are monitored to ensure they do not exceed exposure control levels that are below regulatory limits. Doses to visitors and contractors are also monitored. Only workers classified as Nuclear Energy Workers (NEWs) may perform radioactive work. Visitors are limited to non-radioactive work and escorted by a qualified NEW. Personal information is collected for the purposes of dose reporting.

As human exposures on the site are kept within safe levels through the Health and Safety Management System Program and Radiation Protection Program, on-site receptors are not addressed further in the predictive HHRA. The focus of the HHRA is on off-site members of the public.

6.1.1.2 Receptor Selection and Characterization

The focus of the HHRA is on potential risk to off-site members of the public. Off-site members of the public are potentially exposed to low levels of airborne or waterborne contaminants. The most-affected off-site members of the public are defined as potential "critical groups" or "representative persons". Potential critical groups are defined through site specific surveys and their doses are calculated in the OPG EMP Reports. The most recent site-specific survey was completed in 2021 (OPG, 2021f).

As a result of engagement activities to support the DNNP PERA, representatives from the WTFNs expressed interest in including a new human receptor in the DNNP PERA that aims to better represent the lifestyle characteristics of an Indigenous person who may work and/or live near the DN site and may also harvest traditional foods (animals and plants that are fished, hunted, or gathered from the land and consumed as food (HC, 2018) in the local area. This receptor is assumed to hunt, fish and consume traditional foods in a greater proportion compared to the lifestyles represented by the list of receptors currently characterized in OPG's existing EMPs and ERAs. The new receptor was identified in the DNNP PERA as a "Harvester". The Harvester was developed using publicly available information to form the basis of the diet and exposure characteristics; it is expected that this receptor will be further refined over time through the site-specific survey as well as ongoing engagement activities with Indigenous

Nations and communities. The same diet and exposure characteristics for the Harvester receptor from the DNNP PERA have been implemented in this PERA. The development of the Harvester receptor's diet is described in more detail in **Section 6.1.2.4.1**.

The potential critical group receptors used for the predictive HHRA (shown in **Figure 1-3**) are consistent with OPG's annual PN EMP reports and the 2022 PN ERA (Ecometrix, 2023a), with the addition of the Harvester receptor included as part of this PERA. The seven potential critical groups are:

- The **C2** potential critical group consists of inhabitants at a correctional institute located approximately 3 km NNE of the PN Site. The C2 group obtains drinking water from the Ajax WSP and does not consume locally grown fruits or vegetables. The C2 resident is conservatively assumed to be at this location 100 percent of the time over the full year.

- The **Industrial/Commercial** potential critical group consists of adult workers whose work location is close to the nuclear site. Members of this group are typically at this location about 23% of the time (based on an assumed schedule of 8 hours/day, 5 days/week, 50 weeks/year). They consume water from the Ajax WSP. The closest location for this group is about 1 km NNE of the site.

- The **Urban Residents** potential critical group consists of Pickering and Ajax area residents which surround the PN Site (e.g., Fairport, Fairport Beach, Rosebank, Liverpool, Pickering Village, etc.). The members of this group mostly consume water from the Ajax WSP and also consume a diet composed in part of locally grown produce and some locally caught fish. Members of this potential critical group are also externally exposed to beach sand at local beaches (Beachpoint Promenade, Beachfront Park, or Squires Beach). Surveys indicate that 10% of urban residents work within 5 km of the PN site.

- The **Farm** potential critical group consists of residents of agricultural farms (but not dairy farms) within a 10 km radius of the PN Site. Members of this group obtain most of their water supply from wells but also a portion from the Ajax WSP. Members of this potential critical group consume locally grown produce and animal products, as well as locally caught fish. They are also externally exposed to beach sand at local beaches (Beachpoint Promenade, Beachfront Park, or Squires Beach).

- The **Dairy Farm** potential critical group consists of residents of dairy farms within a 20 km radius of the PN Site. This group obtains most of their water supply from local wells. They also consume locally grown fruit and vegetables and locally produced animal products, including fresh cow's milk. Members of this potential critical group are also externally exposed to beach sand at local beaches (Beachpoint Promenade, Beachfront Park, or Squires Beach).

- The **Sport Fisher** potential critical group is comprised of non-commercial individuals fishing near the PN site outfalls, 0.5 km south of the PN site. Members of this group were

conservatively assumed to obtain their entire amount of fish for consumption from the vicinity of the PN site and spend 1% of their time at the outfall location where atmospheric exposure occurs.

- The **Harvester** potential critical group represents local residents in the vicinity of PN site who hunt, fish and regularly consume traditional foods harvested from the areas around the PN site. The Harvester is meant to represent Indigenous local residents, some of whom may also work near the PN site. It is conservatively assumed that 10% of the adult Harvesters work within 5 km of the PN site (consistent with the assumption from the EMP for the urban resident). Doses to this portion of adults are adjusted using the Industrial/Commercial worker dose to account for the increased exposure while at work due to proximity of this worker location to the station. The Harvester potential critical group has been conservatively placed in the West-North-West (WNW) wind sector, approximately 1 km from the PN site, consistent with the urban resident location.

The predictive HHRA and receptor selection does not directly address sensitive or vulnerable populations; however, demonstration that the receptors evaluated are well below the public dose limit would indicate that sensitive or vulnerable human health groups are considered protected as well. The public dose limit of 1,000 µSv/a is protective of all ages and populations.

6.1.1.3 Selection of Chemical, Radiological, and Other Stressors

The only COPCs that were identified for further assessment were radionuclides including tritium and C-14 in air, and tritium, C-14, and beta/gamma in water. Airborne particulates, noble gases and radioiodine emissions were not assessed as their sources terms are either minor or will be eliminated as described in 2017 Safe Storage PEA (Golder and Ecometrix, 2017).

Non-radionuclide COPCs or physical stressors were not identified for the Tier 2 assessment.

6.1.1.4 Selection of Exposure Pathways

For exposure of human receptors to radiological COPCs, the relevant exposure pathways include:

- Air inhalation and external exposure to air;
- Ingestion of water (WSP, wells) and external exposure to water (lakes, WSPs, wells)
- Incidental ingestion of soil and beach sand;
- External exposure to soil and beach sand; and,
- Ingestion of food (homegrown and traditional foods).

The complete exposure pathways, as defined in OPG's EMP, for exposure of relevant receptors to radiological COPCs are summarized in **Table 6-1**, with the addition of the Harvester receptor.

Table 6-1: Complete Exposure Pathways for Receptors for Exposure to Radiological COPCs

Receptor	Exposure Pathway	Environmental Media
Sport Fisher	Inhalation	Air
	Ingestion	Aquatic animals (fish)
	External	Air
Industrial/Commercial Worker[(1)]	Inhalation	Air
	Ingestion	Water (Ajax WSP) Soil (incidental) Sediment (incidental) Aquatic animals (fish) Terrestrial plants (local produce) Terrestrial animals (local produce)
	External	Air Water Soil Sediment
Urban Resident	Inhalation	Air
	Ingestion	Water (Ajax WSP) Soil (incidental) Sediment (incidental) Aquatic animals (fish) Terrestrial plants (local produce) Terrestrial animals (local produce)
	External	Air Water Soil Sediment
Correctional Institution	Inhalation	Air
	Ingestion	Water (Ajax WSP) Soil (incidental)
	External	Air Water Soil
Farm	Inhalation	Air
	Ingestion	Water (Wells/Ajax WSP) Soil (incidental) Sediment (incidental) Terrestrial plants (locally grown) Terrestrial animals (locally grown)
	External	Air Water Soil Sediment

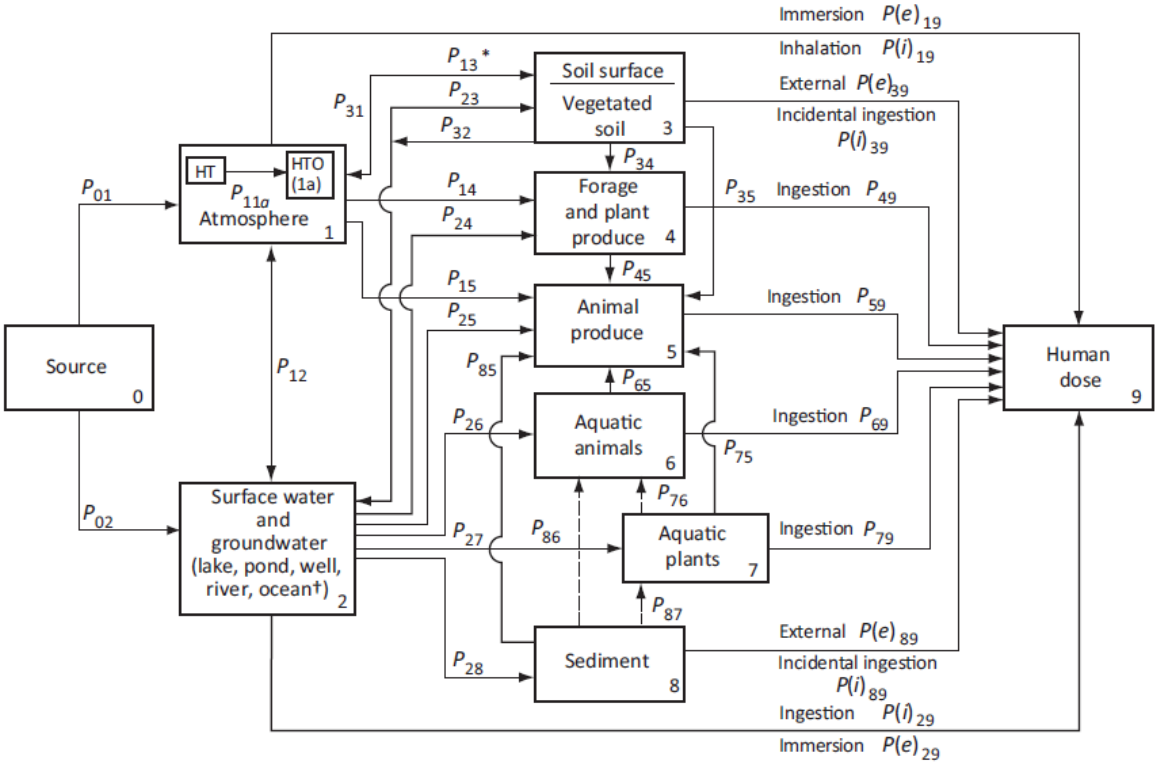
Receptor	Exposure Pathway	Environmental Media
Dairy Farm	Inhalation	Air
	Ingestion	Water (Wells) Soil (incidental) Sediment (incidental) Terrestrial plants (locally grown) Terrestrial animals (locally grown)
	External	Air Water Soil Sediment
Harvester	Inhalation	Air
	Ingestion	Water (Ajax WSP) Soil (incidental) Sediment (incidental) Aquatic animals (fish) Terrestrial plants (traditional foods) Terrestrial animals (traditional foods)
	External	Air Water Soil Sediment

Note:
(1) A small fraction of Industrial/Commercial workers are also Urban Residents; therefore, the ingestion pathway is included to account for when the worker is at home.

6.1.1.5 Human Health Conceptual Site Model

The human health CSM illustrates how human receptors are exposed to COPCs. It represents the relationship between the source and receptors by identifying the source of contaminants, receptor locations and the exposure pathways to be considered in the assessment for each receptor. Exposure pathways represent the various routes by which radionuclides and/or chemicals may enter the body of the receptor, or (for radionuclides) how they may exert effects from outside the body.

A generic CSM, taken from CSA N288.1:20 (CSA, 2020) is shown in **Figure 6-1**, and is applied to human receptors around the PN Site. This represents the exposure pathways from source to receptor. It is appropriate for radiological and non-radiological COPCs, except that, for non-radionuclides, external and immersion pathways are represented by dermal exposure. No non-radiological COPCs were identified for the predictive HHRA.



*Includes transfer factors P_{13area}, P_{13mass}, and P_{13spw}.
†For ocean water, pathways P_{23}, P_{24}, P_{25}, and $P(i)_{29}$ are not used.
Notes:
(1) *The broken lines represent pathways that are not explicitly considered in the model or are considered only in special circumstances.*
(2) *Factors include multiple transfers where appropriate.*

Figure 6-1: Conceptual Model for Human Receptors (CSA, 2020)

6.1.1.6 Uncertainties in the Problem Formulation

The data used in the predictive HHRA problem formulation were concluded to be of adequate quality and quantity to support the objectives of the PERA.

The development of the Harvester receptor relied on generic, non-site-specific information relating to Indigenous diet composition and traditional food consumption rates from the Ontario First Nations Food, Nutrition and Environment Study (FNFNES) published by Chan et al. (2014). The data used were for the ecozone that includes the PN site, but were not specific to the PN local area. Though the data used are considered adequate for modelling exposures to local Indigenous receptors via the traditional food consumption pathway, the inclusion of site-specific consumption information, if available, would reduce uncertainties in future risk assessments relating to the Harvester receptor's exposure to COPCs in local traditional foods.

6.1.2 Exposure Assessment

The exposure assessment includes identification of exposure locations and exposure factors for each receptor, explanation of dispersion models, and presentation of modelled exposure concentrations and doses. Uncertainties are also discussed. This section presents the information used in the IMPACT model, and the model results.

6.1.2.1 Exposure Locations

An exposure location is the place where the receptor comes into contact with a COPC. The relevant human receptors are the potential critical groups defined in OPG's annual PN EMP reports and the 2022 PN ERA (Ecometrix, 2023a), with the addition of the Harvester receptor included as part of this PERA. The exposure locations of the human receptors have been conservatively located at the nearest/most exposed location for each potential critical group. **Figure 1-3** presents the locations of these receptors which are generally consistent with the 2022 PN ERA (Ecometrix, 2023a), with the exception of the new Harvester receptor conservatively located at the same location as the urban resident location, which consistently receives the highest radionuclide concentrations in air due to distance from source and location within one of the predominant wind directions, i.e. to the WNW based on the annual average meteorology data from 2020 to 2024.

6.1.2.2 Exposure Duration and Frequency

Consistent with the 2017 Safe Storage PEA and the 2022 PN ERA, full-time residency was assumed for the correctional institute resident, Urban Resident, Farm resident, and Dairy Farm resident. For this PERA, full-time residency was also assumed for the Harvester. For each of the Industrial/Commercial Worker, the Sport Fisher, the Harvester, and the Urban Resident that swims at Beachfront Park, the following was assumed:

- The Industrial/Commercial workers are assumed to have an occupancy factor of 0.23 (23% of the time), which is calculated based on an assumed schedule of 8 hours/day, 5 days/week, 50 weeks/year.

- The Sport Fisher potential critical group is comprised of non-commercial individuals who live distant from the PN site but fish south of the PN site discharge, approximately 500 metres offshore. This group was created by OPG to take into account local fish consumption given that site-specific survey results of nearby residents indicated that they eat very little local fish, yet a number of people were observed fishing near the Pickering site. Members of this group are conservatively assumed to obtain their entire fish consumption from the vicinity of the PN site and spend 1% of their time (or approximately 87.6 hours per year representing 4 hours/day, 1 day/week, 22 weeks/year) at the discharge location where atmospheric exposure occurs.

- The Urban Resident is assumed to go swimming at Beachfront Park. The frequency of exposure to beach sand is identified in Table 6-2 of the PERA and is identified as the

shoreline occupancy factor of 0.02 (unitless) consistent with Clause 7.10.3 of CSA N288.1:20 which represents a one-hour per day from May to October on contaminated shoreline.

- A small fraction (10%) of urban residents living near the PN Site also work within 5 km of the PN Generating Station; therefore, they receive a portion of their dose while at home and a portion of their dose while at work. The same fraction (10%) as the Urban Resident was assumed for the Harvester. A small fraction (8%) of workers in the Industrial/Commercial critical group also live near the PN Site; therefore, they receive a portion of their dose while at work and a portion of their dose while at home. The dose received by these critical groups has been adjusted to account for these lifestyles, consistent with the annual EMP reports.

6.1.2.3 Exposure and Dose Calculations

Radiological dose calculations follow the equations presented in CSA N288.1:20 (CSA, 2020) which are not reproduced in this report. IMPACT 5.5.2 is used for the dose calculations and is consistent with the method of dose calculation described in CSA N288.1:20 (CSA, 2020).

As no non-radiological contaminants of potential concern were carried forward from the Tier 1 screening assessment, non-radiological exposure and dose calculations were not required.

6.1.2.4 Exposure Factors

For the radiological dose calculations, the exposure factors (e.g., intake rates, occupancy and shielding factors, etc.) are generally those in CSA N288.1:20 (CSA, 2020). The intake rates for ingestion and inhalation are the central or mean intake rates provided in CSA N288.1:20 (CSA, 2020), with the exception of the drinking water intake rate for a 1-year old infant. The drinking water intake rate for the 1-year old infant was adjusted from the default value in CSA N288.1 based on guidance in Clause 6.15.3.2, since the PN infant is assumed to drink only cow's milk (and not water and infant formula) (OPG, 2024d). **Table 6-2** summarizes the exposure factors used in the radiological dose calculations that were used for the 2023 EMP report (OPG, 2024g).

Table 6-2: Human Exposure Factors for Radiological Dose Calculations

Exposure Factor	Units[6]	Infant 1 year	Child 10 year	Adult
Inhalation rate	m^3/a	1830	5660	5950
Inhalation occupancy factor	unitless	1.0	1.0	1.0
Incidental soil ingestion rates	g dw/d	0.061	0.055	0.004
Incidental ingestion of sediment	g dw/d	0.061	0.055	0.004
Drinking water intake rate[1]	L/a	0	151.1	379.6
Aquatic animal intake rate[2]	kg/a	1.68	4.82	6.86
Terrestrial animal intake rates[3]	kg/a	262.3	286.3	255.5
Terrestrial plant intake rates[4]	kg/a	144.5	331.1	440
Outdoor occupancy factor	unitless	0.2	0.2	0.2

Exposure Factor	Units[6]	Infant 1 year	Child 10 year	Adult
Indoor plume shielding factor (skin dose and pure beta emitters)	unitless	1.0	1.0	1.0
Indoor groundshine shielding factor (gamma emitters)[5]	unitless	0.5	0.5	0.5
Groundshine shielding factor (uneven surface shielding)	unitless	0.2	0.2	0.2
Beach swim occupancy factor	unitless	0	0.014	0.014
Bathing occupancy factor	unitless	0.014	0.014	0.014
Pool swim occupancy factor (WSP fill)	unitless	0	0.028	0.028
Pool swim occupancy factor (Well water fill)	unitless	0	0.014	0.014
Skin area	m^2	0.72	1.46	2.19
Dilution factor (DF) for shoreline sediments	unitless	1.0	1.0	1.0
Shore Width factor (lake)	unitless	0.3	0.3	0.3
Shoreline occupancy factor[7]	unitless	0.02	0.02	0.02
No. days/a soil ingested	d/a	135	135	135
No. days/a sediment ingested	d/a	45	45	45

Note:

(1) The infant is conservatively assessed as consuming only cow's milk which is included in the terrestrial animal intake rate.
(2) Excludes shellfish due to freshwater environment at PN. Shellfish are a marine environment food product.
(3) Includes meat intake, milk intake, and honey intake.
(4) Includes plant intake with honey and dulse removed.
(5) For effective and skin dose. For essentially pure beta emitters, this shielding factor is zero.
(6) dw used in specification of units indicates dry weight.
(7) Represents one-hour per day from May to October on contaminated shoreline.

Sources: (COG, 2013; CSA, 2020)

6.1.2.4.1 Harvester Diet

Neither a site-specific traditional foods diet study nor a WTFNs Indigenous Knowledge study is available at this time to help inform this PERA; therefore, publicly available information is used to form the initial basis of the diet for the Harvester. OPG also engaged in dedicated discussions with Michi Saagiig WTFNs regarding the Harvester Receptor during the DNNP PERA process with feedback and insights from those discussions applied to the PN PERA. The assumptions for the Harvester diet identified below, including quantities and types of traditional foods consumed, are consistent with those assumed in the DNNP PERA (R00 and R01).

Additionally, OPG has developed and shared a list of topics with the Michi Saagiig WTFNs applicable across nuclear generating stations to help inform current and future ERAsand PERAs. The Harvester is one of the main topics included (specifically, related to naming, location, characterization, and site-specific knowledge).

OPG remains committed to refining characteristics of this receptor and welcomes engagement to further align assumptions in terms of design and use.

The diet for the Harvester receptor is composed of traditional foods as well as store-bought foods. Traditional foods are animals and plants that are fished, hunted, or gathered from the land and consumed as food (HC, 2018). The discussion below is focused on the traditional foods component of the diet. The main source of information for ingestion rates and food components of traditional foods is the FNFNES for Ontario (Chan et al., 2014). Part of the FNFNES included household interviews to collect information on foods consumed. The FNFNES is the most recent publicly available study from Ontario on traditional food consumption rates. The FNFNES is split up by the three ecozones in Ontario: Boreal Shield, Hudson Plains, and Mixedwood Plains.

The Harvester receptor utilizes, as an initial set of characteristics, available information from the FNFNES for the Mixedwood Plains (Chan et al., 2014). The PN site is located in the Mixedwood Plains ecozone which consists of gentle rolling hills and lowlands, bounded by the Great Lakes. Data were collected from 18 First Nations communities in Ontario, with 4 located in the Mixedwood Plains. Based on the data review, the following key assumptions and methodologies for traditional foods consumption were applied:

- The consumption rates for the average consumer were assumed to be representative of the Harvester receptor. Harvesting of traditional food was conservatively assumed to occur near the PN site.

- The consumption rates were assumed to be the average of those reported for male and female, for each traditional food category (fish, game meat, game organs, birds, and plants). The consumption rate for fish, game meat and organs is higher for males, and the consumption rate for birds and plants is higher for females; therefore, the gender-averaged consumption rates were considered appropriate.

- The traditional food categories are broken down into more detailed categories which include: fish, large mammal, small mammal, mammal organs, riparian bird, terrestrial bird, and plants.

- Based on knowledge of ecological receptors that exist near the PN site, a representative traditional food was then selected to represent the traditional foods identified in each traditional food category (**Table 6-4**).

    - Walleye was selected as the representative fish since it was more commonly observed in Lake Ontario near the PN site than Yellow Perch (*Perca flavescens*) or Smallmouth Bass.

    - Deer was selected as the representative large mammal. While deer are uncommon at the PN site, deer potentially breed near the PN site and are present year-round. The closest Wildlife Management Unit in Ontario that allows sustainable harvest of moose is approximately 100 km away. While members of Indigenous peoples may harvest moose, deer is more common near the PN site.

- Canada goose was selected as the representative terrestrial bird. While both Canada goose and wild turkey have been observed on the PN site, Canada goose was selected since it was identified as a species that has been injured/killed through vehicle collisions; indicating it is likely more common than wild turkeys near the PN site.

- Corn, squash and beans were the three most frequently consumed (self-reported) plant-based traditional foods for the Mixedwood Plains ecozone (Chan et al., 2014); thus, these plants were selected to represent all plant-based traditional foods harvested near the PN site.

The consumption rates used for each food category for the Harvester receptor are shown in **Table 6-3** in the column "proportioned consumption rate". The specific food items that are modelled to represent each food category are shown in **Table 6-4** in the column "representative traditional food for modelling". It is understood that this is the starting point to represent the Harvester diet for assessment purposes and these characteristics will be refined over time and updated in future ERAs.

Table 6-3: Proportioned Consumption Rates for Harvester Modelling

Traditional Food Groups and Items	Average Daily Consumption Rate by Food Group (g/d) [a,b]	Average Daily Consumption Rate by Food Item (g/d) [a,c]	% of Traditional Food Item[e]	Traditional Food Category for Modelling	% of Traditional Food Category for Modelling [f]	Proportioned Consumption Rate (g/d)[g]	% of Traditional Food Diet[h]
Total Traditional Food	**41.81**	-	-	-	-	**41.81**	**100%**
Fish	**10.35**	-	**100%**	-	-	-	-
Walleye/pickerel	-	4.92	34%	Fish	100%	10.35	25%
Yellow perch	-	6.69	46%				
Smallmouth bass	-	2.99	20%				
Game meat	**8.21**	-	**100%**	-	-	-	-
Deer	-	6.71	55%	Large mammal	83%	6.85	16%
Moose	-	3.51	29%				
Rabbit	-	2.03	17%	Small mammal	17%	1.36	3%
Game organs	**4.88**	-	**100%**	-	-	-	-
Moose liver	-	3.69	56%	Mammal organs	100%	4.88	12%
Deer liver	-	2.9	44%				
Birds	**2.28**	-	**100%**	-	-	-	-
Wild turkey	-	0.97	30%	Terrestrial bird	69%	1.58	4%
Canada Goose	-	1.27	39%				
Ducks	-	1.00	31%	Riparian bird	31%	0.7	2%
Plants	**16.09**	-	**100%**	-	-	-	-
Corn	-	3.79	37%	Terrestrial Plants	100%	16.09	38%
Squash	-	2.30	22%				
Beans	-	4.28	41%				

Note:

[a] Average consumption rates represent the average of men and women surveyed in the FNFNES for the Mixedwood Plains (Chan et al., 2014).

[b] Daily consumption rates for traditional food groups are presented in Table 10a and 10e in the FNFNES (Chan et al., 2014). Note that in the FNFNES, food group totals do not equal the sum of the items. Food groups are indicated in bold text with green shading.

[c] Daily consumption rates for the top three individual food items per group by frequency are presented in Table 10e in the FNFNES (Chan et al., 2014). Note that only two types of organ meats are reported to be consumed. Food items are indicated in plain text without shading. The values from Table 10e were included primarily to identify the individual food items and proportions of the diet.

[d] Total traditional food was calculated as the sum of the consumption rates of each food group presented in **Table 6-3**, rather than the total reported in Table 10a in the FNFNES (Chan et al., 2014). This was considered conservative.
[e] Calculated as: (daily consumption rate of an individual food item / sum (daily consumption rates of top three food items per group)) x 100.
[f] Calculated as: sum of percent of traditional food item in each food category for modelling.
[g] Calculated as: average daily consumption rate by food group x percent of traditional food category for modelling.
[h] Calculated as: (proportioned consumption rate of the traditional food category for modelling / proportioned consumption rate of total traditional food) x 100.

Table 6-4: Traditional Foods Selected for Harvester Modelling

Traditional Food Category	Traditional Food Category (Detailed)	Traditional Foods Most Consumed (from FNFNES)	Representative Traditional Food for Modelling
Fish	Fish	Walleye/Pickerel	Walleye
		Yellow Perch	
		Smallmouth Bass	
Game	Large mammal	Deer	Deer
		Moose	
	Small mammal	Rabbit	Rabbit
Game Organs	Mammal organs	Deer organs	Deer organs
		Moose organs	
Birds	Riparian bird	Duck	Mallard
	Terrestrial bird	Canada Goose	Canada goose
		Wild Turkey	
Plants	Plants	Corn	Vegetables
		Squash	
		Beans	

The adult, child, and infant age groups were assessed for the Harvester in this PERA. The Harvester was conservatively assumed to be located at the same location as the Urban Resident potential critical group characterized in OPG's existing EMP and ERAs, since the Urban Resident location consistently has the highest radionuclide concentrations in air due to distance from source and location within one of the predominant wind directions, i.e. to the WNW, based on the annual average meteorology data from 2020 to 2024. The Harvester was conservatively assumed to reside at the most exposed residential location 100% of the time, except for those who may work near the PN site.

The Harvester is assumed to obtain the majority of drinking water from the Ajax WSP, which is the same as the Urban Resident. Other water for drinking, bathing, and gardening is obtained from both shallow and deep wells. Consistent with existing EMP assumptions, a small fraction of adult residents living near PN also work within 5 km of the PN site. Therefore, it is assumed that 10% of the Harvester residents are also Industrial/Commercial workers, spending 23% of their time at work and 77% of the time at home.

The traditional food items consumed by the Harvester adult were conservatively assumed to be taken from locations close to the residence, and fish were obtained from the outfall location at PN, which is representative of fish in Lake Ontario in the initial mixing zone.

The local food intake fractions implemented in the IMPACT model for the Harvester receptor are shown in **Table 6-5**. The local food intake fraction was calculated as follows:

> Local Intake Fraction (%) = (Annual Intake of a Traditional Food Type / Total Annual Food Intake in the Corresponding Food Category) * Local Harvest Fraction * 100%

where,

Annual Intake of a Traditional Food Type = annual ingestion rate of a traditional food type consumed within each relevant food category (kg/yr).

Total Annual Food Intake in the Corresponding Food Category = annual ingestion rate for traditional + store bought food in the food category (kg/yr).

Local Harvest Fraction = the fraction of the traditional food type that is harvested locally (unitless). For this assessment a local harvest fraction of 1 has been conservatively assumed for all food types.

As discussed above, the annual traditional food intake of the Harvester adult was developed utilizing the available information from the FNFNES for the Mixedwood Plains ecozone, while the total annual food intake of a Harvester adult is taken from Table G.9b in CSA N288.1:20 (CSA, 2020), split up by food categories. The data in CSA N288.1:20 (CSA, 2020) are based on a survey conducted jointly by HC and Statistics Canada in 2004 (Statistics Canada, 2004). They represent the average dietary intakes for the different age groups of the general population, with diets adjusted to reference energy intakes. The FNFNES report only provides traditional food intake rates for adults. The traditional food intake rates for the Harvester 10y-child and Harvester 1y-infant were determined based on the ratio of the consumption rates by food item for the 10y-child/adult and 1y-infant/adult, as provided in CSA N288.1:20; Table G.9b (CSA, 2020).

Table 6-5: Local Food Intake Fractions for Harvester for IMPACT Model – Adult, Child, and Infant

Food Group in IMPACT Model	Traditional Food Type (Detailed)	Representative Traditional Food Items for Modelling	Adult			Child-10y			Infant-1y		
			Total Diet by Food Category (kg fw/a) [a]	Proportioned Traditional Foods Consumption Rate (kg fw/a) [b]	Local Intake Fraction [c]	Total Diet by Food Category (kg fw/a) [a]	Proportioned Traditional Foods Consumption Rate (kg fw/a) [d]	Local Intake Fraction [c]	Total Diet by Food Category (kg fw/a) [a]	Proportioned Traditional Foods Consumption Rate (kg fw/a) [d]	Local Intake Fraction [c]
Aquatic Animals	Fish	Walleye	6.86	3.78	55.07%	4.82	2.65	55.03%	1.68	0.92	55.02%
Terrestrial Animals	Large mammal	Deer	253.9 [e]	2.50	0.98%	286.25 [e]	0.70	0.24%	262.28 [e]	0.20	0.08%
	Small mammal	Rabbit		0.50	0.20%		0.14	0.05%		0.05	0.02%
	Mammal organs	Deer organs		1.78	0.70%		1.24	0.43%		0.45	0.17%
	Riparian bird	Mallard		0.26	0.10%		0.14	0.05%		0.05	0.02%
	Terrestrial bird	Canada Goose		0.58	0.23%		0.32	0.11%		0.12	0.05%
Terrestrial Plants	Plants	Vegetables	441.7 [f]	5.87	1.33%	331.09 [f]	3.19	0.96%	144.54 [f]	0.12	0.08%

Note:

[a] Total diet by food category is from CSA N288.1:20; Table G.9b.

[b] Proportioned consumption rate in **Table 6-3** with unit conversion from g/d to kg/a.

[c] Local Intake Fraction represents the percentage of food in the food category that is obtained from traditional foods near the PN site. The remaining portion of the diet is obtained from store bought foods which are not impacted by releases from the PN site. Local Intake Fraction = (annual food Intake of a traditional food type / total annual food intake in the corresponding food category) * local harvest fraction * 100%. Note, local harvest fraction is conservatively assumed to be 1 indicating that all traditional food to be consumed is obtained locally.

[d] Consumption rates for 10y-child and 1y-infant were proportioned from adult based on the consumption rate ratio of 10y-child/adult and 1y-infant/adult by food item as provided in CSA N288.1:20; Table G.9b.[e] The terrestrial plant intake rates include all plants listed in Table G.9b, with dulse excluded. This includes grain, fruit & berries, vegetables, mushrooms, potatoes, and honey for a total of 441.7 kg/a for the adult.

[f] The total terrestrial animal diet intake rate was calculated by summing the intake rates for milk, beef, beef offal, veal, pork, lamb, poultry, eggs, deer, and rabbit for a total of 253.9 kg/a for the adult.

6.1.2.5 Dispersion Models

An environmental transport and pathways model, IMPACT Version 5.5.2, is used to evaluate the transport and effects of contaminants on the local environment including human and ecological receptors. IMPACT is a modelling tool, created, maintained and supported by Ecometrix Incorporated (Ecometrix). The IMPACT model is a customizable tool that allows the user to assess the transport and fate of COPCs through a user-specified environment. The model is used to estimate concentrations of COPCs in a range of media.

IMPACT Version 5.5.2 is consistent with the equations outlined in CSA N288.1:20 (CSA, 2020) for pathways analysis and for calculation of radiological dose to humans. IMPACT uses specific activity models for tritium and C-14 as per CSA N288.1:20 (CSA, 2020) and as recommended by CSA N288.6:22 (CSA, 2022). The formation of organically bound tritium (OBT) in plants and animals from HT (elemental tritium) and HTO is accounted for in the specific activity model for tritium and the dose from OBT is included in the dose results in IMPACT.

The model was originally developed in 1993 as part of research projects funded by the Atomic Energy Control Board (now the CNSC). Since the initial development, the IMPACT software package has been continuously revised to improve the interface, and the integration with various operating systems, and most importantly to embody an up-to-date understanding of the fate, transport and dose impacts of radionuclides released to the environment. There are several built in libraries for parameters relevant to atmospheric dispersion, groundwater transport, soil processes, and water-sediment interaction. IMPACT can be used in various applications such as: human and ecological risk assessment; environmental impact assessments; pathways analysis; food-chain modeling; cumulative impacts; and derived release limits. IMPACT is able to model doses from emissions that can otherwise not be calculated from environmental measurements, including doses for future timeframes.

IMPACT was verified and validated in accordance with CSA N286.7-99. It has also been audited against CSA N286.7-16 and meets these requirements. The IMPACT code is verified in the IMPACT 5.5.2 – Tool Qualification Report (Ecometrix, 2023f).

IMPACT is designed to model routine, continuous and low-level emissions, and models transport of radionuclides through equilibrium partitioning. Time-dependent equations are used to model the soil compartment. Initial concentrations in environmental media (background concentrations) are not accounted for in the analysis. Thus, doses calculated from facility emissions are incremental doses.

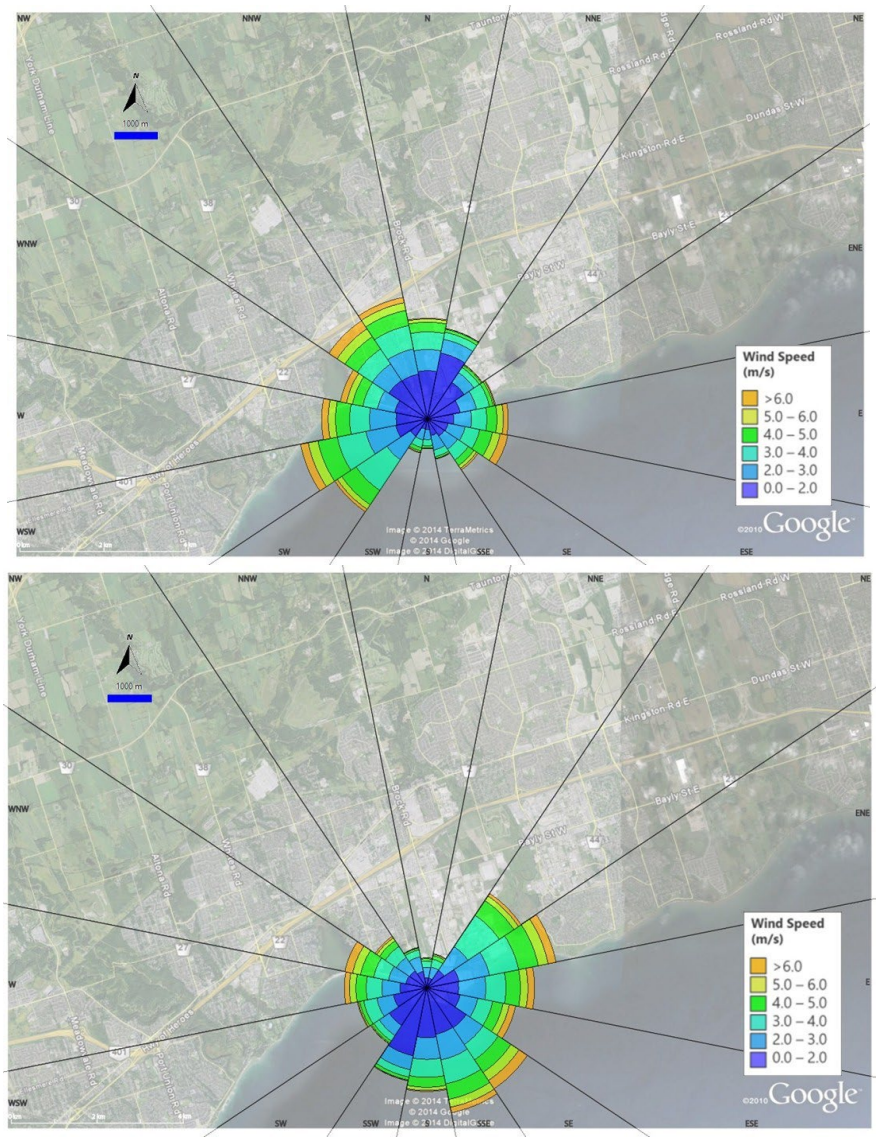
The IMPACT code models radionuclides cycling through the biosphere from both airborne and waterborne effluent releases.

A RMA10 was used in the 2017 Safe Storage PEA to predict changes to lake currents, sediment transport and water temperature in Lake Ontario during the previous operational conditions (for 6 operating units) and SWS. The surface water model provides plume concentration factors at selected receptor locations that were used to predict concentration of COPCs at these locations.

The concentrations of COPCs were used as inputs (dictator sources) to the IMPACT model to calculate radiological doses to human receptors identified in **Section 6.1.1.2**.

6.1.2.5.1 Meteorological Data

Meteorological data (wind speed, direction and frequency; precipitation) averaged over the 2020-2024 period were used in the human IMPACT scenario. Wind data were provided by OPG and are consistent with the data used for the annual EMP reports. Wind data from the 10 m meteorological tower on the PN site was used for years 2020, 2021, and 2024. Wind data from the PN site exceeded the 10% annual unavailability limit as defined for the program for the year 2022 and 2023; therefore, data from the 10 m meteorological tower on the DN site was used for 2022 and 2023. The wind data are summarized in a windrose diagram (**Figure 6-2**) showing the wind speed and direction where wind blows from and to.



Direction shown is where wind comes from.

Direction shown is where wind blows to.

Figure 6-2: 2020-2024 Annual Average Windrose at 10m Tower at Pickering Site

6.1.2.6 Exposure Point Concentrations and Doses

Exposure point concentrations are based on the predicted airborne and waterborne emissions from the PNGS for the conservative estimate of emissions (during the SWS Phase) identified in **Section 4.2.3.2.1.4** of the 2017 Safe Storage PEA.

Concentration factors (**Table 5-24**) from the surface water model for a number of receptor locations were applied to the predicted conservative waterborne discharge concentrations identified in the 2017 Safe Storage PEA. The 2017 Safe Storage PEA assumed 50,000 m^3/day of cooling water from the RBSW is released with the RLWMS stream via the PNGS Units 5-8 outfall during the SWS Phase. Based on current Project planning, additional dilution will be available from CCW pumps compared to that assumed in the 2017 Safe Storage PEA. In using the 2017

Safe Storage PEA assumptions, no credit is taken for the additional dilution available. As such, the assumptions from the 2017 Safe Storage PEA are a conservative representation of conditions during PNGS Units 1-4 decommissioning and PNGS Units 5-8 refurbishment (see **Table 5-24)**.

To determine the exposure point concentrations for tritium, carbon-14, and gross beta/gamma, the end of pipe RBSW concentrations were multiplied by the concentration factors for different locations of interest. Cs-134 is considered appropriate to represent gross beta/gamma in water based on the most recent derived release limit calculations (OPG, 2024d). An example is provided to illustrate the calculation:

$$Surface\ Water\ Concentration\ \left(\frac{Bq}{L}\right) = Discharge\ Concentration\ \left(\frac{Bq}{L}\right) \times RBSW\ Concentration\ Factor$$

Example for Tritium at Sport Fisher Location:

$$Surface\ Water\ Concentration\ \left(\frac{Bq}{L}\right) = 7000\ \left(\frac{Bq}{L}\right) \times 1.25E-03 = 8.78\left(\frac{Bq}{L}\right)$$

Note: Surface water concentration may differ due to rounding of concentration factor shown in equation.

The exposure point concentrations for waterborne radionuclides used as input (dictator sources) to the IMPACT model for dose calculations are presented in **Table 6-6**. For receptors exposed to the beach (e.g., urban resident), the average of the water concentrations from Squires Beach, Liverpool Beach, and Frenchman's Bay Inlet were used.

Table 6-6: Exposure Point Concentrations for Water Contaminants of Potential Concern Used in Dose Calculations

Location of Interest[a]	Concentration Factor RBSW Discharge to PNGS Units 5-8[b]	Tritium (Bq/L)	Carbon-14 (Bq/L)	Beta/Gamma[c] (Bq/L)
RBSW Discharge	N/A	7.00E+03	3.00E-01	5.00E-01
Sport Fisher	1.25E-03	8.78E+00	3.76E-04	6.27E-04
Squires Beach	7.48E-04	5.24E+00	2.24E-04	3.74E-04
Liverpool Beach	3.62E-04	2.53E+00	1.08E-04	1.81E-04
Frenchman's Bay Inlet	3.16E-04	2.21E+00	9.47E-05	1.58E-04
Average Beach[d]	N/A	3.33E+00	1.43E-04	2.38E-04
Ajax Intake[e]	1.01E-04	7.08E-01	3.03E-05	5.06E-05

Note:
Estimated average concentration factors based on constant discharge concentration of 1 g/m^3 (1 mg/L)
(a) This table is consistent with the exposure point concentrations presented in Table 6-3 in the 2017 Safe Storage PEA.
(b) Concentration factor applies to RBSW end of pipe concentration where flow is 50,000 m^3/day.
(c) Gross beta / gamma is represented in IMPACT by cesium-134 based on the 2024 PN DRLs (In the 2017 Safe Storage PEA Cs-137 was used based on the 2016 PN DRLs).
(d) "Average Beach" is the average of Squires Beach, Liverpool Beach, and Frenchman's Bay (inlet).

(e) The Industrial/Commercial Worker, Urban Resident, Correctional Institution, Farm, and Harvester drink water from the Ajax WSP.

For airborne emissions, predicted releases of tritium and carbon-14 were presented in **Table 4-2** in the 2017 Safe Storage PEA and reconfirmed in the 2022 PEA Addendum (**Table 5.1**). Airborne particulates, noble gases and radioiodine emissions were not assessed as their sources terms are either minor or will be eliminated as described in 2017 Safe Storage PEA (Golder and Ecometrix, 2017).

The Gaussian plume model described in CSA N288.1:20 (CSA, 2020) and implemented in IMPACT was used to estimate COPC concentrations in air at receptor locations. The PN Generating Station has multiple sources of airborne releases; however, two virtual sources were modelled, one in the midpoint of PNGS Units 1-4 and one in the midpoint of PNGS Units 5-8, consistent with the 2017 Safe Storage PEA. This simplification has been shown to have little effect on modelled concentrations at receptor locations 1 km or more off-site (COG, 2019). The air concentrations at human receptor locations including the Harvester are shown in **Table 6-7**.

Meteorological data used in the atmospheric dispersion model were average triple joint frequencies of wind direction, speed and stability class compiled from hourly data collected over the 5-year period 2020 to 2024 from the on-site Pickering meteorological tower at the 10 m elevation (with DN meteorological data used for 2022 and 2023).

Table 6-7: Air Concentrations at Human Receptor Locations

Receptor Locations	Unit	Carbon-14	Tritium
Farm	Bq/m^3	7.28E-05	4.32E-01
Dairy Farm	Bq/m^3	2.18E-05	1.30E-01
Sport Fisher	Bq/m^3	5.19E-03	3.14E+01
Urban Resident WNW	Bq/m^3	8.47E-04	4.98E+00
Harvester	Bq/m^3	9.81E-04	5.75E+00
Industrial/Commercial	Bq/m^3	9.15E-04	5.30E+00
C2	Bq/m^3	1.69E-04	1.00E+00

The resulting dose to the harvester as well as the other human receptors based on the exposure point concentrations for air and water presented above are summarized in **Table 6-8**. The dose breakdown by pathway is presented for each potential critical group in **Appendix C**. A sample calculation for the Harvester Adult is shown in **Appendix D**.

Table 6-8: Total Dose to Human Receptors for Conservative Estimate

Receptors	Adult Total Dose (µSv/a)	Child 10 yr old Total Dose (µSv/a)	Infant 1 yr old Total Dose (µSv/a)
Farm	2.02E-01	1.86E-01	1.39E-01
Dairy Farm	6.78E-02	7.13E-02	7.58E-02
Sport Fisher	3.40E-01	2.18E-01	1.09E-01
Urban Resident+	9.51E-01	1.11E+00	7.75E-01
Harvester+	1.27E+00	**1.37E+00**	9.13E-01
Industrial Commercial+	2.78E-01	N/A	N/A
C2	1.85E-01	2.16E-01	N/A

Note:
"+" indicates that a portion of the adults work near PN site and for modelling purposes are attributed the Industrial Commercial receptor dose while at work.
Bold indicates the receptor with the highest dose.

6.1.2.7 Uncertainties in the Exposure Assessment

The IMPACT model was used to predict dose to identified human receptors from the Project. This model is a steady state model; however, it includes time dependent equations to account for buildup in soil from deposition, for all radionuclides released.

It includes progeny buildup through use of progeny inclusive dose coefficients. Forty years of ingrowth was used to develop the progeny inclusive external dose coefficients for sediment and soil for each radionuclide, which is the timeframe used in CSA N288.1:20 for development of progeny-inclusive dose coefficients for sediment and soil exposure (CSA, 2020). This is a reasonable assumption considering the timeline for the Project. Exposure factors were based on best-available information from literature with preference for exposure factors identified in CSA N288.1:20 (CSA, 2020).

Uncertainties in predictions of media concentrations arise from inherent uncertainty in the air model in IMPACT. The model reports an annual average concentration, and typically over-predicts this concentration by a factor of 1.5. Uncertainty in the air predictions arises from the following assumptions made in the model:

- The activity in the plume has a normal distribution in the vertical plane.
- The effects of building-induced turbulence on the effective release height and plume spread have been generalized, while data suggest that effects of building wakes vary substantially depending upon the geometry of the buildings and their orientation with respect to wind direction.

- A given set of meteorological and release conditions leads to a unique modelled air concentration, whereas in reality measured concentrations can vary by a factor of 2 under identical conditions.

The dispersion model is valid for distances up to approximately 20 km. CSA N288.1:20 indicates that at distances greater than 20 km the dispersion model should be used with caution because at distances greater than 20 km the assumption of steady state meteorological conditions implicit in the model becomes less valid (CSA, 2020).

The concentration factors developed through the RMA10 model were used to predict water concentrations used in the dose calculations. The uncertainties associated with the hydrodynamic model were outlined in the 2017 Safe Storage PEA. The main uncertainties include:

- The data available for use in developing the model has limits, as is common for any field data, and the limits are discussed in Section A.2 of the 2017 Safe Storage PEA.

- The calibration of the model indicates acceptable results however, as with all surface water models there is not perfect reproducibility of actual conditions. A qualitative assessment of the model indicates that the model predicts alongshore current well, but is less accurate for offshore components of flow. Alongshore current is considered the primary factor affecting thermal and contaminant plumes and therefore this was not considered a significant limitation. Quantitative calibration and verification were conducted and indicate the model generally meets industry standard acceptance criteria with a higher degree of uncertainty for offshore flow (see Section A.3 of the 2017 Safe Storage PEA).

- The sensitivity of the model predictions with respect to the concentration factors is addressed by providing predictions for extended simulation periods. These simulation periods are expected to encompass all of the expected variations and combinations of current speed, current direction, duration of current event, and water temperature. Appendix A of the 2017 Safe Storage PEA provides the average, minimum, maximum, and standard deviation for concentration factors at each of the receptor locations. Use of the average concentration factor was considered suitable for long term predictions. However, it is expected that use of the maximum concentration factors would still result in acceptable dose calculations as the doses calculated are orders of magnitude below the acceptable limits.

The uncertainties from the exposure assessment also include uncertainty in the exposure factors selected as well as the exposure duration assumed for the human receptor groups (including the Industrial/Commercial worker and the Sport Fisher) who do not reside at their respective locations for a full year. The Sport Fisher potential critical group was initially developed by OPG to take into account local fish consumption given that site-specific survey results of nearby residents indicated very little local fish consumption, yet a number of people were observed fishing near the Pickering site. Members of this group are conservatively assumed to obtain their

entire fish consumption from the vicinity of the PN site and spend 1% of their time (or approximately 87.6 hours per year) at the discharge location where atmospheric exposure occurs. There is uncertainty associated with this assumption, but it is considered reasonable. In general, exposure factors used to characterize human receptors were selected from published sources such as CSA N288.1:20 (CSA, 2020), or site-specific values were identified based on OPG's site-specific surveys.

For the Harvester, there is uncertainty related to the dietary assumptions. Publicly available information from FNFNES (Chan et al., 2014) was used; however, the intent is to refine the assumptions through site specific surveys, if possible. In lieu of site-specific information for the Harvester, various conservative assumptions were made. The Harvester was conservatively assumed to live at the Urban Resident location that has the highest air concentrations for a residential location and harvest traditional foods nearby. The Harvester was also conservatively assumed to remain at this location 100% of their time, except for those who may work within 5 km of the PN site, which is also considered in the total dose.

Considering the conservatism described above in the air and surface water model, and in the exposure factors, it is reasonable to conclude that doses arising from Project activities have not been underestimated.

6.1.3 Toxicity Assessment

The public dose limit for radiation protection is 1,000 µSv/a, as described in the Radiation Protection Regulations under the NSCA. This limit is defined as an incremental dose. It is set at a fraction of natural background exposure to radiation. Public doses arising from licensed facilities are compared to the public dose limit. Doses above the public dose limit are considered unacceptable.

6.1.4 Risk Characterization

The total radiation doses to human receptors are compared to the regulatory public dose limit of 1,000 µSv/a. A summary of the total dose for each human receptor and age group and comparison against the dose limit is provided in **Table 6-9**.

The total dose to the Harvester is 1.37 µSv/a for the Harvester (child). The dose estimate for the Harvester is 0.14% of the regulatory public dose limit (1,000 µSv/a). The highest dose for other receptors is 1.11 µSv/a to an urban resident (child), which is 0.11% of the regulatory public dose limit. Demonstrating that these human receptor groups are protected implies that other receptor groups near the PN site with anticipated lower exposure are also protected.

If the dose from the additional SBs and from the PCSS are considered, the dose for the Sport Fisher could be up to 0.48 µSv/a (0.34 µSv/a + 0.14 µSv/a + 0.00489 µSv/a). This cumulative dose is likely an overestimate of dose since the PCSS dose also includes contribution from other SBs.

Since the dose estimates are a small fraction of the incremental public dose limit of 1,000 µSv/a, and of the natural background dose of 1,400 µSv/a, no health effects are anticipated due to exposure of potential critical groups to radiological releases from the PN Site.

Table 6-9: Summary of Total Dose to Human Receptors and Comparison to Dose Limit

Human Receptor	Adult		Child-10y		Infant-1y	
	Total Dose (µSv/a)	% of Dose Limit	Total Dose (µSv/a)	% of Dose Limit	Total Dose (µSv/a)	% of Dose Limit
Farm	2.02E-01	0.02%	1.86E-01	0.02%	1.39E-01	0.01%
Dairy Farm	6.78E-02	0.01%	7.13E-02	0.01%	7.58E-02	0.01%
Sport Fisher	3.40E-01	0.03%	2.18E-01	0.02%	1.09E-01	0.01%
Urban Resident+	9.51E-01	0.10%	1.11E+00	0.11%	7.75E-01	0.08%
Harvester+	1.27E+00	0.13%	**1.37E+00**	0.14%	9.13E-01	0.09%
Industrial Commercial+	2.78E-01	0.03%	N/A	N/A	N/A	N/A
C2	1.85E-01	0.02%	2.16E-01	0.02%	N/A	N/A

Note:
"+" indicates that a portion of the adults work near PN site and for modelling purposes are attributed the Industrial Commercial receptor dose while at work.
The bold value indicates the highest total dose for a human receptor due to radiological releases to air and water
NA: not applicable.
There are no exceedances of the public dose limit of 1,000 µSv/a.

6.1.4.1 Uncertainty in Risk Characterization

The uncertainties in the characterization of risk consist of those identified in the exposure assessment (**Section 6.1.2.7**) and toxicity assessment (**Section 6.1.3**), since these two assessments are the inputs to the risk characterization.

The uncertainties from the exposure assessment include model uncertainty and uncertainty in the exposure factors selected. There were no major uncertainties identified from the toxicity assessment. In general, in each step of the predictive HHRA, conservative assumptions were used to address uncertainties or realistic assumptions were made. The use of this approach is far more likely to overestimate potential risk than to underestimate it.

6.2 Predictive Ecological Risk Assessment (EcoRA)

6.2.1 Problem Formulation

The Tier 1 assessment concluded that further evaluations of aquatic habitat impacts and thermal effects should be conducted in the Tier 2 assessment. All other Project-related interactions with the environmental components examined in the Tier 1 assessment were deemed to pose negligible risks, or to be sufficiently mitigated, or they are bounded by previously completed risk assessments or current operating conditions.

The predictive EcoRA provides a detailed assessment of aquatic impacts and thermal effects with respect to aquatic receptors in Lake Ontario.

6.2.1.1 Receptor Selection and Characterization

Fish species considered for the Tier 2 assessment were selected based on their presence during the 2024 and 2025 Fish Community studies and/or classification as ecological receptors in the 2022 PN ERA. In total, 32 fish species were considered for the Tier 2 assessment. Of these, 30 were found during the 2024 and 2025 Fish Community studies in the deepwater and nearshore study areas. While the remaining 2 species (Emerald Shiner, and American Eel) were not found during the 2024 or 2025 studies, they were included in the assessment due to their known presence near PN and inclusion as ecological receptors in the 2022 PN ERA.

As of late January 2026, two fish species, Lake Sturgeon and American Eel are notably risk SAR. Lake Sturgeon (Great Lakes – Upper St. Lawrence populations) are currently not on Schedule 1 of the SARA but are under consideration for addition. They are listed as "Threatened" by COSEWIC. Provincially, Lake Sturgeon are listed as "Endangered" on the SARO list (O. Reg. 230/08). Similarly, the American Eel is also currently not listed on Schedule 1 of the SARA but is under consideration for addition. They are classified as "Threatened" by COSEWIC. In Ontario, the provincial government has listed American Eel as "Endangered" on the SARO list.

6.2.1.2 Assessment and Measurement Endpoints

Assessment endpoints are explicit expressions of the environmental values that are to be protected. Assessment endpoints should include the ecological receptor and the attribute of the receptor that is to be protected (e.g., abundance or viability of populations) (FCSAP, 2012). Measurement endpoints are conceptually related to assessment endpoints and are defined as the tools that are used to measure exposure of or effects on each ecological receptor. Based on these measures, a potential for effect on the attribute of an assessment endpoint can be inferred. Measurement endpoints are the foundation for the lines of evidence (LOE) that are used to estimate risks to ecological receptors (FCSAP, 2012).

For most ecological receptors, the assessment endpoint is the viability of the population. This implies that very localized areas of effect on individuals may be tolerated, based on minimal expected effect at the population level. For SAR, the assessment endpoint is individual health, recognizing that each individual is important to the population.

The assessment and measurement endpoints considered for the predictive EcoRA are presented in **Table 6-10**.

Table 6-10: Assessment Endpoints, Measurement Endpoints, and Lines of Evidence

Organism Class	Level of Protection	Protection Goal	Assessment Endpoint	Lines of Evidence (LOE)	
				Line of Evidence	Use of Measurement Endpoints for Specific LOEs
Bottom Feeding Fish	Population or Individual for SAR (*i.e., Lake Sturgeon, American Eel*)	*Population:* Maintenance of bottom feeding fish populations in Lake Ontario as source of food for piscivorous fish and wildlife. *Species at Risk:* Survival of individual organisms.	Viability of bottom-feeding fish populations.	Habitat Loss	Evaluate the amount, quality and type of habitat lost in relation to the habitat needs of each species and life stage.
				Water Temperature	Comparison of water temperature metrics with thermal benchmarks for effect on each species and life stage. TRV
Pelagic Fish	Population	Maintenance of pelagic fish populations in Lake Ontario as source of food for piscivorous fish and wildlife.	Viability of pelagic fish populations.	Habitat Loss	Evaluate the amount, quality and type of habitat lost in relation to the habitat needs of each species and life stage.
				Water Temperature	Comparison of water temperature metrics with thermal benchmarks for effect on each species and life stage.

6.2.1.3 Selection of Chemical, Radiological and Other Stressors

Based on the results of the Tier 1 assessment, aquatic habitat loss and thermal effects are the only stressors retained for the Tier 2 ecological assessment. No chemical or radiological COPCs were identified based on the Tier 1 assessment.

6.2.1.4 Selection of Exposure Pathways

As no chemical or radiological COPCs were identified for the Tier 2 assessment, an assessment of selected exposure pathways is not warranted.

6.2.1.5 Ecological Health Conceptual Site Model

The ecological health CSM illustrates how receptors are exposed to the physical stressors retained for the Tier 2 EcoRA. It identifies the source of the stressors, main exposure effects and receptor responses to be considered in each assessment. The CSM for the predictive EcoRA is illustrated in **Figure 6-3**.

6.2.1.6 Uncertainties in the Problem Formulation

In general, the data used in the predictive EcoRA Problem Formulation were concluded to be of adequate quality and quantity to support the objectives of the PERA. The EcoRA Problem Formulation is based on the current understanding of the existing aquatic habitat and thermal conditions in Lake Ontario. Aquatic monitoring studies were completed based on project planning for the DWI at the time when the studies were designed. Further data collection occurred in 2025 for the aquatic environment to accommodate the changes to DWI planning

since the studies were initiated (see **Section 4.3.1.4**). Additional aquatic environment studies helped to further reduce uncertainties associated with the proposed changes to the DWI and helped further characterize the aquatic habitat for the predictive EcoRA. The results of these studies are incorporated in this revision of the PERA.

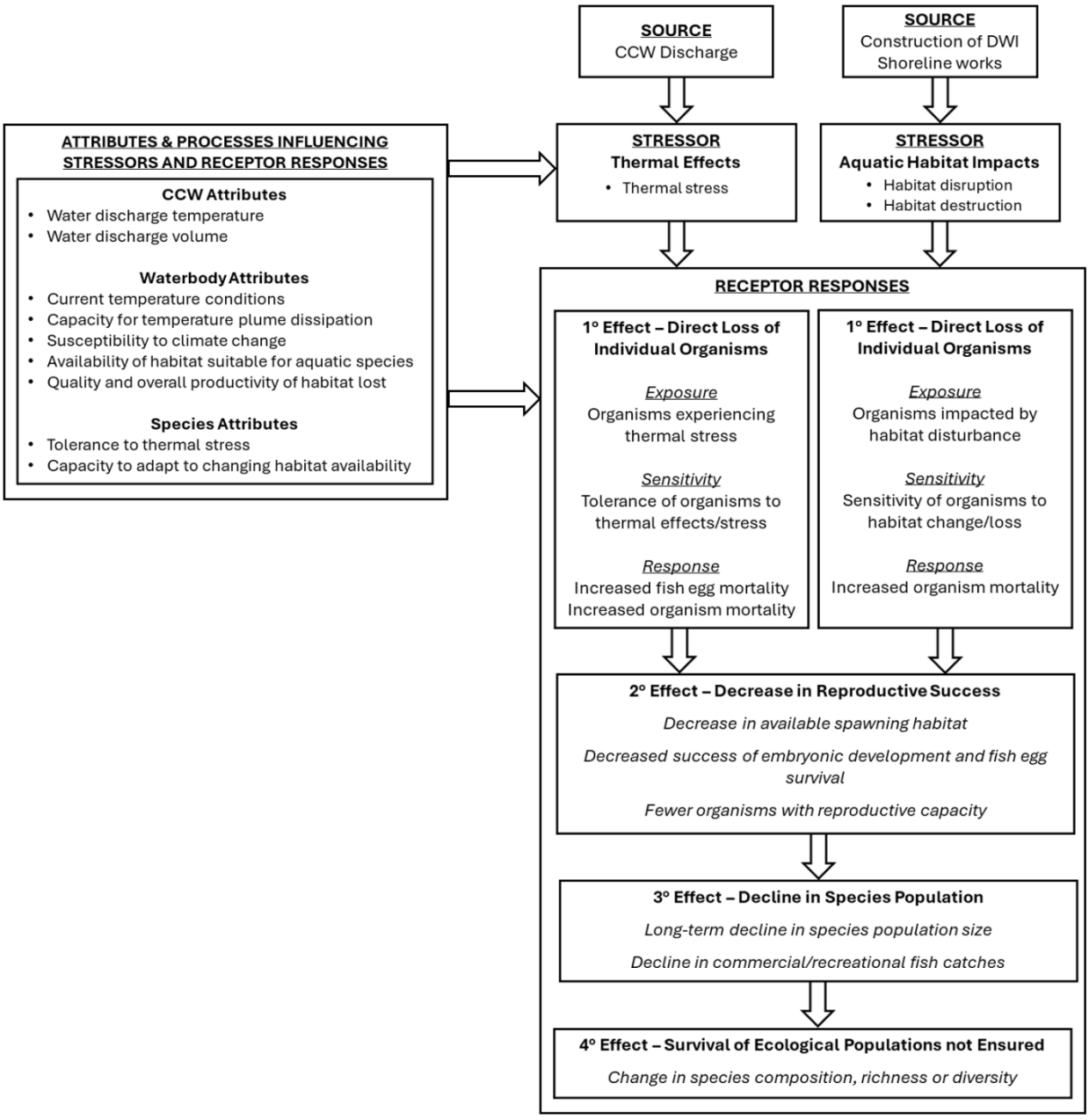


Figure 6-3: Ecological Health CSM for Physical Stressors in the Tier 2 Assessment

6.2.2 Aquatic Habitat Impacts

The proposed DWI will draw deeper, cooler water from Lake Ontario and is expected to provide some benefits to the aquatic environment. Fish impingement and entrainment (**Section 5.3.2.1.2**) and potential biofouling events with attached algae (**Section 5.7.2**), are expected to be greatly reduced, as identified in the Tier 1 assessment. The shift from the existing shoreline intake to the DWI was proposed in order to reduce the interaction of the station with aquatic organisms and provide a more robust system for future operations under changing climate conditions. Construction of the DWI intake infrastructure and associated shoreline works will also result in localized disturbance and some loss of aquatic habitat. These construction-related potential adverse effects are described in the sections below.

Activities associated with the construction of the DWI that are expected to interact with aquatic habitat are:

- Installation of the intake cap.
- Shoreline modifications, including:
    - Construction of a cutoff wall within the forebay.
    - Two temporary structures east and west of the forebay entrance to facilitate the cutoff wall installation.

Other construction activities are expected to have minimal or low environmental impact. These include boring of the tunnel several metres below the lake bed from PNGS to the intake cap, which is anticipated to have minimal environmental effect, and a potential bridge over the PNGS Units 5–8 CCW outfall, whose design has been modified to minimize any in-water footprint or habitat loss within the PNGS Units 5–8 discharge channel.

Currently, the intake cap is planned for 1.5 km offshore, south of the existing forebay. An alternate location, was previously under consideration for the intake cap, sited at 1.25 km offshore. The areal footprint of the construction activities associated with these modifications is depicted in **Figure 6-4.** This section integrates results of the 2024 and 2025 environmental studies conducted within these areas to estimate the potential impacts of refurbishment activities on fish habitat.

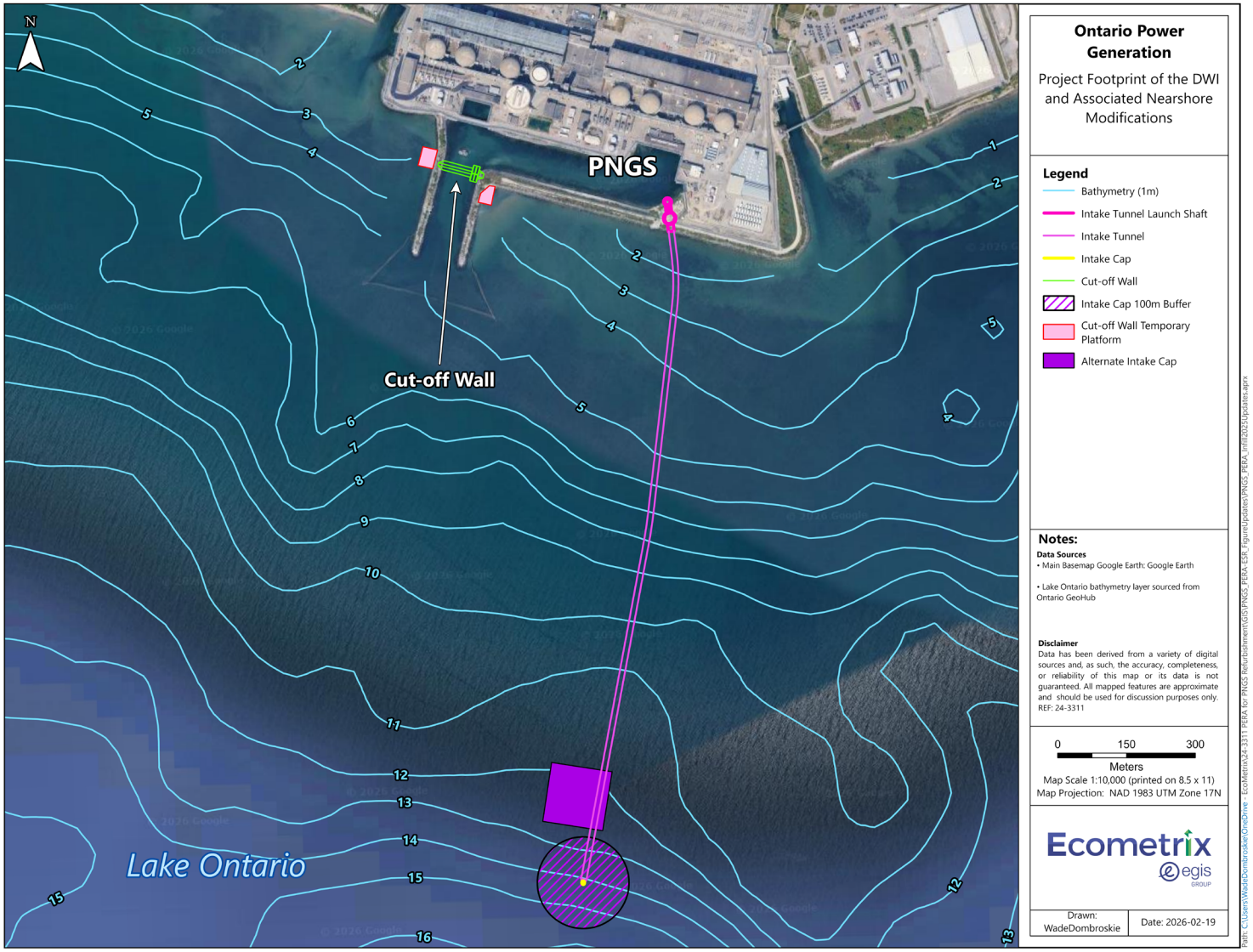


Figure 6-4: Project Footprint of Potential DWI and Nearshore Modifications Associated with the PNGS Refurbishment

6.2.2.1 Characterization of Habitat disturbance associated with Project activities

The proposed DWI and associated nearshore structures are located within Lake Ontario, which is home to a rich diversity of aquatic life, including over 90 fish species. As part of the 2024 and 2025 environmental studies, the Deepwater Fish Community Studies documented 16 fish species in the area proposed for the originally proposed intake cap and the alternate intake cap, while the Nearshore Fish Community Studies recorded 21 species across the Infill, Shoreline Erosion Modification, and Cutoff Wall Study Areas. In addition, 10 fish species were caught in the Mid-depth Study Area as a part of the 2025 Mid-depth Fish Community Study. Although the proposed structures in the Infill, Shoreline Erosion Mitigation, and Mid-depth Study Areas have been removed from the project scope, fish communities in these areas are still considered in the assessment, as they may also be present in areas associated with the structures that remain planned.

Construction works associated with project activities could lead to direct fish mortality, which is prohibited under subsection 34.4(1) of the Fisheries Act. Additionally, Harmful Alteration, Destruction, and Disruption (HADD) of fish habitat may result from physical changes or habitat loss due to infrastructure development. As such, a FAA application will be submitted to the DFO for the proposed activities.

In order to assess the potential impacts on aquatic habitat, the areal extent (in hectares) of the footprint associated with each project activity was estimated, along with the corresponding type of disturbance (i.e., alteration, disruption, or destruction, as defined in the Fisheries Act). These estimates are presented in **Table 6-11**. It is important to note that these numbers are preliminary estimates based on conceptual designs and are subject to change as the design progresses.

Table 6-11: Estimated Areal Footprint and Disturbance Type for Construction Activities of the DWI and Cutoff Wall

Component	Disturbance Type	Structure / Area	Approximate Aquatic Habitat Use	Estimated Area Disturbed (ha)
DWI	Destruction	DWI (1500m)[a]	Transient foraging and seasonal movement corridor.	1.00
		Previously considered alternate DWI Location (1250m)[a]		1.0
	Disruption	Intake Cap	Transient foraging and seasonal movement - progressing to potential spawning and sheltering habitat with decreasing depth.	1.5
Forebay	Destruction	Cutoff wall	Transient foraging and sheltering habitat when FDS is not in place.	0.213
	Alteration	Cutoff wall temporary platforms	Foraging habitat and physical shelter for small fish species.	0.037
	Destruction	Forebay	Transient foraging and sheltering habitat when FDS is not in place.	4.79

Note:
a – Based on 50 m radius intake cap structure.

6.2.2.2 Habitat Suitability Assessment – Exposure Assessment

To assess the suitability of the areas proposed for the construction of the DWI and cutoff wall, for fish captured during the 2024 and 2025 Deepwater, Mid-depth and Nearshore fish community studies, species-specific habitat preferences from the literature were compared against the existing habitat conditions identified through the 2024 and 2025 aquatic habitat studies. Additionally, although Emerald Shiner (*Notropis atherinoides*) and American Eel were not captured in the 2024-2025 fish community studies, these species were included in this assessment due to their known presence in the area and status as ecological receptors in the 2022 PN ERA.

The habitat preferences for spawning and adult life stages were evaluated separately, as these can differ significantly. The habitat preferences for the adult stage of the species considered,

including substrate type, water temperature, depth, and other relevant requirements, are presented in **Table 6-12**. Similarly, habitat preferences for spawning are listed in **Table 6-13**. The substrate types identified in the Deepwater and nearshore study areas, as well as their associated proportions, are presented in **Table 6-14**. Substrates were considered one of the most important physical habitat parameters because many species require specific substrates for spawning because eggs adhere to them.

Table 6-12: Catch and/or Life History Information of Adult Fish Species Near PNGS

Catch Location[1,2]	Catch Season[3]	Species	Scientific Name	Thermal Regime[5]	Catch / Life History Information[1,4]				
					Substrate	Trophic Class	Catch Depth (m)	Temperature (°C) at Capture Depth	Substrate at Capture Location
Nearshore/Mid-depth/Offshore	SP, SU, FA	Atlantic Salmon	*Salmo salar*	Cold	benthopelagic	invertivore/carnivore	2.4	14.3	sand/cobble/boulder
Nearshore/Mid-depth/Offshore	SU,FA	Brown Bullhead	*Ameiurus nebulosus*	Warm	sed/sand	invertivore/herbivore/carnivore	1.9-3.4	20.3-22.9	sand/gravel/boulder
Nearshore	SP, FA	Common Carp	*Cyprinus carpio*	Warm	benthopelagic	invertivore/detritivore	3.4	21.2	sand/cobble/boulder
Nearshore	SP, FA	Chinook Salmon	*Oncorhynchus tshawytscha*	Cold	pelagic	invertivore/carnivore	1.6	15.0	sand/cobble/boulder
Nearshore	SU	Coho Salmon	*Oncorhynchus kisutch*	Cold	pelagic	invertivore/carnivore	2	22.8	sand/gravel/boulder
Nearshore	FA	Largemouth Bass	*Micropterus nigricans*	Warm	benthopelagic	invertivore/carnivore	4.9	21	sand/gravel/boulder
Nearshore	FA	Log Perch	*Percina caprodes*	Warm	benthic	invertivore	4.9	21	sand/gravel/boulder
Nearshore	SP, FA	Longnose Sucker	*Catostomus catostomus*	Cold	benthic	invertivore	3.8-4.9	21-21.1	sand/gravel/boulder
Nearshore	FA	Pumpkinseed	*Lepomis gibbosus*	Warm	benthopelagic	invertivore/carnivore	3.4	20.6	sand/cobble/boulder
Nearshore/Mid-depth	SP, SU	Rainbow Trout	*Oncorhynchus mykiss*	Cold	benthopelagic	invertivore/carnivore	4.1	11.1	sand/gravel/cobble/boulder
Nearshore	FA	Mottled Sculpin	*Cottus bairdii*	Cold	benthic	invertivore	3.8	21	sand/gravel/boulder
Nearshore	SP	Threespine Stickleback	*Gasterosteus aculeatus*	Cold	benthopelagic	invertivore	1.6	15	sand/cobble/boulder
Mid-depth/Nearshore	FA	Yellow Perch	*Perca flavescens*	Cold	benthopelagic	invertivore/carnivore	3.8	21	sand/gravel/boulder
Nearshore/Offshore	SP,FA	Brown Trout	*Salmo trutta*	Cold	benthopelagic	invertivore/carnivore	5.5 - 14	11.4-21.1	sand/gravel/cobble/boulder
Nearshore/Mid-depth/Offshore	SP,SU	Alewife	*Alosa pseudoharengus*	Cold	pelagic	planktivore	1.6 - 19.7	8.6-27	sand/gravel/cobble/boulder
Nearshore/Mid-depth/Offshore	FA	Rainbow Smelt	*Osmerus mordax*	Cold	pelagic	invertivore/carnivore	2.8 - 19.7	9.7-22.6	sand/gravel/cobble/boulder
Nearshore/Offshore	SU,FA	Rock Bass	*Ambloplites rupestris*	Cold	benthopelagic	invertivore/carnivore	2.8 - 17	8.6-22.6	sand/gravel/cobble/boulder
Nearshore/Mid-depth/Offshore	SP,SU,FA	Round Goby	*Neogobius melanostomus*	Cold	benthic	invertivore	1.6 - 17	10.4-27	sand/gravel/cobble/boulder
Nearshore/Offshore	FA	Walleye	*Sander vitreus*	Cold	benthopelagic	invertivore/carnivore	5.5 - 17	9.9-21.1	sand/gravel/cobble/boulder
Nearshore/Offshore	SP, SU,FA	White Sucker	*Catostomus commersonii*	Cold	benthic	invertivore/detritivore	3.4 - 15	9.9-21.2	gravel/cobble/boulder
Offshore	SU	Burbot	*Lota lota*	Cold	benthic	invertivore/carnivore	15	10.8	gravel/cobble/boulder
Offshore	FA	Lake Sturgeon	*Acipenser fulvescens*	Cool	mud-gravel	invertivore/herbivore	19.5	10.7	gravel/cobble/boulder
Nearshore/Mid-depth/Offshore	SP,SU,FA	Lake Trout	*Salvelinus namaycush*	Cold	benthopelagic	invertivore/carnivore	11 - 21.1	8.6-10.6	sand/gravel/cobble/boulder
Offshore	SP, FA	Lake Whitefish	*Coregonus clupeaformis*	Cold	benthic	invertivore/carnivore	11 - 21.1	8.6-10.7	sand/gravel/cobble/boulder
Offshore	SP,FA	Round Whitefish	*Prosopium cylindraceum*	Cold	benthopelagic	invertivore/carnivore	11 - 19.7	9.7-10	sand/gravel/cobble/boulder
Offshore	FA	Sea Lamprey	*Petromyzon marinus*	Cold	benthopelagic	herbivore/detritivore (carnivore)	13.1	8.6	sand/gravel/cobble
Mid-depth	FA	White Bass	*Morone chrysops*	Warm	benthopelagic	invertivore/carnivore	4.2	10	sand/gravel/cobble
Nearshore	SP	Gizzard Shad	*Dorosoma cepedianum*	Cool	pelagic	herbivore	2	13.1	sand/gravel/boulder
NA[1]	NA	American Eel	*Anguilla rostrata*	Cool	sand/gravel/cobble	invertivore/carnivore	<15[2]	-	mud/sand/cobble/boulder[2]
NA[1]	NA	Emerald Shiner	*Notropis atherinoides*	Cold	benthopelagic	planktivore	Shallow[2]	-	sand/gravel[2]
Mid-depth	FA	Northern Pike	*Esox lucius*	Cold	vegetation	carnivore	Shallow[2]	-	mud/sand/gravel - Weeds[2]
Offshore	FA	Smallmouth Bass	*Micropterus dolomieu*	Cold	benthopelagic	invertivore/carnivore	5-7[2]	-	rocky and sandy areas[2]

Note:
1 - Catch information was collected during the 2024 and 2025 field studies at PNGS.
2 - Fish species with "NA" catch location are included in this table despite not being caught in the 2024 and 2025 field studies. These were chosen due either to their ecological importance, SAR status, and/or due to their known prevalence in the area.
3 - SP = Spring, SU = Summer, FA = Fall.
4 - In the case of fish species that were not caught in 2024 or 2025, known depth and substrate preferences were used in the place of catch information.
5 – Fish species are grouped into thermal guilds based on their thermal optimums. In general, cold-water species prefer waters <19°C in the summer, cool-water fish prefer between 19-25°C, and warm-water fish prefer waters >25°C (Coker et al., 2001; Magnuson et al., 1979).
Fish life history data was collected from Scott and Crossman (1973), and from the Ontario Fishes Life History database (Eakins, R.J. 2024, accessed December 2025).

Table 6-13: Habitat Preferences of Fish Species Based on Spawning Requirements

Catch Location[1,2]	Catch Season[3]	Species	Scientific Name	Thermal Regime	Adult Fish Spawning Preferences				
					Preferred Spawning Substrate	Spawning Guild	Preferred Spawning Temperature (°C)	Preferred Spawning Depth (m)	Preferred Spawning Season
Nearshore/Mid-depth/Offshore	SP, SU, FA	Atlantic Salmon	*Salmo salar*	Cold	NA (Riverine)	Lithophils	6-10	NA (Riverine)	Oct-Nov
Nearshore/Mid-depth/Offshore	SU,FA	Brown Bullhead	*Ameiurus nebulosus*	Warm	Cobble/Boulder	Speleophils	14-25	Shallow	May-June
Nearshore	SP, FA	Common Carp	*Cyprinus carpio*	Warm	vegetation, logs, etc	Phyto-lithophils	17-26	Shallow	May-Aug
Nearshore	SP, FA	Chinook Salmon	*Oncorhynchus tshawytscha*	Cold	NA (Riverine)	Lithophils	5.5-14.5	NA (Riverine)	Sept-Oct
Nearshore	SU	Coho Salmon	*Oncorhynchus kisutch*	Cold	NA (Riverine)	Lithophils	4-8	NA (Riverine)	Oct-Nov
Nearshore	FA	Largemouth Bass	*Micropterus nigricans*	Warm	Sand/Gravel	Polyphils	15-21	<6	May-June
Nearshore	FA	Log Perch	*Percina caprodes*	Warm	Sand/Gravel/Cobble	Lithophils	10-18	Shallow	May-June
Nearshore	SP, FA	Longnose Sucker	*Catostomus catostomus*	Cold	Gravel/Cobble	Litho-pelagophils	5-15	<1-2	April-June
Nearshore	FA	Pumpkinseed	*Lepomis gibbosus*	Warm	Sand/Gravel	Polyphils	17-26	Shallow	May-Aug
Nearshore/Mid-depth	SP, SU	Rainbow Trout	*Oncorhynchus mykiss*	Cold	NA (Riverine)	Lithophils	4-10	NA (Riverine)	March-May
Nearshore	FA	Mottled Sculpin	*Cottus bairdii*	Cold	Cobble/Boulder	Speleophils	5-16	Shallow	April-May
Nearshore	SP	Threespine Stickleback	*Gasterosteus aculeatus*	Cold	vegetation	Ariadnophils	10-22	Shallow	May-July
Mid-depth/Nearshore	FA	Yellow Perch	*Perca flavescens*	Cold	vegetation/logs, etc	Phyto-lithophils	6-12	Shallow	April-May
Nearshore/Offshore	SP,FA	Brown Trout	*Salmo trutta*	Cold	NA (Riverine)	Lithophils	6-9	NA (Riverine)	Oct-Nov
Nearshore/Mid-depth/Offshore	SP,SU	Alewife	*Alosa pseudoharengus*	Cold	vegetation/logs, etc	Phyto-lithophils	13-21	Shallow	June-Aug
Nearshore/Mid-depth/Offshore	FA	Rainbow Smelt	*Osmerus mordax*	Cold	Sand/Gravel	Litho-pelagophils	4.5-11	Shallow	March-April
Nearshore/Offshore	SU,FA	Rock Bass	*Ambloplites rupestris*	Cold	Veg, Gravel/Cobble/Boulder	Polyphils	16-23	Shallow	May-June
Nearshore/Mid-depth/Offshore	SP,SU,FA	Round Goby	*Neogobius melanostomus*	Cold	Sand/Gravel/Cobble	Lithophils	9-26	Shallow	May-July
Nearshore/Offshore	FA	Walleye	*Sander vitreus*	Cold	Gravel/Cobble/Boulder	Litho-pelagophils	4-11	Shallow	April-June
Nearshore/Offshore	SP, SU,FA	White Sucker	*Catostomus commersonii*	Cold	Gravel/Cobble	Litho-pelagophils	10-20	Shallow	April-June
Offshore	SU	Burbot	*Lota lota*	Cold	Sand/Gravel	Litho-pelagophils	1-4	Shallow	Jan-March
Offshore	FA	Lake Sturgeon	*Acipenser fulvescens*	Cool	Gravel/Cobble/Boulder	Litho-pelagophils	11-18	1-8m	May-June
Nearshore/Mid-depth/Offshore	SP,SU,FA	Lake Trout	*Salvelinus namaycush*	Cold	Gravel/Cobble/Boulder	Lithophils	9-14	Wide Range, prefer shoals	Sept-Nov
Offshore	SP, FA	Lake Whitefish	*Coregonus clupeaformis*	Cold	Gravel/Cobble/Boulder	Litho-pelagophils	1-8	5-10	Oct-Dec
Offshore	SP,FA	Round Whitefish	*Prosopium cylindraceum*	Cold	Sand/Gravel/Cobble	Lithophils	2-4.5	1-2m	Nov-Dec
Offshore	FA	Sea Lamprey	*Petromyzon marinus*	Cold	NA (Riverine)	Lithophils	11-24	NA (Riverine)	May-June
Mid-depth	FA	White Bass	*Morone chrysops*	Warm	Sand/Gravel	Phytolithophils	14-22.5	1-3m	May-June
Nearshore	SP	Gizzard Shad	*Dorosoma cepedianum*	Cool	vegetation, rock, etc.	Litho-pelagophils	17-23	Shallow	June-July
NA[2]	-	American Eel	*Anguilla rostrata*	Cool	NA (Marine)	Litho-pelagophils	17	NA (Marine)	Feb-March
NA[2]	-	Emerald Shiner	*Notropis atherinoides*	Cold	Sand/Gravel	Pelagophils	20-24	Shallow	June-Aug
Mid-depth	-	Northern Pike	*Esox lucius*	Cold	vegetation	Phytophils	4-11	Shallow	March-May
Offshore	-	Smallmouth Bass	*Micropterus dolomieu*	Cold	Sand/Gravel	Polyphils	13-20	Shallow	May-June

Note:
1 - Catch information was collected during the 2024 and 2025 field studies at PNGS.
2 - Fish species with "NA" catch location are included in this table despite not being caught in the 2024 and 2025 field studies. These were chosen due either to their ecological importance, SAR status, and/or due to their known prevalence in the area.
3 - SP = Spring, SU = Summer, FA = Fall.
Fish life history data was collected from Scott and Crossman (1973), and from the Ontario Fishes Life History database (Eakins, R.J. 2024, accessed January 2026).

Table 6-14: Substrate Types and Proportions in the Footprint of the DWI and Cutoff wall

Components	Disturbance Type	Structure / Area	Total Area (ha)	Substrate Type													
				Sand		Sand/Gravel		Sand/Gravel/Cobble		Gravel/Cobble		Gravel/Cobble/Boulder		Cobble/Boulder		Boulder	
				%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)
DWI	Destruction	DWI Cap (1500 m)[a]	1	0.0	0.0	0.2	0.0	21.1	0.2	61.5	0.6	17.1	0.2	0.2	0.0	0.0	0.0
	Destruction	Previously considered alternate DWI Cap Location (1250 m)[a]	1	0.0	0.0	0.0	0.0	33.4	0.3	60.7	0.6	6.0	0.1	0.0	0.0	0.0	0.0
	Disruption	DWI Cap	1.5	NA													
Forebay	Destruction	Cutoff wall	0.21	63.0	0.1	28.6	0.1	0.0	0.0	5.3	0.01	1.0	0.002	2.2	0.005	0.0	0.0
	Destruction	Forebay	4.79	0.4													

Note:
Average substrate composition percentages of grids S2 and S5 as determined from the 2024-2025 Aquatic Habitat studies were used to calculate the area of each substrate type overprinted by the original DWI cap. Substrate composition percentages for the S2 grid were applied to determine the area of each substrate type overprinted by the alternate DWI cap location.
As the area overprinted by the cut off wall will be in the forebay (which was not directly surveyed), the substrate composition from the Cutoff Wall Study Area was used to estimate the area of each substrate type overprinted by this structure.
The platforms that are proposed to support the construction o the cutoff wall are not included in these estimates as the structures will be temporary and are expected to have a negligible footprint (<0.05 ha).
NA = Not evaluated during the 2024 or 2025 field studies.
a - Based on 50 m radius intake cap.

6.2.2.2.1 Deepwater Study Area

The 2024 and 2025 Deepwater Fish Community Studies identified 16 fish species utilizing the offshore waters of the Deepwater Study Area. Substrate types and depths consistent with the adult foraging habitat of all species could be found in the Deepwater Study Area. Adult stages of most species captured in the study utilize substrate types including gravel/cobble in, gravel/boulder, and densely packed cobble/boulder). While neither of the proposed intake cap locations contain a substantial amount of cobble/boulder, both intake locations are primarily composed (>60%) of gravel/cobble. Therefore, both intake cap locations reside in suitable habitat for the adult stages of the species identified in the Deepwater Study Area.

The species observed in this area in 2024 and 2025 were Alewife, Atlantic Salmon, Brown Bullhead (*Ameiurus nebulosus*), Brown Trout (*Salmo trutta*), Burbot, Lake Sturgeon, Lake Trout, Lake Whitefish, Round Whitefish, Round Goby, Rock Bass (*Ambloplites rupestris*), Sea Lamprey (*Petromyzon marinus*), White Sucker, Walleye, Rainbow Smelt (*Osmerus mordax*), and Smallmouth Bass. Alewife was the most frequently caught species in the spring and summer sampling events of the 2024 deepwater fish community study, while Lake Trout and Lake Whitefish dominated the fall catch. In 2025, the spring catch was dominated by Lake Trout and Round Whitefish, followed by Alewife in the summer and Round Goby in the fall. These seasonal patterns are consistent with typical fish community dynamics in the area. These seasonal shifts in the dominant species captured are reflective of the migratory nature of Alewife, which make seasonal spawning migrations to the nearshore zone to spawn in the late spring. Other species captured likely also use the area for foraging. Salmonid species encountered at various times during the sampling program such as Brown Trout and Lake Trout are known to prey on smaller fish species such as Alewife, Rainbow Smelt, and Round Goby. Other species caught such as Walleye and White Sucker use the waters in Lake Ontario to move into, around, and between foraging habitats along the lake's shoreline and nearby waterbodies such as Frenchman's Bay, Rouge River, and Duffin's Creek. Most of the species identified in the Deepwater Study Area belonged to the invertivore/carnivore trophic class, reflecting the foraging opportunities available in the deepwater habitat (see **Section 4.3.3**).

Two invasive species, namely, Round Goby and Sea Lamprey, were caught in the Deepwater Study Area. Round Goby have historically been a sub-dominant yet ubiquitous species in past OPG studies near PNGS and DNGS (Golder 2007a, Hatch, 2013, Ecometrix, 2021). Sea Lamprey are parasitic and prey on Lake Trout, Salmon, Whitefish, Cisco and Burbot in the Great Lakes.

A Lake Sturgeon was captured during the fall 2024 sampling event, which is a rare occurrence at that location and depth in the lake. Lake Sturgeon have been stocked by the New York state into the Lake Ontario-St. Lawrence River system intermittently since 1993, with the most recent program conducted from 2014 to 2019 (Great Lakes Fishery Commission, 2023; Stewart et al., 2012; Welsh et al., 2020). While Lake Sturgeon occasionally migrate long distances in search of food or suitable spawning habitat and to avoid unfavourable environmental conditions, they are rarely found outside their shallow riverine spawning areas (Auer, 1996; Bemis and Kynard, 1997; Peterson et al., 2007). Given that sturgeon prefer muddy, sandy or gravel substrates, rather than the cobble/boulder of the Deepwater Study Area, it is possible that this individual was caught

moving between foraging habitats. It should be noted that American Eel, a SAR that has been consistently recorded in the annual impingement monitoring from 2016 to 2024, was not captured in the 2024-2025 Fish Community Studies. Typically, the freshwater habitat in lakes for American Eel spans from depths of 10 m to deeper waters (COSEWIC, 2012). Given their frequent detection in previous studies and consistent presence in impingement monitoring, it is likely that American Eel remain present in the area despite not being captured in this study. To further investigate whether the area serves as habitat for Lake Sturgeon and American Eel, a targeted SAR assessment was conducted in fall 2025 using focused netting (see **Section 4.3.1.1.3**). Though no SAR were captured, current data suggests that Lake Sturgeon populations are slowly recovering and their occurrence in Lake Ontario is well documented in low numbers. It is likely that neither Lake Sturgeon nor American Eel reside within the study area, but pass through while travelling to more productive feeding habitat elsewhere.

Although it was not evaluated in the 2024 Deepwater Fish Community study, presence and use of the Deepwater Study Area by spawning Round Whitefish, Lake Trout, and Lake Whitefish spawn was assessed in 2025 (**Section 4.3.1.1.1**). Results of this study indicated that even though a large portion of the Deepwater Study Area is outside of the preferred spawning depths for Lake Trout and Lake Whitefish, some individuals might use the area for spawning grounds due to the presence of preferred substrate and the prevailing north-east wind direction orientation, which would provide favorable conditions for egg deposition, and protection for developing larval fish. Meaningful conclusions regarding Round Whitefish spawning could not be drawn due to the low number of individuals captured and weather conditions that prevented sampling later in the Round Whitefish spawning period (late December).

As indicated by the results of the 2025 Ichthyoplankton tows (**Section 4.3.1.1.2**), larval fish and eggs are generally found in low abundance in the vicinity of the proposed DWI intake cap, which support the estimate. In terms of species composition, the majority of eggs collected in the area were identified as Alewife, or Round Goby, while larval fish caught included Lake Whitefish, Round Goby, and Burbot. The low abundance of Lake Whitefish larvae, combined with findings from the Fall Spawning Assessment (**Section 4.3.1.1.1**) suggests that while spawning may be occurring near the area, the sampled area itself may not provide suitable nursery habitat, or optimal spawning habitat for this species. As mentioned in **Section 4.3.1.1.2** the presence of the larval Burbot in the Deepwater Study Area in the summer is not likely the result of spawning occurring within the study area but rather the result of summer spawning in deeper water and larval drift towards shore.

The ichthyoplankton communities in this area thus reflect the typical assemblage of early life stages present in Lake Ontario. Alewife are broadcast spawners that release non-adhesive eggs into the water column and do not rely on discrete benthic or structured nursery habitats (Lane et al., 1996; Mullen et al., 1986; Teletchea et al., 2009). Round Goby are benthic nest spawners but are habitat generalists with no specific or limited spawning habitat requirements. As such, while eggs and larvae of these species may occur within the Deepwater Study Area, the area represents only a small portion of the spawning and early life-stage habitat available in Lake

Ontario. It does not contain the physical or hydrological features typically associated with specialized or critical spawning or nursery habitats required by other fish species in the lake.

In addition, substrate suitable for spawning is available for species such as Alewife, Rainbow Smelt, Rock Bass, Round Goby, Walleye, and White Sucker. However, these fish typically utilize shallower nearshore waters with faster flow rates for spawning.

Of the two species that were not caught in the 2024 fish community studies but were assessed as ecological receptors in the 2022 PN ERA (Ecometrix 2023), i.e., American Eel and Emerald Shiner, both species may potentially utilize the Deepwater Study Area for foraging as adults. Neither species is expected to utilize the substrates or depths of the study area for spawning.

Overall, the primary use of the proposed area of the DWI structure by fish species captured during the 2024 and 2025 Fish Community Studies appears to be for transient foraging and as a seasonal movement corridor. In addition, the area may also provide spawning habitat for Lake Trout and Lake Whitefish, as suggested by the 2025 Fall Spawning Study. The proposed intake locations, S2 and S5, were classified as Mixed–Soft and Cobble/Gravel, respectively. Fish communities in grids with these substrate types did not differ significantly from any other substrate class (**Section A.3.1**). This suggests that the fish community at the proposed intake locations is consistent with the broader study area, with no meaningful ecological differences detected. As such, the approximate loss of 1.0 ha of bottom habitat associated with DWI construction is not unique and represents a relatively small proportion of the total offshore foraging and spawning habitat that is available in Lake Ontario. Thus, the proposed works are not expected to result in any adverse population-level impacts on fish species. OPG will implement fish habitat offsetting measures, as required under the Fisheries Act, to further mitigate any potential effects.

6.2.2.2.2 Nearshore Study Areas and Forebay

The 2024 and 2025 Nearshore Fish Community Study identified 21 fish species in the Shoreline Erosion Mitigation, Infill, and Cutoff Wall Study Areas. In 2024, small-bodied forage fish such as Alewife and Round Goby dominated spring and summer communities, while fall communities were more varied, and were characterized by larger-bodied bottom feeders, salmonids, and predatory fish. A similar pattern was seen in the 2025 Cutoff Wall Fish Community Study, with Alewife and Round Goby dominating the catch in the summer and the communities being varied in the spring and fall.

As seen in the Deepwater Study Area, the adult stages of most species captured in the nearshore study areas utilized sand/gravel/cobble, gravel/cobble, and gravel/cobble/boulder. The Cutoff Wall Study Area was primarily composed of finer substrates such as sand. This composition likely reflects the depositional nature of the area adjacent to the breakwall. The increase in substrate size and decrease in diversity closer to shore reflects the high wave energy and exposure in shallow areas. As such, both nearshore study areas provide diverse substrate opportunities, which can be utilized by the species identified based on their specific habitat preferences. It is important to note though that this habitat type is not unique to the study area

and is common throughout the north shore of Lake Ontario due to the prevailing north-east winds in this region.

The nearshore study areas likely serve as adult foraging habitats for the species captured. As with the fish in the Deepwater Study Area, most species captured belong to invertivore/carnivore trophic levels. Small-bodied fish species such as Alewife, Round Goby, and Rainbow Smelt present in these areas likely serve as prey for larger species observed in the area such as Walleye, Brown Trout, Rainbow Trout, Largemouth Bass, Atlantic Salmon, and Coho Salmon.

Of the species that were not captured in the nearshore study areas but observed in the Deepwater Study areas, most are deepwater species that utilize offshore waters as adults. However, Round Whitefish may feed on benthic invertebrates associated with aquatic vegetation and diverse substrates found within the nearshore study areas, as they have previously been seen in nearshore environments. Additionally, although Emerald Shiner, American Eel, Northern Pike (*Esox Lucius*), and Smallmouth Bass were not captured in the nearshore areas in the 2024 and 2025 nearshore fish community studies, it is possible that these species use the nearshore study areas as foraging habitats. Emerald Shiner, a small planktivorous species, is typically found in the nearshore regions of Lake Ontario, including the shallows near breakwalls of the forebay. The nearshore waters may also serve as overwintering habitats for species such as Lake Trout and White Sucker, though these fish may prefer embayments to avoid the effects of wave action along the shoreline.

The forebay contains both inshore and regional fish species. For instance, impingement monitoring for the 4-year period from 2021 to 2024 identified 55 species of fish which may occupy the intake forebay (OPG, 2022c, 2023e, 2024h, 2025f). Piscivorous species such as Smallmouth Bass, Northern Pike, Walleye, and Lake Trout have been observed in the forebay and may feed on the schools of baitfish such as Alewife and Rainbow Smelt present here (Golder and SENES, 2009). Round Whitefish and White Sucker may forage on bottom-dwelling invertebrates associated with aquatic vegetation and the diverse substrates within the forebay. In addition, species such as Northern Pike likely use the forebay as overwintering habitat. In contrast, Lake Trout, Round Whitefish, and Emerald Shiner are well adapted to winter conditions in Lake Ontario and would not be expected to rely on the forebay for overwintering.

Once the cutoff wall is installed, approximately 5 ha of this fish habitat will be lost. Although designs for the cutoff wall are still under consideration to prevent fish from entering the forebay, some fish, particularly small-bodied species, may still be able to pass through as the cutoff wall will include small openings to allow minimal flow into the forebay to provide emergency service water to the station. For conservatism, this entire area is assumed to represent a loss of habitat. In addition, if some fish are able to pass through the openings, they will not contribute meaningfully to the productivity of Lake Ontario. As highlighted in **Section 6.2.2.2.1**, although American eels were not captured in the Fish Community Study of the nearshore areas, the species traverses the nearshore study areas and the forebay, as they are routinely impinged at PNGS.

Based only on substrate types available and depth of water, the nearshore areas may support spawning for approximately 16 of the 21 species identified in the 2024 and 2025 Nearshore Fish Community Studies. Species like Round Whitefish and Lake Trout, known to spawn on shoals and rocky substrates in shallow nearshore study areas, may utilize these habitats. During the 2025 fish spawning assessment, two running Lake Whitefish were captured in the Cutoff Wall study area, while 29 individuals were captured in the Deepwater Study Area. This suggests that these fish may stage in deeper waters before moving into shallower nearshore habitats when they are ready to actively spawn.

It is not known whether any of the fish species identified in the nearshore study areas use the forebay for spawning or nesting. Earlier studies have described vegetation cover along the forebay shorelines as sparse and have characterized the forebay as a depositional area due to the protection from wave action provided by the armourstone groynes (Burchat, 1988; Golder and SENES, 2009). Water depths in the intake lagoon generally range from 2–5 m, with a maximum recorded depth of 7 m (Golder and SENES, 2009). Based on these conditions, it is possible that some species could utilize the forebay for spawning. For example, the sand and gravel substrates present, along with the available depths, could support spawning by species such as Smallmouth Bass, which are routinely observed in the forebay. However, the FDS is in place to exclude fish from the forebay between April and November, which encompasses the spawning period for most species. As noted earlier, fall-spawning species such as Lake Trout, Lake Whitefish, and Round Whitefish are adapted to winter conditions and typically utilize gravel, cobble, or boulder substrates; therefore, they are unlikely to spawn within the forebay. The FDS will remain in place until approval for its removal is granted by DFO.

Overall, the proposed area associated with the construction of the cutoff wall and the forebay offers potential foraging, spawning, and overwintering habitats for certain fish species in Lake Ontario.

6.2.2.3 Potential Impacts and Mitigation Strategies – Risk Characterization

Based on the results of the 2024 and 2025 fish community studies, DWI construction is expected to result in localized impacts on aquatic habitat, primarily affecting areas used by fish for foraging, movement, and seasonal staging. Construction of the DWI cap will result in the destruction of approximately 1.0 ha of habitat utilized by species for foraging, spawning, and migration. The construction of the cutoff wall will result in the destruction of 5 ha of habitat provided by the forebay.

Overall, habitat features within the proposed construction areas are not unique and are widely distributed throughout Lake Ontario. While localized impacts will occur, it is not expected to result in population-level impacts for any fish species. The approximate loss of 1 ha of deepwater habitat and 5 ha of habitat in the forebay represents a small proportion of the total offshore and nearshore habitat available to these species along the northern shore of Lake Ontario, where suitable spawning substrate and prey resources such as zooplankton and benthic invertebrates are widespread and abundant. To mitigate the impacts of habitat loss resulting from project activities, several strategies will be implemented during construction. These include measures to

limit the spread of aquatic invasive species, such as cleaning, draining, and drying any equipment used in the water, and avoiding the transfer of organisms or water between bodies of water. Additionally, OPG will replace and restore disturbed habitat features, as well as remediate any impacted areas, in accordance with DFO authorization requirements, as applicable.

6.2.3 Thermal Effects

PNGS Units 1 and 4 were permanently shut down in Q4 of 2024 and are now in Stabilization phase. Units were shut down in two phases with a three-month interval between phases, reducing the risk of cold shock to aquatic life in the area. To facilitate PNGS Units 1 and 4 Stabilization activities, a minimum of two CCW pumps will continue to run to support Stabilization activities. When all units at PNGS Units 5-8 are shutdown, the RLWMS flow will discharge through either the PNGS Units 1-4 CCW discharge channel or the PNGS Units 5-8 CCW discharge channel. In comparison to existing conditions, the reduced flow from the Units 1-4 CCW discharge is expected to result in a corresponding decrease in water temperatures around the PNGS Units 1-4 CCW discharge. As a result, fish species that were drawn to the warmer temperatures of the PNGS Units 1-4 discharge (e.g., Smallmouth Bass, Common Carp, and Emerald Shiner) may reduce in number in the immediate vicinity of the discharge channel over the coming years. Aquatic productivity in the area around the discharge is also expected to decline toward levels more commonly associated with regional Lake Ontario nearshore habitat. No long-term adverse thermal effect is anticipated from the reduced flow from the PNGS Units 1-4 discharge.

During PNGS Units 5-8 refurbishment, the DWI will be constructed and become operational by 2030. Once the DWI is in use, a cutoff wall will be installed in the intake channel, with small holes to allow some water to pass through. The existing PNGS Units 5-8 CCW discharge channel will still be used. All CCW discharge from Units 5-8 will be paused starting in the fall of 2026 as Units 5-8 will be shut down for refurbishment (**Figure 5-3**). The shutdown will be done in stages to reduce potential cold shock to aquatic life and, likewise, re-start near the end of the refurbishment process will also occur in stages allowing time for aquatic life to thermally adjust.

During PNGS Units 5-8 continued operations, the DWI will operate at full capacity bringing water into PNGS Units 5-8 for use during operations. As such, the discussion around thermal effects below is focused on continued operations.

6.2.3.1 Anticipated Discharge Temperatures post DWI Implementation – Exposure Assessment

The PNGS DWI is currently planned to be constructed and become operational by 2030, at which point the plant will receive intake water at temperatures below what is currently being used from the surface intake since the water will be drawn in from the bottom of the lake, at a farther distance than the intake channel. Discharge temperatures are estimated to be similar to or slightly less than previous operational conditions (with 6 operating units). Thermal data from the existing PNGS intake channel and PNGS Units 5-8 CCW discharge channel were compared to similar data from DNGS to estimate potential effluent temperatures at PNGS post DWI construction and implementation.

DNGS currently utilizes a DWI roughly 800-1000 m offshore at a depth of about 10 m. Water is pulled in through the DWI for the four DNGS reactor units and then discharged to Lake Ontario via a diffuser system. The flow rate through the DNGS DWI as it is currently operated is 123.1 m^3/s (OPG, 2022e). The flow rate at PNGS once Units 5-8 are back online from refurbishment is expected to be slightly higher than at DNGS. A higher flow rate means the water absorbs less heat per unit volume, resulting in a lower average discharge temperature. The DWI setup and operational load (i.e., providing cooling for four reactor units) at DNGS is akin to what PNGS would experience post-refurbishment, with the exception of moderately lower flow rates at DNGS than what is projected for PNGS. This, along with the proximity of the stations (roughly 27 km apart) on the north shore of Lake Ontario, suggests that future PNGS discharge temperatures upon continued operation of PNGS Units 5-8 would be similar to or slightly lower than those at DNGS.

Figure 6-5 presents the surface intake and effluent temperatures at PNGS, and the DWI intake and calculated effluent temperatures at DNGS, from January 2021 to December 2023.

DNGS DWI intake temperatures were consistently 3-5°C cooler than PNGS surface intake temperatures across the three years. This is expected given the colder temperatures at the depth in which the DWI operates, as opposed to the warmer surface water currently being used by PNGS at the intake. Notably however, DNGS calculated discharge temperatures were equivalent to current PNGS discharge temperatures. Therefore, while DNGS intake temperatures are lower than those at PNGS, DNGS experiences a larger ΔT, resulting in similar discharge temperatures between sites.

Though the DWI intake at PNGS will be installed at a depth ranging from 11.5 – 15 m, which is deeper than the offshore intake at DNGS (10 m), thermal profiles taken offshore from PNGS in 2024 and 2025 (see **Section 1.1.1.1.1**) indicate that the change in temperature from 10 m to 11.5 m depth is minimal (roughly 1°C) once the lake has turned over (Lake Ontario turnover occurred during late spring and fall in 2024-2025).

It is anticipated that the discharge temperatures at PNGS during continued operations could be similar to or slightly lower than current temperatures.

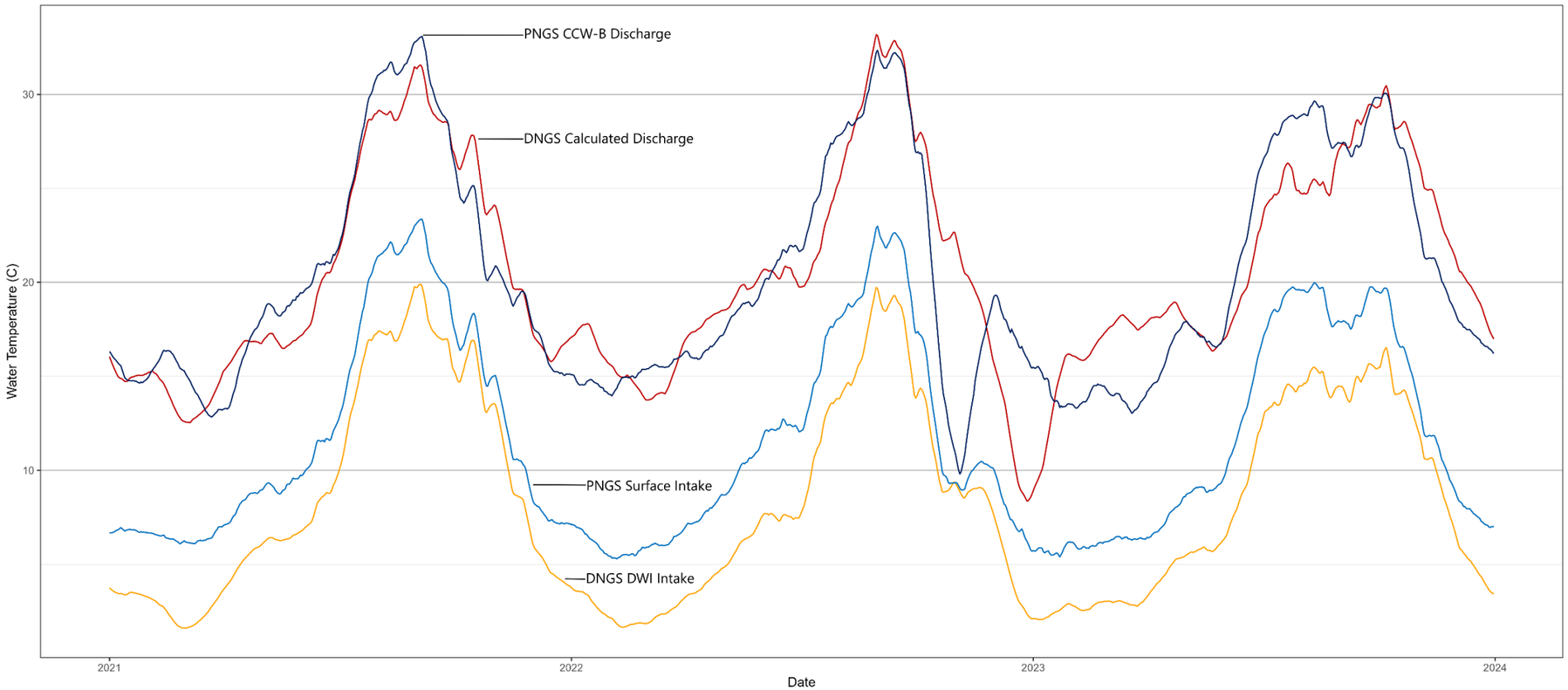


Figure 6-5: Intake and Discharge Temperatures (°C) at PNGS and DNGS from January 2021 to December 2023

6.2.3.2 Anticipated Thermal Effects on Fish Communities – Risk Characterization

The potential effects of the thermal plume on fish eggs and larvae were evaluated several times at PNGS (Cooper, 2013; Golder, 2007a; OPG, 2018c, 2021g). Golder (2007a) evaluated modeled Maximum Weekly Average Temperature (MWAT) against MWAT criteria provided by the ECCC for Smallmouth Bass, Emerald Shiner, and Lake Trout, and Round Whitefish. Water temperatures were monitored across all four seasons in the PNGS Intake channel, PNGS Units 5-8 CCW discharge channel, the nearshore study areas west and east of PNGS, and the nearshore area in front (south) of PNGS. They found no exceedances during the appropriate timeframes for these species. Cooper (2013) compared water temperatures around the PNGS Units 5-8 discharge to MWAT and short-term daily maximum (STDM) criteria of 15 different fish species, nine of which are considered in the 2022 PN ERA. These fish were American Eel, Brown Bullhead, Round Whitefish, White Sucker, Emerald Shiner, Lake Trout, Northern Pike, Smallmouth Bass and Walleye. Cooper found that five of the nine species had exceedances in their criteria when using temperatures from the PNGS Units 5-8 thermal plume. Four of these species however, had exceedances in the reference areas (Thickson Point and Bonnie Brae Point) as well. Only Walleye demonstrated a marginally high exceedance (5% above the thermal criteria) in the thermal plume. However, the temperatures in the reference area were only slightly below the Walleye thermal criteria (4%).

OPG evaluated the effects of the PNGS thermal plume on Round Whitefish embryo survival in 2009-2012 (OPG, 2018c) and 2019-2020 (OPG, 2021g). The plume was modelled using measured water temperature in the winter (December). In both studies, embryo losses generally fell well below the CNSC threshold of concern of 10% relative survival loss. Both studies found that there is no chronic adverse effect on round whitefish egg survival. Griffiths (1980) conducted a study on acute round whitefish egg mortality at varying water temperatures (2, 4, 7, and 10°C). After continuous exposure, only the eggs in 10°C water experienced acute mortality. OPG chose to use a conservative value of 7°C as the threshold at which there could be a possible indication of acute temperature effects on Round Whitefish embryonic development. Any exceedances in lake bottom temperatures greater than 7°C during the study were short term (maximum of 26 hours), and are believed to have no adverse effects on the development of round whitefish embryos. More recently, in a Tri-party meeting (CNSC, ECCC, and OPG), it was agreed that 6°C would serve as the thermal threshold that triggers an adaptive management response for Round Whitefish embryos, particularly during Block 1 development.

Previous work at PNGS on the potential thermal effects from the PNGS Units 5-8 CCW discharge have found there to be minimal impact on the local fish communities (Specifically the species described above). Considering that PNGS Units 5-8 discharge temperatures during continued operations are estimated to be the same or slightly lower than current conditions (with 6 operating units), no change in direct thermal effects are expected after the refurbishment and continued operation of PNGS Units 5-8.

6.2.3.3 Climate Change Considerations for Thermal Effects

Thermal plume temperatures are not anticipated to increase from current conditions as a direct result of the PNGS Units 5-8 refurbishment and continued operations. However, indirect impacts

to the lake thermal environment must be considered. Lake water temperatures are anticipated to increase as climate change progresses over the long-term. Generally, larger waterbodies like Lake Ontario are expected to see less severe climate related changes than small waterbodies (Woolway and Merchant, 2019). In a recent paper, (Ivanova et al., 2024) summarize the potential environmental changes in the Great Lakes. These could include shorter periods of ice cover, earlier spring and later fall overturn, which would in turn create a longer stratification period, and a smaller hypolimnion between spring and fall because of a deeper thermocline (Ivanova et al., 2024). Mean water column temperatures are anticipated to increase by 2°C by 2050-2100, with most of this temperature increase anticipated to occur in the epilimnion of stratified lakes and varying seasonally (Logfren, 2014). In contrast, hypolimnetic effects are largely confined to the summer stratified period. It is still not fully understood how this may impact fish communities. Adult cold-water fish may be able to behaviorally thermoregulate by moving to deeper waters, but their spawning needs may not be as adaptable (i.e., requiring specific substrates, water temperatures, plant growth, etc.). Warmwater fish species might be most exposed to climate-related changes in lake water temperature, as they typically dwell in the epilimnion and near shore.

Future conditions resulting from climate change related warming in Lake Ontario is a large and fluctuating topic in the scientific literature. Several assumptions have to be made when considering the intersection of climate change and warm-water discharge from PNGS, and how these may impact the local aquatic environment. These assumptions are as follows:

1) Any discussion involving long term environmental impacts as a result of climate change are subject to change. Water temperature predictions are estimated via climate modelling, and may vary between sources, and fluctuate over time from the same source.

2) Recent literature indicates that deeper layers in lakes are expected to warm at a slower/more variable rate under climate change due to weaker coupling with air temperature (Anderson et al., 2021; Butcher et al., 2015; Pilla et al., 2020). For example, projections specific to Lake Ontario which account for this predicts that annual water temperature is predicted to increase by 1.3-1.6°C at the surface and by 0.4-1.0°C in the hypolimnion by 2070. These projections, originally developed by Trumpickas et al. (2009) and later utilized in Ivanova et al., (2024) based on low and high CO_2 emission scenarios for the period 2011–2070 (IPCC, 2000) with earlier onset of spring and delay of fall. Therefore, for the purposes of the following evaluation to address thermal effects from the PNGS Units 5-8 CCW discharge and climate change on the local fish communities, it was assumed that the mean water temperature is expected to increase by 1.3-1.6°C at the surface and 0.4-1.0°C below the thermocline.

3) It is assumed based on current modelling that, despite increases in water temp due to effects of climate change, the discharge temp following the shift will not increase relative to current. OPG intends to confirm these predictions via further thermal monitoring once the DWI is operational.

6.2.3.3.1 Potential Effects to Round Whitefish

Past assessments by OPG on thermal effects of PNGS discharge on Round Whitefish have found there to be no chronic or acute adverse effects on embryo survival and development (OPG, 2018c, 2021g). The monitoring threshold of 6°C was exceeded several times within the thermal plume, but only for short periods of time and at specific locations. Round Whitefish typically spawn over gravel and cobble substrates at preferred depths of 5–10 m during the winter. As noted by Ivanova et al. (2024), the warming expected in deeper habitats during winter is relatively minor. To estimate changes in hypolimnion temperature relative to surface water during this period, they applied 7% of the surface water temperature increase. In contrast, an increase of 63% was used to represent hypolimnion changes during summer, when stratification reaches its maximum extent.

Extreme weather events may lead to an increase in the frequency and duration of threshold exceedances, potentially affecting survival and recruitment. However, based on the average increase in the hypolimnion water temperatures in the winter, impacts are expected to be minor and gradual. As such, it is likely that under these climate change scenarios, that water temperatures at depths below 5 m will continue to fall below 3°C, the spawning MWAT criteria for round whitefish (ECCC, 2019; Logfren, 2014). Therefore, considering depth and thermal dynamics, climate change may have some influence, but the spawning success and embryo survival of Round Whitefish within the PNGS Units 5–8 CCW thermal plume are not expected to change significantly.

Other climate-driven effects, beyond those occurring in the hypolimnion, may also influence Round Whitefish embryonic survival. Although there is a lot of interannual variability in ice cover, most climate models project an overall decline in ice cover across the Great Lakes by the mid- and late twenty-first century (Lofgren et al., 2002; Notaro et al., 2015). Ice cover plays an important role in moderating winter thermal stability and reducing wave action. Reduced ice cover may increase water movement, potentially leading to egg displacement, mechanical damage, or increased sedimentation, all of which can reduce egg survival (Lynch et al., 2015). While long-term projections indicate that reduced ice cover may decrease the likelihood of under-ice hypoxia in some areas of the Great Lakes, the net effect on embryonic survival remains uncertain. The magnitude and direction of these effects are difficult to predict due to substantial interannual variability and site-specific habitat conditions.

Importantly, discharge temperatures are expected to remain similar to or lower than current conditions following the construction and operation of the DWI, even with climate change. This suggests that there will be no additional thermal load from PNGS following Refurbishment, with the potential for improved conditions. Future monitoring of intake and discharge temperatures will validate any changes in the thermal plume.

6.2.3.3.2 Potential Effects to Other Fish Species

Cooper (2013) found that, while there were HQ exceedances of the thermal criteria of several fish species within the thermal plume of PNGS, similar exceedances (with the exception of

Walleye) were seen in reference areas outside of the effect of the PNGS Units 5-8 CCW discharge. This suggests that exceedances of thermal criteria may be more tied to high ambient lake temperatures than to the Units 5-8 discharge. However, HQ are useful as a screening tool for assessing potential impacts, and as such are more of a qualitative tool. Therefore, although HQ can identify fish species and life stages potentially sensitive to thermal effects, it should be regarded as a screening-level method. Future analyses incorporating climate change considerations may be required, using a risk-based approach that integrates available data on thermal preference, habitat, population, and behaviour to further quantify thermal effects and supplement the HQ methodology.

Golder (2007) found that modeled temperatures (predicted for the timeline of the refurbishment) in the PNGS discharges, nearshore environment south of PNGS, and the nearshore environments east and west of PNGS, did not exceed the thermal criteria for Smallmouth Bass, Round Whitefish, Emerald Shiner, or Lake Trout in the months critical to spawning and development (Golder, 2007a). Apart from Smallmouth Bass, even an additional warming of 1.3-1.6°C at the surface would not exceed these fish's upper lethal temperatures. Smallmouth Bass were found to utilize the PNGS discharge channels for spawning and can be exposed to fairly high temperatures relative to natural Lake Ontario habitats.

The effects of lake warming are anticipated to impact all fish in varying degrees. In conjunction with warm water discharge from PNGS Units 5-8, this is likely to place more stress on the local fish communities by reducing the margin between water temperatures and fish thermal criteria. Walleye and Smallmouth Bass populations might experience the greatest shift in stress from the combined inputs of climate change and the PNGS discharge. It is likely these fish may shift to different habitats as climate change progresses to stay within a more optimal temperature range.

6.2.3.3.3 Future Investigations

Discharge temperatures from PNGS Units 5-8 during continued operations are anticipated to remain similar to or slightly lower than current temperatures. As thermal effects have already been examined for previous operational conditions (with 6 operating units), an additional thermal effects assessment of existing conditions is not considered necessary at this time, but may be required as climate change progresses.

7.0 Cumulative Site Effects Consideration

Cumulative effects are those that may result from the combined effects of one project with those of other existing, planned, and/or reasonably anticipated future projects. The focus of this discussion is on other OPG projects on the same site, or at nearby sites. Environmental monitoring data collected at PN would include the contribution, if any, from DNGS effluent and emissions as well as, in the future, DNNP effluent and emissions. However, considering the PN site is approximately 34 km west of the DN site, the influence from the DNGS and future DNNP at PN would be small.

As part of OPG's commitment under the Environmental Monitoring and Environmental Assessment Follow-up (EMEAF) Program for the DNNP, OPG has initiated a cumulative effects assessment for the aquatic environment. The thermal plume, habitat loss, impingement and entrainment, and climate change will be integrated to inform a cumulative effects assessment for the aquatic environment which considers PNGS, DNGS, and DNNP. The cumulative effects assessment for the aquatic environment is being performed as part of a separate assessment for the DNNP outside of this PERA.

This PERA encompasses all existing and known future activities on the PN site including evaluation of: PNGS operations (for the previous 6 operating units), PNGS Units 1 and 4 Stabilization, PNGS Units 1-4 SWS and early dismantle/demolish activities, PNGS Units 5-8 Refurbishment (including construction and operation of the DWI), PNGS Units 5-8 Continued Operations, and NSS-PWMF operations including construction of additional SB (SB5) and the PCSS, and construction of other planned buildings such as the RFRISA. As shown in **Figure 1-2**, based on the conceptual timeline, some Project activities will occur at the same time. For example, in 2027, PNGS Units 1 and 4 are still in the Stabilization Phase and PNGS Units 2 and 3 are in SWS phase, risk reduction and removal activities will also occur, along with early PNGS Units 5-8 refurbishment activities, and construction of the DWI. In the Tier 1 assessment, the air and noise model conservatively evaluated this bounding case where maximum emissions from equipment and vehicular traffic are expected to occur from Project activities occurring at the same timeframe. In the Tier 1 surface water assessment three configurations of water balance were evaluated: PNGS Units 1 and 4 in Stabilization with PNGS Units 5-8 in shutdown for Refurbishment (**Figure 5-3**), PNGS Units 1-4 in SWS and 1 unit from PNGS Units 5-8 returned to service (DWI is operational, **Figure 5-5**), and PNGS Units 5-8 in continued operations with PNGS Units 1-4 in SWS (**Figure 5-6**). As such, cumulative effects on the PN site haves been considered in this PERA.

8.0 Conclusions

8.1 Tier 1 Assessment Conclusions

The Tier 1 assessment evaluated PNGS Units 1-4 Decommissioning and PNGS Units 5-8 Refurbishment activities to determine potential Project interactions with various environmental components and receptors. **Table 5-37** summarizes these interactions and the findings from this assessment, identifying which interactions require further quantitative evaluation in the Tier 2 assessment. In general, Project activities during the Stabilization and SWS phases of PNGS Units 1-4 were found to be sufficiently bounded by the 2017 Safe Storage PEA, the 2022 PEA Addendum, or the 2022 PN ERA; thus, no additional evaluation is needed. Although risk reduction and removal activities, and dismantling activities for PNGS Units 1-4 were not previously assessed, they are expected to have minimal environmental effects due to the implementation of construction best practices and mitigation plans. Future dismantling and demolition activities, starting in 2040, will be detailed in subsequent DDP updates and PERA updates when more precise work packages are defined.

Refurbishment activities for PNGS Units 5-8, including islanding the unit, refurbishment of reactor auxiliary systems, and other enhancements were determined to have negligible interaction with the environment in the Tier 1 assessment. Some activities, such as the construction of the PCSS, are evaluated as part of a separate PERA. Other activities, including defueling and dewatering the units, are bounded by the 2017 Safe Storage PEA and the 2022 PEA Addendum, while other activities, such as the management of tritium emissions, are bounded by the 2022 PN ERA. As these activities are bounded by previous assessments, no further evaluation was warranted in the Tier 2 assessment.

The construction and operation of the DWI, along with associated activities such as the potential construction of the cutoff wall, and material disposal, are major activities that were not part of the project scope at the time of earlier assessments. The Tier 1 screening identified that the impacts resulting from these activities—particularly in relation to the atmospheric environment, and aquatic ecosystems—are not bounded by earlier assessments or previous operational conditions (with 6 operating units). Specifically, aquatic habitat impacts from DWI construction and thermal effects, particularly as they relate to climate change, required further assessment. These interactions were retained for further evaluation in the Tier 2 assessment to determine the potential for negative impacts.

To support this PERA, predictive air quality and noise modelling was completed to assess potential impacts to human and ecological receptors resulting from the planned PNGS Units 1-4 Decommissioning and PNGS Units 5-8 Refurbishment. The modelling was developed as a conservative "worst-case" bounding scenario for the planned Project activities.

No long-term human health effects are expected to occur as a result of the predicted ambient air quality or noise conditions for the bounding scenario. Exceedances of the selected AAQC were predicted for TSP, PM_{10}, $PM_{2.5}$), nitrogen dioxide (NO_2), representative of nitrogen oxides [NO_X]), and benzo(a)pyrene (BaP, representative of PAHs) for at least one of the human receptor

locations assessed. No health risks are anticipated for the bounding scenario since short-term air quality criteria exceedances are predicted to occur infrequently (i.e., only a few days up to a few weeks in the year), or at receptor locations where people stay for short periods of time (i.e., the Sport Fisher). For noise, predicted exceedances of human health noise guidelines are modelled to only occur at locations where people stay for short periods of time (i.e., the Sport Fisher, Industrial/Commercial Worker), limiting the overall exposure to elevated noise levels.

No long-term ecological health effects are expected to occur as a result of the predicted ambient air quality for the bounding scenario. Some exceedances of the selected AAQC were predicted for TSP, PM_{10}, $PM_{2.5}$, NO_2, and BaP for at least one of the ecological receptor locations assessed. No effects are expected since exceedances are largely localized to the PN site where mitigation measures (e.g., dust suppression measures) will be utilized to further minimize dust and particulate emissions. Project-related exceedances of short-term 24-hr TSP and PM_{10} criteria off-site at Frenchman's Bay occur relatively infrequently (i.e., exceedances on a few days up to a few weeks in a year). It is expected that Frenchman's Bay will continue to provide suitable habitat for local terrestrial and riparian biota over the course of the Project.

No noise impacts to receptors at Hydro Marsh and Frenchman's Bay are expected since predicted noise levels are less than the 10 dB guideline for incremental change above existing conditions. Exceedances of noise guideline are localized to the PN site. It is presumed that wildlife currently inhabiting the PN site are well adjusted to noise levels characteristic of an urban/semi-urban environment and are relatively tolerant of human activity. Increased noise levels above the 10 dB guideline are predicted at the Bank Swallow FFEE. As such, mitigation measures should be considered to reduce noise levels during the breeding season (approximately April 1st to August 31st). Additionally, the "worst-case" assumptions in the noise model may not actually occur during the breeding season and the model can be re-evaluated once Project planning is further underway to provide more realistic predictions.

While air quality and noise were not assessed further for any human or ecological receptors in the Tier 2 assessment, recommendations are included to protect breeding birds on-site including SAR from elevated air concentrations and noise levels (see recommendations, **Section 8.3**). Barn Swallow and Peregrine Falcon are known to breed on the PN site.

No specific COPCs were identified for the atmospheric or surface water environment. However, feedback from WTFNs on other PERAs indicated the inclusion of a Harvester receptor would be beneficial for the PERA. Thus, an assessment of a Harvester was carried out as part of the Tier 2 quantitative assessment.

Post-refurbishment, PNGS Units 5-8 will operate in a manner consistent with previous operations (with 6 operating units). Therefore, the potential effects of the Continued Operation Phase on most environmental components are similar to those previously assessed in the 2022 PN ERA for six operating units and comparable to existing conditions with four units (PNGS Units 5-8) operating.

As shown in the conceptual timeline for the Project in **Figure 1-2**, there will be activities occurring in one phase that occur at the same time as another phase. For example, while PNGS Units 1 and 4 are in the Stabilization Phase and PNGS Units 2 and 3 are in SWS phase, risk reduction and removal activities will also occur, along with PNGS Units 5-8 refurbishment activities, and construction of the DWI. The air quality and noise modelling and surface water quality modelling considered a bounding scenario when activities are occurring at the same time, where relevant to the assessment.

In summary, the following potential effects were evaluated in the Tier 2 assessment:

- Inclusion of a Harvester in the Predictive HHRA to assess radiation dose from exposure to releases of tritium, carbon-14, and beta/gamma to the atmospheric and surface water environment.
- Evaluation of aquatic habitat loss and potential changes to habitat quality in the Predictive Ecological Risk Assessment (EcoRA) from construction of the proposed DWI and associated nearshore modifications.
- Evaluation of changes to thermal effects on indicator fish species in the Predictive EcoRA due to operation of the DWI.

8.2 Tier 2 Assessment Conclusions

8.2.1 Predictive Human Health Risk Assessment (HHRA)

A Harvester receptor was further evaluated in the Tier 2 assessment. The radiological emissions to air and water assessed in the 2017 Safe Storage PEA continue to remain a conservative estimate of radiological emissions based on current Project planning for PNGS Units 1-4 Stabilization and SWS, as well as for PNGS Units 5-8 Refurbishment.

The incremental radiation dose from the Project to all human receptors evaluated is predicted to be well below the regulatory public dose limit of 1,000 µSv/a. The total dose to the Harvester is 1.37 µSv/a for the Harvester (child), representing 0.14% of the regulatory public dose limit (1,000 µSv/a). The highest dose to other receptors is 1.11 µSv/a for an urban resident (child), which is 0.11% of the regulatory public dose limit. This PERA has demonstrated that receptor groups near the PN site with anticipated lower exposure are also protected.

Since the dose estimates are a small fraction of the incremental public dose limit of 1,000 µSv/a and of the natural background dose of 1,400 µSv/a, The Tier 2 predictive HHRA determined there are no health effects anticipated due to exposure of potential critical groups to radiological releases from the PN site.

Based on the results of this PERA, the planned safe storage of PNGS Units 1 and 4, decommissioning of PNGS Units 1-4 and refurbishment of PNGS Units 5-8 are not predicted to cause any adverse effects to the human receptors evaluated.

8.2.2 Predictive Ecological Risk Assessment (EcoRA)

Further evaluations of aquatic habitat impacts and thermal effects were conducted in the Tier 2 assessment. All other Project interactions with the environmental components examined in the Tier 1 assessment were deemed to either pose negligible risks, be sufficiently managed or mitigated, or are bounded by previously completed assessments or current operating conditions.

8.2.2.1 Aquatic Habitat Impacts

The proposed DWI will draw deeper, cooler water from Lake Ontario and is expected to significantly reduce fish impingement and entrainment as well as reduce potential biofouling events with attached algae as identified in the Tier 1 assessment. The shift from the existing shoreline intake to the DWI was proposed in order to reduce the interaction of the station with aquatic organisms and provide a more robust system for future operations under changing climate conditions. However, construction of the DWI intake infrastructure and associated shoreline works will result in localized disturbance and some loss of aquatic habitat.

Based on the habitat assessment, the construction of the DWI and cutoff wall could result in the destruction of approximately 6 ha of fish habitat utilized by species for potential spawning, foraging and migration. The temporary structures created to support the construction of the cutoff wall will result in the alteration of approximately 0.037 ha in the nearshore area. Additionally, the construction of the intake channel (a bored tunnel running from the intake cap to PNGS) could result in temporary disruption of approximately 1.5 ha of fish habitat.

Overall, habitat features within the proposed construction areas are not unique and are widely distributed throughout Lake Ontario. While localized impacts to the aquatic environment are expected to occur, it is not expected to result in population-level impacts for any fish species. The proposed intake locations, S2 and S5, were classified as Mixed–Soft and Cobble/Gravel, respectively. Fish communities in grids with these substrate types did not differ significantly from any other substrate class. This suggests that the fish community at the proposed intake locations is consistent with the broader study area, with no meaningful ecological differences detected. Thus, the approximate loss of 1 ha of deepwater habitat and 5 ha of forebay habitat represents a small proportion of the total offshore and nearshore habitat available to these species along the northern shore of Lake Ontario, where suitable spawning substrate and prey resources such as zooplankton and benthic invertebrates are widespread and abundant.

8.2.2.2 Thermal Effects

The thermal impact of the PNGS Units 5-8 discharge during operation of the DWI was evaluated. It is anticipated that once the DWI is in operation the discharge temperature will be the same or lower than the existing PNGS Units 5-8 discharge temperatures. Thus, the PNGS Refurbishment activities are not expected to add any additional thermal load to the aquatic environment, and may even result in an improvement relative to current thermal conditions.

In the future, lake water temperatures are anticipated to increase as climate change progresses over the long-term; however, it is generally understood that larger waterbodies like Lake Ontario are expected to see less severe climate related changes than smaller waterbodies. The effects of lake warming are anticipated to impact all fish in varying degrees. Some fish species may have to shift to different habitats to remain within their optimal temperature range or acclimate as climate change continues to progress.

During Continued Operation the thermal effects are expected to be similar or slightly less than previous conditions (i.e., with 6 operating units).

8.2.2.3 Overall Conclusions

The PERA aims to quantify and characterize the risk to representative human and ecological receptors posed by proposed activities. The PERA uses the predictions of risk to draw conclusions on potential effects.

Based on the predictions of risk in the PERA, most activities associated with PNGS Units 1-4 Decommissioning, PNGS Units 5-8 Refurbishment, and Continued Operations are not likely to result in adverse effects to human and/or ecological receptor groups evaluated. Some aquatic habitat will be disturbed or removed as a result of DWI construction – OPG will meet all DFO authorization requirements including implementation of fish habitat compensation measures to offset the loss of habitat and associated productivity, As such the effect of aquatic habitat loss should be minimal with implementation of mitigation measures. While some individual exceedances of air quality or noise guidelines were identified, mitigation measures identified in **Section 8.3** will be implemented, and monitoring will confirm that there will be no adverse effects.

8.3 Recommendations for Monitoring and Mitigation

OPG has a robust EMP where environmental media are sampled and analyzed at locations within and outside the PN site. This program will continue during PNGS Units 1-4 Decommissioning, PNGS Units 5-8 Refurbishment, and Continued Operations.

Through the normal course of implementation of the N288 standards, the changes in activities associated with the Project will be considered as part of the periodic review and update of the monitoring programs resulting in a continual assessment of effects on human and non-human biota.

Based on the results of this PERA, the following recommendations are made for monitoring and mitigation in **Table 8-1** below.

Table 8-1: Recommendations for Monitoring and Mitigation

Environmental Component	Recommendation for Monitoring and Mitigation
Atmospheric Environment	• Air Quality: Air monitoring of existing conditions (TSP, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, VOCs, and PAHs) was conducted to provide sufficient data to characterize the existing environment. The air monitoring data from January to December 2025 are included in the current R001 version of the PERA which captures seasonal variability of existing conditions. Follow up air monitoring is recommended for one year during refurbishment to verify predictions and confirm the effectiveness of mitigation measures. Final constituent selection will be established during future program design and in consultation with regulators. • Air Quality: Implementation of a dust management plan, if required could involve mitigative measures such as the application of dust suppressants, stabilization of completed soil surfaces, and suspension of dust-generating activities during periods of inclement weather. This is expected to reduce dust and particulate emissions and deposition on to vegetation surfaces, limiting pollution of local wildlife habitat. • Noise: The development and implementation of a Noise Management Plan will outline best construction practices and available mitigation measures for controlling noise generation. • Noise: OPG plans to review its noise assessment for the period of bird breeding season for the peak noise level year. If noise is predicted to potentially impact species at risk (SAR) such as Bank Swallow, Barn Swallow and Peregrine Falcon during the breeding season (April 1 to August 31), mitigation measures should be explored to reduce impacts. Mitigation measures could include; • A work buffer between high-noise equipment and active Bank Swallow nesting habitat where feasible; • Appropriately sized equipment for the required tasks and avoiding clustering of equipment near Bank Swallow nesting areas where practical; • Stationary equipment with built-in or accessory noise controls (e.g., enclosures, silencers) where feasible that are maintained in good working order; • Mobile equipment with effective mufflers that are maintained in good working order; • Minimizing drop heights during loading/unloading and material handling where feasible; • Avoiding tailgate banging and adhering to posted speed limits for trucks;

Environmental Component	Recommendation for Monitoring and Mitigation
	• A no-idling policy to limit unnecessary noise where practical; and • Temporary noise barriers as needed on a case-by-case basis, considering the duration of the work, type of equipment involved, proximity to Bank Swallow habitat, and observed nesting sensitivity.
Surface Water Environment	• No additional recommendations beyond continuing to implement existing surface water quality monitoring through OPG's ongoing EMP. • OPG will employ best practices for stormwater management that would meet Ontario Ministry of Environment, Conservation and Parks (MECP) requirements and industrial sewage works rules.
Aquatic Environment	• Aquatic monitoring studies were completed in 2024 to support the PERA R000 based on Project planning for the DWI at the time. As the design of the DWI evolved, so did the study area size and location. As such, further data (fish community, benthic macroinvertebrate community, microzooplankton community) were collected in 2025 (between R000 and R001 of the PERA) for the aquatic environment to reflect changes to DWI planning since the Project was initiated. The additional aquatic environment are included in the current R001 version of the PERA. • Aquatic Habitat: To mitigate impacts of habitat loss from DWI construction, measures should be taken to limit the spread of aquatic invasive species, such as cleaning, draining, and drying any equipment used in the water, and avoiding the transfer of organisms or water between bodies of water. Additionally, OPG will replace and restore disturbed habitat features, as well as remediate any impacted areas, in accordance with DFO authorization requirements, as applicable. • Aquatic Habitat: An Erosion and Sediment Control Plan should be developed to minimize the mobilization of suspended materials into the water during DWI construction. Mitigation measures may include conducting in-water works in isolation of open or flowing water to reduce sediment introduction into the watercourse, regular inspection and maintenance of erosion controls, monitoring for signs of sedimentation, and ensuring the proper disposal of dredged materials. Similarly, a spill response plan should be implemented to prevent spills of deleterious substances. • Aquatic Habitat: An analysis of options for disposal of spoils from the construction of the DWI is currently being undertaken. Following selection of an option, a comprehensive spoils

Environmental Component	Recommendation for Monitoring and Mitigation
	management plan should be developed to minimize environmental impacts. • Impingement and Entrainment: The FDS should remain in place to minimize impingement and entrainment until the DWI is operational and thereafter until DFO grants approval for its removal. • Impingement and Entrainment: The reduction of impingement and entrainment once the DWI is operational should be confirmed through follow up monitoring programs. • Thermal Effects: OPG should incorporate a staggered and sequential shutdown of Pickering Units 5-8 during refurbishment to allow for fish acclimation, and to reduce the risk of a cold shock event. • Thermal Effects: The assumption that PNGS Units 5-8 discharge temperatures post-DWI implementation will be the same or slightly lower than previous operational conditions (with 6 operating units) should be confirmed through monitoring of discharge temperatures. To reduce uncertainty related to the potential impacts of climate change on aquatic habitat and species, future monitoring of lake bottom temperatures is recommended once the DWI is operational. This evaluation should be summarized in a future PN ERA update.
Geological and Hydrogeological Environment	• OPG and all sub-contractors should utilize construction best practices and follow a construction Environmental Management Plan to ensure that all equipment is well maintained and functioning correctly to limit fuel spills and environmental contamination. • During construction of the PCSS, SB5, and RFRISA, and other planned buildings any dewatering during excavation should be completed with the necessary permissions following MECP regulations intended to be protective against discharge or re-infiltration of collected groundwater. • A geotechnical investigation should be completed to determine if dewatering is required for the RFRISA or any other planned building. A geotechnical investigation has already been completed for the PCSS and is discussed in the PCSS PERA.
Terrestrial Environment	• See atmospheric environment row for recommendations on reducing noise levels for SAR. • As much as it's possible to do so, consider adjusting construction activities to minimize impacts, such as modifying work schedules

Environmental Component	Recommendation for Monitoring and Mitigation
	or implementing noise and activity restrictions near nesting sites. To further reduce disturbance, heavy construction activity should be avoided during key breeding periods, to the extent possible. Furthermore, work could be planned to occur during daytime hours to minimize disruption of nocturnal wildlife. • OPG will comply with the species and habitat protection provisions of the Species Conservation Act, Species at Risk Act, and Migratory Birds Convention Act during all project activities. • OPG will continue to monitor breeding birds and conduct broader biodiversity monitoring on an annual basis to support conservation efforts and regulatory compliance. • Best safe driving practices should be implemented to minimize the likelihood of wildlife strikes during construction activities associated with refurbishment.
Radiation and Radioactivity (Gamma Radiation)	• Future iterations of the PN ERA (based on the time period they encompass) should consider the new NSS-PWMF layout with inclusion of the transferred DSMs from the Phase I to the Phase II NSS-PWMF site. TLDs will be installed to monitor gamma radiation fields around the DSMs transferred to NSS-PWMF Phase II site. Data from TLDs surrounding the DSMs as well as quarterly catch basin stormwater monitoring can be used to verify the conclusion that doses remain acceptable.
Climate change considerations	• The DWI and cutoff wall should be designed using engineering best practices to withstand extreme weather conditions such as storms, droughts, floods, and blizzards. • OPG should also continue utilizing the AAWS, a predictive tool developed in 2019, to forecast and monitor algae events, and adjust operations accordingly to mitigate the effects.

9.0 References

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Appendix A Detailed Description of Existing Conditions

A.1 Atmospheric Environment

A.1.1 Air Quality

A.1.1.1 Radiological Air Emissions

The PN site emits relatively low quantities of radiological contaminants to the atmosphere during normal operations. Routinely monitored parameters include HTO, iodine-131 (I-131), carbon-14 (C-14), and radioactive noble gases and particulates.

As described in the recent 2024 EMP report (OPG, 2025a), atmospheric HTO emissions within the last 10-years peaked during 2016 and 2017. Since then, HTO emissions decreased over time until 2020, following improved management of airborne HTO. In 2020, HTO emissions increased due to a heat transport system leak in Unit 1 and a moderator purification valve leak on Unit 6. These leaks have since been repaired and HTO emissions have continued to decline from 2021, to 2024. In October 2020, a microscrubber was installed on Unit 4 and it was placed into service in 2021. The microscrubber removes a significant portion of the tritium from airborne emissions and converts it into waterborne tritium effluent, which is directed to the Active Liquid Waste Tanks (ALW) for controlled release to the CCW within acceptable limits. Overall, emissions of HTO have gradually decreased between 2020 and 2024 following the noted increase in 2020.

Atmospheric C-14 emissions gradually increased between 2020 and 2023, but were lower than the emissions recorded in 2018 which represent the 10-year high. C-14 emissions were elevated in 2018 due to work associated with the moderator purification system on Units 1 and 6. In 2023, elevated C-14 emissions were attributed to the removal of the Unit 6 moderator purification system in preparation of a planned Unit 6 outage in Q1 and moderator gas purging on Unit 4 in Q2. In 2024, C-14 emissions were lower than in 2023 and were consistent with levels observed between 2020 and 2022 (OPG, 2025a).

As described in the recent 2024 EMP report, radioactive noble gas stack emissions are often measured below instrument detection limits; thus, measurements taken from environmental noble gas monitors located outside of PNGS are used to trend PN noble gas emissions. Argon-41 is the predominant radionuclide measured in noble gas around PN and is associated with operation of PNGS Units 1 and 4. A Mann-Kendall trend analysis indicates that there is not a statistically significant trend in Ar-41 emissions over the last 10 years. In 2020, a notable decrease in Ar-41 emissions was attributed to a decrease in the operating time of Units 1 and 4. In 2021, Ar-41 emissions increased again but have gradually decreased between 2022 and 2024 (OPG, 2025a). Xenon-133 is occasionally measured above the detection limit at PN, though this radionuclide composes a relatively small percentage of noble gas emissions compared with Ar-41. Xe-135 and Iridium-192 were not detected in noble gas emissions at the PN site between 2021 and 2024 (OPG, 2025a). Additionally, radioactive particulates and radioiodine emissions are noted to have a minimal contribution to public dose (OPG, 2025a).

A.1.1.2 Non-Radiological (Chemical) Air Emissions

Emission Summary and Dispersion Modelling Reports

ESDM reports from 2015 (Golder, 2015) and 2017-2020 (Ortech, 2019a, 2019b, 2020, 2021) were consulted to aid in the selection of airborne chemical COPCs in the 2022 PN ERA (Ecometrix, 2023a) and the 2022 PEA and PEA Addendum for PN Safe Storage (Ecometrix, 2023b; Golder and Ecometrix, 2017). This PERA considers the most recent ESDM reports prepared for 2020 to 2024 (Ortech, 2021, 2022, 2023, 2024, 2025) to characterize previous conditions (with 6 operating units) relating to chemical emissions from PNGS.

Contaminant emissions are assessed within the ESDM reports by comparing POI concentrations estimated from PNGS emission rates to POI exposure benchmarks listed in the MECP publication, Air Contaminants Benchmarks (*ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants* (the 'ACB list'). The ACB list encompasses the air standards set out in O. Reg. 419/05, as well as a broader list of additional benchmarks intended to aid facilities in preparing ESDM reports. As of 2018, the modelling of all ESDM-reported contaminants transitioned to AERMOD, with POI concentrations provided for 1-hour, 24-hour, or annual averaging periods depending on the MECP POI limits.

All contaminants with MECP POI standards that are emitted from the PN site were found to have POI concentrations less than their respective MECP POI limits. As part of the ESDM reporting, hydrazine is the subject of a site-specific Maximum Ground Level Concentration (MAXGLC) approval. Between 2020 and 2024, hydrazine was found to have POI concentrations below the approved MAXGLC value.

Updated 2025 Air Quality Monitoring

Past air monitoring studies and the data requirements of this PERA provided the basis for the selection of airborne COPCs for the monitoring program. Several COPCs were identified as relevant to the program, including total suspended particulates (TSP), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), CO, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), volatile organic compounds (VOC; as represented by acrolein) and polycyclic aromatic hydrocarbons (PAH; as represented by benzo[a]pyrene). Measurements of these airborne COPCs were compared against applicable ambient air quality criteria, namely the Canadian Ambient Air Quality Standards (CAAQS) provided by the CCME (ECCC, 2023) and the Ambient Air Quality Criteria (AAQC) provided by the Ontario MECP (MECP, 2023). Of note, acrolein and benzo(a)pyrene were selected as surrogate parameters for VOCs and PAHs, respectively, as these chemicals each have the lowest (i.e., most conservative) AAQC values within their respective chemical groups.

The location of the AQ1 monitoring station was selected by considering various parameters including location within the PN site, exposure to PN-associated air emissions, local obstructions, meteorological conditions, and site accessibility, maintenance and security considerations. The optimal placement of the monitoring station was determined by considering the inlet height, horizontal and vertical distances from the inlet to support structures and the

distance from the inlet to nearby airflow obstructions. The establishment of a single monitoring station follows the siting and network design principles outlined in the CCME National Air Pollution Surveillance (NAPS) QA/QC Guidelines (CCME, 2019) and the Ontario Operations Manual for Air Quality Monitoring in Ontario (MECP, 2016).

In general, the operation of monitoring instrumentation followed a schedule consistent with the NAPS program[1]. Over the course of the program, continuous monitors collected data on an hourly basis for PM_{10} and $PM_{2.5}$, NO_X, CO, and SO_2. The intermittent sampling was conducted to coincide with the intermittent samples collected under the NAPS schedule of 1-in-6 days for TSP and the Ontario MECP schedule of 1-in-12 days for PAHs and VOCs.

A chemiluminescence analyzer was used to measure nitrogen oxides, a gas filter correlation was used for CO and pulsed fluorescence techniques were used to measure SO_2. Continuous instruments were connected to a common data logger, allowing synchronized data acquisition. Samples of TSP and PAHs were collected using High-Volume Air Samplers.

[1] The National Air Pollution Surveillance (NAPS) Program, established in 1969 and coordinated by Environment and Climate Change Canada (ECCC), aims to provide robust and long-term ambient air quality data of a uniform standard across the populated regions of Canada.

A.1.2 Noise

Noise emissions from the PNGS originate from a wide variety of on-site sources. Past acoustic assessments have identified the following sources:

- Standby gas generators (SGs) for both PNGS Units 1-4 and U5-8;
- Emergency power generators (EPGs);
- Auxiliary Diesel Generators;
- Building exhaust and ventilation systems;
- Chillers and air conditioning units;
- Combustion turbine units (CTUs); and
- Emergency pumps.

The most significant sources of noise at the PN site are the SGs, EPGs, CTUs and other emergency equipment, such as pumps operated only during emergency situations (OPG, 2025b).

A.1.2.1 Updated September 2024 Noise Monitoring

The noise monitoring locations were selected based on the Ontario MECP Environmental Noise Guideline (NPC-300; MECP, 2013b)) and the receptor framework established in the most recent PNGS Acoustic Assessment Report (AAR; OPG, 2024g). Sensitive receptors were defined to be located in residential, community, or recreational areas where people may reasonably be expected to experience noise impacts. Building on past AAR receptor locations, noise monitoring stations were strategically placed in close proximity to nearby communities and sensitive ecological receptors located in areas to the north-east and north-west of PNGS to ensure that exposures to existing noise levels may be sufficiently characterized. Specifically, these areas were selected to capture a range of residential and recreational receptors surrounding PNGS, consistent with regulatory guidance, past monitoring practices, and OPG's operational considerations.

Based on these criteria, the following locations were selected (shown in **Figure 4-1**):

- **N1**: Liverpool Road (P4 in EMP). This location corresponds to one of the three residential areas assessed in the AAR (Point of Reception; POR#2).
- **N2**: Sandy Beach Road (P3 in EMP).
- **N3**: Montgomery Park Road (P2 in EMP).

- **N4**: Montgomery Park Road (P6 in EMP). This location is in close proximity to the Fixed Face Earthen Embankment (FFEE), an artificial nesting structure design for Bank Swallow (see **Section 4.5.2**).

The MECP Publication *NPC-300 Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning* (MECP, 2013) outlines sound level limits for outdoor and POW points of reception. Consistent with the guidance document, a "Class 1 area" refers to an acoustic environment typical of a major urban population centre where background sound levels are dominated by human activities, such as road traffic. Comparably, a "Class 2 area" refers to an acoustic environment that has qualities of a Class 1 area during daytime hours (7:00 a.m. to 7:00 p.m.) and qualities of a Class 3 area during nighttime hours (7:00 p.m. to 7:00 a.m.). A "Class 3 area" refers to an area dominated by natural sounds typical of a wilderness or agricultural area, or a small community with minimal road traffic (MECP, 2013).

Larson Davis Class 1 integrating sound level meters (SLM) were used for the collection of sound level data. Instrumentation and procedural guidelines for the measurement of sound as part of the recent noise monitoring program were consistent with the Ontario MECP's NPC-102 (Instrumentation) and NPC-103 (Procedures) publications (MOE, 1978). The SLMs were positioned such that they remained a minimum of 3 m away from any adjacent buildings or structures and a minimum of 1.5 m above the ground surface. Consistent with the MECP NPC-103 guidance document, any noise data deemed to be negatively influenced by weather and poor meteorological conditions (e.g., high winds) were discarded from the dataset to ensure an accurate representation of existing noise conditions without interference from weather-related events. Noise monitoring was completed over a 2-week period in September 2024 using an averaging period of 1-hour for the collection of sound level measurements. A summary of the noise monitoring data and a comparison against the Class 1 and Class 2 sound level limits is provided in **Table 4-5**.

A.2 Surface Water Environment

A.2.1 Water and Sediment Quality

A.2.1.1 Water Quality

LWE-1, located offshore of the stormwater location M5-1 and previously sampled in 2015, was not included in the 2024 sampling program. LWE-1 was initially sampled for the 2014 supplementary study for hydrazine to support the Pickering EMP to determine if hydrazine concentrations in the vicinity of PNGS posed a risk to human and aquatic receptors. The location was specifically chosen because it was 500 m downstream of PNGS based on prevailing plume directions at the time of sampling. Due to its relevance to the 2014 hydrazine program, LWE-1 was included in the 2015 surface water sampling program for analysis of additional parameters to support the 2017 PN ERA. Both the 2014 and 2015 studies demonstrated that concentrations of hydrazine and other parameters were higher at the PNGS Units 5-8 outfall (LW21) than at LWE-1. Based on these outcomes, the 2024 study chose LW21 as more representative for potential exposure to COPCs.

For the Lake Ontario stations, water samples were collected near the surface (0.5 m depth, denoted with a -S after the station name) and at the bottom (0.5 m off bottom, denoted with a -B after the station name) of the water column to capture the vertical profile. Mid-depth samples (denoted by -M after the station name) were collected in Frenchman's Bay and the PNGS outfall locations (LW21 and LW10), as thermal stratification is unlikely in the shallow depths observed in this area. The list of parameters evaluated in 2024 was expanded to include microbes, volatile organics, and radionuclides such as Iodine-131, Thorium-series, and Uranium-series. Results from this program were compared against selected human health and ecological screening criteria. Selection of the applicable human health screening criteria followed the hierarchical decision-tree presented in **Figure A-1** and outlined below:

- The most conservative value between:
    - Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada, 2025); or,
    - Ontario Regulation 169/03: Ontario Drinking Water Quality Standards (MECP, 2020); or,
    - Groundwater Component Values (GW1) for a Potable Water Scenario in coarse textured soils derived from Ontario Regulation 153/04: Records of Site Condition (MOE, 2011); or,
- Guidelines available from other reputable jurisdictions:
    - British Columbia Ministry of Environment (BC MOE) Source Drinking Water Quality Guidelines (BC MOE, 2020); or,

  - United States Environmental Protection Agency (US EPA) 2018 Edition of the Drinking Water Standards and Health Advisories Tables (US EPA, 2018); or,
  - US EPA Regional Screening Levels (RSLs) for tap water (target hazard quotients (THQ) of 0.2) (US EPA, 2024); or,
  - World Health Organization (WHO) Guidelines for Drinking Water, Chapter 9 – Radiological Aspects (WHO, 2020); or,
- Highest observed environmental concentrations reported in published sources:
  - WHO International Programme on Chemical Safety & WHO Task Group on Environmental Health Criteria for Titanium (WHO, 1982); or,
  - Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Cesium (ATSDR, 2004).

Similarly, selection of the applicable ecological screening criteria followed the hierarchical decision tree that is presented in **Figure A-2** and summarized below:

- The most conservative value between:
  - CCME Canadian Water Quality Guidelines (CWQG) for Protection of Aquatic Life (CCME, n.d.); or,
  - Provincial Water Quality Objectives (MECP, 2003); or,
  - Interim Provincial Water Quality Objectives; or,
  - Federal Environmental Quality Guidelines (ECCC, 2016, 2017, 2018, 2019, 2020, 2021a, 2021b, 2021c, 2021d); or,
- Other jurisdictional guidelines:
  - MECP Aquatic Protection Values (MOE, 2011); or,
- Guidelines from other sources and toxicological literature:
  - Suter and Tsao, (1996). *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*.
  - Borgmann et al., (2005). *Toxicity of Sixty-Three Metals and Metalloids to Hyalella Azteca at Two Levels of Water Hardness*.

For guidelines requiring input parameters to determine applicable water quality criteria, site-specific seasonal average values for temperature, pH, total hardness, total alkalinity, and dissolved organic carbon (DOC) were used. **Table A-1** summarizes the guidelines considered,

the derivation of parameter-dependent criteria, and the selection process for the spring samples. **Table A-2, Table A-3, Table A-4** present the screening results for the spring, summer, and fall 2024 sampling events, respectively, using guidelines derived from season-specific input data where applicable.

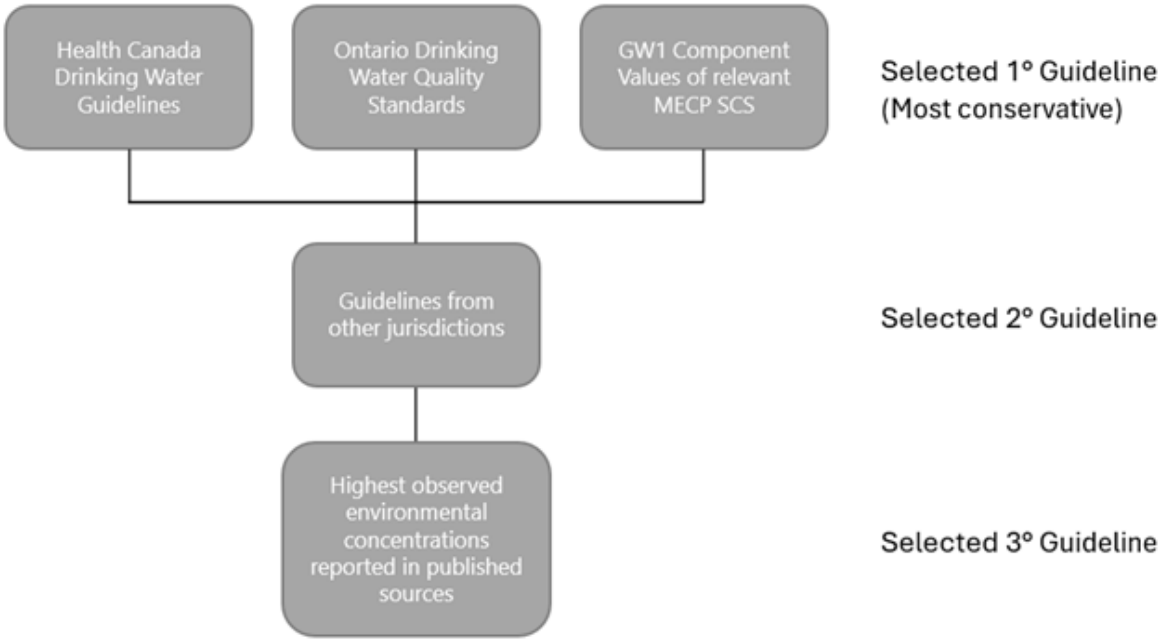


Figure A-1: Hierarchy of Human Health Screening Criteria for Non-Radiological Constituents in Surface Water

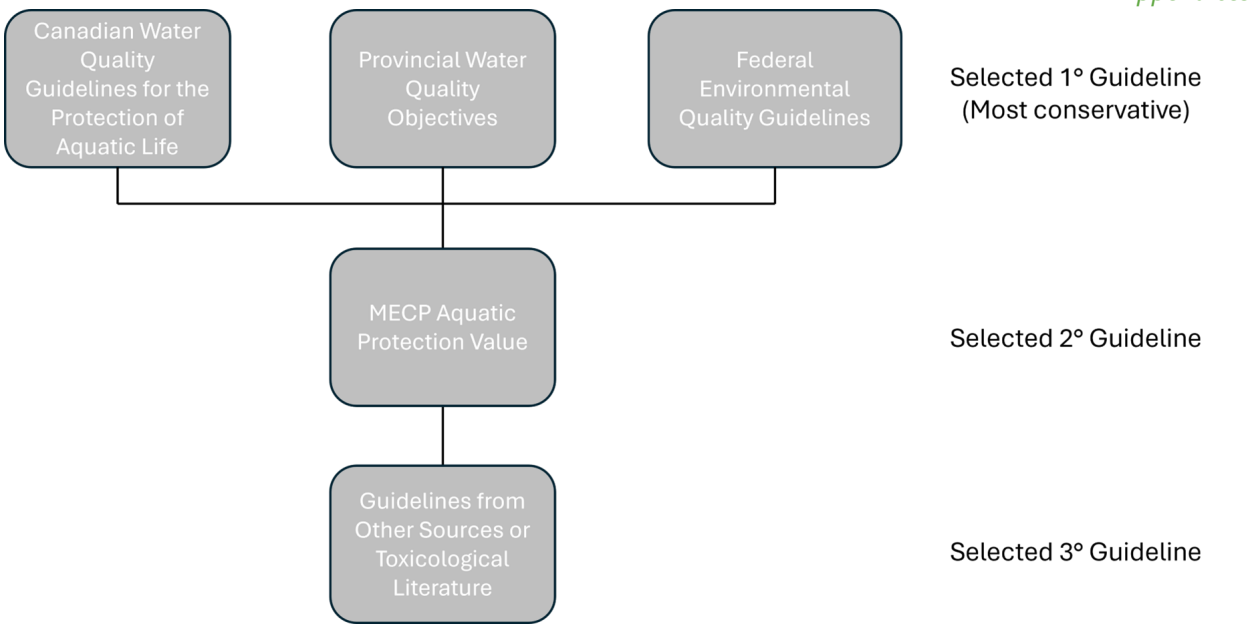


Figure A-2: Hierarchy of Ecological Screening Criteria for Non-Radiological Constituents in Surface Water

Lake Ontario

Exceedances of the Provincial Water Quality Objective (PWQO) upper pH limit of 8.5 were observed in a few samples, including LW9-S, LW9-B, LW2401-S, and LW2402-S during the summer event. The maximum pH value, 8.63, was detected in the LW9-B sample, and represents an exceedance of approximately 1.5% above the guideline. While pH is not considered a chemical contaminant, it is measured as the MECP considers freshwater bodies with a pH between 6.5 to 8.5 to be the most bio-productive. Surface waters with pH above the upper limit of the PWQO may be less productive. However, Lake Ontario is a well-documented productive habitat for aquatic biota, as demonstrated by numerous aquatic biota studies (Barbiero et al., 2001; EC, 2009; Golder, 2007; OPG, 2016, 2023a), including the 2024 and 2025 deepwater and nearshore fish community, macroinvertebrate, and microzooplankton studies (see Section 4.3). Given this, the slight exceedance is likely due to natural spatial variability and is not a cause for concern. Additionally, the CCME CWQG for pH ranges from 6.5 to 9.0 for the protection of freshwater biota, a standard also recommended by the International Joint Commission (IJC, 1977) and the U.S. EPA (US EPA, 1986). This range is considered protective of fish and benthic invertebrates, though pH changes within it may influence the toxicity of other contaminants, such as ammonia. Since all surface water samples collected fell within the CCME guideline range and Lake Ontario remains highly productive, the minor exceedances in pH are not expected to have any adverse impacts on aquatic biota in the lake.

Exceedances of the CCME guidelines for un-ionized ammonia were found in samples taken from the PN intake (LW9-S and LW9-B), the PNGS Units 5-8 outfall (LW21-M), mouth of Frenchman's

Bay (FB1-S), and the four stations centered around the originally proposed intake cap (LW2401-S, LW2402-S, LW2403-B, LW2404-S; **Figure 4-3**) during the summer sampling event. In addition, the CCME total ammonia guideline was exceeded at LW2403-B. It should be noted, however, that ammonia concentrations were elevated across the PN Study area and the reference area (LWC-1) in comparison to the spring sampling event, indicating a system wide increase not associated with PNGS.

While ammonia can be a toxicant, it is also a key component of the nitrogen cycle and a source of bioavailable nitrogen. The occurrence of exceedances only in the summer suggest the possibility that elevated water temperatures in this season contributed to increased decomposition of organic matter and enhanced biological activity, resulting in greater production of nitrogenous waste in the form of ammonia. Hydrazine may also be a source for this observed increase as it can decompose to ammonia in aqueous solution due to oxidation. The rate of this decomposition increases with increases in dissolved oxygen, pH, and temperature. Additionally, certain cyanobacterial genera associated with algal blooms are capable of nitrogen fixation, converting atmospheric nitrogen into various forms including ammonium (Favot et al., 2023). It should be noted that ammonia concentrations declined from summer to fall at all lake sampling locations, consistent with reduced biochemical activity resulting from lower water temperatures.

Adverse health effects for humans as well as birds and mammals are not expected, as ammonia is naturally produced and efficiently metabolized in healthy individuals from these groups (HC, 2013). All sample concentrations were below the 1.5 mg/L odor threshold which induces avoidance behaviors for birds and mammals, thereby limiting ingestion of surface water. Potential risks to aquatic biota in these areas will be assessed further in the 2027 ERA. However, the absence of exceedances near the outfalls and in all lake sampling locations during the spring and fall events, along with waterborne ammonia emissions from PN consistently being below regulatory limits (as detailed in **Section 4.2.2.1.3.1**), suggests that the elevated concentrations reflect a seasonal effect rather than an impact of PN operations.

The total suspended solids (TSS) concentration (Fall 2024) exceeded the applicable ecological guideline of 5.3 mg/L in FB1-B, the Frenchman's Bay entrance, which is a wetland-influenced, shallow embayment. The exceedance in the sample may have been influenced by localized sediment resuspension during the sampling process, given the soft-bottom conditions and limited water exchange in this area. As the exceedance was limited to a single sample and location, it does not indicate a broader water quality concern for Lake Ontario.

The measured concentrations of dissolved and total calcium at most Lake Ontario sampling locations exceeded the screening criteria of 11.6 mg/L, which represents an estimated no-effect concentration calculated as one-tenth of the lowest chronic value (LCV) from Suter and Tsao (1996). However, calcium is a major naturally occurring constituent of the environment, and concentrations in the Great Lakes have been reported to range from 13 to 41.3 mg/L (Dove, 2009; HC, 1987). The 2024 sampling results fall within this natural range, with a maximum measured concentration of 38.6 mg/L. As an essential element for plant and animal life, calcium is generally not considered toxic. In living organisms, calcium metabolism is governed by a

series of efficient homeostatic mechanisms, and any adverse toxic effects are only observed following exposure to extremely large quantities of calcium (HC, 1987). In toxicity tests for chloride, the CCME has used calcium as the cation (i.e., $CaCl_2$) to ensure that effect concentrations are associated with the chloride anion and not with the cation (CCME, 2011). In addition, as a component of water hardness, calcium has the effect of competing with and blocking heavy metal absorption and can decrease an organism's susceptibility to heavy metal toxicity (HC, 1987). Therefore, the measured calcium concentrations from the 2024 sampling program do not pose a risk to non-human biota in Lake Ontario.

Similarly, the measured concentrations of magnesium slightly exceeded the ecological screening criterion of 8,200 µg/L at most Lake Ontario locations, with a maximum concentration of 8,900 µg/L. However, magnesium is a naturally-occurring metal commonly found in surface water and is an essential element for all organisms. The concentrations observed during the 2024 sampling program are consistent with those reported in other Lake Ontario studies, which recorded a maximum concentration of 8,680 µg/L (Dove, 2009). In areas rich in magnesium-containing rocks, surface water can contain magnesium in the concentration range of 10,000 to 50,000 µg/L (HC, 1978). Maximum magnesium concentrations across all samples fell below this range. Additionally, magnesium concentrations did not exceed the U.S. EPA's freshwater screening benchmark of 82,000 µg/L (US EPA, 1993). For these reasons, magnesium is not expected to pose a risk for ecological receptors.

Total hexavalent chromium exceeded the applicable ecological guideline of 1 µg/L in LW2401-B, LW2404-B, and LW9-B during the fall 2024 sampling event. Similarly, the concentrations of total cobalt, copper, and silver exceeded their respective ecological and/or human guidelines in LW9-B during the same event. In contrast, the maximum measured concentrations of cobalt and silver in 2015 were below detection limits, while the maximum copper concentration in 2015 was considerably lower than that observed in LW9-B in 2024. Total hexavalent chromium was not screened in the 2015 samples. Since these metal exceedances were not detected in any other samples near the PN outfall, including the corresponding surface-water sample from the intake, and were below detection limits during the spring and summer sampling events, they likely reflect sporadic variations in lake water quality rather than impacts from PN operations.

The total coliform and *E. coli* levels in certain Lake Ontario surface water samples exceeded the Health Canada guideline that stipulates these microbial parameters must not be detectable (i.e., below method detection limit). However, it should be noted that, total coliforms, whose counts do not correlate well with the incidence of gastrointestinal illness, exceeded this guideline in many more locations than *E. coli*, which does. Ultimately though, both total coliforms and *E. coli* are naturally-occurring in the environment and are not released in the course of normal operations at PNGS. Thus, these levels are not considered hazardous and do not represent a risk from the PNGS.

Hydrazine exceeded the CCME screening guideline of 2.6 µg/L at the sampling station near the PNGS Units 5-8 outfall (LW21) in the spring sampling event with a concentration of 4.2 µg/L. Hydrazine is added to feedwater for oxygen removal and is discharged into the aquatic environment through boiler blowdown and flushing to the intake forebay. Boiler blowdown is

generally continuous and intermittent at PNGS Units 5-8 and intermittent at PNGS Units 1-4. As such, hydrazine concentrations in the CCW discharges from PNGS Units 1-4 and PNGS Units 5-8 are monitored weekly as a part of the ECA requirements for PNGS. Monitoring data indicated that during the week of the spring 2024 sampling event, the concentration of hydrazine in the CCW discharge from PNGS Units 5-8 was above the detection limit of 2 µg/L, measuring at 3 µg/L. However, concentrations fell below the detection limit in the following week. Additionally, 85% of samples from the PNGS Units 5-8 outfall were non-detect over the 2024 monitoring period, as were subsequent samples from LW21 in the 2024 surface water sampling program. Taken together, this suggests that the exceedance observed in spring 2024 was transient and infrequent, with no sustained risk.

Hydrazine is also classified by the International Agency for Research on Cancer (IARC) as a Group 1A carcinogen and the US EPA as a Group B2 carcinogen (probable human carcinogen), and by the European Commission as Category 2 for carcinogenicity (should be regarded as if it is carcinogenic to man). Although there is no Health Canada drinking water guideline for hydrazine, the US EPA estimated that a hydrazine concentration of 0.00001 mg/L corresponds to a cancer risk level of one in one million ($1x10^{-6}$) (EC and HC, 2011; US EPA, 1988), based on a drinking water intake rate of 2 L/day and no exposure amortization. The concentration at LW21 in the spring 2024 sampling event exceeds the drinking water value of 0.00001 mg/L.

The exceedance at LW21 is unlikely to pose a risk to the public for two key reasons. First, hydrazine has a short chemical half-life, ranging from 0.6 to 1.31 days (EC and HC, 2011), and degrades rapidly. Second, conditions during water treatment at nearby water supply plants (WSPs) such as Bowmanville and Oshawa WSPs further promote its degradation. The treatment process involves multiple chlorination steps using sodium hypochlorite, which increases pH, followed by pH adjustment with sulfuric acid (Durham Region, 2022a, 2022b). Hydrazine degradation is highly influenced by pH; alkaline conditions favour its degradation (Choudhary and Hansen, 1998). Additionally, degradation of hydrazine occurs through oxidation in the presence of oxygen; the reaction tends to be catalyzed (i.e., sped up) in the presence of certain compounds like Copper (II) and phosphate ions, which are likely to be present in some amount in drinking water. Hydrazine degradation is also favoured in the presence of organic matter, which also is likely to be present in drinking water. Hydrazine was found to decrease by more than 90% when added to chlorinated, filtered county water after 1 day (Choudhary and Hansen, 1998).

Follow-up hydrazine monitoring was conducted in 2025 to better characterize hydrazine concentrations in the lake water near PNGS and to provide additional information to understand the previous exceedance at LW21 (**Table A-5**). Samples were collected from stations LW21, LW10, LW9, FB1, and LWC1 (**Figure 4-5**). All samples exhibited hydrazine concentrations below the Method Detection Limit (≤0.15 µg/L). Taken together with the results from the 2024 water sampling program and the weekly ECA monitoring data from 2024, these findings suggest that the exceedance observed in spring 2024 was transient and infrequent, with no sustained risk to non-human biota from PNGS operations. Nevertheless, the potential risk associated with this exceedance will be quantitatively evaluated in the 2027 ERA.

No exceedances of the selected ecological or human health guidelines were identified for morpholine.

Frenchman's Bay

As highlighted in **Section 4.2.2.1.2**, the exceedances of the pH, ammonia, and total phosphorous in samples from Frenchman's Bay indicate that the area is nutrient-enriched and exhibits characteristics typical of a wetland.

As in 2015, aluminum, copper, and iron exceeded applicable ecological and/or human benchmarks in 2024 surface water samples from Frenchman's Bay. This is not uncommon for an area like Frenchman's Bay, which is heavily influenced by urban runoff.

Based on the maximum concentrations of these parameters in the 2015 surface water and sediment samples, the 2017 and 2022 PN ERAs found that the HQs for aluminum, copper, and iron exceeded the acceptable risk level of 1 for certain receptors (Aluminum: Muskrat, Bufflehead; Copper: Aquatic plants; Iron: Bufflehead, Trumpeter Swan, Common Tern, and Ring-billed Gull). The ERA concluded that as most of these receptors do not reside exclusively in Frenchman's Bay, the HQs presented were conservative, and the overall communities were not expected to be affected. Additionally, HQs calculated for ecological receptors using a surface water model to estimate aluminum and iron concentrations attributable to PN releases were all below 1. Since the maximum concentrations of aluminum and iron in surface water samples from 2024 are lower than those in 2015, and were below the relevant screening criteria in the associated sediment samples, the conclusions from the 2017 ERA still remain applicable.

Maximum and mean copper concentrations in surface water in 2024 are comparable to those from the 2015 sampling program. Additionally, the ERA determined that the contribution from PN operations to maximum and mean copper concentrations in water at Frenchman's Bay is low, ranging from 9% to 11%. Given the similarities in concentrations across the 2015 and 2024 sampling programs, the conclusions from the PN ERA regarding copper remain valid.

As with the Lake Ontario water samples, calcium and magnesium exceeded their respective ecological screening criteria derived using the LCV from Suter and Tsao (1996). However, as highlighted above, both are naturally occurring, essential elements that are required for biological processes. Magnesium concentrations also remained below the U.S. EPA's freshwater screening benchmark of 82,000 µg/L. While calcium and magnesium concentrations in Frenchman's Bay are slightly higher than those measured in Lake Ontario, this is likely driven by the natural wetland conditions in the area, including slower water exchange and interactions with calcium- and magnesium-rich sediments. Therefore, the calcium and magnesium levels in Frenchman's Bay are not expected to pose a risk to ecological receptors.

Exceedances of the ecological guideline for total hexavalent chromium were observed at LOC3 and PN5-1 during the summer and fall sampling events, and at PN10 in the fall. Hexavalent chromium was not specifically assessed in the PN ERA; however, measured concentrations of total chromium did not exceed applicable ecological guideline. Zirconium exceeded the selected

human health screening guideline of 0.32 µg/L at LOC1 during the summer sampling event. Zirconium was not detected in the 2015 samples, likely due to a higher analytical detection limit (1 µg/L) at the time. In 2024, the lower detection limit (0.1 µg/L) allowed for the identification of low-level background concentrations, with a maximum measured concentration of 0.39 µg/L. Neither chromium nor zirconium are associated with operations at the PN site, and the elevated concentrations observed in water samples from Frenchman's Bay are likely reflective of inputs from urban runoff. As such, it is unlikely that chromium or zirconium pose a risk to non-human or human receptors, respectively, from PN operations.

Finally, the estimated total coliform and *E. coli* bacteria concentrations in surface water samples from Frenchman's Bay in 2024 did not meet the associated Health Canada screening criteria which stipulates that these bacteria must not be detectable. However, as highlighted earlier, *E. coli* and other coliform bacteria are naturally-occurring in the environment and not considered to be hazardous. Though the levels of these bacteria were higher in surface water samples from Frenchman's Bay compared to those from Lake Ontario, this is expected as Frenchman's Bay and other coastal wetlands along the lake's shoreline have been shown to act as reservoirs for *E. coli* (Harrow-Lyle et al., 2024). This is likely due to internal sources such the increased presence of waterfowl and other wildlife, as well as environmental conditions (pH, temperature, moisture) that promote microbial growth. These total coliform and *E. coli* exceedances do not result from normal PNGS operations, and they are not deemed a risk to human health.

Table A-1: Surface Water Quality Screening Criteria for Spring 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria										Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Field Measurements																			
Field Temperature	N/A	Celsius	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Field Measured pH	N/A	pH	6.5-9.0	-	6.5-8.5	-	-	-	-	-	6.5-8.5	(3)	-	-	-	6.5 - 8.5	(19)	-	-[a]
Specific conductivity	N/A	µs/cm	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Conductivity	N/A	µs/cm	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Dissolved Oxygen (DO)	N/A	%	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Dissolved Oxygen (DO)	N/A	mg/L	< 6 **	-	-	-	-	-	-	-	< 6	(1)	-	-	-	-	-	-	-[a]
Turbidity	N/A	NTU	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Calculated Parameters																			
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Total Un-ionized Ammonia	0.0015	mg/L	0.019	-	0.02	-	-	-	-	-	0.019	(1)	-	-	-	-	-	-	-[a]
Total Hardness (CaCO3)	0.50	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Inorganics																			
Total Ammonia-N	0.050	mg/L	0.197[b]	-	-	-	-	-	-	-	0.197	(1)	-	-	-	-	-	-	-[a]
Total Biochemical Oxygen Demand (BOD)	2	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Conductivity	1.0	umho/cm	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Dissolved Organic Carbon	0.40	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Orthophosphate (P)	0.010	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
pH	N/A	pH	6.5-9.0	-	6.5-8.5	-	-	-	-	-	6.5-8.5	(3)	-	-	-	6.5 - 8.5	(19)	-	-[a]
Total Phosphorus	0.020	mg/L	-	-	-	0.02	-	-	-	-	0.02	(3)	-	-	-	-	-	-	-[a]
Total Residual Chlorine	0.003	mg/L	0.0005	-	0.002	-	-	-	-	-	0.002[c]	(3)	-	-	-	-	-	-	-[a]
Total Suspended Solids	1	mg/L	5 mg/L above the background value[d]	-	-	-	-	-	-	-	5.3	(1)	-	-	-	-	-	-	-[a]
Turbidity	0.1	NTU	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Nitrite (N)	0.010	mg/L	0.197	-	-	-	-	-	-	-	0.197	(1)	1	-	-	-	-	1	(16)
Nitrate (N)	0.10	mg/L	13	-	-	-	-	-	-	-	13	(1)	10	-	-	-	-	10	(16)
Nitrate + Nitrite (N)	0.10	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-
Metals																			
Dissolved Aluminum (Al)	0.5	µg/L	-	-	-	75[e]	-	-	-	-	75	(3)	-	-	-	-	-	2900	(16)
Total Aluminum (Al)	0.5	µg/L	100[f]	-	-	-	857.09	-	-	-	100	(1)	2900	-	-	-	-	2900	(16)
Dissolved Antimony (Sb)	0.02	µg/L	-	-	-	-	-	-	-	-	20	(3)	-	-	-	-	-	6	(16,17,18)

Parameter	Detection Limit	Units	Ecological screening criteria									Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Total Antimony (Sb)	0.02	µg/L	-	-	-	20	-	1600	-	-	20	(3)	6	6	6	-	-	6	(16,17,18)
Dissolved Arsenic (As)	0.02	µg/L	-	-	-	-	-	-	-	-	5	(1,3)	-	-	-	-	-	10	(16,17)
Total Arsenic (As)	0.02	µg/L	5	-	100	5	-	150	-	-	5	(1,3)	10	10	25	-	-	10	(16,17)
Dissolved Barium (Ba)	0.02	µg/L	-	-	-	-	-	-	-	-	2300	(12)	-	-	-	-	-	1000	(17,18)
Total Barium (Ba)	0.02	µg/L	-	-	-	-	-	2300	4	(14)[g]	2300	(12)	2000	1000	1000	-	-	1000	(17,18)
Dissolved Beryllium (Be)	0.01	µg/L	-	-	-	-	-	-	-	-	1100	(3)	-	-	-	-	-	4	(18)
Total Beryllium (Be)	0.01	µg/L	-	-	1100[h]	-	-	5.3	-	-	1100	(3)	-	-	4	-	-	4	(18)
Dissolved Bismuth (Bi)	0.005	µg/L	-	-	-	-	-	-	-	-	2.5	(15)	-	-	-	-	-	-	-[a]
Total Bismuth (Bi)	0.005	µg/L	-	-	-	-	-	-	2.5	(15)[i]	2.5	(15)	-	-	-	-	-	-	-[a]
Dissolved Boron (B)	10	µg/L	-	-	-	-	-	-	-	-	200	(3)	-	-	-	-	-	5000	(16,17,18)
Total Boron (B)	10	µg/L	1500	-	-	200	-	3550	-	-	200	(3)	5000	5000	5000	-	-	5000	(16,17,18)
Dissolved Cadmium (Cd)	0.005	µg/L	-	-	-	-	-	-	-	-	0.2	(1,3)	-	-	-	-	-	5	(17,18)
Total Cadmium (Cd)	0.005	µg/L	0.2[j]	-	0.2	0.5[k]	-	0.21	-	-	0.2	(1,3)	7	5	5	-	-	5	(17,18)
Dissolved Calcium (Ca)	10	µg/L	-	-	-	-	-	-	-	-	11600	(14)	-	-	-	-	-	-	-[a]
Total Calcium (Ca)	10	µg/L	-	-	-	-	-	-	11600	(14)[g]	11600	(14)	-	-	-	-	-	-	-[a]
Dissolved Cesium (Cs)	0.05	µg/L	-	-	-	-	-	-	-	-	315	(15)	-	-	-	-	-	1	(20)
Total Cesium (Cs)	0.05	µg/L	-	-	-	-	-	-	315	(15)[i]	315	(15)	-	-	-	1	(20)	1	(20)
Dissolved Chromium (Cr)	0.1	µg/L	-	-	-	-	-	-	-	-	64	(13)	-	-	-	-	-	50	(16,17,18)
Total Chromium (Cr)	0.1	µg/L	-	-	-	-	-	64	-	-	64	(13)	50	50	50	-	-	50	(16,17,18)
Chromium (VI)[s]	0.50	ug/L	1	-	1	-	5	-	-	-	1	(1,3)	50	50	25	-	-	25	(18)
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	-	1	-	5	11	-	-	1	(1,3)	50	-	25	-	-	25	(18)
Chromium (+3)[s]	0.5	ug/L	8.9	-	8.9	-	-	-	-	-	8.9	(1,3)	-	-	-	-	-	-	-[a]
Unfiltered Chromium (+3)	0.99	ug/L	8.9	-	8.9	-	-	-	-	-	8.9	(1,3)	-	-	-	-	-	-	-[a]
Dissolved Cobalt (Co)	0.005	µg/L	-	-	-	-	-	-	-	-	0.9	(3)	-	-	-	-	-	3	(18)
Total Cobalt (Co)	0.005	µg/L	-	-	-	0.9	1.13	5.2	-	-	0.9	(3)	-	-	3	-	-	3	(18)
Dissolved Copper (Cu)	0.05	µg/L	-	-	-	-	-	-	-	-	2.133	(6)	-	-	-	-	-	1000	(18)
Total Copper (Cu)	0.05	µg/L	2.95[l]	-	5	5[m]	2.133[n]	6.9	-	-	2.133	(6)	2000	-	1000	-	-	1000	(18)
Dissolved Iron (Fe)	1	µg/L	-	-	-	-	-	-	-	-	290	(8)	-	-	-	-	-	-	-[a]
Total Iron (Fe)	1	µg/L	300	-	300	-	290	-	-	-	290	(8)	-	-	-	-	-	-	-[a]
Dissolved Lead (Pb)	0.005	µg/L	-	-	-	-	6.82	-	-	-	6.82	(9)	-	-	-	-	-	5	(16)
Total Lead (Pb)	0.005	µg/L	4.41[o]	-	25[p]	5	-	2	-	-	4.41	(1)	5	10	10	-	-	5	(16)
Dissolved Lithium (Li)	0.5	µg/L	-	-	-	-	-	-	-	-	14	(14)	-	-	-	-	-	8	(21)
Total Lithium (Li)	0.5	µg/L	-	-	-	-	-	-	14	(14)[g]	14	(14)	-	-	-	8	(21)	8	(21)
Dissolved Magnesium (Mg)	10	µg/L	-	-	-	-	-	-	-	-	8200	(14)	-	-	-	-	-	-	-[a]
Total Magnesium (Mg)	10	µg/L	-	-	-	-	-	-	8200	(14)[g]	8200	(14)	-	-	-	-	-	-	-[a]
Dissolved Manganese (Mn)	0.05	µg/L	260[r]	-	-	-	-	-	-	-	260	(1)	-	-	-	-	-	120	(16)
Total Manganese (Mn)	0.05	µg/L	-	-	-	-	-	-	-	-	260	(1)	120	-	-	-	-	120	(16)
Dissolved Mercury (Hg)	0.01	ug/L	-	-	0.2	-	-	-	-	-	0.2	(3)	-	-	-	-	-	1	(16,17,18)

Parameter	Detection Limit	Units	Ecological screening criteria										Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Mercury (Hg)	0.01	ug/L	0.026	-	-	-	-	0.77	-	-	0.026	(1)	1	1	1	-	-	1	(16,17,18)
Dissolved Methyl Mercury	0.050	ng/L	-	-	-	-	-	-	-	-	4	(1)	-	-	-	-	-	-	-
Total Methyl Mercury	0.050	ng/L	4	-	-	-	-	-	-	-	4	(1)	-	-	-	-	-	-	-
Dissolved Molybdenum (Mo)	0.05	µg/L	-	-	-	-	-	-	-	-	40	(3)	-	-	-	-	-	70	(18)
Total Molybdenum (Mo)	0.05	µg/L	73	-	-	40	-	730	-	-	40	(3)	-	-	70	-	-	70	(18)
Dissolved Nickel (Ni)	0.02	µg/L	-	-	-	-	-	-	-	-	25	(3)	-	-	-	-	-	100	(18)
Total Nickel (Ni)	0.02	µg/L	116.2[k]	-	25	-	-	39	-	-	25	(3)	-	-	100	-	-	100	(18)
Dissolved Potassium (K)	10	µg/L	-	-	-	-	-	-	-	-	5300	(14)	-	-	-	-	-	-	-[a]
Total Potassium (K)	10	µg/L	-	-	-	-	-	-	5300	(14)[g]	5300	(14)	-	-	-	-	-	-	-[a]
Dissolved Selenium (Se)	0.04	µg/L	-	-	-	-	-	-	-	-	1	(1)	-	-	-	-	-	10	(18)
Total Selenium (Se)	0.04	µg/L	1	-	100	-	-	5	-	-	1	(1)	50	50	10	-	-	10	(18)
Dissolved Silicon (Si)	50	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-[a]
Total Silicon (Si)	50	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-[a]
Dissolved Silver (Ag)	0.005	µg/L	-	-	-	-	-	-	-	-	0.1	(3)	-	-	-	-	-	100	(18)
Total Silver (Ag)	0.005	µg/L	0.25	-	0.1	-	-	0.12	-	-	0.1	(3)	-	-	100	-	-	100	(18)
Dissolved Sodium (Na)	10	µg/L	-	-	-	-	-	-	-	-	180000	(13)	-	-	-	-	-	200000	(18)
Total Sodium (Na)	10	µg/L	-	-	-	-	-	180000	-	-	180000	(13)	-	-	200000	-	-	200000	(18)
Dissolved Strontium (Sr)	0.050	µg/L	-	-	-	-	-	-	-	-	2500	(10)	-	-	-	-	-	7000	(16)
Total Strontium (Sr)	0.050	µg/L	-	-	-	-	2500	-	-	-	2500	(10)	7000	-	-	-	-	7000	(16)
Dissolved Thallium (Tl)	0.002	µg/L	-	-	-	-	-	-	-	-	0.3	(3)	-	-	-	-	-	2	(18)
Total Thallium (Tl)	0.002	µg/L	0.8	-	-	0.3	-	40	-	-	0.3	(3)	-	-	2	-	-	2	(18)
Dissolved Thorium (Th)	0.05	µg/L	-	-	-	-	-	-	-	-	0.52	(15)	-	-	-	-	-	246	(22)
Total Thorium (Th)	0.05	µg/L	-	-	-	-	-	-	0.52	(15)[i]	0.52	(15)	-	-	-	246	(22)	246	(22)
Dissolved Tin (Sn)	0.2	µg/L	-	-	-	-	-	-	-	-	73	(14)	-	-	-	-	-	2400	(21)
Total Tin (Sn)	0.2	µg/L	-	-	-	-	-	-	73	(14)[g]	73	(14)	-	-	-	2400	(21)	2400	(21)
Dissolved Titanium (Ti)	0.5	µg/L	-	-	-	-	-	-	-	-	27.2	(15)	-	-	-	-	-	15	(23)
Total Titanium (Ti)	0.5	µg/L	-	-	-	-	-	-	27.2	(15)[i]	27.2	(15)	-	-	-	15[v]	(23)	15	(23)
Dissolved Tungsten (W)	0.01	µg/L	-	-	-	-	-	-	-	-	30	(3)	-	-	-	-	-	3.2	(21)
Total Tungsten (W)	0.01	µg/L	-	-	-	30	-	-	-	-	30	(3)	-	-	-	3.2	(21)	3.2	(21)
Dissolved Uranium (U)	0.002	µg/L	-	-	-	-	-	-	-	-	5	(3)	-	-	-	-	-	20	(16,17,18)
Total Uranium (U)	0.002	µg/L	15	-	5	5	-	33	-	-	5	(3)	20	20	20	-	-	20	(16,17,18)
Dissolved Vanadium (V)	0.2	µg/L	-	-	-	-	-	-	-	-	6	(3)	-	-	-	-	-	6.2	(18)
Total Vanadium (V)	0.2	µg/L	-	-	6	6	120	20	-	-	6	(3)	-	-	6.2	-	-	6.2	(18)
Dissolved Zinc (Zn)	0.1	µg/L	15.89[e]	-	-	-	-	-	-	-	15.89	(1)	-	-	-	-	-	5000	(18)
Total Zinc (Zn)	0.1	µg/L	-	-	30	20	-	89	-	-	20	(3)	-	-	5000	-	-	5000	(18)
Dissolved Zirconium (Zr)	0.1	µg/L	-	-	-	-	-	-	-	-	4	(3)	-	-	-	-	-	0.16	(21)
Total Zirconium (Zr)	0.1	µg/L	-	-	-	4	-	-	-	-	4	(3)	-	-	-	0.32	(21)	0.32	(21)
Volatile Organics																			

Parameter	Detection Limit	Units	Ecological screening criteria										Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Benzene	0.10	ug/L	370	-	-	100	-	-	-	-	100	(3)	5	1	5	-	-	1	(17)
Bromodichloromethane	0.10	ug/L	-	-	-	200	-	-	-	-	200	(3)	-	-	16	-	-	16	(18)
Bromoform	0.20	ug/L	-	-	-	60	-	-	-	-	60	(3)	-	-	25	-	-	25	(18)
Chloroform	0.10	ug/L	1.8	-	-	-	-	-	-	-	1.8	(1)	100	-	25	-	-	25	(18)
Ethylbenzene	0.10	ug/L	90	-	-	8	-	-	-	-	8	(3)	140	140	2.4	-	-	2.4	(18)
BTEX & F1 Hydrocarbons																-	-		
F1 (C6-C10)	25	ug/L	-	167	-	-	-	-	-	-	167	(2)	-	-	820	-	-	820	(18)
F1 (C6-C10) - BTEX	25	ug/L	-	167	-	-	-	-	-	-	167	(2)	-	-	820	-	-	820	(18)
F2-F4 Hydrocarbons																			
F2 (C10-C16 Hydrocarbons)	100	ug/L	-	42	-	-	-	-	-	-	42	(2)	-	-	300	-	-	300	(18)
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	1000	-	-	1000	(18)
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	1100	-	-	1100	(18)
Microbiological*																			
Background*	10	CFU/100mL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fecal coliform*	10	CFU/100mL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Coliforms*	10	CFU/100mL	-	-	-	-	-	-	-	-	100[w]	(3)	10	-	-	-	-	10	(16)
*Escherichia coli**	10	CFU/100mL	-	-	100	-	-	-	-	-	100	(3)	10	-	-	-	-	10	(16)
Radionuclides																			
H-3	14	Bq/kg	-	-	7000	-	-	-	-	-	-	-[u]	7000	-	-	-	-	-	-[u]
C-14	0.027	Bq/g	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Co-60	0.73	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Cs-134	0.75	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Cs-137	0.6	Bq/kg	-	-	50	-	-	-	-	-	-	-[u]	10	-	-	-	-	-	-[u]
I-131	1.2	Bq/kg	-	-	10	-	-	-	-	-	-	-[u]	6	-	-	-	-	-	-[u]
K-40	7.1	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Th-Series	1.8	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
U-Series	1.5	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Other Parameters																			
Hydrazine*	0.1	ug/L	-	-	-	-	2.6	-	-	-	2.6	(12)	-	-	-	0.01	(24)	0.01	(24)
Monomethyl Hydrazine*	0.25	ug/L	-	-	-	-	-	-	-	-	2.6	(12)	-	-	-	-	-	-	-
1,1-Dimethylhydrazine*	0.25	ug/L	-	-	-	-	-	-	-	-	2.6	(12)	-	-	-	-	-	-	-
Chlorophyll a	1.3	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Morpholine	4	ug/L	-	-	-	4	-	-	-	-	4	(3)	-	-	-	1700	(25)	1700	(25)

Note:
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline or benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (129.32 mg/L), pH (8.35), temperature (13.23°C), alkalinity (112.23 mg/L), and DOC (2.37 mg/L) from spring samples were used.
* Only censored results provided by lab.
** Lowest acceptable dissolved oxygen concentration for early life stages of warm water biota applies (6000 µg/L). This is the most conservative minimum bound for DO of all life stage and thermal types of biota presented in CCME.

† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
a The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
b Total Ammonia guideline (Long Term Concentration (mg/L) Table): Retrieved from: https://ccme.ca/en/chemical/5#_aql_fresh_concentration
c PWQO is selected as the benchmark for TRC, as there is no current methodology to reach the CCME guideline of 0.0005 mg/L.
d 5 mg/L above the mean background value was used according to the CCME CWQG "narrative" for clear flow. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).
e Dissolved Aluminum guideline: The Interim PWQO is 15 µg/L between pH 4.5 to 5.5, and 75 µg/L between pH 6.5 to 9.0. Between pH 5.5 - 6.5, no condition should be permitted which would increase the acid soluble inorganic aluminum concentration in clay-free samples to more than 10% above natural background concentrations for waters representative of that geological area of the Province that are unaffected by man-made inputs. The use of clay-free samples demonstrates that the method is better suited for measuring dissolved aluminum.
f Total Aluminum guideline (Long Term Concentration (µg/L) Variable): If pH < 6.5, the CWQG is 5 µg/L. If pH ≥ 6.5, the guideline is 100 µg/L.
g Secondary Chronic Values (SCV) were selected for COPCs. If the SCV was not available, the lowest LC50 value was modified by a safety factor of 10.
h Total Beryllium guideline (µg/L): If Hardness < 75 mg/L, the PWQO is 11 µg/L. If Hardness > 75 mg/L, then the PWQO is 1100 µg/L.
i To be conservative, the measured LC50 values of H. Azteca (software or hardwater) was divided by a safety factor of 10. If there is no measured value, the tap water LC50 (nominal) values were adjusted by a safety factor of 10, considering the water in Lake Ontario is similar to tap water used in this study.
j Total Cadmium guideline (Long Term concentration (µg/L) equation): When the water hardness is > 0 to < 17 mg/L, the CWQG is 0.04 µg/L. At hardness ≥ 17 to ≤ 280 mg/L, the CWQG is calculated as 10{0.83(log[hardness]) – 2.46}. At hardness > CWQG (µg/L) = 10{0.83(log[hardness]) – 2.46}.
k Total Cadmium guideline (µg/L): If Hardness 0-100 mg/L, the Interim PWQO is 0.1 µg/L. If Hardness > 100 mg/L, then the Interim PWQO is 0.5 µg/L.
l Total Copper guideline (Long Term concentration (µg/L) equation): When the water hardness is 0 to < 82 mg/L, the CWQG is 2 µg/L. At hardness ≥82 to ≤180 mg/L the CWQG is calculated using this equation: 0.2 * e{0.8545[ln(hardness)]-1.465}. At hardness >180 mg/L, the CWQG is 4 µg/L.
m Total Copper guideline (µg/L): If Hardness 0-20 mg/L, the Interim PWQO is 1 µg/L. If Hardness > 20 mg/L, then the Interim PWQO is 5 µg/L.
n Copper Biotic Ligand Model from ECCC
o Total Lead guideline (Long Term concentration (µg/L) equation): When the hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L. At hardness >60 to ≤ 180 mg/L the CWQG is calculated as e{1.273[ln(hardness)]-4.705}. At hardness >180 mg/L, the CWQG is 7 µg/L. At hardness >180 mg/L, the CWQG is 7 µg/L.
p Total Lead guideline: If Hardness is 30-80 mg/L, then the Interim PWQO is 3 µg/L. If Hardness is > 80 mg/L, then the Interim PWQO is 5 µg/L.
r Dissolved Manganese concentration (Long Term concentration (µg/L) equation): Calculated using the CWQG calculator in Appendix B of the Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese. Retrieved from:
https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fccme.ca%2Fen%2Fres%2F2019-manganese-cwqg-scd-appendix-b-en.xlsx&wdOrigin=BROWSELINK
s Total Nickel guideline (Long Term concentration (µg/L) equation): When the water hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L. At hardness > 60 to ≤ 180 mg/L the CWQG is calculated as e{0.76[ln(hardness)]+1.06}. At hardness >180 mg/L, the CWQG is 150 µg/L.
t Dissolved Zinc guideline (Long Term concentration (µg/L) equation): The CWQG is calculated as exp(0.947[ln(hardness mg·L-1)] - 0.815[pH] + 0.398[ln(DOC mg·L-1)] + 4.625).
This equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1, which is the range of data used to derive the hardness, pH and DOC slopes.
u Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).
v Upper range limit (0.5 - 15 µg/L) of titanium concentrations found in an investigation of 42 municipal water supplies in the United States (Durfor & Becker, 1964).
w The screening guideline for E.coli was conservatively applied to screen total coliforms.

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Table A-2: Screening of Surface Water Quality Parameters in Spring 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Field Measurements																										
Field Temperature	N/A	Celsius	-	-[a]	-	-[a]	10.100	9.400	12.500	9.200	11.900	9.900	12.300	9.030	12.300	9.030	17.600	13.500	10.600	20.900	13.400	10.400	17.300	17.400	17.600	17.300	15.800	13.600
Field Measured pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.120	8.120	8.250	8.330	8.270	8.350	8.320	8.360	8.350	8.360	8.290	8.350	8.310	8.230	8.400	8.420	8.340	**8.510**	**8.560**	**8.590**	8.500	8.440
Specific conductivity	N/A	µs/cm	-	-[a]	-	-[a]	303	303	340	421	340	320	335	310	330	316	321	324	336	335	399	319	869	843	796	744	625	704
Conductivity	N/A	µs/cm	-	-[a]	-	-[a]	217.9	217.5	258.2	217.9	254.9	225	253.2	213.7	248.8	219.9	280.4	284.4	243.2	308.4	311	230.7	739	721	685	639	516	604
Dissolved Oxygen (DO)	N/A	%	-	-[a]	-	-[a]	107.9	108.2	115.1	109.1	114.6	109.8	115.1	109.5	114.7	110.1	124	116.4	113	132.2	113.2	115.3	10.24	115.8	122.8	122.9	114.5	118.7
Dissolved Oxygen (DO)	N/A	mg/L	< 6	(1)	-	-[a]	12.130	12.370	12.250	12.540	12.330	12.440	12.300	12.740	12.320	12.340	11.920	12.150	12.580	12.240	11.810	12.590	10.250	11.060	11.690	11.740	11.310	11.520
Turbidity	N/A	NTU	-	-[a]	-	-[a]	-0.52	-0.53	-0.34	-0.46	-0.37	-0.48	-0.37	-0.48	-0.37	-0.48	-0.18	-0.43	-0.5	0.37	1.6	-0.34	9.72	11.9	6.5	4.68	10.34	5.26
Calculated Parameters																										
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	111.000	110.000	120.000	123.000	125.000	118.000	120.000	121.000	125.000	121.000	115.000	112.000	116.000	115.000	125.000	115.000	192.000	184.000	179.000	169.000	166.000	165.000
Total Un-ionized Ammonia	0.0015	mg/L	0.019	(1)	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.010	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	120.000	119.000	116.000	121.000	120.000	116.000	120.000	114.000	118.000	117.000	117.000	114.000	117.000	117.000	120.000	117.000	161.000	161.000	187.000	177.000	138.000	138.000
Inorganics																										
Total Ammonia-N	0.050	mg/L	0.197	(1)	-	-[a]	0.019	0.041	0.010	-0.010	0.019	0.022	0.017	0.015	0.018	0.015	0.015	0.049	0.059	0.120	0.064	0.018	0.046	0.000	0.003	0.012	0.016	0.024
Total Biochemical Oxygen Demand (BOD)	2	mg/L	-	-[a]	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.000	3.000	5.000	3.000	3.000	3.000
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-[a]	-	-[a]	4.300	5.700	8.300	4.000	5.500	4.700	5.500	5.500	5.100	5.500	4.300	7.800	5.700	4.300	9.200	4.600	24.000	19.000	19.000	15.000	13.000	18.000
Conductivity	1.0	umho/cm	-	-[a]	-	-[a]	300.000	310.000	330.000	360.000	340.000	330.000	350.000	340.000	330.000	340.000	330.000	330.000	340.000	340.000	350.000	330.000	920.000	880.000	810.000	780.000	660.000	730.000
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-[a]	-	-[a]	0.150	0.170	0.260	0.270	0.250	0.230	0.200	0.280	0.260	0.280	0.200	0.300	0.170	0.240	0.290	0.240	0.420	0.420	0.360	0.360	0.390	0.320
Dissolved Organic Carbon	0.40	mg/L	-	-[a]	-	-[a]	1.900	1.900	1.800	1.900	1.800	1.900	2.000	1.800	1.900	1.800	1.900	2.000	1.900	1.900	1.900	1.900	3.900	4.100	3.900	3.500	3.200	3.400
Orthophosphate (P)	0.010	mg/L	-	-[a]	-	-[a]	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	-0.000	-0.000	-0.000	0.000	0.000	-0.000
pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.070	8.180	8.170	8.210	8.200	8.240	8.180	8.250	8.120	8.250	8.230	8.230	8.250	8.220	8.220	8.220	8.150	8.180	8.280	8.140	8.200	8.210
Total Phosphorus	0.020	mg/L	0.02	(3)	-	-[a]	0.000	-0.000	0.004	0.001	0.006	0.008	0.004	0.002	0.004	0.002	0.003	0.017	0.010	0.003	0.013	0.003	**0.023**	**0.025**	0.020	0.013	0.015	0.017
Total Residual Chlorine	0.003	mg/L	0.002[c]	(3)	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Suspended Solids	1	mg/L	5.3	(1)	-	-[a]	0.000	0.600	0.400	0.400	0.400	0.400	0.600	0.400	0.600	0.400	0.800	0.800	0.400	1.000	0.800	1.000	**19.000**	**19.000**	**24.000**	**12.000**	**14.000**	**11.000**
Turbidity	0.1	NTU	-	-[a]	-	-[a]	0.200	0.200	0.200	0.300	0.300	0.200	0.300	0.200	0.400	0.200	0.200	0.200	0.200	0.200	0.500	0.300	5.500	4.500	4.500	4.000	3.800	6.300
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-[a]	-	-[a]	94.000	95.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	96.000	97.000	98.000	100.000	99.000	170.000	160.000	150.000	150.000	130.000	130.000
Nitrite (N)	0.010	mg/L	0.197	(1)	1	(16)	0.001	0.000	-0.000	-0.000	0.001	0.001	0.002	0.001	0.001	0.001	-0.001	0.000	0.001	0.002	-0.000	-0.000	0.008	0.006	0.001	0.003	0.003	0.004
Nitrate (N)	0.10	mg/L	13	(1)	10	(16)	0.290	0.290	0.320	0.520	0.610	0.380	0.560	0.350	0.480	0.350	0.550	0.480	0.720	0.640	0.400	0.400	0.000	0.000	0.000	0.000	0.000	0.000
Nitrate + Nitrite (N)	0.10	mg/L	-	-[a]	-	-	0.290	0.290	0.320	0.520	0.610	0.380	0.560	0.350	0.480	0.350	0.550	0.480	0.720	0.640	0.400	0.400	-0.022	0.023	-0.003	-0.004	0.075	0.056
Metals																										
Dissolved Aluminum (Al)	0.5	µg/L	75	(3)	2900	(16)	42.300	10.800	3.770	5.180	2.260	3.560	2.400	2.240	2.000	2.240	1.670	2.370	2.500	1.900	4.410	2.510	4.050	3.680	2.630	2.300	2.790	7.850
Total Aluminum (Al)	0.5	µg/L	100	(1)	2900	(16)	2.63	5.59	6.20	2.23	5.41	3.37	4.71	6.00	6.19	6.00	3.93	4.41	36.60	4.31	11.30	6.18	**126.00**	**146.00**	**108.00**	56.50	81.40	84.00
Dissolved Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.149	0.143	0.155	0.136	0.137	0.131	0.133	0.136	0.134	0.136	0.130	0.132	0.141	0.131	0.148	0.127	0.280	0.245	0.240	0.232	0.227	0.243
Total Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.145	0.141	0.130	0.132	0.148	0.126	0.133	0.129	0.139	0.129	0.131	0.135	0.137	0.130	0.133	0.128	0.236	0.231	0.254	0.246	0.185	0.240

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario															Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.780	0.827	0.766	0.714	0.701	0.713	0.710	0.721	0.716	0.721	0.704	0.708	0.711	0.688	0.660	0.692	0.561	0.551	0.528	0.536	0.593	0.616
Total Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.818	0.842	0.716	0.684	0.689	0.692	0.681	0.703	0.706	0.703	0.718	0.714	0.692	0.688	0.715	0.715	0.544	0.578	0.625	0.654	0.576	0.794
Dissolved Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	21.70	21.10	23.70	22.00	22.50	21.80	21.70	22.20	21.90	22.20	21.50	21.80	21.80	21.60	25.10	21.90	41.20	39.40	37.70	37.20	36.40	36.70
Total Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	23.10	23.10	21.20	21.50	21.70	21.00	21.20	21.60	21.60	21.60	21.60	21.60	21.40	21.40	23.00	22.10	37.20	37.10	42.20	40.30	30.50	32.40
Dissolved Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.003	0.005	-0.000	-0.001	0.005	0.001	0.001	0.010	0.006	0.010	-0.000	-0.001	0.001	-0.001	-0.001	0.000	0.004	-0.002	0.001	0.002	-0.002	-0.000
Total Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.006	0.005	0.004	0.007	0.002	0.004	0.003	0.003	0.002	0.003	-0.000	0.003	-0.000	-0.000	-0.001	-0.001	0.012	0.016	-0.000	0.007	-0.002	0.057
Dissolved Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	0.009	0.000	0.002	0.000	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.000	-0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.001
Total Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	-0.001	0.000	0.001	0.001	0.002	0.000	0.002	0.001	0.002	0.001	-0.000	0.000	0.000	-0.000	0.000	-0.000	0.005	0.007	0.006	0.004	0.003	0.014
Dissolved Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	22.000	22.000	24.000	27.000	25.000	24.000	26.000	24.000	26.000	24.000	24.000	24.000	26.000	24.000	25.000	22.000	39.000	37.000	35.000	34.000	32.000	32.000
Total Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	25.000	24.000	23.000	26.000	25.000	23.000	27.000	23.000	25.000	23.000	23.000	22.000	24.000	24.000	21.000	21.000	42.000	40.000	37.000	35.000	41.000	40.000
Dissolved Cadmium (Cd)	0.005	µg/L	0.2	(1,3)	5	(17,18)	0.007	0.004	0.003	0.003	0.004	0.002	0.002	0.003	0.003	0.003	0.004	0.003	0.004	0.004	0.003	0.003	0.000	-0.000	0.001	0.001	0.001	0.001
Total Cadmium (Cd)	0.005	µg/L	0.2	(1,3)	5	(17,18)	0.003	0.004	0.003	0.007	0.005	0.003	0.005	0.005	0.004	0.005	0.004	0.005	0.003	0.003	0.004	0.003	0.017	0.030	0.008	0.007	0.007	0.024
Dissolved Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**31100**	**31000**	**33400**	**35000**	**35800**	**33800**	**34300**	**34200**	**36100**	**34200**	**33100**	**32100**	**33100**	**33100**	**36800**	**33200**	**61800**	**58400**	**56800**	**52600**	**51700**	**51500**
Total Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**33800**	**33600**	**32300**	**33900**	**34000**	**32900**	**34000**	**33000**	**33300**	**33000**	**33000**	**32000**	**33200**	**33100**	**34200**	**33200**	**51500**	**51300**	**60000**	**56200**	**42600**	**42800**
Dissolved Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.004	0.002	0.002	0.004	0.003	0.001	0.001	0.001	0.005	0.001	0.003	0.003	0.003	0.003	0.003	0.002	-0.001	0.002	0.001	0.001	-0.001	0.000
Total Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.003	0.003	0.003	0.005	0.004	0.002	0.005	0.004	0.063	0.004	0.002	0.003	0.004	0.002	0.002	0.002	0.018	0.020	0.008	0.006	0.009	0.011
Dissolved Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.100	0.110	0.088	0.075	0.099	0.190	0.110	0.077	0.093	0.077	0.080	0.094	0.091	0.079	0.077	0.100	0.120	0.051	0.061	0.083	0.043	0.110
Total Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.120	0.100	0.091	0.130	0.120	0.080	0.092	0.170	0.110	0.170	0.180	0.100	0.130	0.100	0.140	0.110	0.270	0.660	0.220	0.160	0.210	0.220
Chromium (VI)[†]	0.50	ug/L	1	(1,3)	25	(18)	0.196	0.194	0.230	0.233	0.209	0.201	0.225	0.175	0.205	0.218	0.260	0.147	0.215	0.213	0.238	0.187	0.145	0.177	0.172	0.150	0.175	0.159
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	(1,3)	25	(18)	0.580	0.960	0.350	-0.250	-0.130	-0.100	-0.240	-0.200	-0.070	-0.200	0.100	0.240	0.230	0.360	0.210	0.480	0.000	-0.020	-0.550	0.270	0.030	-0.210
Chromium (+3)[‡]	0.5	ug/L	8.9	(1,3)	-	-[a]	0.104	0.113	0.000	0.000	0.000	0.189	0.105	0.166	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.104	0.123	0.000	0.000	0.000	0.000	0.114
Unfiltered Chromium (+3)	0.99	ug/L	8.9	(1,3)	-	-[a]	0.116	0.103	0.000	0.126	0.120	0.000	0.000	0.114	0.108	0.169	0.184	0.101	0.129	0.101	0.137	0.112	0.271	0.657	0.223	0.156	0.215	0.221
Dissolved Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.017	0.011	0.011	0.023	0.023	0.015	0.019	0.012	0.020	0.012	0.017	0.014	0.021	0.019	0.018	0.014	0.038	0.036	0.032	0.030	0.032	0.033
Total Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.010	0.010	0.011	0.024	0.023	0.011	0.021	0.014	0.027	0.014	0.018	0.015	0.023	0.018	0.018	0.015	0.105	0.139	0.107	0.076	0.069	0.087
Dissolved Copper (Cu)	0.05	µg/L	2.133	(6)	1000	(18)	0.925	0.721	0.790	0.834	0.751	0.664	0.720	0.725	0.707	0.725	0.777	0.762	0.714	0.736	0.711	0.693	0.578	0.627	0.602	0.627	0.693	1.110
Total Copper (Cu)	0.05	µg/L	2.133	(6)	1000	(18)	0.733	0.770	0.642	0.769	0.778	0.631	0.746	0.664	0.780	0.664	1.250	0.776	0.825	0.887	0.775	0.712	1.090	1.290	1.250	1.040	1.030	1.780
Dissolved Iron (Fe)	1	µg/L	290	(8)	-	-[a]	6.30	8.80	2.10	9.20	1.80	3.70	2.20	1.60	2.00	1.60	1.50	2.20	3.20	1.30	4.00	5.80	10.90	8.50	6.40	6.40	11.40	11.40
Total Iron (Fe)	1	µg/L	290	(8)	-	-[a]	2.50	3.50	3.70	2.70	9.60	4.90	10.50	4.60	9.40	4.60	8.80	6.60	8.40	7.30	15.30	12.20	**320.00**	**324.00**	**309.00**	177.00	187.00	212.00
Dissolved Lead (Pb)	0.005	µg/L	6.82	(9)	5	(16)	0.279	0.111	0.020	0.013	0.017	0.017	0.012	0.007	0.007	0.007	0.009	0.016	0.010	0.007	0.016	0.012	0.067	0.027	0.016	0.015	0.028	0.039
Total Lead (Pb)	0.005	µg/L	4.41	(1)	5	(16)	0.021	0.034	0.009	0.010	0.019	0.008	0.019	0.016	0.023	0.016	0.015	0.032	0.025	0.013	0.036	0.025	0.554	0.605	0.612	0.385	0.369	0.420
Dissolved Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.630	1.470	1.670	1.720	1.780	1.640	1.730	1.650	1.680	1.650	1.720	1.690	1.800	1.730	1.830	1.650	2.310	2.250	2.290	2.350	2.150	2.420
Total Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.590	1.620	1.680	1.780	1.740	1.750	1.750	1.790	1.770	1.790	1.660	1.480	1.600	1.590	1.620	1.560	2.360	2.430	2.310	2.250	2.270	2.640
Dissolved Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	8000	7900	**8890**	**8510**	**8670**	8200	**8320**	**8600**	**8380**	**8600**	7980	7800	8060	7940	8070	7760	**9190**	**9150**	**9150**	**9160**	**8870**	**8920**
Total Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	**8620**	**8630**	**8560**	**8740**	**8540**	**8280**	**8480**	**8400**	**8520**	**8400**	**8350**	**8220**	**8340**	**8280**	**8430**	8170	7850	7890	**9040**	**8970**	7680	7600
Dissolved Manganese (Mn)	0.05	µg/L	260	(1)	120	(16)	1.020	0.675	0.744	2.020	1.630	0.834	1.530	0.637	1.310	0.637	1.310	1.010	1.590	1.360	2.050	0.978	9.190	8.070	4.340	2.280	3.920	12.000
Total Manganese (Mn)	0.05	µg/L	260	(1)	120	(16)	0.474	0.538	0.651	1.650	2.000	0.798	1.730	0.730	1.630	0.730	1.590	1.350	2.090	1.650	2.680	2.310	66.700	66.400	79.500	64.100	49.700	57.600
Dissolved Mercury (Hg)	0.01	ug/L	0.2	(3)	1	(16,17,18)	0.003	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.002	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.003	0.001	0.002	0.002	0.002

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario															Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Mercury (Hg)	0.01	ug/L	0.026	(1)	1	(16,17,18)	0.0007	0.000	0.003	0.002	0.003	0.002	0.003	0.003	0.002	0.002	0.001	0.002	0.002	0.001	0.001	0.001	0.003	0.002	0.002	0.002	0.003	0.002
Dissolved Methyl Mercury	0.050	ng/L	4	(1)	-	-	0.066	0.048	0.039	0.024	0.031	0.013	0.025	0.017	0.014	0.016	0.030	0.022	0.021	0.011	0.010	0.010	0.024	0.012	0.027	0.060	0.015	0.014
Total Methyl Mercury	0.050	ng/L	4	(1)	-	-	0.032	0.012	0.014	0.070	0.018	0.015	0.012	0.001	0.014	0.008	0.013	0.019	0.032	0.053	0.022	0.016	0.001	0.001	0.005	0.026	0.022	0.011
Dissolved Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.170	1.120	1.280	1.210	1.190	1.160	1.220	1.140	1.170	1.140	1.190	1.180	1.290	1.200	1.210	1.170	1.350	1.340	1.330	1.330	1.350	1.380
Total Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.230	1.220	1.120	1.200	1.170	1.110	1.180	1.140	1.210	1.140	1.210	1.170	1.260	1.210	1.160	1.150	1.110	1.150	1.370	1.360	1.090	1.120
Dissolved Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.668	0.536	0.592	0.567	0.574	0.513	0.523	0.548	0.495	0.548	0.838	0.549	0.606	0.562	0.495	0.505	0.535	0.553	0.521	0.533	0.533	0.557
Total Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.553	0.565	0.503	0.562	0.569	0.484	0.549	0.529	0.571	0.529	0.794	0.541	0.685	0.724	0.591	0.507	0.630	0.730	0.752	0.609	0.610	0.690
Dissolved Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1470	1480	1700	1790	1860	1580	1720	1640	1680	1640	1700	1640	1830	1770	1680	1590	2210	2160	2120	2050	2030	2050
Total Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1570	1610	1580	1750	1800	1570	1770	1600	1680	1600	1680	1650	1840	1760	1660	1570	1870	1910	2160	2130	1730	1760
Dissolved Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.124	0.136	0.119	0.123	0.131	0.131	0.138	0.118	0.126	0.118	0.136	0.128	0.148	0.135	0.120	0.119	0.095	0.094	0.105	0.099	0.105	0.117
Total Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.143	0.149	0.123	0.138	0.132	0.132	0.139	0.117	0.125	0.108	0.137	0.113	0.131	0.142	0.127	0.122	0.124	0.101	0.131	0.125	0.094	0.123
Dissolved Silicon (Si)	50	µg/L	-	-	-	-[a]	332	304	224	280	260	217	251	226	256	226	268	267	290	279	354	265	1090	1090	1090	987	856	742
Total Silicon (Si)	50	µg/L	-	-	-	-[a]	359	325	216	265	263	216	250	253	236	224	270	266	278	278	258	264	1070	1140	1230	1080	821	721
Dissolved Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	0.003	0.002	0.000	0.001	0.001	0.000	0.000	0.002	0.001	0.002	0.002	0.004	0.002	0.002	0.001	0.002	0.000	0.000	0.000	0.001	0.001	0.002
Total Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	0.001	-0.000	0.000	0.001	0.001	-0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.002	0.003	0.001	0.003	0.008
Dissolved Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	12700	12500	15500	17200	17300	14600	16400	15100	16200	15100	15800	14900	16700	16300	30100	15600	92900	87200	85100	78000	66700	66700
Total Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	13600	13600	14700	17000	17000	14700	16700	14800	16300	14800	15700	15200	16700	16000	17600	15600	78300	74600	84000	77600	52500	58600
Dissolved Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	175	174	207	193	198	190	193	195	191	195	176	174	181	177	197	176	304	298	273	260	276	296
Total Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	189	192	174	178	178	172	175	174	175	174	176	173	176	172	178	175	258	256	294	297	226	250
Dissolved Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.006	0.005	0.008	0.006	0.007	0.007	0.006	0.007	0.006	0.007	0.006	0.007	0.008	0.006	0.005	0.007	0.001	0.000	-0.001	-0.000	0.001	0.002
Total Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.006	0.007	0.005	0.006	0.004	0.006	0.005	0.005	0.005	0.005	0.006	0.007	0.006	0.005	0.007	0.007	0.004	0.007	0.004	0.002	0.003	0.004
Dissolved Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.004	0.003	-0.001	0.003	0.006	0.006	0.002	0.003	0.003	0.003	-0.003	0.004	0.013	-0.002	-0.001	-0.001	0.003	0.005	-0.002	-0.002	0.005	0.001
Total Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.004	0.004	-0.003	-0.000	-0.001	0.003	-0.002	-0.001	0.001	-0.001	0.010	0.005	0.005	0.007	0.007	0.013	0.027	0.023	0.025	0.020	0.017	0.014
Dissolved Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.031	0.083	0.066	0.009	0.021	0.028	0.027	0.051	0.017	0.051	0.041	1.130	0.043	0.021	0.010	0.037	0.029	0.030	0.019	0.081	0.018	0.123
Total Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.013	0.028	0.011	0.015	0.010	0.008	0.004	0.185	0.017	0.185	0.024	0.012	0.380	0.013	0.010	0.012	0.034	0.036	0.032	0.026	0.022	0.042
Dissolved Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	0.306	0.256	0.246	0.344	0.198	0.278	0.160	0.206	0.143	0.206	0.118	0.153	0.213	0.149	0.147	0.159	0.140	0.155	-0.156	-0.112	0.187	0.267
Total Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	0.016	0.024	-0.041	-0.114	0.135	0.032	0.031	-0.007	0.036	-0.007	0.171	0.082	0.190	0.073	0.335	0.240	5.600	6.400	5.780	3.090	3.900	3.700
Dissolved Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.073	0.076	0.083	0.073	0.074	0.077	0.076	0.079	0.075	0.079	0.080	0.071	0.089	0.076	0.071	0.078	0.053	0.048	0.046	0.048	0.060	0.065
Total Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.077	0.082	0.069	0.072	0.071	0.070	0.072	0.074	0.070	0.074	0.078	0.071	0.080	0.073	0.071	0.071	0.051	0.044	0.056	0.059	0.056	0.056
Dissolved Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.369	0.360	0.407	0.365	0.379	0.363	0.366	0.370	0.361	0.370	0.365	0.353	0.368	0.340	0.387	0.364	0.529	0.511	0.525	0.519	0.469	0.441
Total Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.379	0.379	0.371	0.379	0.373	0.366	0.372	0.367	0.375	0.367	0.362	0.369	0.368	0.352	0.385	0.363	0.474	0.451	0.504	0.491	0.400	0.388
Dissolved Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.450	0.193	0.240	0.210	0.210	0.250	0.210	0.220	0.210	0.220	0.196	0.184	0.191	0.196	0.230	0.195	0.450	0.470	0.370	0.360	0.380	0.360
Total Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.172	0.210	0.149	0.144	0.153	0.139	0.150	0.380	0.150	0.380	0.126	0.140	0.194	0.133	0.230	0.135	0.760	0.800	0.860	0.660	0.540	0.520
Dissolved Zinc (Zn)	0.1	µg/L	15.89	(1)	5000	(18)	4.380	7.540	0.920	0.580	0.600	1.800	0.920	0.760	0.670	0.760	5.020	0.650	1.460	0.770	0.630	1.660	0.800	1.520	0.350	0.220	0.280	0.870
Total Zinc (Zn)	0.1	µg/L	20	(3)	5000	(18)	0.380	5.240	0.840	0.610	0.900	0.410	1.400	8.720	4.760	8.720	2.420	1.000	1.620	0.770	0.810	0.550	3.400	4.800	2.830	1.650	2.200	6.500
Dissolved Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.010	0.010	0.012	0.012	0.018	0.006	0.010	0.011	0.013	0.011	0.014	0.039	0.038	0.013	0.013	0.020	0.019	0.019	0.021	0.016	0.022	0.017
Total Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.009	0.004	0.006	0.014	0.009	0.016	0.016	0.014	0.011	0.014	0.006	0.015	0.011	0.019	0.018	0.013	0.060	0.072	0.035	0.044	0.032	0.043
Volatile Organics																												

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																					
							Lake Ontario																		Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Benzene	0.10	ug/L	100	(3)	1	(17)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.170
Bromodichloromethane	0.10	ug/L	200	(3)	16	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bromoform	0.20	ug/L	60	(3)	25	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloroform	0.10	ug/L	1.8	(1)	25	(18)	0.000	0.000	0.110	0.000	0.110	0.000	0.110	0.000	0.000	0.000	0.000	0.000	0.160	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ethylbenzene	0.10	ug/L	8	(3)	2.4	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BTEX & F1 Hydrocarbons																												
F1 (C6-C10)	25	ug/L	167	(2)	820	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F1 (C6-C10) - BTEX	25	ug/L	167	(2)	820	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F2-F4 Hydrocarbons																												
F2 (C10-C16 Hydrocarbons)	100	ug/L	42	(2)	300	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	1000	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	1100	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Microbiological*																												
Background*	10	CFU/100mL	-	-	-	-	<10	320.00	310.00	360	1200	840	620	420	680	440	440	680	200	190	420	440	2200	3100	2600	2100	2600	38000
Fecal coliform*	10	CFU/100mL	-	-	-	-	<10	<10	10.00	<10	10	<10	<10	<10	20	<10	<10	<10	<10	<10	<10	10	<10	20	10	10	10	780
Total Coliforms*	10	CFU/100mL	100ᵠ	(3)	10	(16)	<10	<10	**50**	**40**	**510**	10	**60**	<10	**140**	10	**520**	**30**	**30**	**20**	**20**	10	**1500**	**3400**	**940**	**30**	**70**	**14000**
*Escherichia coli**	10	CFU/100mL	100	(3)	10	(16)	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	10	**20**	<10	<10	<10	**480**
Radionuclides																												
H-3	14	Bq/kg	-	-ᵘ	-	-ᵘ	-5.270	15.900	5.310	5.280	5.300	0.000	5.300	0.000	5.300	5.310	31.700	21.200	0.000	15.900	26.500	15.800	31.800	37.100	31.800	37.000	31.800	31.600
C-14	0.027	Bq/g	-	-ᵘ	-	-ᵘ	-0.050	-0.047	-0.039	-0.045	-0.043	-0.042	-0.044	-0.038	-0.043	-0.054	-0.037	-0.034	-0.045	-0.046	-0.031	-0.041	-0.033	-0.027	-0.031	-0.036	-0.037	-0.046
Co-60	0.73	Bq/kg	-	-ᵘ	-	-ᵘ	-0.352	0.513	0.036	0.389	0.053	0.149	-0.182	0.069	-0.067	-0.079	-0.197	0.050	0.298	-0.253	0.163	0.054	-0.087	-0.147	0.080	-0.170	-0.133	-0.086
Cs-134	0.75	Bq/kg	-	-ᵘ	-	-ᵘ	0.145	-0.110	0.111	0.173	-0.110	-0.232	0.211	-0.151	0.373	0.231	-0.080	-0.070	-0.226	0.199	-0.084	0.309	-0.281	-0.127	0.129	0.121	0.146	-0.070
Cs-137	0.6	Bq/kg	-	-ᵘ	-	-ᵘ	0.275	-0.214	0.129	-0.044	-0.110	0.258	0.271	0.209	-0.361	0.174	0.353	0.057	0.042	0.306	-0.506	0.190	0.314	-0.369	-0.653	-0.464	0.196	0.105
I-131	1.2	Bq/kg	-	-ᵘ	-	-ᵘ	0.198	0.029	-0.043	-0.986	0.065	0.051	-0.003	-0.517	-0.850	0.428	1.080	0.719	-0.332	-1.030	0.730	-0.938	0.333	-0.291	0.373	0.580	-0.334	0.290
K-40	7.1	Bq/kg	-	-ᵘ	-	-ᵘ	2.670	-0.125	-0.757	1.090	2.490	4.960	2.410	8.370	-0.924	0.004	2.760	1.520	-3.400	3.090	0.999	2.820	5.800	-1.710	0.960	22.300	-2.070	-4.050
Th-Series	1.8	Bq/kg	-	-ᵘ	-	-ᵘ	-2.040	-0.468	-0.122	0.731	-0.691	-0.866	0.271	-0.425	-0.563	-1.390	1.470	-0.295	-1.980	0.551	0.618	-1.430	-0.501	1.250	-0.086	1.540	0.440	-0.577
U-Series	1.5	Bq/kg	-	-ᵘ	-	-ᵘ	0.911	1.340	0.274	1.220	-0.016	0.566	0.213	0.173	1.100	0.154	0.452	0.292	-0.901	0.587	-0.454	-1.020	-0.331	0.076	0.149	-0.245	0.228	0.087
Other Parameters																												
Hydrazine*	0.1	ug/L	2.6	(12)	0.01	(24)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	**4.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Monomethyl Hydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorophyll a	1.3	ug/L	-	-	-	-	1.400	0.019	1.232	1.300	1.241	2.200	1.500	1.600	1.300	1.600	2.000	1.500	2.400	2.300	2.200	4.100	27.000	24.000	27.000	24.000	31.000	27.000
Morpholine	4	ug/L	4	(3)	1700	(25)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note:

Bold	Exceedance of Selected Ecological screening criterion
Bold	Exceedance of Selected Human screening criterion
Bold	Exceedance of Selected Ecological and Human Health screening criteria

Surface water samples from Lake Ontario were collected at a depth of 0.5 meters (denoted by "S" in the sample name), while bottom samples were taken 0.5 meters above the lakebed (denoted by "B"). Mid-depth samples were collected in Frenchman's Bay, as thermal stratification is unlikely in the shallow
depths observed in this area. LWC1 represents the background location. Sampling locations presented in **Figure 4-3**
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline/benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (129.32 mg/L), pH (8.35), temperature (13.23°C), alkalinity (112.23 mg/L), and DOC (2.37 mg/L) from spring samples were used.
* Only censored results provided by lab.
† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
[a] The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
[b] Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).

References
1. CCME Canadian Water Quality Guidelines for Protection of Aquatic Life. Accessed in July 2021.
2. CCME (2008). Canada-wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale: Supporting Technical Document. Accessed in November 2023. The F1 (167 µg/L) and F2 (42 µg/L) TRVs were developed using the surrogate TRV approach from CCME (2008, Appendix H, p. 340 onward). Representative aliphatics and aromatics for each fraction were selected as surrogates, with available aquatic toxicity data combined using weighting factors and uncertainty factors to account for variability and chronic versus sub-chronic responses.
3. Ontario Ministry of Environment and Climate Change (MOECC): Water management: policies, guidelines, provincial water quality objectives (1994).
4. Environment and Climate Change Canada. June 2021. Federal environmental quality guidelines - Aluminium.
5. Environment Canada. May 2017. Canadian environmental quality guidelines - Cobalt.
6. Environment and Climate Change Canada. April 2021. Federal environmental quality guidelines - Copper.
7. Environment and Climate Change Canada. June 2018. Federal environmental quality guidelines - Hexavalent Chromium.
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Table A-3: Screening of Surface Water Quality Parameters in Summer 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Field Measurements																										
Field Temperature	N/A	Celsius	-	-[a]	-	-[a]	18.100	13.300	24.400	16.600	22.800	15.600	23.600	15.400	22.800	15.600	27.200	29.400	17.800	27.700	20.500	17.100	24.000	24.500	24.900	25.100	23.600	23.200
Field Measured pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.320	8.210	8.360	7.940	**8.510**	8.100	8.480	8.120	**8.510**	8.100	8.170	**8.540**	**8.630**	8.360	8.310	8.340	7.690	8.060	8.130	8.300	7.990	7.910
Specific conductivity	N/A	µs/cm	-	-[a]	-	-[a]	262	235	310	307	308	306	308	305	306	307	318	313	309	311	302	304	562	472	463	455	394	396
Conductivity	N/A	µs/cm	-	-[a]	-	-[a]	301.6	302.3	306.1	254.6	294.3	251.8	299.3	252.1	287.5	253.7	325.9	339.6	259.3	327.4	275.5	257.2	582	468.2	461.1	294.3	382.6	378.1
Dissolved Oxygen (DO)	N/A	%	-	-[a]	-	-[a]	104.5	96.6	122.1	96.8	120.9	90.7	122.3	94.2	123.2	94.9	119.9	129.4	117.6	124.6	117.8	102.7	72.5	87	89.1	95.6	99.3	96.6
Dissolved Oxygen (DO)	N/A	mg/L	< 6	(1)	-	-[a]	9.860	10.090	10.170	9.550	10.430	9.030	10.300	9.260	10.720	9.370	9.640	9.940	11.150	9.860	10.620	9.850	6.040	7.140	7.360	7.890	8.440	8.250
Turbidity	N/A	NTU	-	-[a]	-	-[a]	-0.44	-0.16	-0.38	-0.27	-0.39	-0.17	-0.39	-0.37	-0.39	-0.1	-0.13	-0.27	-0.22	-0.13	-0.23	0.48	9.71	7.15	5.77	5.65	1.32	1.95
Calculated Parameters																										
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	112.000	113.000	113.000	108.000	111.000	112.000	112.000	110.000	110.000	114.000	104.000	104.000	114.000	104.000	111.000	111.000	136.000	131.000	132.000	135.000	106.000	125.000
Total Un-ionized Ammonia	0.0015	mg/L	0.019	(1)	-	-[a]	0.007	0.008	0.012	**0.048**	**0.031**	0.005	**0.029**	0.008	**0.044**	0.005	**0.021**	**0.048**	**0.022**	0.012	**0.038**	0.004	0.009	**0.027**	0.018	**0.038**	0.003	0.005
Total Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	115.00	118.00	107.00	110.00	106.00	107.00	108.00	110.00	110.00	104.00	95.00	108.00	113.00	101.00	94.90	106.00	128.00	118.00	127.00	120.00	97.20	99.90
Inorganics																										
Total Ammonia-N	0.050	mg/L	0.41	(1)	-	-[a]	0.090	0.180	0.090	**1.500**	0.190	0.120	0.180	0.190	0.270	0.130	0.190	0.190	0.150	0.072	0.410	0.055	0.300	0.370	0.210	0.300	0.051	0.100
Total Biochemical Oxygen Demand (BOD)	2	mg/L	-	-[a]	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	3.000	0.000	0.000	2.000	0.000	0.000	0.000	4.000	5.000	4.000	11.000	4.000	3.000	3.000	3.000	6.000
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-[a]	-	-[a]	4.700	7.200	-1.039	-3.562	-1.119	-3.411	-3.595	-2.745	-1.487	-3.030	-3.411	-3.191	2.800	-3.026	-3.390	-2.545	0.886	-3.281	-3.579	-0.620	-3.001	-2.636
Conductivity	1.0	umho/cm	-	-[a]	-	-[a]	300.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	300.000	300.000	300.000	550.000	460.000	460.000	450.000	390.000	400.000
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-[a]	-	-[a]	0.170	0.230	0.180	1.300	0.200	0.270	0.370	0.180	0.870	0.350	0.220	0.230	0.170	0.180	0.640	0.180	0.560	0.550	0.940	0.330	0.290	0.360
Dissolved Organic Carbon	0.40	mg/L	-	-[a]	-	-[a]	2.000	1.900	1.900	2.000	2.000	2.100	2.000	2.100	2.000	2.100	2.100	2.100	2.100	2.100	2.000	2.100	4.400	3.400	3.400	3.300	2.900	3.000
Orthophosphate (P)	0.010	mg/L	-	-[a]	-	-[a]	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.001	0.002	0.002	0.005
pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.280	8.060	8.330	8.180	8.350	7.970	8.330	8.160	8.370	8.190	8.220	8.320	8.290	8.060	8.340	8.350	8.010	8.110	8.190	8.240	8.190	8.140
Total Phosphorus	0.020	mg/L	0.02	(3)	-	-[a]	0.012	0.005	0.003	0.010	0.001	0.006	-0.003	0.004	0.002	0.002	0.002	0.004	0.010	0.006	0.002	0.004	**0.045**	**0.036**	**0.026**	**0.030**	0.019	**0.034**
Total Residual Chlorine	0.003	mg/L	0.002[c]	(3)	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Suspended Solids	1	mg/L	5.6	(1)	-	-[a]	0.400	0.800	0.800	1.000	0.800	1.000	0.400	3.000	0.600	2.000	2.000	0.800	1.000	2.000	1.000	2.000	**14.000**	**12.000**	**11.000**	**9.000**	5.000	4.000
Turbidity	0.1	NTU	-	-[a]	-	-[a]	0.300	0.300	0.300	0.400	0.400	0.400	0.400	0.300	0.400	0.400	0.600	1.500	0.400	0.500	0.400	0.700	10.000	11.000	6.700	6.100	2.400	2.600
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-[a]	-	-[a]	98.000	98.000	110.000	97.000	96.000	94.000	99.000	96.000	98.000	99.000	96.000	99.000	99.000	95.000	97.000	100.000	120.000	120.000	120.000	120.000	110.000	110.000
Nitrite (N)	0.01	mg/L	0.197	(1)	1	(16)	0.000	0.000	0.002	0.002	0.003	0.006	0.003	-0.006	0.003	0.003	0.003	0.003	0.005	0.003	0.002	0.003	0.010	0.011	0.008	0.005	0.008	0.007
Nitrate (N)	0.1	mg/L	13	(1)	10	(16)	0.180	0.220	0.190	0.290	0.170	0.260	0.180	0.210	0.160	0.280	0.340	0.170	0.160	0.280	0.170	0.150	0.100	0.000	0.000	0.000	0.000	0.000
Nitrate + Nitrite (N)	0.1	mg/L	-	-[a]	-	-	0.180	0.220	0.190	0.290	0.170	0.260	0.180	0.210	0.160	0.280	0.340	0.170	0.160	0.280	0.170	0.150	0.100	0.083	0.038	0.029	0.074	0.076
Metals																										
Dissolved Aluminum (Al)	0.5	µg/L	75	(3)	2900	(16)	1.39	1.27	2.34	8.53	8.33	1.98	8.53	5.15	9.04	5.38	42	22.3	2.22	34.1	1.95	2.8	51.4	7.44	10.1	5.63	55.3	4.79
Total Aluminum (Al)	0.5	µg/L	100	(1)	2900	(16)	4.28	4.28	21.4	4.56	21.6	10.1	6.82	6.11	6.88	8.95	54.2	12.1	3.55	33.4	26.9	9.5	**136**	**204**	93.3	94.1	27.5	26.5

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.13	0.119	0.12	0.127	0.13	0.127	0.129	0.119	0.133	0.122	0.111	0.122	0.122	0.123	0.127	0.124	0.216	0.19	0.191	0.203	0.152	0.172
Total Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.122	0.119	0.124	0.12	0.121	0.12	0.121	0.125	0.124	0.121	0.111	0.122	0.128	0.119	0.106	0.117	0.224	0.196	0.194	0.173	0.139	0.135
Dissolved Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.73	0.692	0.727	0.729	0.697	0.737	0.74	0.736	0.726	0.755	0.665	0.675	0.707	0.678	0.723	0.739	0.813	0.86	0.879	0.891	0.737	0.875
Total Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.689	0.728	0.735	0.774	0.711	0.76	0.737	0.783	0.746	0.774	0.639	0.768	0.741	0.675	0.632	0.72	0.923	0.844	0.922	0.867	0.715	0.729
Dissolved Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	18.7	19.2	20.5	21.1	21	21.7	21.1	21.7	20.4	22.3	18.8	19.5	20	19.3	20.4	20.7	28.2	26.6	26.7	26.8	21.6	24.9
Total Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	20.4	21.3	20.9	21.6	20.5	22.6	20.2	23.1	20.5	22.6	18.4	20.1	19.3	19.1	17.6	20.5	28.5	25.4	27	25.2	20.2	20.5
Dissolved Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	-0.002	-0.001	-0.0001	-0.0011	-0.0012	-0.0022	-0.0011	-0.0011	0.0019	-0.0022	-0.0011	0.0021	-0.0022	-0.0023	-0.0034	-0.0022	0	0.0023	0.0001	-0.0023	0	-0.0023
Total Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.0008	0.0015	0	0.0004	0	0.0004	0.0017	0.0004	0	0.0008	0.0008	0.003	0.0017	0.008	0.0034	0.0007	0.009	0.014	0.0048	0.0026	0.0017	-0.0001
Dissolved Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	-0.001	0	-0.0002	0.0001	0.0004	0	0.0003	0.0002	0.0011	0.0001	0.0005	0.0008	0.0002	0.0005	0.0005	0.0004	0.0005	0.0002	0.0002	0.0004	0.0012	0.0012
Total Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	0.0007	0.0008	-0.0004	-0.0005	0.0002	0	-0.0001	-0.0003	-0.0001	0.0001	0.0014	-0.0002	-0.0007	0.0015	0.0012	0.0011	0.006	0.0075	0.0038	0.0036	0.0015	0.0024
Dissolved Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	19	19	24	24	21	23	25	23	23	24	23	23	25	22	22	22	35	30	32	31	24	28
Total Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	22	22	21	20	19	20	20	20	20	20	21	20	20	22	19	21	33	29	32	28	23	23
Dissolved Cadmium (Cd)	0.005	µg/L	0.17	(1)	5	(17,18)	0.002	0.003	0.0026	0.002	0.0025	0.0046	0.0018	0.0038	0.0023	0.0024	0.0044	0.0043	0.0015	0.0049	0.0017	0.0015	0.0038	0.0007	0.001	0	0.0044	0.0012
Total Cadmium (Cd)	0.005	µg/L	0.17	(1)	5	(17,18)	0.0029	0.0036	0.0027	0.0037	0.0028	0.004	0.0023	0.004	0.0023	0.0035	0.0056	0.0028	0.0027	0.0054	0.0041	0.0039	0.0054	0.0078	0.0056	0.0064	0.0025	0.0024
Dissolved Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**31700**	**32000**	**31900**	**30400**	**30800**	**31200**	**31000**	**30800**	**30900**	**32000**	**29500**	**29100**	**32000**	**29100**	**30800**	**31200**	**42000**	**40000**	**39600**	**40800**	**31200**	**36900**
Total Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**32200**	**33200**	**29300**	**30200**	**29400**	**29500**	**29600**	**30200**	**30200**	**27800**	**26400**	**29400**	**31200**	**27900**	**26100**	**29000**	**39000**	**35800**	**37700**	**35600**	**28100**	**28600**
Dissolved Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.002	0.001	0.0018	0.0026	0.0018	0.0041	0.0034	0.0022	0.0021	0.0041	0.0038	0.0025	0.0024	0.0032	0.0042	0.0021	0.0027	0.001	0.0014	0.0011	0.0029	0.0031
Total Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.002	0.0024	0.0044	0.0034	0.0027	0.004	0.0033	0.0027	0.0027	0.0043	0.0045	0.0027	0.0023	0.0049	0.0031	0.0038	0.0128	0.0187	0.0098	0.008	0.0043	0.0027
Dissolved Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.1	0.15	0.2	0.0732	0.12	0.072	0.0919	0.1	0.18	0.1	0.0817	0.18	0.14	0.13	0.0831	0.1	0.17	0.17	0.0757	0.11	0.16	0.15
Total Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.0461	0.11	0.11	0.0856	0.0885	0.11	0.11	0.0748	0.0695	0.0785	0.11	0.12	0.1	0.0902	0.0854	0.13	0.37	0.54	0.28	0.25	0.1	0.14
Chromium (VI)†	0.50	ug/L	1	(1,3)	25	(18)	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0081	0.0000	0.0000	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0079	0.0000	0.0000	0.0000	0.0000
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	(1,3)	25	(18)	0.21	0.02	-1.2	-0.37	-0.41	-0.09	-0.6	-0.21	-0.7	-0.36	-0.49	-0.6	-0.26	0.89	0.18	0.23	**2.65**	0.28	-0.03	**1.8**	-0.5	-1.4
Chromium (+3)‡	0.5	ug/L	8.9	(1,3)	-	-[a]	0.10	0.15	0.20	0.00	0.12	0.00	0.00	0.10	0.18	0.10	0.00	0.18	0.14	0.13	0.00	0.10	0.17	0.17	0.00	0.11	0.16	0.15
Unfiltered Chromium (+3)	0.99	ug/L	8.9	(1,3)	-	-[a]	0.00	0.11	0.11	0.00	0.00	0.11	0.11	0.00	0.00	0.00	0.11	0.12	0.10	0.00	0.00	0.13	0.37	0.54	0.28	0.25	0.10	0.14
Dissolved Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.01	0.008	0.0102	0.0162	0.0126	0.0121	0.0113	0.0108	0.0112	0.0123	0.0181	0.0184	0.0097	0.014	0.0091	0.0121	0.0419	0.0321	0.0346	0.0299	0.0198	0.024
Total Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.0086	0.01	0.0259	0.0143	0.0145	0.0184	0.013	0.0146	0.0105	0.0177	0.022	0.014	0.0106	0.019	0.013	0.016	0.111	0.148	0.075	0.071	0.026	0.03
Dissolved Copper (Cu)	0.05	µg/L	2.494	(6)	1000	(18)	0.591	0.57	0.696	0.813	0.704	0.629	0.723	0.677	0.679	0.642	0.856	0.974	0.585	0.88	0.594	0.622	0.98	0.816	0.867	0.826	1.46	1.24
Total Copper (Cu)	0.05	µg/L	2.494	(6)	1000	(18)	0.679	0.655	0.83	0.694	0.74	0.715	0.704	0.661	0.645	0.718	1.1	0.782	0.651	0.91	0.73	0.64	1.45	1.65	1.36	1.17	1.31	1.4
Dissolved Iron (Fe)	1	µg/L	290	(8)	-	-[a]	1.5	1.9	2.6	2.9	4.6	1.4	2.7	2.8	3.5	2.6	2.3	7.8	2.5	3.1	0.7153	2.6	29.9	18.5	17.2	20.6	8.8	13
Total Iron (Fe)	1	µg/L	290	(8)	-	-[a]	2.2	4.8	18.4	5.3	6	9.9	5.5	9.4	3.8	8.2	10.6	10	4.5	9.6	7.8	17.5	**349**	**393**	207	189	75.4	78.5
Dissolved Lead (Pb)	0.005	µg/L	6.63	(9)	5	(16)	0.004	0.012	0.0052	0.0795	0.02	0.0068	0.034	0.0363	0.0412	0.0182	0.0506	0.137	0.0036	0.0881	0.0062	0.0157	0.112	0.0312	0.0559	0.0489	0.0854	0.0321
Total Lead (Pb)	0.005	µg/L	3.56	(1)	5	(16)	0.0137	0.0146	0.0387	0.0125	0.0352	0.0339	0.0159	0.0181	0.0141	0.0227	0.091	0.0372	0.0091	0.074	0.054	0.034	0.463	0.553	0.406	0.325	0.12	0.127

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario														Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.64	1.73	1.69	1.7	1.65	1.71	1.77	1.69	1.7	1.75	1.78	1.71	1.75	1.79	1.62	1.71	2.13	1.85	2.02	1.89	1.76	1.76
Total Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.72	1.71	1.7	1.58	1.55	1.56	1.62	1.63	1.59	1.58	1.74	1.66	1.65	1.79	1.61	1.67	2.06	1.9	2.07	1.82	1.55	1.64
Dissolved Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	8010	8090	8110	7900	**8240**	**8220**	**8440**	8060	7980	**8240**	7450	7570	8180	7600	8200	8060	7430	7610	7950	8130	6790	8000
Total Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	**8440**	**8590**	**8210**	**8270**	7900	8090	**8360**	**8440**	**8350**	**8290**	7090	**8310**	**8390**	7660	7200	8090	7420	6960	7950	7530	6560	6900
Dissolved Manganese (Mn)	0.05	µg/L	250	(1)	120	(16)	0.193	0.279	0.253	1.06	0.384	0.761	0.437	1.47	0.408	0.972	1.19	1.39	0.334	1.39	0.457	1.82	36.2	11.6	10.4	10	6.57	8.84
Total Manganese (Mn)	0.05	µg/L	250	(1)	120	(16)	0.461	0.65	1.43	1.67	1.17	2.37	1.05	2.58	0.762	2.71	2.74	2.01	1.52	2.56	2.45	5.17	66	55.3	47.4	41.4	22.7	21.9
Dissolved Mercury (Hg)	0.01	ug/L	0.2	(3)	1	(16,17,18)	-0.0003	0.0003	0.0012	0.0011	0.0009	0.0010	0.0005	0.0005	0.0004	0.0006	0.0009	0.0013	0.0010	0.0006	0.0009	0.0006	0.0010	0.0009	0.0012	0.0003	0.0011	0.0003
Mercury (Hg)	0.01	ug/L	0.026	(1)	1	(16,17,18)	0.0014	-0.0002	0.0015	0.0008	0.0001	0.0004	0.0008	0.0011	-0.0001	0.0009	0.0009	0.0011	0.0013	0.0007	0.0004	-0.0001	0.0029	0.0015	0.0012	0.0017	0.0014	0.0002
Dissolved Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.06	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.00	0.00	0.01	0.02	0.02
Total Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.01	0.01	0.02	0.02	0.04	0.01	0.04	0.04	0.01	0.01	0.01	0.02	0.01	0.02	0.00	0.02	0.05	0.01	0.04	0.03	0.03	0.05
Dissolved Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.07	1.03	1.13	1.16	1.14	1.14	1.14	1.12	1.15	1.14	1.27	1.25	1.12	1.44	1.06	1.13	1.16	2.56	2.57	1.19	1.53	1.18
Total Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.08	1.05	1.22	1.16	1.13	1.17	1.17	1.1	1.16	1.16	1.27	1.15	1.14	1.29	1.14	1.09	0.919	0.929	1.1	1.03	0.89	0.907
Dissolved Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.462	0.491	0.503	0.59	0.554	0.507	0.529	0.559	0.515	0.511	0.551	0.628	0.468	0.554	0.468	0.434	0.491	0.484	0.845	0.497	0.49	0.466
Total Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.504	0.525	0.609	0.565	0.546	0.577	0.512	0.528	0.507	0.56	0.55	0.533	0.479	0.55	0.46	0.48	0.62	0.7	0.56	0.58	0.44	1.28
Dissolved Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1320	1360	1570	1590	1590	1650	1550	1540	1540	1650	1550	1490	1560	1500	1510	1510	1860	1820	1750	1820	1440	1800
Total Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1520	1530	1550	1590	1470	1580	1500	1520	1500	1610	1460	1500	1440	1460	1280	1410	1780	1680	1700	1610	1330	1350
Dissolved Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.111	0.121	0.112	0.109	0.113	0.119	0.121	0.106	0.117	0.132	0.11	0.108	0.114	0.109	0.11	0.126	0.095	0.129	0.129	0.121	0.114	0.111
Total Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.11	0.115	0.121	0.129	0.108	0.123	0.122	0.123	0.124	0.116	0.121	0.11	0.128	0.098	0.098	0.112	0.105	0.104	0.113	0.12	0.087	0.094
Dissolved Silicon (Si)	50	µg/L	-	-	-	-[a]	146	240	86	169	76	188	82	210	64	213	112	99	85	105	75	107	1710	1810	1820	1820	803	1040
Total Silicon (Si)	50	µg/L	-	-	-	-[a]	161	261	133	176	82	198	87	221	68	203	113	106	86	111	82	119	1690	1820	1820	1760	798	791
Dissolved Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	0.004	-0.001	0.0004	0.0018	0.0008	0.0004	0.0002	0.0011	0.0007	0.0015	0.0001	0.0044	0.0004	0.001	0.0011	0.0005	0	0.0009	0	0.0005	0.0015	0.0006
Total Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	-0.0007	0.0007	0.0005	0.0002	0.0009	0.0012	0.0005	0.0011	0.0008	0.0008	0.0029	0.0009	0.0007	0.0033	0.0012	0.0002	0.0018	0.0025	0.0023	0.002	0.0007	0.0005
Dissolved Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	12400	12500	12800	12300	13000	12900	12600	12100	12300	12900	12500	12100	12400	12100	12400	12600	45500	34500	32500	32400	21100	26100
Total Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	12800	12700	13500	13500	13000	13200	13000	12900	12900	13600	12000	13500	12900	12300	11100	12500	44400	34200	31900	29600	20700	20300
Dissolved Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	156	157	189	170	184	189	188	181	180	189	152	156	191	154	166	169	222	217	221	221	159	207
Total Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	182	184	173	176	172	172	176	171	176	174	160	172	170	169	158	180	214	194	212	202	165	171
Dissolved Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.005	0.005	0.0071	0.0055	0.0063	0.0063	0.0062	0.0058	0.0062	0.0065	0.0058	0.0057	0.0053	0.006	0.007	0.0069	0.0017	0.0018	0.0016	0.0016	0.0026	0.0026
Total Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.0062	0.0058	0.0073	0.0072	0.007	0.007	0.006	0.0074	0.0064	0.0079	0.0047	0.0072	0.0069	0.0062	0.005	0.0059	0.0043	0.0054	0.0032	0.0034	0.0028	0.0027
Dissolved Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	-0.001	-0.001	0.0018	0.0019	0.0004	0.0029	0.0028	0.003	0.0052	0.0019	0.004	0.0048	0.0044	0.007	0.0036	-0.0006	0.0018	0.0071	0.0072	0.0077	0.0037	0.0076
Total Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.0028	0.0062	0.0013	-0.0002	0.0053	-0.0012	0.0006	0.0029	0.0002	0.0028	0.0008	0.0035	0.001	0.0059	0.0038	0.003	0.0181	0.0193	0.0147	0.012	0.0073	0.0074
Dissolved Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.027	0.019	0.0081	0.0992	0.0285	0.0117	0.0368	0.0936	0.0456	0.0178	0.0683	2.23	0.0216	0.0604	0.0066	0.0134	0.0407	0.014	0.0172	0.012	0.1121	0.0152
Total Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.0103	0.01	0.0202	0.0174	0.0521	0.1979	0.0119	0.0125	0.0174	0.0173	0.0848	0.0183	0.011	0.0548	0.078	0.017	0.036	0.0428	0.0359	0.0294	0.018	0.0288
Dissolved Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	0.085	-0.026	0.0568	0.111	0.1656	0.0487	0.1714	0.0846	0.1733	0.0743	0.2441	0.286	0.0548	0.2537	0.0612	0.1627	0.3953	0.2693	0.2039	0.1641	0.4483	0.1503
Total Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	-0.0352	0.0411	1.24	-0.0967	-0.0613	-0.0285	-0.1331	0.0524	-0.1167	-0.0066	0.3548	0.0535	-0.0494	0.1984	0.2481	0.2853	5.9	9	3.9	3.6	0.8983	0.9566
Dissolved Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.065	0.06	0.071	0.074	0.071	0.074	0.076	0.068	0.077	0.078	0.086	0.077	0.073	0.098	0.066	0.073	0.077	0.077	0.075	0.069	0.092	0.082

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario															Frenchman's Bay		
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Total Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.073	0.071	0.075	0.074	0.074	0.075	0.075	0.072	0.073	0.074	0.078	0.075	0.076	0.075	0.072	0.063	0.172	0.064	0.07	0.071	0.06	0.065
Dissolved Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.297	0.286	0.361	0.334	0.341	0.344	0.364	0.337	0.349	0.344	0.286	0.32	0.347	0.284	0.318	0.314	0.256	0.278	0.288	0.296	0.253	0.283
Total Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.347	0.36	0.326	0.31	0.325	0.308	0.321	0.326	0.315	0.321	0.264	0.331	0.316	0.296	0.277	0.308	0.255	0.244	0.296	0.271	0.246	0.26
Dissolved Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.145	0.157	0.1681	0.49	0.32	0.1932	0.26	0.26	0.35	0.26	1.47	1.07	0.1521	1.86	0.1702	0.24	1.42	0.55	0.54	0.52	2.3	0.43
Total Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.1574	0.1464	0.42	0.1543	0.38	0.29	0.24	0.1372	0.1671	0.24	1.64	0.27	0.1271	1.4	1.12	0.1784	0.89	0.98	0.7	0.64	0.36	0.34
Dissolved Zinc (Zn)	0.1	µg/L	15.05	(1)	5000	(18)	1.03	0.86	0.2	3.4	0.86	0.4	1.24	1.24	2.35	0.88	2.64	4.43	0.32	2.32	0.15	0.37	1.79	0.48	8.27	1.32	2.28	1.4
Total Zinc (Zn)	0.1	µg/L	20	(3)	5000	(18)	0.59	1.16	1.11	1.76	1.35	1.75	0.48	0.86	0.59	0.7	3.2	2.52	0.51	2	1.6	0.9088	3.6	4.2	2.5	1.8	0.9604	0.857
Dissolved Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.004	0	0.0061	0.005	0.0067	0.014	0.0036	-0.001	0.0138	0.0008	0.0156	0.0171	0.0048	0.0071	0.0015	0.0012	0.0237	0.0166	0.0125	0.0103	0.0085	0.0107
Total Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.0048	0.0139	0.0136	0.0082	0.0274	0.0145	0.0131	0.006	0.0094	0.0143	0.0153	0.0121	0.0102	0.0176	0.0061	0.0081	0.0894	0.29	**0.39**	0.0774	0.0142	0.0176
Volatile Organics																												
Benzene	0.10	ug/L	100	(3)	1	(17)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromodichloromethane	0.10	ug/L	200	(3)	16	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromoform	0.20	ug/L	60	(3)	25	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloroform	0.10	ug/L	1.8	(1)	25	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylbenzene	0.10	ug/L	8	(3)	2.4	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BTEX & F1 Hydrocarbons																												
F1 (C6-C10)	25	ug/L	167	(2)	820	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F1 (C6-C10) - BTEX	25	ug/L	167	(2)	820	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F2-F4 Hydrocarbons																												
F2 (C10-C16 Hydrocarbons)	100	ug/L	42	(2)	300	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	1000	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	1100	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Microbiological*																												
Background*	10	CFU/100mL	-	-	-	-	260	970	920	680	160	820	380	1,300	240	760	48,000	16,000	2,100	53,000	5,000	2,800	120,000	63,000	29,000	8,400	5,100	16,000
Fecal coliform*	10	CFU/100mL	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	20	10	<10	10	10	10	13,000	560	2,700	<10	90	240
Total Coliforms*	10	CFU/100mL	100[w]	(3)	10	(16)	**250**	**2,200**	**80**	**640**	<10	**880**	**60**	**740**	10	**460**	**2,500**	**50**	**410**	**640**	**80**	**80**	**85,000**	**11,000**	**2,900**	<10	**280**	**2,600**
*Escherichia coli**	10	CFU/100mL	100	(3)	10	(16)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**20**	10	<10	10	10	10	**6,100**	**560**	**120**	<10	**50**	**60**
Radionuclides																												
H-3	14	Bq/kg	-	-[u]	-	-[u]	5.25	5.27	21.2	0	10.6	0	10.6	-5.33	0	10.5	42.4	106	5.3	47.8	21.2	5.31	21.1	15.9	26.4	20.9	21.2	21.4
C-14	0.027	Bq/g	-	-[u]	-	-[u]	-0.0512	-0.0205	-0.0241	-0.0326	-0.0199	-0.0397	-0.0303	-0.0403	-0.045	-0.0466	-0.0225	0.0115	-0.0302	0.059	0.241	0.0394	0.79	-0.0228	-0.0289	-0.0217	-0.018	-0.0281
Co-60	0.73	Bq/kg	-	-[u]	-	-[u]	0.16	-0.0244	0.149	0.556	0.0324	0.0915	-0.162	0.0514	0.657	0.171	0.455	0.497	0.0614	0.147	-0.146	0.0696	0.0916	0.316	0.289	0.191	-0.481	0.0691
Cs-134	0.75	Bq/g	-	-[u]	-	-[u]	0.48	0.119	0.111	0.126	0.293	0.292	0.12	-0.043	0.0249	-0.0581	0.244	0.0292	0.117	-0.101	0.128	-0.0169	0.0167	0.143	-0.157	-0.207	0.106	-0.124
Cs-137	0.6	Bq/kg	-	-[u]	-	-[u]	0.297	0.249	-0.21	0.294	-0.0462	0.0572	-0.0213	0.0254	-0.0678	-0.236	-0.228	0.102	-0.0569	0.281	0.0631	0.505	0.0966	0.418	-0.0251	-0.0266	0.0542	-0.0355
I-131	1.2	Bq/kg	-	-[u]	-	-[u]	0.022	0.212	-0.278	-0.565	0.351	-0.143	0.27	0.591	-1.33	0.0523	0.222	1.12	0.485	-0.679	0.882	-0.909	2.66	-0.206	0.0767	-1.08	-0.819	0.661
K-40	7.1	Bq/g	-	-[u]	-	-[u]	1.75	0.525	-0.174	1.37	2.64	-0.946	0.127	0.241	2.24	-0.172	-0.208	0.568	-0.32	-0.392	-1.03	-0.459	0.484	-2.5	2.87	0.242	1.71	0.746

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Th-Series	1.8	Bq/kg	-	-[u]	-	-[u]	0.452	-1.09	0.245	1.09	1.17	0.367	0.285	-0.0449	-1.42	-0.132	0.332	0.459	-0.57	0.355	-0.329	-0.435	0.392	0.434	0.482	0.851	-0.416	0.125
U-Series	1.5	Bq/kg	-	-[u]	-	-[u]	-0.204	0.116	0.336	0.564	-0.0785	0.702	-0.0708	-0.285	-0.246	-0.00287	0.575	-0.275	0.671	-0.015	-0.024	-0.0357	-0.0261	0.421	-0.0693	0.159	-0.328	0.242
Others Parameters																												
Hydrazine*	0.1	ug/L	2.6	(12)	0.01	(24)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Monomethyl Hydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorophyll a	1.3	ug/L	-	-	-	-	2.80	1.80	1.90	2.90	1.90	2.50	2.40	1.09	2.30	2.30	3.20	2.50	4.30	3.50	3.50	4.80	13.00	10.00	11.00	9.00	6.00	8.00
Morpholine	4	ug/L	4	(3)	1700	(25)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note:

Bold Exceedance of Selected Ecological Screening Criterion

Bold Exceedance of Selected Human Screening Criterion

Bold Exceedance of Selected Ecological and Human Health Screening Criteria

Surface water samples from Lake Ontario were collected at a depth of 0.5 meters (denoted by "S" in the sample name), while bottom samples were taken 0.5 meters above the lakebed (denoted by "B"). Mid-depth samples were collected in Frenchman's Bay, as thermal stratification is unlikely in the shallow
depths observed in this area. LWC1 represents the background location. Sampling locations presented in **Figure 4-3**.
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline/benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (109.2 mg/L), pH (8.23), temperature (21.51°C), alkalinity (103.2 mg/L), and DOC (2.41 mg/L) from summer samples were used.
* Only censored results provided by lab.
† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
[a] The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
[b] Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).
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Table A-4: Screening of Surface Water Quality Parameters in Fall 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Field Measurements																										
Field Temperature	N/A	Celsius	-	-[a]	-	-[a]	7.5	6.2	14.3	9.7	13.9	9.6	12.9	9.6	13.6	9.4	31.6	15	9	18.6	18.1	17.8	12.2	13.8	16.9	14.7	12.6	12.5
Field Measured pH	N/A	pH	6.5-8.5	(3)	-	-[a]	7.42	7.54	7.83	7.8	7.6	7.62	7.69	7.65	7.68	7.69	8.12	7.87	7.6	7.61	7.82	7.67	7.56	8.25	8.17	8.13	8.15	7.97
Specific conductivity	N/A	µs/cm	-	-[a]	-	-[a]	203	306	307	304	307	305	306	305	307	304	309	308	307	311	309	314	792	518	495	474	461	470
Conductivity	N/A	µs/cm	-	-[a]	-	-[a]	-	-	-	-	-	-	-	-	-	-	-	249.1	214.4	273	268.1	268.2	598	407.5	418.5	396.2	-	-
Dissolved Oxygen (DO)	N/A	%	-	-[a]	-	-[a]	83.7	81.4	103.8	94	103	94.9	103	94.7	102.3	91.6	102.7	92.8	85	92.6	97.8	95.7	83	97.3	95.8	94.7	102.4	99.3
Dissolved Oxygen (DO)	N/A	mg/L	< 6	(1)	-	-[a]	10.030	10.090	10.560	10.710	10.610	10.790	10.720	10.750	10.620	10.490	7.540	9.350	9.750	9.340	9.200	9.100	8.850	10.050	9.240	9.800	10.930	10.580
Turbidity	N/A	NTU	-	-[a]	-	-[a]	-0.38	-0.43	-0.39	NA	-0.39	0.1	-0.41	-0.24	-0.42	-0.05	0.68	754	754	754	753.6	753.3	754.7	758.3	753.5	754.3	2.58	2.37
Calculated Parameters																										
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	112	108	117	114	119	114	117	115	117	116	106	115	114	113	115	114	166	142	147	138	130	134
Total Un-ionized Ammonia	0.0015	mg/L	0.019	(1)	-	-[a]	0.00075	0.0015	0	0.0015	0	0	0.0014	0.00072	0.00095	0.0011	0.0083	0.0013	0.0011	0	0.0045	0.0033	0.0051	**0.022**	**0.037**	**0.021**	0.013	0.0081
Total Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	117	117	117	130	116	115	116	114	116	116	99.3	114	105	91.5	111	112	137	138	140	141	140	141
Inorganics																										
Total Ammonia-N	0.050	mg/L	0.588	(1)	-	-[a]	0.15	0.26	0.0453	0.11	0.0481	0.0154	0.099	0.074	0.067	0.11	0.065	0.055	0.14	0.0249	0.16	0.17	0.53	0.42	**0.67**	0.49	0.35	0.32
Total BOD	2	mg/L	-	-[a]	-	-[a]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-[a]	-	-[a]	5.5	6.2	5.1	3.69	6.2	3.34	6.2	5.8	5.5	1.56	14	0.43	0.77	-0.6	4.6	3.18	18	10	6.6	4.5	12	6.5
Conductivity	1.0	umho/cm	-	-[a]	-	-[a]	310	300	310	310	320	320	320	320	320	310	300	320	320	320	310	320	820	540	500	510	460	480
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-[a]	-	-[a]	0.42	0.43	0.23	0.16	0.16	0.22	0.24	0.33	0.27	0.18	0.3	0.38	0.33	0.32	0.39	0.27	0.83	0.86	0.72	0.57	0.89	0.65
Dissolved Organic Carbon	0.40	mg/L	-	-[a]	-	-[a]	1.9	1.9	2.1	1.9	2.1	1.9	2.1	1.9	2	1.9	2.3	2.1	2	2	2.2	2.2	5.2	3.9	3.7	3.7	3.3	4.5
Orthophosphate (P)	0.010	mg/L	-	-[a]	-	-[a]	0.0012	0.0009	-0.0014	-0.0016	-0.0016	0.0002	-0.0017	-0.0016	-0.0007	-0.0017	0.0032	0.0005	0.0006	0.0012	-0.0017	-0.0015	0.0029	-0.0005	-0.0033	0.0003	-0.0002	0.0011
pH	N/A	pH	6.5-8.5	(1)	-	-[a]	8.11	8.13	8.1	8.12	8.1	8.13	7.85	8.15	8.06	8.15	8.13	8.15	8.09	8.1	8.16	8.09	8	8.2	8.12	8.21	8.16	8.06
Total Phosphorus	0.020	mg/L	0.02	(3)	-	-[a]	0.0009	0.0003	0.0017	-0.0022	0.007	0.0015	0.0014	-0.0004	0.0056	-0.0003	0.0173	-0.0038	0.0014	0.0029	0.0096	0.005	**0.024**	**0.023**	**0.027**	**0.024**	0.0164	0.019
Total Residual Chlorine	0.003	mg/L	0.002[c]	(3)	-	-[a]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Suspended Solids	1	mg/L	5.2	(1)	-	-[a]	0.2	0.2	0.2	0.4	0.4	0.4	0	0.4	1	5	1	0.6	0.8	1	1	**33**	4	**11**	**35**	**9**	4	5
Turbidity	0.1	NTU	-	-[a]	-	-[a]	0.1	0.1	0.2	0.1	0.2	0.2	0.3	0.1	0.2	0.2	0.9	0.3	0.3	0.2	0.4	0.5	3.4	8.3	9.5	6.2	3	2.9
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-[a]	-	-[a]	98	100	96	96	96	96	95	96	95	92	98	98	99	99	98	96	150	130	120	120	120	120
Nitrite (N)	0.010	mg/L	0.197	(1)	1	(16)	0.0054	0.0035	-0.0124	0.0025	0.0013	0.00036514	0.0018	-0.0000963	0.0012	-0.0003025	0.0044	0.01	0.007	0.0063	0.017	0.013	0.0091	-6E-05	0.00097	0.0028	0.0029	0.0056
Nitrate (N)	0.10	mg/L	13	(1)	10	(16)	0.34	0.34	0.3	0.3	0.3	0.3	0.3	0.28	0.31	0.28	0.19	0.23	0.3	0.3	0.17	0.17	0	0	0	0	0	0
Nitrate + Nitrite (N)	0.10	mg/L	-	-[a]	-	-	0.34	0.34	0.3	0.3	0.3	0.3	0.3	0.28	0.31	0.28	0.19	0.24	0.3	0.3	0.19	0.18	0.0944	0.0141	0.02	0.0181	0.0969	0.0956
Metals																										
Dissolved Aluminum (Al)	0.50	µg/L	75	(3)	2900	(16)	4.23	5.69	4.18	3.99	7.3	3.49	11.9	2.38	24.2	2.89	11.5	10.5	2.42	12.1	13.8	11.5	6.25	6.52	**98.8**	5.24	5.02	14.4
Total Aluminum (Al)	3.00	µg/L	100	(1)	2900	(16)	6.76	7.8	7.82	3.96	12.1	21.7	5.83	2.94	7.77	24.4	20.5	8.6	7.8	8.1	6.03	3.41	34.8	**128**	4.47	54.1	27.4	33
Dissolved Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.128	0.124	0.128	0.127	0.129	0.127	0.125	0.128	0.143	0.135	0.216	0.139	0.134	0.133	0.133	0.128	0.282	0.203	0.203	0.195	0.171	0.19
Total Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.126	0.126	0.135	0.132	0.133	0.131	0.141	0.13	0.128	0.132	0.194	0.129	0.123	0.102	0.128	0.128	0.229	0.193	0.177	0.188	0.176	0.184
Dissolved Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.783	0.778	0.73	0.709	0.719	0.718	0.728	0.743	0.746	0.731	0.782	0.781	0.768	0.769	0.783	0.799	0.668	0.72	0.852	0.714	0.712	0.742
Total Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.797	0.795	0.734	0.734	0.756	0.79	0.742	0.723	0.738	0.764	0.728	0.756	0.899	0.623	0.702	0.706	0.59	0.773	0.649	0.798	0.744	0.741
Dissolved Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	19.7	19.4	20.5	20.3	21.1	20.7	20.6	20.3	20.8	20.6	20.6	19.8	19.7	19.7	21.4	21.2	20	18.6	32.6	20.7	21	23.4
Total Barium (Ba)	0.05	µg/L	2300	(12)	1000	(17,18)	22.9	22.2	21.3	20.9	21.3	20.8	20.9	21	21	20.9	19	21.4	20.2	16.1	19.9	20.4	17.4	25.6	20.4	27.8	27.4	29.2
Dissolved Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.0021	0.0026	0.0048	0.0048	0.0049	0.0034	0.0046	0.006	0.0099	0.0021	0.0022	0	0.0067	-0.0004	0.0001	0.0001	0.0033	0.0011	0.0089	0.006	0.0017	0.0048
Total Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0	0.0012	-0.0009	0.0015	0.0027	0.0051	-0.0008	0.0027	-0.0021	-0.0008	0.003	0.0056	0.0001	0.0019	-0.0005	0.0015	0.0059	0.0095	-0.0015	0.0002	0.0047	-0.0011
Dissolved Bismuth (Bi)	0.01	µg/L	2.5	(15)	-	-[a]	0.0005	0.0004	0.0009	0.0006	0.0012	0.0006	0.0008	0.0005	0.0017	0.0005	0.0001	0.0005	-0.0002	0.0003	0.0012	0.0004	-0.0001	0.0001	0.0029	0.0007	-0.0001	0.0017
Total Bismuth (Bi)	0.01	µg/L	2.5	(15)	-	-[a]	0.0005	0.0003	0.0008	0.0002	0.0011	0.0087	0.0007	-0.0001	0.0011	0.0008	0.002	0.0003	0.0031	0.0002	0.0002	0.0004	0.0022	0.0043	-0.0002	0.0026	0.0011	0.0007
Dissolved Boron (B)	10.00	µg/L	200	(3)	5000	(16,17,18)	23	23	23	23	22	22	22	22	24	23	22	23	23	23	26	25	81	42	42	39	37	37
Total Boron (B)	10.00	µg/L	200	(3)	5000	(16,17,18)	27	26	24	24	25	25	24	23	26	25	20	22	20	20	24	23	68	41	38	39	41	39
Dissolved Cadmium (Cd)	0.01	µg/L	0.18	(1)	5	(17,18)	0.0059	0.0046	0.0063	0.0054	0.0083	0.0057	0.0066	0.0066	0.0084	0.0069	-0.0097	0.0028	0.006	0.0025	-0.0093	-0.0079	0	0.001	-0.0065	0.0026	0.001	0.0047
Total Cadmium (Cd)	0.01	µg/L	0.18	(1)	5	(17,18)	0.0062	0.0058	0.004	0.0038	0.0125	0.0625	0.004	0.0038	0.0035	0.0082	0.001	0.0023	0.0048	0.0031	-0.0086	-0.0091	0.0026	0.0107	-0.0098	0.0027	0.0023	0.0028
Dissolved Calcium (Ca)	10.00	µg/L	11600	(14)	-	-[a]	**31500**	**30300**	**33500**	**32800**	**34200**	**32700**	**33500**	**33000**	**33800**	**33200**	**29400**	**31700**	**31500**	**31600**	**32100**	**32100**	**51500**	**43100**	**44400**	**41500**	**38700**	**40100**
Total Calcium (Ca)	50.00	µg/L	11600	(14)	-	-[a]	**32800**	**32700**	**33100**	**38600**	**32600**	**32500**	**32800**	**32500**	**32800**	**33200**	**27900**	**31600**	**29100**	**25700**	**31800**	**31900**	**42700**	**41500**	**43400**	**41900**	**41200**	**41600**
Dissolved Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.0018	0.0022	0.0028	0.0031	0.0038	0.0036	0.0044	0.0037	0.0039	0.0036	0.0027	0.0025	0.0028	0.0022	0.0043	0.0038	0.001	0.0008	0.0084	0.0017	0.0013	0.0023
Total Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.0027	0.0022	0.0022	0.0031	0.0036	0.0296	0.0027	0.0021	0.0026	0.0037	0.006	0.0024	0.0022	0.0023	0.0014	0.0016	0.0034	0.0117	-0.0002	0.0059	0.003	0.0049
Dissolved Chromium (Cr)	0.10	µg/L	64	(13)	50	(16,17,18)	0.25	0.0988	0.17	0.11	0.15	0.19	0.15	0.17	0.17	0.11	0.084	0.17	0.0916	0.074	0.12	0.13	0.0694	0.0468	0.16	0.0595	0.0514	0.11
Total Chromium (Cr)	0.10	µg/L	64	(13)	50	(16,17,18)	0.0936	0.12	0.12	0.0731	0.0968	0.11	0.13	0.0773	0.11	0.12	0.18	0.087	0.0998	0.072	0.21	0.0567	0.16	0.28	0.0593	0.18	0.0871	0.14
Chromium (VI)[†]	0.50	ug/L	1	(1,3)	25	(18)	0.0965	0.0679	0.1107	0.0873	0.0366	0.0975	0.0602	0.0632	0.1006	0.0027	0.1727	0.0853	0.1378	0.0875	0.2058	0.1775	0.0302	0.0515	0.1556	0.0827	0.0385	0.0588
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	(1,3)	25	(18)	0.59	0.7	0.53	0.62	0.46	**1.3**	0.65	**1.5**	0.34	0.57	0.79	0.62	**1.2**	0.79	0.77	0.81	**2.89**	0.83	0.36	**3.18**	**1.15**	0.67
Chromium (+3)[‡]	0.5	ug/L	8.9	(1,3)	-	-[a]	0.2522	0	0.1726	0.1146	0.149	0.185	0.1457	0.1713	0.1651	0.1089	0	0.1737	0	0	0.1184	0.1345	0	0	0.1593	0	0	0.1076
Unfiltered Chromium (+3)	0.99	ug/L	8.9	(1,3)	-	-[a]	0	0.1192	0.1213	0	0	-1.175	0.1313	-1.45	0.1117	0.1176	0.183	0	-1.24	0	0.2144	0	0.1606	0.2753	0	0.1768	0	0.1446
Dissolved Cobalt (Co)	0.01	µg/L	0.9	(3)	3	(18)	0.0094	0.0096	0.0144	0.0121	0.0165	0.0128	0.0177	0.0113	0.025	0.0128	0.0153	0.0157	0.0106	0.0078	0.0175	0.017	0.0485	0.0303	0.0846	0.0269	0.0231	0.0286
Total Cobalt (Co)	0.01	µg/L	0.9	(3)	3	(18)	0.011	0.0074	0.0139	0.0099	0.0186	0.0403	0.0124	0.0102	0.0144	0.0238	0.026	0.013	**4.14**	0.012	0.0135	0.0114	0.054	0.102	0.0283	0.058	0.0366	0.0407
Dissolved Copper (Cu)	0.05	µg/L	1.5042	(6)	1000	(18)	0.926	0.616	0.734	0.64	0.892	0.602	0.787	0.615	**1.9**	0.642	1.03	0.621	0.59	0.601	0.638	0.698	0.55	0.678	1.04	0.606	1.05	**2.16**
Total Copper (Cu)	0.10	µg/L	1.5042	(6)	1000	(18)	1.47	0.72	0.865	0.684	0.861	0.799	0.802	0.638	0.996	0.937	1.09	0.78	**24**	0.8	0.978	0.623	0.8	1.21	0.8	**1.55**	0.875	**1.72**

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario													Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Iron (Fe)	1.00	µg/L	300	(1)	-	-[a]	6.5	6.1	3.6	5	6.2	3.9	3.3	3.4	16.1	2.9	4	11.1	1.7	1.2	18.4	19.7	21.2	15.3	262	9.2	10.2	15.8
Total Iron (Fe)	5.00	µg/L	300	(1)	-	-[a]	7.5	8.1	7.6	6.7	14.1	58.1	6	2.5	9.4	35.3	27.8	8.6	10.9	10.8	6.3	1.4	165	297	10.6	170	110	118
Dissolved Lead (Pb)	0.01	µg/L	7.01	(9)	5	(16)	0.0221	0.0145	0.0183	0.0229	0.0458	0.0474	0.037	0.0082	0.367	0.0144	0.0368	0.0847	0.0082	0.004	0.0249	0.0306	0.0171	0.019	0.44	0.0249	0.0191	0.0714
Total Lead (Pb)	0.02	µg/L	4.02	(1)	5	(16)	0.0467	0.018	0.0206	0.0143	0.0637	0.127	0.0207	0.0073	0.0299	0.103	0.108	0.027	0.027	0.03	0.0517	0.0091	0.205	0.49	0.0296	0.389	0.2	0.213
Dissolved Lithium (Li)	0.50	µg/L	14	(14)	8	(21)	1.8	1.87	1.73	1.72	1.76	1.73	1.73	1.75	1.74	1.68	1.5	1.73	1.68	1.74	1.68	1.7	2.9	2.19	2.07	2.14	2.16	2.42
Total Lithium (Li)	0.50	µg/L	14	(14)	8	(21)	1.74	1.74	1.73	1.69	1.7	1.7	1.77	1.7	1.71	1.72	1.4	1.89	1.82	1.52	1.49	1.48	2.57	2.4	1.87	2.51	2.16	2.23
Dissolved Magnesium (Mg)	10.00	µg/L	8200	(14)	-	-[a]	8070	7980	7960	7840	8090	7820	7980	7910	7970	7960	7780	**8700**	**8570**	**8250**	**8390**	**8220**	**9060**	**8270**	**8690**	**8400**	8070	**8360**
Total Magnesium (Mg)	50.00	µg/L	8200	(14)	-	-[a]	**8590**	**8670**	**8260**	**8220**	**8290**	**8230**	**8230**	8090	**8220**	7930	7180	**8470**	7900	6650	7590	7860	7460	**8370**	7750	**8960**	**8940**	**8930**
Dissolved Manganese (Mn)	0.05	µg/L	470	(1)	120	(16)	0.505	0.341	0.669	0.872	0.89	0.483	0.747	0.407	3.19	0.435	3.08	1.61	0.767	0.908	2.29	2.77	49.7	6.11	102	1.08	2.61	4.58
Total Manganese (Mn)	0.10	µg/L	470	(1)	120	(16)	0.75	0.519	0.847	0.545	1.61	2.12	0.781	0.552	1.17	3.57	4.63	1.61	4.72	1.44	0.915	0.686	52.5	86	2.01	81.9	52.4	43.6
Dissolved Mercury (Hg)	0.01	ug/L	0.2	(3)	1	(16,17,18)	0.0018	0.0027	-0.0007	0.0012	0.0016	0.0013	0.0005	0.0007	0.0004	0.0008	0.001	-0.001	-0.0008	0	0.0003	0.0011	-0.0002	-0.0001	0.0002	-0.0011	0.0025	0.0027
Mercury (Hg)	0.01	ug/L	0.026	(1)	1	(16,17,18)	0.001	0.001	0.0011	0.0009	0.0022	0.0024	0.0031	0.0017	0.0016	0.0017	0.00105	0.0004	0.0003	0.0001	0.0007	-0.0003	0.0001	0.0013	0.0004	0.0001	0.0012	0.0023
Dissolved Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.021725	0.018389	0.04274813	0.067	0.1	0.083	0.051	0.07	0.38	0.088	0.066	0.01959	0.0162	0.00609	0.03136	0.00692	0.01149	0.00422	0.01149	0.00568	0.01901	0.027
Total Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.028804	0.027525	0.02317083	0.01911476	0.062	0.02387015	0.067	0.058	0.11	0.02317083	0.1	0.062	0.04105	0.03774	0.02641	0.01135	0.01735	0.23	0.01735	0.03906	0.02638	0.054
Dissolved Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.16	1.15	1.18	1.12	1.18	1.14	1.22	1.13	1.27	1.18	1.13	1.18	1.15	1.18	1.17	1.16	1.1	1.09	1.1	1.12	1.13	1.12
Total Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.13	1.17	1.17	1.15	1.22	1.13	1.23	1.12	1.21	1.12	1.08	1.05	1.04	0.935	1.14	1.11	0.886	0.892	1.06	1.02	1.06	1.12
Dissolved Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	1.14	1.48	0.701	0.791	0.832	0.85	0.876	1.6	1.67	1.26	0.804	0.622	0.588	0.604	0.49	1.57	0.53	0.464	0.635	0.53	0.889	0.602
Total Nickel (Ni)	0.10	µg/L	25	(3)	100	(18)	1.88	0.612	0.73	2.25	6.41	1.16	0.565	0.488	0.81	0.822	0.62	0.64	12	0.84	0.922	0.65	0.69	0.75	0.557	0.74	0.531	0.658
Dissolved Potassium (K)	10.00	µg/L	5300	(14)	-	-[a]	1440	1430	1530	1480	1620	1520	1580	1450	1540	1510	1510	1490	1480	1480	1560	1550	2350	1870	1920	1790	1740	1920
Total Potassium (K)	50.00	µg/L	5300	(14)	-	-[a]	1510	1470	1580	1530	1580	1550	1580	1530	1570	1490	1330	1530	1420	1200	1510	1450	1920	1840	1760	1940	1820	1870
Dissolved Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.123	0.13	0.133	0.132	0.126	0.133	0.134	0.129	0.141	0.127	0.115	0.109	0.117	0.131	0.128	0.119	0.1	0.103	0.109	0.097	0.1	0.106
Total Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.118	0.136	0.125	0.155	0.135	0.124	0.133	0.135	0.141	0.131	0.114	0.132	0.197	0.108	0.116	0.105	0.093	0.113	0.092	0.105	0.114	0.102
Dissolved Silicon (Si)	50.00	µg/L	-	-	-	-[a]	561	570	359	388	409	394	354	397	359	412	258	353	450	449	270	294	2660	2480	2890	2380	1800	1620
Total Silicon (Si)	50.00	µg/L	-	-	-	-[a]	561	573	363	471	371	400	366	398	360	436	272	350	412	377	238	265	2330	2630	2550	2520	1940	1710
Dissolved Silver (Ag)	0.01	µg/L	0.1	(3)	100	(18)	0.0003	0.0011	0	0.001	0.001	0.0006	0.0009	0.0001	0.0011	0.0012	0.0014	0.0003	0.0005	0.0004	0.0019	0.0005	0	-0.0002	0.0023	0.0006	0.0003	0.0011
Total Silver (Ag)	0.01	µg/L	0.1	(3)	100	(18)	0.0016	0.0003	0.0012	0.0009	0	0.0068	0.0008	0.0004	0.0012	0.0014	0.005	0.001	**0.448**	0.0004	0.0007	0.0003	0.0014	0.0016	0.0008	0.002	0.0007	0.0019
Dissolved Sodium (Na)	10.00	µg/L	180000	(13)	200000	(18)	12600	12500	13200	12700	13500	13000	13300	12800	13300	12900	12300	14000	13700	13700	13300	13600	84100	42700	38100	39700	33300	36400
Total Sodium (Na)	50.00	µg/L	180000	(13)	200000	(18)	13100	13200	13400	13000	13300	13200	13100	12800	13200	12500	11500	13200	12400	11000	11900	12900	68000	39500	34000	38700	34000	36900
Dissolved Strontium (Sr)	0.05	µg/L	2500	(10)	7000	(16)	164	164	172	164	173	164	170	169	171	172	165	169	172	170	178	178	257	217	225	216	205	226
Total Strontium (Sr)	0.05	µg/L	2500	(10)	7000	(16)	179	173	174	172	174	172	178	171	174	169	145	177	158	134	163	162	210	215	208	218	210	235
Dissolved Thallium (Tl)	0.00	µg/L	0.3	(3)	2	(18)	0.0066	0.0067	0.0069	0.0071	0.0065	0.0075	0.0073	0.0078	0.009	0.0069	0.0062	0.0066	0.0069	0.0064	0.0065	0.0065	0.0007	0.0008	0.0021	0.0011	0.0022	0.0019
Total Thallium (Tl)	0.00	µg/L	0.3	(3)	2	(18)	0.007	0.0072	0.0066	0.0065	0.0076	0.0149	0.0066	0.0078	0.0077	0.0061	0.006	0.0065	0.0066	0.0052	0.0071	0.0067	0.001	0.0021	0.0011	0.0016	0.0025	0.0021
Dissolved Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	-0.0012	-0.002	0.0053	0.0029	0.0058	0.0102	0.0017	0.0023	0.0059	0.0027	0.0061	0.001	-0.001	0.0014	0.0029	0.0039	0.0008	0.0027	0.0206	0.0027	-0.0013	0.0027
Total Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.0011	0.0023	0.003	0.004	0.201	0.0133	0.004	0.004	0.0054	0.0117	0.02	-0.0028	-0.0008	0.0023	0.0105	0.0136	0.0102	0.0122	0.0096	0.0028	0.0111	0.0136
Dissolved Tin (Sn)	0.20	µg/L	73	(14)	2400	(21)	0.0858	0.0393	0.0199	0.0312	0.0332	0.0242	0.0237	0.1058	0.1092	0.0196	0.0493	0.0275	0.0252	0.0135	0.0119	0.0171	0.0141	0.0093	0.0329	0.0218	0.0518	0.0867
Total Tin (Sn)	0.20	µg/L	73	(14)	2400	(21)	0.0151	0.0491	0.0354	0.0282	0.0323	0.0568	0.0195	0.0266	0.0258	0.0196	0.03	0.0528	0.0395	0.0504	0.2	0.019	0.0517	0.049	0.0219	0.0405	0.0325	0.0302
Dissolved Titanium (Ti)	0.50	µg/L	27.2	(15)	15	(23)	0.1496	0.1823	0.1281	0.2927	0.1622	4.48	0.1076	0.0863	0.2085	0.1269	0.2014	0.2318	0.1048	0.0617	0.5	0.53	0.1304	0.2351	3.84	0.0959	0.379	0.15375
Total Titanium (Ti)	2.00	µg/L	27.2	(15)	15	(23)	0.1842	0.0695	0.1689	0.0932	0.3209	0.1773	0.1649	0.1337	0.1508	0.72	0.694	0.1916	0.2606	0.2042	0.0159	0.0026	1.4158	5.6	0	2.1	1.24	1.72
Dissolved Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.072	0.074	0.082	0.074	0.075	0.072	0.076	0.075	0.079	0.074	0.07	0.071	0.072	0.07	0.074	0.074	0.051	0.063	0.071	0.062	0.066	0.066
Total Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.068	0.076	0.075	0.073	0.078	0.096	0.076	0.07	0.073	0.078	0.061	0.067	0.068	0.055	0.076	0.071	0.045	0.057	0.065	0.063	0.061	0.071
Dissolved Uranium (U)	0.00	µg/L	5	(3)	20	(16,17,18)	0.317	0.316	0.337	0.327	0.343	0.339	0.336	0.344	0.341	0.34	0.338	0.317	0.325	0.324	0.308	0.302	0.307	0.289	0.286	0.29	0.294	0.301
Total Uranium (U)	0.01	µg/L	5	(3)	20	(16,17,18)	0.339	0.33	0.333	0.327	0.347	0.367	0.335	0.337	0.324	0.324	0.297	0.301	0.376	0.258	0.377	0.409	0.272	0.264	0.356	0.287	0.327	0.32
Dissolved Vanadium (V)	0.20	µg/L	6	(3)	6.2	(18)	0.21	0.26	0.2	0.1335	0.23	0.1477	0.28	0.1369	0.37	0.1513	0.46	0.24	0.23	0.23	0.1981	0.21	0.53	0.54	0.73	0.49	0.4	0.41
Total Vanadium (V)	0.20	µg/L	6	(3)	6.2	(18)	0.1728	0.22	0.1539	0.132	0.21	0.186	0.1526	0.1429	0.1754	0.1854	0.25	0.1666	0.1368	0.1356	0.125	0.1511	0.53	0.76	0.42	0.62	0.5	0.51
Dissolved Zinc (Zn)	0.10	µg/L	24.2	(1)	5000	(18)	2.5	1.01	1.18	0.58	2.48	0.68	1.81	1.2	6.09	0.51	2.58	1.55	0.91	0.52	0.28	1.09	0.67	0.51	1.87	0.51	0.9	5.6
Total Zinc (Zn)	1.00	µg/L	20	(3)	5000	(18)	1.02	1.83	1.49	0.65	2.43	1.23	1.43	0.38	1.16	1.79	2.5	0.7132	1.4	1	1.19	1.06	1.6	3.1	1.72	1.8	1.26	1.51
Dissolved Zirconium (Zr)	0.10	µg/L	4	(3)	0.32	(21)	0.0085	0.0073	0.0165	0.0081	0.0133	0.0149	0.0121	0.0011	0.0152	0.0073	0.0065	0.0118	0.0084	0.006	0.0078	0.0079	0.0198	0.0146	0.0192	0.0098	0.0095	0.0159
Total Zirconium (Zr)	0.10	µg/L	4	(3)	0.32	(21)	0.0056	0.0036	0.0109	0.0175	0.0186	0.0187	0.015	0.0058	0.0195	0.0121	0.015	0.0046	0.0028	0.0083	0.0066	0.0067	0.0319	0.0382	0.0108	0.0177	0.0179	0.0168
Volatile Organics																												
Benzene	0.10	ug/L	100	(3)	1	(17)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14	0	0	0	0
Bromodichloromethane	0.10	ug/L	200	(3)	16	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromoform	0.20	ug/L	60	(3)	25	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloroform	0.10	ug/L	1.8	(1)	25	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.24	0	0	0	0	0
Ethylbenzene	0.10	ug/L	8	(3)	2.4	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0
BTEX & F1 Hydrocarbons																												
F1 (C6-C10)	25	ug/L	167	(2)	820	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F1 (C6-C10) - BTEX	25	ug/L	167	(2)	820	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F2-F4 Hydrocarbons																												
F2 (C10-C16 Hydrocarbons)	100	ug/L	42	(2)	300	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	1000	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	1100	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microbiological*																												
Background*	10	CFU/100mL	-	-	-	-	380	4800	2600	2500	1100	1100	1200	1200	780	1200	60000	440	540	880	880	8000	6600	5200	3200	4000	8000	6200
Fecal coliform*	10	CFU/100mL	-	-	-	-	<10	20	120	<10	20	<10	60	<10	110	<10	650	<10	10	<10	20	10	220	90	20	<10	10	10
Total Coliforms*	10	CFU/100mL	100*	(3)	10	(16)	10	**30**	**470**	**60**	**200**	**60**	**150**	**50**	**260**	**40**	**2400**	**40**	10	10	**120**	**80**	**540**	**640**	**50**	**50**	**50**	**280**
Escherichia coli*	10	CFU/100mL	100	(3)	10	(16)	<10	**20**	<10	<10	<10	<10	<10	<10	<10	<10	**240**	<10	<10	<10	<10	10	**200**	**60**	10	10	<10	10
Radionuclides																												
H-3	14	Bq/kg	-	-[u]	-	-[u]	-10.5	-10.5	10.5	5.27	10.5	5.26	15.8	0	15.8	0	31.7	-10.5	-10.4	10.5	-10.6	-5.24	20.7	30.8	-5.26	31.2	26	21

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																					
							Lake Ontario																		Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
C-14	0.027	Bq/g	-	-[a]	-	-[a]	-0.00027	-4.3E-05	-0.0000511	-0.0000151	0.00000301	0.0000028	-0.0000364	0.0000857	0.0000191	-0.0000649	1.2E-05	-4E-05	-4E-05	-0.0003	0.0002	0.00033	-0.0002	-6E-05	8.7E-05	-0.0002	-0.0003	3.2E-05
Co-60	0.73	Bq/kg	-	-[a]	-	-[a]	0.309	0.337	0.331	0.229	0.317	-0.121	0.00977	-0.2	0.177	-0.184	0.493	-0.252	-0.0625	0.573	-0.32	0.0024	-0.635	0.325	0.21	0.267	0.332	-0.687
Cs-134	0.75	Bq/kg	-	-[a]	-	-[a]	0.233	0.116	-0.187	-0.544	0.128	0.269	-0.261	0.027	0.0443	0.184	0.0442	-0.174	0.262	-0.27	-0.448	-0.0034	0.493	0.0312	0.0359	0.234	0.128	-0.139
Cs-137	0.6	Bq/kg	-	-[a]	-	-[a]	0.265	-0.0635	-0.12	0.203	0.261	-0.521	-0.582	-0.263	-0.283	-0.37	0.265	-0.0345	0.41	0.0321	0.224	-0.646	0.42	-0.201	-0.0762	-0.308	0.0623	0.0672
I-131	1.2	Bq/kg	-	-[a]	-	-[a]	0.318	0.0444	0.457	1.32	0.738	-0.272	-0.0151	-0.672	-0.69	0.169	2.19	-0.507	-0.564	0.127	-0.159	0.386	-0.142	0.0859	0.131	0.0322	0.346	0.415
K-40	7.1	Bq/kg	-	-[a]	-	-[a]	2.28	2.15	-1.73	-2.32	-7.45	-0.279	0.36	-5.01	-0.371	-0.387	2.49	4.7	-4.69	-1.4	0.177	-0.912	-0.0788	0.781	1.07	-0.483	1.42	1.81
Th-Series	1.8	Bq/kg	-	-[a]	-	-[a]	-1.14	-1.32	0.672	-0.581	0.226	-1.08	-0.495	0.0944	-0.941	0.693	-1.42	0.509	0.925	0.484	-0.314	0.859	1.1	-0.0161	-0.269	1.26	0.261	-0.737
U-Series	1.5	Bq/kg	-	-[a]	-	-[a]	0.0513	1.77	-0.469	-0.884	-0.11	0.018	-0.621	0.292	0.0091	0.196	1.01	0.845	0.174	-0.137	-0.335	0.744	0.0954	0.351	0.377	0.215	0	0.299
Others Parameters																												
Hydrazine*	0.1	ug/L	2.6	(12)	0.01	(24)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Monomethyl Hydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorophyll a	1.3	ug/L	-	-	-	-	0.422842	0.147997	0.2740521	0.55080149	0.4215531	0.46522195	0.40497547	0.29566935	0.67823894	0.5404548	0.81781	2.6	1.8	1.20619	3	4.5	5.9	12	12	8.5	9.9	11
Morpholine	4	ug/L	4	(3)	1700	(25)	0	0	0	0	0	0	0	0	0	0	2.53	0	0	0	0	0	0	0	0	0	0	0

Note:

Bold	Exceedance of Selected Ecological Screening Criterion
Bold	Exceedance of Selected Human Screening Criterion
Bold	Exceedance of Selected Ecological and Human Health Screening Criteria

Surface water samples from Lake Ontario were collected at a depth of 0.5 meters (denoted by "S" in the sample name), while bottom samples were taken 0.5 meters above the lakebed (denoted by "B"). Mid-depth samples were collected in Frenchman's Bay, as thermal stratification is unlikely in the shallow
depths observed in this area. LWC1 represents the background location. Sampling locations presented in **Figure 4-3**.
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline/benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (120.17 mg/L), pH (7.79), temperature (13.61°C), alkalinity (104.91 mg/L), and DOC (2.58 mg/L) from fall samples were used.
* Only censored results provided by lab.
† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
[a] The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
[b] Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).

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Table A-5: Hydrazine Concentrations in Water samples from 2025 Hydrazine Monitoring Program

Parameter	Detection Limit	Units	Selected Ecological Screening Criteria	Selected Human Health Screening Criteria	Spring 2025							
					LWC1-T	LWC1-B	LW21	FB1-T	FB1-B	LW9-T	LW9-B	LW10
Hydrazine*	0.1	ug/L	2.6	0.01	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Monomethyl Hydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Parameter	**Detection Limit**	**Units**	**Selected Ecological Screening Criteria**	**Selected Human Health Screening Criteria**	**Summer 2025**							
					FB1-S	**FB1-B**	**LW10-S**	**LW9-B**	**LW9-S**	**LW21-S**	**LWC1-B**	**LWC1-S**
Hydrazine*	0.1	ug/L	2.6	0.01	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Monomethyl Hydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Parameter	**Detection Limit**	**Units**	**Selected Ecological Screening Criteria**	**Selected Human Health Screening Criteria**	**Fall 2025**							
					FB1-B	**FB1-S**	**LW10**	**LW9-B**	**LW9-S**	**LW21**	**LWC1-B**	**LWC1-S**
Hydrazine*	0.1	ug/L	2.6	0.01	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Monomethyl Hydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25

Note:
Sampling locations presented in **Figure 4-3.**

A.2.1.2 Sediment Quality

Concentrations of parameters in sediment samples were compared against the selected screening criteria. Selection of the applicable sediment screening criteria followed the hierarchical decision-tree presented in **Figure A-3** and summarized below:

- The most conservative value between:
    - Ontario Provincial Sediment Quality Guidelines (PSQG; MOEE, 1993) or;
    - CCME Sediment Quality Guidelines (CCME, 2001); or,
- Guidelines from other sources and toxicological literature; or,
- Sediment background concentrations derived from known crustal abundance values:
    - Dragun & Chiasson, 1991. *Elements in North American Soils* (Dragun and Chiasson, 1991).

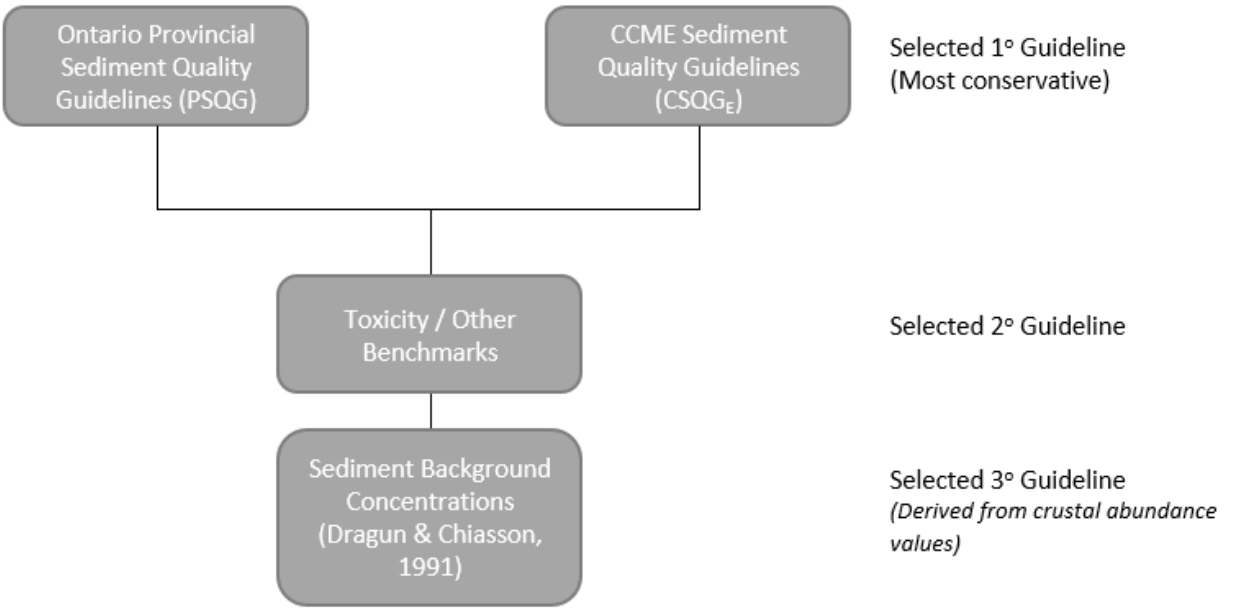


Figure A-3: Hierarchy of Screening Criteria for Non-Radiological Constituents in Sediment

Nearshore Lake Ontario

Estimated maximum copper concentrations in sediment near the PN outfall based on water concentrations in 2015 slightly exceeded benthic invertebrate benchmarks, though mean concentrations did not. However, this exceedance was not anticipated to impact the invertebrate community and should be interpreted with caution as the substrate in the area is transient and primarily comprised of coarse sand (Hart and Petersen, 2013). Both maximum and mean sediment concentrations of other parameters were below their respective ecological benchmarks.

The only parameter to exceed its associated screening criterion from the 2024 sediment samples collected in the Infill and Shoreline Erosion Mitigation Study Areas was total phosphorous (**Table A-6**). The Ontario Sediment Quality Guideline (600 mg/kg) was exceeded at two locations (Infill-03 and Infill-06; **Figure 4-4**). However, this guideline is not based on toxic effects to ecological receptors, but rather represents a nutrient effect on benthic community composition (MECP, 2008). Additionally, the elevated levels of phosphorus are probably a result of agricultural and urban inputs into Lake Ontario. Therefore, these exceedances most likely do not indicate facility-related impacts and are not associated with adverse impacts on aquatic invertebrates. The results from this sampling program cannot be directly compared to the 2015 estimates as the sampling stations were not in proximity to the outfall.

No exceedances of applicable screening criteria were found in the samples collected from the Cutoff Wall Study Area in 2025 (**Table A-7**).

Frenchman's Bay

The fall 2024 sediment program focused on Frenchman's Bay as it is the closest location to the PN site where sediment is likely to accumulate.

The concentrations of metals including aluminum, cadmium, chromium, copper, manganese, nickel, thallium, and tin in sediment samples from 2015 were found to exceed the established screening levels. These exceedances were anticipated, as Frenchman's Bay is highly influenced by urban runoff. Additionally, the levels of total organic carbon (TOC) were greater than the MECP guideline of 10,000 mg/kg (or 1%). However, as highlighted earlier, MECP guidelines for nutrients such as TOC are not based on toxic effects to ecological receptors. Additionally, wetland locations often exceed this screening criterion as organic matter content and nutrient levels may be naturally high in wetlands, which the guideline does not account for as it was established based on a Great Lakes dataset.

In 2024, the list of metals that exceeded their screening criteria (**Table A-7**) and the degree of exceedance of these criteria is comparable to the results from 2015. The only exceptions were aluminum, thallium, and tin, which exceeded screening criteria in 2015 but were below these criteria in 2024. Of the parameters that were quantified for the first time in 2024, certain PAHs and petroleum hydrocarbons, and Aroclor 1260 exceeded their respective sediment quality guidelines. As previously noted, these exceedances can be attributed to the ongoing impact of urban runoff. In line with the 2015 samples, TOC concentrations exceeded the MECP guideline at all locations in Frenchman's Bay. Unlike in 2015, all sediment samples collected from Frenchman's Bay exceeded the MECP guideline for Total Kjeldahl Nitrogen (TKN; 550 mg/kg). The exceedances of TOC and TKN are likely due to the naturally elevated organic content of wetland ecosystems and are not associated with toxic effects. The elevated nutrient levels are probably a result of agricultural and urban inputs, rather than being linked to PNGS operations.

Mid-depth Study Area

The concentrations of metals, PAHs, PCBs, pesticides and herbicides measured in samples from the Mid-Depth Study Area were below their respective guidelines.

Some petroleum hydrocarbon fractions exceeded their respective sediment quality guidelines in two samples (MD-02 and MD-03; **Table A-7**). However, as these exceedances were limited to a small number of samples and are not expected to be associated with PNGS operations, they are not anticipated to pose a sustained risk to wildlife in the area. These exceedances will be further evaluated as part of the 2027 PN ERA.

Radiological Concentrations in Sediment

Frenchman's Bay, which is characterized by the presence of fine-grained sediments and relatively high concentrations of TOC is the nearest depositional area for sediment that is suitable for radiological analyses. Sediments present in the Nearshore areas (primarily coarse sand) are not appropriate for the accumulation of radiological contaminants (Hart and Peterson, 2013), and were thus not analyzed for these parameters.

Sediment samples collected from Frenchman's Bay during the 2015 sampling program were analyzed for radionuclides, including C-14, Co-60, Cs-134, and Cs-137 (Ecometrix and Golder, 2018). In addition, sediment from Frenchman's Bay is sampled every five years to identify possible radionuclide accumulation over time in support of OPG's EMP, with the most recent sampling conducted in 2024 (OPG, 2025a). The same radionuclides analyzed in the 2015 program were assessed in the EMP sampling, with the addition of K-40. Sediment samples collected as a part of the 2024 environmental studies in support of this PERA were also analyzed for the same radionuclides as the 2015 program, with the addition of tritium, K-40, I-131, Thorium-series, and Uranium-series radionuclides.

Across all three sampling events, the majority of sediment samples exhibited concentrations of Co-60 and Cs-134 well below detection limits. Cs-137 was generally detectable in samples from all three events, with similar results being observed; however, its presence cannot be confirmed to be the result of OPG operations. C-14 concentrations across all three sampling events were either low or below detection limits. Concentrations in samples collected in 2024 in support of the PERA (**Table A-4**) were low and comparable to those measured in 2015, while samples collected in 2024 in support of the EMP were below detection limits. Though tritium, K-40, I-131, Thorium-series and Uranium-series radionuclides were all detectable in the samples from the 2024 environmental studies, the concentrations are low.

A.2.1.3 Stormwater Runoff

Stormwater runoff from the PN site is collected by a drainage system and directed south to Lake Ontario. Runoff entering the discharge channels is estimated at 270 m^3/day for PNGS Units 1-4 and 262 m^3/day for PNGS Units 5-8, based on an annual precipitation of 872 mm. The 2017 ERA (Ecometrix and Golder, 2018) included results from a 2015–2016 stormwater sampling campaign to characterize the quality of stormwater. Final concentrations in the discharge channels and in Lake Ontario were compared to relevant water quality screening criteria, and no exceedances of the selected benchmarks were identified.

Consistent with the requirements of CSA N288.6:22 clause 11.1 to periodically review changes to the facility, the expansion of PWMF Phase II will likely result in changes to the stormwater catchments in the East Complex. The appropriate stormwater outfalls in the East Complex should be reviewed and sampled accordingly to be representative of the catchment areas after the completion of the PWMF Phase II expansion. Gross beta-gamma in stormwater was monitored and reported quarterly over the 2016-2020 period; however, in 2021 OPG determined that no routine monitoring is required given the robust design of the used fuel dry

storage containers (DSCs) and absence of liquid inside the DSCs during dry storage (OPG, 2021a). Following their review of the 2017 ERA, CNSC and ECCC recommended that a stormwater sampling plan be included in future ERA submissions. OPG plans to carry out this recommendation after the completion of the PWMF Phase II expansion and results from the stormwater sampling will be included in the subsequent routine updates of the ERA.

Table A-6: Screening of Sediment Quality Parameters in Samples from the Infill, Shoreline Erosion Mitigation, Mid-depth, and Cutoff Wall Study Areas, 2024-2025

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
Calculated Parameters																									
Total (Dry Wt) Methyl Mercury	ng/g	0.084 - 0.24	-	-	-	-	-	-	-	-	-	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.46	0.18	0.10	0.09	0.13	0.00
Total (Wet Wt) Methyl Mercury	ng/g	0.05	-	-	-	-	-	-	-	-	-	0.16	0.05	0.05	0.02	0.03	0.05	0.03	0.21	0.29	0.13	0.07	0.07	0.09	0.03
Inorganics																									
Moisture	%	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen (N)	%	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/kg	500	10000 [a]	100000 [a]	-	-	-	-	-	10000	(1)	2500.00	459.00	1100.00	483.00	670.00	860.00	630.00	2300.00	8500.00	2200.00	5000.00	3000.00	2900.00	0.01
Calculated Total Kjeldahl Nitrogen	µg/g	100	550	4800	-	-	-	-	-	550	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus (P)	mg/kg	10	600	2000	-	-	-	-	-	600	(1)	**986.00**	528.00	**619.00**	459.00	429.00	**979.00**	491.00	-	-	-	-	-	-	-
Nitrite (N)	µg/g	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (N)	µg/g	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite (N)	µg/g	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
< -1 Phi (2 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	100.00	100.00	99.00	100.00	100.00	0.82	1.02	0.99	1.37	1.76	0.91	0.00
< 0 Phi (1 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	100.00	99.00	98.00	100.00	100.00	-	-	-	-	-	-	-
< +1 Phi (0.5 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	100.00	96.00	89.00	100.00	99.00	-	-	-	-	-	-	-
< +2 Phi (0.25 mm)	%	0.1	-	-	-	-	-	-	-	-	-	96.00	94.00	83.00	28.00	47.00	78.00	70.00	-	-	-	-	-	-	-
< +3 Phi (0.12 mm)	%	0.1	-	-	-	-	-	-	-	-	-	45.00	30.00	11.00	1.50	3.10	27.00	2.50	-	-	-	-	-	-	-
< +4 Phi (0.062 mm)	%	0.1	-	-	-	-	-	-	-	-	-	12.00	1.60	1.30	0.60	0.63	0.97	0.58	-	-	-	-	-	-	-
< +5 Phi (0.031 mm)	%	0.1	-	-	-	-	-	-	-	-	-	4.70	1.10	0.96	0.52	0.42	0.75	0.52	-	-	-	-	-	-	-
< +6 Phi (0.016 mm)	%	0.1	-	-	-	-	-	-	-	-	-	2.90	0.63	0.69	0.35	0.42	0.65	0.48	-	-	-	-	-	-	-
< +7 Phi (0.0078 mm)	%	0.1	-	-	-	-	-	-	-	-	-	1.70	0.60	0.50	0.35	0.34	0.52	0.40	-	-	-	-	-	-	-
< +8 Phi (0.0039 mm)	%	0.1	-	-	-	-	-	-	-	-	-	1.20	0.56	0.55	0.38	0.37	0.49	0.33	-	-	-	-	-	-	-
< +9 Phi (0.0020 mm)	%	0.1	-	-	-	-	-	-	-	-	-	1.20	0.37	0.41	0.26	0.29	0.51	0.34	-	-	-	-	-	-	-
Gravel	%	0.1	-	-	-	-	-	-	-	-	-	0.12	0.00	0.00	0.46	0.53	0.00	0.00	-	-	-	-	-	-	-
Sand	%	0.1	-	-	-	-	-	-	-	-	-	88.00	98.00	99.00	99.00	99.00	99.00	99.00	-	-	-	-	-	-	-
Silt	%	0.1	-	-	-	-	-	-	-	-	-	11.00	1.00	0.80	0.22	0.25	0.48	0.25	-	-	-	-	-	-	-
Clay	%	0.1	-	-	-	-	-	-	-	-	-	1.20	0.56	0.55	0.38	0.37	0.49	0.33	-	-	-	-	-	-	-
Physical testing																									
Moisture-Subcontracted	%	0.3	-	-	-	-	-	-	-	-	-	19.00	19.00	19.00	18.00	19.00	18.00	20.00	-	-	-	-	-	-	-
Metals																									
Total Aluminum (Al)	mg/kg	100.00	-	-	-	-	58030	(3)	-	58030	(3)	1760.00	1070.00	1240.00	992.00	1160.00	1460.00	1120.00	1400.00	1800.00	1200.00	1000.00	1400.00	1600.00	1100.00
Total Antimony (Sb)	mg/kg	0.10	-	-	-	-	2	(6)	-	2	(6)	0.04	0.02	0.03	0.03	0.03	0.04	0.02	0.03	0.06	0.01	0.02	0.02	0.05	0.03
Total Arsenic (As)	mg/kg	0.20	6	33	5.9	17	-	-	-	5.9	(2)	1.50	1.37	1.34	1.29	1.39	2.63	1.41	1.30	1.40	1.40	1.30	1.20	1.40	1.30
Total Barium (Ba)	mg/kg	0.10	-	-	-	-	-	-	10 - 5000	10 - 5000	(7)	10.40	6.11	6.26	6.13	6.40	7.35	6.17	7.60	13.00	7.70	5.80	8.60	8.30	6.10
Total Beryllium (Be)	mg/kg	0.20	-	-	-	-	-	-	<1.0 - 15	<1.0 - 15	(7)	0.13	0.07	0.16	0.10	0.10	0.12	0.11	0.09	0.11	0.08	0.08	0.09	0.10	0.10
Total Bismuth (Bi)	mg/kg	0.10	-	-	-	-	-	-	<10 - 15	<10 - 15	(7)	0.02	0.01	0.01	0.01	0.01	0.02	0.01	-	-	-	-	-	-	-
Total Boron (B)	mg/kg	1.00	-	-	-	-	-	-	<20 - 300	<20 - 300	(7)	3.30	2.10	3.70	3.10	2.70	2.90	2.60	1.42	2.36	1.06	1.24	0.97	1.57	1.34
Hot Water Ext. Boron (B)	µg/g	0.05	-	-	-	-	1.5	(8)	-	1.5	(8)	0.27	0.06	0.08	0.04	0.05	0.05	0.04	0.21	1.10	0.11	0.05	0.09	0.08	0.05
Total Cadmium (Cd)	mg/kg	0.05	0.6	10	0.60	3.50	-	-	-	0.6	(2)	0.04	0.02	0.04	0.03	0.04	0.05	0.02	0.06	0.07	0.02	0.02	0.02	0.06	0.03
Total Calcium (Ca)	mg/kg	100	-	-	-	-	-	-	100 - 320,000	100 - 320000	(7)	79100.00	76100.00	79900.00	76000.00	81000.00	83000.00	81500.00	-	-	-	-	-	-	-
Total Cesium (Cs)	mg/kg	1	-	-	-	-	-	-	0.25 - 25	0.25 - 25	(7)	0.14	0.07	0.08	0.08	0.10	0.10	0.10	-	-	-	-	-	-	-
Total Chromium (Cr)	mg/kg	0.5	26	110	37.3	90	-	-	-	26	(1)	8.32	3.64	4.11	4.04	3.41	6.95	3.85	4.40	6.00	3.70	3.60	5.10	6.00	5.00
Total Cobalt (Co)	mg/kg	0.1	-	-	-	-	50	(4)	-	50	(4)	2.24	1.17	1.40	1.27	1.31	1.87	1.37	1.60	2.00	1.30	1.20	1.80	1.70	1.40
Total Copper (Cu)	mg/kg	0.5	16	110	35.7	197	-	-	-	16	(1)	3.27	1.65	1.70	1.53	1.83	2.46	1.56	2.40	4.60	5.30	2.10	3.90	3.10	2.20
Total Iron (Fe)	mg/kg	100	20000 [a]	40000 [a]	-	-	-	-	-	20000	(1)	13200.00	5470.00	6880.00	7400.00	5440.00	12000.00	6710.00	6100.00	8300.00	5600.00	5500.00	7600.00	8500.00	7900.00

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
Total Lead (Pb)	mg/kg	0.1	31	250	35	91.3	-	-	-	31	(31)	2.52	1.85	1.91	1.80	2.14	2.23	1.98	2.10	2.80	2.00	1.70	2.10	2.10	2.00
Total Lithium (Li)	mg/kg	0.5	-	-	-	-	-	-	<5.0 - 140	<5.0 - 140	(7)	2.53	1.67	1.96	1.81	2.14	2.21	1.87	-	-	-	-	-	-	-
Total Magnesium (Mg)	mg/kg	100	-	-	-	-	-	-	50 - >100,000	50 - >100000	(7)	4320.00	3280.00	3340.00	2670.00	2790.00	3740.00	2820.00	3500.00	4200.00	3000.00	2800.00	3600.00	4600.00	3700.00
Total Manganese (Mn)	mg/kg	0.2	460	1100	-	-	-	-	-	460	(1)	185.00	129.00	148.00	131.00	142.00	161.00	138.00	150.00	190.00	130.00	120.00	150.00	150.00	140.00
Total Mercury (Hg)	mg/kg	0.05	0.2	2	0.17	0.486	-	-	-	0.17	(2)	0.00	0.00	0.03	0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00
Total Molybdenum (Mo)	mg/kg	0.1	-	-	-	-	13.8	(5)	-	13.8	(5)	0.19	0.10	0.14	0.16	0.12	0.16	0.12	0.11	0.14	0.11	0.12	0.13	0.12	0.09
Total Nickel (Ni)	mg/kg	0.5	16	75	-	-	-	-	-	16	(1)	4.30	2.33	2.77	2.50	2.90	3.34	2.50	3.40	4.20	2.70	2.50	3.10	3.20	2.60
Total Potassium (K)	mg/kg	100	-	-	-	-	-	-	50 - 63,000	50 - 63000	(7)	291.00	169.00	192.00	177.00	214.00	232.00	185.00	230.00	320.00	196.50	175.85	220.00	250.00	184.66
Total Selenium (Se)	mg/kg	0.5	-	-	-	-	1.9	(5)	-	1.9	(5)	0.08	0.03	0.08	0.04	0.05	0.04	0.04	0.06	0.15	0.07	0.05	0.08	0.08	0.03
Total Silver (Ag)	mg/kg	0.05	-	-	-	-	0.5	(4)	-	0.5	(4)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Sodium (Na)	mg/kg	100	-	-	-	-	-	-	<500 - 100,000	<500 - 100000	(7)	112.00	78.58	92.54	82.24	80.98	103.00	75.45	-	-	-	-	-	-	-
Total Strontium (Sr)	mg/kg	0.1	-	-	-	-	-	-	<5 - 3000	<5 - 3000	(7)	125.00	118.00	127.00	117.00	125.00	131.00	125.00	-	-	-	-	-	-	-
Total Thallium (Tl)	mg/kg	0.05	-	-	-	-	-	-	<0.25 - 10	<0.25 - 10	(7)	0.05	0.03	0.03	0.03	0.03	0.03	0.02	0.01	0.03	0.01	0.01	0.02	0.03	0.01
Total Thorium (Th)	mg/kg	0.1	-	-	-	-	-	-	2.2 - 31	2.2 - 31	(7)	1.78	1.34	1.42	0.90	1.95	1.43	1.02	-	-	-	-	-	-	-
Total Tin (Sn)	mg/kg	0.1	-	-	-	-	-	-	<0.1 - 10	<0.1 - 10	(7)	0.35	0.16	0.21	0.19	0.17	0.27	0.18	-	-	-	-	-	-	-
Total Titanium (Ti)	mg/kg	1	-	-	-	-	-	-	70 - 20,000	70 - 20000	(7)	276.00	132.00	183.00	158.00	121.00	252.00	150.00	-	-	-	-	-	-	-
Total Tungsten (W)	mg/kg	0.5	-	-	-	-	-	-	<100 - 1000	<100 - 1000	(7)	0.21	0.13	0.11	0.12	0.11	0.16	0.14	-	-	-	-	-	-	-
Total Uranium (U)	mg/kg	0.05	-	-	-	-	104.4	(5)	-	104.4	(5)	0.45	0.26	0.37	0.31	0.26	0.41	0.34	0.29	0.35	0.30	0.25	0.30	0.37	0.32
Total Vanadium (V)	mg/kg	1	-	-	-	-	35.2	(5)	-	35.2	(5)	24.20	8.80	11.30	13.00	8.50	21.80	10.90	9.80	14.00	8.70	9.20	14.00	16.00	14.00
Total Zinc (Zn)	mg/kg	1	120	820	123	315	-	-	-	120	(1)	16.80	9.40	10.30	8.80	11.70	13.30	10.30	17.00	20.00	11.00	9.90	13.00	16.00	12.00
Total Zirconium (Zr)	mg/kg	0.5	-	-	-	-	-	-	<20 - 2000	<20 - 2000	(7)	1.36	0.96	1.24	0.99	1.05	1.51	1.06	-	-	-	-	-	-	-
PCBs																									
Aroclor 1016	µg/g	0.02	0.007	53	-	-	-	-	-	0.007	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1221	µg/g	0.02	-	-	-	-	0.12	(3)	-	0.12	(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1232	µg/g	0.02	-	-	-	-	0.6	(3)	-	0.6	(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1242	µg/g	0.02	-	-	-	-	0.17	(3)	-	0.17	(3)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1248	µg/g	0.02	0.03	150	-	-	-	-	-	0.03	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1254	µg/g	0.02	0.06	34	-	-	-	-	-	0.06	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1260	µg/g	0.02	0.005	24	-	-	-	-	-	0.005	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1262	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1268	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PCB	µg/g	0.02	0.07	530	-	-	-	-	-	0.07	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polyaromatic Hydrocarbons																									
Anthracene	µg/g	0.01	0.22	370	0.0469	0.2450	-	-	-	0.0469	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzo(a)anthracene	µg/g	0.01	0.32	1480	0.0317	0.3850	-	-	-	0.0317	(2)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Benzo(a)pyrene	µg/g	0.01	0.37	1440	0.0319	0.7820	-	-	-	0.0319	(2)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Benzo(g,h,i)perylene	µg/g	0.01	0.17	320	-	-	-	-	-	0.17	(1)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Benzo(k)fluoranthene	µg/g	0.01	0.24	1340	-	-	-	-	-	0.24	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chrysene	µg/g	0.01	0.34	460	0.0571	0.8620	-	-	-	0.0571	(2)	-	-	-	-	-	-	-	0.01	0.01	0.01	0.00	0.01	0.00	0.00
Dibenzo(a,h)anthracene	µg/g	0.01	0.06	130	0.0062	0.1350	-	-	-	0.00622	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluoranthene	µg/g	0.01	0.75	1020	0.1110	2.3550	-	-	-	0.111	(2)	-	-	-	-	-	-	-	0.01	0.02	0.02	0.01	0.01	0.01	0.01
Fluorene	µg/g	0.01	0.19	160	0.0212	0.1440	-	-	-	0.0212	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	µg/g	0.01	0.2	320	-	-	-	-	-	0.2	(1)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Phenanthrene	µg/g	0.01	0.56	950	0.0419	0.5150	-	-	-	0.0419	(2)	-	-	-	-	-	-	-	0.00	0.01	0.02	0.00	0.00	0.00	0.00
Pyrene	µg/g	0.01	0.49	850	0.0530	0.8750	-	-	-	0.053	(2)	-	-	-	-	-	-	-	0.01	0.02	0.01	0.01	0.01	0.01	0.01

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
BTEX & F1 Hydrocarbons																									
Benzene	µg/g	0	-	-	-	-	1.24	(9)	-	1.24	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Toluene	µg/g	0	-	-	-	-	1.4	(9)	-	1.4	(9)	-	-	-	-	-	-	-	0.00	0.96	0.00	0.00	0.00	0.00	0.00
Ethylbenzene	µg/g	0	-	-	-	-	1.16	(9)	-	1.16	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
o-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p+m-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Xylenes	µg/g	0	-	-	-	-	1.28	(9)	-	1.28	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F1 (C6-C10)	µg/g	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aliphatic C6-C8	µg/g	-	-	-	-	-	14	(9)	-	14	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aliphatic C>8-C10	µg/g	-	-	-	-	-	10.5	(9)	-	10.5	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aromatic C>8-C10	µg/g	-	-	-	-	-	11.6	(9)	-	11.6	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F1 (C6-C10) - BTEX	µg/g	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F2-F4 Hydrocarbons																									
F2 (C10-C16 Hydrocarbons)	µg/g	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	36.00	8.70	0.00	0.00	0.00
Aliphatic C>10-C12	µg/g	-	-	-	-	-	8.7	(9)	-	8.7	(9)	-	-	-	-	-	-	-	0.00	0.00	**12.96**	3.13	0.00	0.00	0.00
Aliphatic C>12-C16	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	-	-	-	-	-	-	-	0.00	0.00	15.84	3.83	0.00	0.00	0.00
Aromatic C>10-C12	µg/g	-	-	-	-	-	5.7	(9)	-	5.7	(9)	-	-	-	-	-	-	-	0.00	0.00	3.24	0.78	0.00	0.00	0.00
Aromatic C>12-C16	µg/g	-	-	-	-	-	2.5	(9)	-	2.5	(9)	-	-	-	-	-	-	-	0.00	0.00	**3.96**	0.96	0.00	0.00	0.00
F3 (C16-C34 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	100.00	85.00	0.00	0.00	0.00	0.00
Aliphatic C>16-C21	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	-	-	-	-	-	-	-	0.00	56.00	47.60	0.00	0.00	0.00	0.00
Aliphatic C>21-C34	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	-	-	-	-	-	-	-	0.00	24.00	20.40	0.00	0.00	0.00	0.00
Aromatic C>16-C21	µg/g	-	-	-	-	-	1.7	(9)	-	1.7	(9)	-	-	-	-	-	-	-	0.00	**14.00**	**11.90**	0.00	0.00	0.00	0.00
Aromatic C>21-C34	µg/g	-	-	-	-	-	5.4	(9)	-	5.4	(9)	-	-	-	-	-	-	-	0.00	**6.00**	5.10	0.00	0.00	0.00	0.00
F4 (C34-C50 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aliphatic C>34	µg/g	-	-	-	-	-	98.8 [c]	(9)	-	98.8	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aromatic C>34	µg/g	-	-	-	-	-	0.4 [c]	(9)	-	0.4	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calculated Parameters																									
Aldrin + Dieldrin	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane (Total)	µg/g	0.004	0.007	6	0.0045	0.00887	-	-	-	0.0045	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heptachlor + Heptachlor epoxide	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o,p-DDT + p,p-DDT	µg/g	0.004	0.008	71	0.00119	0.00477	-	-	-	0.00119	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pesticides & Herbicides																									
Aldrin	µg/g	0.004	0.002	8	-	-	-	-	-	0.002	(1)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
a-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
g-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dieldrin	µg/g	0.004	0.002	91	0.00285	0.00667	-	-	-	0.002	(1)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lindane	µg/g	0.004	-	-	0.00094	0.00138	-	-	-	0.0094	(2)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Endrin	µg/g	0.004	0.003	130	0.00267	0.0624	-	-	-	0.00267	(2)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor	µg/g	0.004	-	-	0.0006	0.00274	-	-	-	0.0006	(2)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor epoxide	µg/g	0.004	0.005	5	-	-	-	-	-	0.005	(1)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
alpha-BHC	µg/g	0.004	0.006	10	-	-	-	-	-	0.006	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
beta-BHC	µg/g	0.004	0.005	21	-	-	-	-	-	0.005	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
delta-BHC	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
Mirex	µg/g	0.004	0.007	130	-	-	-	-	-	0.007	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radionuclides																									
Co-60	Bq/kg	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs-134	Bq/kg	0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs-137	Bq/kg	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I-131	Bq/kg	2.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K-40	Bq/kg	1.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Th-Series	Bq/kg	0.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U-Series	Bq/kg	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H-3	Bq/kg	24.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C-14	Bq/g	0.0096	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note:

Bold Exceeded selected screening criteria

The symbol '-' denotes no value was determined and/or required.

Highlighting and bold font denotes that the maximum concentration of a parameter exceeds the relevant screening criteria value.

Sampling locations are presented in **Figure 4-4**.

* The concentrations of PHC subfractions were obtained by dividing the concentration of total fraction (eg: F2, F3, F4) by the ratios of the subfractions provided in CCME (2008). The concentrations of the subfractions were then compared to their equivalent guidelines from Atlantic PIRI (2012).

a - Converted from % to mg/kg.

b - Sediment criteria could not be calculated based on a toxic endpoint to aquatic species due to the low solubility of the fraction in water, resulting in a low potential for migration to or accumulation in sediment.

c - based on the Chronic benchmarks for aliphatic C19-C36 and aromatic C16-C36 calculated by Atlantic PIRI (2012) using the model developed by DiToro and McGrath (2000) using the benchmarks from Batelle (2007)

LEL - Lowest Effect Level

SEL- Severe Effect Level

ISQG- Interim Sediment Quality Guidelines

PEL- Probable Effects Level

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Table A-7: Screening of Sediment Quality Parameters in Frenchman's Bay Samples, 2024

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																	
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
Calculated Parameters																													
Total (Dry Wt) Methyl Mercury	ng/g	0.084 - 0.24	-	-	-	-	-	-	-	-	-	-	0.35	0.00	-	0.00	-	-	-	0.17	-	0.00	0.00	-	-	-	-	0.24	-
Total (Wet Wt) Methyl Mercury	ng/g	0.05	-	-	-	-	-	-	-	-	-	-	0.07	0.03	-	0.01	-	-	-	0.06	-	0.01	0.04	-	-	-	-	0.06	-
Inorganics																													
Moisture	%	1	-	-	-	-	-	-	-	-	-	44	80	40	74	77	78	77	61	59	77	78	48	67	48	72	56	77	61
Nitrogen (N)	%	0.01	-	-	-	-	-	-	-	-	-	0.17	0.89	0.18	0.63	0.78	0.81	0.74	0.41	0.31	0.67	0.66	0.18	0.40	0.16	0.55	0.29	0.76	0.34
Total Organic Carbon	mg/kg	500	10000 [a]	100000 [a]	-	-	-	-	-	10000	(1)	**14000.00**	**94000.00**	**19000.00**	**76000.00**	**75000.00**	**100000.00**	**86000.00**	**46000.00**	**24000.00**	**66000.00**	**60000.00**	**14000.00**	**36000.00**	**13000.00**	**53000.00**	**26000.00**	**65000.00**	**21000.00**
Calculated Total Kjeldahl Nitrogen	µg/g	100	550	4800	-	-	-	-	-	550	(1)	**1700.00**	**8900.00**	**1800.00**	**6300.00**	**7800.00**	**8100.00**	**7400.00**	**4100.00**	**3100.00**	**6700.00**	**6600.00**	**1800.00**	**4000.00**	**1600.00**	**5500.00**	**2900.00**	**7600.00**	**3400.00**
Total Phosphorus (P)	mg/kg	10	600	2000	-	-	-	-	-	600	(1)	**787.00**	**869.00**	**782.00**	**1000.00**	**884.00**	**875.00**	**1050.00**	**1040.00**	**800.00**	**951.00**	**935.00**	**604.00**	**870.00**	597.00	**1110.00**	**808.00**	**1030.00**	**815.00**
Nitrite (N)	µg/g	0.5	-	-	-	-	-	-	-	-	-	0.02	0.09	0.00	0.04	0.07	0.07	0.00	0.04	0.36	0.16	0.05	0.02	0.04	0.01	0.03	0.01	0.21	0.01
Nitrate (N)	µg/g	2	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrate + Nitrite (N)	µg/g	3	-	-	-	-	-	-	-	-	-	0.28	0.46	0.17	0.11	0.41	0.34	0.28	0.15	1.61	0.48	0.35	0.36	0.36	0.24	0.36	0.26	0.47	0.61
< -1 Phi (2 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	99.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.00	100.00	100.00	100.00	100.00
< 0 Phi (1 mm)	%	0.1	-	-	-	-	-	-	-	-	-	99.00	100.00	97.00	100.00	100.00	99.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	96.00	100.00	100.00	100.00	100.00
< +1 Phi (0.5 mm)	%	0.1	-	-	-	-	-	-	-	-	-	98.00	99.00	94.00	99.00	100.00	99.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	93.00	100.00	99.00	100.00	100.00
< +2 Phi (0.25 mm)	%	0.1	-	-	-	-	-	-	-	-	-	96.00	97.00	88.00	98.00	100.00	99.00	100.00	99.00	99.00	100.00	99.00	93.00	99.00	80.00	99.00	94.00	100.00	98.00
< +3 Phi (0.12 mm)	%	0.1	-	-	-	-	-	-	-	-	-	83.00	89.00	69.00	96.00	99.00	97.00	99.00	96.00	88.00	99.00	97.00	52.00	93.00	46.00	91.00	59.00	99.00	86.00
< +4 Phi (0.062 mm)	%	0.1	-	-	-	-	-	-	-	-	-	55.00	81.00	43.00	95.00	94.00	94.00	98.00	85.00	56.00	93.00	94.00	25.00	71.00	23.00	87.00	42.00	97.00	56.00
< +5 Phi (0.031 mm)	%	0.1	-	-	-	-	-	-	-	-	-	28.00	70.00	27.00	87.00	83.00	82.00	93.00	67.00	39.00	81.00	87.00	17.00	56.00	19.00	74.00	34.00	87.00	39.00
< +6 Phi (0.016 mm)	%	0.1	-	-	-	-	-	-	-	-	-	17.00	59.00	20.00	70.00	67.00	63.00	80.00	45.00	29.00	62.00	75.00	13.00	44.00	15.00	61.00	26.00	69.00	30.00
< +7 Phi (0.0078 mm)	%	0.1	-	-	-	-	-	-	-	-	-	10.00	36.00	13.00	38.00	37.00	35.00	21.00	24.00	20.00	34.00	52.00	9.10	28.00	11.00	40.00	18.00	45.00	21.00
< +8 Phi (0.0039 mm)	%	0.1	-	-	-	-	-	-	-	-	-	8.70	27.00	11.00	26.00	20.00	20.00	11.00	19.00	17.00	20.00	43.00	8.30	24.00	10.00	34.00	15.00	37.00	18.00
< +9 Phi (0.0020 mm)	%	0.1	-	-	-	-	-	-	-	-	-	6.90	12.00	8.70	8.20	7.70	9.60	7.00	7.50	7.10	8.10	24.00	6.50	17.00	7.50	25.00	11.00	22.00	8.20
Gravel	%	0.1	-	-	-	-	-	-	-	-	-	0.05	0.00	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	2.00	0.00	0.00	0.00	0.00
Sand	%	0.1	-	-	-	-	-	-	-	-	-	45.00	19.00	55.00	5.40	5.90	6.30	1.70	15.00	44.00	6.70	5.90	75.00	29.00	75.00	13.00	58.00	2.90	44.00
Silt	%	0.1	-	-	-	-	-	-	-	-	-	46.00	53.00	32.00	68.00	74.00	74.00	87.00	66.00	39.00	73.00	51.00	16.00	47.00	13.00	54.00	27.00	60.00	38.00
Clay	%	0.1	-	-	-	-	-	-	-	-	-	8.70	27.00	11.00	26.00	20.00	20.00	11.00	19.00	17.00	20.00	43.00	8.30	24.00	10.00	34.00	15.00	37.00	18.00
Physical testing																													
Moisture-Subcontracted	%	0.3	-	-	-	-	-	-	-	-	-	-	79.00	40.00	-	77.00	-	-	-	62.00	-	78.00	45.00	-	-	-	-	76.00	
Metals																													
Total Aluminum (Al)	mg/kg	100.00	-	-	-	-	58030	(3)	-	58030	(3)	4210.00	9220.00	5740.00	12300.00	10100.00	9720.00	11300.00	10100.00	6260.00	10600.00	11600.00	3620.00	7000.00	4110.00	11400.00	6170.00	12100.00	5920.00
Total Antimony (Sb)	mg/kg	0.10	-	-	-	-	2	(6)	-	2	(6)	0.26	0.78	0.42	0.93	0.63	0.71	0.64	0.84	0.24	0.49	0.46	0.16	0.33	0.17	0.53	0.23	0.62	0.30
Total Arsenic (As)	mg/kg	0.20	6	33	5.9	17	-	-	-	5.9	(2)	1.22	2.61	1.61	3.05	3.67	3.17	2.44	2.61	2.72	4.07	3.83	2.20	2.97	2.37	4.15	2.88	3.94	2.91
Total Barium (Ba)	mg/kg	0.10	-	-	-	-	-	-	10 - 5000	10 - 5000	(7)	32.00	71.70	37.70	93.10	92.30	80.00	97.30	74.10	50.60	93.40	106.00	28.30	63.80	30.40	95.20	43.80	99.00	49.50
Total Beryllium (Be)	mg/kg	0.20	-	-	-	-	-	-	<1.0 - 15	<1.0 - 15	(7)	0.19	0.44	0.30	0.52	0.44	0.45	0.50	0.43	0.32	0.45	0.49	0.19	0.37	0.21	0.51	0.30	0.53	0.30
Total Bismuth (Bi)	mg/kg	0.10	-	-	-	-	-	-	<10 - 15	<10 - 15	(7)	0.10	0.16	0.11	0.23	0.16	0.15	0.19	0.22	0.08	0.15	0.15	0.04	0.11	0.05	0.18	0.07	0.17	0.08
Total Boron (B)	mg/kg	1.00	-	-	-	-	-	-	<20 - 300	<20 - 300	(7)	4.50	11.10	6.30	10.20	8.20	10.00	9.00	9.00	6.40	9.00	7.40	3.90	6.00	4.40	9.40	6.00	8.90	5.60
Hot Water Ext. Boron (B)	µg/g	0.05	-	-	-	-	1.5	(8)	-	1.5	(8)	0.35	0.31	0.41	0.61	0.22	0.20	0.35	0.35	0.30	0.26	0.24	0.23	0.33	0.29	0.32	0.31	0.24	0.32
Total Cadmium (Cd)	mg/kg	0.05	0.6	10	0.60	3.50	-	-	-	0.6	(2)	0.15	0.39	0.21	0.53	0.47	0.39	0.44	**0.60**	0.36	**0.60**	**0.61**	0.17	0.33	0.24	0.56	0.29	0.54	0.34
Total Calcium (Ca)	mg/kg	100	-	-	-	-	-	-	100 - 320,000	100 - 320000	(7)	56200.00	71000.00	72400.00	92900.00	118000.00	87500.00	97000.00	97100.00	104000.00	122000.00	134000.00	91000.00	106000.00	92100.00	115000.00	94400.00	128000.00	103000.00
Total Cesium (Cs)	mg/kg	1	-	-	-	-	-	-	0.25 - 25	0.25 - 25	(7)	0.29	0.60	0.46	0.82	0.66	0.62	0.65	0.63	0.46	0.62	0.64	0.32	0.53	0.36	0.73	0.46	0.62	0.44
Total Chromium (Cr)	mg/kg	0.5	26	110	37.3	90	-	-	-	26	(1)	11.20	20.40	16.10	**29.80**	23.60	22.80	25.20	**30.10**	15.40	25.20	25.30	9.15	17.60	9.71	**27.40**	14.80	**26.90**	15.50
Total Cobalt (Co)	mg/kg	0.1	-	-	-	-	50	(4)	-	50	(4)	3.24	5.78	5.71	7.91	6.82	6.16	6.75	7.86	5.69	7.18	7.67	4.29	5.69	4.46	8.68	5.56	7.96	5.51
Total Copper (Cu)	mg/kg	0.5	16	110	35.7	197	-	-	-	16	(1)	15.30	**38.60**	**24.30**	**54.10**	**45.20**	**41.40**	**48.50**	**57.10**	**35.80**	**60.40**	**56.00**	**16.10**	**38.60**	**16.60**	**73.90**	**31.80**	**53.30**	**32.60**
Total Iron (Fe)	mg/kg	100	20000 [a]	40000 [a]	-	-	-	-	-	20000	(1)	8660.00	15000.00	12300.00	19800.00	17300.00	16300.00	18800.00	18000.00	13100.00	17900.00	19700.00	8350.00	14100.00	9090.00	19200.00	12000.00	**20200.00**	12500.00

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																	
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
Total Lead (Pb)	mg/kg	0.1	31	250	35	91.3	-	-	-	31	(31)	9.02	24.90	14.60	**33.60**	30.00	25.90	28.30	**31.80**	17.50	**34.60**	**35.20**	10.10	17.90	9.72	**31.90**	17.40	**33.20**	16.60
Total Lithium (Li)	mg/kg	0.5	-	-	-	-	-	-	<5.0 - 140	<5.0 - 140	(7)	4.93	10.30	8.06	14.60	11.60	10.80	13.00	11.80	8.51	12.20	13.00	5.52	9.24	6.27	13.70	8.17	13.20	8.15
Total Magnesium (Mg)	mg/kg	100	-	-	-	-	-	-	50 - >100,000	50 - >100000	(7)	4650.00	5730.00	5940.00	8120.00	6870.00	7150.00	7550.00	9080.00	7710.00	8280.00	8580.00	5320.00	8310.00	5520.00	9920.00	6850.00	8080.00	7370.00
Total Manganese (Mn)	mg/kg	0.2	460	1100	-	-	-	-	-	460	(1)	214.00	369.00	261.00	**522.00**	**538.00**	436.00	**534.00**	**463.00**	423.00	**632.00**	**599.00**	268.00	430.00	296.00	**593.00**	342.00	**616.00**	382.00
Total Mercury (Hg)	mg/kg	0.05	0.2	2	0.17	0.486	-	-	-	0.17	(2)	0.03	0.09	0.04	0.08	0.07	0.06	0.07	0.07	0.05	0.08	0.07	0.03	0.04	0.02	0.07	0.04	0.08	0.04
Total Molybdenum (Mo)	mg/kg	0.1	-	-	-	-	13.8	(5)	-	13.8	(5)	0.28	0.78	0.46	0.91	0.70	0.81	0.80	0.84	0.43	0.76	0.85	0.23	0.64	0.31	0.98	0.44	0.77	0.45
Total Nickel (Ni)	mg/kg	0.5	16	75	-	-	-	-	-	16	(1)	7.13	14.40	11.90	**19.90**	**17.40**	15.60	**17.80**	**19.20**	14.40	**20.00**	**21.80**	9.83	15.10	10.30	**22.40**	13.60	**20.60**	13.30
Total Potassium (K)	mg/kg	100	-	-	-	-	-	-	50 - 63,000	50 - 63000	(7)	530.00	1180.00	859.00	1610.00	1290.00	1230.00	1370.00	1250.00	919.00	1420.00	1520.00	579.00	1090.00	632.00	1590.00	918.00	1410.00	883.00
Total Selenium (Se)	mg/kg	0.5	-	-	-	-	1.9	(5)	-	1.9	(5)	0.23	0.84	0.25	0.77	0.85	0.89	0.66	0.50	0.48	0.95	0.87	0.27	0.56	0.33	0.85	0.42	0.87	0.51
Total Silver (Ag)	mg/kg	0.05	-	-	-	-	0.5	(4)	-	0.5	(4)	0.03	0.08	0.04	0.10	0.10	0.08	0.11	0.11	0.09	0.16	0.18	0.05	0.08	0.04	0.17	0.07	0.13	0.08
Total Sodium (Na)	mg/kg	100	-	-	-	-	-	-	<500 - 100,000	<500 - 100000	(7)	221.00	**513.00**	349.00	429.00	385.00	427.00	**521.00**	**503.00**	260.00	401.00	403.00	169.00	281.00	167.00	400.00	240.00	452.00	228.00
Total Strontium (Sr)	mg/kg	0.1	-	-	-	-	-	-	<5 - 3000	<5 - 3000	(7)	95.60	139.00	123.00	172.00	207.00	167.00	180.00	174.00	187.00	233.00	237.00	161.00	196.00	159.00	223.00	166.00	224.00	180.00
Total Thallium (Tl)	mg/kg	0.05	-	-	-	-	-	-	<0.25 - 10	<0.25 - 10	(7)	0.07	0.15	0.12	0.20	0.20	0.16	0.17	0.19	0.15	0.21	0.18	0.13	0.15	0.12	0.22	0.15	0.20	0.16
Total Thorium (Th)	mg/kg	0.1	-	-	-	-	-	-	2.2 - 31	2.2 - 31	(7)	1.48	1.97	1.76	**2.47**	**2.23**	2.01	**2.33**	**2.28**	2.06	**2.41**	**2.48**	1.50	2.01	1.53	**2.61**	1.92	**2.44**	1.86
Total Tin (Sn)	mg/kg	0.1	-	-	-	-	-	-	<0.1 - 10	<0.1 - 10	(7)	0.91	2.00	1.34	2.94	2.25	2.15	2.41	3.75	1.35	2.66	2.41	0.76	1.59	0.80	2.36	1.21	2.49	1.24
Total Titanium (Ti)	mg/kg	1	-	-	-	-	-	-	70 - 20,000	70 - 20000	(7)	271.00	286.00	260.00	333.00	295.00	312.00	260.00	331.00	256.00	325.00	285.00	202.00	267.00	203.00	358.00	277.00	314.00	267.00
Total Tungsten (W)	mg/kg	0.5	-	-	-	-	-	-	<100 - 1000	<100 - 1000	(7)	0.22	0.48	0.32	0.68	0.40	0.44	0.49	0.80	0.22	0.35	0.37	0.12	0.24	0.15	0.38	0.17	0.42	0.22
Total Uranium (U)	mg/kg	0.05	-	-	-	-	104.4	(5)	-	104.4	(5)	0.36	0.62	0.41	0.58	0.54	0.66	0.54	0.54	0.50	0.62	0.64	0.38	0.55	0.40	0.64	0.49	0.58	0.47
Total Vanadium (V)	mg/kg	1	-	-	-	-	35.2	(5)	-	35.2	(5)	13.60	21.10	16.80	26.30	23.70	23.20	22.80	23.20	17.10	24.00	23.40	11.50	18.30	12.00	25.60	17.00	25.20	17.10
Total Zinc (Zn)	mg/kg	1	120	820	123	315	-	-	-	120	(1)	81.60	**161.00**	119.00	**240.00**	**171.00**	**170.00**	**211.00**	**271.00**	104.00	**156.00**	**162.00**	51.90	105.00	60.10	**177.00**	82.70	**199.00**	95.20
Total Zirconium (Zr)	mg/kg	0.5	-	-	-	-	-	-	<20 - 2000	<20 - 2000	(7)	0.73	2.15	0.92	1.93	1.80	2.05	2.12	2.00	1.42	2.20	1.91	1.02	1.41	0.77	2.15	1.39	2.36	1.29
PCBs																													
Aroclor 1016	µg/g	0.02	0.007	53	-	-	-	-	-	0.007	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1221	µg/g	0.02	-	-	-	-	0.12	(3)	-	0.12	(3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1232	µg/g	0.02	-	-	-	-	0.6	(3)	-	0.6	(3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1242	µg/g	0.02	-	-	-	-	0.17	(3)	-	0.17	(3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1248	µg/g	0.02	0.03	150	-	-	-	-	-	0.03	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1254	µg/g	0.02	0.06	34	-	-	-	-	-	0.06	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.011	0.000	0.017	0.000	0.000	0.000
Aroclor 1260	µg/g	0.02	0.005	24	-	-	-	-	-	0.005	(1)	0.003	**0.012**	0.000	**0.024**	**0.019**	**0.013**	**0.019**	**0.016**	0.000	**0.019**	**0.036**	**0.009**	**0.010**	**0.006**	**0.016**	0.000	**0.017**	**0.011**
Aroclor 1262	µg/g	0.02	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1268	µg/g	0.02	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total PCB	µg/g	0.02	0.07	530	-	-	-	-	-	0.07	(1)	0.000	0.012	0.000	0.024	0.019	0.013	0.020	0.016	0.000	0.019	0.036	0.018	0.011	0.000	0.033	0.000	0.017	0.011
Polyaromatic Hydrocarbons																													
Anthracene	µg/g	0.01	0.22	370	0.0469	0.2450	-	-	-	0.0469	(2)	0.040	0.022	0.029	0.034	0.029	0.030	0.033	0.019	0.021	0.024	0.028	0.016	0.027	0.008	0.022	0.018	0.028	0.023
Benzo(a)anthracene	µg/g	0.01	0.32	1480	0.0317	0.3850	-	-	-	0.0317	(2)	**0.150**	**0.088**	**0.190**	**0.170**	**0.130**	**0.150**	**0.140**	**0.140**	**0.074**	**0.073**	**0.078**	**0.050**	**0.081**	0.022	**0.077**	**0.048**	**0.130**	**0.069**
Benzo(a)pyrene	µg/g	0.01	0.37	1440	0.0319	0.7820	-	-	-	0.0319	(2)	**0.210**	**0.150**	**0.260**	**0.300**	**0.230**	**0.260**	**0.240**	**0.210**	**0.093**	**0.110**	**0.140**	**0.065**	**0.110**	0.030	**0.110**	**0.062**	**0.230**	**0.095**
Benzo(g,h,i)perylene	µg/g	0.01	0.17	320	-	-	-	-	-	0.17	(1)	**0.180**	0.160	**0.210**	**0.290**	**0.220**	**0.230**	**0.230**	**0.190**	0.076	0.110	0.150	0.046	0.089	0.027	0.096	0.050	**0.210**	0.073
Benzo(k)fluoranthene	µg/g	0.01	0.24	1340	-	-	-	-	-	0.24	(1)	0.120	0.089	0.140	0.180	0.130	0.150	0.130	0.120	0.055	0.065	0.091	0.042	0.065	0.017	0.070	0.035	0.130	0.054
Chrysene	µg/g	0.01	0.34	460	0.0571	0.8620	-	-	-	0.0571	(2)	**0.210**	**0.140**	**0.280**	**0.290**	**0.210**	**0.220**	**0.240**	**0.210**	**0.093**	**0.093**	**0.120**	**0.093**	**0.110**	0.030	**0.110**	**0.065**	**0.210**	**0.090**
Dibenzo(a,h)anthracene	µg/g	0.01	0.06	130	0.0062	0.1350	-	-	-	0.00622	(2)	**0.035**	**0.026**	**0.044**	**0.045**	**0.036**	**0.037**	**0.040**	**0.035**	**0.016**	**0.020**	**0.024**	**0.010**	**0.017**	0.000	**0.017**	**0.009**	**0.038**	**0.013**
Fluoranthene	µg/g	0.01	0.75	1020	0.1110	2.3550	-	-	-	0.111	(2)	**0.460**	**0.300**	**0.580**	**0.580**	**0.430**	**0.510**	**0.470**	**0.460**	**0.200**	**0.220**	**0.240**	**0.220**	**0.230**	0.066	**0.220**	**0.140**	**0.430**	**0.200**
Fluorene	µg/g	0.01	0.19	160	0.0212	0.1440	-	-	-	0.0212	(2)	**0.064**	0.015	**0.026**	0.015	0.017	0.019	0.016	0.011	0.009	0.000	0.010	0.011	0.010	0.004	0.009	0.007	0.014	0.010
Indeno(1,2,3-cd)pyrene	µg/g	0.01	0.2	320	-	-	-	-	-	0.2	(1)	0.180	0.150	**0.210**	**0.270**	**0.220**	**0.220**	**0.220**	0.180	0.077	0.110	0.150	0.047	0.089	0.027	0.090	0.051	**0.210**	0.076
Phenanthrene	µg/g	0.01	0.56	950	0.0419	0.5150	-	-	-	0.0419	(2)	**0.230**	**0.073**	**0.220**	**0.140**	**0.110**	**0.130**	**0.140**	**0.130**	**0.064**	**0.054**	**0.060**	**0.190**	**0.084**	0.018	**0.065**	**0.047**	**0.110**	**0.077**
Pyrene	µg/g	0.01	0.49	850	0.0530	0.8750	-	-	-	0.053	(2)	**0.360**	**0.260**	**0.480**	**0.510**	**0.380**	**0.420**	**0.410**	**0.390**	**0.180**	**0.200**	**0.220**	**0.180**	**0.210**	**0.063**	**0.210**	**0.130**	**0.390**	**0.180**

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
BTEX & F1 Hydrocarbons																													
Benzene	µg/g	0	-	-	-	-	1.24	(9)	-	1.24	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Toluene	µg/g	0	-	-	-	-	1.4	(9)	-	1.4	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.000	0.000	0.000	0.000	0.000
Ethylbenzene	µg/g	0	-	-	-	-	1.16	(9)	-	1.16	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p+m-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Xylenes	µg/g	0	-	-	-	-	1.28	(9)	-	1.28	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F1 (C6-C10)	µg/g	10	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aliphatic C6-C8	µg/g	-	-	-	-	-	14	(9)	-	14	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aliphatic C>8-C10	µg/g	-	-	-	-	-	10.5	(9)	-	10.5	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aromatic C>8-C10	µg/g	-	-	-	-	-	11.6	(9)	-	11.6	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F1 (C6-C10) - BTEX	µg/g	11	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F2-F4 Hydrocarbons																													
F2 (C10-C16 Hydrocarbons)	µg/g	7	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.000	0.000	0.000	0.000	8.100	0.000	0.000
Aliphatic C>10-C12	µg/g	-	-	-	-	-	8.7	(9)	-	8.7	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.520	0.000	0.000	0.000	2.916	0.000	0.000
Aliphatic C>12-C16	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.080	0.000	0.000	0.000	3.564	0.000	0.000
Aromatic C>10-C12	µg/g	-	-	-	-	-	5.7	(9)	-	5.7	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.630	0.000	0.000	0.000	0.729	0.000	0.000
Aromatic C>12-C16	µg/g	-	-	-	-	-	2.5	(9)	-	2.5	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.770	0.000	0.000	0.000	0.891	0.000	0.000
F3 (C16-C34 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	160.000	160.000	360.000	350.000	170.000	56.000	200.000	500.000	140.000	56.000	67.000	130.000	120.000	120.000	300.000	170.000	190.000	150.000
Aliphatic C>16-C21	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	89.600	89.600	201.600	196.000	95.200	31.360	112.000	280.000	78.400	31.360	37.520	72.800	67.200	67.200	168.000	95.200	106.400	84.000
Aliphatic C>21-C34	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	38.400	38.400	86.400	84.000	40.800	13.440	48.000	120.000	33.600	13.440	16.080	31.200	28.800	28.800	72.000	40.800	45.600	36.000
Aromatic C>16-C21	µg/g	-	-	-	-	-	1.7	(9)	-	1.7	(9)	**22.400**	**22.400**	**50.400**	**49.000**	**23.800**	**7.840**	**28.000**	**70.000**	**19.600**	**7.840**	**9.380**	**18.200**	**16.800**	**16.800**	**42.000**	**23.800**	**26.600**	**21.000**
Aromatic C>21-C34	µg/g	-	-	-	-	-	5.4	(9)	-	5.4	(9)	**9.600**	**9.600**	**21.600**	**21.000**	**10.200**	3.360	**12.000**	**30.000**	**8.400**	3.360	4.020	**7.800**	**7.200**	**7.200**	**18.000**	**10.200**	**11.400**	**9.000**
F4 (C34-C50 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	110.000	98.000	290.000	270.000	120.000	0.000	160.000	420.000	82.000	0.000	0.000	0.000	61.000	0.000	160.000	76.000	140.000	69.000
Aliphatic C>34	µg/g	-	-	-	-	-	98.8 [c]	(9)	-	98.8	(9)	88.000	78.400	**232.000**	**216.000**	96.000	0.000	**128.000**	**336.000**	65.600	0.000	0.000	0.000	48.800	0.000	**128.000**	60.800	**112.000**	55.200
Aromatic C>34	µg/g	-	-	-	-	-	0.4 [c]	(9)	-	0.4	(9)	**22.000**	**19.600**	**58.000**	**54.000**	**24.000**	0.000	**32.000**	**84.000**	**16.400**	0.000	0.000	0.000	**12.200**	0.000	**32.000**	**15.200**	**28.000**	**13.800**
Calculated Parameters																													
Aldrin + Dieldrin	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chlordane (Total)	µg/g	0.004	0.007	6	0.0045	0.00887	-	-	-	0.0045	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor + Heptachlor epoxide	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o,p-DDT + p,p-DDT	µg/g	0.004	0.008	71	0.00119	0.00477	-	-	-	0.00119	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pesticides & Herbicides																													
Aldrin	µg/g	0.004	0.002	8	-	-	-	-	-	0.002	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
a-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
g-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000
Dieldrin	µg/g	0.004	0.002	91	0.00285	0.00667	-	-	-	0.002	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lindane	µg/g	0.004	-	-	0.00094	0.00138	-	-	-	0.0094	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Endrin	µg/g	0.004	0.003	130	0.00267	0.0624	-	-	-	0.00267	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor	µg/g	0.004	-	-	0.0006	0.00274	-	-	-	0.0006	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor epoxide	µg/g	0.004	0.005	5	-	-	-	-	-	0.005	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
alpha-BHC	µg/g	0.004	0.006	10	-	-	-	-	-	0.006	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
beta-BHC	µg/g	0.004	0.005	21	-	-	-	-	-	0.005	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
delta-BHC	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																	
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
Mirex	µg/g	0.004	0.007	130	-	-	-	-	-	0.007	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Radionuclides																													
Co-60	Bq/kg	0.09	-	-	-	-	-	-	-	-	-	0.050	0.527	0.171	0.622	0.586	0.146	0.076	0.158	0.211	0.447	0.728	-0.022	-0.029	0.415	0.082	-0.192	0.091	0.104
Cs-134	Bq/kg	0.18	-	-	-	-	-	-	-	-	-	0.155	-0.029	0.209	-0.381	0.009	0.128	0.176	0.252	-0.051	0.073	0.265	0.089	0.076	-0.090	0.344	-0.126	0.127	0.054
Cs-137	Bq/kg	0.16	-	-	-	-	-	-	-	-	-	0.625	0.563	0.823	1.470	1.450	1.130	0.967	0.731	2.200	1.890	2.420	1.240	2.230	1.550	2.190	1.270	1.380	2.390
I-131	Bq/kg	2.70	-	-	-	-	-	-	-	-	-	-0.785	-1.850	3.310	-0.337	-0.426	3.390	3.070	-1.630	1.040	0.479	-0.850	1.100	0.773	0.790	-0.797	0.362	-1.120	0.218
K-40	Bq/kg	1.30	-	-	-	-	-	-	-	-	-	353.000	105.000	106.000	138.000	106.000	104.000	117.000	207.000	202.000	110.000	117.000	236.000	192.000	237.000	152.000	235.000	128.000	202.000
Th-Series	Bq/kg	0.51	-	-	-	-	-	-	-	-	-	7.720	-0.366	4.560	0.256	-3.670	0.677	5.230	-0.561	5.620	4.830	4.840	1.250	5.750	4.800	6.000	6.780	6.150	5.570
U-Series	Bq/kg	0.33	-	-	-	-	-	-	-	-	-	8.740	3.810	4.200	6.680	4.850	3.350	5.530	7.340	5.670	4.510	6.310	5.860	7.030	5.330	5.330	6.350	5.260	6.620
H-3	Bq/kg	24.00	-	-	-	-	-	-	-	-	-	227.000	99.500	94.800	177.000	28.500	20.500	20.600	68.600	22.300	19.600	30.400	20.700	29.000	28.800	26.800	30.500	70.700	30.700
C-14	Bq/g	0.0096	-	-	-	-	-	-	-	-	-	0.008	-0.016	-0.003	0.002	-0.013	0.012	-0.011	-0.003	-0.009	0.002	-0.002	-0.003	-0.009	-0.008	-0.001	0.003	-0.004	-0.004

Note:

Bold Exceeded selected screening criteria

The symbol '-' denotes no value was determined and/or required.

Highlighting and bold font denotes that the maximum concentration of a parameter exceeds the relevant screening criteria value.

Sampling locations are presented in **Figure 4-4**.

* The concentrations of PHC subfractions were obtained by dividing the concentration of total fraction (eg: F2, F3, F4) by the ratios of the subfractions provided in CCME (2008). The concentrations of the subfractions were then compared to their equivalent guidelines from Atlantic PIRI (2012).

a - Converted from % to mg/kg.

b - Sediment criteria could not be calculated based on a toxic endpoint to aquatic species due to the low solubility of the fraction in water, resulting in a low potential for migration to or accumulation in sediment.

c - based on the Chronic benchmarks for aliphatic C19-C36 and aromatic C16-C36 calculated by Atlantic PIRI (2012) using the model developed by DiToro and McGrath (2000) using the benchmarks from Batelle (2007)

LEL - Lowest Effect Level

SEL- Severe Effect Level

ISQG- Interim Sediment Quality Guidelines

PEL- Probable Effects Level

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A.3 Aquatic Environment

A.3.1 Fish

A.3.1.1 Fish Community

Deepwater Fish Community Study

Assessment of the fish community in the proposed area of the intake cap followed a similar approach to that used at DNNP for intake siting (Ecometrix, 2021). The initial 2024 Deepwater Study Area encompassed an area of approximately 1 km^2, divided into 333 m x 333 m grids (labelled S1 to S9; **Figure 4-5**)**.** This area centered on the originally proposed intake cap location at 1,500 m offshore, and comprised the 12 m to 20 m depth contours. To encompass the alternate intake cap location, the study area was expanded to include an additional 0.33 km^2 closer to shore (grids S10- S12; **Figure 4-5**). The complete deepwater study area comprised 1.33 km^2, extending from the 9 m to 20 m depth contours.

The gillnets used for fish community sampling were consistent with the Ontario Ministry of Natural Resources and Forestry (MNRF) *Lake Ontario Fish Community Index Netting Protocol* (MNRF, 2018) as well as with past studies conducted for OPG at Darlington Nuclear Generating Station (DNGS) (Ecometrix, 2021). The program comprised of three sampling events in the spring, summer, and fall of 2024. During each event in 2024, net sets were deployed in one of nine sampling grids (S1-S9) using the the fixed-sequential-random design, where three net grids were fixed (one per depth stratum 12-14, 14-16 and 16-18 m), three were sequential (one per depth stratum; randomly assigned, excluding the fixed locations), and three were set at random grid locations. In 2025, one net set was deployed in each grid-square (S10-S12) in the extended Deepwater Study Area during each of the spring, summer, and fall. During these sampling events, all nets were set within the 9-12 m depth stratum.

This study design focused on variation in depth. Thus, while specific grids pertaining to the DWI structure (grid S5 and S2) may not have been sampled in some cases, the broader results for the various depths are considered representative of the community within that depth stratum throughout the study area. The expected fish community metrics at these locations will also be discussed based on the results of the depth and substrate statistical analyses below.

Across both the 2024 and 2025 fish community studies, all fish caught were identified and enumerated. Weight (in grams), length (in cm or mm), sex (where external determination was possible) and external condition (e.g., fin clips, eroded fins, deformities, lamprey scars) were also assessed for up to 30 individuals per species per season. Representative photos were taken of each fish species collected in the gillnets. Live fish from gillnet catches were released. Eight individual fish from up to three abundant species were used for tissue burden assessment in the spring and fall sampling events in 2024 (see **Section A.2.1**).

Species composition of fish caught during the spring, summer, and fall sampling events are summarized in **Figure A-4** for 2024 and **Figure A-5** for 2025. Additional calculated parameters,

including total count, species richness, Catch Per Unit Effort (CPUE), and Biomass Per Unit Effort (BPUE) from the 2024 and 2025 studies are provided in **Table A-8** and **Table A-9**, respectively.

Across all three sampling events in 2024, a standardized total (corrected for net length) of 1912.33 fish from 13 different species were captured across S1-S9 sampling grids. Species composition by season is depicted in **Figure A-4**. Alewife comprised >97% of the standardized catch in the spring and summer, while Lake Trout and Lake Whitefish dominated the fall catch. This seasonal shift in the dominant species captured is reflective of the migratory nature of Alewife, which make seasonal spawning migrations to the nearshore zone to spawn in the late spring. As detailed earlier, one Lake Sturgeon was caught and released during the deepwater fish community studies in the fall sampling event, marking the first observation of this species near PN in nearly two decades. Lake Sturgeon are generally uncommon in the main lake as they typically inhabit the cool, bottom waters of lakes and large streams, preferring sand and silt substrates (Holm et al., 2021). Of the nine sampling grids defined in the deepwater area for this study, S1 and S6 had the highest number of fish and species (8) collected during individual net sets across all three sampling events. In contrast, S3 had the fewest fish (49) and lowest species count (1) among sampling events.

In 2025, a standardized total of 618 fish across 9 species were caught in the S10-S12 grids. Species composition by season is depicted in **Figure A-5**. In the spring, Lake Trout was the most abundant species, representing approximately 62% of the standardized catch, followed by Round Whitefish and Brown Trout. In the summer, Alewife became the dominant species (>92% of the standardized catch), while Atlantic Salmon, Round Goby, and White Sucker comprised smaller proportions of the catch. In the fall, Round Goby emerged as the dominant species, comprising approximately 49% of the standardized catch, followed by Alewife at nearly 39%. Round Goby is an invasive benthic forage fish species that is abundant near the PN site and throughout Lake Ontario. In addition, Atlantic Salmon, Brown Bullhead, and Smallmouth Bass were also captured. As highlighted earlier, the Atlantic Salmon that were caught during this study are not considered individuals of the native Lake Ontario population, which is considered extinct by the COSEWIC. The current population is the result of Ontario's restoration program and New York State's put-grow-take program and are not assigned either a COSEWIC or SAR conservation status.

To determine if and how the deepwater fish catch varied through water depth, season, and substrate, a set of generalized linear models (GLMs) were run for metrics of species richness, diversity, and abundance (CPUE and BPUE) using data collected during 2024 and 2025. Results of the GLMs are detailed in **Table A-10** and **Table A-11**.

For the deepwater fish community as a whole, model results indicated no significant influence of depth on any of the evaluated fish metrics; however, CPUE and diversity were significantly influenced by season (**Figure A-6; Table A-10**). CPUE was similar between spring and fall but was significantly higher during the summer. Species diversity was significantly higher in the fall relative to the spring and summer, with no significant difference observed between the spring and summer sampling events. When analyses were limited to small-bodied fish (i.e., Alewife and Round Goby), both CPUE and BPUE were significantly affected by season. These metrics differed

significantly among all three seasons, with the highest values observed in summer, followed by spring, and the lowest values in fall.

Diversity also varied by substrate classification. Sites with *Mixed–Hard* substrate (S10, S11, S12, S13, S14, and S15) showed significantly higher diversity than those characterized by *Cobble/Gravel/Sand* substrates (S1, S4, and S7) (**Figure A-7**; **Table A-11**). No other significant differences were observed among the remaining substrate classes.

The proposed intake locations, S2 and S5, were classified as *Mixed–Soft* and *Cobble/Gravel*, respectively. Fish CPUE, BPUE, richness, and diversity at these substrate types did not differ significantly from any other substrate class. This indicates that the fish community at the proposed intake locations is consistent with the broader study area, with no meaningful ecological differences detected.

Overall, the fish community composition in the Deepwater Study Area, including the proposed DWI structure (i.e., grids S2 and S5), is generally consistent with previous fish community characterization studies conducted in the area (Ecometrix, 2018, 2020; Golder, 2007; MNRF, 2023), which also identified Alewife as having the highest CPUE. Golder (2007a) also noted the seasonal differences in the fish communities in the general study area, which can either be driven by foraging opportunities or spawning requirements that are both influenced by seasonal and local conditions. For example, Alewife make seasonal spawning migrations to nearshore zones to spawn in the late spring. In contrast, Lake Trout can only forage closer to shore when colder water temperatures are present due to season or wind-driven upwellings of colder lake water. However, prey availability during these periods may vary, as prey species may avoid the area during cold shock events or become cold shock stressed.

Notable differences in the results of the 2024-2025 Deepwater Fish Community study relative to previous studies included higher abundances of Lake Whitefish and the capture of a single Lake Sturgeon during the Fall 2024 event. The high catch of Lake Whitefish 2024 is likely due to this species preference for cooler water temperatures, such as those observed during the Fall 2024 netting program. The higher numbers of Lake Whitefish in Fall 2024 compared to other fish community studies in the area may also indicate fall spawning activity in the general vicinity of the Deepwater Study Area; previous fall studies were not likely completed when water temperatures were appropriate to make this determination. To address this uncertainty, a fall spawning assessment was conducted in 2025 (see below). In addition, a Species at Risk assessment for Lake Sturgeon (see below) was completed to evaluate whether additional individuals are present in the study area.

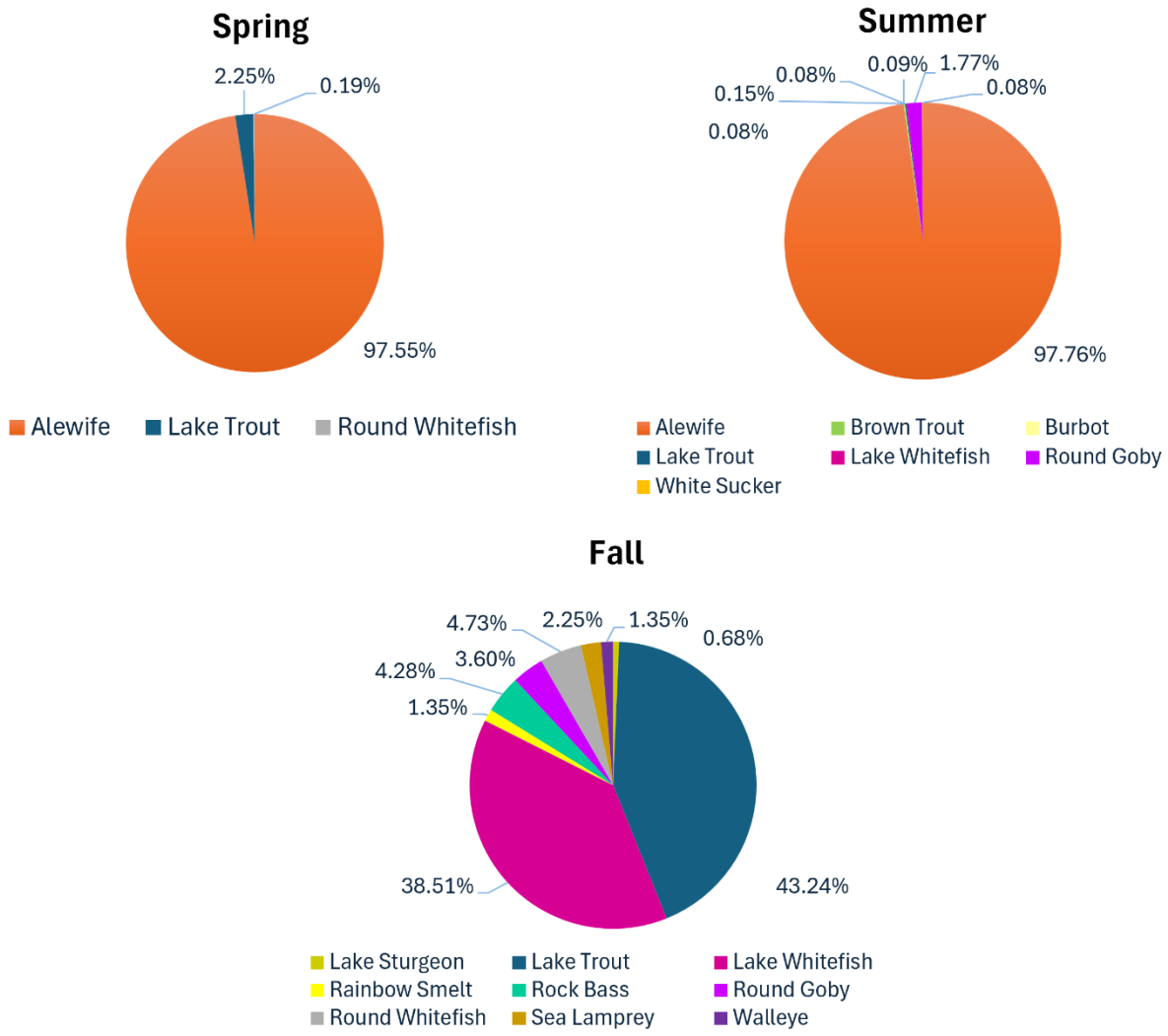


Figure A-4: Fish Species Composition of Fish Caught in Monitoring Nets During the Spring, Summer, and Fall Sampling Events of the 2024 Deepwater Fish Community Study

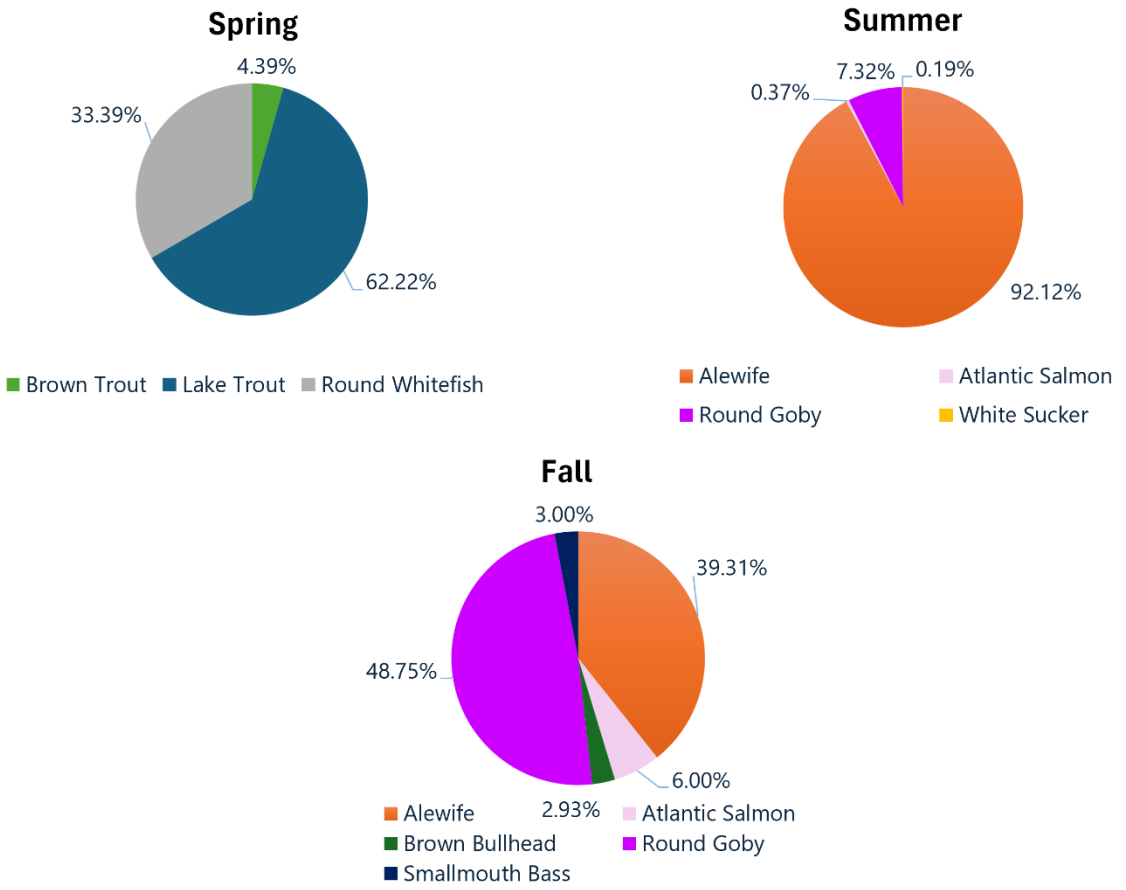


Figure A-5: Fish Species Composition of Fish Caught in Monitoring Nets During the Spring, Summer, and Fall Sampling Events of the 2025 Extended Deepwater Area Fish Community Study

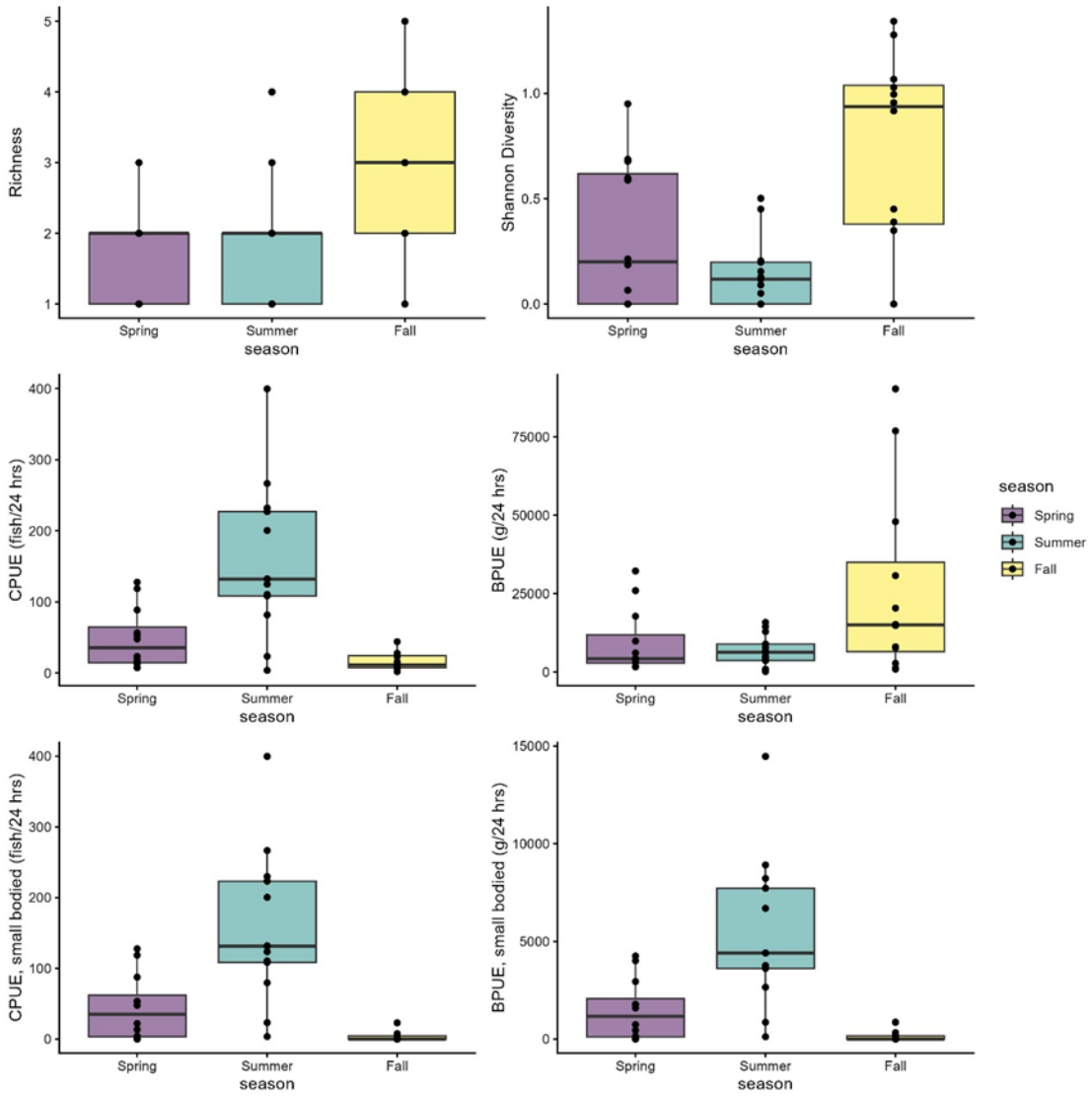


Figure A-6: Boxplots and Raw Data (points) of Fish Endpoints Expressed by Season from the 2024 and 2025 Deepwater Fish Community Study

Note: CPUE – Catch-per-unit effort, BPUE – Biomass-per-unit effort. Boxplots are a common and useful when visually depicting variation of the raw data (black dots): the box spans the interquartile range (IQR; 25th percentile to 75th percentile), the horizontal line within the box is the median, the vertical lines extend outwards to the furthest datapoint within 1.5 x IQR, and any points outside of this vertical line are beyond 1.5 x IQR.

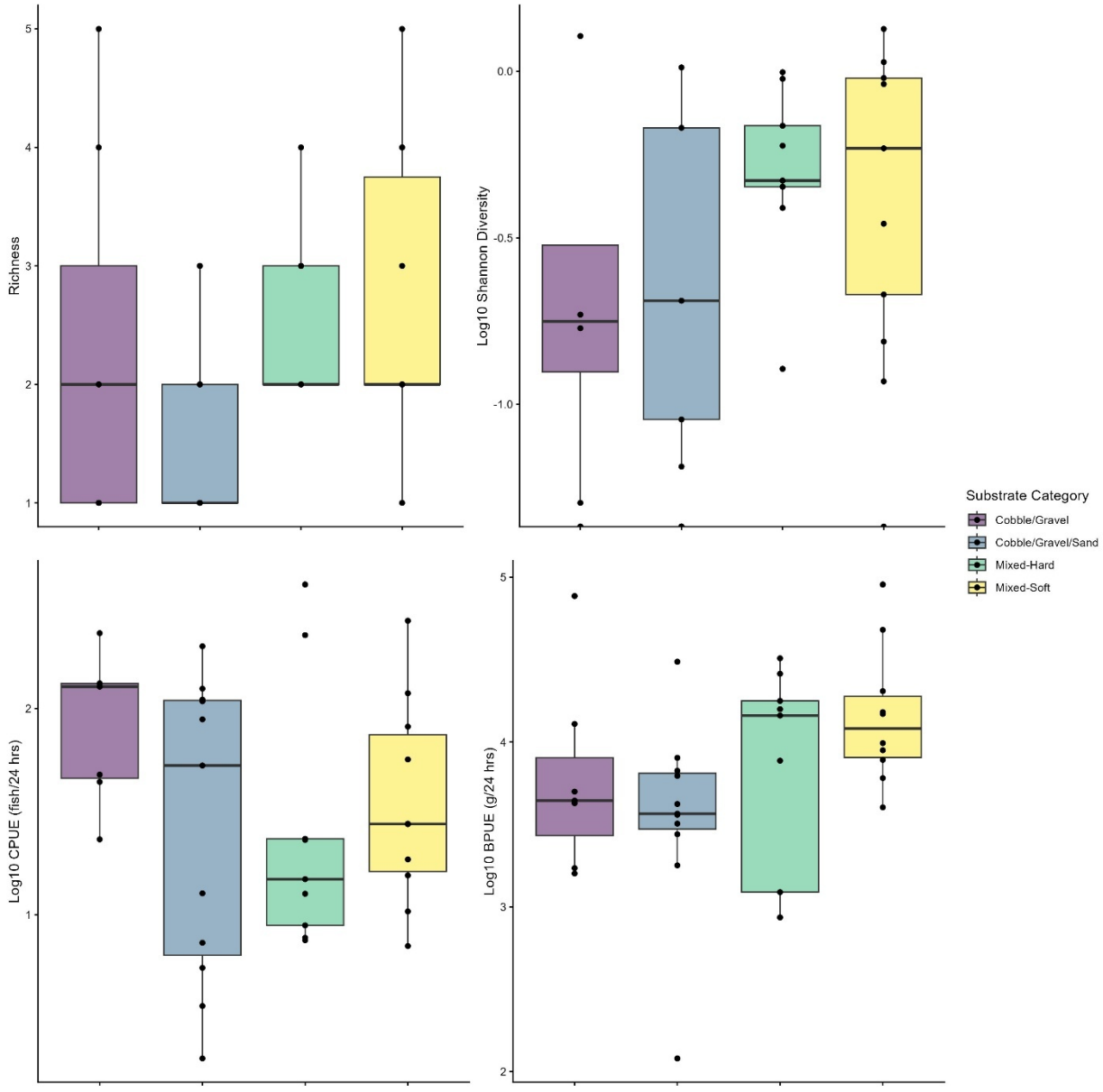


Figure A-7: Boxplots and Log10 Transformed Data (points) of Fish Endpoints Expressed by Substrate Classification

Note: CPUE – Catch-per-unit effort, BPUE – Biomass-per-unit effort. Boxplots are a common and useful when visually depicting variation of the raw data (black dots): the box spans the interquartile range (IQR; 25th percentile to 75th percentile), the horizontal line within the box is the median, the vertical lines extend outwards to the furthest datapoint within 1.5 x IQR, and any points outside of this vertical line are beyond 1.5 x IQR.

Table A-8: Total Catch, CPUE, BPUE, and weight of fish caught during 2024 Deepwater Fish Community Study

Sampling grid	Species	Total Catch*	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring						
S2	Alewife*	109.7	119.64	100.00%	4,047.6	3,710.3
S3	Alewife*	120.0	128.76	100.00%	4,293.0	4,000.8
S3 (DUP)	Alewife*	43.3	48.19	100.00%	1,606.5	1,444.7
S4	Alewife*	83.0	88.27	98.81%	2,970.1	2,792.7
	Round Whitefish	1.0	1.06	1.19%	1,260.3	1,185.0
S4 (DUP)	Alewife*	53.0	53.33	100.00%	1,798.2	1,787.0
S5	Alewife*	21.0	22.32	95.45%	745.7	701.7
	Lake Trout	1.0	1.06	4.55%	977.7	920.0
S7	Alewife*	4.3	4.33	59.09%	146.0	146.0
	Lake Trout	3.0	3.00	40.91%	3,051.0	3,051.0
S8	Alewife*	51.7	53.91	94.51%	1,775.3	1,701.4
	Lake Trout	3.0	3.13	5.49%	8,080.7	7,744.0
S9	Alewife*	13.3	13.57	72.73%	452.4	444.5
	Lake Trout	5.0	5.09	27.27%	5,592.1	5,495.0
Total		512.3	545.7	-	36796.6	35124.2
Summer						
S1	Alewife*	94.0	120.32	95.59%	3,621.3	2,829.1
	Brown Trout	1.0	1.28	1.02%	2,464.0	1,925.0
	Round Goby*	3.3	4.27	3.39%	179.2	140.0
S1 (DUP)	Alewife*	185.3	202.18	98.23%	6,741.6	6,179.8
	Round Goby*	3.3	3.64	1.77%	129.1	118.3
S2	Alewife*	206.7	259.23	96.42%	2,067.1	6,890.3
	Round Goby*	7.7	9.62	3.58%	346.8	276.5
S4	Alewife*	110.7	111.44	100.00%	3,702.1	3,676.3
S5	Alewife*	113.0	132.29	99.12%	4,438.1	3,790.9
	Lake Whitefish	1.0	1.17	0.88%	597.1	510.0

Sampling grid	Species	Total Catch*	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
S6	Alewife*	122.0	133.09	100.00%	4,446.2	4,075.7
S6 (DUP)	Alewife*	205.0	224.49	95.94%	7,501.3	6,850.1
	Burbot	1.0	1.10	0.47%	4,955.1	4,525.0
	Round Goby*	6.7	7.30	3.12%	288.4	263.3
	White Sucker	1.0	1.10	0.47%	191.6	175.0
S7	Alewife*	110.0	109.39	100.00%	3,647.1	3,667.4
S8	Alewife*	78.3	80.28	97.51%	2,677.3	2,612.2
	Lake Trout	2.0	2.05	2.49%	5,129.7	5,005.0
Total		1252.0	1404.2		53123.1	53510.1
Fall						
S1	Lake Whitefish	6.0	5.52	100.00%	8,018.0	8,714.0
S2	Lake Trout	4.0	4.03	57.14%	11,369.4	11,298.3
	Round Whitefish	2.0	2.01	28.57%	1,937.1	1,925.0
	Walleye	1.0	1.01	14.29%	1,871.7	1,860.0
S2 (DUP)	Lake Trout	6.0	5.96	38.30%	17,956.3	18,081.0
	Lake Whitefish	3.0	2.98	19.15%	2,104.4	2,119.0
	Rock Bass	3.3	3.31	21.28%	149.0	150.0
	Sea Lamprey	3.3	3.31	21.28%	149.0	150.0
S4	Lake Trout	5.0	5.29	41.67%	20,124.6	19,034.5
	Lake Whitefish	5.0	5.29	41.67%	7,897.8	7,470.0
	Round Whitefish	2.0	2.11	16.67%	2,685.5	2,540.0
S4 (DUP)	Lake Whitefish	2.0	2.01	100.00%	2,754.6	2,745.0
	Lake Trout	15.0	16.00	36.29%	47,531.8	44,561.1
	Lake Whitefish	17.0	18.13	41.13%	25,656.7	24,053.1
	Rock Bass	3.0	3.20	7.26%	794.7	745.0
	Round Goby*	5.3	5.69	12.90%	233.6	128.0

Sampling grid	Species	Total Catch*	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
	Walleye	1.0	1.07	2.42%	2,688.0	2,520.0
S8	Lake Sturgeon[1]	1.0	1.10	4.00%	34,902.4	31,751.5
	Lake Trout	16.0	17.59	64.00%	44,766.8	40,725.3
	Lake Whitefish	5.0	5.50	20.00%	8,134.6	7,400.2
	Rainbow Smelt	1.0	1.10	4.00%	22.0	20.0
	Round Whitefish	2.0	2.20	8.00%	2,506.3	2,280.0
S9	Lake Trout	17.0	15.64	56.67%	33,224.0	36,108.0
	Lake Whitefish	11.0	10.12	36.67%	13,875.5	15,080.0
	Rainbow Smelt	1.0	0.92	3.33%	18.4	20.0
	Round Whitefish	1.0	0.92	3.33%	837.3	910.0
S9 (DUP)	Lake Trout	1.0	1.15	11.11%	2,384.6	2,070.0
	Lake Whitefish	8.0	9.22	88.89%	12,408.2	10,771.0
Total		148.0	152.4	-	307002.0	295230.1

Note:
Sampling locations are presented in **Figure 4-5**
Individual fish not measured in the field were assigned average species weight values for BPUE calculations.
1 To prevent undo harm, the Lake Sturgeon was removed from the gillnet and returned to the water without measurement and the size was estimated.
* Standardized fish counts are based on an extrapolated catch from the 15 m 1 ½" mesh panel to the standard 50 m length and therefore fish counts can result in partial number.

Table A-9: Total Catch, CPUE, BPUE, and weight of fish caught in Expanded Deepwater Study Area during 2025 Deepwater Fish Community Study

Sampling grid	Species	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring						
S10	Lake Trout	5	9.02	71.43%	21,663.2	12,005.0
	Round Whitefish	2	3.61	28.57%	4,285.7	2,375.0
S11	Lake Trout	5	8.26	55.56%	23,438.4	14,190.0
	Round Whitefish	4	6.61	44.44%	8,779.1	5,315.0
S12	Brown Trout	1	1.55	20.00%	6,150.7	3,980.0
	Lake Trout	3	4.64	60.00%	9,573.7	6,195.0
	Round Whitefish	1	1.55	20.00%	2,039.9	1,320.0
Total		21	35.2	-	75930.7	45380
Summer						
S10	Alewife*	156.7	192.49	84.08%	6,942.4	5,649.4
	Atlantic Salmon	2.0	2.46	1.07%	5,702.0	4,640.0
	Round Goby*	26.7	32.76	14.31%	1,358.3	1,105.3
	White Sucker	1.0	1.23	0.54%	1,892.5	1,540.0
S11	Alewife*	16.7	19.61	83.33%	707.1	601.0
	Round Goby*	3.3	3.92	16.67%	162.5	138.2
S12	Alewife*	346.7	391.84	97.20%	14,131.9	12,500.8
	Round Goby*	10.0	11.30	2.80%	468.6	414.5
Total		563.0	655.6	-	31365.3	26589.2
Fall						
S10	Round Goby*	6.7	7.77	86.96%	332.4	285.0
	Brown Bullhead	1.0	1.17	13.04%	898.0	770.0
S11	Alewife*	3.3	3.87	16.67%	129.8	111.7
	Round Goby*	16.7	19.37	83.33%	740.0	636.7
S12	Alewife*	3.3	3.97	52.63%	137.1	115.0
	Atlantic Salmon	2.0	2.38	31.58%	5,925.5	4,970.0
	Smallmouth Bass	1.0	1.19	15.79%	1,639.3	1,375.0
Total		34.0	39.7	-	9802.0	8263.3

Note:
Sampling locations are presented in **Figure 4-5**.

Table A-10: Summary of GLM modelling results for 2024 and 2025 Deepwater Fish Community Study (Depth and Season)

Parameter	R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
					Season	Mean	Lower Confidence Limit	Upper Confidence Limit				
Richness	0.10	Depth	0.592	No	Spring	1.7	1.1	2.7	-	-	-	-
		Season	0.148	No	Summer	2.1	1.4	3.0	-	-		
					Fall	2.9	2.1	4.1	-	-		
CPUE - log10(x + 1)	0.46	Depth	0.522	No	Spring	31.8	17.2	57.9	Spring	Summer	0.014	(Spring = Fall) <Summer
		Season	<0.001	Yes	Summer	107.2	60.6	189.2	Spring	Fall	0.085	
					Fall	12.3	6.4	23.0	Summer	Fall	<0.001	
BPUE - log10(x+1)	0.14	Depth	0.246	No	Spring	5,609.8	2,610.0	12,055.8	-	-	-	-
		Season	0.136	No	Summer	4,411.1	2,114.6	9,200.4	-	-		
					Fall	12,046.7	5,604.7	25,891.6	-	-		
Diversity - Shannon, log10(x+1)	0.33	Depth	0.896	No	Spring	0.3	0.1	0.5	Spring	Summer	0.391	Fall > (Summer = Spring)
		Season	<0.001	Yes	Summer	0.1	0.0	0.3	Spring	Fall	0.037	
					Fall	0.7	0.4	0.9	Summer	Fall	0.001	
CPUE SB - log10(x+1)	0.58	Depth	0.958	No	Spring	15.3	5.9	37.5	Spring	Summer	0.008	Summer > Spring > Fall
		Season	<0.001	Yes	Summer	106.9	46.2	245.6	Spring	Fall	0.005	
					Fall	1.1	-0.1	3.9	Summer	Fall	<0.001	
BPUE SB - log10(x+1)	0.51	Depth	0.896	No	Spring	218.1	44.9	1,043.7	Spring	Summer	0.035	Summer > Spring > Fall
		Season	<0.001	Yes	Summer	3,554.8	791.6	15,951.4	Spring	Fall	0.008	
					Fall	5.8	0.4	31.3	Summer	Fall	<0.001	

Note:
Shaded cells indicates p-value < 0.05, which was considered significant.
CPUE – Catch-per-unit effort, BPUE – biomass-per-unit effort, SB – small-bodied. These comparisons are shown in **Figure A-7**.
Depending on the metric, a different error distribution family of GLM was used appropriate to the data and model fit (richness: Poisson; diversity, BPUE, and CPUE: Gaussian with log10(x+1)). Residual plots were examined to assess model fit. Analysis of Deviance (analysis to ANOVA in classic regression) tables were used to determine overall effects of depth and season at the p = 0.1 statistical significance level. Post-hoc Tukey multiple comparisons were used to determine if and how seasons were statistically different. For consistency across model types, the Cox and Snell pseudo-R^2 GLMs used as an assessment of the proportion of variation explained by the depth and season effects. For non-gaussian GLMs, although pseudo R^2 are analogous to R^2 in regression, they are not directly interpretable as the proportion of explained variance. GLMs for CPUE and BPUE were run on a small-bodied fish species (i.e., here, only Alewife and Round Goby) using the same approach above as it is anticipated they may be more susceptible to impingement.

Table A-11: Summary of GLM modelling results for 2024 and 2025 Deepwater Fish Community Study (Substrate and Season)

Parameter	R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
					Substrate	Mean	Lower Confidence Limit	Upper Confidence Limit				
Richness	0.16	Season	0.189	No	Cobble/Gravel	2.43	1.48	3.98	-	-	-	-
		Substrate	0.461	No	Cobble/Gravel/Sand	1.61	1.01	2.57	-	-	-	-
					Mixed-Hard	2.39	1.57	3.64	-	-	-	-
					Mixed-Soft	2.5	1.68	3.71	-	-	-	-
CPUE - log10(x + 1)	0.55	Season	<0.001	Yes	Cobble/Gravel	61.6	28.8	130.5	-	-	-	-
		Substrate	0.101	No	Cobble/Gravel/Sand	23	12.4	42.3	-	-	-	-
					Mixed-Hard	26.3	13.4	51	-	-	-	-
					Mixed-Soft	48.4	25.5	91	-	-	-	-
BPUE - log10(x+1)	0.22	Season	0.213	No	Cobble/Gravel	6,760.60	2,476.00	18,456.30	-	-	-	-
		Substrate	0.32	No	Cobble/Gravel/Sand	3,724.40	1,680.00	8,255.20	-	-	-	-
					Mixed-Hard	6,604.40	2,763.40	15,782.30	-	-	-	-
					Mixed-Soft	12,557.00	5,403.80	29,177.40	-	-	-	-
Diversity - Shannon, log10(x+1)	0.48	Season	<0.001	Yes	Cobble/Gravel	0.25	0.06	0.49	Cobble/Gravel/Sand	Cobble/Gravel	0.95	Mixed-Hard > Cobble/Gravel/ Sand
		Substrate	0.035	Yes	Cobble/Gravel/Sand	0.18	0.03	0.36	Cobble/Gravel/Sand	Mixed-Hard	0.051	
					Mixed-Hard	0.55	0.33	0.8	Cobble/Gravel	Mixed-Soft	0.644	
					Mixed-Soft	0.43	0.24	0.65	Cobble/Gravel	Mixed-Hard	0.254	
									Cobble/Gravel/Sand	Mixed-Soft	0.24	
									Mixed-Hard	Mixed-Soft	0.866	

Note:
Shaded cells indicates p-value < 0.05, which was considered significant.
CPUE – Catch-per-unit effort, BPUE – biomass-per-unit effort, SB – small-bodied. These comparisons are shown in **Figure A-7**.
Depending on the metric, a different error distribution family of GLM was used appropriate to the data and model fit (richness: Poisson; diversity, BPUE, and CPUE: Gaussian with log10(x+1)). Residual plots were examined to assess model fit. Analysis of Deviance (analysis to ANOVA in classic regression) tables were used to determine overall effects of depth and season at the p = 0.05 statistical significance level. Post-hoc Tukey multiple comparisons were used to determine if and how seasons were statistically different. For consistency across model types, the Cox and Snell pseudo-R2 GLMs used as an assessment of the proportion of variation explained by the depth and season effects. For non-gaussian GLMs, although pseudo R2 are analogous to R2 in regression, they are not directly interpretable as the proportion of explained variance. GLMs for CPUE and BPUE were run on a small-bodied fish species (i.e., here, only Alewife and Round Goby) using the same approach above as it is anticipated they may be more susceptible to impingement.
Means and Confidence Limits for parameters that have been log10 transformed were back-transformed ((10^x)-1) for ease of interpretation.

Mid-depth Fish Community Study

Fish community surveys were conducted in the Mid-depth Study Area (**Figure 4-5**) during the spring, summer, and fall of 2025 to assess the fish community stratum of the previously proposed dredged channel and dock. This study area is inclusive of the 3 m to 9 m depth stratum from the southern extent of the Infill area, to the northern extent of the Deepwater study area. Each sampling event employed three sets of MNRF small mesh broadscale monitoring (BSM) nets and three sets of experimental (EXP) long gillnets. These nets were deployed randomly through the study area, capturing depths from 2 to 7.9 m, depending on water depth at each location. Consistent with the Deepwater Fish Community Study, all fish caught were identified and enumerated, and fish morphometrics were assessed for up to 30 individuals per species per season. Additionally, species composition, species richness, CPUE, and a morphometric summary were calculated.

Species composition of fish caught during the spring, summer, and fall sampling events are summarized in **Figure A-8**. Total catch, species richness, CPUE, and BPUE are provided in **Table A-12**.

A total of 1246 fish across 10 species were caught in the EXP and BSM nets across the 2025 Mid-depth Fish Community Study. Only six fish were captured during the spring sampling event, including 2 Lake Trout, 2 Round Goby, and 1 Rainbow Smelt in the EXP net, and 1 Rainbow Smelt in the BSM net. During the summer sampling event, 1196 fish were captured across the EXP and BSM nets, with Alewife and Round Goby comprising the majority of the catch. Other species captured included Atlantic Salmon and Rainbow Trout. Fish abundance declined in the fall sampling event, with a total of 44 fish captured. Round Goby dominated the catch in both the EXP and BSM nets. Species not observed during the spring or summer events, including White Bass, Northern Pike, and Yellow Perch, were captured in the EXP nets.

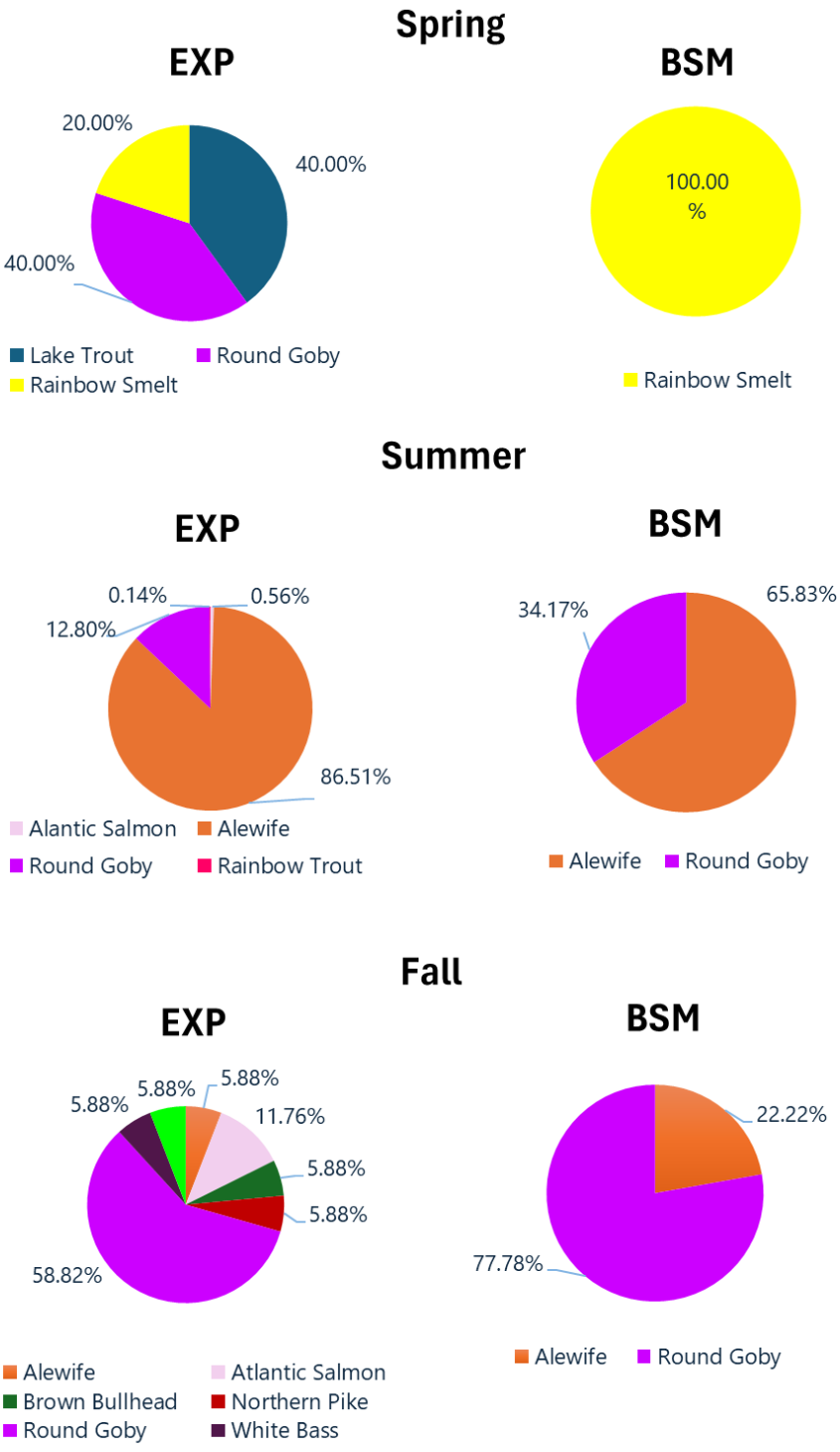


Figure A-8: Fish Species Composition Caught in Experimental (EXP) Nets and Broad Scale Monitoring (BSM) in the Mid-depth Study Area During the Spring, Summer, and Fall 2025 Sampling Events

Table A-12: Total Catch, CPUE, BPUE, and weight of fish caught in Mid-depth Study Area during 2025 Mid-depth Fish Community Study

Species	Total Catch	CPUE (fish caught/24h)	% Composition	BPUE (g of fish/24h	Total Weight of Fish Caught (g)
Spring					
EXP Net					
Lake Trout	2	1.0	40.0%	2684.5	5505.0
Round Goby	2	1.0	40.0%	10.0	20.5
Rainbow Smelt	1	0.5	20.0%	13.9	28.5
Total	5	2.4	100.0%	2708.4	5554.0
BSM Net					
Rainbow Smelt	1	0.5	100.0%	8.1	17.0
Total	1	0.5	100.0%	8.1	17.0
Summer					
EXP Net					
Alantic Salmon	4	1.5	0.6%	1097.1	2860.0
Alewife	622	238.6	86.5%	8538.3	22258.8
Round Goby	92	35.3	12.8%	513.8	1339.4
Rainbow Trout	1	0.4	0.1%	270.4	705.0
Total	719	275.8	100.0%	10419.6	27163.2
BSM Net					
Alewife	314	137.9	65.8%	2991.2	6809.2
Round Goby	163	71.6	34.2%	658.9	1499.9
Total					
Fall					
EXP Net					
Alewife	1	0.4	5.9%	13.8	36.1
Atlantic Salmon	2	0.8	11.8%	915.0	2397.5
Brown Bullhead	1	0.4	5.9%	209.9	550.0
Northern Pike	1	0.4	5.9%	1085.8	2845.0
Round Goby	10	3.8	58.8%	73.3	192.0
White Bass	1	0.4	5.9%	13.0	34.0
Yellow Perch	1	0.4	5.9%	28.2	74.0
Total	17	6.5	100.0%	2339.0	6128.6
BSM Net					
Alewife	6	2.4	22.2%	40.0	102.0
Round Goby	21	8.2	77.8%	125.8	320.7

Species	Total Catch	CPUE (fish caught/24h)	% Composition	BPUE (g of fish/24h	Total Weight of Fish Caught (g)
Total	27	10.6	100.0%	165.8	422.7

Note:
Sampling locations are presented in **Figure 4-5**.

Nearshore Fish Community Study

For the nearshore fish community study, existing fish community data were collected in the

the Cutoff Wall Study Area to understand the fish community in the area of cutoff wall in the spring, summer, and fall of 2025. Fish community data were also collected previously for other proposed structures which have since been excluded from the project plans including the Infill and Shoreline Erosion Mitigation Study Areas during the spring, summer, and fall of 2024. Though these structures are no longer being considered, the results are presented because they represent the nearshore fish community.

One EXP and one BSM net was used in each sampling event for the Cutoff Wall Study Area. In the Infill and Shoreline Erosion Mitigation Study Areas, each sampling event employed two sets of BSM nets and one EXP net. These nets were deployed approximately perpendicular to shore, capturing depths from 3 to 5.2 m in the Cutoff Wall Study Area, and 1.2 to 3 m in the Infill and Shoreline Erosion Mitigation Study Areas, depending on water depth at each location. Consistent with the fish community study in the Deepwater Study Area, all fish were collected and enumerated. Fish morphometrics were assessed for up to 30 individuals per species per season. Additionally, species composition, species richness, CPUE, and a morphometric summary were calculated.

Cutoff Wall Study Area

Species composition across the three sampling events is depicted in **Figure A-9**. Total fish counts, species richness, CPUE, and BPUE for the Cutoff Wall Study Area are provided in **Table A-15**. Across the spring, summer, and fall 2025 sampling events, a total of 321 fish across 10 species were captured in the EXP and BSM nets. In the spring, 13 fish were captured, with the majority collected in EXP nets. Rainbow Smelt accounted for the largest portion of the catch in EXP nets, while Round Goby dominated the BSM net catch. Other species captured in the EXP nets included Atlantic Salmon, Common Carp, Lake Trout, Longnose Sucker, and White Sucker. During the summer, 283 fish were captured, primarily in BSM nets. Alewife overwhelmingly dominated the catch, with Round Goby observed in small numbers. Species captured in the EXP nets included Brown Bullhead, Rock Bass, and White Sucker. In the fall, a total of 25 fish were captured, with Round Goby and Alewife the most abundant species in EXP nets, and Yellow Perch dominating the BSM net catch. Other species captured included Brown Bullhead, Brown Trout, Chinook Salmon, and White Sucker.

Infill and Shoreline Erosion Mitigation Study Areas

Species composition across the three sampling events in the Infill and Shoreline Erosion Mitigation Study Areas is depicted in **Figure A-10** and **Figure A-11**, respectively. Total fish counts and species richness, CPUE, and BPUE for the Infill Study Area and the Shoreline Erosion Mitigation Study Area are provided in **Table A-13** and **Table A-14**, respectively. .

Across both Study Areas, 574 fish from 20 different species were caught in the BSM and EXP nets across the spring, summer, and fall sampling events. Alewife and Round Goby consistently dominated the catch, accounting for >95% of the total catch in both the Infill and Shoreline Erosion Mitigation Study Areas in the spring and summer. Other species captured in the BSM nets included the Rainbow Trout, Brown Trout, and Atlantic Salmon, which like the Alewife, make seasonal spawning migrations into the nearshore zone. In the fall, species distributions varied more noticeably across the two net types and nearshore study areas. Round Goby continued to dominate the BSM net catch in both nearshore study areas; however, the Shoreline Erosion Mitigation Study Area exhibited greater species richness. Unlike the Infill Study Area, fish captured here included benthic species such as Brown Bullhead, Yellow Perch, Logperch, Longnose Sucker, and Mottled Sculpin, all of which are common along the Lake Ontario shoreline. In the EXP nets, White Sucker and Walleye were commonly captured in these two nearshore areas.

Nearshore Fish Community Summary

The differences in fish community composition between these three study areas are likely driven by differences in substrate and other aquatic habitat characteristics (see **Section A.3.4**).

The Cutoff Wall study area was almost entirely sandy substrate with large areas of dense macrophyte growth. Species observed here, such as Atlantic Salmon, Common Carp, Lake Trout, Round Goby, and White Sucker in spring, and Brown Bullhead, Rock Bass, and Alewife in summer and fall, reflect the preferences of fish that favor calmer waters, vegetated habitat for shelter, and softer substrates suitable for foraging and spawning. Overall, the Cutoff Wall area shows indications that it is relatively protected from strong wave action and erosion, while the other areas show evidence of strong wave action throughout the year. This may greatly influence preferred spawning locations, as wave-driven disturbance in shallow areas has been shown to significantly reduce the survival of eggs and newly hatched larvae (Great Lakes Fishery Commission, 2021). The Infill Study Area had roughly even proportions of sand, gravel, and cobble, with some boulder as well. This area's diverse substrate and moderate structural complexity likely provide a range of foraging opportunities for a mix of pelagic and benthic species. The Shoreline Erosion Mitigation Study Area consisted primarily of gravel, cobble, and boulder, with sandy patches nearshore, and a substantial presence of macrophytes. This area supported fish such as Alewife, Brown Trout, Rainbow Trout, Gizzard Shad, and Round Goby in spring, with more benthic oriented species like Walleye, Longnose Sucker, and Log Perch appearing in fall. The combination of coarse substrate and dense macrophytes likely provides some spawning areas, shelter from predators, supporting both pelagic and benthic species.

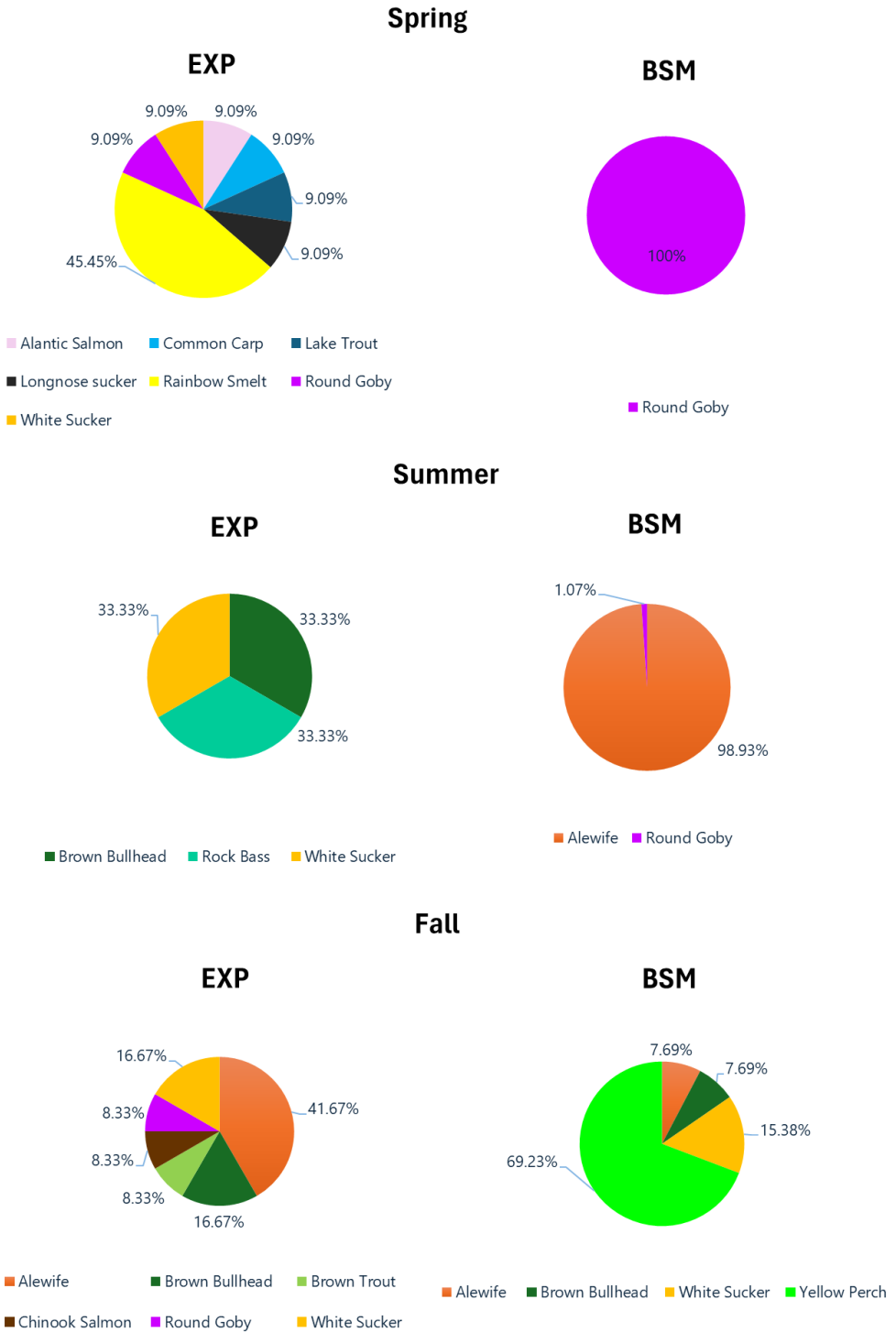


Figure A-9: Fish Species Composition Caught in Experimental (EXP) and Broad Scale Monitoring (BSM) Nets in the Cutoff Wall Study Area, 2025

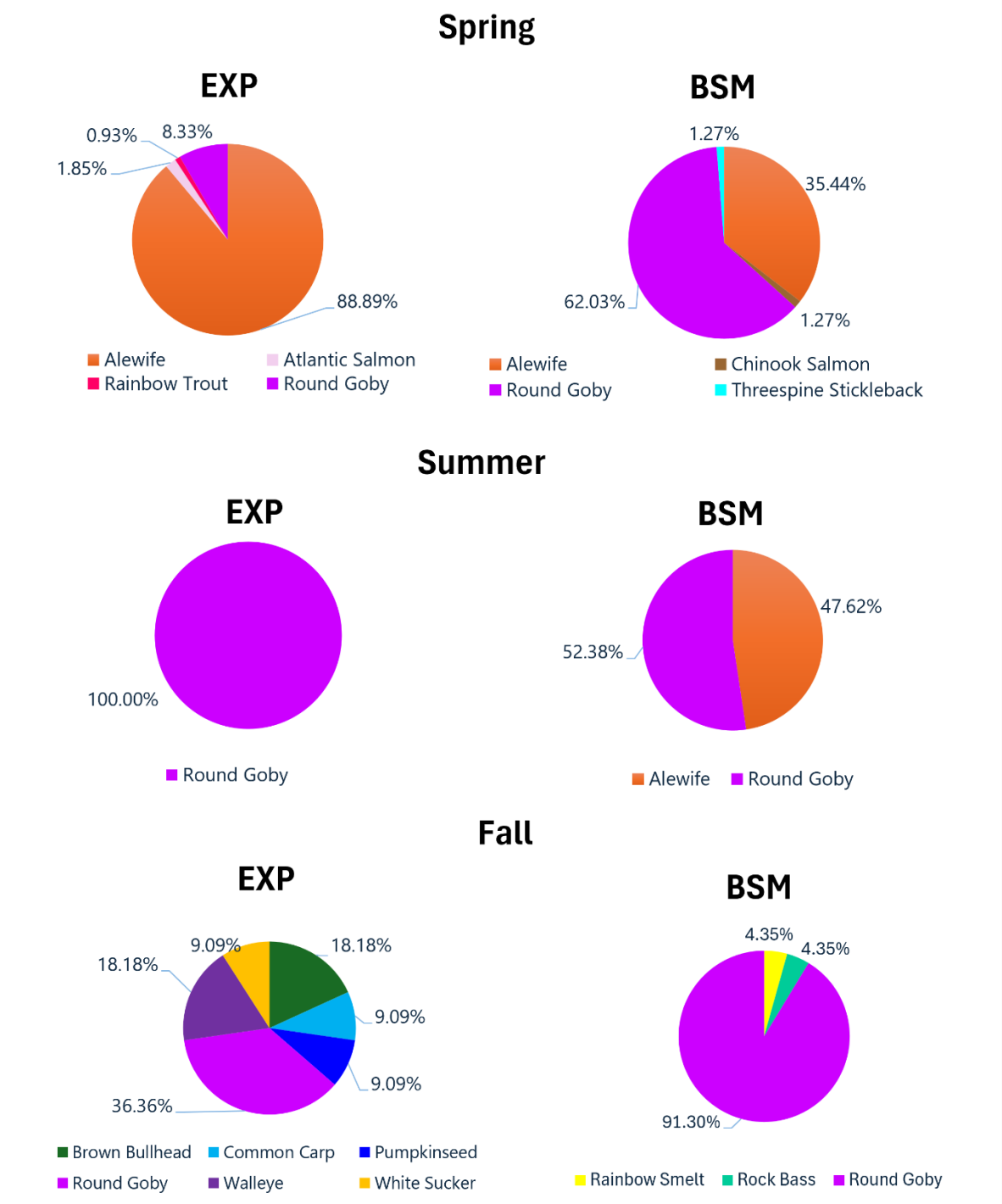


Figure A-10: Fish Species Composition Caught in Experimental (EXP) and Broad Scale Monitoring (BSM) Nets in the Infill Study Area, 2024

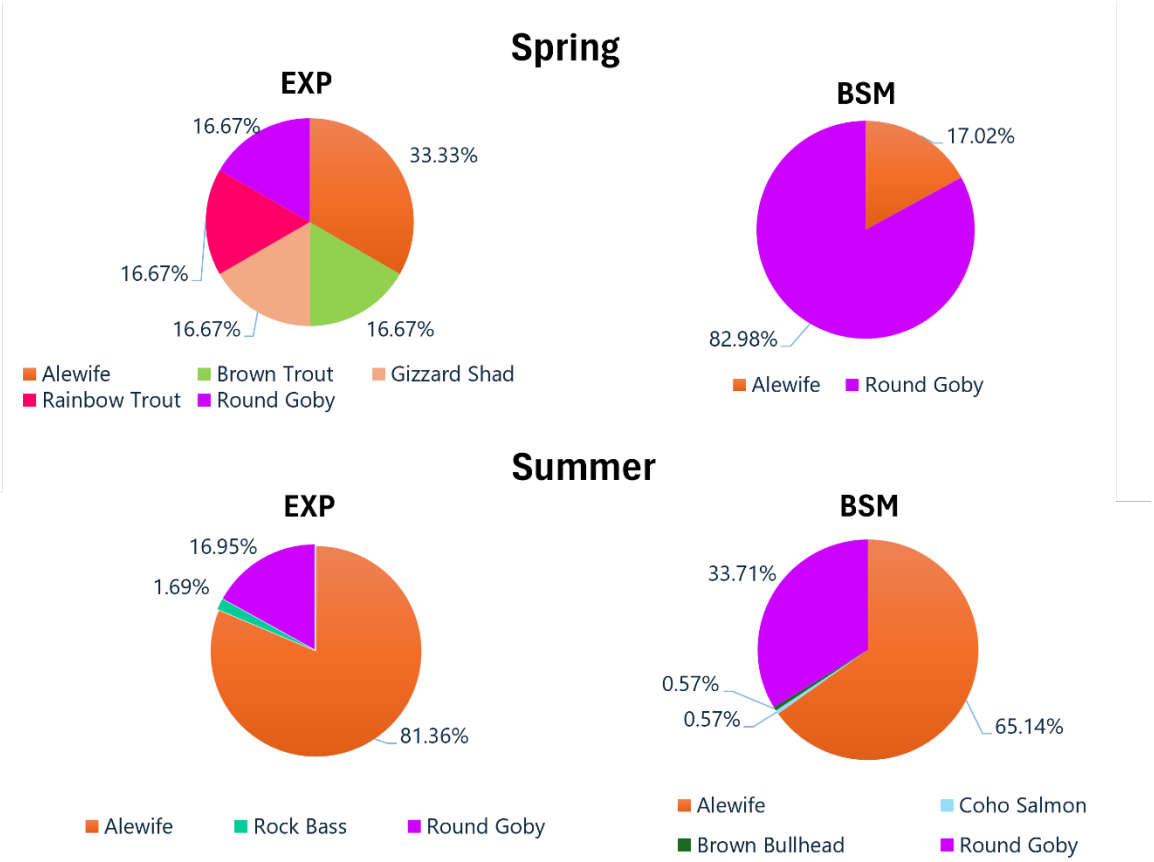


Figure A-11: Fish Species Composition Caught in Experimental (EXP) and Broad Scale Monitoring (BSM) Nets in the Shoreline Erosion Mitigation Study Area, 2024

Table A-13: Total Catch, CPUE, BPUE, and weight of fish caught in Infill Area during 2024 Nearshore Fish Community Study

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring					
EXP Nets					
Alewife	96	128.6	88.89%	4257.4	3178.3
Atlantic Salmon	2	2.7	1.85%	3851.2	2875.0
Rainbow Trout	1	1.3	0.93%	1640.9	1225.0
Round Goby	9	12.1	8.33%	151.4	113.1
Total	108	144.7	100%	9900.9	7391.3
BSM Nets					
Alewife	28	19.0	35.44%	539.2	795.7
Chinook Salmon	1	0.7	1.27%	4.1	6.0
Round Goby	49	33.2	62.03%	350.9	517.9
Threespine Stickleback	1	0.7	1.27%	1.0	1.5
Total	79	53.5	100%	895.2	1321.1
Summer					
EXP Nets					
Round Goby	1	1.1	100.00%	11.8	11.0
Total	1	1.1	1	11.8	11.0
BSM Nets					
Alewife	20	10.9	47.62%	281.2	517.2
Round Goby	22	12.0	52.38%	81.7	150.3
Total	42	22.8	100%	362.8	667.5
Fall					
EXP Nets					
Brown Bullhead	2	2.1	18.18%	556.9	524.0
Common Carp	1	1.1	9.09%	4973.6	4680.0
Pumpkinseed	1	1.1	9.09%	45.7	43.0
Round Goby	4	4.3	36.36%	41.4	39.0
Walleye	2	2.1	18.18%	6535.8	6150.0
White Sucker	1	1.1	9.09%	201.9	190.0
Total	11	11.7	100%	12355.3	11626.0
BSM Nets					

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Rainbow Smelt	1	0.5	4.35%	18.6	36.0
Rock Bass	1	0.5	4.35%	6.2	12.0
Round Goby	21	10.9	91.30%	197.0	381.0
Total	23	11.9	100%	221.8	429.0

Note:
Sampling locations are presented in **Figure 4-5**.

Table A-14: Total Catch, CPUE, BPUE, and weight of fish caught in Shoreline Erosion Mitigation Study Area during 2024 Nearshore Fish Community Study

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring					
EXP Nets					
Alewife	2	3.1	33.33%	118.5	76.5
Brown Trout	1	1.5	16.67%	5809.5	3752.0
Gizzard Shad	1	1.5	16.67%	2160.0	1395.0
Rainbow Trout	1	1.5	16.67%	1432.3	925.0
Round Goby	1	1.5	16.67%	13.9	9.0
Total	6	9.3	100%	9534.2	6157.5
BSM Nets					
Alewife	8	5.8	17.02%	192.9	265.2
Round Goby	39	28.4	83.0%	254.2	349.6
Total	47	34.2	100%	447.1	614.8
Summer					
EXP Nets					
Alewife	48	55.1	81.36%	1847.2	1609.9
Rock Bass	1	1.1	1.69%	281.1	245.0
Round Goby	10	11.5	16.95%	152.9	133.2
Total	59	67.7	100%	2281.2	1988.2
BSM Nets					
Alewife	114	66.6	65.14%	1852.1	3170.4
Coho Salmon	1	0.6	0.57%	NA	NA
Brown Bullhead	1	0.6	0.57%	134.4	230.0
Round Goby	59	34.5	33.71%	309.6	530.0
Total	175	102.2	100%	2296.1	3930.5
Fall					
EXP Nets					
Brown Trout	1	1.1	25.00%	1507.2	1345.0
Longnose Sucker	1	1.1	25.00%	NA	NA
Walleye	1	1.1	25.00%	1025.4	915.0
White Sucker	1	1.1	25.00%	784.4	700.0
Total	4	4.5	100%	3317.0	2960.0

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
BSM Nets					
Alewife	3	1.6	15.79%	23.6	44.5
Brown Bullhead	1	0.5	5.26%	28.1	53.0
Largemouth Bass	1	0.5	5.26%	5.8	11.0
Log Perch	1	0.5	5.26%	1.1	2.0
Longnose Sucker	2	1.1	10.53%	16.5	31.0
Rock Bass	1	0.5	5.26%	6.4	12.0
Round Goby	9	4.8	47.37%	20.2	38.0
Yellow Perch	1	0.5	5.26%	4.2	8.0
Total	19	10.1	100%	105.9	199.5

Note:
Sampling locations are presented in **Figure 4-5**.

Table A-15: Total Catch, CPUE, BPUE, and weight of fish caught in Cutoff Wall Study Area during 2025 Nearshore Fish Community Study

Species	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring					
EXP Nets					
Atlantic Salmon	1	1.9	9%	2793.6	1455.0
Common Carp	1	1.9	9%	14899.2	7760.0
Lake Trout	1	1.9	9%	4857.6	2530.0
Longnose Sucker	1	1.9	9%	2841.6	1480.0
Rainbow Smelt	5	9.6	45%	169.4	88.2
Round Goby	1	1.9	9%	24.8	12.9
White Sucker	1	1.9	9%	1152.0	600.0
Total	11	21.1	100%	26738.2	13926.1
BSM Nets					
Round Goby	2	4.0	100%	77.7	39.3
Total	2	4.0	100%	77.7	39.3
Summer					
EXP Nets					
Brown Bullhead	1	1.2	33%	145.6	121.0
Rock Bass	1	1.2	33%	174.4	145.0
White Sucker	1	1.2	33%	60.8	50.5
Total	3	3.6	100%	380.8	316.5
BSM Nets					
Alewife	277	338.0	99%	7768.7	6366.0
Round Goby	3	3.7	1%	53.2	43.6
Total	2	341.7	100%	7821.9	6409.6
Fall					
EXP Nets					
Alewife	5	6.2	42%	151.3	121.9
Brown Bullhead	2	2.5	17%	16.1	13.0
Brown Trout	1	1.2	8%	3190.3	2570.0
Chinook Salmon	1	1.2	8%	5561.4	4480.0
Round Goby	1	1.2	8%	53.4	43.0

Species	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
White Sucker	2	2.5	17%	34.8	28.0
Total	12	14.9	100%	9007.3	7255.9
BSM Nets					
Alewife	1	1.1	8%	39.1	36.1
Brown Bullhead	1	1.1	8%	12.5	11.5
White Sucker	2	2.2	15%	NA	NA
Yellow Perch	9	9.8	69%	100.2	92.4
Total	13	14.1	100%	151.7	139.9

Note:
Sampling locations are presented in **Figure 4-5**.

Fall Spawning Assessment

Detailed meristic results of the fish caught in the 2025 Fall Spawning Assessment are in **Table A-17**.

Table A-16: Meristics Data for Fish Collected and Measured from Nets Set during the Fall 2025 Spawning Assessment

Set Date	Collected Date	Week	Site	Season	Depth	Mesh Size	Common Name	Fork Length (cm)	Total Length (cm)	Weight (g)	Sex	Gonad Class
11/14/2025	11/15/2025	Week1	SEMSA	FA	3.7	50.8	Brown Trout	62.8	63.9	3035	M	-
11/14/2025	11/15/2025	Week1	SEMSA	FA	3.7	76.2	Chinook Salmon	57.2	61	2250	M	-
11/14/2025	11/15/2025	Week1	S14	FA	7.9	76.2	Chinook Salmon	-	-	-	M	-
11/14/2025	11/15/2025	Week1	S5	FA	16.5	50.8	Lake Whitefish	41.3	45.2	770	M	Mature
11/14/2025	11/15/2025	Week1	S5	FA	16.5	76.2	Lake Whitefish	42.3	47.1	785	M	Mature
11/14/2025	11/15/2025	Week1	S5	FA	16.5	63.5	Lake Trout	58.4	64.2	2660	M	Running
11/14/2025	11/15/2025	Week1	S5	FA	16.5	76.2	Lake Trout	602	660	3195	M	Running
11/14/2025	11/15/2025	Week1	S5	FA	16.5	50.8	Lake Trout	-	-	-	-	-
11/14/2025	11/15/2025	Week1	S3	FA	10	63.5	Lake Whitefish	45	48.9	1010	M	Ripe
11/14/2025	11/15/2025	Week1	S3	FA	10	88.9	Lake Whitefish	45.5	50.5	1350	F	Mature
11/14/2025	11/15/2025	Week1	S3	FA	10	101.6	Lake Whitefish	41.4	45.7	765	M	Mature
11/14/2025	11/15/2025	Week1	S3	FA	10	76.2	Lake Trout	-	-	-	-	-
11/19/2025	11/20/2025	Week2	S1	FA	11.9	76.2	Lake Whitefish	41	45.7	750	M	Mature
11/19/2025	11/20/2025	Week2	S1	FA	11.9	76.2	Lake Whitefish	39	43	635	M	Ripe
11/19/2025	11/20/2025	Week2	S4	FA	16.5	76.2	Lake Trout	83.5	90	7870	M	Ripe
11/19/2025	11/20/2025	Week2	S4	FA	16.5	63.5	Lake Trout	75.2	81.6	5630	M	Ripe
2025-11-19	2025-11-20	Week2	SEMSA	FA	3.6	101.6	Common Carp	63.8	69.5	4995	-	-
2025-11-19	2025-11-20	Week2	SEMSA	FA	5.3	101.6	Northern Pike	67.2	71	3025	-	-
2025-11-19	2025-11-20	Week2	SEMSA	FA	5.3	50.8	Brown Trout	-	67.5	4695	F	-
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	76.2	Atlantic Salmon	56.2	59.5	2435	-	-
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	101.6	Lake Whitefish	49	54.3	14.95	F	Running
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	50.8	Brown Trout	27.5	28.7	230	M	-
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	101.6	Chinook Salmon	62.2	67	2580	M	-

Set Date	Collected Date	Week	Site	Season	Depth	Mesh Size	Common Name	Fork Length (cm)	Total Length (cm)	Weight (g)	Sex	Gonad Class
2025-11-19	2025-11-20	Week2	S18	FA	7.1	101.6	Lake Whitefish	47.4	51	1365	F	Ripe
2025-11-19	2025-11-20	Week2	S18	FA	7.1	101.6	Lake Whitefish	43	47.3	860	M	Ripe
2025-11-19	2025-11-20	Week2	S12	FA	10	101.6	Lake Whitefish	47.4	52.4	1140	M	Ripe
2025-11-19	2025-11-20	Week2	S12	FA	10	101.6	Walleye	45.4	47.3	1490	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	5.3	76.2	Northern Pike	83.4	86.7	4790	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	5.3	63.5	White Sucker	27.7	29.4	250	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	3.5	63.5	White Sucker	21.1	23.3	125	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	3.5	88.9	Brown Trout	55	57	2790	-	-
11/24/2025	11/25/2025	Week3	COWSA	FA	3.9	63.5	Brown Trout	60.1	61	3085	-	-
11/24/2025	11/25/2025	Week3	COWSA	FA	3.9	101.6	Brown Trout	-	53.4	1610	F	-
11/24/2025	11/25/2025	Week3	COWSA	FA	3.9	101.6	Lake Whitefish	45.2	49.6	1345	F	Running
11/24/2025	11/25/2025	Week3	S12	FA	9.8	88.9	Lake Trout	61	66.1	2520	M	Ripe
11/24/2025	11/25/2025	Week3	S12	FA	9.8	101.6	Round Whitefish	46.3	49.8	1165	M	Mature
11/24/2025	11/25/2025	Week3	S15	FA	8.3	88.9	Round Whitefish	51.4	54.9	1690	F	Ripe
11/24/2025	11/25/2025	Week3	S8	FA	17.9	88.9	Lake Trout	68.4	74.6	3745	M	Ripe
11/24/2025	11/25/2025	Week3	S3	FA	10.9	88.9	Lake Whitefish	51	56.3	1600	M	Spent
11/24/2025	11/25/2025	Week3	S3	FA	10.9	88.9	Lake Whitefish	39.4	43.6	700	M	Spent
11/24/2025	11/25/2025	Week3	S3	FA	10.9	101.6	Lake Whitefish	44	48.6	970	M	Spent
12/1/2025	12/2/2025	Week4	S1	FA	10.2	50.8	Eel Slime	-	-	-	-	-
12/1/2025	12/2/2025	Week4	SEMSA	FA	5.4	63.5	Cisco	24.3	27.5	150.00	-	-
12/1/2025	12/2/2025	Week4	S7	FA	17.8	76.2	Lake Whitefish	39.6	44	695	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	42.1	46.7	870	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	41.8	46.7	756	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Round Whitefish	46.6	51	1025	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	45.6	50.4	1000	M	Ripe

Set Date	Collected Date	Week	Site	Season	Depth	Mesh Size	Common Name	Fork Length (cm)	Total Length (cm)	Weight (g)	Sex	Gonad Class
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	43.3	47.2	1025	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	41	45.1	825	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	41.3	46	810	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	40.3	44.2	740	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	40.2	44.5	710	M	Spent
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	38.6	42.9	635	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	49	45.2	755	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	42.7	46.7	785	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	44	48.4	940	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	38.1	42.4	668	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	40.5	44.6	685	M	Spent
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	39.2	43.6	605	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	44	48.7	965	M	Ripe

Note:
"-" the parameter was not measured, or that the sex was not identified possibly because fish were not in spawning condition or lethally sampled. Sampling locations are presented in **Figure 4-6**.
S1-S12 indicate that the fish was caught in a net set in the Deepwater Study Area, S13-16 in the Mid-depth Study Area, COWSA – Cutoff Wall Study Area, SEMSA – Shoreline Erosion Mitigation Study Area.

Larval Fish and Eggs

Detailed results of the 2025 Ichytoplankton studies are presented below.

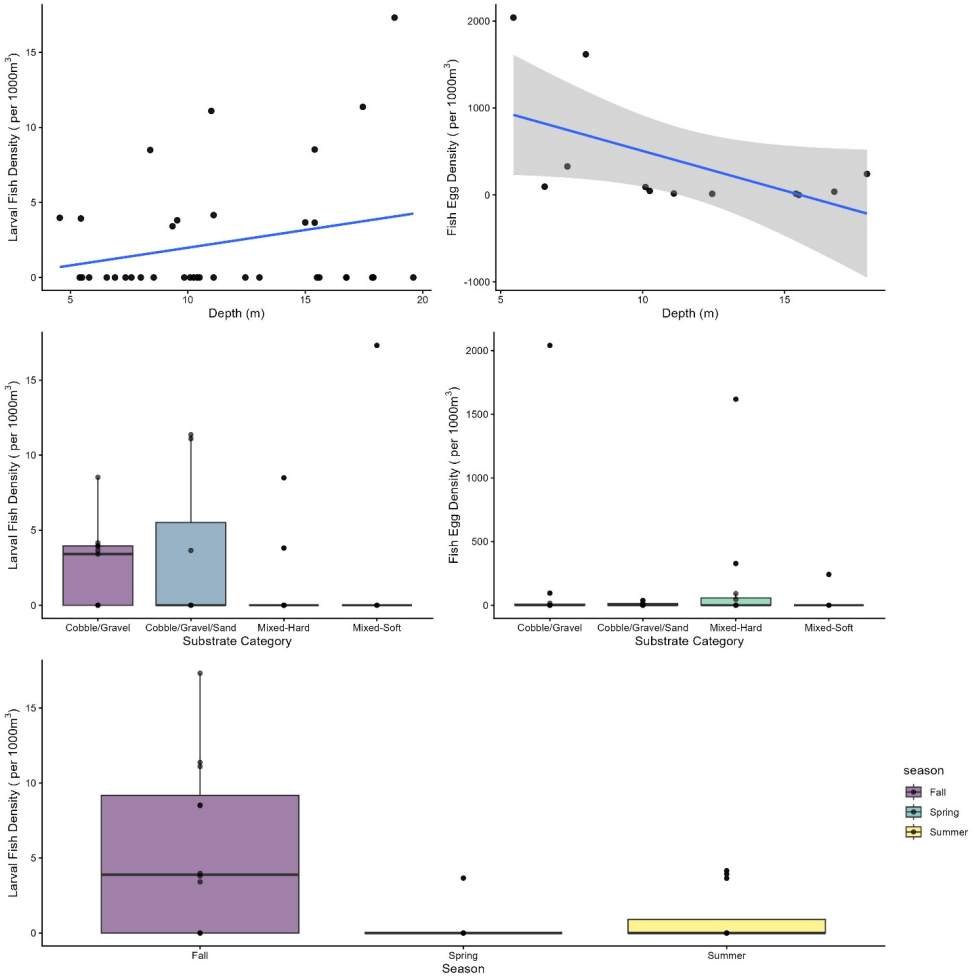


Figure A-12: Scatterplots and Boxplots of Larval Fish Density (Individuals per 1000m^3) Expressed by Depth, Substrate, and Season.

Note:
The box spans the interquartile range (IQR; 25th percentile (bottom of box) to 75th percentile (top of box)), the horizontal line within the box is the median, the vertical lines extend outwards to the furthest datapoint within 1.5 x IQR, and any points outside of this vertical line are beyond 1.5 x IQR.

Table A-17: Larval Fish and Egg Total and Proportional Catch in Horizontal Tows by Matrix, 2025

Spring													
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S2**	**S4**	**S6**	**S8**	**S9**	**S11**	**S12**	**S13**	**S15**	**S17**	**S18**
Count	Larval Fish	Lake Whitefish	0	0	0	1	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Proportion (%)	Larval Fish	Lake Whitefish	0	0	0	100	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Summer														
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S3**	**S4**	**S6**	**S7**	**S9**	**S11**	**S12**	**S14**	**S15**	**S16**	**S18**
Count	Larval Fish	Round Goby	0	1	1	0	0	0	0	0	0	0	0	1
	Eggs	spiny-rayed fishes (Alewife or Gizzard Shad)	4	4	4	0	11	63	21	13	413	79	24	519
Proportion (%)	Larval Fish	Round Goby	0	33.3	33.3	0	0	0	0	0	0	0	0	33.3
	Eggs	spiny-rayed fishes (Alewife or Gizzard Shad)	0.35	0.35	0.35	0	0.95	5.45	1.82	1.13	35.8	6.84	2.08	44.9
Fall														
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S3**	**S4**	**S6**	**S7**	**S9**	**S11**	**S12**	**S13**	**S14**	**S16**	**S17**
Count	Larval Fish	Burbot	3	1	0	2	3	5	0	1	2	0	0	1
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Proportion (%)	Larval Fish	Burbot	16.7	5.56	0	11.1	16.7	27.8	0	5.56	11.1	0	0	5.56
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0

Note:
Highlighted cells indicate where larval fish or eggs were caught.
Sampling areas are presented in **Figure 4-7**.

Table A-18: Larval Fish and Total Eggs Caught in Vertical Tows by Matrix, 2025

Spring													
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S1**	**S11**	**S12**
Count	Larval Fish	NA	0	0	0	0	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Summer														
Metric	**Life Stage**	**Species**	**Grid No.**											
			S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**
Count	Larval Fish	Clupeidae	0	3	0	0	0	0	0	0	0	0	0	0
	Eggs	Clupeidae	0	0	0	0	0	0	1	0	0	0	0	0
Fall														
Metric	**Life Stage**	**Species**	**Grid No.**											
			S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**
Count	Larval Fish	NA	0	0	0	0	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0

Note:
Highlighted cells indicate where larval fish or eggs were caught.
Sampling areas are presented in **Figure 4-7**.

Table A-19: Horizontal Tow Information, Habitat Descriptions, and Summary Statistics for Larval Fish and Eggs Caught in Spring, Summer, and Fall 2025 Sampling Events

Grid	Date	Tow Length (m)	Average Tow Depth (m)	Sample Volume (m^3)	Larval Fish Species Richness	Larval Fish Density (per 1000m^3)	Egg Species Richness	Egg Density (per 1000m^3)	Dominant Matrix Substrate	Substrate (% Cobble)
Spring										
S1	13-Apr-25	293.89	11.1	259.54	0	0	0	0	gravel/cobble/boulder	89.9%
S2 (Intake location option)	13-Apr-25	314.31	13.1	277.58	0	0	0	0	gravel/cobble/boulder	55.1%
S4	13-Apr-25	273.95	16.8	241.93	0	0	0	0	gravel/cobble	76.0%
S6	13-Apr-25	309.00	15.0	272.88	1	3.665	0	0	gravel/cobble	96.3%
S8	13-Apr-25	246.39	17.9	217.60	0	0	0	0	gravel/cobble	47.3%
S9	13-Apr-25	298.08	19.6	263.24	0	0	0	0	gravel/cobble	28.9%
S11	13-Apr-25	289.44	10.4	255.61	0	0	0	0	sand/gravel/cobble	75.0%
S12	13-Apr-25	302.87	10.5	267.47	0	0	0	0	sand/gravel/cobble	73.5%
S13	12-Apr-25	310.80	8.6	274.48	0	0	0	0	sand/gravel/cobble	68.7%
S15	13-Apr-25	298.03	7.6	263.19	0	0	0	0	sand/gravel/cobble/boulder	75.0%
S17	12-Apr-25	302.44	5.4	267.09	0	0	0	0	sand/gravel/cobble	95.1%
S18	12-Apr-25	311.56	5.8	275.15	0	0	0	0	gravel/cobble/boulder	100.0%
Minimum	--	**246.39**	**5.40**	**217.60**	**0.00**	**0.00**	**0.00**	**0.00**	--	**28.9%**
Median	--	**300.26**	**10.80**	**265.17**	**0.00**	**0.00**	**0.00**	**0.00**	--	**75.0%**
Mean	--	**295.90**	**11.80**	**261.31**	**0.08**	**0.31**	**0.00**	**0.00**	--	**73.4%**
Standard Deviation	--	**19.21**	**4.70**	**16.96**	**0.29**	**1.06**	**0.00**	**0.00**	--	**21.3%**
Q25	--	**292.78**	**8.31**	**258.56**	**0.00**	**0.00**	**0.00**	**0.00**	--	**65.3%**
Q75	--	**309.45**	**15.44**	**273.28**	**0.00**	**0.00**	**0.00**	**0.00**	--	**91.2%**
Maximum	--	**314.31**	**19.60**	**277.58**	**1.00**	**3.66**	**0.00**	**0.00**	--	**100.0%**

Grid	Date	Tow Length (m)	Average Tow Depth (m)	Sample Volume (m^3)	Larval Fish Species Richness	Larval Fish Density (per 1000m^3)	Egg Species Richness	Egg Density (per 1000m^3)	Dominant Matrix Substrate	Substrate (% Cobble)
Summer										
S1	23-Jul-25	345.45	12.6	305.08	0	0.0	1	13.1	gravel/cobble/boulder	88.6%
S3	23-Jul-25	272.54	10.6	240.68	1	4.2	1	16.6	gravel/cobble	99.4%
S4	23-Jul-25	309.99	15.7	273.76	1	3.7	1	14.6	gravel/cobble/boulder	45.4%
S6	23-Jul-25	282.21	15.3	249.23	0	0.0	0	0.0	gravel/cobble	77.5%
S7	23-Jul-25	329.45	17.2	290.95	0	0.0	1	37.8	gravel/cobble	85.6%
S9	23-Jul-25	294.97	18.0	260.49	0	0.0	1	241.9	gravel/cobble	60.4%
S11	23-Jul-25	259.73	10.1	229.37	0	0.0	1	91.6	sand/gravel/cobble	74.4%
S12	23-Jul-25	317.33	10.4	280.24	0	0.0	1	46.4	gravel/cobble/boulder	71.8%
S14	23-Jul-25	289.07	7.7	255.29	0	0.0	1	1617.8	gravel/cobble/boulder	75.0%
S15	22-Jul-25	272.65	8.5	240.79	0	0.0	1	328.1	sand/gravel/cobble	75.0%
S16	23-Jul-25	285.56	5.9	252.19	0	0.0	1	95.2	sand/gravel/cobble	92.9%
S18	22-Jul-25	288.07	5.7	254.40	1	3.9	1	2040.1	gravel/cobble/boulder	98.3%
Minimum	--	**259.73**	**5.70**	**229.37**	**0.00**	**0.00**	**0.00**	**0.00**	--	**45.4%**
Median	--	**288.57**	**10.50**	**254.84**	**0.00**	**0.00**	**1.00**	**68.97**	--	**76.2%**
Mean	--	**295.58**	**11.48**	**261.04**	**0.25**	**0.98**	**0.92**	**378.59**	--	**78.7%**
Standard Deviation	--	**25.29**	**4.27**	**22.33**	**0.45**	**1.77**	**0.29**	**690.66**	--	**15.7%**
Q25	--	**279.82**	**8.30**	**247.12**	**0.00**	**0.00**	**1.00**	**16.12**	--	**73.8%**
Q75	--	**311.83**	**15.40**	**275.38**	**0.25**	**0.91**	**1.00**	**263.41**	--	**89.7%**
Maximum	--	**345.45**	**18.00**	**305.08**	**1.00**	**4.15**	**1.00**	**2040.10**	--	**99.4%**

Grid	Date	Tow Length (m)	Average Tow Depth (m)	Sample Volume (m^3)	Larval Fish Species Richness	Larval Fish Density (per 1000m^3)	Egg Species Richness	Egg Density (per 1000m^3)	Dominant Matrix Substrate	Substrate (% Cobble)
Fall										
S1	6-Nov-25	306.13	11.0	270.35	1	11.097	0	0	gravel/cobble	61.2%
S3	6-Nov-25	331.64	9.4	292.88	1	3.414	0	0	gravel/cobble	97.8%
S4	6-Nov-25	292.46	15.6	258.28	0	0	0	0	sand/gravel/cobble	75.3%
S6	6-Nov-25	265.62	15.4	234.57	1	8.526	0	0	gravel/cobble/boulder	78.8%
S7	6-Nov-25	298.81	17.5	263.88	1	11.369	0	0	gravel/cobble/boulder	77.7%
S9	6-Nov-25	326.97	18.8	288.76	1	17.316	0	0	sand/gravel/cobble	53.8%
S11	6-Nov-25	300.93	9.9	265.76	0	0	0	0	gravel/cobble/boulder	74.4%
S12	6-Nov-25	297.14	9.6	262.41	1	3.811	0	0	gravel/cobble/boulder	74.0%
S13	6-Nov-25	266.66	8.4	235.49	1	8.493	0	0	sand/gravel/cobble	74.4%
S14	6-Nov-25	337.66	6.9	298.20	0	0	0	0	gravel/cobble/boulder	75.0%
S16	6-Nov-25	315.01	5.5	278.20	0	0	0	0	gravel/cobble	84.9%
S17	6-Nov-25	285.01	4.6	251.70	1	3.973	0	0	gravel/cobble	98.4%
Minimum	--	**265.62**	**4.55**	**234.57**	**0.00**	**0.00**	**0.00**	**0.00**	--	**53.8%**
Median	--	**299.87**	**9.70**	**264.82**	**1.00**	**3.89**	**0.00**	**0.00**	--	**75.1%**
Mean	--	**302.00**	**11.03**	**266.71**	**0.67**	**5.67**	**0.00**	**0.00**	--	**77.1%**
Standard Deviation	--	**23.25**	**4.71**	**20.53**	**0.49**	**5.67**	**0.00**	**0.00**	--	**12.7%**
Q25	--	**290.60**	**8.03**	**256.63**	**0.00**	**0.00**	**0.00**	**0.00**	--	**74.3%**
Q75	--	**318.00**	**15.45**	**280.84**	**1.00**	**9.17**	**0.00**	**0.00**	--	**80.3%**
Maximum	--	**337.66**	**18.80**	**298.20**	**1.00**	**17.32**	**0.00**	**0.00**	--	**98.4%**

Note:
Sampling locations are presented in **Figure 4-7**.

Table A-20: Date, Time, Grid Location, Substrate, Depth, and Estimated Volume of Vertical Ichthyoplankton Tows Conducted During Spring, Summer, and Fall 2025

Date	Time	Grid	Substrate	Water Depth (m)	Volume sampled (m^3)	Catch
Spring						
04/12/2025	1:55	S1	Cobble	11.4	4.42	-
04/12/2025	1:27	S2	Gravel/Cobble	12.8	4.42	-
04/12/2025	1:09	S3	Cobble/Boulder	10.9	4.42	-
04/11/2025	23:50	S4	Cobble	16.9	4.42	-
04/12/2025	0:20	S5	Cobble	16.4	4.42	-
04/12/2025	0:47	S6	Cobble	15.8	4.42	-
04/11/2025	23:22	S7	Gravel/Cobble	18.7	4.42	-
04/11/2025	22:55	S8	Sand	18.8	4.42	-
04/11/2025	22:26	S9	Sand	18.7	4.42	-
04/12/2025	2:16	S10	Cobble	9.9	4.37	-
04/12/2025	2:37	S11	Cobble	11.4	4.42	-
04/12/2025	2:57	S12	Cobble	9.8	4.33	-
Summer						
07/16/2025	2:15	S1	Cobble	11.5	4.42	-
07/16/2025	1:53	S2	Gravel/Cobble	12.0	4.42	3 Clupeidae Larvae 0.90 larvae /m^3
07/16/2025	1:30	S3	Cobble/Boulder	11.0	4.42	-
07/16/2025	1:04	S4	Cobble	16.0	4.42	-
07/16/2025	12:35	S5	Cobble	16.0	4.42	-
07/16/2025	12:06	S6	Cobble	15.6	4.42	-
07/15/2025	11:38	S7	Gravel/Cobble	18.5	4.42	1 Clupeidae egg

Date	Time	Grid	Substrate	Water Depth (m)	Volume sampled (m^3)	Catch
						0.23 eggs/m^3
07/15/2025	11:24	S8	Sand/Cobble	18.5	4.42	-
07/15/2025	10:29	S9	Sand	19.0	4.42	-
07/16/2025	3:18	S10	Cobble	10.0	4.42	-
07/16/2025	3:00	S11	Cobble	10.5	4.42	-
07/16/2025	2:40	S12	Cobble	10.0	4.42	-
07/16/2025	2:15	S1	Cobble	11.5	4.42	-
Fall						
09/25/2025	23:02	S1	Cobble	11.0	4.42	-
09/25/2025	22:50	S2 (intake location option)	Gravel/Cobble	12.0	4.42	-
09/25/2025	22:38	S3	Cobble/Boulder	10.0	4.42	-
09/25/2025	21:57	S4	Cobble	15.2	4.42	-
09/25/2025	22:10	S5 (Intake location option)	Cobble	15.6	4.42	-
09/25/2025	22:25	S6	Cobble	15.0	4.42	-
09/25/2025	21:43	S7	Gravel/Cobble	17.4	4.42	-
09/25/2025	21:25	S8	Sand	17.5	4.42	-
09/25/2025	21:05	S9	Sand	18.5	4.42	-
09/25/2025	23:15	S10	Cobble	9.4	4.15	-
09/25/2025	23:25	S11	Cobble	10.2	4.42	-
09/25/2025	23:36	S12	Cobble	9.5	4.20	-

Note:
Sampling locations are presented in **Figure 4-7**.

Table A-21: Summary of Generalized Linear Model Results for Larval Fish and Eggs

Parameter	AIC Value	R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
						Season / Area	Mean	Lower Confidence Limit	Upper Confidence Limit				
Fish Density - Depth	207.4	0.012	Depth	0.139	No	--	2.3	0.9	3.7	--	--	--	--
Fish Density - Season	196.9	0.073	Season	<0.001	Yes	Fall	5.7	3.6	7.7	Fall	Spring	0.002	Fall > (Spring = Summer)
						Spring	0.3	-1.7	2.4	Fall	Summer	0.006	
						Summer	1.0	-1.1	3.0	Spring	Summer	0.884	
Fish Density - Substrate	211.7	0.010	Substrate	0.705	No	Cobble/Gravel	2.5	-0.1	5.1	--	--	--	--
						Cobble/Gravel/Sand	3.3	0.2	6.3				
						Mixed-Hard	1.0	-1.5	3.5				
						Mixed-Soft	3.5	-0.4	7.3				
Summer Egg Density - Depth	191.5	0.023	Depth	0.061	Yes	--	378.6	-8.8	766.0	--	--	--	As Depth increases, egg density decreases
Summer Egg Density - Substrate	198.5	0.007	Substrate	0.402	No	Cobble/Gravel	538.0	-342.4	1418.3	--	--	--	--
						Cobble/Gravel/Sand	21.8	-994.7	1038.4				
						Mixed-Hard	521.0	-359.4	1401.3				
						Mixed-Soft	241.9	-1518.9	2002.6				

Note: Shaded cells indicates p-value < 0.1, which was considered significant.

A model comparing density across season was not run for fish eggs as eggs were only found in the summer sample period (July 22-23, 2025). Fish egg density was only compared across depth and substrate for data collected in the summer sample period.

A.3.1.2 Fish Tissue

The screening of metals and radionuclides in fish tissue collected in 2024 to support the protection of human health are presented in **Table A-22**.

Table A-22: Fish Tissue Analysis Results, 2024

Parameter	Units	Detection Limit	Federal guidelines (1,2,3)[a]	Toxicity reference value-derived concentrations (4-7)[b]	Regulatory Dose Limit-derived Concentrations (8)[c]	Selected screening criteria	Nearshore Lake Ontario								Deepwater Intake Area											
							Rainbow Trout		Atlantic Salmon	Walleye					Lake Trout								Alewife					
							RT-1	RT-2	AS-1	WE-1	WE-2	WE-3	WE-4	WE-5	LT-1	LT-2	LT-3	LT-4	LT-5	LT-6	LT-7	LT-8	LWF-1	LWF-2	LWF-3	LWF-4	LWF-5	LWF-6
Metals																												
Aluminum (Al)	mg/kg (wt)	0.2	-	1.18E+03	-	1.18E+03	0.38	0.17665	0.25	0.33	0.27	0.33	0.3	0.12735	0.4	0.14252	0.31	0.26	4.17	0.22	0.19308	0.15673	0.33	0.18528	0.38	0.18974	0.16808	0.12048
Antimony (Sb)	mg/kg (wt)	0.001	-	4.71E-01	-	4.71E-01	0.0002	0.00014	0.00025	0.00024	0.00031	0.00037	0.00033	0.00011	0.00026	0.00025	0.00027	0.00032	0.00045	0.00031	0.00066	0.0018	0.00069	0.00039	0.00036	0.00036	-0.0003	-0.0004
Arsenic (As)	mg/kg (wt)	0.004	8.88E-01	6.55E-02	-	8.88E-01	0.0592	0.0503	0.144	0.095	0.097	0.127	0.132	0.197	0.0802	0.187	0.216	0.176	0.124	0.0991	0.119	0.312	0.145	0.0754	0.114	0.114	0.13	0.0884
Barium (Ba)	mg/kg (wt)	0.01	-	2.24E+02	-	2.24E+02	0.018	0.0087	0.012	0.00429	0.00242	0.00329	0.01	0.00223	0.014	0.00297	0.016	0.018	0.013	0.00486	0.00481	0.00696	0.011	0.00919	0.0095	0.00603	0.01	0.00926
Beryllium (Be)	mg/kg (wt)	0.001	-	2.36E+00	-	2.36E+00	-0.0002	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0004	-0.0005
Bismuth (Bi)	mg/kg (wt)	0.001	-	-	-	-	0.00046	0.00026	0.00028	0.00054	0.00068	0.00056	0.00014	0.00026	0.00021	0.00011	0.00024	0.00039	0.00058	0.00042	0.00049	0.00007	0.0044	0.0018	0.0024	0.0015	0.0015	0.0016
Boron (B)	mg/kg (wt)	0.2	-	3.77E+02	-	3.77E+02	-0.0077	-0.0155	-0.0018	-0.0218	-0.0273	-0.0208	-0.0095	-0.0159	-0.0255	-0.0248	-0.0238	-0.022	-0.0211	-0.0247	0.13142	-0.0244	-0.025	-0.0201	0.25	-0.0144	-0.0126	-0.0347
Cadmium (Cd)	mg/kg (wt)	0.001	-	9.43E-01	-	9.43E-01	0.00057	0.00009	0.00033	0.0001	0.00005	0.00066	0.0011	0.00009	0.00011	-3E-05	0.00006	0.00031	0.00015	-1E-05	-5E-05	0.00002	0.00002	0	0.00011	0.0001	-5E-05	-0.0002
Calcium (Ca)	mg/kg (wt)	2	-	-	-	-	180	138	82.3	116	115	106	209	115	243	71.3	169	173	121	75.9	203	63.6	188	132	181	97.4	122	80.7
Chromium (Cr)	mg/kg (wt)	0.01	-	2.59E+00	-	2.59E+00	0.00663	0.00443	0.00884	0.00744	0.00622	0.0081	0.0078	0.00657	0.00592	0.00784	0.00523	0.011	0.0072	0.00466	0.00495	0.0055	0.00934	0.00716	0.012	0.00796	0.00275	0.00358
Cobalt (Co)	mg/kg (wt)	0.0013	-	1.18E+00	-	1.18E+00	0.0045	0.004	0.0018	0.00052	0.00027	0.00039	0.00051	0.00051	0.002	0.0013	0.0021	0.0021	0.0023	0.0017	0.0019	0.0015	0.0029	0.0133	0.0044	0.0065	0.0057	0.002
Copper (Cu)	mg/kg (wt)	0.01	-	5.02E+02	-	5.02E+02	0.188	0.206	0.297	0.113	0.118	0.133	0.217	0.294	0.23	0.238	0.355	0.293	0.242	0.353	0.264	0.284	0.201	0.192	0.271	0.423	0.181	0.234
Iron (Fe)	mg/kg (wt)	0.25	-	3.54E+03	-	3.54E+03	3.5	2.53	2.58	1.08	0.78	1.09	1.82	2.13	2.14	1.81	3.23	3.4	2.43	2.29	1.71	2.54	2.71	3.54	3.46	6.68	2.83	5.76
Lead (Pb)	mg/kg (wt)	0.001	-	5.89E-01	-	5.89E-01	0.006	0.0014	0.0026	0.00047	0.00016	0.00017	0.00042	0.0011	0.00093	0.00049	0.0021	0.002	0.0066	0.0011	0.00055	0.00076	0.0028	0.001	0.0018	0.00072	0.0012	0.0019
Magnesium (Mg)	mg/kg (wt)	0.4	-	5.89E+03	-	5.89E+03	303	306	305	324	345	348	306	318	280	282	282	281	286	237	272	215	263	276	250	263	222	247
Manganese (Mn)	mg/kg (wt)	0.01	-	2.95E+01	-	2.95E+01	0.109	0.081	0.091	0.087	0.091	0.103	0.081	0.069	0.108	0.077	0.098	0.113	0.095	0.072	0.091	0.067	0.127	0.12	0.131	0.126	0.138	0.118
Mercury (Hg)	mg/kg (wt)	0.002	-	2.36E-01	-	2.36E-01	0.0378	0.0348	0.0509	0.0983	0.156	**0.353**	0.167	**0.267**	0.11	0.0853	0.0777	0.0677	0.095	0.119	0.116	0.191	0.0224	0.0559	0.0196	0.0371	0.0471	0.0397
Molybdenum (Mo)	mg/kg (wt)	0.004	-	3.54E+01	-	3.54E+01	0.00196	0.00155	0.0018	0.00073	0.00102	0.0009	0.00078	0.00062	0.00081	0.00068	0.00089	0.00097	0.00066	0.00131	0.00117	0.00223	0.00097	0.00043	0.00103	0.00101	0.00175	0.00059
Nickel (Ni)	mg/kg (wt)	0.01	-	1.41E+01	-	1.41E+01	0.00944	0.00637	0.00775	0.0056	0.00312	0.00343	0.00528	0.00317	0.00521	0.00788	0.022	0.00545	0.00627	0.0048	0.00461	0.00601	0.00693	0.01	0.00645	0.00577	0.00551	0.00545
Phosphorus (P)	mg/kg (wt)	2	-	2.72E+05	-	2.72E+05	2830	2940	2860	2580	2770	2630	2560	2530	2670	2590	2740	2700	2740	2340	2520	2090	2570	2430	2520	2560	2070	2300
Potassium (K)	mg/kg (wt)	2	-	-	-	-	4680	4990	4690	4790	5060	4760	4430	4520	4220	4070	4160	4080	4650	3920	4090	3420	4080	4000	4170	4260	3660	4150
Selenium (Se)	mg/kg (wt)	0.01	1.70E+00	6.48E+00	-	1.70E+00	0.353	0.502	0.348	0.39	0.459	0.526	0.42	0.395	0.629	0.544	0.416	0.524	0.549	0.33	0.437	0.344	0.636	0.61	0.594	0.62	0.485	0.546
Silver (Ag)	mg/kg (wt)	0.001	-	5.89E+00	-	5.89E+00	0.00003	0.00009	0.00005	0.0001	0	0.00009	0.00004	-5E-05	0.00005	0.00012	0.00006	0.00007	0.00007	0.00012	0.00021	0.00012	0.0002	0.00005	0.00018	0.00003	0.00013	0.00011
Sodium (Na)	mg/kg (wt)	2	-	-	-	-	250	240	260	501	350	373	401	413	260	210	263	215	326	418	440	354	392	397	344	430	522	338
Strontium (Sr)	mg/kg (wt)	0.01	-	7.07E+02	-	7.07E+02	0.216	0.127	0.057	0.051	0.054	0.042	0.117	0.052	0.214	0.042	0.149	0.177	0.083	0.063	0.197	0.055	0.285	0.168	0.313	0.123	0.176	0.105
Thallium (Tl)	mg/kg (wt)	0.0004	-	1.59E-02	-	1.59E-02	0.00818	0.0101	**0.0187**	0.0106	0.0145	**0.0183**	0.0146	0.0118	**0.0389**	**0.0228**	**0.027**	**0.0203**	**0.0213**	0.0107	0.0149	0.012	0.00046	0.00066	0.00106	0.00484	0.00118	0.00222
Tin (Sn)	mg/kg (wt)	0.02	-	3.54E+02	-	3.54E+02	0.00752	0.00247	0.00428	0.00437	0.00365	0.0047	0.00564	0.00122	0.00223	0.00158	0.00301	0.0035	0.00171	0.00169	0.00264	0.0038	0.00104	0.00198	0.00278	0.00273	-0.0017	-0.0026
Titanium (Ti)	mg/kg (wt)	0.02	-	-	-	-	0.296	0.299	0.301	0.294	0.305	0.285	0.265	0.277	0.284	0.269	0.297	0.273	0.309	0.266	0.259	0.243	0.268	0.27	0.272	0.274	0.235	0.237
Uranium (U)	mg/kg (wt)	0.0004	-	7.07E-01	-	7.07E-01	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0004	-0.0005
Vanadium (V)	mg/kg (wt)	0.02	-	3.06E+01	-	3.06E+01	-0.0006	-0.0017	-0.0014	0.00067	0.00008	0.00076	0.00188	0.00114	-0.0009	-0.0003	0.00062	-0.0004	-5E-05	0.00003	0.00069	0.00081	0.00147	0.00179	0.00443	0.00354	-0.0014	0.00034
Zinc (Zn)	mg/kg (wt)	0.04	-	5.66E+02	-	5.66E+02	4.08	3.92	3.77	4.13	3.66	4.22	4.17	3.47	3.48	3.19	3.56	4	3.17	2.89	3.45	2.84	3.31	3.59	3.85	3.65	3.1	3.28
Physical Properties																												
Moisture	%	0.3	-	-	-	-	74	74	72	76	76	76	75	75	77	75	74	76	77	78	78	70	76	68	76	71	74	74
Elements																												
Methyl Mercury	ng/g (wt)	10	33	-	-	33	0.71	0.85	1.06	**81**	**150**	**350**	**110**	**270**	**120**	**66**	**79**	**66**	**80**	**160**	**100**	**210**	16	**39**	16	29	**38**	33
Radionuclides																												
C-14	Bq/kg	0	-	-	7.95E+03	7.95E+03	53.6	55.4	41.1	31	80.8	44.6	50.8	33	33	32	33	41	31	33	42.5	49	41	36	60	33	38	54.7

Parameter	Units	Detection Limit	Federal guidelines (1,2,3)[a]	Toxicity reference value-derived concentrations (4-7)[b]	Regulatory Dose Limit-derived Concentrations (8)[c]	Selected screening criteria	Nearshore Lake Ontario								Deepwater Intake Area											
							Rainbow Trout		Atlantic Salmon	Walleye					Lake Trout								Alewife					
							RT-1	RT-2	AS-1	WE-1	WE-2	WE-3	WE-4	WE-5	LT-1	LT-2	LT-3	LT-4	LT-5	LT-6	LT-7	LT-8	LWF-1	LWF-2	LWF-3	LWF-4	LWF-5	LWF-6
Co-60	Bq/kg	0	-	-	1.36E+03	1.36E+03	0.692	-2.03	0.296	-0.127	0.199	-1.1	-37.1	0.784	-0.25	-0.348	-1.11	-1.52	1	-18.4	1.64	-1.48	-1.69	-0.922	0.915	0.623	1.32	1.09
Cs-134	Bq/kg	0	-	-	2.43E+02	2.43E+02	1.01	0.39	0.21	-2.43	-2.62	1.54	0.959	-1.37	-1.95	-1.43	2.04	0.0973	0.962	-0.99	0.606	-1.42	-0.388	0.105	0.943	-1.96	1.27	3.59
Cs-137	Bq/kg	0	-	-	3.55E+02	3.55E+02	-0.114	0.857	0.677	0.259	1.24	-1.63	0.646	-1.61	0.251	0.132	-0.425	-0.719	0.244	1.55	2.59	-0.3	1.73	1.1	-0.354	1.02	-1.31	-0.281
I-131	Bq/kg	0	-	-	2.10E+02	2.10E+02	0.237	0.682	0.681	2.39	-0.222	0.186	0.811	0.929	0.42	1.62	1.5	-2.02	-1.1	-0.404	-1.46	-0.627	-0.796	-0.701	-0.687	-0.77	0.195	1.65
K-40	Bq/kg	0	-	-	7.44E+02	7.44E+02	182	122	248	298	243	84.3	147	191	192	78.6	148	226	143	-3.61	89	78.7	76.5	-69	64.4	176	123	113
Th-Series	Bq/kg	0	-	-	-	-	-0.701	-1.26	1.92	0.357	0.426	1.7	0.338	-0.143	0.84	1.03	-0.223	-1.21	-1.8	0.118	-0.785	-22.5	-33	3.15	-4.39	1	0.806	1.13
U-Series	Bq/kg	0	-	-	-	-	0.268	1.38	1.18	1.79	0.735	1.71	2.05	2.96	1.29	0.299	1.92	-0.881	3.2	-0.177	-0.225	2.32	-4.44	3.28	-0.356	1.79	-0.499	0.757
H-3	Bq/kg	0	-	-	1.00E+05	1.00E+05	27.5	14.3	9.42	4.03	1.71	7.04	1.37	2.45	1.66	3.08	2.99	2.03	2.1	1.67	3.73	0	1.14	1.96	-2.12	1.65	2.22	0.97
H-3 OBT	-	0	-	-	1.00E+05	1.00E+05	190	902	580	117	43	231	62	48	93.7	137	164	1500	129	204	99	87	58	228	232	223	212	6000
% Moisture	%	0	-	-	-	-	62.64	62.95	61.23	63.88	64.51	65.9	62.89	66.32	61.85	64.51	61.97	54.68	65.11	63.02	58.42	50.87	53.94	60.76	66.05	63.52	59.38	59.89

Note:
Sampling locations are presented in **Figure 4-5**.
Bold Exceeds selected screening criteria
Negative values indicate uncensored values that are less than the detection limit.
"-" does not exist
[a]Where applicable, to compare directly to laboratory results, guidelines in dry weight (dw) were converted to wet weight (ww) based on average moisture concentrations in the samples.
[b]Screening levels were developed using constituent-specific toxicity reference values (TRVs) based on the fish ingestion rate of high consumers of traditional foods in Ecozone 4 (Chan et al., 2014). TRVs were sourced, in order of preference, from Health Canada (2025), MECP (2025), US EPA IRIS (2025), and US ATSDR (2025).
[c]The screening level for a given radionuclide in fish represents the activity or mass concentration which, if consumed as part of a the high consumer's diet year-round, would result in 10% of the public dose limit of 1 millisievert per year (1 mSv/year), following the methodology outlined in CNSC (2023). This approach is appropriate because the public dose limit accounts for contributions from all radionuclides. For metals, each element was assessed individually; a 10% TDI was not applied.

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A.3.1.3 Thermal Effects

Thermal Plume Effects on Fish Eggs and Larvae

The potential effects of the thermal plume on the early life stages of 4 fish species were evaluated in the Aquatic Environment TSD for the EA for the refurbishment and continued operation of PNGS Units 5-8 (Golder, 2007). The species assessed included two warm water fish species (Smallmouth Bass and Emerald Shiner) and two cold water species (Round Whitefish and Lake Trout) based on their abundance in the area, and sensitivity to thermal plume effects. A numerical model was used to delineate the thermal regime in various potential habitat areas within the receiving environment, incorporating seasonal and spatial variations in water temperature. The modelled water Maximum Weekly Average Temperatures (MWATs) within the plume were compared to species-specific Maximum Weekly Average Temperature (MWAT) criteria relevant to spawning and embryo-larval development. These criteria represent the upper bound of suitable temperatures for the biological processes under chronic exposure conditions.

In the timeframe relevant to the two warmwater species (April-May), only the discharge channels had modelled MWAT values marginally above MWAT criteria for embryo-larval development of Emerald Shiner. Given that this exceedance was limited to the discharge channels, it likely does not impact the population as a whole. In the winter period, relevant to the Lake Trout, modelled MWAT values above MWAT criteria were found in the discharge channels and at one lake location near the PNGS Units 5-8 discharge, both of which do not represent Lake Trout habitat. Therefore, it was concluded that temperatures in the thermal plume are unlikely to have adverse effects on fish embryo-larval development.

OPG continuously measures the temperatures within the discharge channels, providing data to assess the degree and frequency with which embryo-larval MWAT criteria are exceeded. In the 2022 PN ERA, the rolling 7-day average temperatures from the PNGS Units 5-8 discharge channels were calculated from the instantaneous daily maximum effluent temperatures between 2016-2020 (OPG, 2017, 2018a, 2019, 2020, 2021b), and those exceeding MWAT criteria for the April-May embryo larval period for Smallmouth Bass (24.3°C) and Emerald Shiner (27°C) were counted. Over this 5 year period, there were no occurrences where the 7-day average exceeded MWAT criteria for Emerald Shiner, and only one occurrence for Smallmouth Bass. The results remained fairly consistent after incorporation of thermal data from 2021-2024 (OPG, 2022, 2023b, 2024b, 2025c) during which there were no exceedances of MWAT criteria for Emerald Shiner, and 3 exceedances for Smallmouth Bass. Additionally, the duration and degree of these exceedances remained consistent with previous years, with no exceedance persisting for more than 2 consecutive days in late May or exceeding 25.2°C. Thus, as concluded by the 2022 PN ERA, these exceedances are likely not detrimental to reproductive performance or embryo/larval development of these species because they occur infrequently, late in the embryo-larval life stages, and are localized to the discharge channel which spans a small area (0.0062 km^2).

In 2013, the potential effects of the PNGS thermal plume on fish spawning and embryo-larval development were qualitatively evaluated by comparing lake temperatures near the PNGS Units 5-8 discharge against the thermal criteria for these physiological processes of 15 species found

in the vicinity of PN (Cooper, 2013). Lake temperatures in reference areas (Thickson Point and Bonnie Brae Point, 20 km east and 26 km east of Pickering Nuclear, respectively) were also compared against these thermal criteria to provide context for natural temperature conditions. Besides MWAT criteria, this study also used Short-Term Daily Maximum (STDM) criteria, which represents upper bound temperatures considered suitable for short periods such as 24 hours. Hazard quotients (HQs) were calculated by taking the measured MWAT or STDM at each location, for the period relevant to each species, and dividing by the MWAT or STDM criterion. HQs are a useful "screening" methodology for thermal effects assessments, where a HQ equal to or greater than 1 indicates the potential for thermal effects.

Of the 15 species evaluated, nine were considered as Valued Ecosystem Components in the 2022 PN ERA. The HQ values relevant to spawning and embryo-larval development for the highest temperature location in the plume area were at least marginally above 1 for five of these species, indicating potential adverse effects from the thermal plume. However, in cases where the HQs were above 1 in the plume area, they were not substantially elevated relative to the reference area. The presence of HQ values above 1 in the reference area may not reflect potential effects in these areas, but rather suggest that some of the thermal criteria used were lower than background levels observed in the lake (possibly due to a general warming trend in the lake since the development of these criteria). Overall, these results indicated that there is no evidence of adverse chronic or acute impacts on fish reproduction and development caused by the thermal plume.

Thermal Increments and Embryo-larval Survival of Round Whitefish

The effects of the thermal plume on embryo survival of Round Whitefish was quantitatively evaluated in 2018 (OPG, 2018b). Round Whitefish were chosen for the study as these fish spawn nearshore on coarse substrate in late fall, with eggs hatching in early spring. The embryos of this species are also particularly sensitive to elevated water temperatures during the winter months, making them susceptible to elevated plume temperatures. Using temperature data from Round Whitefish spawning beds over the 2009-2010, 2010-2011 and 2011-2012 embryo-larval incubation periods (OPG, 2010, 2012, 2013), a thermal survival model was generated to estimate survival losses in Block 1 (i.e., the early incubation period) and Block 3 (i.e., the late incubation period). The estimated survival loss at the plume stations compared to the reference stations (Thickson Point and Bonnie Brae) was below the CNSC threshold no-effect level of 10% for Round Whitefish embryo survival loss in all years. Following this, data from two years of additional monitoring over the winters of 2018-2019 and 2019-2020 was also incorporated into the model (OPG, 2021c). Across both years, the largest relative survival loss observed was well below the 10% survival loss threshold. Therefore, no chronic adverse effects are expected from the thermal plume on Round Whitefish egg survival.

As mentioned by OPG (OPG, 2018b), acute threshold temperatures for Round Whitefish embryos are not available. Although not designed to develop an acute threshold, a study that continuously exposed Round Whitefish embryos to 7°C found no increases in acute mortality in either Block 1 or Block 3 (Griffiths, 1980). However, continuous exposure at 10°C did result in increased mortality in both developmental stages. The study also tested the impacts of

temperature cycles, where the embryos were exposed to 7°C for 18 hours and 10°C for 6 hours each day, which resulted in increased mortality in Block 1 (50% survival after 17 days) and Block 3 (16% survival after 30 days). Though there are limitations to interpreting these findings as the experimental thermal regimes do not necessarily reflect the behavior of the plume, it can be postulated that 50% mortality could occur between 7°C and 10°C provided that the exposure time is of sufficient duration. Accordingly, OPG has chosen a conservative value of 6°C for winter ambient temperatures above which temperature effects could occur. However, both the extent and duration of the exceedance need to be determined. Though short-term exceedances of this temperature were found to occur between December 2018 and March 2019, they were not expected to have any effects on the Round Whitefish development as they were transient and occasional (OPG, 2020b).

Thermal Plume Effects on Juvenile and Adult Fish

As a part of the Aquatic Environment TSD for the EA for the refurbishment and continued operation of the PNGS Units 5-8 (Golder, 2007), the potential effects of the thermal plume on juvenile and adult stages of the 4 species evaluated were also assessed. The modelled water MWATs did not exceed associated criteria for growth of juveniles and adults of Round Whitefish and Lake Trout at the time that they are present in the nearshore area (mid-November to early December for Round Whitefish and mid-November to April for Lake Trout). In contrast, the modelled water MWATs marginally exceeded (by less than 1°C) the criteria for Smallmouth Bass occasionally at one lake location near the PNGS Units 5-8 discharge over the period that these fish would potentially be exposed to the thermal plume. Given that these exceedances occurred only in the surface water and not in the deeper waters where the fish primarily reside, it is unlikely that they would be exposed to temperatures that would negatively impact growth.

As highlighted earlier, OPG continuously measures the temperatures in the discharge channels. The rolling 7-day average temperatures near the PNGS Units 5-8 discharge from 2016-2020 (OPG, 2017, 2018a, 2019, 2020, 2021b) were compared to the MWAT criteria for Smallmouth Bass and Emerald Shiner. There were 18 occurrences between 2016 and 2020 when the 7-day average exceeded the 30°C MWAT criterion for Emerald Shiner, with an average duration of 16 days. Similarly, there were 15 occurrences when the 7-day average exceeded the 32°C MWAT criterion for Smallmouth Bass, with an average event duration of 10 days. Between 2021 and 2024 (OPG, 2022, 2023b, 2024b, 2025c), the number of occurrences exceeding the MWAT criteria for both species remained generally consistent, while the average duration of these exceedances increased slightly. Specifically, there were 12 exceedances of the Emerald Shiner MWAT criterion, with an average duration of approximately 25 days. For Smallmouth Bass, there were 15 exceedances of the MWAT criterion, with the average event lasting around 14 days. However, these exceedances are not considered detrimental channel. Additionally, unlike the for growth of Smallmouth Bass or Emerald Shiner because they are occasional and localized to the discharge embryonic and larval stages, juvenile and adult fish can use behavioural thermoregulatory strategies such as moving in and out of the discharge channel to optimize exposure to these temperatures.

As a part of the quantitative evaluation of the potential effects of the PNGS thermal plume on the 15 species found in the vicinity of PN, the effects on juvenile and adult growth were also assessed (Cooper, 2013). As with the developmental stages, HQs were calculated by taking the measured water MWAT or STDM, for the seasonal period relevant to each species, and dividing by the MWAT or STDM criterion. Of the nine species considered as Valued Ecosystem Components in the 2022 PN ERA, the highest HQs were only marginally above 1 in the plume for Lake Trout. However, these values were less than or equal to the reference values. Therefore, it is unlikely that there are any chronic or acute effects arising from the thermal plume on juvenile or adult stages of any fish species.

Thermal Plume Contribution to Winter Cold Shock

Cold shock in fish can occur either due to natural changes in water temperature, or can be induced by a reduction in temperature when the number of operating units declines, or when fish pass through the thermal plume and encounter a high thermal gradient between plume and ambient conditions. For example, during an outage, thermal additions to receiving water can be rapidly curtailed, such that water temperature in the plume decline more rapidly than fish are able to acclimate to lower temperatures (Coutant, 1977). Unless induced by natural events, cold shock is likely to occur only during a full station outage, which occurs infrequently. Unfortunately, the science is not well established for predicting cold shock events during the winter months using a predictive tool. However, OPG takes into consideration the effects of cold shock in the planning and scheduling of the shutdown of PNGS units and will incorporate appropriate mitigative measures if needed such that the rate of lowering water temperature is unlikely to result in any significant effects to fish. OPG is currently evaluating the potential for natural and operationally induced cold shock at PN and are in discussion with DFO on this topic, and as a precautionary measure, OPG will incorporate a staggered and sequential shutdown of Pickering Units 5-8 during refurbishment to allow for fish acclimation, and to reduce the risk of a cold shock event.

Thermal Stratification in Lake Ontario

During the 2024 and 2025 Fish Community, Benthic Macroinvertebrate Community, Macrozooplankton Community, and Larval Fish and Eggs studies, Temperature measurements were taken at 1 m increments throughout the water column to characterize thermal stratification in the Deepwater Study Area. Thermal profiles generated from data collected during these sampling programs in 2024 and 2025 are shown in **Figure A-13** and **Figure A-14**, respectively.

Temperature profiles at PNGS in 2024 and 2025 highlight clear interannual differences in water temperature regimes. In spring 2024, stratification began to form by mid-May, with a shallow epilimnion and variable mixing, though the thermocline and hypolimnion were only weakly defined. By contrast, spring 2025 remained largely uniform, with minimal temperature variation throughout the upper water column, reflecting the colder conditions and an earlier sampling start in mid-April. The earlier sampling likely captured the lake before stratification typically develops, whereas the warmer mid-May 2024 sampling coincided with the onset of epilimnion formation.

During the summer, 2024 exhibited strong stratification with clearly defined epilimnion, metalimnion, and hypolimnion layers, although a high wind event on July 25 partially disrupted this layering and increased vertical mixing. In 2025, early July showed weaker and more inconsistent stratification, with variable temperatures throughout the water column. By late July (July 25), however, stratification became well established, with a distinct thermocline separating the epilimnion from the metalimnion and gradual cooling into the hypolimnion. These observations indicate that summer stratification in 2025 was delayed relative to 2024 but stabilized once formed.

In fall 2024, stratification persisted into November, with a shallow thermocline and stable metalimnion temperatures. In contrast, fall 2025 was characterized by a largely uniform water column. A shallow epilimnion was observed in September, but below 3 m, mixing was minimal, and by November temperatures had become largely consistent throughout the water column. Minor surface warming likely influenced by PNGS thermal discharges was observed in some profiles.

Overall, 2024 exhibited earlier onset and more persistent stratification, whereas 2025 was characterized by delayed, weaker, and less consistent thermal layering, highlighting interannual variability in lake thermal dynamics driven by seasonal temperatures, meteorological events, and sampling timing.

Across all three seasons in both studies, the temperature at depths of 10.0-12 m (the proposed range for the planned DWI, with the exact depth to be determined) is 3-5°C lower than surface temperatures. The implications of the change in the temperature of water being drawn in through the intake on the thermal plume, and potential effects on aquatic biota are further evaluated in **Section 5.3.3**.

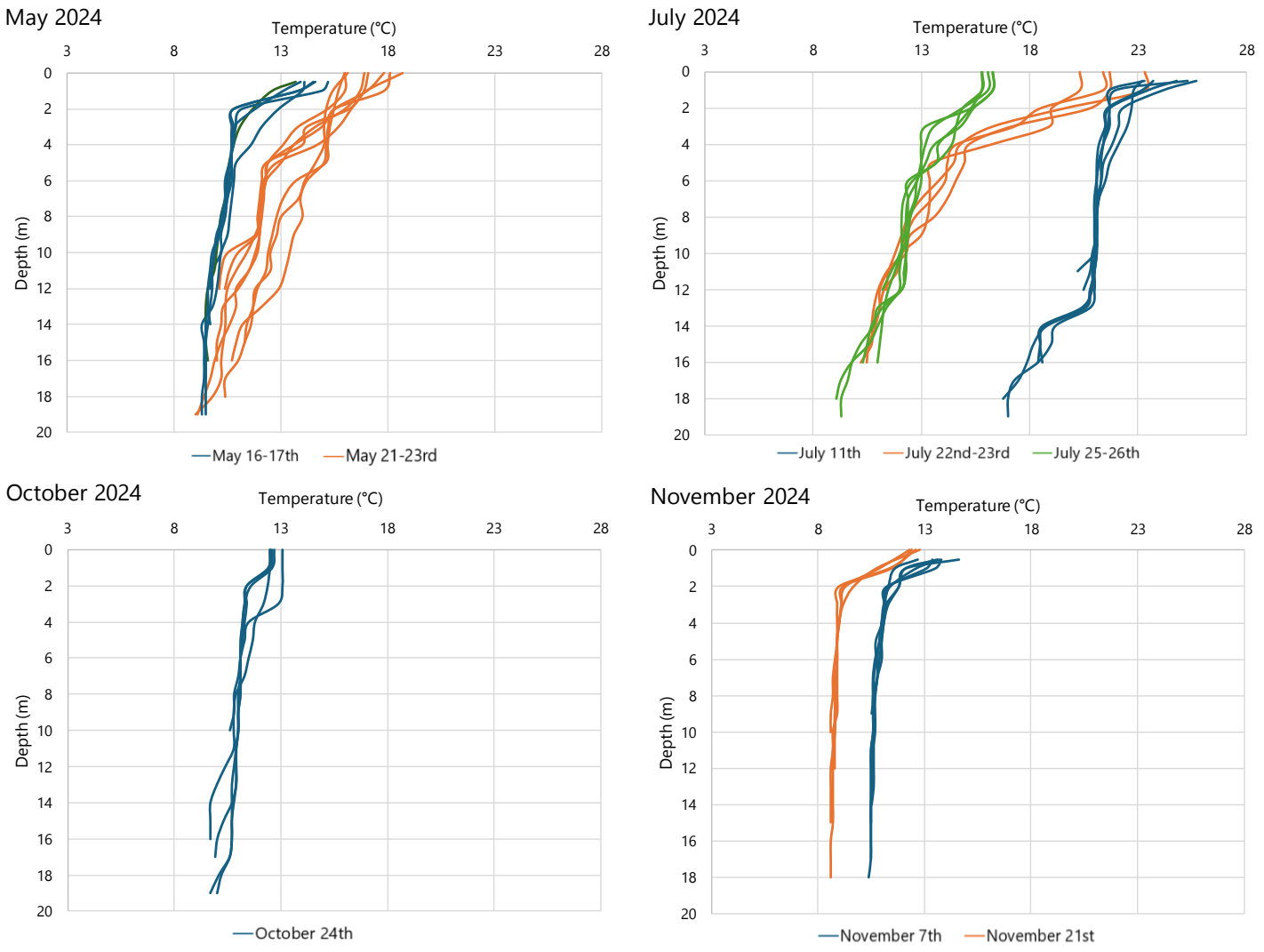


Figure A-13: Temperature Profiles Conducted Throughout the 2024 PNGS Biological Investigations

Note: Blue, orange, and green colours are indicative of separate sampling events in chronological order.

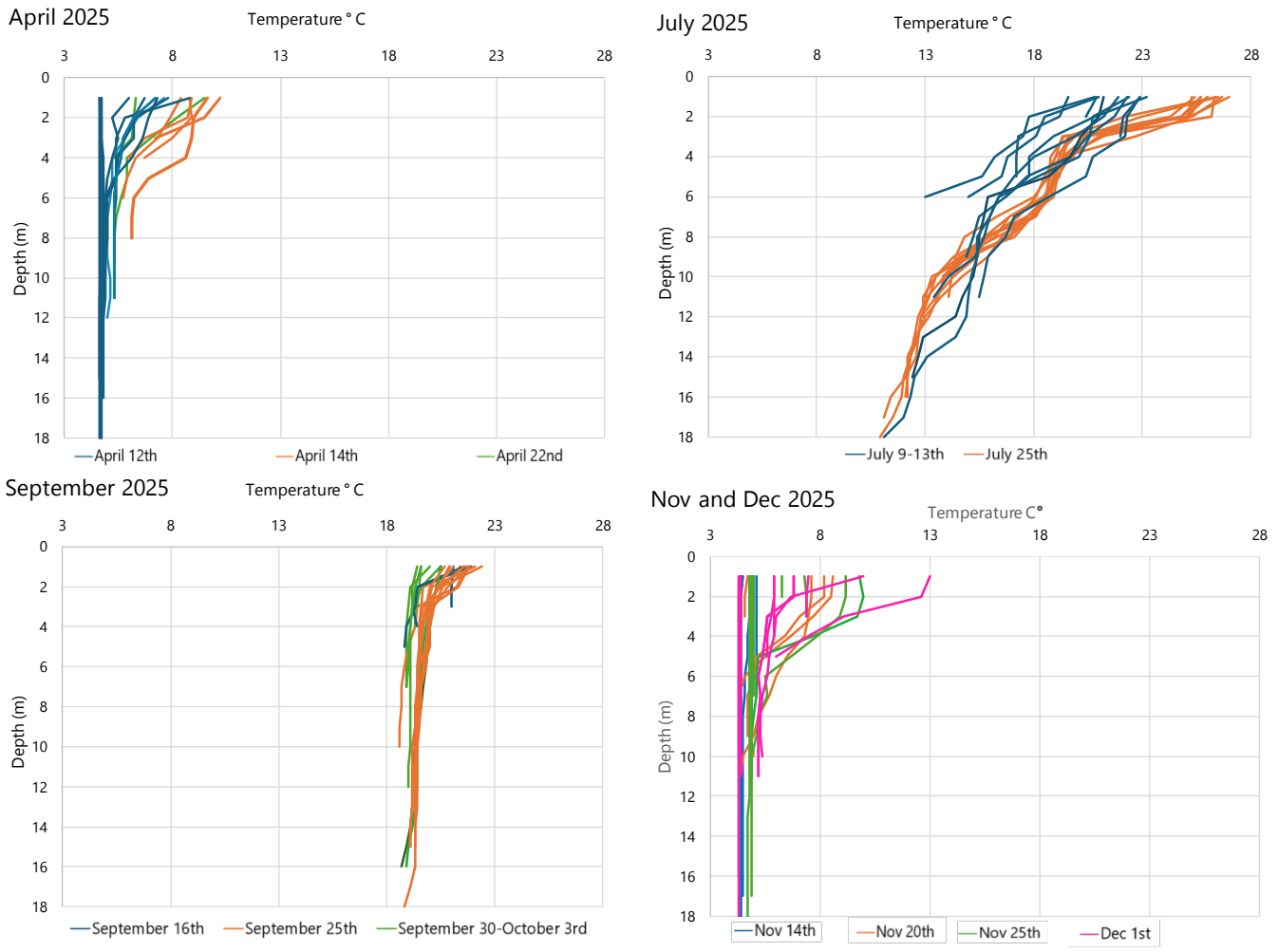


Figure A-14: Temperature Profiles Conducted Throughout the 2025 PNGS Biological Investigations

Note: Blue, orange, and green colours are indicative of separate sampling events in chronological order.

A.3.2 Benthic Macroinvertebrates

A.3.2.1 Deepwater Study Area

In 2024, standard ponar grabs were used to collect a benthic invertebrate sample from each of the following stations within the Deepwater Study Area: S4, S7, S8, and S9. Calculated benthic macroinvertebrate metrics for these samples are presented in **Figure A-15** and **Figure A-16**. Density ranged from 2,462 (S9) to 7,552 (S8) organisms/m^2. Communities in S9, S8, and S7 were dominated by copepods such as O. Harpacticoida, followed by worms from Phylum Nemata for S9, and Oligochaetes for S8 and S7. S4 was dominated by Oligochaetes, closely followed by O. Harpacticoida.

All Cl. Bivalvia organisms were *Dreissena bugensis*, otherwise knowns as the Quagga mussel. This invasive dreissenid mussel species was observed in three of the four samples, but only made up 4.8% to 12.8% of the overall community composition in the samples it was observed. Mussels tend to prefer attachment to hard substrates as opposed to the soft sediments that were targeted by ponar in the Deepwater Study Area.

In 2025, a benthic sled was used to collect benthic macroinvertebrate samples from grids S1, S2, S5, S6, S7, S8, S11, and S12 throughout the Deepwater Study Area to provide additional characterization of benthic conditions. Community composition for these samples is presented in **Figure A-16**. Benthic macroinvertebrate densities were variable across the study area, ranging from 4.18 organisms/m^2 in grid S7 to 58.11 organisms/m^2 in grid S6.

Across all sampled grids, benthic communities were consistently dominated by dreissenid bivalves, which accounted for an average of approximately 40% of the benthic invertebrate community. Hydrobiid snails were also abundant at several locations, particularly in grids S1, S2, S5, S6, and S7, while gammarid amphipods were most prominent in grids S8 and S12. In grid S11, the community was characterized by a high proportion of hydrobiid snails and limnesiid mites. Species richness and diversity varied across the Deepwater Study Area, with higher richness and diversity generally observed in grids with more heterogeneous substrate conditions. Lower evenness values observed across most grids reflect the strong dominance of dreissenid bivalves within the benthic community. Quagga Mussel biomass varied across sampling locations, ranging from 0.28 kg in grid S7 to 3.80 kg in grid S6. The elevated biomass observed at select locations reflects localized areas of high mussel colonization associated with suitable hard substrate.

Station	DW-01 (grid S9)	DW-02 (grid S8)	DW-03 (grid S7)	DW-04 (grid S4)	Average
Density (organisms/m^2)	2,462.14	7,552.28	2,921.41	3,623.05	4,139.72
Richness	21	13	18	14	16.5
Simpson's Diversity	0.59	0.76	0.73	0.84	0.73
Simpson's Evenness	0.12	0.33	0.21	0.45	0.27
P. Nemata	13.99%	8.78%	13.97%	4.23%	10.24%
Cl. Oligochaeta	3.63%	16.22%	17.90%	46.48%	21.06%
O. Harpacticoida	61.92%	42.57%	47.16%	28.17%	44.95%
Cl. Ostracoda	3.89%	9.46%	0.44%	8.45%	5.56%
O. Diptera	7.77%	6.08%	14.85%	11.97%	10.17%
Cl. Bivalvia	5.96%	12.84%	4.80%	0.00%	5.90%
Other	2.85%	4.05%	0.87%	0.70%	2.12%

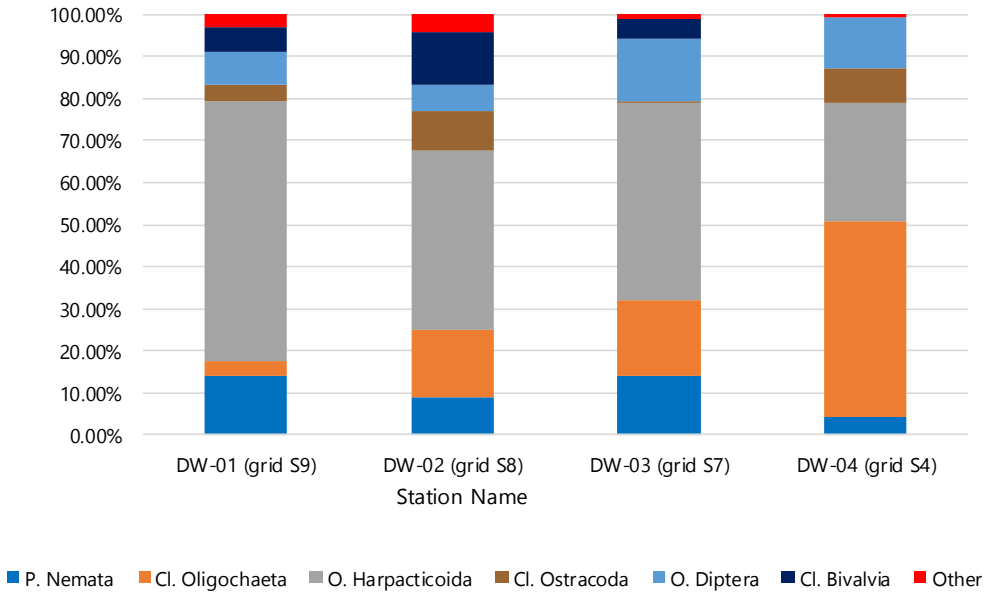


Figure A-15: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Standard Ponar Grab Samples Conducted Throughout the Deepwater Study Area, November 2024

Note:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.
Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.
Sampling locations are presented in **Figure 4-8**.

Matrix Grid	S1	S2	S5	S6	S7	S8	S11	S12	Average
Density (organisms/m^2)	46.65	30.32	11.16	58.11	4.18	10.66	10.96	50.55	27.82
Richness	15	14	16	10	16	18	18	19	15.8
Simpson's Diversity	0.83	0.66	0.70	0.52	0.81	0.71	0.86	0.86	0.74
Simpson's Evenness	0.39	0.21	0.21	0.21	0.34	0.19	0.39	0.38	0.29
Cl. Oligochaeta	17.40%	2.75%	2.37%	1.34%	7.39%	6.37%	9.11%	12.48%	7.40%
Cl. Arachnida	21.30%	11.02%	13.76%	4.03%	24.43%	9.38%	35.99%	19.61%	17.44%
Cl. Ostracoda	2.34%	3.27%	0.43%	0.67%	3.98%	1.06%	1.37%	2.50%	1.95%
O. Amphipoda	10.91%	5.68%	7.96%	5.37%	8.52%	25.84%	9.34%	24.96%	12.32%
Cl. Gastropoda	14.29%	24.96%	32.04%	23.15%	19.89%	7.43%	18.22%	14.80%	19.35%
Cl. Bivalvia	32.47%	51.98%	42.80%	65.44%	32.95%	47.08%	21.87%	23.71%	39.79%
Other	1.30%	0.34%	0.65%	0.00%	2.84%	2.83%	4.10%	1.96%	1.75%

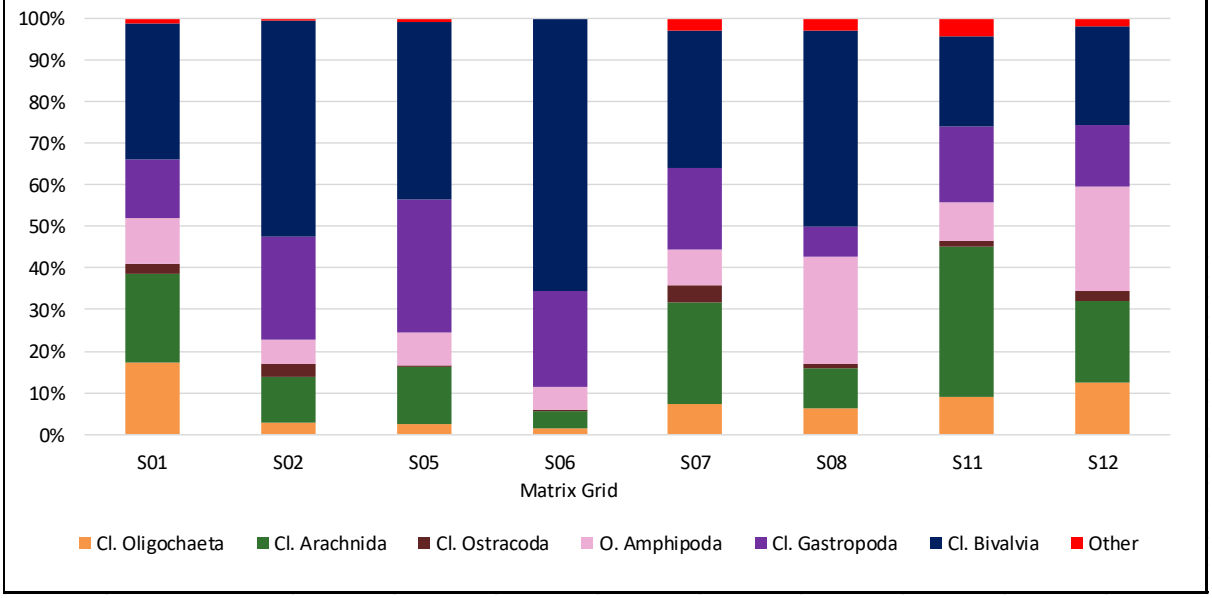


Figure A-16: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Benthic Tows Conducted Throughout the Deepwater Study Area, September 2025

Note:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.
Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.
Sampling locations are presented in **Figure 4-8**.

A.3.2.2 Mid-depth Study Area

Benthic macroinvertebrate samples were collected from stations MD-01, MD-02, MD-03, MD-04, and MD-05 in the Mid-Depth Study Area using a petite ponar in Fall 2025 Community composition for these samples is presented in **Figure A-17**.

In the Mid-Depth Study Area, benthic macroinvertebrate densities ranged from 143.52 organisms/ m^2 at station MD-04 to 3,918.06 organisms/m^2 at station MD-02. Species richness was similarly variable, with the lowest richness observed at MD-04 and the highest at MD-02. Overall community composition in the Mid-Depth Study Area was dominated by oligochaete worms, particularly *Potamothrix moldaviensis*. Oligochaetes were the dominant taxon at stations MD-01, MD-02, MD-04, and MD-05, accounting for an average of approximately two-thirds of the benthic community at these locations. In contrast, no oligochaetes were observed at station MD-03, where the benthic community was instead dominated by dipteran midges, which comprised over 80% of the assemblage.

Arachnid mites were present at most stations and formed a notable component of the benthic community at MD-01, MD-02, MD-03, and MD-05, but were absent from MD-04. Caddisflies, which are often considered indicators of water quality, were observed only at station MD-02 and occurred at low abundance. Dreissenid bivalves were also restricted to station MD-02, where they accounted for approximately 12.5% of the benthic macroinvertebrate community.

Station	MD-01	MD-02	MD-03	MD-04	MD-05	Average
Density (organisms/m^2)	545.37	3,918.06	229.63	143.52	688.89	1,105.09
Richness	7	15	6	4	5	7.4
Simpson's Diversity	0.57	0.71	0.64	0.64	0.36	0.58
Simpson's Evenness	0.33	0.23	0.46	0.69	0.31	0.41
Cl. Oligochaeta	65.79%	67.03%	0.00%	60.00%	83.33%	55.23%
O. Amphipoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O. Diptera	13.16%	5.13%	81.25%	40.00%	12.50%	30.41%
Cl. Gastropoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cl. Bivalvia	0.00%	0.00%	12.50%	0.00%	0.00%	2.50%
O. Trichoptera	0.00%	1.10%	0.00%	0.00%	0.00%	0.22%
Cl. Arachnida	15.79%	25.64%	6.25%	0.00%	4.17%	10.37%
Cl. Ostracoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	5.26%	1.10%	0.00%	0.00%	0.00%	1.27%

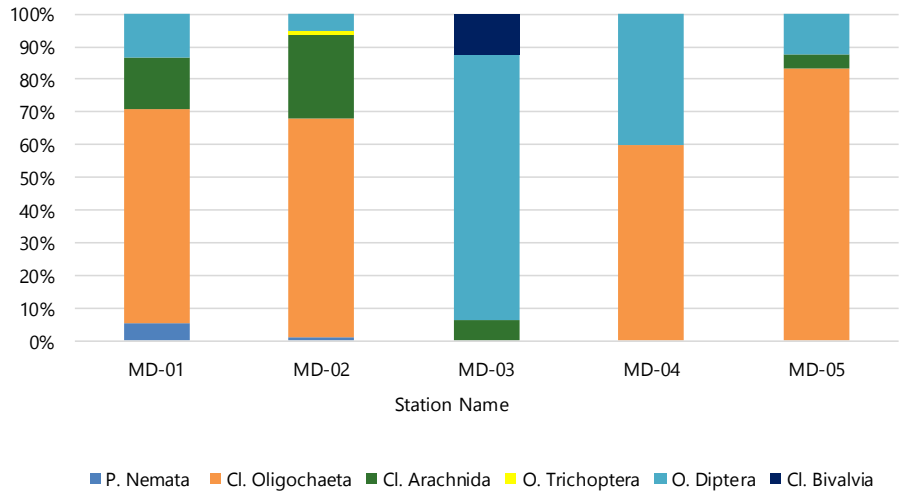


Figure A-17: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grab Samples Conducted Throughout the Mid-Depth Study Area, November 2025

Note:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.

Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL. Sampling locations are presented in **Figure 4-8**.

A.3.2.3 Cutoff Wall Study Area

Samples were collected from stations COW-01, COW-02, and COW-03 in the Cutoff Wall Study Area. The Cutoff Wall benthic macroinvertebrate community data is summarized in **Figure A-18** and discussed below.

Three (3) petite ponar grab samples were collected for the characterization of the Cutoff Wall benthic macroinvertebrate community (COW-01, COW-02, COW-03;). Benthic macroinvertebrate densities in the Cutoff Wall study area ranged from 14.35 organisms/m^2 at COW-03 to 7,922.24 organisms/m^2 at COW-01. LPL richness ranged from 1 species at COW-B3 to 9 species at COW-B1. Diversity and Evenness values for COW-03 were not reported, as only one species was observed at this station. Evenness was low across the samples as the communities across all three samples were comprised predominantly of Oligochaete worms.

Station	COW-01	COW-02	COW-03	Average
Density (organisms/m^2)	7,922.24	5,611.59	14.35	4516.06
Richness	11	5	1	5.7
Simpson's Diversity	0.58	0.42	N/A	0.50
Simpson's Evenness	0.27	0.35	N/A	0.31
Cl. Oligochaeta	84.47%	96.16%	100.00%	93.55%
O. Diptera	10.25%	2.30%	0	4.18%
Cl. Arachnida	5.28%	1.53%	0	2.27%

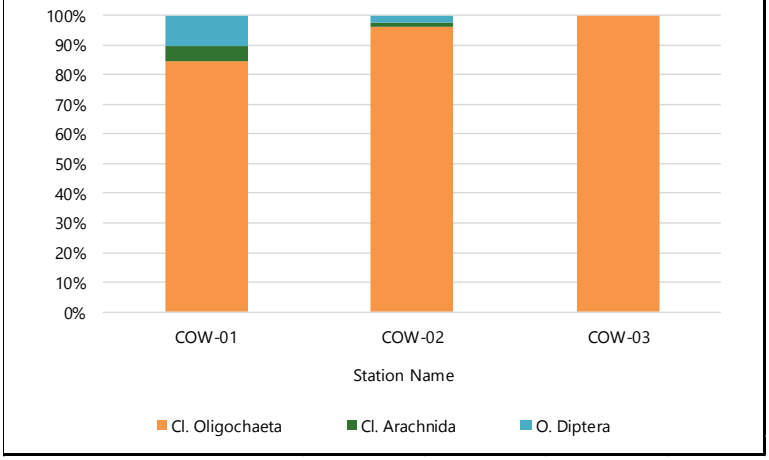


Figure A-18: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grab Samples Conducted Throughout the Cutoff Wall Study Area, September and November 2025

Notes:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).

Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.

Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.

Sampling locations are presented in **Figure 4-8**.

Infill and Shoreline Erosion Mitigation Study Areas

Benthic macroinvertebrate samples were collected using a petite ponar in the Infill and Shoreline Erosion Mitigation Study Areas in 2024. Samples were collected from stations Infill-01, Infill-02, Infill-03, Infill-04, and Infill-05 in the Infill Study Area. The benthic macroinvertebrate community data from this area is summarized in **Figure A-19** and discussed below.

Benthic macroinvertebrate densities in the Infill Study Area ranged from 38.27 organisms/m^2 at Infill-05, to 1,990 organisms/m^2 at Infill-01. LPL richness ranged from two (2) species at Infill-05, to 12 species at Infill-03. Simpson's Diversity at Infill stations were generally in the range of 0.37-0.49, except for Infill-03 which had a diversity of 0.76. Simpson's Evenness was generally low, with all stations other than Infill-05 having evenness values of equal to or less than 0.35.

Infill-01, Infill-02 and Infill-04 had very high proportions of Oligochaetes, whereas Infill-03 had lower proportions of Oligochaetes (~30%) and a high proportion of Quagga Mussel (>45%), and at Infill-05 high there were high proportions of Arachnids and Ostracods and no Oligochaetes observed.

Samples were collected from stations Infill-06, Infill-07, Infill-08, Infill-09, and Infill-10 in the Shoreline Erosion Mitigation Study Area. The benthic macroinvertebrate community data from this area is summarized in **Figure A-20** and discussed below.

Benthic macroinvertebrate densities in the Shoreline Erosion Mitigation Study Area ranged from 19.14 organisms/m^2 at Infill-08, to 248.77 organisms/m^2 at Infill-07. LPL richness was highest at Infill-09 and lowest at Infill-08. Simpson's Diversity was generally high throughout the Shoreline Erosion Mitigation Study Area, with the lowest diversity value observed at Infill-08 (0.67). Evenness was high at stations Infill-06 and Infill-08 due to the low amount of equally represented species at these locations.

The taxa that contributed the highest proportion of total density was Diptera at Infill-06 and Infill-07, and Bivalves at Infill-10. At Infill-08 there was equal representation of Bivalves, Diptera, and Arachnids, and at Infill-09 there was generally an equal distribution of Dipteran and Oligochaete taxa groups.

Station	Infill-01	Infill-02	Infill-03	Infill-04	Infill-05	Average
Density (organisms/m^2)	1,990.13	1,129.01	1,301.24	491.15	38.27	989.96
Richness	10	7	12	9	2	8.0
Simpson's Diversity	0.41	0.45	0.76	0.37	0.49	0.50
Simpson's Evenness	0.17	0.26	0.35	0.18	0.97	0.39
P. Nemata	1.92%	0.56%	3.92%	3.90%	0.00%	2.06%
Cl. Oligochaeta	92.95%	96.61%	31.37%	84.42%	0.00%	61.07%
Cl. Arachnida	0.00%	0.56%	0.00%	0.00%	58.33%	11.78%
Cl. Ostracoda	0.00%	0.00%	7.84%	2.60%	41.67%	10.42%
O. Amphipoda	0.00%	0.00%	0.00%	1.30%	0.00%	0.26%
Cl. Entognatha	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O. Diptera	3.21%	1.69%	9.80%	6.49%	0.00%	4.24%
Cl. Bivalvia	1.92%	0.56%	47.06%	1.30%	0.00%	10.17%

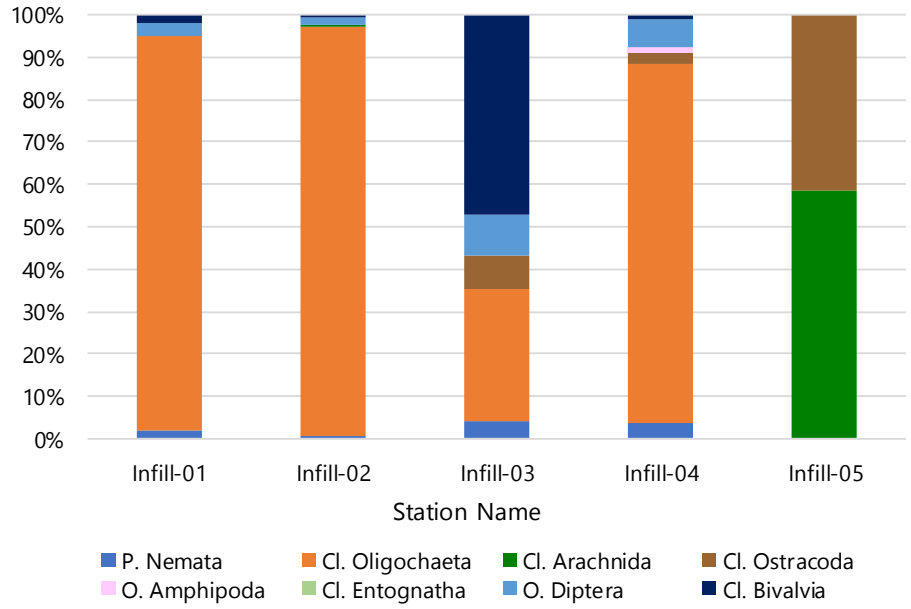


Figure A-19: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grabs Conducted Throughout the Infill Study Area, September 2024

Notes:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.
Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.

Sampling locations are presented in **Figure 4-8**.

Station	Infill-06	Infill-07	Infill-08	Infill-09	Infill-10	Average
Density (organisms/m^2)	153.09	248.77	19.14	548.56	178.60	229.63
Richness	6.00	10.00	3.00	20.00	7.00	9.2
Simpson's Diversity	0.80	0.81	0.67	0.91	0.75	0.79
Simpson's Evenness	0.84	0.53	1.00	0.55	0.57	0.70
P. Nemata	0.00%	5.13%	0.00%	13.95%	3.57%	4.53%
Cl. Oligochaeta	12.50%	23.08%	0.00%	38.37%	3.57%	15.50%
Cl. Arachnida	8.33%	2.56%	33.33%	2.33%	35.71%	16.45%
Cl. Ostracoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O. Amphipoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cl. Entognatha	0.00%	2.56%	0.00%	0.00%	0.00%	0.51%
O. Diptera	50.00%	53.85%	33.33%	38.37%	7.14%	36.54%
Cl. Bivalvia	29.17%	12.82%	33.33%	6.98%	50.00%	26.46%

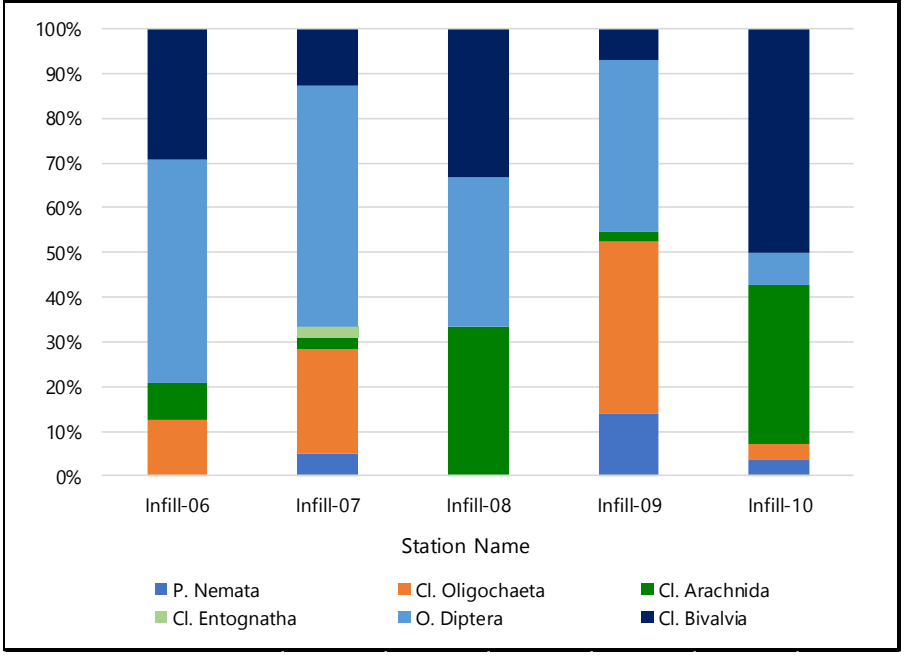


Figure A-20: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grabs Conducted Throughout the Shoreline Erosion Mitigation Study Area, September 2024

Notes:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.

Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL. Sampling locations are presented in **Figure 4-8**.

Table A-23: Raw Benthic Macroinvertebrate Community Data (Total Number of Organisms per m^2) at the Lowest Practical Level, Fall 2024

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Study Area				Infill Study Area					Shoreline Erosion Mitigation Study Area				
							DW-01	DW-02	DW-03	DW-04	Infill-01	Infill-02	Infill-03	Infill-04	Infill-05	Infill-06	Infill-07	Infill-08	Infill-09	Infill-10
ROUNDWORMS																				
P. Nemata	-	-	-	-	-	-	344	663	408	153	38	6	51	19	0	0	13	0	77	6
ANNELIDS																				
WORMS																				
P. Annelida	Cl. Oligochaeta	-	-	F. Enchytraeidae	-	-	0	0	13	0	13	0	0	0	0	0	6	0	26	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Dero*	0	0	0	0	0	0	26	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais bretscheri*	0	0	0	0	0	0	0	0	0	0	0	0	70	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais pardalis*	0	0	0	0	0	0	0	0	0	0	26	0	13	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais variabilis*	0	0	0	0	0	0	0	6	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Limnodrilus hoffmeisteri*	0	0	0	0	0	0	77	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Limnodrilus udekemianus*	19	0	57	0	0	0	26	0	0	0	0	0	6	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Psammoryctides barbatus*	0	1021	0	657	0	0	0	0	0	0	0	0	6	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Potamothrix moldaviensis*	6	0	0	147	332	319	51	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures with hair chaetae	38	51	364	293	13	0	0	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures without hair chaetae	19	51	57	587	1493	772	230	389	0	19	26	0	64	0
P. Annelida	-	-	-	F. Naididae	S.F. Rhyacodrilinae	*Bothrioneurum vejdovskyanum*	0	102	32	0	0	0	0	19	0	0	0	0	26	0
P. Annelida	-	-	-	F. Lumbriculidae	-	*Stylodrilus heringianus*	6	0	0	0	0	0	0	0	0	0	0	0	0	6
ARTHROPODS																				
MITES																				
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	-	-	-	-	0	0	0	0	0	0	0	0	6	0	0	0	0	6
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Hygrobatidae	-	*Hygrobates*	0	0	0	0	0	0	0	0	0	0	0	0	0	13
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Lebertiidae	-	*Lebertia*	0	0	0	0	0	6	0	0	0	0	6	0	0	0
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	F. Limnesiidae	-	*Limnesia*	57	255	13	26	0	0	0	0	19	13	0	6	13	45
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	F. Pionidae	-	indeterminate	0	51	0	0	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS																				
P. Arthropoda	-	-	O. Harpacticoida	-	-	-	1524	3215	1378	1021	0	0	0	0	0	0	0	0	0	0
SEED SHRIMPS																				
P. Arthropoda	Cl. Ostracoda	-	-	-	-	-	96	714	13	306	0	0	102	13	13	0	0	0	0	0
WATER SCUDS																				
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Gammarus*	0	0	0	0	0	0	0	6	0	0	0	0	0	0
SPRINGTAILS																				
P. Arthropoda	Cl. Entognatha	-	O. Collembola	-	-	-	0	0	13	0	0	0	0	0	0	0	6	0	0	0
INSECTS																				
TRUE FLIES																				
MIDGES																				

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Study Area				Infill Study Area					Shoreline Erosion Mitigation Study Area				
							DW-01	DW-02	DW-03	DW-04	Infill-01	Infill-02	Infill-03	Infill-04	Infill-05	Infill-06	Infill-07	Infill-08	Infill-09	Infill-10
Cl. Insecta	O. Diptera	-	-	F. Chironomidae		chironomid pupae	0	0	0	0	13	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Chironomus*	51	0	255	51	13	13	0	0	0	51	0	0	13	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Cryptochironomus*	0	0	0	0	0	0	0	0	0	0	0	6	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Dicrotendipes*	6	0	13	0	13	0	26	6	0	13	89	0	77	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Micropsectra*	26	153	38	204	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Paratanytarsus*	0	0	0	0	0	0	26	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Polypedilum halterale*	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Polypedilum scalaenum*	0	0	0	26	0	0	0	0	0	0	0	0	6	6
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Rheotanytarsus*	0	0	0	0	0	0	77	0	0	0	0	0	51	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Saetheria*	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Sergentia*	32	51	0	0	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Stictochironomus*	6	0	38	51	13	6	0	26	0	13	0	0	32	6
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Tanytarsus*	6	0	13	0	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Diamesinae	*Potthastia*	0	0	38	26	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus*	0	0	0	0	0	0	0	0	0	0	32	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus/Orthocladius*	6	0	0	0	0	0	0	0	0	0	13	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Heterotrissocladius*	32	255	38	77	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Parakiefferiella*	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	indeterminate	13	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Prodiamesinae	*Monodiamesa*	13	0	0	0	13	0	0	0	0	0	0	0	0	0
MOLLUSCS																				
SNAILS																				
P. Mollusca	Cl. Gastropoda	-	-	F. Hydrobiidae	-	*Potamopyrgus antipodarum*	13	0	0	0	-	-	-	-	-	-	-	-	-	-
CLAMS																				
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena bugensis*	147	970	140	0	0	0	51	0	0	13	0	0	19	19
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena* immature	0	0	0	0	38	6	561	6	0	32	32	6	19	70
TOTAL DENSITY (org/m²)							**2462**	**7552**	**2921**	**3623**	**1990**	**1129**	**1301**	**491**	**38**	**153**	**249**	**19**	**549**	**179**
TOTAL NUMBER OF TAXA							**21**	**13**	**18**	**14**	**10**	**7**	**12**	**9**	**2**	**6**	**10**	**3**	**20**	**7**

Note:
Sampling locations are presented in **Figure 4-8**.
"-" indicates that the organism was not identified in the sample, or that there is no Class, Subclass, Order, Family, Subfamily, or Species information.

Table A-24: Deepwater Benthic Tow Raw Benthic Invertebrate Community Data at the Lowest Practical Level, Fall 2025

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Matrix Grid							
							S1	S2	S5	S6	S7	S8	S11	S12
ROUNDWORMS														
P. Nemata	-	-	-	-	-	-	-	0.05	-	-	-	0.11	-	-
FLATWORMS														
P. Platyhelminthes	Cl. Turbellaria		O. Tricladida				-	0.10	0.02	-	-	-	-	0.27
P. Platyhelminthes	Cl. Turbellaria		O. Tricladida	F. Dugesiidae		Girardia	0.24	-	-	-	-	-	0.05	-
UNSEGMENTED WORMS														
P. Nemerta						Prostoma	-	-	-	-	-	-	0.05	-
ANNELIDS														
WORMS														
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Chaetogaster diaphanus*	-	-	-	-	-	0.04	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais bretscheri*	0.95	0.10	-	-	0.02	0.04	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais variabilis*	6.68	0.73	0.22	0.78	0.17	0.57	0.80	5.93
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais*	-	-	-	-	0.07	-	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Strylaria lacustris*	0.48	-	-	-	0.05	-	0.20	0.09
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Vejdovskyella intermedia*	-	-	0.02	-	-	-	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures with hair chaetae	-	-	-	-	-	0.04	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures without hair chaetae	-	-	-	-	-	-	-	-
P. Annelida	-	-	-	F. Lumbriculidae	-	*Stylodrilus heringianus*	-	-	0.02	-	-	-	-	0.26
ARTHROPODS														
MITES														
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	-	-	-	Immature	8.72	1.77	0.86	1.17	0.21	0.26	2.40	8.25
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Hygrobatidae	-	*Hygrobates*	0.24	1.14	0.12	0.59	0.05	-	0.25	0.18
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Lebertiidae	-	*Lebertia*	0.73	0.26	0.17	-	0.14	0.15	0.10	0.27
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	F. Limnesiidae	-	*Limnesia*	0.24	0.16	0.36	0.20	0.62	0.38	1.20	1.08
HARPACTICOIDS														
P. Arthropoda	-	-	O. Harpacticoida	-	-	-	-	-	0.02	0.39	-	0.08	-	0.09
SEED SHRIMPS														
P. Arthropoda	Cl. Ostracoda	-	-	-	-	-	-	-	-	-	0.07	0.04	-	-
WATER SCUDS														
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	-	-	-								
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Crangonyctidae	-	*Crangonyx*	0.12	0.26	0.05	-	0.07	0.04	0.05	0.54
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Echinogammarus ischnus*	2.06	0.62	0.62	2.34	0.21	2.49	0.60	6.54
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Gammarus fasciatus*	0.48	0.10	0.02	0.20	0.05	0.15	0.05	0.54

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Matrix Grid							
							S1	S2	S5	S6	S7	S8	S11	S12
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Gammarus immature*	2.42	0.68	0.19	0.59	0.02	0.04	0.50	4.93
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*immature*	-	0.05	-	-	-	0.04	0.10	-
AQUATIC SOW BUGS														
P. Arthropoda		-	O. Isopoda	F. Asellidae	-	*Caecidotae*	1.09	0.99	0.05	0.39	0.10	0.08	0.15	1.25
INSECTS														
TRUE FLIES														
MIDGES														
Cl. Insecta	O. Diptera	-	-	F. Chironomidae		chironomid pupae	0.12	-	-	-	0.02	-	-	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Chironomus*	-	-	-	-	-	-	0.05	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Dicrotendipes*	0.12	-	-	-	-	-	0.15	0.27
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Paratanytarsus*	-	-	-	-	0.07	-	-	0.09
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Polypedilum halterale*	-	-	-	-	-	-	-	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Rheotanytarsus*	-	-	-	-	-	0.04	0.05	0.09
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Stictochironomus*	-	-	-	-	-	-	-	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus/Orthocladius*	0.12	0.05	-	-	-	0.15	-	0.45
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Hydrobaenus*	-	-	0.05	-	0.02	-	0.05	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Hydrosmitta*	-	-	0.02	-	-	-	0.05	0.09
MOLLUSCS														
SNAILS														
P. Mollusca	Cl. Gastropoda	-	-	F. Hydrobiidae	-	*Potamopyrgus antipodarum*	6.66	7.54	3.57	13.46	0.83	0.79	2.00	7.44
CLAMS														
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena bugensis*	12.24	9.93	3.38	26.13	1.09	4.11	1.90	8.78
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena* immature	2.91	5.77	1.39	11.90	0.29	0.91	0.50	3.14
TOTAL DENSITY (org/m^2)							**46.65**	**30.32**	**11.16**	**58.11**	**4.18**	**10.66**	**10.96**	**50.55**
RICHNESS							**15**	**14**	**16**	**10**	**16**	**18**	**18**	**19**
SIMPSON'S DIVERSITY							**0.831**	**0.662**	**0.704**	**0.515**	**0.815**	**0.710**	**0.857**	**0.860**
SIMPSON'S EVENNESSS							**0.395**	**0.211**	**0.211**	**0.206**	**0.337**	**0.192**	**0.389**	**0.376**

Note:

"-" indicates that the organism was not identified in the sample, or that there is no Class, Subclass, Order, Family, Subfamily, or Species information.
Sample ID locations are show in **Figure 4-8.**

Table A-25: Raw Benthic Invertebrate Community Data at the Lowest Practical Level, Fall 2025

Phylum		Subclass	Order	Family	Subfamily	Species	Mid-Depth Stations					Cutoff Wall Stations		
							MD-1	MD-2	MD-3	MD-4	MD-5	COW-01	COW-02	COW-03
ROUNDWORMS														
P. Nemata	-	-	-	-	-	-	2	3	-	-	-	-	-	-
ANNELIDS														
WORMS														
P. Annelida	Cl. Oligochaeta	-	-	-	-	-								-
P. Annelida	S.F. Tubificainae	-	-	-	-	-								-
P. Annelida	S.F. Tubificainae	-	-	F. Naididae	S.F. Naidinae	*Nais variabilis*	-	-	-	-	-	44	-	
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Limnodrilus hoffmeisteri*	1	64	-	-	-		-	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Potamothrix moldaviensis*	3	-	-	-	-	44	56	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*immatures with hair chaetae*	-	9	-	1	2	261	94	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*immatures without hair chaetae*	21	110	-	5	38	739	226	1
ARTHROPODS														
MITES														
P. Arthropoda	Cl. Arachnida	-	-	-	-	-								
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	-	-	*Immature*						8		
P. Arthropoda	Cl. Arachnida	-	O. Trombidiformes	F. Hygrobatidae	-	*Hygrobates*	-	3	-	-	-	4	-	-
P. Arthropoda	Cl. Arachnida	-	O. Trombidiformes	F. Limnesiidae	-	*Limnesia*	6	65	-	-	2	56	6	-
P. Arthropoda	Cl. Arachnida	-	O. Trombidiformes	F. Pionidae	-	*indeterminate*	-	1	-	-	-	-	-	-
P. Arthropoda	Cl. Arachnida	-	O. Amphipoda	F. Gammaridae	-	*Immature*	-	1	1	-	-	-	-	-
INSECTS														
CADDISFLIES														
P. Arthropoda	Cl. Insecta	-	O. Trichoptera	F. Hydroptilidae	-	*pupae*	-	3	-	-	-	-	-	-
TRUE FLIES														
MIDGES														
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Chironomus*	*1*	5	-	1	1	72	8	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Cryptochironomus*	*1*	1	-	-	-	-	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Dicrotendipes*	*3*	3	9	-	-	48	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Rheotanytarsus*	-	1	2	-	-	-	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Stictochironomus*	-	2	1	3	5	8	1	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Diamesinae	*Potthastia*	-	1	-	-	-	-	-	-

Phylum		Subclass	Order	Family	Subfamily	Species	Mid-Depth Stations					Cutoff Wall Stations		
							MD-1	MD-2	MD-3	MD-4	MD-5	COW-01	COW-02	COW-03
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus*	-	-	1	-	-	-	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Orthocladiinae	*Hydrosmittia*	-	1	-	-	-	-	-	-
MOLLUSCS														
CLAMS														
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena bugensis*	-	-	2	-	-	-	-	-
TOTAL DENSITY (org/m^2)							**545.37**	**3,918.06**	**229.63**	**143.52**	**688.89**	**7,922.24**	**5,611.59**	**14.35**
TOTAL NUMBER OF TAXA							**38.00**	**273.00**	**16.00**	**10.00**	**48.00**	**9.00**	**391.00**	**1.00**
SIMPSON'S DIVERSITY							**7.00**	**15.00**	**6.00**	**4.00**	**5.00**	**0.58**	**5.00**	**1.00**
SIMPSON'S EVENNESSS							**8.00**	**16.00**	**6.00**	**4.00**	**5.00**	**0.27**	**6.00**	**1.00**

Note:
Sampling locations are presented in **Figure 4-8**.
"-" indicates that the organism was not identified in the sample, or that there is no Class, Subclass, Order, Family, Subfamily, or Species information

A.3.3 Results of 2024 Macrozooplankton Community Study

Proportions of major macrozooplankton groups in samples from the spring, summer, and fall sampling events from 2024 are presented in **Table A-26**. A detailed composition of the macrozooplankton community in each sample is provided in **Table A-30**. Of the major groups identified, Cladocera were the most abundant in the spring and summer samples (>82% of total community composition), which is consistent with the findings from previous studies of zooplankton communities in the area (EC, 1998; Barbiero et al., 2001). This was followed by Calanoida, and Cyclopoida. Mysida were the least abundant group in the spring (<1% of total composition) and were not recorded in any of the summer samples. Unlike spring and summer, Calanoida made up the majority of the community in the five out of six samples (56-79% of total community composition) in the fall. The most common cladoceran species in the samples included *Daphnia sp*., *Leptodora sp. Bythotrephes* sp., and *Cercopagis sp*., and the most common calanoidan species included *Skistodiaptomus sp., Leptodiaptomus sicilis* and *Epischura sp.*

A summary of parameters such as density (no. of organisms/L), BPUE, family-level taxa richness, and Simpson's Diversity from the samples collected in the spring, summer, and fall are presented in **Table A-27**, **Table A-28**, and **Table A-29**, respectively. During the summer sampling program, algal mats were present that were inhabited by three species of Cladocera (*Bythotrephes sp., Cercopagis sp., and Leptodora sp.*), which significantly influenced the abundance and biomass of the samples collected. As such, density, biomass per unit effort, and Simpson's Diversity are presented both with and without organisms found in algae in **Table A-28**. To determine if and how the macrozooplankton community varied through time (i.e., season) or by depth within the study area, metrics of richness (lowest-practical-level, or LPL, and family-level), diversity (family-level), and abundance (Density in #/L and Biomass in mg/L) were compared using GLMs. Results are detailed in **Table A-31**, and presented in **Figure A-21**.

Results indicated that, excluding organisms associated with algae, there was no influence from depth on macrozooplankton community metrics; however, all metrics were significantly influenced by season. Specifically, LPL richness was significantly different across all three sampling seasons, and was highest in the summer and lowest in the fall. For family richness, no difference was observed between spring and summer, and both seasons had significantly greater richness than observed in fall. Although density was significantly influenced by seasonal effects and fall had the highest mean density observed, between season comparisons did not show any differences due to high variability between the replicates. Finally, diversity at the family level was significantly highest in the summer, and no difference was observed between spring and fall. The seasonal differences in diversity and richness indicate fluctuations in communities in the Deepwater Study Area throughout the year, potentially due to seasonal variability in the timing of various zooplankton species peaks as well as the influence of lake currents, which are known to affect macrozooplankton distribution. When consideration of organisms associated with algae was given, similar significant seasonal effects were observed in density, biomass, and diversity; however, diversity was also significantly influenced by depth, whereby the metric increased 0.034 at every 1 m depth interval.

The seasonal differences in diversity and richness indicate fluctuations in communities in the deepwater area throughout the year, potentially due to seasonal variability in the timing of various zooplankton species peaks. In addition, lake currents, which are known to affect macrozooplankton distribution, can have a significant influence on species distributions. When organisms associated with algae were considered, similar significant seasonal effects were observed in density, biomass, and diversity. Additionally, macrozooplankton diversity was also significantly influenced by depth. This increase in diversity at depth was driven by the presence of three additional species, and this effect was only apparent though in the summer when algal mats were observed.

Overall, the macrozooplankton community went through seasonal changes as expected, but did not appear to be influenced by depth when algal mats were not present. This would imply that the placement of the deepwater intake does not need to take depth into consideration with regard to macrozooplankton communities.

Table A-26: Proportions of Major Macrozooplankton Groups in Samples from 2024 Macrozooplankton Community Study

Spring						
Group	**S2**	**S3**	**S4**	**S5**	**S7**	**S9**
Cladocera	87.6	95.5	83	81.6	82.1	93.1
Calanoida	11.2	4.5	14.1	15.8	14.3	4.6
Cyclopoida	1.2	0	2.2	2.5	3.2	2.3
Mysida	0	0	0.7	0	0.4	0
Total	100	100	100	100	100	100
Summer						
Group	**S2**	**S3**	**S6**	**S4**	**S8**	**S9**
Cladocera	98.7	97.8	97.7	96.5	97.5	97.1
Calanoida	1	1.2	2	3.5	2.1	1.9
Cyclopoida	0.3	1	0.3	0	0.3	1
Mysida	0	0	0	0	0	0
Total	100	100	100	100	100	100
Fall						
Group	**S1**	**S3**	**S4**	**S5**	**S8**	**S9**
Cladocera	21.43	77.49	34.76	44.3	34.59	35.94
Calanoida	78.57	22.51	65.24	55.7	65.41	64.06
Cyclopoida	0	0	0	0	0	0
Mysida	0	0	0	0	0	0
Total	100	100	100	100	100	100

Table A-27: Summary Statistics of Calculated Macrozooplankton Metrics, Spring 2024

Station	Station Depth (m)	Richness-LPL	Richness-Family	Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family
S3	12.4	5	5	0.0122	0.00006	0.93
S2	14.5	7	7	0.0264	0.00019	0.81
S5	16.9	10	8	0.0423	0.00029	1.24
S4	17.4	8	8	0.0176	0.00019	1.16
S7	19.3	11	9	0.0328	0.00033	1.34
S9	19.4	7	8	0.1488	0.00095	0.79
Minimum	**12.4**	**5**	**5**	**0.0122**	**0.00006**	**0.79**
Median	**17.2**	**8**	**8**	**0.0296**	**0.00024**	**1.04**
Mean	**16.7**	**8.2**	**7.5**	**0.0467**	**0.00033**	**1.04**
Standard Deviation	**2.8**	**2.1**	**1.4**	**0.0511**	**0.00032**	**0.23**
Q25 (First quartile)	**15.1**	**7.3**	**7.3**	**0.0198**	**0.00019**	**0.84**
Q75 (Third quartile)	**18.8**	**9.5**	**8**	**0.04**	**0.00032**	**1.22**
Maximum	**19.4**	**11**	**9**	**0.1488**	**0.00095**	**1.34**

Table A-28: Summary Statistics of Calculated Macrozooplankton Metrics, Summer 2024

Station	Station Depth (m)	Richness-LPL	Richness-Family	No Algae			With Algae		
				Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family	Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family
S3	11.4	14	10	0.1592	0.00254	1.83	0.3665	0.00462	1.17
S2	12.5	11	9	0.2274	0.00193	1.59	0.4686	0.00362	1.33
S6	16.4	15	10	0.1049	0.00092	1.62	0.1645	0.00128	1.31
S4	16.6	12	9	0.337	0.00236	1.74	0.4941	0.00319	1.71
S8	19	15	11	0.1195	0.00093	1.8	0.2022	0.00161	1.57
S9	20	13	10	0.109	0.00092	1.89	0.1752	0.00144	1.63
Minimum	**11.4**	**11**	**9**	**0.1049**	**0.00092**	**1.59**	**0.1645**	**0.00128**	**1.17**
Median	**16.5**	**13.5**	**10**	**0.1394**	**0.00143**	**1.77**	**0.2844**	**0.0024**	**1.45**
Mean	**16**	**13.3**	**9.8**	**0.1762**	**0.0016**	**1.75**	**0.3119**	**0.00263**	**1.45**
Standard Deviation	**3.4**	**1.6**	**0.8**	**0.0912**	**0.00077**	**0.12**	**0.1505**	**0.00138**	**0.21**
Q25 (First quartile)	**13.5**	**12.3**	**9.3**	**0.1116**	**0.00092**	**1.65**	**0.1819**	**0.00148**	**1.32**
Q75 (Third quartile)	**18.4**	**14.8**	**10**	**0.2104**	**0.00225**	**1.82**	**0.4431**	**0.00351**	**1.61**
Maximum	**20**	**15**	**11**	**0.337**	**0.00254**	**1.89**	**0.4941**	**0.00462**	**1.71**

Table A-29: Summary Statistics of Calculated Macrozooplankton Metrics, Fall 2024

Station	Station Depth (m)	Richness-LPL	Richness-Family	Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family
S3	10.5	3	3	0.5203	0.05148	0.58
S1	10.6	5	4	0.1014	0.00514	0.75
S5	15	5	5	0.3107	0.02408	0.94
S4	16.8	4	4	0.2475	0.01462	0.82
S8	18.7	3	3	0.2285	0.01604	0.83
S9	19.7	4	4	0.1868	0.01101	0.89
Minimum	**10**	**3**	**3**	**0.1014**	**0.00514**	**0.58**
Median	**15.5**	**4**	**4**	**0.238**	**0.01533**	**0.83**
Mean	**14.7**	**4**	**3.8**	**0.2659**	**0.02039**	**0.8**
Standard Deviation	**3.9**	**0.9**	**0.8**	**0.1427**	**0.01645**	**0.13**
Q25 (First quartile)	**11.3**	**3.3**	**3.3**	**0.1972**	**0.01191**	**0.77**
Q75 (Third quartile)	**17.5**	**4.8**	**4**	**0.2949**	**0.02207**	**0.87**
Maximum	**19**	**5**	**5**	**0.5203**	**0.05148**	**0.94**

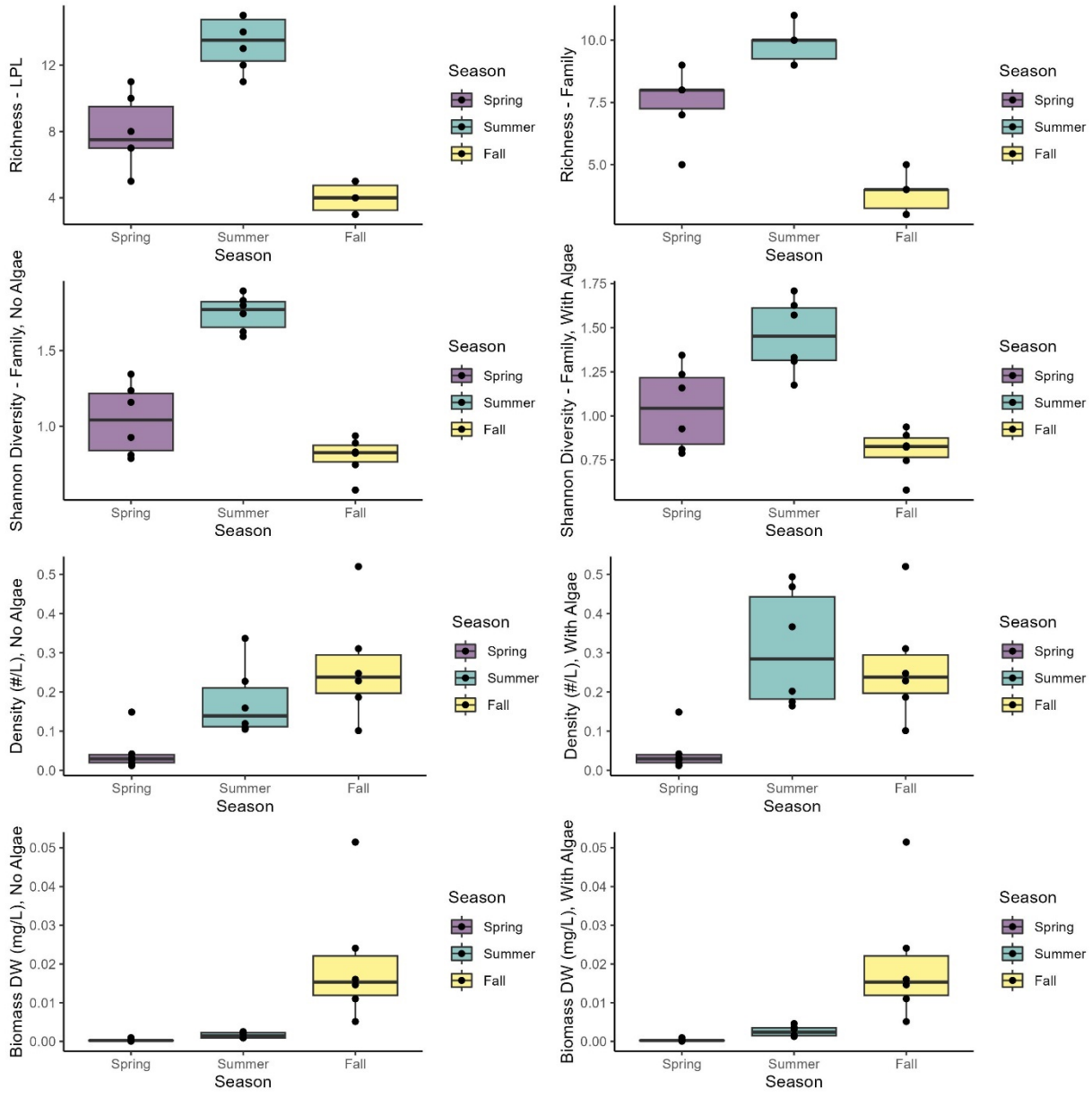


Figure A-21: Boxplots and Raw Data (points) of Macrozooplankton Endpoints Expressed by Season

Note: "No Algae" indicates that zooplankton estimates for those trapped in dense algae were not included whereas "With Algae" indicates they were.

Table A-30: Macrozooplankton Community Composition from samples collected in 2024

Spring								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 5**	**Grid 4**	**Grid 7**	**Grid 9**
		Station Depth (m)	12.4	14.5	16.9	17.4	19.3	19.4
Cladocera	Bosminidae	Bosminidae indet. [1]						X
	Bosminidae	Eubosmina sp.	X	X	X	X	X	
	Cercopagididae	Cercopagis sp.	X	X	X	X	X	X
	Daphniidae	Daphnia sp.	X	X	X	X	X	X
	Leptodoridae	Leptodora sp.	X	X	X	X	X	X
	Polyphemidae	Polyphemus pediculus			X		X	X
	Total Cladocera		**4**	**4**	**5**	**4**	**5**	**4**
Copepoda Calanoida	Centropagidae	Limnocalanus macrurus		X	X	X	X	X
	Diaptomidae	Diaptomidae indet. [1]	X	X	X	X	X	X
	Diaptomidae	Leptodiaptomus sicilis	X	X	X	X	X	X
	Total Calanoida		**1**	**2**	**2**	**2**	**2**	**2**
Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.			X		X	
	Cyclopidae	Diacyclops sp.		X	X	X	X	X
	Cyclopidae	Mesocyclops edax			X		X	
	Total Cyclopoida		**0**	**1**	**3**	**1**	**3**	**1**
Mysida	Mysidae	Mysidae indet.				X	X	
	Total Mysida		**0**	**0**	**0**	**1**	**1**	**0**
Taxa Richness			**5**	**7**	**10**	**8**	**11**	**7**
Overall Richness			**10**					

Summer								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 6**	**Grid 4**	**Grid 8**	**Grid 9**
		Station Depth (m)	11.4	12.5	16.4	16.6	19	20
Cladocera	Bosminidae	Bosmina longirostris					X	
	Bosminidae	Eubosmina coregoni	X	X	X	X	X	X
	Bosminidae	Eubosmina longispina				X	X	
	Cercopagididae	Bythotrephes sp.	X		X		X	X
	Cercopagididae	Cercopagis sp.	X	X	X	X	X	X
	Chydoridae	Acroperus sp.			X			
	Chydoridae	Camptocercus sp.	X	X	X			X
	Chydoridae	Eurycercus sp.	X	X	X	X	X	X
	Chydoridae	Oxyurella sp.	X		X	X	X	X
	Daphniidae	Ceriodaphnia sp.	X	X	X		X	
	Daphniidae	Daphnia sp.	X	X	X	X	X	X
	Holopediidae	Holopedium gibberum	X	X	X	X	X	X
	Leptodoridae	Leptodora sp.	X	X	X	X	X	X
	Polyphemidae	Polyphemus pediculus	X	X	X	X	X	X

Summer								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 6**	**Grid 4**	**Grid 8**	**Grid 9**
		Station Depth (m)	11.4	12.5	16.4	16.6	19	20
Cladocera	Sididae	Sida crystallina					X	
	Total Cladocera		**11**	**9**	**12**	**9**	**13**	**10**
Copepoda Calanoida	Diaptomidae	Diaptomidae indet. [1]					X	X
	Diaptomidae	Leptodiaptomus minutus	X		X	X		
	Diaptomidae	Skistodiaptomus oregonensis				X		
	Temoridae	Epischura sp.	X	X	X	X	X	X
		Calanoida indet. [1]				X		
	Total Calanoida		**2**	**1**	**2**	**3**	**1**	**1**
Summer								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 6**	**Grid 4**	**Grid 8**	**Grid 9**
Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	X					X
	Cyclopidae	Diacyclops sp.		X			X	X
	Cyclopidae	Eucyclops sp.			X			
		Cyclopoida indet. [1]	X					X
	Total Cyclopoida		**1**	**1**	**1**	**0**	**1**	**2**
Taxa Richness			**14**	**11**	**15**	**12**	**15**	**13**
Overall Richness			**21**					
Fall								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 1**	**Grid 5**	**Grid 4**	**Grid 8**	**Grid 9**
		Station Depth (m)	10.5	10.6	15	16.8	18.7	19.7
Cladocera	Bosminidae	Eubosmina coregoni		X	X			
	Cercopagididae	Bythotrephes sp.	X	X	X	X	X	X
	Daphniidae	Daphnia sp.			X			
	Total Cladocera		**1**	**2**	**3**	**1**	**1**	**1**
Copepoda Calanoida	Centropagidae	Limnocalanus macrurus				X		X
	Diaptomidae	Diaptomidae indet. [1]	X		X	X	X	X
	Diaptomidae	Leptodiaptomus sicilis	X	X	X	X	X	X
	Diaptomidae	Skistodiaptomus oregonensis		X				
	Temoridae	Epischura sp.	X	X	X	X	X	X
		Calanoida indet. [1]	X	X	X		X	X
	Total Calanoida		**2**	**3**	**2**	**3**	**2**	**3**
Total Zooplankton (excluding algae)			**3**	**5**	**5**	**4**	**3**	**4**
Total Unique Taxa			**7**					

Note:

[1] Indet = indeterminant. As there was uncertainty over the identification of these organisms, they were excluded from the richness count.

Sampling grids are presented in **Figure 4-5**.

X – indicates taxon was present in the sample, "-" indicates taxon was not present in the sample. Taxa Richness is calculated for each station individually based on the sum of all the taxa (excluding indets.) present in the column, whereas Overall Richness is the sum of all taxa (excluding indets) across stations.

Table A-31: Summary of GLM Modelling Results to identify effects of season and depth on Macrozooplankton Community Parameters

Parameter		R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
						Season	Mean	Lower Confidence Limit	Upper Confidence Limit				
Richness - LPL		0.77	Depth	0.48	No	Spring	7.9	5.9	10.5	Spring	Summer	0.012	Summer > Spring > Fall
			Season	<0.001	Yes	Summer	13.3	10.6	16.5	Spring	Fall	0.027	
						Fall	4.1	2.7	6.1	Summer	Fall	<0.001	
Richness - Family		0.61	Depth	0.458	No	Spring	7.3	5.5	9.9	Spring	Summer	0.324	Summer = Spring > Fall
			Season	<0.001	Yes	Summer	9.8	7.6	12.6	Spring	Fall	0.043	
						Fall	3.9	2.6	5.9	Summer	Fall	<0.001	
Algae excluded	Diversity - Family	0.9	Depth	0.053	No	Spring	1.024	0.887	1.161	Spring	Summer	<0.001	Summer > Spring = Fall
			Season	<0.001	Yes	Summer	1.742	1.607	1.878	Spring	Fall	0.116	
						Fall	0.826	0.688	0.964	Summer	Fall	<0.001	
	Density	0.58	Depth	0.651	No	Spring	0.047	0.028	0.15	Spring	Summer	0.104	Summer = Spring = Fall
			Season	0.002	Yes	Summer	0.176	0.105	0.554	Spring	Fall	0.063	
						Fall	0.252	0.147	0.882	Summer	Fall	0.725	
	Biomass	0.9	Depth	0.264	No	Spring	0.0003	0.0002	0.0009	Spring	Summer	0.045	Fall > Summer > Spring
			Season	<0.001	Yes	Summer	0.0016	0.001	0.0042	Spring	Fall	0.012	
						Fall	0.017	0.01	0.0554	Summer	Fall	0.02	

Parameter		R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
						Season	Mean	Lower Confidence Limit	Upper Confidence Limit				
Algae included	Diversity - Family	0.8	Depth	0.006	Yes	Spring	1.014	0.869	1.158	Spring	Summer	0.001	Summer > Spring = Fall
			Season	<0.001	Yes	Summer	1.446	1.304	1.589	Spring	Fall	0.207	
						Fall	0.839	0.693	0.985	Summer	Fall	<0.001	
	Density	0.65	Depth	0.412	No	Spring	0.047	0.028	0.143	Spring	Summer	0.045	Summer > Spring Fall > Spring Fall = Summer
			Season	<0.001	Yes	Summer	0.306	0.184	0.89	Spring	Fall	0.058	
						Fall	0.245	0.147	0.733	Summer	Fall	0.862	
	Biomass	0.88	Depth	0.234	No	Spring	0.0003	0.0002	0.0009	Spring	Summer	0.025	Fall > Summer > Spring
			Season	<0.001	Yes	Summer	0.0026	0.0016	0.007	Spring	Fall	0.012	
						Fall	0.0167	0.0098	0.0552	Summer	Fall	0.032	
						Depth*	0.034	0.01	0.0587	-	-	-	

Note:
Shaded cells indicates p-value < 0.05, which was considered significant.

A.3.4 Aquatic Habitat

Substrate types within each sampling grid in the Deepwater Study Area from 2024 and 2025 are detailed in **Table A-32**. Results of underwater video substrate analysis for transects in Shoreline Erosion Mitigation Area and Infill Study Areas are presented in **Table A-33**.

Sediment samples collected from the Deepwater Study Area, Mid-depth Study Area, Cutoff Wall Study Area, Infill and Shoreline Erosion Mitigation Areas were collected and analyzed for grain size to compare with the sidescan sonar–derived substrate classification map (**Figure 4-10**). The results of these grain size analyses are presented in **Figure A-22** to **Figure A-25**.

Table A-32: Substrate Characterization in the Proposed Deepwater Study Area, 2024 and 2025

Sampling grid	Depths (m)	Substrate characterization
S1	10-14	Substrates primarily comprised of sand/gravel/cobble. Other substrate types identified include sand/gravel/cobble, gravel/cobble, and gravel/cobble/boulder. In general, coarser substrates (cobble and infrequent boulder) were observed in the mid and northern section of the grid in depths of approximately 10 to 13m. Finer substrates were observed in deeper areas (12 to 14m), with a large patch of sand/gravel/cobble present in the southwest section of the sampling grid.
S2 (Intake location option)	11-14	Substrates primarily comprised of sand/gravel/cobble. Small sections containing larger substrates (cobble/boulder) are present to the northwest and mid grid to the east. These sections of larger substrates are generally associated with the 12m depth contours. Compared to other grids, S2 has a higher proportion of sand/gravel, which is generally concentrated in the middle of the grid. Grid S3 to the east has coarser substrates (mostly cobble boulder), grid S1 has similar substrates, but with sections of sand/gravel concentrated in the south-west corner, and grid S5 (the other intake option) contains mixed substrates, but with less sand and more cobble than grid S2. The proposed intake location is located at the approximate center of grid S2. This location was identified as mixed sand/gravel/cobble substrate, which was observed in sections throughout the study area.
S3	10-13	Substrates primarily comprised of coarser substrates (gravel/cobble/boulder). Substrate size tends to increase in size from west to east in the sampling grid. The furthest eastern edge of this sampling grid is comprised primarily of cobble and boulder substrates.
S4	14-17	Substrates primarily comprised of sand/gravel/cobble. Finer substrates are found in patches located to the south and southeast between depths of 16 to 17m. Coarser substrates are present along the edge of the southeast section of the sampling grid in 16 to 17 m depths.
S5 (Intake location option)	14-17	Substrates primarily composed of gravel/cobble. These substrates are generally located throughout the northwestern section of the sampling grid. The southern/southeastern section of the sampling grid contains diverse substrate types, containing substrates ranging from sand to boulder in patches throughout the entire southeast section of the sampling grid. When compared to adjacent grids in different depth bands, grid S5 has a higher proportion of sand/gravel which is generally concentrated in the middle of the grid, and grid S8 is much less homogenous than S5, with mixed substrates of sand, gravel, cobble, and boulder found in patches throughout.The proposed intake is located at the

Sampling grid	Depths (m)	Substrate characterization
		boundary between S5 and S2, approximately 100m from the eastern edge of these grids. This location was identified primarily as gravel/cobble, with some boulder substrates, which is common throughout the study area.
S6	11-17	Substrates primarily composed of gravel/cobble and gravel/cobble/boulder. There was a general pattern of less coarse substrates in the southwest and more coarse substrates to the northeast. The largest substrates (cobble/boulder and boulder) within this sampling grid are located in the north-east section between the 11 to 14 m depth contours.
S7	16-19	Substrates primarily composed of gravel/cobble and gravel/cobble/boulder. Finer substrates are generally located to the mid-south (17 to 19 m) sections of the sampling grid, while coarser substrates tend to be located to the east and west, adjacent to the sampling grid extent.
S8	17-20	Substrates are variable throughout the sampling grid, with all substrate types observed. Generally, coarser substrates (gravel/cobble/boulder and cobble/boulder) are present to the west, between the 17 and 18 m depth contours, while patches of finer substrates (sand/gravel) tend to be present throughout the middle and to the east of the sampling grid across all depths.
S9	17-20	The substrate is diverse and comprised of sand/gravel, sand/gravel/cobble, and gravel/cobble, with patches of sand and gravel/cobble/boulder. The finest substrates (sand and sand/gravel) generally occur between the 18 and 19m depth contours, while coarser substrates are present throughout the eastern extent of the sampling grid across all depths.
S10	9-11	Substrate is relatively uniform throughout and composed of gravel/cobble, with small patches of sand/gravel/cobble in the northern extent of the grid between the 9-10 m depth contours, along with some sections of coarser substrates, gravel/cobble/boulder, along the southern extent of the grid, close to the 11 m depth contour.
S11	9-12	Substrate is primarily gravel/cobble, with small patches of sand/gravel/cobble, with a large patch of finer substrates along the southern edge of the sampling grid between the 11-12 m depth contours.
S12	9-11	Substrate is primarily gravel/cobble, with small patches of sand/gravel/cobble. The finer substrates are mostly located within the eastern extent of the sampling grid, between the 9 m and 10 m depth contours

Note:
Sampling area presented in **Figure 4-9**.

Table A-33: Results of Underwater Video Substrate Analysis for transects in Shoreline Erosion Mitigation Area and Infill Study Areas

Infill Area	Transect Number	Transect	Video Title	Image	Direction Travelled	Timestamp (mm:ss)	Distance (m)	Substrate	Substrate Coverage Type	Veg Coverage (%)	Veg Coverage Value	Mussel Coverage (%)	Mussel Coverage Value	Fish Presence (Y/N)
Shoreline Erosion Mitigation Study Area	1	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD1	GX010002	0	East	00:06	0	Sand	2	0	0	0	0	N
				1		00:51	76.72	Sand	2	0	0	0	0	N
				2		01:42	153.44	Sand	2	35	3	0	0	N
				3		02:33	230.16	Sand	2	0	0	0	0	N
				4		03:25	306.88	Sand	2	25	2	0	0	N
				5		04:16	383.6	Sand	2	25	2	0	0	N
				6		05:07	460.32	Sand	2	35	3	0	0	N
				7		05:58	537.04	Sand	2	50	5	0	0	N
				8		06:49	613.76	Sand, Cobbles	3	45	5	0	0	N
				9		07:40	690.48	Sand	2	30	3	0	0	N
				10		08:31	767.2	Cobbles	4	70	7	0	0	N
	2	SHORELINE_EROSION_MITIGATION_AREA__WESTWRD1	GX010003	0	West	00:02	0	Sand, Boulders	5	100	10	0	0	N
				1		00:46	83.29	Gravel, Boulders	5	100	10	0	0	N
				2		01:34	166.58	Sand, Gravel, Boulders	4	90	9	0	0	N
				3		02:20	249.87	Sand, Boulders	5	100	10	0	0	N
				4		03:07	333.16	Cobbles	3	100	10	0	0	N
				5		03:54	416.45	Boulders, Sand, Cobbles	4	100	10	0	0	N
				6		04:41	499.74	Boulders, Sand, Cobbles	4	100	10	0	0	N
				7		05:28	583.03	Sand, Boulders	5	30	3	0	0	N
				8		06:14	666.32	Sand, Boulders	5	40	4	0	0	N
				9		07:01	749.61	Sand	2	10	1	0	0	N
				10		07:48	832.90	Sand, Boulders	5	20	2	0	0	N
	3	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD2	GX010004	0	East	00:03	0.00	Boulders, Cobbles	6	100	100	5	1	N
				1		00:43	88.19	Sand	2	80	8	0	0	N
				2		01:27	176.38	Boulders, Cobbles	6	100	10	0	0	N
				3		02:10	264.57	Boulders, Cobbles	6	100	10	0	0	N
				4		02:54	352.76	Boulders, Cobbles	6	80	8	20	2	N
	3	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD2	GX010004	5	East	03:37	440.95	Boulders, Cobbles	5	90	9	10	1	N
				6		04:21	529.14	Boulders, Cobbles	5	90	9	10	1	N
				7		05:04	617.33	Boulders, Cobbles	5	80	8	5	1	N
				8		05:48	705.52	Boulders, Cobbles	6	80	8	20	2	N
				9		06:31	793.71	Boulders, Cobbles	6	90	9	20	2	N
				10		07:14	881.90	Boulders, Cobbles, Gravel	5	30	3	0	0	N
	4	SHORELINE_EROSION_MITIGATION_AREA__WESTWRD2	GX010005	0	West	00:03	0.00	Cobbles, Boulders	3	100	10	10	1	N
				1		00:52	88.71	Sand, Boulders	2	5	1	0	0	N
				2		01:45	177.42	Cobbles, Boulders	3	100	10	10	1	N
				3		02:37	266.13	Sand	2	5	1	0	0	N
				4		03:30	354.84	Cobbles, Boulders	6	90	9	0	0	N
				5		04:22	443.55	Cobbles, Boulders	6	100	10	30	3	N
				6		05:15	532.26	Cobbles, Boulders	6	80	8	0	0	N
				7		06:07	620.97	Sand, Cobbles, Boulders	6 and 2	50	5	0	0	N

Infill Area	Transect Number	Transect	Video Title	Image	Direction Travelled	Timestamp (mm:ss)	Distance (m)	Substrate	Substrate Coverage Type	Veg Coverage (%)	Veg Coverage Value	Mussel Coverage (%)	Mussel Coverage Value	Fish Presence (Y/N)
				8		07:00	709.68	Boulders, Cobbles	5	90	9	40	4	N
				9		07:52	798.39	Sand	2	0	0	0	0	N
				10		08:45	887.10	Boulders, Cobbles	6	100	10	20	2	N
	5	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD3	GX010006	0	East	00:04	0.00	Boulders, Cobbles, Gravel	4	80	8	50	5	N
				1		00:48	90.44	Boulders, Cobbles, Gravel	4	30	3	0	0	N
				2		01:35	180.88	Sand	2	0	0	0	0	N
				3		02:23	271.32	Sand, Cobbles, Boulders	4	20	2	0	0	N
				4		03:10	361.76	Sand, Cobbles, Boulders	4	10	1	0	0	N
				5		03:58	452.2	Cobbles, Boulders	6	90	9	40	4	N
				6		04:46	542.64	Sand	2	0	0	0	0	N
				7		05:33	633.08	Cobbles, Boulders	6	35	4	15	2	N
				8		06:21	723.52	Boulders, Cobbles	6	70	7	60	6	N
				9		07:08	813.96	Boulders, Cobbles	6	40	4	10	1	N
				10		07:56	904.4	Sand. Boulders	5	5	1	0	0	N
Infill Study Area	1	INFILL_WEST_WESTWRD1	GX010007	0	West	00:09	0	Sand	2	0	0	0	0	N
				1		00:39	64.04	Sand	2	0	0	0	0	N
				2		01:18	128.08	Sand	2	0	0	0	0	N
				3		01:57	192.12	Sand	2	0	0	0	0	N
				4		02:36	256.16	Sand	2	0	0	0	0	N
				5		03:15	320.20	Sand	2	0	0	0	0	N
				6		03:54	384.24	Sand	2	0	0	0	0	N
				7		04:33	448.28	Sand	2	0	0	0	0	N
				8		05:12	512.32	Sand	2	0	0	0	0	N
				9		05:51	576.36	Sand	2	0	0	0	0	N
				10		06:30	640.40	Sand	2	0	0	0	0	N
	2	INFILL_WEST_EASTWRD1	GX010008	0	East	00:09	0.00	Sand	2	0	0	5	0	N
				1		00:37	65.00	Sand	2	0	0	0	0	N
				2		01:14	130.00	Sand	2	0	0	0	0	N
				3		01:51	195.00	Sand	2	0	0	0	0	N
				4		02:29	260.00	Cobbles, Boulders, Gavel, Sand	5	5	1	0	0	N
				5		03:06	325.00	Sand	2	5	1	0	0	N
				6		03:43	390.00	Cobbles, Boulders	6	70	7	20	2	N
				7		04:20	455.00	Boulders, Sand	5	15	2	5	1	N
				8		04:57	520.00	Sand, Boulders	5	0	0	0	0	N
				9		05:34	585.00	Sand	2	5	1	0	0	N
				10		06:11	650.00	Boulders, Sand	5	70	7	10	1	N
	3	INFILL_WEST_WESTWRD2	GX010009	0	West	00:04	0.00	Boulders, Cobbles, Sand	5	80	8	40	4	N
				1		00:40	69.67	Boulders, Cobbles, Sand	5	90	9	5	1	N
				2		01:20	139.34	Sand	2	0	0	0	0	N
				3		01:59	209.01	Boulders, Cobbles, Sand	5	30	3	10	1	N
				4		02:39	278.68	Boulders, Cobbles	6	100	10	60	6	N

Infill Area	Transect Number	Transect	Video Title	Image	Direction Travelled	Timestamp (mm:ss)	Distance (m)	Substrate	Substrate Coverage Type	Veg Coverage (%)	Veg Coverage Value	Mussel Coverage (%)	Mussel Coverage Value	Fish Presence (Y/N)
				5		03:19	348.35	Boulders, Cobbles, Sand	5	40	4	20	2	N
	3	INFILL_WEST_WESTWRD 2	GX010009	6	West	03:59	418.02	Sand	2	0	0	0	0	N
				7		04:39	487.69	Boulders, Cobbles, Sand	5	0	0	0	0	N
				8		05:18	557.36	Sand	2	0	0	0	0	N
				9		05:58	627.03	Sand	2	0	0	0	0	N
				10		06:38	696.70	Sand	2	0	0	0	0	N
	4	INFILL_WEST_EASTWRD2	GX010010	0	East	00:03	0.00	sand	2	0	0	0	0	N
				1		00:38	67.00	Sand	2	0	0	0	0	N
				2		01:15	134.00	Sand	2	0	0	0	0	N
				3		01:53	201.00	Sand	2	0	0	0	0	N
				4		02:31	268.00	Sand	2	0	0	0	0	N
				5		03:08	335.00	Sand	2	0	0	0	0	N
				6		03:46	402.00	Boulders, Cobble, Sand	5	90	9	70	7	N
				7		04:23	469.00	Sand	2	10	1	0	0	N
				8		05:01	536.00	Sand	2	10	1	0	0	N
				9		05:39	603.00	Boulders, Cobbles, Sand	5	90	9	50	5	N
				10		06:16	670.00	Boulders, Cobbles, Sand	5	70	7	40	4	N
	5	INFILL_WEST_WESTWRD 3	GX010011	0	West	00:01	0.00	Boulders, Cobbles, Sand	5	80	8	20	2	N
				1		00:02	62.67	Boulders, Sand	5	80	8	10	1	N
				2		00:04	125.34	Boulders, Sand	5	90	9	10	1	N
				3		00:06	188.01	Boulders, Sand	5	90	9	10	1	N
				4		00:08	250.68	Boulders, Cobbles, Sand	5	95	9	10	1	N
				5		00:10	313.35	Boulders, Cobbles, Sand	5	95	9	10	1	N
				6		00:12	376.02	Sand	2	0	0	0	0	N
				7		00:14	438.69	Sand	2	0	0	0	0	N
				8		00:16	501.36	Sand	2	0	0	0	0	N
				9		00:18	564.03	Sand	2	0	0	0	0	N
				10		00:20	626.70	Sand	2	0	0	0	0	N

Note:

Sampling area presented in **Figure 4-9**.

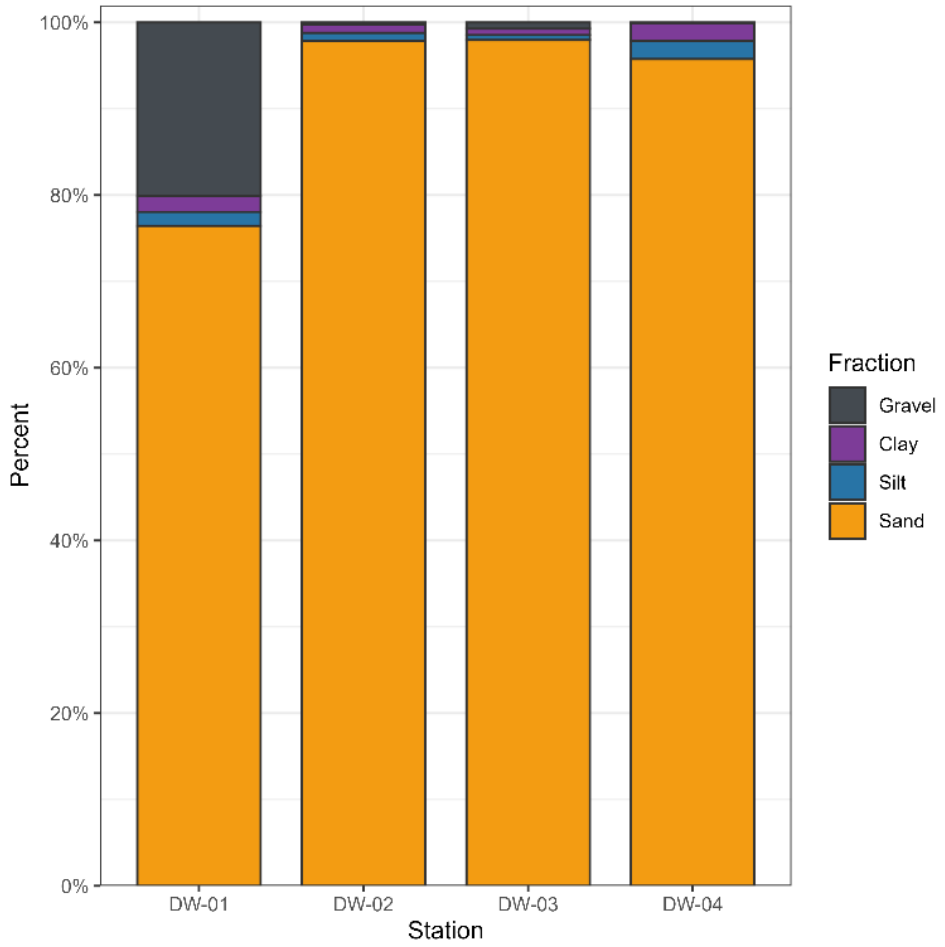


Figure A-22: Grain Size Results for Sediment Samples Collected in the Deepwater Study Area

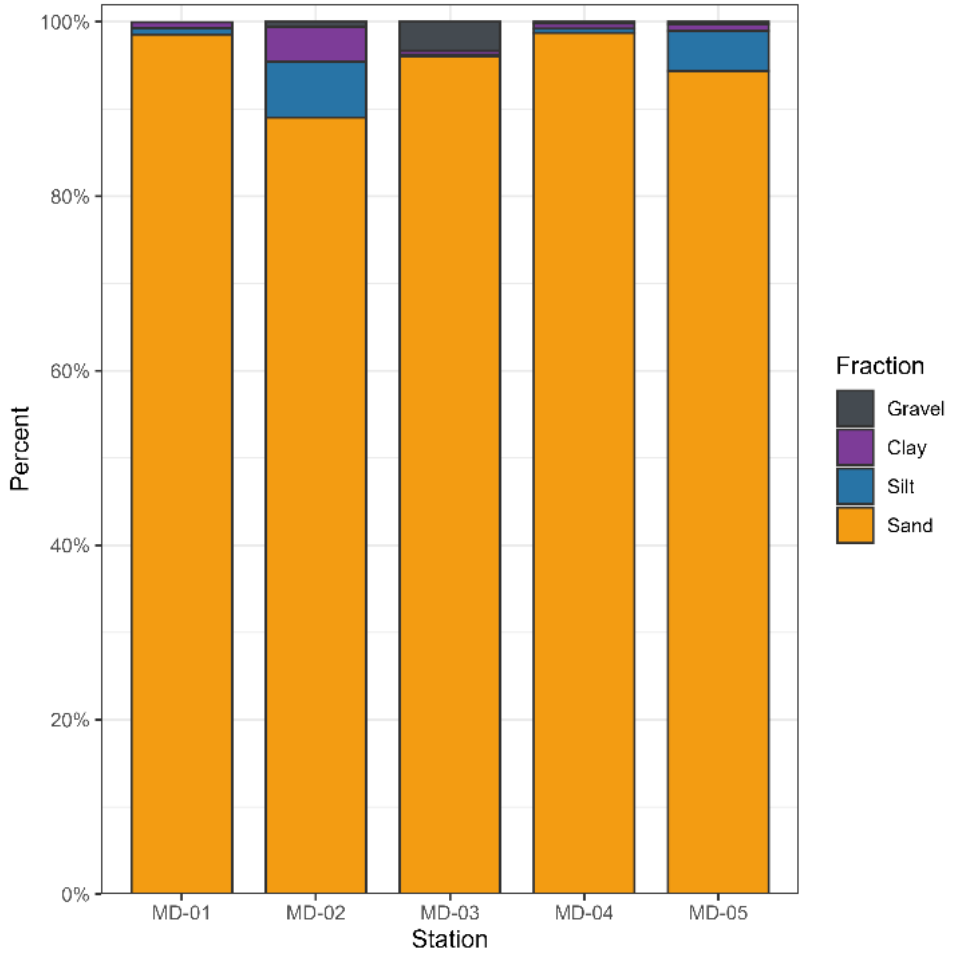


Figure A-23: Grain Size Results for Sediment Samples Collected in the Mid-Depth Study Area

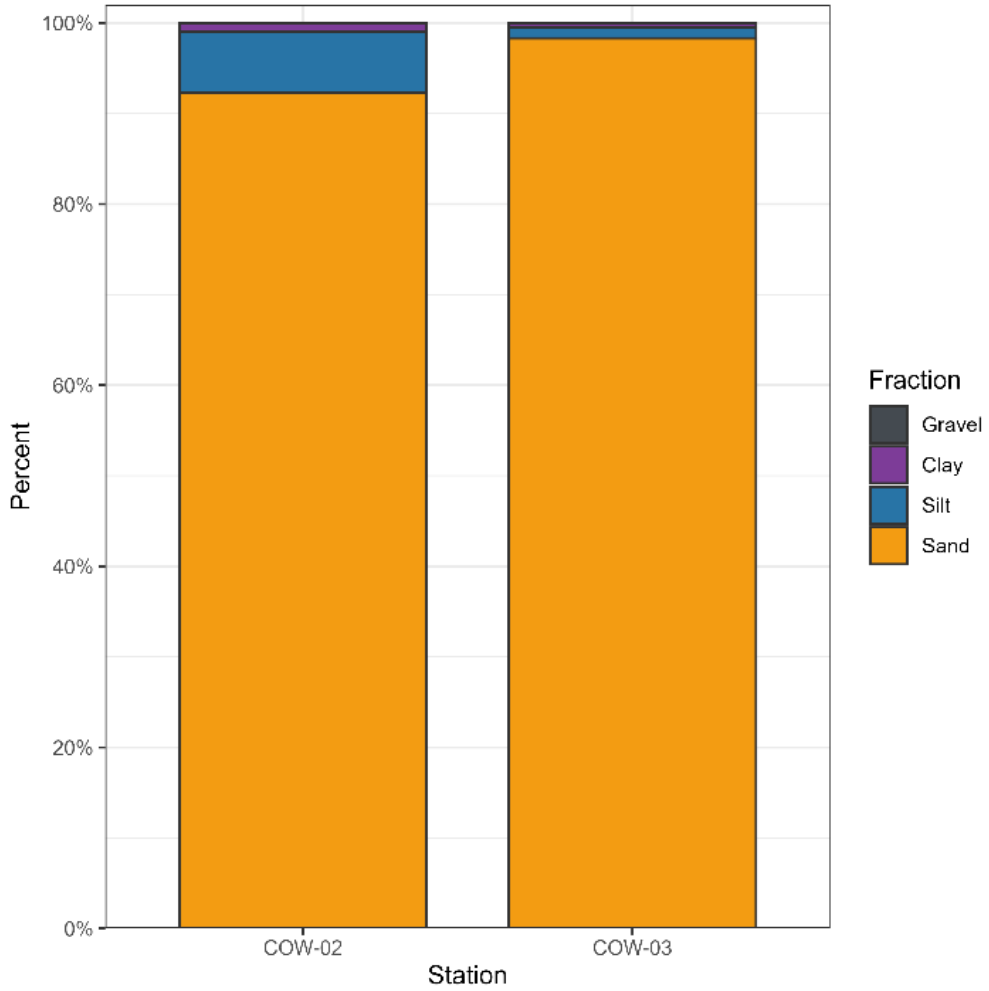


Figure A-24: Grain Size Results for Sediment Samples Collected in the Cutoff Wall Study Area

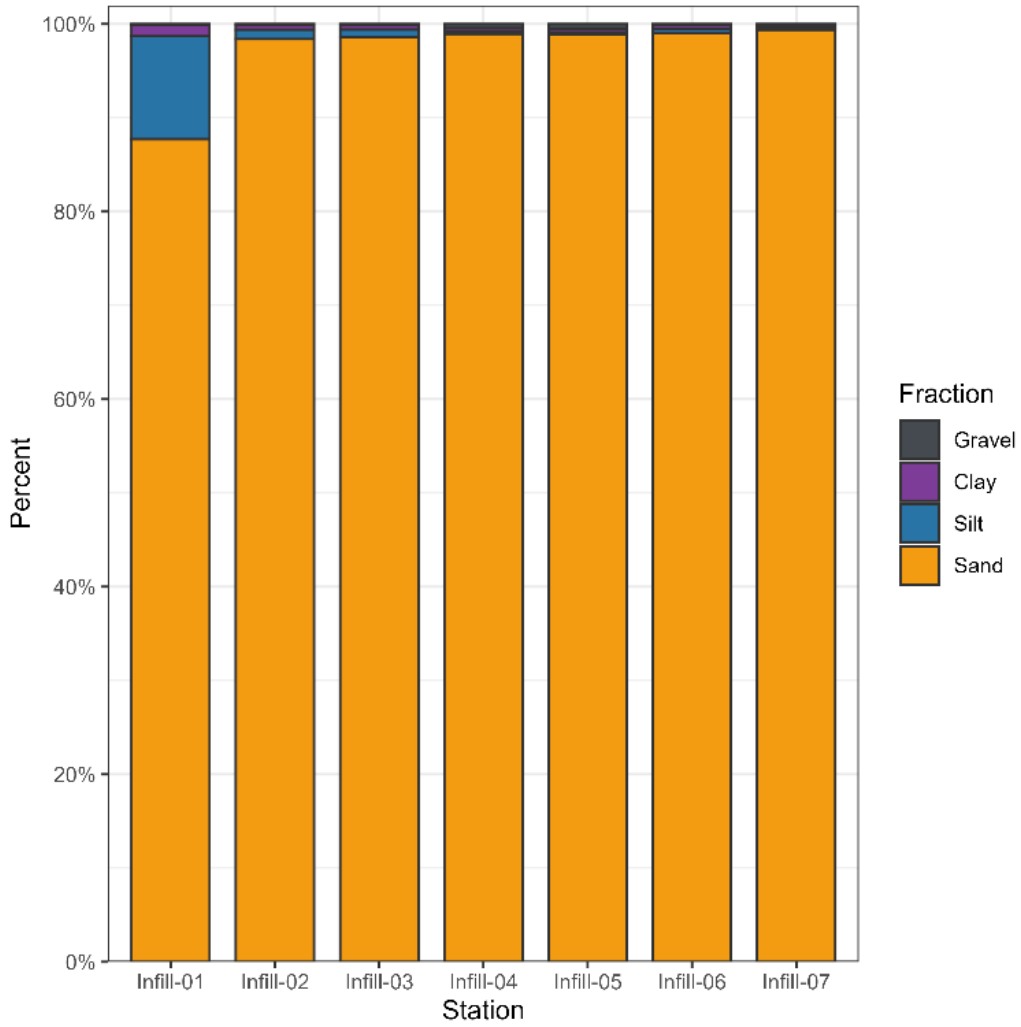


Figure A-25: Grain Size Results for Sediment Samples Collected in the in the Infill Area (Infill 01-05) and Shoreline Erosion Mitigation Area (Infill-06 and 07)

A.4 Geological and Hydrogeological Environment

A.4.1 2015 Soil Sampling Program at the PN Site

The first site-wide soil monitoring program was initiated in 1999 to characterize soil quality at the PN site. As part of the 2014 ERA, soil samples (0-1.5 metres in depth) collected as part of the site-wide monitoring program were compared against newly issued soil standards at the time following the Ontario MECP's update to O. Reg. 153/04. The 2014 ERA had identified a short-list of metals that were found to exceed their respective soil screening criteria. Ultimately, the 2014 ERA concluded that additional monitoring was recommended in areas of the PN site where metal concentrations were found to exceed soil benchmarks to ensure the protection of plants and soil organisms. To address this recommendation, an updated soil monitoring program was conducted in October 2015 in support of the 2017 ERA, focusing on the areas of contamination identified in the 2014 ERA.

The 2017 ERA (Ecometrix and Golder, 2018) and the 2022 PN ERA (Ecometrix, 2023a) documented that surface soil samples (collected in 2015 between 0 to 20 cm in depth) were analyzed for polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), petroleum hydrocarbons (PHC) fractions F1 to F4, metals and inorganics, glycol, tritium (H-3), gamma emitters (i.e., Cs-137, Cs-134, Co-60) and C-14. Concentrations of chemical constituents were compared against soil quality guidelines (SQGs) from the MECP and CCME that are considered protective of various classes of ecological receptors (e.g., plants, soil organisms, birds and mammals). In the 2015 sampling program, the maximum measured on-site concentration of PHC F4 was found to exceed the selected screening criteria and was hypothesized to be related to minor historic spills and impacted surface water runoff. Cadmium, strontium, and thallium, which were assessed as soil COPCs in the 2014 ERA, did not exceed their selected screening criteria based on the 2015 site soil data and were dropped as COPCs in the 2017 and 2022 PN ERAs. As of the most recent 2022 PN ERA, the list of soil COPCs included metals (arsenic, copper, lead and zinc), free cyanide, and PHC F4. Overall, based on the soil samples collected in 2015, exceedances of soil screening criteria were found to be localized and generally limited to the eastern portion of the PN site, suggesting that contamination was not a result of widespread atmospheric deposition and that further accumulation of contaminants in soil was unlikely to occur over time (Ecometrix, 2023a).

A.4.1.1 2024 Soil Monitoring Program

A.4.1.1.1 Chemical Soil COPCs

Non-radiological chemical parameters were screened against the lower of either the MECP's ecological component values (Eco CVs) (MOE, 2011), or the CCME's SQGs for the protection of environmental and human health (CCME, 2010). Where an Eco CV is provided for both plants and soil organisms, and for birds and mammals, the lower of the two values was retained. Where Eco CVs were unavailable, for PAHs and VOCs, the free phase threshold value was used as the screening criteria. Where SQGs were provided for both ecological protection and human health protection, the lower of the two values was retained. Where SQGs were unavailable, interim SQGs from the CCME were retained for the screening assessment. Lastly, in cases where the

selected screening criterion was found to be more conservative than the MECP's Ontario background soil value, the background soil value was retained as the screening criteria since screening criteria should not be set below a reasonable upper end of background (as per Clause 7.2.5.3.2 in CSA N288.6:22).

Based on the results of the recent soil monitoring program, the maximum concentration of zinc (350 µg/g) was found to exceed its selected soil screening criterion (340 µg/g), though this occurred at only one sampling location in an on-site drainage ditch at Site 14-SS6-2 (**Table A-34**). Soils in drainage ditches are likely to represent "worst-case" conditions, as surface runoff during precipitation events is expected to continuously wash metals from nearby surfaces and concentrate them within soils in the drainage ditch. Although this exceedance was observed at this location, it is important to note that the soil concentrations of zinc measured 15 m upstream and 15 m downstream were 110 and 130 µg/g, respectively, both of which meet the soil screening criterion. The maximum concentration of zinc in the 2022 PN ERA (3,200 µg/g) is approximately a full order of magnitude higher than the concentration measured during the recent 2024 sampling event, and zinc concentrations at multiple sampling locations across the site have been decreasing indicating improvement in soil with respect to zinc. Compared with the previous ERAs, arsenic, copper and lead all met their respective soil screening criteria and would no longer be considered soil COPCs. Similarly, cyanide and PHC F4, which exceeded their respective screening criteria in 2015, met these criteria during the 2024 soil sampling event. However, in contrast to the previous soil sampling event, two general soil quality parameters, electrical conductivity and sodium adsorption ratio, exceeded their respective screening criteria at two of the assessed sampling locations.

Table A-34: Screening of Soil Quality Parameters in 2024 samples

Parameters	Units	(1) MECP Eco CV	(2) CCME SQG	(3) ON Background	Selected Soil Screening Criteria	Source	GMS-28-1	GMS-28-2	GMS-28-3	GMS-31-1	GMS-31-2	GMS-31-3	GSM - 26	GSM - 38	SITE 14-SS5- 1	SITE 14-SS5- 2	SITE 14-SS5- 3	SITE 14-SS6- 1	SITE 14-SS6- 2	SITE 14-SS6- 3	SITE 15-1	SITE 15-2	SITE 15-3	SITE 7 - SS4
General Parameters																								
Conductivity	mS/cm	1.4	4	0.57	1.4	(1)	0.075	0.13	0.13	1.2	0.13	0.28	0.19	0.31	**2.6**	**2.3**	0.42	**1.5**	0.091	0.24	0.29	0.26	0.15	0.23
Moisture	%	-	-	-	NA	-	2.3	5.6	3.5	1.5	2.8	9.6	15	13	3.4	4.5	8.1	5.9	2.3	2.6	15	11	7.7	6.5
WAD Cyanide (Free)	ug/g	0.11	8	0.051	0.11	(1)	0.00104	0.00108	0.00203	0.00323	0.00106	0	0	0	0.00093	0.00108	0.00111	0.00219	0.00184	0.00105	0.00228	0.00116	0	0
pH	Unitless	6.0-9.0	6.0-8.0	-	6.0-8.0	(2)	7.78	7.64	7.67	7.94	7.59	7.19	7.34	7.4	8.06	8.02	7.66	8.27	7.78	7.87	7.42	7.39	7.58	7.49
Available (CaCl2) pH	Unitless	6.0-9.0	6.0-8.0	-	6.0-8.0	(2)	7.78	7.64	7.67	7.94	7.59	7.19	7.34	7.4	8.06	8.02	7.66	8.27	7.78	7.87	7.42	7.39	7.58	7.49
Sodium Adsorption Ratio	Unitless	12	12	2.4	12	(1,2)	0.38	0.31	0.3	**13**	0.27	0.24	0.22	3.7	4	7.8	2.5	**31**	0.38	2.2	0.33	0.21	0.26	0.22
Fluoride (F-)	ug/g	-	2000	-	2000	(2)	1.01	0.629	0.6154	0.6895	1.6076	3.1446	9	5	2.2944	1.9249	1.9453	0.9462	0.407	0.5253	2.5341	2.3873	1.6028	1.621
Metals																								
Acid Extractable Aluminum (Al)	ug/g	-	-	-	-	-	2200	3300	3200	3000	6200	16000	19000	18000	3900	3900	2900	2400	3200	2900	4100	7900	6100	7600
Acid Extractable Antimony (Sb)	ug/g	40	40	1.3	40	(1,2)	0.117113	0.55	0.36	0.195417	0.29	0.192684	0.148608	0.17626	0.27	0.9	0.3	0.48	1.1	0.48	0.180305	0.59	0.53	0.185422
Acid Extractable Arsenic (As)	ug/g	40	12	18	18	(3)	1	1.7	1.3	1.7	2.3	2.6	2.2	2.4	1.9	5.3	1.7	2.2	5.1	2.2	1.2	3.6	3.6	1.9
Acid Extractable Barium (Ba)	ug/g	670	2000	220	670	(1)	13	19	23	18	40	84	130	110	30	88	19	24	51	44	25	42	42	48
Acid Extractable Beryllium (Be)	ug/g	8	8	2.5	8	(1,2)	0.118876	0.16675	0.15845	0.151433	0.28	0.65	0.69	0.69	0.199574	0.196886	0.12982	0.121457	0.163851	0.147049	0.195197	0.31	0.25	0.32
Acid Extractable Bismuth (Bi)	ug/g	-	-	-	-	-	0.029566	0.047217	0.0303	0.0455	0.06049	0.104254	0.098957	0.096984	0.062868	0.07582	0.029529	0.053377	0.064478	0.036806	0.047591	0.095557	0.237605	0.078156
Acid Extractable Boron (B)	ug/g	120	-	36	120	(1)	2.229387	6.2	6.7	3.806344	4.862406	5.1	4.580761	6.8	8.3	7.4	3.860754	4.265377	5.2	4.512741	7.2	8.6	6.1	5.7
Hot Water Ext. Boron (B)	ug/g	2	-	0.5	2	(1)	0.069	0.18	0.19	0.55	0.36	0.39	0.19	0.28	0.45	0.51	0.19	0.48	0.25	0.21	0.56	0.7	0.31	0.28
Acid Extractable Cadmium (Cd)	ug/g	1.9	22	1.2	1.9	(1)	0.036642	0.066484	0.052764	0.084144	0.81	0.23	0.18	0.23	0.1	0.22	0.093704	0.12	0.24	0.14	0.066416	0.22	0.15	0.11
Acid Extractable Calcium (Ca)	ug/g	-	-	-	-	-	140000	140000	160000	130000	110000	20000	9600	24000	260000	240000	170000	200000	150000	140000	130000	120000	130000	110000
Acid Extractable Chromium (Cr)	ug/g	160	87	70	87	(2)	7.2	10	8.8	13	19	21	26	28	29	18	8.9	29	23	11	8.4	30	17	18
Chromium (VI)	ug/g	8	1.4	0.66	1.4	(2)	0.03503	0.02075	0.01362	0.03755	0	0	0	0	0.1798	0.07478	0.03997	0.12166	0.05638	0.04933	0	0	0.01845	0
Acid Extractable Cobalt (Co)	ug/g	80	300	21	80	(1)	1.8	2.4	2.6	2.6	5.3	7.2	8.5	8.8	2.6	6.5	3.1	2.9	6.4	3.5	4.3	7.1	5.9	5.3
Acid Extractable Copper (Cu)	ug/g	230	91	92	92	(3)	5.7	11	8.1	9.1	21	16	19	19	13	62	22	25	69	29	26	52	39	14
Acid Extractable Iron (Fe)	ug/g	-	-	-	-	-	8700	11000	9700	9000	15000	21000	24000	23000	9400	11000	9300	9800	15000	11000	8400	16000	14000	15000
Acid Extractable Lead (Pb)	ug/g	32	600	120	120	(3)	2.4	6.8	6.4	5.4	10	15	12	16	11	24	9.5	11	32	17	6.8	40	20	12
Acid Extractable Lithium (Li)	ug/g	-	-	-	-	-	2.9	4.7	4.9	4.3	7.6	14	17	16	6.4	6	3.9	3.4	4.3	4.1	5.6	9.5	7.4	9.2
Acid Extractable Magnesium (Mg)	ug/g	-	-	-	-	-	5300	11000	13000	7400	9400	4800	5400	6200	8900	11000	6200	8700	7000	7700	12000	11000	11000	8700
Acid Extractable Manganese (Mn)	ug/g	-	-	-	-	-	200	240	290	260	360	360	420	560	390	370	210	310	280	240	240	370	340	330
Acid Extractable Mercury (Hg)	ug/g	20	50	0.27	20	(1)	0.003749	0.015629	0.00097	0.014912	0.012471	0.030845	0.042643	0.025467	0.000427	0.004109	0.002183	0.02384	0.006822	0.00806	0.02166	0.03078	0.010828	0.013969
Acid Extractable Molybdenum (Mo)	ug/g	40	40	2	40	(1)	0.224903	0.360788	0.298907	0.33666	0.74	0.446075	0.387123	0.421086	0.61	1.3	0.36203	1.3	3	0.71	0.296694	0.77	0.74	0.51
Acid Extractable Nickel (Ni)	ug/g	270	89	82	89	(2)	3.4	6	6.1	6.6	14	17	19	19	7.5	7.6	5.4	12	13	6.6	47	23	15	12
Acid Extractable Phosphorus (P)	ug/g	-	-	-	-	-	670	660	540	670	700	730	790	1000	500	510	600	510	600	540	680	930	760	820
Acid Extractable Potassium (K)	ug/g	-	-	-	-	-	430	840	990	590	1300	1800	2300	3000	1100	970	660	490	720	720	840	1600	1200	1500
Acid Extractable Selenium (Se)	ug/g	5.5	2.9	1.5	2.9	(2)	0.030076	0.075979	0.046236	0.13598	0.136815	0.281947	0.285436	0.299313	0.073868	0.205447	0.068279	0.063427	0.174247	0.090472	0.155839	0.281874	0.214031	0.130775
Acid Extractable Silver (Ag)	ug/g	40	40	0.5	40	(1,2)	0.016615	0.024994	0.017109	0.029158	0.028906	0.047931	0.06628	0.063013	0.035736	0.066383	0.027501	0.047872	0.103955	0.051165	0.032194	0.073614	0.050657	0.028835
Acid Extractable Sodium (Na)	ug/g	-	-	1300	1300	(3)	99	150	120	790	140	130	150	570	970	1100	250	920	160	220	160	160	170	170
Acid Extractable Strontium (Sr)	ug/g	-	-	-	-	-	180	180	210	180	150	37	25	48	340	360	220	270	200	190	170	170	170	150
Acid Extractable Thallium (Tl)	ug/g	3.6	1	1	1	(2)	0.030258	0.058	0.07	0.05	0.11	0.15	0.16	0.16	0.086	0.066	0.055	0.031143	0.063	0.055	0.056	0.11	0.086	0.12
Acid Extractable Tin (Sn)	ug/g	-	300	-	300	(2)	0.479391	0.677175	0.401801	0.593036	0.865187	0.936885	0.825836	0.867254	0.715216	3.3	1.2	1.5	3.4	1.4	0.747311	2.3	2	4
Acid Extractable Titanium (Ti)	ug/g	-	-	-	-	-	260	250	230	230	320	400	680	660	98	120	230	210	250	220	190	280	280	350
Acid Extractable Uranium (U)	ug/g	33	300	2.5	33	(1)	0.33	0.55	0.3	0.64	0.4	0.53	0.67	0.59	0.37	0.44	0.34	0.34	0.35	0.31	0.49	0.53	0.43	0.48
Acid Extractable Vanadium (V)	ug/g	18	130	86	86	(3)	15	18	15	14	20	33	38	38	13	12	16	13	18	15	13	22	20	22
Acid Extractable Zinc (Zn)	ug/g	340	410	290	340	(1)	28	56	41	39	67	110	66	70	73	270	85	110	**350**	130	46	200	160	140
Petroleum Hydrocarbons + BTEX																								
F1 (C6-C10)	ug/g	320	320	25	320	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F1 (C6-C10) - BTEX	ug/g	320	320	25	320	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F2 (C10-C16 Hydrocarbons)	ug/g	260	260	10	260	(1,2)	0	0	8.5	7	0	0	0	0	0	0	0	0	0	0	0	0	0	9.8
F3 (C16-C34 Hydrocarbons)	ug/g	1700	1700	240	1700	(1,2)	0	53	68	110	70	53	0	55	150	79	200	300	89	78	77	85	83	120

Parameters	Units	(1) MECP Eco CV	(2) CCME SQG	(3) ON Background	Selected Soil Screening Criteria	Source	GMS-28-1	GMS-28-2	GMS-28-3	GMS-31-1	GMS-31-2	GMS-31-3	GSM - 26	GSM - 38	SITE 14-SS5- 1	SITE 14-SS5- 2	SITE 14-SS5- 3	SITE 14-SS6- 1	SITE 14-SS6- 2	SITE 14-SS6- 3	SITE 15-1	SITE 15-2	SITE 15-3	SITE 7 - SS4
F4 (C34-C50 Hydrocarbons)	ug/g	3300	3300	120	3300	(1,2)	0	0	0	130	51	0	0	0	400	140	540	660	170	110	79	97	100	110
Benzene	ug/g	180	0.03	0.02	0.03	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Toluene	ug/g	500	0.37	0.2	0.37	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethylbenzene	ug/g	300	0.082	0.05	0.082	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
o-Xylene	ug/g	350	11	0.05	11	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
p+m-Xylene	ug/g	350	11	0.05	11	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Xylenes	ug/g	350	11	0.05	11	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polycyclic Aromatic Hydrocarbons (PAHs)																								
1-Methylnaphthalene	ug/g	3600	-	0.59	3600	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Methylnaphthalene	ug/g	3600	-	0.59	3600	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acenaphthene	ug/g	46000	-	0.072	46000	(1)	0	0	0	0	0	0	0	0	0	0	0	0.066	0	0	0	0	0	0
Acenaphthylene	ug/g	2900	-	0.093	2900	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthracene	ug/g	32	32	0.16	32	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0.078	0	0	0	0	0	0
Benzo(a)anthracene	ug/g	1	10	0.36	1	(1,2)	0	0	0	0	0	0.003472	0	0.003772	0	0	0	0.081	0	0	0	0.0088	0	0
Benzo(a)pyrene	ug/g	72	72	0.3	72	(1,2)	0	0.0096	0	0	0.0062	0.0071	0.0062	0.011	0	0	0	0.086	0	0	0.0071	0.018	0	0.0065
Benzo(b/j)fluoranthene	ug/g	7600	10	0.47	10	(2)	0	0.013	0.004107	0.038078	0.011	0.013	0.0085	0.014	0	0	0	0.11	0	0	0.012	0.028	0	0.011
Benzo(e)pyrene	ug/g	-	-	-	-	-	0	0.015	0.0055	0	0.01	0.01	0.0073	0.013	0	0	0	0.08	0	0	0.011	0.025	0	0.017
Benzo(g,h,i)perylene	ug/g	13	-	0.68	13	(1)	0.003179	0.009	0	0	0.0072	0.0072	0.0052	0.01	0	0	0.045628	0.073	0	0	0.0095	0.019	0	0.008
Benzo(k)fluoranthene	ug/g	15	10	0.48	10	(2)	0	0	0	0	0	0.003518	0	0.0052	0	0	0	0.040772	0	0	0.004075	0.0081	0	0
Chrysene	ug/g	14	-	2.8	14	(1)	0	0.003636	0	0	0.0061	0.0052	0	0.0051	0	0	0	0.071	0	0	0.004551	0.011	0	0.0062
Dibenzo(a,h)anthracene	ug/g	7600	10	0.1	10	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluoranthene	ug/g	180	180	0.56	180	(1,2)	0	0.0053	0	0.052	0.0099	0.014	0.011	0.015	0	0	0	0.31	0	0	0.01	0.032	0	0.011
Fluorene	ug/g	2800	-	0.12	2800	(1)	0	0	0	0	0	0	0	0	0	0	0	0.07	0	0	0	0	0	0
Indeno(1,2,3-cd)pyrene	ug/g	0.76	10	0.23	0.76	(1)	0	0.004378	0	0	0.004418	0.0059	0.004221	0.0076	0	0	0	0.046121	0	0	0.0057	0.013	0	0.004774
Naphthalene	ug/g	22	22	0.09	22	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perylene	ug/g	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.003828	0	0.003647
Phenanthrene	ug/g	12	50	0.69	12	(1)	0	0.003666	0	0	0.0077	0.0064	0.004688	0.0062	0	0	0	0.42	0	0	0.0056	0.014	0	0.0082
Pyrene	ug/g	99000	100	1	100	(2)	0	0.0069	0	0.045657	0.0095	0.011	0.0096	0.013	0	0	0	0.24	0	0	0.0093	0.027	0	0.009
Volatile Organic Compounds (VOCs)																								
1,1,1,2-Tetrachloroethane	ug/g	4400	-	0.05	4400	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1,1-Trichloroethane	ug/g	35	50	0.05	35	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1,2,2-Tetrachloroethane	ug/g	6700	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1,2-Trichloroethane	ug/g	160	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1-Dichloroethane	ug/g	17	50	0.05	17	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1-Dichloroethylene	ug/g	100	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,2-Dichlorobenzene	ug/g	6.8	10	0.05	6.8	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,2-Dichloroethane	ug/g	29	50	0.05	29	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,2-Dichloropropane	ug/g	50	50	0.05	50	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,3-Dichlorobenzene	ug/g	9.6	10	0.05	9.6	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,3-Dichloropropene (cis+trans)	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,4-Dichlorobenzene	ug/g	7.2	10	0.05	7.2	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acetone (2-Propanone)	ug/g	92000	-	0.5	92000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromodichloromethane	ug/g	5500	-	0.05	5500	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromoform	ug/g	11000	-	0.05	11000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromomethane	ug/g	7300	-	0.05	7300	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Tetrachloride	ug/g	12	50	0.05	12	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlorobenzene	ug/g	12	10	0.05	10	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloroform	ug/g	68	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cis-1,2-Dichloroethylene	ug/g	4600	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cis-1,3-Dichloropropene	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Parameters	Units	(1) MECP Eco CV	(2) CCME SQG	(3) ON Background	Selected Soil Screening Criteria	Source	GMS-28-1	GMS-28-2	GMS-28-3	GMS-31-1	GMS-31-2	GMS-31-3	GSM - 26	GSM - 38	SITE 14-SS5- 1	SITE 14-SS5- 2	SITE 14-SS5- 3	SITE 14-SS6- 1	SITE 14-SS6- 2	SITE 14-SS6- 3	SITE 15-1	SITE 15-2	SITE 15-3	SITE 7 - SS4
Dibromochloromethane	ug/g	10000	-	0.05	10000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dichlorodifluoromethane (FREON 12)	ug/g	80	-	0.05	80	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene Dibromide	ug/g	2000	-	0.05	2000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hexane	ug/g	1500	6.5	0.05	6.5	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Ethyl Ketone (2-Butanone)	ug/g	70	-	0.5	70	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Isobutyl Ketone	ug/g	5100	-	0.5	5100	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl t-butyl ether (MTBE)	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methylene Chloride (Dichloromethane)	ug/g	1.6	50	0.05	1.6	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Styrene	ug/g	34	50	0.05	34	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tetrachloroethylene	ug/g	34	0.6	0.05	0.6	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
trans-1,2-Dichloroethylene	ug/g	4600	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
trans-1,3-Dichloropropene	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichloroethylene	ug/g	200	0.01	0.05	0.05	(3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichlorofluoromethane (FREON 11)	ug/g	32	-	0.25	32	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vinyl Chloride	ug/g	6.8	-	0.02	6.8	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Radionuclides																								
Carbon-14	Bq/g	-	-	-	-	-	NV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon-14	Bq/kg-C	-	-	-	-	-	< 157	< 200	< 161	< 229	< 170	< 232	1193	904	< 108	< 165	< 182	< 155	< 228	< 175	< 106	215	< 145	258
Cesium-134	Bq/kg	-	-	-	-	-	0.35	0.299	0.197	0.218	0.465	0.801	0.225	0.579	0.284	0.0635	0.0486	0.191	0.126	0.149	0.374	0.3	0.152	0.37
Cesium-137	Bq/kg	-	-	-	-	-	-0.0689	0.231	0.0526	1.27	0.111	2.25	2.95	1.66	0.116	0.702	0.471	0.144	0.321	0.0154	0.13	0.773	0.556	0.671
Cobalt-60	Bq/kg	-	-	-	-	-	0.193	0.876	0.133	0.308	0.299	0.428	0.371	0.455	0.382	0.65	0.0239	0.34	0.162	0.508	1.34	0.0356	0.926	0.0282
Iodine-131	Bq/kg	-	-	-	-	-	-0.528	1.94	1.03	0.26	2.6	0.785	0.865	2.56	1.22	2.38	3.15	0.289	1.43	2.05	0.686	0.905	0.346	0.791
Potassium-40	Bq/kg	-	-	-	-	-	293	286	304	368	447	657	674	682	273	175	236	190	253	236	268	305	310	493
Thorium - Series	Bq/kg	-	-	-	-	-	6.75	8.13	5.52	1.2	13.6	25.2	25.4	24.9	3.8	5.78	5.96	4.5	8.56	4.61	5.03	9.62	11.2	15.5
Tritium (Hydrogen-3)	Bq/kg	-	-	-	-	-	11.8	17.4	16.1	11.1	19.7	32.8	154	140	57.7	30.3	103	133	10.1	9.97	42.3	40.4	30.4	31
Uranium - Series	Bq/kg	-	-	-	-	-	8	9.48	7.77	9.22	15.8	23	22.8	22.9	11	7.38	7.39	5.11	7.08	6.82	8.9	10.3	12.2	16
Other parameters																								
Total Carbon	mg/kg	-	-	-	-	-	42000	55000	57000	42000	53000	41000	41000	45000	76000	79000	50000	71000	57000	57000	72000	68000	60000	59000
Total Organic Carbon	mg/kg	-	-	-	-	-	5600	10000	9300	6800	21000	33000	26000	40000	7200	8700	11000	11000	10000	10000	28000	34000	22000	24000

Note:

Bold Exceeds selected screening criteria

Lowest of the Plants & Soil Organisms or Mammals & Birds Component Values were used from MOE 2011, Table 2 - Full Depth, Potable Water Scenario, Coarse soil, Commercial/Industrial Land Use.
Yellow highlighted values indicate exceedances of selected soil criteria. Sampling locations presented in **Figure 4-11**.
References:

1. Ontario Ministry of the Environment (MOE). 2011. Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario. Standards Development Branch. April.
2. CCME. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health. Accessed July 2021.
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A.4.1.1.2 Radiological Soil COPCs

Compared with the 2015 soil monitoring event, the maximum measured concentrations of C-14 and H-3 were found to have increased approximately 2.1- and 1.7-times, with the maximum concentrations being measured at the same sampling location (GMS-26) during both the 2015 and the recent 2024 soil monitoring program. Co-60, Cs-134 and Cs-137 were all previously reported as being measured below laboratory detection limits. Although detection limits in 2024 did change slightly, these radionuclides were measured above detection in some of the 2024 soil samples. Cs-137 is not specifically associated with PN operations and exists in the environment mainly as a result of historic atmospheric weapons testing. The maximum measured concentration of K-40 remains comparable between the previous and recent soil sampling events. The maximum concentration of I-131 was reported as below the laboratory detection limit. Lastly, the maximum reported concentrations for the Th-series and U-series naturally occurring radionuclides were 25.4 Bq/kg and 23 Bq/kg, respectively.

In general, K-40 is environmentally abundant and is not associated with station operations. The cesium and cobalt isotopes are included as COPCs to address potential concern about deposition of particulate activity. Only Cs-134 and Co-60 are specific to reactor operations, and these are usually not detected in PN's annual environmental monitoring program (Ecometrix, 2023a). The presence of Cs-137 is primarily due to historic atmospheric weapons test fallout and not reactor operations. However, exposure to Cs-134, Cs-137, and Co-60 in soil are included in the public dose calculations in the interest of public safety.

A.4.2 Groundwater

A.4.2.1 Groundwater Flow

Eight hydrostratigraphic units (HUs) have been identified beneath the PN site. The eight HUs have been grouped into four primary groundwater flow systems. These include the "shallow groundwater system" (HU 1-3); "intermediate overburden groundwater system" (HU 6); "deep overburden groundwater system" (HU 7) and the "shallow bedrock groundwater system" (HU 8). HUs 4 and 5 are not always observed, and where they are observed, are generally thin and are grouped into the shallow groundwater system. The shallow groundwater system is an aquifer, and the intermediate overburden and bedrock groundwater flow systems are considered to be aquitards. The deep overburden groundwater system may represent an aquifer; however, contaminant migration into this HU from overlying HUs is considered to be limited due to the low permeability of the till materials in HU 6.

Groundwater flow within the PN site is significantly influenced by the inactive Turbine Auxiliary Bay foundation drainage system located beneath the deep building foundations. The inactive Turbine Auxiliary Bay foundation drainage system is used to control groundwater beneath the building. Groundwater from the Turbine Auxiliary Bay foundation drains flows into each unit's sump and then is discharged via a monitored pathway to the intake channel via pumping. Groundwater from the granular horizons in the Lower Till and the granular foundation backfill is collected in the foundation drains. The drainage system has locally lowered groundwater levels

below the level of Lake Ontario, creating a hydraulic sink that captures groundwater beneath and immediately adjacent to the PN reactor buildings (SENES, 2007). Measured flow into the Turbine Auxiliary Bay foundation drains is on the order of about 25 and 77 m^3/day for PNGS Units 1-4 and U5-8, respectively. Estimated horizontal flow velocities in groundwater across the site range from 0.3 to 11 m/y (CH2M, 2000).

The vacuum building ramp sump (VBRS) is also a hydraulic sink for the south portion of the PNGS Units 1-4 side. The VBRS is located at the bottom of a truck ramp that is installed at basement elevation of the vacuum building and collects shallow groundwater in the vicinity of the building. During operations the groundwater collected in the VBRS is also discharged via a monitored pathway to the forebay.

Other subsurface features that have the potential to influence groundwater flow at the site include the RLWMS foundation drains and the reactor building (RB) foundation drains. The RLWMS foundation drains and sumps are located at a lower elevation than the TAB foundation drains. The RB foundation drains are installed at a higher elevation and may intercept shallow groundwater.

A.4.2.2 Groundwater Quality

A.4.2.2.1 Chemical COPCs in Groundwater

Screening benchmarks for non-radiological COPCs included Ontario MECP Site Condition Standards (SCS), specifically Table 3 (Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition) or Table 9 (Generic Site Condition Standards for Use within 30 m of a Water Body in a Non-Potable Ground Water Condition) standards (MOE, 2011). For substances without MECP SCS, groundwater data were compared against screening levels based on 10 times (10x) the lowest of the Ontario Provincial Water Quality Objectives (PWQO) and the CCME water quality guidelines. The 10x factor is consistent with the MECP derivation of the groundwater to surface water pathway component values (GW3), which assumes at least 10-fold dilution of groundwater in surface water (MOE, 2011).

A monitored natural attenuation program (MNA) was implemented in the Units 1 to 4 Standby Generators (SG-A) area, SG-A Overflow area, and the Units 5 to 8 Standby Generators (SG-B) area in 2011, following remedial activities. The SG-A area is monitored annually, the other areas are monitored biennially.

In total, within the MNA areas, one (1) monitoring well was sampled in 2021 and twenty-four (24) monitoring wells were sampled in 2022. Six (6) monitoring wells were monitored in 2023; however, consistent with the PN Sampling Analysis Plan and GWMP, none of the wells were sampled as free phase product was found in all six wells. Free phase product thicknesses were measured and were found to be comparable with historical monitoring results in recent years.

Concentrations of PHC F2 and PHC F3 were found to have exceeded their respective MECP SCS in both 2021 and 2022 at three MNA monitoring well locations. Similarly, in both 2021, and 2022, maximum concentrations of dissolved iron were also found to exceed the selected

screening criteria of 3,000 µg/L, derived by multiplying the Ontario PWQO value of 300 µg/L by a factor of 10 as described above. All exceedances were measured in close proximity to PNGS Units 1-4 and occurred in wells drilled to approximately the same depth (~15 m below ground surface). The localized presence of PHCs and iron at concentrations above the groundwater evaluation criteria are expected in these areas, where remediation using a natural monitored attenuation approach is ongoing.

In 2022, one monitoring well associated with each of the East and West Landfills was sampled for the analysis of dissolved iron (MW-024-20 and MW-205-35). Concentrations of iron were found to be 1,000 µg/L and 1,900 µg/L, respectively, and remained within the historical range and below the evaluation criteria of 3,000 µg/L.

Although there are exceedances reported for PHCs and dissolved iron, these chemical constituents are not expected to pose adverse effects to human health and the environment. As noted in the 2022 PN ERA, continued monitoring has shown that PHCs are not migrating from groundwater to the intake channel or Lake Ontario. Human receptors are restricted from accessing the intake channel and recreational activities would occur further out into the lake, away from any potential groundwater inputs to Lake Ontario. Furthermore, the nearest water supply plant (WSP) is situated approximately 7 km east of the PN site in Ajax, Ontario; concentrations of any COPCs in groundwater would thus be subject to considerable dilution before they could migrate to a point of water intake for human consumption. With respect to dissolved iron, no health risks are expected based on the same assumptions provided above. Furthermore, the Ontario PWQO from which the dissolved iron screening criteria is derived is based on the protection of freshwater aquatic life and is considered extremely conservative for assessing risk to humans.

Similarly, groundwater COPCs are not expected to pose any risks to ecological receptors at the PN site. Most terrestrial ecological receptors are unlikely to be exposed to groundwater as there is no reasonable complete exposure pathway. Continued monitoring has shown that aquatic receptors most at-risk of potentially contacting discharged groundwater (e.g., benthic invertebrates, bottom-feeding and pelagic fish in Lake Ontario) are not at risk as any groundwater COPCs discharging into the lake are sufficiently diluted and COPC concentrations within sampled lake water are consistently measured below screening guidelines protective of ecological health.

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Appendix B Hazard Quotients for Atmospheric COPCs for Human Health Air Quality Screening

Table B-1: Hazard Quotients for TSP during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr TSP (Total)	Annual TSP (Total)
		unitless	unitless
R1	Local Harvesting Area 1 [a]	**2.6**	0.4
R2	Local Harvesting Area 2 [a]	**2.4**	0.4
R3	Local Harvesting Area 3 [a]	**2.5**	0.4
R20	Industrial/Commercial Worker	**13.7**	0.8
R21	Sport Fisher	0.8	0.4
R22	Correctional Institute (C2)	**1.0**	0.4
R23	Farm	0.7	0.4
R24	Dairy Farm	0.5	0.4
R25	Urban Resident/Harvester [b] (WNW)	**2.0**	0.4
R26	Urban Resident/Harvester [b] (NW)	**2.2**	0.4
R27	Urban Resident/Harvester [b] (NNW)	**2.5**	0.4

Note:
Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-2: Hazard Quotients for PM_{10} during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr PM10 (Total)
		unitless
R1	Local Harvesting Area 1 [a]	**1.5**
R2	Local Harvesting Area 2 [a]	**1.4**
R3	Local Harvesting Area 3 [a]	**1.4**
R20	Industrial/Commercial Worker	**6.6**
R21	Sport Fisher	0.7
R22	Correctional Institute (C2)	0.8
R23	Farm	0.6
R24	Dairy Farm	0.5
R25	Urban Resident/Harvester [b] (WNW)	**1.2**
R26	Urban Resident/Harvester [b] (NW)	**1.3**
R27	Urban Resident/Harvester [b] (NNW)	**1.4**

Note:
Highlighted cell indicates HQ>1.

[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-3: Hazard Quotients for $PM_{2.5}$ during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr $PM_{2.5}$ (Total)	Annual $PM_{2.5}$ (Total)
		unitless	unitless
R1	Local Harvesting Area 1 [a]	0.9	0.8
R2	Local Harvesting Area 2 [a]	0.8	0.8
R3	Local Harvesting Area 3 [a]	0.9	0.8
R20	Industrial/Commercial Worker	**3.2**	0.9
R21	Sport Fisher	0.5	0.8
R22	Correctional Institute (C2)	0.6	0.8
R23	Farm	0.5	0.8
R24	Dairy Farm	0.4	0.8
R25	Urban Resident/Harvester [b] (WNW)	0.8	0.8
R26	Urban Resident/Harvester [b] (NW)	0.8	0.8
R27	Urban Resident/Harvester [b] (NNW)	0.8	0.8

Note:
Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-4: Hazard Quotients for NO_2 during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	98th-% 1-hr NO_2 (Total)	Max 1-hr NO_2 (Total)	Max 24-hr NO_2 (Total)	Annual NO_2 (Total)
		unitless	unitless	unitless	unitless
R1	Local Harvesting Area 1 [a]	0.8	0.7	0.3	0.5
R2	Local Harvesting Area 2 [a]	0.8	0.7	0.3	0.5
R3	Local Harvesting Area 3 [a]	0.8	0.6	0.3	0.5
R20	Industrial/Commercial Worker	**1.1**	0.7	0.3	0.5
R21	Sport Fisher	**1.7**	0.4	0.4	0.6
R22	Correctional Institute (C2)	0.6	0.4	0.2	0.4
R23	Farm	0.6	0.2	0.1	0.4
R24	Dairy Farm	0.6	0.2	0.1	0.4
R25	Urban Resident/Harvester [b] (WNW)	0.9	0.6	0.3	0.5
R26	Urban Resident/Harvester [b] (NW)	0.8	0.6	0.2	0.5
R27	Urban Resident/Harvester [b] (NNW)	0.8	0.7	0.3	0.5

Note:

Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-5: Hazard Quotients for BaP during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr BaP (Total)	Annual BaP (Total)
		unitless	unitless
R1	Local Harvesting Area 1 [a]	0.8	**2.0**
R2	Local Harvesting Area 2 [a]	0.8	**2.0**
R3	Local Harvesting Area 3 [a]	0.8	**2.0**
R20	Industrial/Commercial Worker	0.8	**2.0**
R21	Sport Fisher	0.8	**2.0**
R22	Correctional Institute (C2)	0.8	**2.0**
R23	Farm	0.8	**2.0**
R24	Dairy Farm	0.8	**2.0**
R25	Urban Resident/Harvester [b] (WNW)	0.8	**2.0**
R26	Urban Resident/Harvester [b] (NW)	0.8	**2.0**
R27	Urban Resident/Harvester [b] (NNW)	0.8	**2.0**

Note:
Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Appendix C Predicted Radiation Dose to Human Receptors

Table C-1: Estimated Radiation Dose by Pathway to Human Receptors

Human Receptor	COPC	Radiological Dose by Pathway during Project Phases (μSv/a)												
		Air (internal)	Air (external)	Water (internal)	Water (external)	Soil (internal)	Soil (external)	Sediment (internal)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total by COPC
Farm NE - Adult	C-14	5.19E-06	5.97E-09	1.32E-06	1.33E-10	8.36E-14	3.78E-12	5.22E-10	2.78E-10	0.00E+00	4.27E-04	8.61E-04	3.55E-04	1.65E-03
	Cs-134	0.00E+00	0.00E+00	6.96E-05	1.40E-05	1.80E-10	5.22E-05	6.50E-06	1.55E-02	0.00E+00	1.29E-02	1.10E-05	1.16E-07	2.85E-02
	HTO	7.71E-02	0.00E+00	2.77E-02	9.03E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.26E-05	5.38E-02	4.25E-03	1.64E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-05	7.03E-03	6.90E-04	7.74E-03
	Total by pathway	7.71E-02	5.97E-09	2.78E-02	9.17E-04	1.80E-10	5.22E-05	6.50E-06	1.55E-02	0.00E+00	1.34E-02	6.17E-02	5.30E-03	2.02E-01
Farm NE - Child 10y	C-14	7.41E-06	5.97E-09	7.22E-07	1.33E-10	1.58E-12	3.78E-12	9.90E-09	2.78E-10	0.00E+00	4.14E-04	8.37E-04	2.69E-04	1.53E-03
	Cs-134	0.00E+00	0.00E+00	2.04E-05	1.40E-05	1.83E-09	5.22E-05	6.58E-05	1.55E-02	0.00E+00	6.67E-03	5.40E-06	4.63E-08	2.23E-02
	HTO	9.17E-02	0.00E+00	1.38E-02	7.52E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.74E-05	4.56E-02	2.92E-03	1.55E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-05	6.79E-03	5.22E-04	7.33E-03
	Total by pathway	9.17E-02	5.97E-09	1.38E-02	7.66E-04	1.83E-09	5.22E-05	6.58E-05	1.55E-02	0.00E+00	7.14E-03	5.33E-02	3.72E-03	1.86E-01
Farm NE - Infant 1y	C-14	5.06E-06	5.97E-09	0.00E+00	5.43E-12	3.52E-12	3.78E-12	2.20E-08	2.78E-10	0.00E+00	2.89E-04	7.10E-04	1.80E-04	1.18E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	5.94E-07	2.31E-09	6.79E-05	8.34E-05	2.02E-02	0.00E+00	2.66E-03	2.81E-06	1.71E-08	2.30E-02
	HTO	6.33E-02	0.00E+00	0.00E+00	3.56E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E-05	4.30E-02	2.23E-03	1.09E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-05	5.94E-03	4.06E-04	6.36E-03
	Total by pathway	6.33E-02	5.97E-09	0.00E+00	3.56E-04	2.32E-09	6.79E-05	8.35E-05	2.02E-02	0.00E+00	2.99E-03	4.97E-02	2.82E-03	1.39E-01
Dairy Farm - Adult	C-14	1.56E-06	1.79E-09	1.74E-07	1.28E-10	0.00E+00	0.00E+00	5.22E-10	2.78E-10	0.00E+00	0.00E+00	2.26E-04	5.54E-04	7.82E-04
	Cs-134	0.00E+00	0.00E+00	8.65E-06	1.35E-05	0.00E+00	0.00E+00	6.50E-06	1.55E-02	0.00E+00	0.00E+00	0.00E+00	1.70E-09	1.55E-02
	HTO	2.33E-02	0.00E+00	6.78E-03	4.31E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.86E-03	1.13E-02	4.96E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-03	7.88E-04	1.88E-03
	Total by pathway	2.33E-02	1.79E-09	6.79E-03	4.44E-04	0.00E+00	0.00E+00	6.50E-06	1.55E-02	0.00E+00	0.00E+00	9.18E-03	1.27E-02	6.78E-02
Dairy Farm - Child 10y	C-14	2.22E-06	1.79E-09	9.57E-08	1.28E-10	0.00E+00	0.00E+00	9.90E-09	2.78E-10	0.00E+00	0.00E+00	2.21E-04	6.14E-04	8.37E-04
	Cs-134	0.00E+00	0.00E+00	2.54E-06	1.35E-05	0.00E+00	0.00E+00	6.58E-05	1.55E-02	0.00E+00	0.00E+00	0.00E+00	5.94E-10	1.56E-02
	HTO	2.77E-02	0.00E+00	3.37E-03	3.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-03	1.50E-02	5.31E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-03	7.59E-04	1.82E-03
	Total by pathway	2.77E-02	1.79E-09	3.38E-03	3.72E-04	0.00E+00	0.00E+00	6.58E-05	1.55E-02	0.00E+00	0.00E+00	7.91E-03	1.64E-02	7.13E-02
Dairy Farm - Infant 1y	C-14	1.52E-06	1.79E-09	0.00E+00	9.99E-14	0.00E+00	0.00E+00	2.20E-08	2.78E-10	0.00E+00	0.00E+00	1.64E-04	8.55E-04	1.02E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.34E-05	2.02E-02	0.00E+00	0.00E+00	0.00E+00	4.35E-10	2.02E-02
	HTO	1.91E-02	0.00E+00	0.00E+00	1.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-03	2.83E-02	5.28E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.13E-04	9.92E-04	1.80E-03
	Total by pathway	1.91E-02	1.79E-09	0.00E+00	1.00E-04	0.00E+00	0.00E+00	8.35E-05	2.02E-02	0.00E+00	0.00E+00	6.26E-03	3.01E-02	7.58E-02
FSHR - Adult	C-14	3.71E-06	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.07E-03	0.00E+00	0.00E+00	9.08E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-01	0.00E+00	0.00E+00	2.74E-01
	HTO	5.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.03E-04	0.00E+00	0.00E+00	5.69E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.88E-04	0.00E+00	0.00E+00	3.88E-04
	Total by pathway	5.60E-02	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.84E-01	0.00E+00	0.00E+00	3.40E-01
FSHR - Child 10y	C-14	5.29E-06	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.79E-03	0.00E+00	0.00E+00	8.80E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-01	0.00E+00	0.00E+00	1.42E-01
	HTO	6.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.93E-04	0.00E+00	0.00E+00	6.74E-02

Human Receptor	COPC	Radiological Dose by Pathway during Project Phases (μSv/a)												
		Air (internal)	Air (external)	Water (internal)	Water (external)	Soil (internal)	Soil (external)	Sediment (internal)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total by COPC
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E-04	0.00E+00	0.00E+00	3.73E-04
	Total by pathway	6.66E-02	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-01	0.00E+00	0.00E+00	2.18E-01
FSHR - Infant 1y	C-14	3.61E-06	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.13E-03	0.00E+00	0.00E+00	6.13E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.64E-02	0.00E+00	0.00E+00	5.64E-02
	HTO	4.59E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.86E-04	0.00E+00	0.00E+00	4.65E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-04	0.00E+00	0.00E+00	2.68E-04
	Total by pathway	4.59E-02	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.34E-02	0.00E+00	0.00E+00	1.09E-01
Urban Resident WNW - Adult	C-14	6.05E-05	6.96E-08	5.49E-06	2.30E-10	9.19E-13	4.16E-11	5.22E-10	2.78E-10	0.00E+00	6.35E-06	8.01E-04	6.87E-08	8.73E-04
	Cs-134	0.00E+00	0.00E+00	2.99E-04	2.26E-05	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.92E-04	8.97E-06	5.05E-12	1.66E-02
	HTO	8.88E-01	0.00E+00	1.18E-02	5.66E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.32E-07	2.93E-02	1.91E-06	9.30E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E-07	3.95E-03	4.31E-07	3.95E-03
	Total by pathway	8.88E-01	6.96E-08	1.21E-02	5.89E-04	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.99E-04	3.40E-02	2.41E-06	9.51E-01
Urban Resident WNW - Child 10y	C-14	8.63E-05	6.96E-08	3.01E-06	2.30E-10	1.74E-11	4.16E-11	9.90E-09	2.78E-10	0.00E+00	6.15E-06	7.82E-04	7.29E-08	8.77E-04
	Cs-134	0.00E+00	0.00E+00	8.78E-05	2.26E-05	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	9.92E-05	4.36E-06	2.19E-12	1.64E-02
	HTO	1.06E+00	0.00E+00	5.89E-03	4.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55E-07	2.47E-02	1.72E-06	1.09E+00
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-07	3.83E-03	4.25E-07	3.83E-03
	Total by pathway	1.06E+00	6.96E-08	5.98E-03	4.94E-04	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	1.06E-04	2.93E-02	2.22E-06	1.11E+00
Urban Resident WNW - Infant 1y	C-14	5.89E-05	6.96E-08	0.00E+00	2.63E-11	3.87E-11	4.16E-11	2.20E-08	2.78E-10	0.00E+00	4.29E-06	6.11E-04	1.03E-07	6.75E-04
	Cs-134	0.00E+00	0.00E+00	0.00E+00	3.01E-06	2.55E-08	7.47E-04	8.34E-05	2.02E-02	0.00E+00	3.95E-05	2.05E-06	1.26E-12	2.10E-02
	HTO	7.29E-01	0.00E+00	0.00E+00	2.27E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.10E-07	2.13E-02	2.42E-06	7.50E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E-07	3.10E-03	5.81E-07	3.10E-03
	Total by pathway	7.29E-01	6.96E-08	0.00E+00	2.30E-04	2.55E-08	7.47E-04	8.35E-05	2.02E-02	0.00E+00	4.44E-05	2.51E-02	3.10E-06	7.75E-01
Harvester -Adult	C-14	7.00E-05	8.05E-08	5.49E-06	2.30E-10	9.19E-13	4.16E-11	5.22E-10	2.78E-10	0.00E+00	5.00E-03	6.85E-04	5.38E-03	1.11E-02
	Cs-134	0.00E+00	0.00E+00	2.99E-04	2.26E-05	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.51E-01	1.16E-05	4.92E-04	1.68E-01
	HTO	1.03E+00	0.00E+00	1.30E-02	5.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.98E-04	3.28E-02	2.20E-02	1.10E+00
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E-04	3.28E-03	3.47E-03	6.96E-03
	Total by pathway	1.03E+00	8.05E-08	1.33E-02	6.22E-04	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.56E-01	3.68E-02	3.14E-02	1.28E+00
Harvester - Child 10y	C-14	9.99E-05	8.05E-08	3.02E-06	2.30E-10	1.74E-11	4.16E-11	9.90E-09	2.78E-10	0.00E+00	4.84E-03	5.13E-04	3.68E-03	9.13E-03
	Cs-134	0.00E+00	0.00E+00	8.78E-05	2.26E-05	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	7.80E-02	4.64E-06	2.02E-04	9.44E-02
	HTO	1.22E+00	0.00E+00	6.46E-03	4.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.37E-04	2.23E-02	1.22E-02	1.26E+00
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-04	2.44E-03	2.08E-03	4.73E-03
	Total by pathway	1.22E+00	8.05E-08	6.55E-03	5.22E-04	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	8.35E-02	2.52E-02	1.81E-02	1.37E+00
Harvester - Infant 1y	C-14	6.82E-05	8.05E-08	0.00E+00	2.63E-11	3.87E-11	4.16E-11	2.20E-08	2.78E-10	0.00E+00	3.37E-03	3.73E-05	2.65E-03	6.13E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	3.01E-06	2.55E-08	7.47E-04	8.34E-05	2.02E-02	0.00E+00	3.11E-02	1.93E-07	8.46E-05	5.21E-02
	HTO	8.42E-01	0.00E+00	0.00E+00	2.56E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.23E-04	1.72E-03	9.11E-03	8.53E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E-04	1.83E-04	1.52E-03	1.85E-03
	Total by pathway	8.42E-01	8.05E-08	0.00E+00	2.59E-04	2.55E-08	7.47E-04	8.35E-05	2.02E-02	0.00E+00	3.49E-02	1.94E-03	1.34E-02	9.13E-01
Industrial - Adult	C-14	1.50E-05	1.73E-08	1.52E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-05
	Cs-134	0.00E+00	0.00E+00	8.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.29E-05

Human Receptor	COPC	Radiological Dose by Pathway during Project Phases (µSv/a)												
		Air (internal)	Air (external)	Water (internal)	Water (external)	Soil (internal)	Soil (external)	Sediment (internal)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total by COPC
	HTO	2.18E-01	0.00E+00	1.24E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total by pathway	2.18E-01	1.73E-08	1.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-01
C2 - Adult	C-14	1.21E-05	1.39E-08	6.61E-06	2.67E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.87E-05
	Cs-134	0.00E+00	0.00E+00	3.61E-04	2.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.63E-04
	HTO	1.79E-01	0.00E+00	5.39E-03	4.57E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total by pathway	1.79E-01	1.39E-08	5.76E-03	4.81E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-01
C2 - Child 10y	C-14	1.73E-05	1.39E-08	3.63E-06	2.67E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E-05
	Cs-134	0.00E+00	0.00E+00	1.06E-04	2.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-04
	HTO	2.13E-01	0.00E+00	2.68E-03	3.81E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total by pathway	2.13E-01	1.39E-08	2.79E-03	4.05E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-01

Table C-2: Concentrations of Radionuclides in Environmental Media

Environmental Media	Location	Unit	Estimated Point Concentrations of Radionuclides			
			C-14	Cs-134	HTO	OBT
Outdoor air	Farm NE	Bq/m3	7.28E-05	0.00E+00	4.32E-01	0.00E+00
	Dairy Farm	Bq/m3	2.18E-05	0.00E+00	1.30E-01	0.00E+00
	Sport Fisher	Bq/m3	5.19E-03	0.00E+00	3.14E+01	0.00E+00
	Urban Resident WNW	Bq/m3	8.47E-04	0.00E+00	4.98E+00	0.00E+00
	Harvester	Bq/m3	9.81E-04	0.00E+00	5.75E+00	0.00E+00
	Industrial	Bq/m3	9.15E-04	0.00E+00	5.30E+00	0.00E+00
	C2	Bq/m3	1.69E-04	0.00E+00	1.00E+00	0.00E+00
	On-Site Worker	Bq/m3	4.49E-03	0.00E+00	2.62E+01	0.00E+00
Loam	Farm NE	Bq/kg(dw)	2.67E-07	1.76E-05	0.00E+00	0.00E+00
	Dairy Farm	Bq/kg(dw)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Urban Resident WNW	Bq/kg(dw)	2.93E-06	1.93E-04	0.00E+00	0.00E+00
	Harvester	Bq/kg(dw)	2.93E-06	1.93E-04	0.00E+00	0.00E+00
	C2	Bq/kg(dw)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Deep Well	Well (11.3) in Farm NE	Bq/L	3.93E-07	0.00E+00	9.97E+00	0.00E+00
	Well (22.2) in Farm NE	Bq/L	3.72E-07	0.00E+00	5.18E+00	0.00E+00
	Well (25.1) in Farm NE	Bq/L	3.67E-07	0.00E+00	4.35E+00	0.00E+00
	Well (40.6) in Farm NE	Bq/L	3.39E-07	0.00E+00	1.72E+00	0.00E+00
Loam PoreWater	Dairy Farm	Bq/L	1.25E-07	0.00E+00	5.92E+00	0.00E+00
	Harvester	Bq/L	5.60E-06	5.22E-07	2.61E+02	0.00E+00
Deep Well	Well (21.6) in Dairy Farm	Bq/L	1.12E-07	0.00E+00	1.62E+00	0.00E+00
	Well (22.1) in Dairy Farm	Bq/L	1.12E-07	0.00E+00	1.57E+00	0.00E+00
	Well (24.7) in Dairy Farm	Bq/L	1.10E-07	0.00E+00	1.35E+00	0.00E+00
Well	Well (9.2) in Harvester	Bq/L	5.35E-06	0.00E+00	1.50E+02	0.00E+00
	Well (10.4) in Harvester	Bq/L	5.32E-06	0.00E+00	1.40E+02	0.00E+00
LakeShore Water	Outfall	Bq/L	4.00E-04	6.00E-04	8.78E+00	0.00E+00
Lake Sediment	Outfall	Bq/kg(dw)	2.00E-02	5.70E+00	0.00E+00	0.00E+00
LakeShore Water	A-WSP	Bq/L	3.00E-05	5.00E-05	7.10E-01	0.00E+00

Table C-3: Concentrations of Radionuclides in Food Items

Food Item	Location	Unit	Estimated Point Concentrations of Radionuclides in Food Items for Human Receptors			
			C-14	Cs-134	HTO	OBT
Beef(meat)	Farm NE	Bq/kg(fw)	6.91E-02	8.51E-07	2.50E+01	1.58E+00
Deer	Farm NE	Bq/kg(fw)	6.96E-02	4.82E-07	1.53E+01	1.05E+00
Poultry(egg)	Farm NE	Bq/kg(fw)	1.45E-02	4.94E-08	1.34E+01	1.31E+00
Poultry(meat)	Farm NE	Bq/kg(fw)	2.26E-02	3.33E-07	1.34E+01	1.57E+00
Fruits	Farm NE	Bq/kg(fw)	1.73E-02	9.75E-06	4.10E+01	1.78E+00
Potatoes	Farm NE	Bq/kg(fw)	3.64E-02	4.79E-06	3.60E+01	3.75E+00
Garden Vegetables	Farm NE	Bq/kg(fw)	1.73E-02	9.75E-06	4.10E+01	1.78E+00
Honey Bee	Farm NE	Bq/kg(fw)	1.73E-01	5.30E-08	1.07E+02	1.05E+01
Beef(meat)	Dairy Farm	Bq/kg(fw)	1.96E-02	0.00E+00	6.14E+00	3.23E-01
Poultry(egg)	Dairy Farm	Bq/kg(fw)	0.00E+00	0.00E+00	1.25E+00	1.09E-01
Poultry(meat)	Dairy Farm	Bq/kg(fw)	0.00E+00	0.00E+00	1.25E+00	1.38E-01
Cow(milk)	Dairy Farm	Bq/kg(fw)	6.33E-03	0.00E+00	7.46E+00	7.41E-02
Fruits	Dairy Farm	Bq/kg(fw)	5.19E-03	0.00E+00	7.25E+00	3.16E-01
Potatoes	Dairy Farm	Bq/kg(fw)	1.09E-02	0.00E+00	6.36E+00	6.63E-01
Garden Vegetables	Dairy Farm	Bq/kg(fw)	5.19E-03	0.00E+00	7.25E+00	3.16E-01
Fruits	Urban Resident WNW	Bq/kg(fw)	2.02E-01	1.04E-04	2.80E+02	1.22E+01
Potatoes	Urban Resident WNW	Bq/kg(fw)	4.24E-01	5.13E-05	2.46E+02	2.56E+01
Garden Vegetables	Urban Resident WNW	Bq/kg(fw)	2.02E-01	1.04E-04	2.80E+02	1.22E+01
Deer	Harvester	Bq/kg(fw)	9.39E-01	5.30E-06	2.04E+02	1.40E+01
Deer Organ	Harvester	Bq/kg(fw)	9.39E-01	4.80E-06	2.04E+02	1.40E+01
Canada Goose	Harvester	Bq/kg(fw)	1.14E+00	2.56E-06	2.06E+02	1.25E+01
Mallard	Harvester	Bq/kg(fw)	1.61E+01	1.00E-01	1.33E+01	8.72E-01
Rabbit	Harvester	Bq/kg(fw)	9.39E-01	5.06E-04	2.01E+02	1.50E+01
Garden Vegetables	Harvester	Bq/kg(fw)	2.02E-01	1.04E-04	2.80E+02	1.22E+01
Freshwater plant	Outfall	Bq/kg(fw)	2.36E+00	1.32E-01	6.59E+00	9.66E-01
Freshwater Invertebrate	Outfall	Bq/kg(fw)	2.24E+00	5.94E-02	6.59E+00	1.23E+00
Walleye	Outfall	Bq/kg(fw)	2.28E+00	2.10E+00	6.59E+00	1.23E+00

Appendix D Sample Calculations

Table D-1: Harvester Adult Radiological Dose for HTO from PN Emissions

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Environmental Media Concentrations					
Well (9.2) Bath	$C_{w(B)}$	-	1.50E+02	Bq/L	Table C-2
Well (10.4) DW	$C_{w(D)}$	-	1.40E+02	Bq/L	Table C-2
Ajax WSP	$C_{w(A)}$	-	7.10E-01	Bq/L	Table C-2
Lakeshore Water (At Beach)	$C_{w(L)}$	-	3.33E+00	Bq/L	Table 6-6
Loam Pore Water	$C_{w(P)}$	-	2.61E+02	Bq/L	Table C-2
Sediment Concentration	$C_{sed(dw)}$	-	0.00E+00	Bq/kg_{dw}	Table C-2
Soil Concentration (dry weight)	$C_{s(dw)}$	-	0.00E+00	Bq/kg_{dw}	Table C-2
Outdoor Air Concentration	C_a	-	5.75E+00	Bq/m^3	Table 6-7
Soil Dry Bulk Density (Loam)	ρ_s	-	1.30E+00	kg_{dw}/L	CSA N288.1:20
Soil Mixing Depth	d	-	2.00E-01	m	CSA N288.1:20
Soil Surface Concentration	C_{ss}	$C_{ss} = C_{s(dw)} * \rho_s * d * 1000\ L/m^3$	0.00E+00	Bq_{dw}/m^2	Calculated
Sediment Mixing Depth	d'	-	5.00E-02	m	Assumed
Polygon Fraction Outdoor Air	Pf_a	-	1.00E+00	Unitless	Assumed
Polygon Fraction Soil	PF_s	-	1.00E+00	Unitless	Assumed
Polygon Fraction Water	PF_w	-	1.00E+00	Unitless	Assumed
Polygon Fraction Lake Sediment in Beach	PF_L	-	1.00E+00	Unitless	Assumed
Air Immersion Dose					
Fraction of Time at Location	f_o	-	1.00E+00	Unitless	Assumed
Outdoor Occupancy Factor	f_u	-	2.00E-01	Unitless	CSA N288.1:20
Building Shielding Factor	S_b	-	5.00E-01	Unitless	CSA N288.1:20
Dose Conversion Factor (Immersion)	DCF_a	-	0.00E+00	$(Sv/a)/(Bq/m^3)$	CSA N288.1:20
Air Immersion Dose	D_a	$D_a = C_a * f_o * (f_u + (1 - f_u) * S_b) * DCF_a * PF_a$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{a'}$	$D_{a'} = D_a * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Air Inhalation Dose					
Inhalation Rate	IR_i	-	5.95E+03	m^3/a	CSA N288.1:20

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Dose Conversion Factor (Inhalation)	DCF_i	-	3.00E-11	Sv/Bq	CSA N288.1:20
Air Inhalation Dose	D_i	$D_i = C_a * IR_i * DCF_i * PF_a$	1.03E-06	Sv/a	Calculated
Unit conversion	$D_{i'}$	$D_{i'} = D_i * 1000$ mSv / Sv	1.03E-03	mSv/a	Calculated
Water Immersion Dose					
Diffusion through Wetted Skin	D_f	-	1.05E+02	$L/m^2/a$	CSA N288.1:20
Skin surface area	S_a	-	2.19E+00	m^2	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Occupancy Factor - Bath Water	OF_B	-	1.40E-02	Unitless	CSA N288.1:20
Occupancy Factor - Pool Water	OF_P	-	2.80E-02	Unitless	CSA N288.1:20
Occupancy Factor - Swimming Surface Water (Beach)	OF_S	-	1.40E-02	Unitless	CSA N288.1:20
Removal Factor (Sedimentation)	ρ	-	1.00E+00	Unitless	CSA N288.1:20
Well (9.2) Bath					
Water Use Fraction - Well (9.2) Bath (Bathing)	F_B	-	1.70E-02	Unitless	Assumed
Water Immersion Dose - Well (9.2) Bath (Bathing)	$D_{w(B)}$	$D_{w(B)} = C_{w(B)} * F_B * D_f * S_a * DCF_f * OF_B * \rho$	1.65E-10	Sv/a	Calculated
Unit Conversion	$D_{w(B)'}$	$D_{w(B)'} = D_{w(B)} * 1000$ mSv / Sv	1.65E-07	mSv/a	Calculated
Ajax WSP					
Water Use Fraction - Ajax WSP (Bathing)	F_A	-	9.79E-01	Unitless	Assumed
Water Use Fraction - Ajax WSP (Pool Swimming)	$F_{A'}$	-	1.00E+00	Unitless	Assumed
Bath Immersion Dose - Ajax WSP	$D_{w(AB)}$	$D_{w(AB)} = C_{w(A)} * F_A * D_f * S_a * DCF_f * OF_B * \rho$	4.48E-11	Sv/a	Calculated
Pool Immersion Dose - Ajax WSP	$D_{w(AP)}$	$D_{w(AP)} = C_{w(A)} * F_{A'} * D_f * S_a * DCF_f * OF_P * \rho$	9.14E-11	Sv/a	Calculated
Water Immersion Dose - Ajax WSP	$D_{w(A)}$	$D_{w(A)} = D_{w(AB)} + D_{w(AP)}$	1.36E-10	Sv/a	Calculated
Unit Conversion	$D_{w(A)'}$	$D_{w(A)'} = D_{w(A)} * 1000$ mSv / Sv	1.36E-07	mSv/a	Calculated
Lakeshore Water					
Water Use Fraction - Lakeshore Water (Beach Swimming)	F_L	-	1.00E+00	Unitless	Assumed
Water Immersion Dose - Lakeshore Water (Beach Swimming)	$D_{w(L)}$	$D_{w(L)} = C_{w(L)} * F_L * D_f * S_a * DCF_f * OF_S$	2.14E-10	Sv/a	Calculated
Unit Conversion	$D_{w(L)'}$	$D_{w(L)'} = D_{w(L)} * 1000$ mSv / Sv	2.14E-07	mSv/a	Calculated

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Loam Pore Water					
Water Use Fraction - Loam Pore Water (Bathing)	$F_{B''}$	-	5.00E-03	Unitless	Assumed
Water Immersion Dose - Loam Pore Water (Bathing)	$D_{w(P)}$	$D_{w(P)} = C_{w(P)} * F_{B''} * D_f * S_a * DCF_f * OF_B * \rho$	8.41E-11	Sv/a	Calculated
Unit Conversion	$D_{w(P)'}$	$D_{w(P)'} = D_{w(P)} * 1000$ mSv / Sv	8.41E-08	mSv/a	Calculated
Total Water Immersion Dose					
Total Immersion Dose from Water	D_w	$D_w = D_{w(B)} + D_{w(A)} + D_{w(L)} + D_{w(P)}$	5.99E-10	Sv/a	Calculated
Unit conversion	$D_{w'}$	$D_{w'} = D_w * 1000$ mSv / Sv	5.99E-07	mSv/a	Calculated
Water Ingestion Dose					
Water Ingestion Rate	IR_w	-	3.80E+02	L/a	CSA N288.1:20
Fraction from Water Source - Well (10.4) DW	F_{ing}	-	8.00E-03	Unitless	Assumed
Fraction from Water Source - Ajax WSP	$F_{ing'}$	-	8.30E-01	Unitless	Assumed
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Water Ingestion Dose	D_{ing}	$D_{ing} = (C_{w(D)} * F_{ing} + C_{w(A)} * F_{ing'}) * IR_w * DCF_f * PF_w$	1.30E-08	Sv/a	Calculated
Unit Conversion	$D_{ing'}$	$D_{ing'} = D_{ing} * 1000$ mSv / Sv	1.30E-05	mSv/a	Calculated
Sediment External Dose					
Shoreline Occupancy Factor	OF_s	-	2.00E-04	Unitless	CSA N288.1:20
Shoreline Width Factor	W	-	3.00E-01	Unitless	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Sediment Dilution Factor	DF_s	-	1.00E+00	Unitless	CSA N288.1:20
Sediment External Dose	D_s	$D_s = C_{sed(dw)} * OF_s * W * DCF_f * DF_s$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{s'}$	$D_{s'} = D_s * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Sediment Ingestion Dose					
Sediment Ingestion Rate	IR_{SD}	-	4.00E-06	kg/a fw	CSA N288.1:20
Sediment Exposure Frequency	EF_{sed}	-	4.50E+01	d/y	CSA N288.1:20
Sediment Dilution Factor	DF_s	-	1.00E+00	Unitless	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Internal Sediment Dose	D_{sed}	$D_{sed} = C_{sed(dw)} * IR_{SD} * EF_{sed} * DCF_f * DF_s$	0.00E+00	Sv/a	Calculated

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Unit conversion	$D_{sed'}$	$D_{sed'} = D_{sed} * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Soil External Dose					
Dose reduction factor from surface roughness and terrain irregularities	f_r	-	6.80E-01	Unitless	CSA N288.1:20
Groundshine Shielding Factor	S_g	-	2.00E-01	Unitless	CSA N288.1:20
Dose Conversion Factor (Soil)	DCF_g	-	0.00E+00	(Sv/a)/(Bq/m2)	CSA N288.1:20
Soil External Dose	D_g	$D_g = C_{ss} * f_o * f_r * (f_u + (1 - f_u) * S_g) * DCF_g * PF_s$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{g'}$	$D_{g'} = D_g * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Soil Ingestion Dose					
Soil Intake Rate	IR_s	-	4.00E-06	kg(dw)/d	CSA N288.1:20
Soil Exposure Frequency	t_d	-	1.35E+02	d/y	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Internal Soil Dose	D_{soil}	$D_{soil} = C_{s(dw)} * IR_s * t_d * DCF_f * PF_s$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{soil'}$	$D_{soil'} = D_{soil} * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Terrestrial Plants Dose					
Garden Vegetables Concentration	$C_{GV(DF)}$	-	2.80E+02	Bq/kg fw	Table C-3
Food Intake (Terrestrial Plants)	IR_{TP}	-	4.40E+02	kg/a fw	COG 2013
Local Intake Fraction of Garden Vegetables	$IF_{GV(DF)}$	-	1.33E-02	Unitless	Assumed
Dose Conversion Factor (Food)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Ingestion Dose (Terrestrial Plants)	$D_{TP(DF)}$	$D_{TP(DF)} = C_{GV(DF)} * IF_{GV(DF)} * IR_{TP} * DCF_f$	3.28E-08	Sv/a	Calculated
Unit conversion	$D_{TP(DF)'}$	$D_{TP(DF)'} = D_{TP(DF)} * 1000$ mSv / Sv	3.28E-05	mSv/a	Calculated
Aquatic Animals Dose					
Walleye Concentration	C_{WA}	-	6.59E+00	Bq/kg fw	Table C-3
Food Intake (Walleye)	IR_{WA}	-	6.86E+00	kg/a fw	COG 2013
Local Intake Fraction Walleye	IF_{WA}	-	5.51E-01	Unitless	Table 6-5
Dose Conversion Factor (Food)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Ingestion Dose (Walleye)	D_{WA}	$D_{WA} = C_{WA} * IF_{WA} * IR_{WA} * DCF_f$	4.98E-10	Sv/a	Calculated
Unit conversion	$D_{WA'}$	$D_{WA'} = D_W * 1000$ mSv / Sv	4.98E-07	mSv/a	Calculated
Terrestrial Animals Dose					
Canada Goose (meat) Concentration	$C_{CG(DF)}$	-	2.06E+02	Bq/kg fw	Table C-3

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Deer Organ (meat) Concentration	$C_{DO(DF)}$	-	2.04E+02	Bq/kg fw	Table C-3
Deer (meat) Concentration	$C_{D(DF)}$	-	2.04E+02	Bq/kg fw	Table C-3
Mallard (meat) Concentration	$C_{M(DF)}$	-	1.33E+01	Bq/kg fw	Table C-3
Rabbit (meat) Concentration	$C_{R(DF)}$		2.01E+02	Bq/kg fw	Table C-3
Food Intake (Terrestrial Animals)	IR_{TA}	-	2.56E+02	kg/a fw	COG 2013
Local Intake Fraction Canada Goose (meat)	$IF_{CG(DF)}$	-	2.30E-03	Unitless	Table 6-5
Local Intake Fraction Deer Organ (meat)	$IF_{DO(DF)}$	-	7.00E-03	Unitless	Table 6-5
Local Intake Fraction Deer (meat)	$IF_{D(DF)}$	-	9.80E-03	Unitless	Table 6-5
Local Intake Fraction Mallard (meat)	$IF_{M(DF)}$	-	1.00E-03	Unitless	Table 6-5
Local Intake Fraction Rabbit (meat)	$IF_{R(DF)}$	-	2.00E-03	Unitless	Table 6-5
Dose Conversion Factor (Food)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Ingestion Dose (Terrestrial Animals)	D_{TA}	$D_{TA(DF)} = (C_{CG(DF)} * IF_{CG(DF)} + C_{DO(DF)} * IF_{DO(DF)} + C_{D(DF)} * IF_{D(DF)} + C_{M(DF)} * IF_{M(DF)} + C_{R(DF)} * IF_{R(DF)}) * IR_{TA} * DCF_f$	2.20E-08	Sv/a	Calculated
Unit conversion	$D_{TA'}$	$D_{TA(DF)'} = D_{TA(DF)} * 1000$ mSv / Sv	2.20E-05	mSv/a	Calculated
Harvester Adult Total Dose					
Total Dose	D_{total}	$D_{total} = D_a + D_i + D_w + D_{ing} + D_s + D_{sed} + D_g + D_{soil} + D_{TP} + D_{WA} + D_{TA}$	1.10E-06	Sv/a	Calculated
Unit conversion	$D_{total'}$	$D_{total'} = D_{total} * 1000$ mSv / Sv	1.10E-03	mSv/a	Calculated

Appendix A Detailed Description of Existing Conditions

A.1 Atmospheric Environment

A.1.1 Air Quality

A.1.1.1 Radiological Air Emissions

The PN site emits relatively low quantities of radiological contaminants to the atmosphere during normal operations. Routinely monitored parameters include HTO, iodine-131 (I-131), carbon-14 (C-14), and radioactive noble gases and particulates.

As described in the recent 2024 EMP report (OPG, 2025a), atmospheric HTO emissions within the last 10-years peaked during 2016 and 2017. Since then, HTO emissions decreased over time until 2020, following improved management of airborne HTO. In 2020, HTO emissions increased due to a heat transport system leak in Unit 1 and a moderator purification valve leak on Unit 6. These leaks have since been repaired and HTO emissions have continued to decline from 2021, to 2024. In October 2020, a microscrubber was installed on Unit 4 and it was placed into service in 2021. The microscrubber removes a significant portion of the tritium from airborne emissions and converts it into waterborne tritium effluent, which is directed to the Active Liquid Waste Tanks (ALW) for controlled release to the CCW within acceptable limits. Overall, emissions of HTO have gradually decreased between 2020 and 2024 following the noted increase in 2020.

Atmospheric C-14 emissions gradually increased between 2020 and 2023, but were lower than the emissions recorded in 2018 which represent the 10-year high. C-14 emissions were elevated in 2018 due to work associated with the moderator purification system on Units 1 and 6. In 2023, elevated C-14 emissions were attributed to the removal of the Unit 6 moderator purification system in preparation of a planned Unit 6 outage in Q1 and moderator gas purging on Unit 4 in Q2. In 2024, C-14 emissions were lower than in 2023 and were consistent with levels observed between 2020 and 2022 (OPG, 2025a).

As described in the recent 2024 EMP report, radioactive noble gas stack emissions are often measured below instrument detection limits; thus, measurements taken from environmental noble gas monitors located outside of PNGS are used to trend PN noble gas emissions. Argon-41 is the predominant radionuclide measured in noble gas around PN and is associated with operation of PNGS Units 1 and 4. A Mann-Kendall trend analysis indicates that there is not a statistically significant trend in Ar-41 emissions over the last 10 years. In 2020, a notable decrease in Ar-41 emissions was attributed to a decrease in the operating time of Units 1 and 4. In 2021, Ar-41 emissions increased again but have gradually decreased between 2022 and 2024 (OPG, 2025a). Xenon-133 is occasionally measured above the detection limit at PN, though this radionuclide composes a relatively small percentage of noble gas emissions compared with Ar-41. Xe-135 and Iridium-192 were not detected in noble gas emissions at the PN site between 2021 and 2024 (OPG, 2025a). Additionally, radioactive particulates and radioiodine emissions are noted to have a minimal contribution to public dose (OPG, 2025a).

A.1.1.2 Non-Radiological (Chemical) Air Emissions

Emission Summary and Dispersion Modelling Reports

ESDM reports from 2015 (Golder, 2015) and 2017-2020 (Ortech, 2019a, 2019b, 2020, 2021) were consulted to aid in the selection of airborne chemical COPCs in the 2022 PN ERA (Ecometrix, 2023a) and the 2022 PEA and PEA Addendum for PN Safe Storage (Ecometrix, 2023b; Golder and Ecometrix, 2017). This PERA considers the most recent ESDM reports prepared for 2020 to 2024 (Ortech, 2021, 2022, 2023, 2024, 2025) to characterize previous conditions (with 6 operating units) relating to chemical emissions from PNGS.

Contaminant emissions are assessed within the ESDM reports by comparing POI concentrations estimated from PNGS emission rates to POI exposure benchmarks listed in the MECP publication, Air Contaminants Benchmarks (*ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants* (the 'ACB list'). The ACB list encompasses the air standards set out in O. Reg. 419/05, as well as a broader list of additional benchmarks intended to aid facilities in preparing ESDM reports. As of 2018, the modelling of all ESDM-reported contaminants transitioned to AERMOD, with POI concentrations provided for 1-hour, 24-hour, or annual averaging periods depending on the MECP POI limits.

All contaminants with MECP POI standards that are emitted from the PN site were found to have POI concentrations less than their respective MECP POI limits. As part of the ESDM reporting, hydrazine is the subject of a site-specific Maximum Ground Level Concentration (MAXGLC) approval. Between 2020 and 2024, hydrazine was found to have POI concentrations below the approved MAXGLC value.

Updated 2025 Air Quality Monitoring

Past air monitoring studies and the data requirements of this PERA provided the basis for the selection of airborne COPCs for the monitoring program. Several COPCs were identified as relevant to the program, including total suspended particulates (TSP), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), CO, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), volatile organic compounds (VOC; as represented by acrolein) and polycyclic aromatic hydrocarbons (PAH; as represented by benzo[a]pyrene). Measurements of these airborne COPCs were compared against applicable ambient air quality criteria, namely the Canadian Ambient Air Quality Standards (CAAQS) provided by the CCME (ECCC, 2023) and the Ambient Air Quality Criteria (AAQC) provided by the Ontario MECP (MECP, 2023). Of note, acrolein and benzo(a)pyrene were selected as surrogate parameters for VOCs and PAHs, respectively, as these chemicals each have the lowest (i.e., most conservative) AAQC values within their respective chemical groups.

The location of the AQ1 monitoring station was selected by considering various parameters including location within the PN site, exposure to PN-associated air emissions, local obstructions, meteorological conditions, and site accessibility, maintenance and security considerations. The optimal placement of the monitoring station was determined by considering the inlet height, horizontal and vertical distances from the inlet to support structures and the

distance from the inlet to nearby airflow obstructions. The establishment of a single monitoring station follows the siting and network design principles outlined in the CCME National Air Pollution Surveillance (NAPS) QA/QC Guidelines (CCME, 2019) and the Ontario Operations Manual for Air Quality Monitoring in Ontario (MECP, 2016).

In general, the operation of monitoring instrumentation followed a schedule consistent with the NAPS program[1]. Over the course of the program, continuous monitors collected data on an hourly basis for PM_{10} and $PM_{2.5}$, NO_X, CO, and SO_2. The intermittent sampling was conducted to coincide with the intermittent samples collected under the NAPS schedule of 1-in-6 days for TSP and the Ontario MECP schedule of 1-in-12 days for PAHs and VOCs.

A chemiluminescence analyzer was used to measure nitrogen oxides, a gas filter correlation was used for CO and pulsed fluorescence techniques were used to measure SO_2. Continuous instruments were connected to a common data logger, allowing synchronized data acquisition. Samples of TSP and PAHs were collected using High-Volume Air Samplers.

[1] The National Air Pollution Surveillance (NAPS) Program, established in 1969 and coordinated by Environment and Climate Change Canada (ECCC), aims to provide robust and long-term ambient air quality data of a uniform standard across the populated regions of Canada.

A.1.2 Noise

Noise emissions from the PNGS originate from a wide variety of on-site sources. Past acoustic assessments have identified the following sources:

- Standby gas generators (SGs) for both PNGS Units 1-4 and U5-8;
- Emergency power generators (EPGs);
- Auxiliary Diesel Generators;
- Building exhaust and ventilation systems;
- Chillers and air conditioning units;
- Combustion turbine units (CTUs); and
- Emergency pumps.

The most significant sources of noise at the PN site are the SGs, EPGs, CTUs and other emergency equipment, such as pumps operated only during emergency situations (OPG, 2025b).

A.1.2.1 Updated September 2024 Noise Monitoring

The noise monitoring locations were selected based on the Ontario MECP Environmental Noise Guideline (NPC-300; MECP, 2013b)) and the receptor framework established in the most recent PNGS Acoustic Assessment Report (AAR; OPG, 2024g). Sensitive receptors were defined to be located in residential, community, or recreational areas where people may reasonably be expected to experience noise impacts. Building on past AAR receptor locations, noise monitoring stations were strategically placed in close proximity to nearby communities and sensitive ecological receptors located in areas to the north-east and north-west of PNGS to ensure that exposures to existing noise levels may be sufficiently characterized. Specifically, these areas were selected to capture a range of residential and recreational receptors surrounding PNGS, consistent with regulatory guidance, past monitoring practices, and OPG's operational considerations.

Based on these criteria, the following locations were selected (shown in **Figure 4-1**):

- **N1**: Liverpool Road (P4 in EMP). This location corresponds to one of the three residential areas assessed in the AAR (Point of Reception; POR#2).
- **N2**: Sandy Beach Road (P3 in EMP).
- **N3**: Montgomery Park Road (P2 in EMP).

- **N4**: Montgomery Park Road (P6 in EMP). This location is in close proximity to the Fixed Face Earthen Embankment (FFEE), an artificial nesting structure design for Bank Swallow (see **Section 4.5.2**).

The MECP Publication *NPC-300 Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning* (MECP, 2013) outlines sound level limits for outdoor and POW points of reception. Consistent with the guidance document, a "Class 1 area" refers to an acoustic environment typical of a major urban population centre where background sound levels are dominated by human activities, such as road traffic. Comparably, a "Class 2 area" refers to an acoustic environment that has qualities of a Class 1 area during daytime hours (7:00 a.m. to 7:00 p.m.) and qualities of a Class 3 area during nighttime hours (7:00 p.m. to 7:00 a.m.). A "Class 3 area" refers to an area dominated by natural sounds typical of a wilderness or agricultural area, or a small community with minimal road traffic (MECP, 2013).

Larson Davis Class 1 integrating sound level meters (SLM) were used for the collection of sound level data. Instrumentation and procedural guidelines for the measurement of sound as part of the recent noise monitoring program were consistent with the Ontario MECP's NPC-102 (Instrumentation) and NPC-103 (Procedures) publications (MOE, 1978). The SLMs were positioned such that they remained a minimum of 3 m away from any adjacent buildings or structures and a minimum of 1.5 m above the ground surface. Consistent with the MECP NPC-103 guidance document, any noise data deemed to be negatively influenced by weather and poor meteorological conditions (e.g., high winds) were discarded from the dataset to ensure an accurate representation of existing noise conditions without interference from weather-related events. Noise monitoring was completed over a 2-week period in September 2024 using an averaging period of 1-hour for the collection of sound level measurements. A summary of the noise monitoring data and a comparison against the Class 1 and Class 2 sound level limits is provided in **Table 4-5**.

A.2 Surface Water Environment

A.2.1 Water and Sediment Quality

A.2.1.1 Water Quality

LWE-1, located offshore of the stormwater location M5-1 and previously sampled in 2015, was not included in the 2024 sampling program. LWE-1 was initially sampled for the 2014 supplementary study for hydrazine to support the Pickering EMP to determine if hydrazine concentrations in the vicinity of PNGS posed a risk to human and aquatic receptors. The location was specifically chosen because it was 500 m downstream of PNGS based on prevailing plume directions at the time of sampling. Due to its relevance to the 2014 hydrazine program, LWE-1 was included in the 2015 surface water sampling program for analysis of additional parameters to support the 2017 PN ERA. Both the 2014 and 2015 studies demonstrated that concentrations of hydrazine and other parameters were higher at the PNGS Units 5-8 outfall (LW21) than at LWE-1. Based on these outcomes, the 2024 study chose LW21 as more representative for potential exposure to COPCs.

For the Lake Ontario stations, water samples were collected near the surface (0.5 m depth, denoted with a -S after the station name) and at the bottom (0.5 m off bottom, denoted with a -B after the station name) of the water column to capture the vertical profile. Mid-depth samples (denoted by -M after the station name) were collected in Frenchman's Bay and the PNGS outfall locations (LW21 and LW10), as thermal stratification is unlikely in the shallow depths observed in this area. The list of parameters evaluated in 2024 was expanded to include microbes, volatile organics, and radionuclides such as Iodine-131, Thorium-series, and Uranium-series. Results from this program were compared against selected human health and ecological screening criteria. Selection of the applicable human health screening criteria followed the hierarchical decision-tree presented in **Figure A-1** and outlined below:

- The most conservative value between:
    - Health Canada Guidelines for Canadian Drinking Water Quality (Health Canada, 2025); or,
    - Ontario Regulation 169/03: Ontario Drinking Water Quality Standards (MECP, 2020); or,
    - Groundwater Component Values (GW1) for a Potable Water Scenario in coarse textured soils derived from Ontario Regulation 153/04: Records of Site Condition (MOE, 2011); or,
- Guidelines available from other reputable jurisdictions:
    - British Columbia Ministry of Environment (BC MOE) Source Drinking Water Quality Guidelines (BC MOE, 2020); or,

  - United States Environmental Protection Agency (US EPA) 2018 Edition of the Drinking Water Standards and Health Advisories Tables (US EPA, 2018); or,
  - US EPA Regional Screening Levels (RSLs) for tap water (target hazard quotients (THQ) of 0.2) (US EPA, 2024); or,
  - World Health Organization (WHO) Guidelines for Drinking Water, Chapter 9 – Radiological Aspects (WHO, 2020); or,
- Highest observed environmental concentrations reported in published sources:
  - WHO International Programme on Chemical Safety & WHO Task Group on Environmental Health Criteria for Titanium (WHO, 1982); or,
  - Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Cesium (ATSDR, 2004).

Similarly, selection of the applicable ecological screening criteria followed the hierarchical decision tree that is presented in **Figure A-2** and summarized below:

- The most conservative value between:
  - CCME Canadian Water Quality Guidelines (CWQG) for Protection of Aquatic Life (CCME, n.d.); or,
  - Provincial Water Quality Objectives (MECP, 2003); or,
  - Interim Provincial Water Quality Objectives; or,
  - Federal Environmental Quality Guidelines (ECCC, 2016, 2017, 2018, 2019, 2020, 2021a, 2021b, 2021c, 2021d); or,
- Other jurisdictional guidelines:
  - MECP Aquatic Protection Values (MOE, 2011); or,
- Guidelines from other sources and toxicological literature:
  - Suter and Tsao, (1996). *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*.
  - Borgmann et al., (2005). *Toxicity of Sixty-Three Metals and Metalloids to Hyalella Azteca at Two Levels of Water Hardness*.

For guidelines requiring input parameters to determine applicable water quality criteria, site-specific seasonal average values for temperature, pH, total hardness, total alkalinity, and dissolved organic carbon (DOC) were used. **Table A-1** summarizes the guidelines considered,

the derivation of parameter-dependent criteria, and the selection process for the spring samples. **Table A-2, Table A-3, Table A-4** present the screening results for the spring, summer, and fall 2024 sampling events, respectively, using guidelines derived from season-specific input data where applicable.

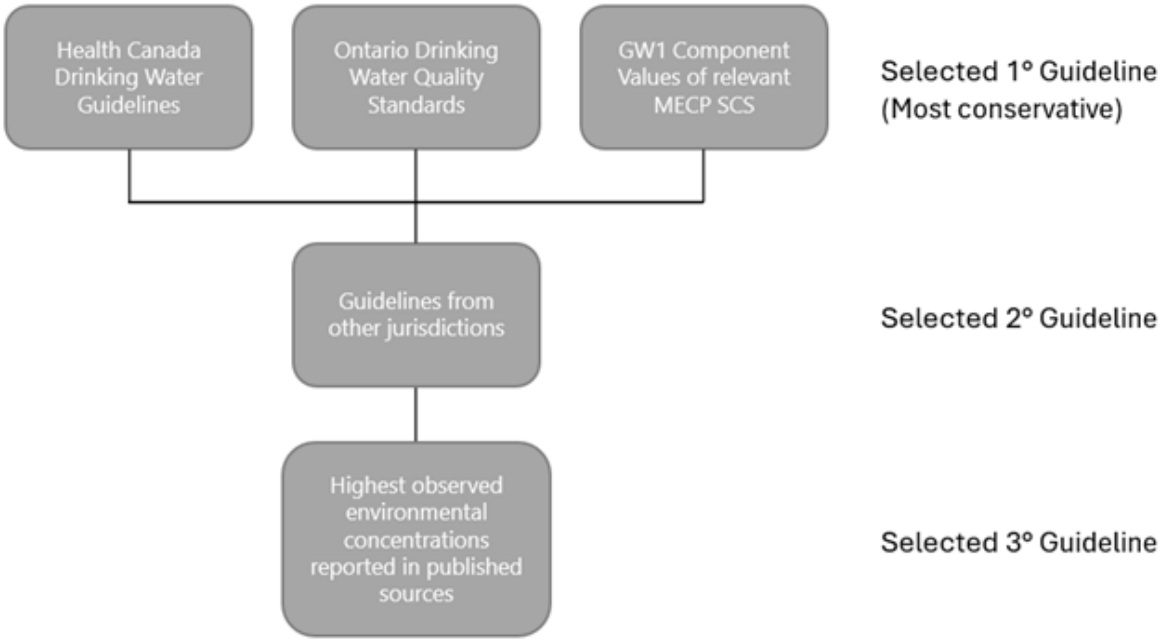


Figure A-1: Hierarchy of Human Health Screening Criteria for Non-Radiological Constituents in Surface Water

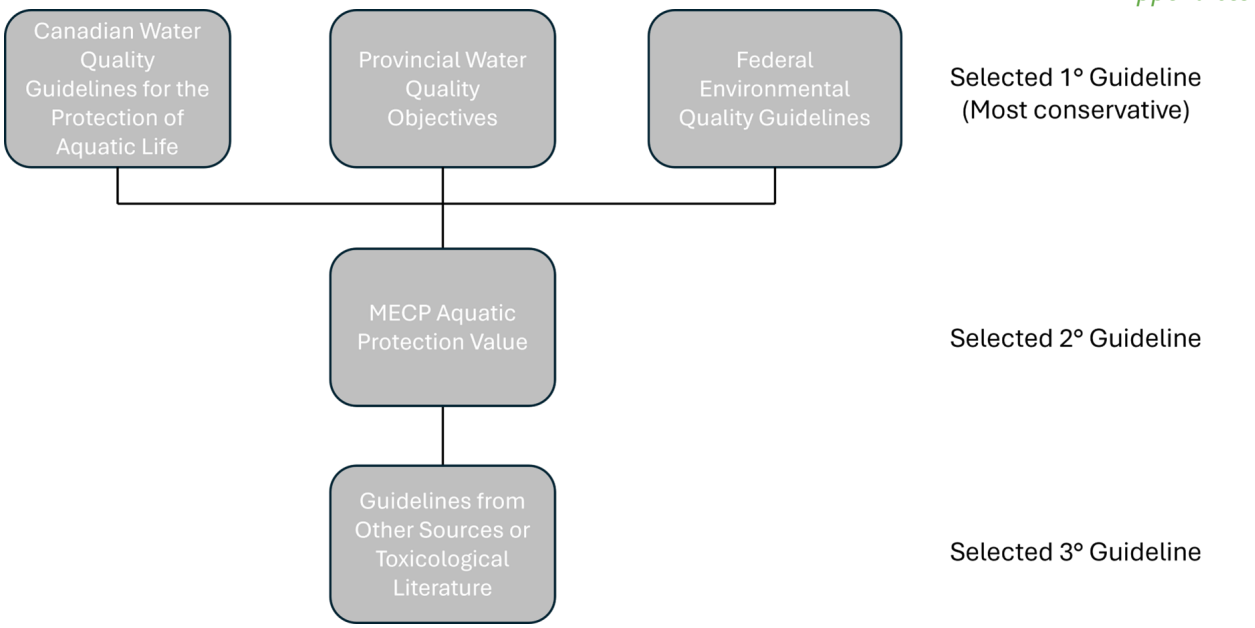


Figure A-2: Hierarchy of Ecological Screening Criteria for Non-Radiological Constituents in Surface Water

Lake Ontario

Exceedances of the Provincial Water Quality Objective (PWQO) upper pH limit of 8.5 were observed in a few samples, including LW9-S, LW9-B, LW2401-S, and LW2402-S during the summer event. The maximum pH value, 8.63, was detected in the LW9-B sample, and represents an exceedance of approximately 1.5% above the guideline. While pH is not considered a chemical contaminant, it is measured as the MECP considers freshwater bodies with a pH between 6.5 to 8.5 to be the most bio-productive. Surface waters with pH above the upper limit of the PWQO may be less productive. However, Lake Ontario is a well-documented productive habitat for aquatic biota, as demonstrated by numerous aquatic biota studies (Barbiero et al., 2001; EC, 2009; Golder, 2007; OPG, 2016, 2023a), including the 2024 and 2025 deepwater and nearshore fish community, macroinvertebrate, and microzooplankton studies (see Section 4.3). Given this, the slight exceedance is likely due to natural spatial variability and is not a cause for concern. Additionally, the CCME CWQG for pH ranges from 6.5 to 9.0 for the protection of freshwater biota, a standard also recommended by the International Joint Commission (IJC, 1977) and the U.S. EPA (US EPA, 1986). This range is considered protective of fish and benthic invertebrates, though pH changes within it may influence the toxicity of other contaminants, such as ammonia. Since all surface water samples collected fell within the CCME guideline range and Lake Ontario remains highly productive, the minor exceedances in pH are not expected to have any adverse impacts on aquatic biota in the lake.

Exceedances of the CCME guidelines for un-ionized ammonia were found in samples taken from the PN intake (LW9-S and LW9-B), the PNGS Units 5-8 outfall (LW21-M), mouth of Frenchman's

Bay (FB1-S), and the four stations centered around the originally proposed intake cap (LW2401-S, LW2402-S, LW2403-B, LW2404-S; **Figure 4-3**) during the summer sampling event. In addition, the CCME total ammonia guideline was exceeded at LW2403-B. It should be noted, however, that ammonia concentrations were elevated across the PN Study area and the reference area (LWC-1) in comparison to the spring sampling event, indicating a system wide increase not associated with PNGS.

While ammonia can be a toxicant, it is also a key component of the nitrogen cycle and a source of bioavailable nitrogen. The occurrence of exceedances only in the summer suggest the possibility that elevated water temperatures in this season contributed to increased decomposition of organic matter and enhanced biological activity, resulting in greater production of nitrogenous waste in the form of ammonia. Hydrazine may also be a source for this observed increase as it can decompose to ammonia in aqueous solution due to oxidation. The rate of this decomposition increases with increases in dissolved oxygen, pH, and temperature. Additionally, certain cyanobacterial genera associated with algal blooms are capable of nitrogen fixation, converting atmospheric nitrogen into various forms including ammonium (Favot et al., 2023). It should be noted that ammonia concentrations declined from summer to fall at all lake sampling locations, consistent with reduced biochemical activity resulting from lower water temperatures.

Adverse health effects for humans as well as birds and mammals are not expected, as ammonia is naturally produced and efficiently metabolized in healthy individuals from these groups (HC, 2013). All sample concentrations were below the 1.5 mg/L odor threshold which induces avoidance behaviors for birds and mammals, thereby limiting ingestion of surface water. Potential risks to aquatic biota in these areas will be assessed further in the 2027 ERA. However, the absence of exceedances near the outfalls and in all lake sampling locations during the spring and fall events, along with waterborne ammonia emissions from PN consistently being below regulatory limits (as detailed in **Section 4.2.2.1.3.1**), suggests that the elevated concentrations reflect a seasonal effect rather than an impact of PN operations.

The total suspended solids (TSS) concentration (Fall 2024) exceeded the applicable ecological guideline of 5.3 mg/L in FB1-B, the Frenchman's Bay entrance, which is a wetland-influenced, shallow embayment. The exceedance in the sample may have been influenced by localized sediment resuspension during the sampling process, given the soft-bottom conditions and limited water exchange in this area. As the exceedance was limited to a single sample and location, it does not indicate a broader water quality concern for Lake Ontario.

The measured concentrations of dissolved and total calcium at most Lake Ontario sampling locations exceeded the screening criteria of 11.6 mg/L, which represents an estimated no-effect concentration calculated as one-tenth of the lowest chronic value (LCV) from Suter and Tsao (1996). However, calcium is a major naturally occurring constituent of the environment, and concentrations in the Great Lakes have been reported to range from 13 to 41.3 mg/L (Dove, 2009; HC, 1987). The 2024 sampling results fall within this natural range, with a maximum measured concentration of 38.6 mg/L. As an essential element for plant and animal life, calcium is generally not considered toxic. In living organisms, calcium metabolism is governed by a

series of efficient homeostatic mechanisms, and any adverse toxic effects are only observed following exposure to extremely large quantities of calcium (HC, 1987). In toxicity tests for chloride, the CCME has used calcium as the cation (i.e., $CaCl_2$) to ensure that effect concentrations are associated with the chloride anion and not with the cation (CCME, 2011). In addition, as a component of water hardness, calcium has the effect of competing with and blocking heavy metal absorption and can decrease an organism's susceptibility to heavy metal toxicity (HC, 1987). Therefore, the measured calcium concentrations from the 2024 sampling program do not pose a risk to non-human biota in Lake Ontario.

Similarly, the measured concentrations of magnesium slightly exceeded the ecological screening criterion of 8,200 µg/L at most Lake Ontario locations, with a maximum concentration of 8,900 µg/L. However, magnesium is a naturally-occurring metal commonly found in surface water and is an essential element for all organisms. The concentrations observed during the 2024 sampling program are consistent with those reported in other Lake Ontario studies, which recorded a maximum concentration of 8,680 µg/L (Dove, 2009). In areas rich in magnesium-containing rocks, surface water can contain magnesium in the concentration range of 10,000 to 50,000 µg/L (HC, 1978). Maximum magnesium concentrations across all samples fell below this range. Additionally, magnesium concentrations did not exceed the U.S. EPA's freshwater screening benchmark of 82,000 µg/L (US EPA, 1993). For these reasons, magnesium is not expected to pose a risk for ecological receptors.

Total hexavalent chromium exceeded the applicable ecological guideline of 1 µg/L in LW2401-B, LW2404-B, and LW9-B during the fall 2024 sampling event. Similarly, the concentrations of total cobalt, copper, and silver exceeded their respective ecological and/or human guidelines in LW9-B during the same event. In contrast, the maximum measured concentrations of cobalt and silver in 2015 were below detection limits, while the maximum copper concentration in 2015 was considerably lower than that observed in LW9-B in 2024. Total hexavalent chromium was not screened in the 2015 samples. Since these metal exceedances were not detected in any other samples near the PN outfall, including the corresponding surface-water sample from the intake, and were below detection limits during the spring and summer sampling events, they likely reflect sporadic variations in lake water quality rather than impacts from PN operations.

The total coliform and *E. coli* levels in certain Lake Ontario surface water samples exceeded the Health Canada guideline that stipulates these microbial parameters must not be detectable (i.e., below method detection limit). However, it should be noted that, total coliforms, whose counts do not correlate well with the incidence of gastrointestinal illness, exceeded this guideline in many more locations than *E. coli*, which does. Ultimately though, both total coliforms and *E. coli* are naturally-occurring in the environment and are not released in the course of normal operations at PNGS. Thus, these levels are not considered hazardous and do not represent a risk from the PNGS.

Hydrazine exceeded the CCME screening guideline of 2.6 µg/L at the sampling station near the PNGS Units 5-8 outfall (LW21) in the spring sampling event with a concentration of 4.2 µg/L. Hydrazine is added to feedwater for oxygen removal and is discharged into the aquatic environment through boiler blowdown and flushing to the intake forebay. Boiler blowdown is

generally continuous and intermittent at PNGS Units 5-8 and intermittent at PNGS Units 1-4. As such, hydrazine concentrations in the CCW discharges from PNGS Units 1-4 and PNGS Units 5-8 are monitored weekly as a part of the ECA requirements for PNGS. Monitoring data indicated that during the week of the spring 2024 sampling event, the concentration of hydrazine in the CCW discharge from PNGS Units 5-8 was above the detection limit of 2 µg/L, measuring at 3 µg/L. However, concentrations fell below the detection limit in the following week. Additionally, 85% of samples from the PNGS Units 5-8 outfall were non-detect over the 2024 monitoring period, as were subsequent samples from LW21 in the 2024 surface water sampling program. Taken together, this suggests that the exceedance observed in spring 2024 was transient and infrequent, with no sustained risk.

Hydrazine is also classified by the International Agency for Research on Cancer (IARC) as a Group 1A carcinogen and the US EPA as a Group B2 carcinogen (probable human carcinogen), and by the European Commission as Category 2 for carcinogenicity (should be regarded as if it is carcinogenic to man). Although there is no Health Canada drinking water guideline for hydrazine, the US EPA estimated that a hydrazine concentration of 0.00001 mg/L corresponds to a cancer risk level of one in one million ($1x10^{-6}$) (EC and HC, 2011; US EPA, 1988), based on a drinking water intake rate of 2 L/day and no exposure amortization. The concentration at LW21 in the spring 2024 sampling event exceeds the drinking water value of 0.00001 mg/L.

The exceedance at LW21 is unlikely to pose a risk to the public for two key reasons. First, hydrazine has a short chemical half-life, ranging from 0.6 to 1.31 days (EC and HC, 2011), and degrades rapidly. Second, conditions during water treatment at nearby water supply plants (WSPs) such as Bowmanville and Oshawa WSPs further promote its degradation. The treatment process involves multiple chlorination steps using sodium hypochlorite, which increases pH, followed by pH adjustment with sulfuric acid (Durham Region, 2022a, 2022b). Hydrazine degradation is highly influenced by pH; alkaline conditions favour its degradation (Choudhary and Hansen, 1998). Additionally, degradation of hydrazine occurs through oxidation in the presence of oxygen; the reaction tends to be catalyzed (i.e., sped up) in the presence of certain compounds like Copper (II) and phosphate ions, which are likely to be present in some amount in drinking water. Hydrazine degradation is also favoured in the presence of organic matter, which also is likely to be present in drinking water. Hydrazine was found to decrease by more than 90% when added to chlorinated, filtered county water after 1 day (Choudhary and Hansen, 1998).

Follow-up hydrazine monitoring was conducted in 2025 to better characterize hydrazine concentrations in the lake water near PNGS and to provide additional information to understand the previous exceedance at LW21 (**Table A-5**). Samples were collected from stations LW21, LW10, LW9, FB1, and LWC1 (**Figure 4-5**). All samples exhibited hydrazine concentrations below the Method Detection Limit (≤0.15 µg/L). Taken together with the results from the 2024 water sampling program and the weekly ECA monitoring data from 2024, these findings suggest that the exceedance observed in spring 2024 was transient and infrequent, with no sustained risk to non-human biota from PNGS operations. Nevertheless, the potential risk associated with this exceedance will be quantitatively evaluated in the 2027 ERA.

No exceedances of the selected ecological or human health guidelines were identified for morpholine.

Frenchman's Bay

As highlighted in **Section 4.2.2.1.2**, the exceedances of the pH, ammonia, and total phosphorous in samples from Frenchman's Bay indicate that the area is nutrient-enriched and exhibits characteristics typical of a wetland.

As in 2015, aluminum, copper, and iron exceeded applicable ecological and/or human benchmarks in 2024 surface water samples from Frenchman's Bay. This is not uncommon for an area like Frenchman's Bay, which is heavily influenced by urban runoff.

Based on the maximum concentrations of these parameters in the 2015 surface water and sediment samples, the 2017 and 2022 PN ERAs found that the HQs for aluminum, copper, and iron exceeded the acceptable risk level of 1 for certain receptors (Aluminum: Muskrat, Bufflehead; Copper: Aquatic plants; Iron: Bufflehead, Trumpeter Swan, Common Tern, and Ring-billed Gull). The ERA concluded that as most of these receptors do not reside exclusively in Frenchman's Bay, the HQs presented were conservative, and the overall communities were not expected to be affected. Additionally, HQs calculated for ecological receptors using a surface water model to estimate aluminum and iron concentrations attributable to PN releases were all below 1. Since the maximum concentrations of aluminum and iron in surface water samples from 2024 are lower than those in 2015, and were below the relevant screening criteria in the associated sediment samples, the conclusions from the 2017 ERA still remain applicable.

Maximum and mean copper concentrations in surface water in 2024 are comparable to those from the 2015 sampling program. Additionally, the ERA determined that the contribution from PN operations to maximum and mean copper concentrations in water at Frenchman's Bay is low, ranging from 9% to 11%. Given the similarities in concentrations across the 2015 and 2024 sampling programs, the conclusions from the PN ERA regarding copper remain valid.

As with the Lake Ontario water samples, calcium and magnesium exceeded their respective ecological screening criteria derived using the LCV from Suter and Tsao (1996). However, as highlighted above, both are naturally occurring, essential elements that are required for biological processes. Magnesium concentrations also remained below the U.S. EPA's freshwater screening benchmark of 82,000 µg/L. While calcium and magnesium concentrations in Frenchman's Bay are slightly higher than those measured in Lake Ontario, this is likely driven by the natural wetland conditions in the area, including slower water exchange and interactions with calcium- and magnesium-rich sediments. Therefore, the calcium and magnesium levels in Frenchman's Bay are not expected to pose a risk to ecological receptors.

Exceedances of the ecological guideline for total hexavalent chromium were observed at LOC3 and PN5-1 during the summer and fall sampling events, and at PN10 in the fall. Hexavalent chromium was not specifically assessed in the PN ERA; however, measured concentrations of total chromium did not exceed applicable ecological guideline. Zirconium exceeded the selected

human health screening guideline of 0.32 µg/L at LOC1 during the summer sampling event. Zirconium was not detected in the 2015 samples, likely due to a higher analytical detection limit (1 µg/L) at the time. In 2024, the lower detection limit (0.1 µg/L) allowed for the identification of low-level background concentrations, with a maximum measured concentration of 0.39 µg/L. Neither chromium nor zirconium are associated with operations at the PN site, and the elevated concentrations observed in water samples from Frenchman's Bay are likely reflective of inputs from urban runoff. As such, it is unlikely that chromium or zirconium pose a risk to non-human or human receptors, respectively, from PN operations.

Finally, the estimated total coliform and *E. coli* bacteria concentrations in surface water samples from Frenchman's Bay in 2024 did not meet the associated Health Canada screening criteria which stipulates that these bacteria must not be detectable. However, as highlighted earlier, *E. coli* and other coliform bacteria are naturally-occurring in the environment and not considered to be hazardous. Though the levels of these bacteria were higher in surface water samples from Frenchman's Bay compared to those from Lake Ontario, this is expected as Frenchman's Bay and other coastal wetlands along the lake's shoreline have been shown to act as reservoirs for *E. coli* (Harrow-Lyle et al., 2024). This is likely due to internal sources such the increased presence of waterfowl and other wildlife, as well as environmental conditions (pH, temperature, moisture) that promote microbial growth. These total coliform and *E. coli* exceedances do not result from normal PNGS operations, and they are not deemed a risk to human health.

Table A-1: Surface Water Quality Screening Criteria for Spring 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria										Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Field Measurements																			
Field Temperature	N/A	Celsius	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Field Measured pH	N/A	pH	6.5-9.0	-	6.5-8.5	-	-	-	-	-	6.5-8.5	(3)	-	-	-	6.5 - 8.5	(19)	-	-[a]
Specific conductivity	N/A	µs/cm	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Conductivity	N/A	µs/cm	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Dissolved Oxygen (DO)	N/A	%	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Dissolved Oxygen (DO)	N/A	mg/L	< 6 **	-	-	-	-	-	-	-	< 6	(1)	-	-	-	-	-	-	-[a]
Turbidity	N/A	NTU	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Calculated Parameters																			
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Total Un-ionized Ammonia	0.0015	mg/L	0.019	-	0.02	-	-	-	-	-	0.019	(1)	-	-	-	-	-	-	-[a]
Total Hardness (CaCO3)	0.50	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Inorganics																			
Total Ammonia-N	0.050	mg/L	0.197[b]	-	-	-	-	-	-	-	0.197	(1)	-	-	-	-	-	-	-[a]
Total Biochemical Oxygen Demand (BOD)	2	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Conductivity	1.0	umho/cm	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Dissolved Organic Carbon	0.40	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Orthophosphate (P)	0.010	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
pH	N/A	pH	6.5-9.0	-	6.5-8.5	-	-	-	-	-	6.5-8.5	(3)	-	-	-	6.5 - 8.5	(19)	-	-[a]
Total Phosphorus	0.020	mg/L	-	-	-	0.02	-	-	-	-	0.02	(3)	-	-	-	-	-	-	-[a]
Total Residual Chlorine	0.003	mg/L	0.0005	-	0.002	-	-	-	-	-	0.002[c]	(3)	-	-	-	-	-	-	-[a]
Total Suspended Solids	1	mg/L	5 mg/L above the background value[d]	-	-	-	-	-	-	-	5.3	(1)	-	-	-	-	-	-	-[a]
Turbidity	0.1	NTU	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-[a]
Nitrite (N)	0.010	mg/L	0.197	-	-	-	-	-	-	-	0.197	(1)	1	-	-	-	-	1	(16)
Nitrate (N)	0.10	mg/L	13	-	-	-	-	-	-	-	13	(1)	10	-	-	-	-	10	(16)
Nitrate + Nitrite (N)	0.10	mg/L	-	-	-	-	-	-	-	-	-	-[a]	-	-	-	-	-	-	-
Metals																			
Dissolved Aluminum (Al)	0.5	µg/L	-	-	-	75[e]	-	-	-	-	75	(3)	-	-	-	-	-	2900	(16)
Total Aluminum (Al)	0.5	µg/L	100[f]	-	-	-	857.09	-	-	-	100	(1)	2900	-	-	-	-	2900	(16)
Dissolved Antimony (Sb)	0.02	µg/L	-	-	-	-	-	-	-	-	20	(3)	-	-	-	-	-	6	(16,17,18)

Parameter	Detection Limit	Units	Ecological screening criteria									Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Total Antimony (Sb)	0.02	µg/L	-	-	-	20	-	1600	-	-	20	(3)	6	6	6	-	-	6	(16,17,18)
Dissolved Arsenic (As)	0.02	µg/L	-	-	-	-	-	-	-	-	5	(1,3)	-	-	-	-	-	10	(16,17)
Total Arsenic (As)	0.02	µg/L	5	-	100	5	-	150	-	-	5	(1,3)	10	10	25	-	-	10	(16,17)
Dissolved Barium (Ba)	0.02	µg/L	-	-	-	-	-	-	-	-	2300	(12)	-	-	-	-	-	1000	(17,18)
Total Barium (Ba)	0.02	µg/L	-	-	-	-	-	2300	4	(14)[g]	2300	(12)	2000	1000	1000	-	-	1000	(17,18)
Dissolved Beryllium (Be)	0.01	µg/L	-	-	-	-	-	-	-	-	1100	(3)	-	-	-	-	-	4	(18)
Total Beryllium (Be)	0.01	µg/L	-	-	1100[h]	-	-	5.3	-	-	1100	(3)	-	-	4	-	-	4	(18)
Dissolved Bismuth (Bi)	0.005	µg/L	-	-	-	-	-	-	-	-	2.5	(15)	-	-	-	-	-	-	-[a]
Total Bismuth (Bi)	0.005	µg/L	-	-	-	-	-	-	2.5	(15)[i]	2.5	(15)	-	-	-	-	-	-	-[a]
Dissolved Boron (B)	10	µg/L	-	-	-	-	-	-	-	-	200	(3)	-	-	-	-	-	5000	(16,17,18)
Total Boron (B)	10	µg/L	1500	-	-	200	-	3550	-	-	200	(3)	5000	5000	5000	-	-	5000	(16,17,18)
Dissolved Cadmium (Cd)	0.005	µg/L	-	-	-	-	-	-	-	-	0.2	(1,3)	-	-	-	-	-	5	(17,18)
Total Cadmium (Cd)	0.005	µg/L	0.2[j]	-	0.2	0.5[k]	-	0.21	-	-	0.2	(1,3)	7	5	5	-	-	5	(17,18)
Dissolved Calcium (Ca)	10	µg/L	-	-	-	-	-	-	-	-	11600	(14)	-	-	-	-	-	-	-[a]
Total Calcium (Ca)	10	µg/L	-	-	-	-	-	-	11600	(14)[g]	11600	(14)	-	-	-	-	-	-	-[a]
Dissolved Cesium (Cs)	0.05	µg/L	-	-	-	-	-	-	-	-	315	(15)	-	-	-	-	-	1	(20)
Total Cesium (Cs)	0.05	µg/L	-	-	-	-	-	-	315	(15)[i]	315	(15)	-	-	-	1	(20)	1	(20)
Dissolved Chromium (Cr)	0.1	µg/L	-	-	-	-	-	-	-	-	64	(13)	-	-	-	-	-	50	(16,17,18)
Total Chromium (Cr)	0.1	µg/L	-	-	-	-	-	64	-	-	64	(13)	50	50	50	-	-	50	(16,17,18)
Chromium (VI)[s]	0.50	ug/L	1	-	1	-	5	-	-	-	1	(1,3)	50	50	25	-	-	25	(18)
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	-	1	-	5	11	-	-	1	(1,3)	50	-	25	-	-	25	(18)
Chromium (+3)[s]	0.5	ug/L	8.9	-	8.9	-	-	-	-	-	8.9	(1,3)	-	-	-	-	-	-	-[a]
Unfiltered Chromium (+3)	0.99	ug/L	8.9	-	8.9	-	-	-	-	-	8.9	(1,3)	-	-	-	-	-	-	-[a]
Dissolved Cobalt (Co)	0.005	µg/L	-	-	-	-	-	-	-	-	0.9	(3)	-	-	-	-	-	3	(18)
Total Cobalt (Co)	0.005	µg/L	-	-	-	0.9	1.13	5.2	-	-	0.9	(3)	-	-	3	-	-	3	(18)
Dissolved Copper (Cu)	0.05	µg/L	-	-	-	-	-	-	-	-	2.133	(6)	-	-	-	-	-	1000	(18)
Total Copper (Cu)	0.05	µg/L	2.95[l]	-	5	5[m]	2.133[n]	6.9	-	-	2.133	(6)	2000	-	1000	-	-	1000	(18)
Dissolved Iron (Fe)	1	µg/L	-	-	-	-	-	-	-	-	290	(8)	-	-	-	-	-	-	-[a]
Total Iron (Fe)	1	µg/L	300	-	300	-	290	-	-	-	290	(8)	-	-	-	-	-	-	-[a]
Dissolved Lead (Pb)	0.005	µg/L	-	-	-	-	6.82	-	-	-	6.82	(9)	-	-	-	-	-	5	(16)
Total Lead (Pb)	0.005	µg/L	4.41[o]	-	25[p]	5	-	2	-	-	4.41	(1)	5	10	10	-	-	5	(16)
Dissolved Lithium (Li)	0.5	µg/L	-	-	-	-	-	-	-	-	14	(14)	-	-	-	-	-	8	(21)
Total Lithium (Li)	0.5	µg/L	-	-	-	-	-	-	14	(14)[g]	14	(14)	-	-	-	8	(21)	8	(21)
Dissolved Magnesium (Mg)	10	µg/L	-	-	-	-	-	-	-	-	8200	(14)	-	-	-	-	-	-	-[a]
Total Magnesium (Mg)	10	µg/L	-	-	-	-	-	-	8200	(14)[g]	8200	(14)	-	-	-	-	-	-	-[a]
Dissolved Manganese (Mn)	0.05	µg/L	260[r]	-	-	-	-	-	-	-	260	(1)	-	-	-	-	-	120	(16)
Total Manganese (Mn)	0.05	µg/L	-	-	-	-	-	-	-	-	260	(1)	120	-	-	-	-	120	(16)
Dissolved Mercury (Hg)	0.01	ug/L	-	-	0.2	-	-	-	-	-	0.2	(3)	-	-	-	-	-	1	(16,17,18)

Parameter	Detection Limit	Units	Ecological screening criteria										Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Mercury (Hg)	0.01	ug/L	0.026	-	-	-	-	0.77	-	-	0.026	(1)	1	1	1	-	-	1	(16,17,18)
Dissolved Methyl Mercury	0.050	ng/L	-	-	-	-	-	-	-	-	4	(1)	-	-	-	-	-	-	-
Total Methyl Mercury	0.050	ng/L	4	-	-	-	-	-	-	-	4	(1)	-	-	-	-	-	-	-
Dissolved Molybdenum (Mo)	0.05	µg/L	-	-	-	-	-	-	-	-	40	(3)	-	-	-	-	-	70	(18)
Total Molybdenum (Mo)	0.05	µg/L	73	-	-	40	-	730	-	-	40	(3)	-	-	70	-	-	70	(18)
Dissolved Nickel (Ni)	0.02	µg/L	-	-	-	-	-	-	-	-	25	(3)	-	-	-	-	-	100	(18)
Total Nickel (Ni)	0.02	µg/L	116.2[k]	-	25	-	-	39	-	-	25	(3)	-	-	100	-	-	100	(18)
Dissolved Potassium (K)	10	µg/L	-	-	-	-	-	-	-	-	5300	(14)	-	-	-	-	-	-	-[a]
Total Potassium (K)	10	µg/L	-	-	-	-	-	-	5300	(14)[g]	5300	(14)	-	-	-	-	-	-	-[a]
Dissolved Selenium (Se)	0.04	µg/L	-	-	-	-	-	-	-	-	1	(1)	-	-	-	-	-	10	(18)
Total Selenium (Se)	0.04	µg/L	1	-	100	-	-	5	-	-	1	(1)	50	50	10	-	-	10	(18)
Dissolved Silicon (Si)	50	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-[a]
Total Silicon (Si)	50	µg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-[a]
Dissolved Silver (Ag)	0.005	µg/L	-	-	-	-	-	-	-	-	0.1	(3)	-	-	-	-	-	100	(18)
Total Silver (Ag)	0.005	µg/L	0.25	-	0.1	-	-	0.12	-	-	0.1	(3)	-	-	100	-	-	100	(18)
Dissolved Sodium (Na)	10	µg/L	-	-	-	-	-	-	-	-	180000	(13)	-	-	-	-	-	200000	(18)
Total Sodium (Na)	10	µg/L	-	-	-	-	-	180000	-	-	180000	(13)	-	-	200000	-	-	200000	(18)
Dissolved Strontium (Sr)	0.050	µg/L	-	-	-	-	-	-	-	-	2500	(10)	-	-	-	-	-	7000	(16)
Total Strontium (Sr)	0.050	µg/L	-	-	-	-	2500	-	-	-	2500	(10)	7000	-	-	-	-	7000	(16)
Dissolved Thallium (Tl)	0.002	µg/L	-	-	-	-	-	-	-	-	0.3	(3)	-	-	-	-	-	2	(18)
Total Thallium (Tl)	0.002	µg/L	0.8	-	-	0.3	-	40	-	-	0.3	(3)	-	-	2	-	-	2	(18)
Dissolved Thorium (Th)	0.05	µg/L	-	-	-	-	-	-	-	-	0.52	(15)	-	-	-	-	-	246	(22)
Total Thorium (Th)	0.05	µg/L	-	-	-	-	-	-	0.52	(15)[i]	0.52	(15)	-	-	-	246	(22)	246	(22)
Dissolved Tin (Sn)	0.2	µg/L	-	-	-	-	-	-	-	-	73	(14)	-	-	-	-	-	2400	(21)
Total Tin (Sn)	0.2	µg/L	-	-	-	-	-	-	73	(14)[g]	73	(14)	-	-	-	2400	(21)	2400	(21)
Dissolved Titanium (Ti)	0.5	µg/L	-	-	-	-	-	-	-	-	27.2	(15)	-	-	-	-	-	15	(23)
Total Titanium (Ti)	0.5	µg/L	-	-	-	-	-	-	27.2	(15)[i]	27.2	(15)	-	-	-	15[v]	(23)	15	(23)
Dissolved Tungsten (W)	0.01	µg/L	-	-	-	-	-	-	-	-	30	(3)	-	-	-	-	-	3.2	(21)
Total Tungsten (W)	0.01	µg/L	-	-	-	30	-	-	-	-	30	(3)	-	-	-	3.2	(21)	3.2	(21)
Dissolved Uranium (U)	0.002	µg/L	-	-	-	-	-	-	-	-	5	(3)	-	-	-	-	-	20	(16,17,18)
Total Uranium (U)	0.002	µg/L	15	-	5	5	-	33	-	-	5	(3)	20	20	20	-	-	20	(16,17,18)
Dissolved Vanadium (V)	0.2	µg/L	-	-	-	-	-	-	-	-	6	(3)	-	-	-	-	-	6.2	(18)
Total Vanadium (V)	0.2	µg/L	-	-	6	6	120	20	-	-	6	(3)	-	-	6.2	-	-	6.2	(18)
Dissolved Zinc (Zn)	0.1	µg/L	15.89[e]	-	-	-	-	-	-	-	15.89	(1)	-	-	-	-	-	5000	(18)
Total Zinc (Zn)	0.1	µg/L	-	-	30	20	-	89	-	-	20	(3)	-	-	5000	-	-	5000	(18)
Dissolved Zirconium (Zr)	0.1	µg/L	-	-	-	-	-	-	-	-	4	(3)	-	-	-	-	-	0.16	(21)
Total Zirconium (Zr)	0.1	µg/L	-	-	-	4	-	-	-	-	4	(3)	-	-	-	0.32	(21)	0.32	(21)
Volatile Organics																			

Parameter	Detection Limit	Units	Ecological screening criteria										Human screening criteria						
			CCME CWQG (1)	CCME TRV (2)	PWQO (3)	Interim PWQO (3)	Federal Environmental Quality Guidelines (4-12)	MECP Aquatic Protection Value (13)	Guideline/Benchmark from Other Source (14-15)		Selected Ecological Screening Criteria	Reference	Health Canada Drinking Water Guidelines (16)	Ontario Drinking Water Quality Standards (17)	MOE GW1 Component Value (18)	Guideline/Benchmark from Other Jurisdiction (19-23)		Selected Human Health Screening Criteria	Reference
									Value	Source						Value	Source		
Benzene	0.10	ug/L	370	-	-	100	-	-	-	-	100	(3)	5	1	5	-	-	1	(17)
Bromodichloromethane	0.10	ug/L	-	-	-	200	-	-	-	-	200	(3)	-	-	16	-	-	16	(18)
Bromoform	0.20	ug/L	-	-	-	60	-	-	-	-	60	(3)	-	-	25	-	-	25	(18)
Chloroform	0.10	ug/L	1.8	-	-	-	-	-	-	-	1.8	(1)	100	-	25	-	-	25	(18)
Ethylbenzene	0.10	ug/L	90	-	-	8	-	-	-	-	8	(3)	140	140	2.4	-	-	2.4	(18)
BTEX & F1 Hydrocarbons																-	-		
F1 (C6-C10)	25	ug/L	-	167	-	-	-	-	-	-	167	(2)	-	-	820	-	-	820	(18)
F1 (C6-C10) - BTEX	25	ug/L	-	167	-	-	-	-	-	-	167	(2)	-	-	820	-	-	820	(18)
F2-F4 Hydrocarbons																			
F2 (C10-C16 Hydrocarbons)	100	ug/L	-	42	-	-	-	-	-	-	42	(2)	-	-	300	-	-	300	(18)
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	1000	-	-	1000	(18)
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	1100	-	-	1100	(18)
Microbiological*																			
Background*	10	CFU/100mL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fecal coliform*	10	CFU/100mL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Coliforms*	10	CFU/100mL	-	-	-	-	-	-	-	-	100[w]	(3)	10	-	-	-	-	10	(16)
*Escherichia coli**	10	CFU/100mL	-	-	100	-	-	-	-	-	100	(3)	10	-	-	-	-	10	(16)
Radionuclides																			
H-3	14	Bq/kg	-	-	7000	-	-	-	-	-	-	-[u]	7000	-	-	-	-	-	-[u]
C-14	0.027	Bq/g	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Co-60	0.73	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Cs-134	0.75	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Cs-137	0.6	Bq/kg	-	-	50	-	-	-	-	-	-	-[u]	10	-	-	-	-	-	-[u]
I-131	1.2	Bq/kg	-	-	10	-	-	-	-	-	-	-[u]	6	-	-	-	-	-	-[u]
K-40	7.1	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Th-Series	1.8	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
U-Series	1.5	Bq/kg	-	-	-	-	-	-	-	-	-	-[u]	-	-	-	-	-	-	-[u]
Other Parameters																			
Hydrazine*	0.1	ug/L	-	-	-	-	2.6	-	-	-	2.6	(12)	-	-	-	0.01	(24)	0.01	(24)
Monomethyl Hydrazine*	0.25	ug/L	-	-	-	-	-	-	-	-	2.6	(12)	-	-	-	-	-	-	-
1,1-Dimethylhydrazine*	0.25	ug/L	-	-	-	-	-	-	-	-	2.6	(12)	-	-	-	-	-	-	-
Chlorophyll a	1.3	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Morpholine	4	ug/L	-	-	-	4	-	-	-	-	4	(3)	-	-	-	1700	(25)	1700	(25)

Note:
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline or benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (129.32 mg/L), pH (8.35), temperature (13.23°C), alkalinity (112.23 mg/L), and DOC (2.37 mg/L) from spring samples were used.
* Only censored results provided by lab.
** Lowest acceptable dissolved oxygen concentration for early life stages of warm water biota applies (6000 µg/L). This is the most conservative minimum bound for DO of all life stage and thermal types of biota presented in CCME.

† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
a The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
b Total Ammonia guideline (Long Term Concentration (mg/L) Table): Retrieved from: https://ccme.ca/en/chemical/5#_aql_fresh_concentration
c PWQO is selected as the benchmark for TRC, as there is no current methodology to reach the CCME guideline of 0.0005 mg/L.
d 5 mg/L above the mean background value was used according to the CCME CWQG "narrative" for clear flow. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).
e Dissolved Aluminum guideline: The Interim PWQO is 15 µg/L between pH 4.5 to 5.5, and 75 µg/L between pH 6.5 to 9.0. Between pH 5.5 - 6.5, no condition should be permitted which would increase the acid soluble inorganic aluminum concentration in clay-free samples to more than 10% above natural background concentrations for waters representative of that geological area of the Province that are unaffected by man-made inputs. The use of clay-free samples demonstrates that the method is better suited for measuring dissolved aluminum.
f Total Aluminum guideline (Long Term Concentration (µg/L) Variable): If pH < 6.5, the CWQG is 5 µg/L. If pH ≥ 6.5, the guideline is 100 µg/L.
g Secondary Chronic Values (SCV) were selected for COPCs. If the SCV was not available, the lowest LC50 value was modified by a safety factor of 10.
h Total Beryllium guideline (µg/L): If Hardness < 75 mg/L, the PWQO is 11 µg/L. If Hardness > 75 mg/L, then the PWQO is 1100 µg/L.
i To be conservative, the measured LC50 values of H. Azteca (software or hardwater) was divided by a safety factor of 10. If there is no measured value, the tap water LC50 (nominal) values were adjusted by a safety factor of 10, considering the water in Lake Ontario is similar to tap water used in this study.
j Total Cadmium guideline (Long Term concentration (µg/L) equation): When the water hardness is > 0 to < 17 mg/L, the CWQG is 0.04 µg/L. At hardness ≥ 17 to ≤ 280 mg/L, the CWQG is calculated as 10{0.83(log[hardness]) – 2.46}. At hardness > CWQG (µg/L) = 10{0.83(log[hardness]) – 2.46}.
k Total Cadmium guideline (µg/L): If Hardness 0-100 mg/L, the Interim PWQO is 0.1 µg/L. If Hardness > 100 mg/L, then the Interim PWQO is 0.5 µg/L.
l Total Copper guideline (Long Term concentration (µg/L) equation): When the water hardness is 0 to < 82 mg/L, the CWQG is 2 µg/L. At hardness ≥82 to ≤180 mg/L the CWQG is calculated using this equation: 0.2 * e{0.8545[ln(hardness)]-1.465}. At hardness >180 mg/L, the CWQG is 4 µg/L.
m Total Copper guideline (µg/L): If Hardness 0-20 mg/L, the Interim PWQO is 1 µg/L. If Hardness > 20 mg/L, then the Interim PWQO is 5 µg/L.
n Copper Biotic Ligand Model from ECCC
o Total Lead guideline (Long Term concentration (µg/L) equation): When the hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L. At hardness >60 to ≤ 180 mg/L the CWQG is calculated as e{1.273[ln(hardness)]-4.705}. At hardness >180 mg/L, the CWQG is 7 µg/L. At hardness >180 mg/L, the CWQG is 7 µg/L.
p Total Lead guideline: If Hardness is 30-80 mg/L, then the Interim PWQO is 3 µg/L. If Hardness is > 80 mg/L, then the Interim PWQO is 5 µg/L.
r Dissolved Manganese concentration (Long Term concentration (µg/L) equation): Calculated using the CWQG calculator in Appendix B of the Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese. Retrieved from:
https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fccme.ca%2Fen%2Fres%2F2019-manganese-cwqg-scd-appendix-b-en.xlsx&wdOrigin=BROWSELINK
s Total Nickel guideline (Long Term concentration (µg/L) equation): When the water hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L. At hardness > 60 to ≤ 180 mg/L the CWQG is calculated as e{0.76[ln(hardness)]+1.06}. At hardness >180 mg/L, the CWQG is 150 µg/L.
t Dissolved Zinc guideline (Long Term concentration (µg/L) equation): The CWQG is calculated as exp(0.947[ln(hardness mg·L-1)] - 0.815[pH] + 0.398[ln(DOC mg·L-1)] + 4.625).
This equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1, which is the range of data used to derive the hardness, pH and DOC slopes.
u Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).
v Upper range limit (0.5 - 15 µg/L) of titanium concentrations found in an investigation of 42 municipal water supplies in the United States (Durfor & Becker, 1964).
w The screening guideline for E.coli was conservatively applied to screen total coliforms.

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Table A-2: Screening of Surface Water Quality Parameters in Spring 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Field Measurements																										
Field Temperature	N/A	Celsius	-	-[a]	-	-[a]	10.100	9.400	12.500	9.200	11.900	9.900	12.300	9.030	12.300	9.030	17.600	13.500	10.600	20.900	13.400	10.400	17.300	17.400	17.600	17.300	15.800	13.600
Field Measured pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.120	8.120	8.250	8.330	8.270	8.350	8.320	8.360	8.350	8.360	8.290	8.350	8.310	8.230	8.400	8.420	8.340	**8.510**	**8.560**	**8.590**	8.500	8.440
Specific conductivity	N/A	µs/cm	-	-[a]	-	-[a]	303	303	340	421	340	320	335	310	330	316	321	324	336	335	399	319	869	843	796	744	625	704
Conductivity	N/A	µs/cm	-	-[a]	-	-[a]	217.9	217.5	258.2	217.9	254.9	225	253.2	213.7	248.8	219.9	280.4	284.4	243.2	308.4	311	230.7	739	721	685	639	516	604
Dissolved Oxygen (DO)	N/A	%	-	-[a]	-	-[a]	107.9	108.2	115.1	109.1	114.6	109.8	115.1	109.5	114.7	110.1	124	116.4	113	132.2	113.2	115.3	10.24	115.8	122.8	122.9	114.5	118.7
Dissolved Oxygen (DO)	N/A	mg/L	< 6	(1)	-	-[a]	12.130	12.370	12.250	12.540	12.330	12.440	12.300	12.740	12.320	12.340	11.920	12.150	12.580	12.240	11.810	12.590	10.250	11.060	11.690	11.740	11.310	11.520
Turbidity	N/A	NTU	-	-[a]	-	-[a]	-0.52	-0.53	-0.34	-0.46	-0.37	-0.48	-0.37	-0.48	-0.37	-0.48	-0.18	-0.43	-0.5	0.37	1.6	-0.34	9.72	11.9	6.5	4.68	10.34	5.26
Calculated Parameters																										
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	111.000	110.000	120.000	123.000	125.000	118.000	120.000	121.000	125.000	121.000	115.000	112.000	116.000	115.000	125.000	115.000	192.000	184.000	179.000	169.000	166.000	165.000
Total Un-ionized Ammonia	0.0015	mg/L	0.019	(1)	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.010	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	120.000	119.000	116.000	121.000	120.000	116.000	120.000	114.000	118.000	117.000	117.000	114.000	117.000	117.000	120.000	117.000	161.000	161.000	187.000	177.000	138.000	138.000
Inorganics																										
Total Ammonia-N	0.050	mg/L	0.197	(1)	-	-[a]	0.019	0.041	0.010	-0.010	0.019	0.022	0.017	0.015	0.018	0.015	0.015	0.049	0.059	0.120	0.064	0.018	0.046	0.000	0.003	0.012	0.016	0.024
Total Biochemical Oxygen Demand (BOD)	2	mg/L	-	-[a]	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.000	3.000	5.000	3.000	3.000	3.000
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-[a]	-	-[a]	4.300	5.700	8.300	4.000	5.500	4.700	5.500	5.500	5.100	5.500	4.300	7.800	5.700	4.300	9.200	4.600	24.000	19.000	19.000	15.000	13.000	18.000
Conductivity	1.0	umho/cm	-	-[a]	-	-[a]	300.000	310.000	330.000	360.000	340.000	330.000	350.000	340.000	330.000	340.000	330.000	330.000	340.000	340.000	350.000	330.000	920.000	880.000	810.000	780.000	660.000	730.000
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-[a]	-	-[a]	0.150	0.170	0.260	0.270	0.250	0.230	0.200	0.280	0.260	0.280	0.200	0.300	0.170	0.240	0.290	0.240	0.420	0.420	0.360	0.360	0.390	0.320
Dissolved Organic Carbon	0.40	mg/L	-	-[a]	-	-[a]	1.900	1.900	1.800	1.900	1.800	1.900	2.000	1.800	1.900	1.800	1.900	2.000	1.900	1.900	1.900	1.900	3.900	4.100	3.900	3.500	3.200	3.400
Orthophosphate (P)	0.010	mg/L	-	-[a]	-	-[a]	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	-0.000	-0.000	-0.000	0.000	0.000	-0.000
pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.070	8.180	8.170	8.210	8.200	8.240	8.180	8.250	8.120	8.250	8.230	8.230	8.250	8.220	8.220	8.220	8.150	8.180	8.280	8.140	8.200	8.210
Total Phosphorus	0.020	mg/L	0.02	(3)	-	-[a]	0.000	-0.000	0.004	0.001	0.006	0.008	0.004	0.002	0.004	0.002	0.003	0.017	0.010	0.003	0.013	0.003	**0.023**	**0.025**	0.020	0.013	0.015	0.017
Total Residual Chlorine	0.003	mg/L	0.002[c]	(3)	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Suspended Solids	1	mg/L	5.3	(1)	-	-[a]	0.000	0.600	0.400	0.400	0.400	0.400	0.600	0.400	0.600	0.400	0.800	0.800	0.400	1.000	0.800	1.000	**19.000**	**19.000**	**24.000**	**12.000**	**14.000**	**11.000**
Turbidity	0.1	NTU	-	-[a]	-	-[a]	0.200	0.200	0.200	0.300	0.300	0.200	0.300	0.200	0.400	0.200	0.200	0.200	0.200	0.200	0.500	0.300	5.500	4.500	4.500	4.000	3.800	6.300
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-[a]	-	-[a]	94.000	95.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	96.000	97.000	98.000	100.000	99.000	170.000	160.000	150.000	150.000	130.000	130.000
Nitrite (N)	0.010	mg/L	0.197	(1)	1	(16)	0.001	0.000	-0.000	-0.000	0.001	0.001	0.002	0.001	0.001	0.001	-0.001	0.000	0.001	0.002	-0.000	-0.000	0.008	0.006	0.001	0.003	0.003	0.004
Nitrate (N)	0.10	mg/L	13	(1)	10	(16)	0.290	0.290	0.320	0.520	0.610	0.380	0.560	0.350	0.480	0.350	0.550	0.480	0.720	0.640	0.400	0.400	0.000	0.000	0.000	0.000	0.000	0.000
Nitrate + Nitrite (N)	0.10	mg/L	-	-[a]	-	-	0.290	0.290	0.320	0.520	0.610	0.380	0.560	0.350	0.480	0.350	0.550	0.480	0.720	0.640	0.400	0.400	-0.022	0.023	-0.003	-0.004	0.075	0.056
Metals																										
Dissolved Aluminum (Al)	0.5	µg/L	75	(3)	2900	(16)	42.300	10.800	3.770	5.180	2.260	3.560	2.400	2.240	2.000	2.240	1.670	2.370	2.500	1.900	4.410	2.510	4.050	3.680	2.630	2.300	2.790	7.850
Total Aluminum (Al)	0.5	µg/L	100	(1)	2900	(16)	2.63	5.59	6.20	2.23	5.41	3.37	4.71	6.00	6.19	6.00	3.93	4.41	36.60	4.31	11.30	6.18	**126.00**	**146.00**	**108.00**	56.50	81.40	84.00
Dissolved Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.149	0.143	0.155	0.136	0.137	0.131	0.133	0.136	0.134	0.136	0.130	0.132	0.141	0.131	0.148	0.127	0.280	0.245	0.240	0.232	0.227	0.243
Total Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.145	0.141	0.130	0.132	0.148	0.126	0.133	0.129	0.139	0.129	0.131	0.135	0.137	0.130	0.133	0.128	0.236	0.231	0.254	0.246	0.185	0.240

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario															Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.780	0.827	0.766	0.714	0.701	0.713	0.710	0.721	0.716	0.721	0.704	0.708	0.711	0.688	0.660	0.692	0.561	0.551	0.528	0.536	0.593	0.616
Total Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.818	0.842	0.716	0.684	0.689	0.692	0.681	0.703	0.706	0.703	0.718	0.714	0.692	0.688	0.715	0.715	0.544	0.578	0.625	0.654	0.576	0.794
Dissolved Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	21.70	21.10	23.70	22.00	22.50	21.80	21.70	22.20	21.90	22.20	21.50	21.80	21.80	21.60	25.10	21.90	41.20	39.40	37.70	37.20	36.40	36.70
Total Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	23.10	23.10	21.20	21.50	21.70	21.00	21.20	21.60	21.60	21.60	21.60	21.60	21.40	21.40	23.00	22.10	37.20	37.10	42.20	40.30	30.50	32.40
Dissolved Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.003	0.005	-0.000	-0.001	0.005	0.001	0.001	0.010	0.006	0.010	-0.000	-0.001	0.001	-0.001	-0.001	0.000	0.004	-0.002	0.001	0.002	-0.002	-0.000
Total Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.006	0.005	0.004	0.007	0.002	0.004	0.003	0.003	0.002	0.003	-0.000	0.003	-0.000	-0.000	-0.001	-0.001	0.012	0.016	-0.000	0.007	-0.002	0.057
Dissolved Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	0.009	0.000	0.002	0.000	0.001	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.000	-0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.001
Total Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	-0.001	0.000	0.001	0.001	0.002	0.000	0.002	0.001	0.002	0.001	-0.000	0.000	0.000	-0.000	0.000	-0.000	0.005	0.007	0.006	0.004	0.003	0.014
Dissolved Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	22.000	22.000	24.000	27.000	25.000	24.000	26.000	24.000	26.000	24.000	24.000	24.000	26.000	24.000	25.000	22.000	39.000	37.000	35.000	34.000	32.000	32.000
Total Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	25.000	24.000	23.000	26.000	25.000	23.000	27.000	23.000	25.000	23.000	23.000	22.000	24.000	24.000	21.000	21.000	42.000	40.000	37.000	35.000	41.000	40.000
Dissolved Cadmium (Cd)	0.005	µg/L	0.2	(1,3)	5	(17,18)	0.007	0.004	0.003	0.003	0.004	0.002	0.002	0.003	0.003	0.003	0.004	0.003	0.004	0.004	0.003	0.003	0.000	-0.000	0.001	0.001	0.001	0.001
Total Cadmium (Cd)	0.005	µg/L	0.2	(1,3)	5	(17,18)	0.003	0.004	0.003	0.007	0.005	0.003	0.005	0.005	0.004	0.005	0.004	0.005	0.003	0.003	0.004	0.003	0.017	0.030	0.008	0.007	0.007	0.024
Dissolved Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**31100**	**31000**	**33400**	**35000**	**35800**	**33800**	**34300**	**34200**	**36100**	**34200**	**33100**	**32100**	**33100**	**33100**	**36800**	**33200**	**61800**	**58400**	**56800**	**52600**	**51700**	**51500**
Total Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**33800**	**33600**	**32300**	**33900**	**34000**	**32900**	**34000**	**33000**	**33300**	**33000**	**33000**	**32000**	**33200**	**33100**	**34200**	**33200**	**51500**	**51300**	**60000**	**56200**	**42600**	**42800**
Dissolved Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.004	0.002	0.002	0.004	0.003	0.001	0.001	0.001	0.005	0.001	0.003	0.003	0.003	0.003	0.003	0.002	-0.001	0.002	0.001	0.001	-0.001	0.000
Total Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.003	0.003	0.003	0.005	0.004	0.002	0.005	0.004	0.063	0.004	0.002	0.003	0.004	0.002	0.002	0.002	0.018	0.020	0.008	0.006	0.009	0.011
Dissolved Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.100	0.110	0.088	0.075	0.099	0.190	0.110	0.077	0.093	0.077	0.080	0.094	0.091	0.079	0.077	0.100	0.120	0.051	0.061	0.083	0.043	0.110
Total Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.120	0.100	0.091	0.130	0.120	0.080	0.092	0.170	0.110	0.170	0.180	0.100	0.130	0.100	0.140	0.110	0.270	0.660	0.220	0.160	0.210	0.220
Chromium (VI)[†]	0.50	ug/L	1	(1,3)	25	(18)	0.196	0.194	0.230	0.233	0.209	0.201	0.225	0.175	0.205	0.218	0.260	0.147	0.215	0.213	0.238	0.187	0.145	0.177	0.172	0.150	0.175	0.159
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	(1,3)	25	(18)	0.580	0.960	0.350	-0.250	-0.130	-0.100	-0.240	-0.200	-0.070	-0.200	0.100	0.240	0.230	0.360	0.210	0.480	0.000	-0.020	-0.550	0.270	0.030	-0.210
Chromium (+3)[‡]	0.5	ug/L	8.9	(1,3)	-	-[a]	0.104	0.113	0.000	0.000	0.000	0.189	0.105	0.166	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.104	0.123	0.000	0.000	0.000	0.000	0.114
Unfiltered Chromium (+3)	0.99	ug/L	8.9	(1,3)	-	-[a]	0.116	0.103	0.000	0.126	0.120	0.000	0.000	0.114	0.108	0.169	0.184	0.101	0.129	0.101	0.137	0.112	0.271	0.657	0.223	0.156	0.215	0.221
Dissolved Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.017	0.011	0.011	0.023	0.023	0.015	0.019	0.012	0.020	0.012	0.017	0.014	0.021	0.019	0.018	0.014	0.038	0.036	0.032	0.030	0.032	0.033
Total Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.010	0.010	0.011	0.024	0.023	0.011	0.021	0.014	0.027	0.014	0.018	0.015	0.023	0.018	0.018	0.015	0.105	0.139	0.107	0.076	0.069	0.087
Dissolved Copper (Cu)	0.05	µg/L	2.133	(6)	1000	(18)	0.925	0.721	0.790	0.834	0.751	0.664	0.720	0.725	0.707	0.725	0.777	0.762	0.714	0.736	0.711	0.693	0.578	0.627	0.602	0.627	0.693	1.110
Total Copper (Cu)	0.05	µg/L	2.133	(6)	1000	(18)	0.733	0.770	0.642	0.769	0.778	0.631	0.746	0.664	0.780	0.664	1.250	0.776	0.825	0.887	0.775	0.712	1.090	1.290	1.250	1.040	1.030	1.780
Dissolved Iron (Fe)	1	µg/L	290	(8)	-	-[a]	6.30	8.80	2.10	9.20	1.80	3.70	2.20	1.60	2.00	1.60	1.50	2.20	3.20	1.30	4.00	5.80	10.90	8.50	6.40	6.40	11.40	11.40
Total Iron (Fe)	1	µg/L	290	(8)	-	-[a]	2.50	3.50	3.70	2.70	9.60	4.90	10.50	4.60	9.40	4.60	8.80	6.60	8.40	7.30	15.30	12.20	**320.00**	**324.00**	**309.00**	177.00	187.00	212.00
Dissolved Lead (Pb)	0.005	µg/L	6.82	(9)	5	(16)	0.279	0.111	0.020	0.013	0.017	0.017	0.012	0.007	0.007	0.007	0.009	0.016	0.010	0.007	0.016	0.012	0.067	0.027	0.016	0.015	0.028	0.039
Total Lead (Pb)	0.005	µg/L	4.41	(1)	5	(16)	0.021	0.034	0.009	0.010	0.019	0.008	0.019	0.016	0.023	0.016	0.015	0.032	0.025	0.013	0.036	0.025	0.554	0.605	0.612	0.385	0.369	0.420
Dissolved Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.630	1.470	1.670	1.720	1.780	1.640	1.730	1.650	1.680	1.650	1.720	1.690	1.800	1.730	1.830	1.650	2.310	2.250	2.290	2.350	2.150	2.420
Total Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.590	1.620	1.680	1.780	1.740	1.750	1.750	1.790	1.770	1.790	1.660	1.480	1.600	1.590	1.620	1.560	2.360	2.430	2.310	2.250	2.270	2.640
Dissolved Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	8000	7900	**8890**	**8510**	**8670**	8200	**8320**	**8600**	**8380**	**8600**	7980	7800	8060	7940	8070	7760	**9190**	**9150**	**9150**	**9160**	**8870**	**8920**
Total Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	**8620**	**8630**	**8560**	**8740**	**8540**	**8280**	**8480**	**8400**	**8520**	**8400**	**8350**	**8220**	**8340**	**8280**	**8430**	8170	7850	7890	**9040**	**8970**	7680	7600
Dissolved Manganese (Mn)	0.05	µg/L	260	(1)	120	(16)	1.020	0.675	0.744	2.020	1.630	0.834	1.530	0.637	1.310	0.637	1.310	1.010	1.590	1.360	2.050	0.978	9.190	8.070	4.340	2.280	3.920	12.000
Total Manganese (Mn)	0.05	µg/L	260	(1)	120	(16)	0.474	0.538	0.651	1.650	2.000	0.798	1.730	0.730	1.630	0.730	1.590	1.350	2.090	1.650	2.680	2.310	66.700	66.400	79.500	64.100	49.700	57.600
Dissolved Mercury (Hg)	0.01	ug/L	0.2	(3)	1	(16,17,18)	0.003	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.002	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.003	0.001	0.002	0.002	0.002

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario															Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Mercury (Hg)	0.01	ug/L	0.026	(1)	1	(16,17,18)	0.0007	0.000	0.003	0.002	0.003	0.002	0.003	0.003	0.002	0.002	0.001	0.002	0.002	0.001	0.001	0.001	0.003	0.002	0.002	0.002	0.003	0.002
Dissolved Methyl Mercury	0.050	ng/L	4	(1)	-	-	0.066	0.048	0.039	0.024	0.031	0.013	0.025	0.017	0.014	0.016	0.030	0.022	0.021	0.011	0.010	0.010	0.024	0.012	0.027	0.060	0.015	0.014
Total Methyl Mercury	0.050	ng/L	4	(1)	-	-	0.032	0.012	0.014	0.070	0.018	0.015	0.012	0.001	0.014	0.008	0.013	0.019	0.032	0.053	0.022	0.016	0.001	0.001	0.005	0.026	0.022	0.011
Dissolved Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.170	1.120	1.280	1.210	1.190	1.160	1.220	1.140	1.170	1.140	1.190	1.180	1.290	1.200	1.210	1.170	1.350	1.340	1.330	1.330	1.350	1.380
Total Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.230	1.220	1.120	1.200	1.170	1.110	1.180	1.140	1.210	1.140	1.210	1.170	1.260	1.210	1.160	1.150	1.110	1.150	1.370	1.360	1.090	1.120
Dissolved Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.668	0.536	0.592	0.567	0.574	0.513	0.523	0.548	0.495	0.548	0.838	0.549	0.606	0.562	0.495	0.505	0.535	0.553	0.521	0.533	0.533	0.557
Total Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.553	0.565	0.503	0.562	0.569	0.484	0.549	0.529	0.571	0.529	0.794	0.541	0.685	0.724	0.591	0.507	0.630	0.730	0.752	0.609	0.610	0.690
Dissolved Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1470	1480	1700	1790	1860	1580	1720	1640	1680	1640	1700	1640	1830	1770	1680	1590	2210	2160	2120	2050	2030	2050
Total Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1570	1610	1580	1750	1800	1570	1770	1600	1680	1600	1680	1650	1840	1760	1660	1570	1870	1910	2160	2130	1730	1760
Dissolved Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.124	0.136	0.119	0.123	0.131	0.131	0.138	0.118	0.126	0.118	0.136	0.128	0.148	0.135	0.120	0.119	0.095	0.094	0.105	0.099	0.105	0.117
Total Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.143	0.149	0.123	0.138	0.132	0.132	0.139	0.117	0.125	0.108	0.137	0.113	0.131	0.142	0.127	0.122	0.124	0.101	0.131	0.125	0.094	0.123
Dissolved Silicon (Si)	50	µg/L	-	-	-	-[a]	332	304	224	280	260	217	251	226	256	226	268	267	290	279	354	265	1090	1090	1090	987	856	742
Total Silicon (Si)	50	µg/L	-	-	-	-[a]	359	325	216	265	263	216	250	253	236	224	270	266	278	278	258	264	1070	1140	1230	1080	821	721
Dissolved Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	0.003	0.002	0.000	0.001	0.001	0.000	0.000	0.002	0.001	0.002	0.002	0.004	0.002	0.002	0.001	0.002	0.000	0.000	0.000	0.001	0.001	0.002
Total Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	0.001	-0.000	0.000	0.001	0.001	-0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.002	0.003	0.001	0.003	0.008
Dissolved Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	12700	12500	15500	17200	17300	14600	16400	15100	16200	15100	15800	14900	16700	16300	30100	15600	92900	87200	85100	78000	66700	66700
Total Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	13600	13600	14700	17000	17000	14700	16700	14800	16300	14800	15700	15200	16700	16000	17600	15600	78300	74600	84000	77600	52500	58600
Dissolved Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	175	174	207	193	198	190	193	195	191	195	176	174	181	177	197	176	304	298	273	260	276	296
Total Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	189	192	174	178	178	172	175	174	175	174	176	173	176	172	178	175	258	256	294	297	226	250
Dissolved Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.006	0.005	0.008	0.006	0.007	0.007	0.006	0.007	0.006	0.007	0.006	0.007	0.008	0.006	0.005	0.007	0.001	0.000	-0.001	-0.000	0.001	0.002
Total Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.006	0.007	0.005	0.006	0.004	0.006	0.005	0.005	0.005	0.005	0.006	0.007	0.006	0.005	0.007	0.007	0.004	0.007	0.004	0.002	0.003	0.004
Dissolved Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.004	0.003	-0.001	0.003	0.006	0.006	0.002	0.003	0.003	0.003	-0.003	0.004	0.013	-0.002	-0.001	-0.001	0.003	0.005	-0.002	-0.002	0.005	0.001
Total Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.004	0.004	-0.003	-0.000	-0.001	0.003	-0.002	-0.001	0.001	-0.001	0.010	0.005	0.005	0.007	0.007	0.013	0.027	0.023	0.025	0.020	0.017	0.014
Dissolved Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.031	0.083	0.066	0.009	0.021	0.028	0.027	0.051	0.017	0.051	0.041	1.130	0.043	0.021	0.010	0.037	0.029	0.030	0.019	0.081	0.018	0.123
Total Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.013	0.028	0.011	0.015	0.010	0.008	0.004	0.185	0.017	0.185	0.024	0.012	0.380	0.013	0.010	0.012	0.034	0.036	0.032	0.026	0.022	0.042
Dissolved Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	0.306	0.256	0.246	0.344	0.198	0.278	0.160	0.206	0.143	0.206	0.118	0.153	0.213	0.149	0.147	0.159	0.140	0.155	-0.156	-0.112	0.187	0.267
Total Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	0.016	0.024	-0.041	-0.114	0.135	0.032	0.031	-0.007	0.036	-0.007	0.171	0.082	0.190	0.073	0.335	0.240	5.600	6.400	5.780	3.090	3.900	3.700
Dissolved Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.073	0.076	0.083	0.073	0.074	0.077	0.076	0.079	0.075	0.079	0.080	0.071	0.089	0.076	0.071	0.078	0.053	0.048	0.046	0.048	0.060	0.065
Total Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.077	0.082	0.069	0.072	0.071	0.070	0.072	0.074	0.070	0.074	0.078	0.071	0.080	0.073	0.071	0.071	0.051	0.044	0.056	0.059	0.056	0.056
Dissolved Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.369	0.360	0.407	0.365	0.379	0.363	0.366	0.370	0.361	0.370	0.365	0.353	0.368	0.340	0.387	0.364	0.529	0.511	0.525	0.519	0.469	0.441
Total Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.379	0.379	0.371	0.379	0.373	0.366	0.372	0.367	0.375	0.367	0.362	0.369	0.368	0.352	0.385	0.363	0.474	0.451	0.504	0.491	0.400	0.388
Dissolved Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.450	0.193	0.240	0.210	0.210	0.250	0.210	0.220	0.210	0.220	0.196	0.184	0.191	0.196	0.230	0.195	0.450	0.470	0.370	0.360	0.380	0.360
Total Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.172	0.210	0.149	0.144	0.153	0.139	0.150	0.380	0.150	0.380	0.126	0.140	0.194	0.133	0.230	0.135	0.760	0.800	0.860	0.660	0.540	0.520
Dissolved Zinc (Zn)	0.1	µg/L	15.89	(1)	5000	(18)	4.380	7.540	0.920	0.580	0.600	1.800	0.920	0.760	0.670	0.760	5.020	0.650	1.460	0.770	0.630	1.660	0.800	1.520	0.350	0.220	0.280	0.870
Total Zinc (Zn)	0.1	µg/L	20	(3)	5000	(18)	0.380	5.240	0.840	0.610	0.900	0.410	1.400	8.720	4.760	8.720	2.420	1.000	1.620	0.770	0.810	0.550	3.400	4.800	2.830	1.650	2.200	6.500
Dissolved Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.010	0.010	0.012	0.012	0.018	0.006	0.010	0.011	0.013	0.011	0.014	0.039	0.038	0.013	0.013	0.020	0.019	0.019	0.021	0.016	0.022	0.017
Total Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.009	0.004	0.006	0.014	0.009	0.016	0.016	0.014	0.011	0.014	0.006	0.015	0.011	0.019	0.018	0.013	0.060	0.072	0.035	0.044	0.032	0.043
Volatile Organics																												

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																					
							Lake Ontario																		Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Benzene	0.10	ug/L	100	(3)	1	(17)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.170
Bromodichloromethane	0.10	ug/L	200	(3)	16	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bromoform	0.20	ug/L	60	(3)	25	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloroform	0.10	ug/L	1.8	(1)	25	(18)	0.000	0.000	0.110	0.000	0.110	0.000	0.110	0.000	0.000	0.000	0.000	0.000	0.160	0.130	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ethylbenzene	0.10	ug/L	8	(3)	2.4	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BTEX & F1 Hydrocarbons																												
F1 (C6-C10)	25	ug/L	167	(2)	820	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F1 (C6-C10) - BTEX	25	ug/L	167	(2)	820	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F2-F4 Hydrocarbons																												
F2 (C10-C16 Hydrocarbons)	100	ug/L	42	(2)	300	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	1000	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	1100	(18)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Microbiological*																												
Background*	10	CFU/100mL	-	-	-	-	<10	320.00	310.00	360	1200	840	620	420	680	440	440	680	200	190	420	440	2200	3100	2600	2100	2600	38000
Fecal coliform*	10	CFU/100mL	-	-	-	-	<10	<10	10.00	<10	10	<10	<10	<10	20	<10	<10	<10	<10	<10	<10	10	<10	20	10	10	10	780
Total Coliforms*	10	CFU/100mL	100ᵠ	(3)	10	(16)	<10	<10	**50**	**40**	**510**	10	**60**	<10	**140**	10	**520**	**30**	**30**	**20**	**20**	10	**1500**	**3400**	**940**	**30**	**70**	**14000**
*Escherichia coli**	10	CFU/100mL	100	(3)	10	(16)	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	10	**20**	<10	<10	<10	**480**
Radionuclides																												
H-3	14	Bq/kg	-	-ᵘ	-	-ᵘ	-5.270	15.900	5.310	5.280	5.300	0.000	5.300	0.000	5.300	5.310	31.700	21.200	0.000	15.900	26.500	15.800	31.800	37.100	31.800	37.000	31.800	31.600
C-14	0.027	Bq/g	-	-ᵘ	-	-ᵘ	-0.050	-0.047	-0.039	-0.045	-0.043	-0.042	-0.044	-0.038	-0.043	-0.054	-0.037	-0.034	-0.045	-0.046	-0.031	-0.041	-0.033	-0.027	-0.031	-0.036	-0.037	-0.046
Co-60	0.73	Bq/kg	-	-ᵘ	-	-ᵘ	-0.352	0.513	0.036	0.389	0.053	0.149	-0.182	0.069	-0.067	-0.079	-0.197	0.050	0.298	-0.253	0.163	0.054	-0.087	-0.147	0.080	-0.170	-0.133	-0.086
Cs-134	0.75	Bq/kg	-	-ᵘ	-	-ᵘ	0.145	-0.110	0.111	0.173	-0.110	-0.232	0.211	-0.151	0.373	0.231	-0.080	-0.070	-0.226	0.199	-0.084	0.309	-0.281	-0.127	0.129	0.121	0.146	-0.070
Cs-137	0.6	Bq/kg	-	-ᵘ	-	-ᵘ	0.275	-0.214	0.129	-0.044	-0.110	0.258	0.271	0.209	-0.361	0.174	0.353	0.057	0.042	0.306	-0.506	0.190	0.314	-0.369	-0.653	-0.464	0.196	0.105
I-131	1.2	Bq/kg	-	-ᵘ	-	-ᵘ	0.198	0.029	-0.043	-0.986	0.065	0.051	-0.003	-0.517	-0.850	0.428	1.080	0.719	-0.332	-1.030	0.730	-0.938	0.333	-0.291	0.373	0.580	-0.334	0.290
K-40	7.1	Bq/kg	-	-ᵘ	-	-ᵘ	2.670	-0.125	-0.757	1.090	2.490	4.960	2.410	8.370	-0.924	0.004	2.760	1.520	-3.400	3.090	0.999	2.820	5.800	-1.710	0.960	22.300	-2.070	-4.050
Th-Series	1.8	Bq/kg	-	-ᵘ	-	-ᵘ	-2.040	-0.468	-0.122	0.731	-0.691	-0.866	0.271	-0.425	-0.563	-1.390	1.470	-0.295	-1.980	0.551	0.618	-1.430	-0.501	1.250	-0.086	1.540	0.440	-0.577
U-Series	1.5	Bq/kg	-	-ᵘ	-	-ᵘ	0.911	1.340	0.274	1.220	-0.016	0.566	0.213	0.173	1.100	0.154	0.452	0.292	-0.901	0.587	-0.454	-1.020	-0.331	0.076	0.149	-0.245	0.228	0.087
Other Parameters																												
Hydrazine*	0.1	ug/L	2.6	(12)	0.01	(24)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	**4.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Monomethyl Hydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorophyll a	1.3	ug/L	-	-	-	-	1.400	0.019	1.232	1.300	1.241	2.200	1.500	1.600	1.300	1.600	2.000	1.500	2.400	2.300	2.200	4.100	27.000	24.000	27.000	24.000	31.000	27.000
Morpholine	4	ug/L	4	(3)	1700	(25)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note:

Bold	Exceedance of Selected Ecological screening criterion
Bold	Exceedance of Selected Human screening criterion
Bold	Exceedance of Selected Ecological and Human Health screening criteria

Surface water samples from Lake Ontario were collected at a depth of 0.5 meters (denoted by "S" in the sample name), while bottom samples were taken 0.5 meters above the lakebed (denoted by "B"). Mid-depth samples were collected in Frenchman's Bay, as thermal stratification is unlikely in the shallow
depths observed in this area. LWC1 represents the background location. Sampling locations presented in **Figure 4-3**
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline/benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (129.32 mg/L), pH (8.35), temperature (13.23°C), alkalinity (112.23 mg/L), and DOC (2.37 mg/L) from spring samples were used.
* Only censored results provided by lab.
† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
[a] The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
[b] Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).

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Table A-3: Screening of Surface Water Quality Parameters in Summer 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Field Measurements																										
Field Temperature	N/A	Celsius	-	-[a]	-	-[a]	18.100	13.300	24.400	16.600	22.800	15.600	23.600	15.400	22.800	15.600	27.200	29.400	17.800	27.700	20.500	17.100	24.000	24.500	24.900	25.100	23.600	23.200
Field Measured pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.320	8.210	8.360	7.940	**8.510**	8.100	8.480	8.120	**8.510**	8.100	8.170	**8.540**	**8.630**	8.360	8.310	8.340	7.690	8.060	8.130	8.300	7.990	7.910
Specific conductivity	N/A	µs/cm	-	-[a]	-	-[a]	262	235	310	307	308	306	308	305	306	307	318	313	309	311	302	304	562	472	463	455	394	396
Conductivity	N/A	µs/cm	-	-[a]	-	-[a]	301.6	302.3	306.1	254.6	294.3	251.8	299.3	252.1	287.5	253.7	325.9	339.6	259.3	327.4	275.5	257.2	582	468.2	461.1	294.3	382.6	378.1
Dissolved Oxygen (DO)	N/A	%	-	-[a]	-	-[a]	104.5	96.6	122.1	96.8	120.9	90.7	122.3	94.2	123.2	94.9	119.9	129.4	117.6	124.6	117.8	102.7	72.5	87	89.1	95.6	99.3	96.6
Dissolved Oxygen (DO)	N/A	mg/L	< 6	(1)	-	-[a]	9.860	10.090	10.170	9.550	10.430	9.030	10.300	9.260	10.720	9.370	9.640	9.940	11.150	9.860	10.620	9.850	6.040	7.140	7.360	7.890	8.440	8.250
Turbidity	N/A	NTU	-	-[a]	-	-[a]	-0.44	-0.16	-0.38	-0.27	-0.39	-0.17	-0.39	-0.37	-0.39	-0.1	-0.13	-0.27	-0.22	-0.13	-0.23	0.48	9.71	7.15	5.77	5.65	1.32	1.95
Calculated Parameters																										
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	112.000	113.000	113.000	108.000	111.000	112.000	112.000	110.000	110.000	114.000	104.000	104.000	114.000	104.000	111.000	111.000	136.000	131.000	132.000	135.000	106.000	125.000
Total Un-ionized Ammonia	0.0015	mg/L	0.019	(1)	-	-[a]	0.007	0.008	0.012	**0.048**	**0.031**	0.005	**0.029**	0.008	**0.044**	0.005	**0.021**	**0.048**	**0.022**	0.012	**0.038**	0.004	0.009	**0.027**	0.018	**0.038**	0.003	0.005
Total Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	115.00	118.00	107.00	110.00	106.00	107.00	108.00	110.00	110.00	104.00	95.00	108.00	113.00	101.00	94.90	106.00	128.00	118.00	127.00	120.00	97.20	99.90
Inorganics																										
Total Ammonia-N	0.050	mg/L	0.41	(1)	-	-[a]	0.090	0.180	0.090	**1.500**	0.190	0.120	0.180	0.190	0.270	0.130	0.190	0.190	0.150	0.072	0.410	0.055	0.300	0.370	0.210	0.300	0.051	0.100
Total Biochemical Oxygen Demand (BOD)	2	mg/L	-	-[a]	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	3.000	0.000	0.000	2.000	0.000	0.000	0.000	4.000	5.000	4.000	11.000	4.000	3.000	3.000	3.000	6.000
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-[a]	-	-[a]	4.700	7.200	-1.039	-3.562	-1.119	-3.411	-3.595	-2.745	-1.487	-3.030	-3.411	-3.191	2.800	-3.026	-3.390	-2.545	0.886	-3.281	-3.579	-0.620	-3.001	-2.636
Conductivity	1.0	umho/cm	-	-[a]	-	-[a]	300.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	310.000	300.000	300.000	300.000	550.000	460.000	460.000	450.000	390.000	400.000
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-[a]	-	-[a]	0.170	0.230	0.180	1.300	0.200	0.270	0.370	0.180	0.870	0.350	0.220	0.230	0.170	0.180	0.640	0.180	0.560	0.550	0.940	0.330	0.290	0.360
Dissolved Organic Carbon	0.40	mg/L	-	-[a]	-	-[a]	2.000	1.900	1.900	2.000	2.000	2.100	2.000	2.100	2.000	2.100	2.100	2.100	2.100	2.100	2.000	2.100	4.400	3.400	3.400	3.300	2.900	3.000
Orthophosphate (P)	0.010	mg/L	-	-[a]	-	-[a]	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.001	0.001	0.002	0.002	0.005
pH	N/A	pH	6.5-8.5	(3)	-	-[a]	8.280	8.060	8.330	8.180	8.350	7.970	8.330	8.160	8.370	8.190	8.220	8.320	8.290	8.060	8.340	8.350	8.010	8.110	8.190	8.240	8.190	8.140
Total Phosphorus	0.020	mg/L	0.02	(3)	-	-[a]	0.012	0.005	0.003	0.010	0.001	0.006	-0.003	0.004	0.002	0.002	0.002	0.004	0.010	0.006	0.002	0.004	**0.045**	**0.036**	**0.026**	**0.030**	0.019	**0.034**
Total Residual Chlorine	0.003	mg/L	0.002[c]	(3)	-	-[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Suspended Solids	1	mg/L	5.6	(1)	-	-[a]	0.400	0.800	0.800	1.000	0.800	1.000	0.400	3.000	0.600	2.000	2.000	0.800	1.000	2.000	1.000	2.000	**14.000**	**12.000**	**11.000**	**9.000**	5.000	4.000
Turbidity	0.1	NTU	-	-[a]	-	-[a]	0.300	0.300	0.300	0.400	0.400	0.400	0.400	0.300	0.400	0.400	0.600	1.500	0.400	0.500	0.400	0.700	10.000	11.000	6.700	6.100	2.400	2.600
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-[a]	-	-[a]	98.000	98.000	110.000	97.000	96.000	94.000	99.000	96.000	98.000	99.000	96.000	99.000	99.000	95.000	97.000	100.000	120.000	120.000	120.000	120.000	110.000	110.000
Nitrite (N)	0.01	mg/L	0.197	(1)	1	(16)	0.000	0.000	0.002	0.002	0.003	0.006	0.003	-0.006	0.003	0.003	0.003	0.003	0.005	0.003	0.002	0.003	0.010	0.011	0.008	0.005	0.008	0.007
Nitrate (N)	0.1	mg/L	13	(1)	10	(16)	0.180	0.220	0.190	0.290	0.170	0.260	0.180	0.210	0.160	0.280	0.340	0.170	0.160	0.280	0.170	0.150	0.100	0.000	0.000	0.000	0.000	0.000
Nitrate + Nitrite (N)	0.1	mg/L	-	-[a]	-	-	0.180	0.220	0.190	0.290	0.170	0.260	0.180	0.210	0.160	0.280	0.340	0.170	0.160	0.280	0.170	0.150	0.100	0.083	0.038	0.029	0.074	0.076
Metals																										
Dissolved Aluminum (Al)	0.5	µg/L	75	(3)	2900	(16)	1.39	1.27	2.34	8.53	8.33	1.98	8.53	5.15	9.04	5.38	42	22.3	2.22	34.1	1.95	2.8	51.4	7.44	10.1	5.63	55.3	4.79
Total Aluminum (Al)	0.5	µg/L	100	(1)	2900	(16)	4.28	4.28	21.4	4.56	21.6	10.1	6.82	6.11	6.88	8.95	54.2	12.1	3.55	33.4	26.9	9.5	**136**	**204**	93.3	94.1	27.5	26.5

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.13	0.119	0.12	0.127	0.13	0.127	0.129	0.119	0.133	0.122	0.111	0.122	0.122	0.123	0.127	0.124	0.216	0.19	0.191	0.203	0.152	0.172
Total Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.122	0.119	0.124	0.12	0.121	0.12	0.121	0.125	0.124	0.121	0.111	0.122	0.128	0.119	0.106	0.117	0.224	0.196	0.194	0.173	0.139	0.135
Dissolved Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.73	0.692	0.727	0.729	0.697	0.737	0.74	0.736	0.726	0.755	0.665	0.675	0.707	0.678	0.723	0.739	0.813	0.86	0.879	0.891	0.737	0.875
Total Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.689	0.728	0.735	0.774	0.711	0.76	0.737	0.783	0.746	0.774	0.639	0.768	0.741	0.675	0.632	0.72	0.923	0.844	0.922	0.867	0.715	0.729
Dissolved Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	18.7	19.2	20.5	21.1	21	21.7	21.1	21.7	20.4	22.3	18.8	19.5	20	19.3	20.4	20.7	28.2	26.6	26.7	26.8	21.6	24.9
Total Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	20.4	21.3	20.9	21.6	20.5	22.6	20.2	23.1	20.5	22.6	18.4	20.1	19.3	19.1	17.6	20.5	28.5	25.4	27	25.2	20.2	20.5
Dissolved Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	-0.002	-0.001	-0.0001	-0.0011	-0.0012	-0.0022	-0.0011	-0.0011	0.0019	-0.0022	-0.0011	0.0021	-0.0022	-0.0023	-0.0034	-0.0022	0	0.0023	0.0001	-0.0023	0	-0.0023
Total Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.0008	0.0015	0	0.0004	0	0.0004	0.0017	0.0004	0	0.0008	0.0008	0.003	0.0017	0.008	0.0034	0.0007	0.009	0.014	0.0048	0.0026	0.0017	-0.0001
Dissolved Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	-0.001	0	-0.0002	0.0001	0.0004	0	0.0003	0.0002	0.0011	0.0001	0.0005	0.0008	0.0002	0.0005	0.0005	0.0004	0.0005	0.0002	0.0002	0.0004	0.0012	0.0012
Total Bismuth (Bi)	0.005	µg/L	2.5	(15)	-	-[a]	0.0007	0.0008	-0.0004	-0.0005	0.0002	0	-0.0001	-0.0003	-0.0001	0.0001	0.0014	-0.0002	-0.0007	0.0015	0.0012	0.0011	0.006	0.0075	0.0038	0.0036	0.0015	0.0024
Dissolved Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	19	19	24	24	21	23	25	23	23	24	23	23	25	22	22	22	35	30	32	31	24	28
Total Boron (B)	10	µg/L	200	(3)	5000	(16,17,18)	22	22	21	20	19	20	20	20	20	20	21	20	20	22	19	21	33	29	32	28	23	23
Dissolved Cadmium (Cd)	0.005	µg/L	0.17	(1)	5	(17,18)	0.002	0.003	0.0026	0.002	0.0025	0.0046	0.0018	0.0038	0.0023	0.0024	0.0044	0.0043	0.0015	0.0049	0.0017	0.0015	0.0038	0.0007	0.001	0	0.0044	0.0012
Total Cadmium (Cd)	0.005	µg/L	0.17	(1)	5	(17,18)	0.0029	0.0036	0.0027	0.0037	0.0028	0.004	0.0023	0.004	0.0023	0.0035	0.0056	0.0028	0.0027	0.0054	0.0041	0.0039	0.0054	0.0078	0.0056	0.0064	0.0025	0.0024
Dissolved Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**31700**	**32000**	**31900**	**30400**	**30800**	**31200**	**31000**	**30800**	**30900**	**32000**	**29500**	**29100**	**32000**	**29100**	**30800**	**31200**	**42000**	**40000**	**39600**	**40800**	**31200**	**36900**
Total Calcium (Ca)	10	µg/L	11600	(14)	-	-[a]	**32200**	**33200**	**29300**	**30200**	**29400**	**29500**	**29600**	**30200**	**30200**	**27800**	**26400**	**29400**	**31200**	**27900**	**26100**	**29000**	**39000**	**35800**	**37700**	**35600**	**28100**	**28600**
Dissolved Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.002	0.001	0.0018	0.0026	0.0018	0.0041	0.0034	0.0022	0.0021	0.0041	0.0038	0.0025	0.0024	0.0032	0.0042	0.0021	0.0027	0.001	0.0014	0.0011	0.0029	0.0031
Total Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.002	0.0024	0.0044	0.0034	0.0027	0.004	0.0033	0.0027	0.0027	0.0043	0.0045	0.0027	0.0023	0.0049	0.0031	0.0038	0.0128	0.0187	0.0098	0.008	0.0043	0.0027
Dissolved Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.1	0.15	0.2	0.0732	0.12	0.072	0.0919	0.1	0.18	0.1	0.0817	0.18	0.14	0.13	0.0831	0.1	0.17	0.17	0.0757	0.11	0.16	0.15
Total Chromium (Cr)	0.1	µg/L	64	(13)	50	(16,17,18)	0.0461	0.11	0.11	0.0856	0.0885	0.11	0.11	0.0748	0.0695	0.0785	0.11	0.12	0.1	0.0902	0.0854	0.13	0.37	0.54	0.28	0.25	0.1	0.14
Chromium (VI)†	0.50	ug/L	1	(1,3)	25	(18)	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0081	0.0000	0.0000	0.0000	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0079	0.0000	0.0000	0.0000	0.0000
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	(1,3)	25	(18)	0.21	0.02	-1.2	-0.37	-0.41	-0.09	-0.6	-0.21	-0.7	-0.36	-0.49	-0.6	-0.26	0.89	0.18	0.23	**2.65**	0.28	-0.03	**1.8**	-0.5	-1.4
Chromium (+3)‡	0.5	ug/L	8.9	(1,3)	-	-[a]	0.10	0.15	0.20	0.00	0.12	0.00	0.00	0.10	0.18	0.10	0.00	0.18	0.14	0.13	0.00	0.10	0.17	0.17	0.00	0.11	0.16	0.15
Unfiltered Chromium (+3)	0.99	ug/L	8.9	(1,3)	-	-[a]	0.00	0.11	0.11	0.00	0.00	0.11	0.11	0.00	0.00	0.00	0.11	0.12	0.10	0.00	0.00	0.13	0.37	0.54	0.28	0.25	0.10	0.14
Dissolved Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.01	0.008	0.0102	0.0162	0.0126	0.0121	0.0113	0.0108	0.0112	0.0123	0.0181	0.0184	0.0097	0.014	0.0091	0.0121	0.0419	0.0321	0.0346	0.0299	0.0198	0.024
Total Cobalt (Co)	0.005	µg/L	0.9	(3)	3	(18)	0.0086	0.01	0.0259	0.0143	0.0145	0.0184	0.013	0.0146	0.0105	0.0177	0.022	0.014	0.0106	0.019	0.013	0.016	0.111	0.148	0.075	0.071	0.026	0.03
Dissolved Copper (Cu)	0.05	µg/L	2.494	(6)	1000	(18)	0.591	0.57	0.696	0.813	0.704	0.629	0.723	0.677	0.679	0.642	0.856	0.974	0.585	0.88	0.594	0.622	0.98	0.816	0.867	0.826	1.46	1.24
Total Copper (Cu)	0.05	µg/L	2.494	(6)	1000	(18)	0.679	0.655	0.83	0.694	0.74	0.715	0.704	0.661	0.645	0.718	1.1	0.782	0.651	0.91	0.73	0.64	1.45	1.65	1.36	1.17	1.31	1.4
Dissolved Iron (Fe)	1	µg/L	290	(8)	-	-[a]	1.5	1.9	2.6	2.9	4.6	1.4	2.7	2.8	3.5	2.6	2.3	7.8	2.5	3.1	0.7153	2.6	29.9	18.5	17.2	20.6	8.8	13
Total Iron (Fe)	1	µg/L	290	(8)	-	-[a]	2.2	4.8	18.4	5.3	6	9.9	5.5	9.4	3.8	8.2	10.6	10	4.5	9.6	7.8	17.5	**349**	**393**	207	189	75.4	78.5
Dissolved Lead (Pb)	0.005	µg/L	6.63	(9)	5	(16)	0.004	0.012	0.0052	0.0795	0.02	0.0068	0.034	0.0363	0.0412	0.0182	0.0506	0.137	0.0036	0.0881	0.0062	0.0157	0.112	0.0312	0.0559	0.0489	0.0854	0.0321
Total Lead (Pb)	0.005	µg/L	3.56	(1)	5	(16)	0.0137	0.0146	0.0387	0.0125	0.0352	0.0339	0.0159	0.0181	0.0141	0.0227	0.091	0.0372	0.0091	0.074	0.054	0.034	0.463	0.553	0.406	0.325	0.12	0.127

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario														Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.64	1.73	1.69	1.7	1.65	1.71	1.77	1.69	1.7	1.75	1.78	1.71	1.75	1.79	1.62	1.71	2.13	1.85	2.02	1.89	1.76	1.76
Total Lithium (Li)	0.5	µg/L	14	(14)	8	(21)	1.72	1.71	1.7	1.58	1.55	1.56	1.62	1.63	1.59	1.58	1.74	1.66	1.65	1.79	1.61	1.67	2.06	1.9	2.07	1.82	1.55	1.64
Dissolved Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	8010	8090	8110	7900	**8240**	**8220**	**8440**	8060	7980	**8240**	7450	7570	8180	7600	8200	8060	7430	7610	7950	8130	6790	8000
Total Magnesium (Mg)	10	µg/L	8200	(14)	-	-[a]	**8440**	**8590**	**8210**	**8270**	7900	8090	**8360**	**8440**	**8350**	**8290**	7090	**8310**	**8390**	7660	7200	8090	7420	6960	7950	7530	6560	6900
Dissolved Manganese (Mn)	0.05	µg/L	250	(1)	120	(16)	0.193	0.279	0.253	1.06	0.384	0.761	0.437	1.47	0.408	0.972	1.19	1.39	0.334	1.39	0.457	1.82	36.2	11.6	10.4	10	6.57	8.84
Total Manganese (Mn)	0.05	µg/L	250	(1)	120	(16)	0.461	0.65	1.43	1.67	1.17	2.37	1.05	2.58	0.762	2.71	2.74	2.01	1.52	2.56	2.45	5.17	66	55.3	47.4	41.4	22.7	21.9
Dissolved Mercury (Hg)	0.01	ug/L	0.2	(3)	1	(16,17,18)	-0.0003	0.0003	0.0012	0.0011	0.0009	0.0010	0.0005	0.0005	0.0004	0.0006	0.0009	0.0013	0.0010	0.0006	0.0009	0.0006	0.0010	0.0009	0.0012	0.0003	0.0011	0.0003
Mercury (Hg)	0.01	ug/L	0.026	(1)	1	(16,17,18)	0.0014	-0.0002	0.0015	0.0008	0.0001	0.0004	0.0008	0.0011	-0.0001	0.0009	0.0009	0.0011	0.0013	0.0007	0.0004	-0.0001	0.0029	0.0015	0.0012	0.0017	0.0014	0.0002
Dissolved Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.06	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.00	0.00	0.01	0.02	0.02
Total Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.01	0.01	0.02	0.02	0.04	0.01	0.04	0.04	0.01	0.01	0.01	0.02	0.01	0.02	0.00	0.02	0.05	0.01	0.04	0.03	0.03	0.05
Dissolved Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.07	1.03	1.13	1.16	1.14	1.14	1.14	1.12	1.15	1.14	1.27	1.25	1.12	1.44	1.06	1.13	1.16	2.56	2.57	1.19	1.53	1.18
Total Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.08	1.05	1.22	1.16	1.13	1.17	1.17	1.1	1.16	1.16	1.27	1.15	1.14	1.29	1.14	1.09	0.919	0.929	1.1	1.03	0.89	0.907
Dissolved Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.462	0.491	0.503	0.59	0.554	0.507	0.529	0.559	0.515	0.511	0.551	0.628	0.468	0.554	0.468	0.434	0.491	0.484	0.845	0.497	0.49	0.466
Total Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	0.504	0.525	0.609	0.565	0.546	0.577	0.512	0.528	0.507	0.56	0.55	0.533	0.479	0.55	0.46	0.48	0.62	0.7	0.56	0.58	0.44	1.28
Dissolved Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1320	1360	1570	1590	1590	1650	1550	1540	1540	1650	1550	1490	1560	1500	1510	1510	1860	1820	1750	1820	1440	1800
Total Potassium (K)	10	µg/L	5300	(14)	-	-[a]	1520	1530	1550	1590	1470	1580	1500	1520	1500	1610	1460	1500	1440	1460	1280	1410	1780	1680	1700	1610	1330	1350
Dissolved Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.111	0.121	0.112	0.109	0.113	0.119	0.121	0.106	0.117	0.132	0.11	0.108	0.114	0.109	0.11	0.126	0.095	0.129	0.129	0.121	0.114	0.111
Total Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.11	0.115	0.121	0.129	0.108	0.123	0.122	0.123	0.124	0.116	0.121	0.11	0.128	0.098	0.098	0.112	0.105	0.104	0.113	0.12	0.087	0.094
Dissolved Silicon (Si)	50	µg/L	-	-	-	-[a]	146	240	86	169	76	188	82	210	64	213	112	99	85	105	75	107	1710	1810	1820	1820	803	1040
Total Silicon (Si)	50	µg/L	-	-	-	-[a]	161	261	133	176	82	198	87	221	68	203	113	106	86	111	82	119	1690	1820	1820	1760	798	791
Dissolved Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	0.004	-0.001	0.0004	0.0018	0.0008	0.0004	0.0002	0.0011	0.0007	0.0015	0.0001	0.0044	0.0004	0.001	0.0011	0.0005	0	0.0009	0	0.0005	0.0015	0.0006
Total Silver (Ag)	0.005	µg/L	0.1	(3)	100	(18)	-0.0007	0.0007	0.0005	0.0002	0.0009	0.0012	0.0005	0.0011	0.0008	0.0008	0.0029	0.0009	0.0007	0.0033	0.0012	0.0002	0.0018	0.0025	0.0023	0.002	0.0007	0.0005
Dissolved Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	12400	12500	12800	12300	13000	12900	12600	12100	12300	12900	12500	12100	12400	12100	12400	12600	45500	34500	32500	32400	21100	26100
Total Sodium (Na)	10	µg/L	180000	(13)	200000	(18)	12800	12700	13500	13500	13000	13200	13000	12900	12900	13600	12000	13500	12900	12300	11100	12500	44400	34200	31900	29600	20700	20300
Dissolved Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	156	157	189	170	184	189	188	181	180	189	152	156	191	154	166	169	222	217	221	221	159	207
Total Strontium (Sr)	0.050	µg/L	2500	(10)	7000	(16)	182	184	173	176	172	172	176	171	176	174	160	172	170	169	158	180	214	194	212	202	165	171
Dissolved Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.005	0.005	0.0071	0.0055	0.0063	0.0063	0.0062	0.0058	0.0062	0.0065	0.0058	0.0057	0.0053	0.006	0.007	0.0069	0.0017	0.0018	0.0016	0.0016	0.0026	0.0026
Total Thallium (Tl)	0.002	µg/L	0.3	(3)	2	(18)	0.0062	0.0058	0.0073	0.0072	0.007	0.007	0.006	0.0074	0.0064	0.0079	0.0047	0.0072	0.0069	0.0062	0.005	0.0059	0.0043	0.0054	0.0032	0.0034	0.0028	0.0027
Dissolved Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	-0.001	-0.001	0.0018	0.0019	0.0004	0.0029	0.0028	0.003	0.0052	0.0019	0.004	0.0048	0.0044	0.007	0.0036	-0.0006	0.0018	0.0071	0.0072	0.0077	0.0037	0.0076
Total Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.0028	0.0062	0.0013	-0.0002	0.0053	-0.0012	0.0006	0.0029	0.0002	0.0028	0.0008	0.0035	0.001	0.0059	0.0038	0.003	0.0181	0.0193	0.0147	0.012	0.0073	0.0074
Dissolved Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.027	0.019	0.0081	0.0992	0.0285	0.0117	0.0368	0.0936	0.0456	0.0178	0.0683	2.23	0.0216	0.0604	0.0066	0.0134	0.0407	0.014	0.0172	0.012	0.1121	0.0152
Total Tin (Sn)	0.2	µg/L	73	(14)	2400	(21)	0.0103	0.01	0.0202	0.0174	0.0521	0.1979	0.0119	0.0125	0.0174	0.0173	0.0848	0.0183	0.011	0.0548	0.078	0.017	0.036	0.0428	0.0359	0.0294	0.018	0.0288
Dissolved Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	0.085	-0.026	0.0568	0.111	0.1656	0.0487	0.1714	0.0846	0.1733	0.0743	0.2441	0.286	0.0548	0.2537	0.0612	0.1627	0.3953	0.2693	0.2039	0.1641	0.4483	0.1503
Total Titanium (Ti)	0.5	µg/L	27.2	(15)	15	(23)	-0.0352	0.0411	1.24	-0.0967	-0.0613	-0.0285	-0.1331	0.0524	-0.1167	-0.0066	0.3548	0.0535	-0.0494	0.1984	0.2481	0.2853	5.9	9	3.9	3.6	0.8983	0.9566
Dissolved Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.065	0.06	0.071	0.074	0.071	0.074	0.076	0.068	0.077	0.078	0.086	0.077	0.073	0.098	0.066	0.073	0.077	0.077	0.075	0.069	0.092	0.082

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario															Frenchman's Bay		
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Total Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.073	0.071	0.075	0.074	0.074	0.075	0.075	0.072	0.073	0.074	0.078	0.075	0.076	0.075	0.072	0.063	0.172	0.064	0.07	0.071	0.06	0.065
Dissolved Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.297	0.286	0.361	0.334	0.341	0.344	0.364	0.337	0.349	0.344	0.286	0.32	0.347	0.284	0.318	0.314	0.256	0.278	0.288	0.296	0.253	0.283
Total Uranium (U)	0.002	µg/L	5	(3)	20	(16,17,18)	0.347	0.36	0.326	0.31	0.325	0.308	0.321	0.326	0.315	0.321	0.264	0.331	0.316	0.296	0.277	0.308	0.255	0.244	0.296	0.271	0.246	0.26
Dissolved Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.145	0.157	0.1681	0.49	0.32	0.1932	0.26	0.26	0.35	0.26	1.47	1.07	0.1521	1.86	0.1702	0.24	1.42	0.55	0.54	0.52	2.3	0.43
Total Vanadium (V)	0.2	µg/L	6	(3)	6.2	(18)	0.1574	0.1464	0.42	0.1543	0.38	0.29	0.24	0.1372	0.1671	0.24	1.64	0.27	0.1271	1.4	1.12	0.1784	0.89	0.98	0.7	0.64	0.36	0.34
Dissolved Zinc (Zn)	0.1	µg/L	15.05	(1)	5000	(18)	1.03	0.86	0.2	3.4	0.86	0.4	1.24	1.24	2.35	0.88	2.64	4.43	0.32	2.32	0.15	0.37	1.79	0.48	8.27	1.32	2.28	1.4
Total Zinc (Zn)	0.1	µg/L	20	(3)	5000	(18)	0.59	1.16	1.11	1.76	1.35	1.75	0.48	0.86	0.59	0.7	3.2	2.52	0.51	2	1.6	0.9088	3.6	4.2	2.5	1.8	0.9604	0.857
Dissolved Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.004	0	0.0061	0.005	0.0067	0.014	0.0036	-0.001	0.0138	0.0008	0.0156	0.0171	0.0048	0.0071	0.0015	0.0012	0.0237	0.0166	0.0125	0.0103	0.0085	0.0107
Total Zirconium (Zr)	0.1	µg/L	4	(3)	0.32	(21)	0.0048	0.0139	0.0136	0.0082	0.0274	0.0145	0.0131	0.006	0.0094	0.0143	0.0153	0.0121	0.0102	0.0176	0.0061	0.0081	0.0894	0.29	**0.39**	0.0774	0.0142	0.0176
Volatile Organics																												
Benzene	0.10	ug/L	100	(3)	1	(17)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromodichloromethane	0.10	ug/L	200	(3)	16	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bromoform	0.20	ug/L	60	(3)	25	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloroform	0.10	ug/L	1.8	(1)	25	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylbenzene	0.10	ug/L	8	(3)	2.4	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BTEX & F1 Hydrocarbons																												
F1 (C6-C10)	25	ug/L	167	(2)	820	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F1 (C6-C10) - BTEX	25	ug/L	167	(2)	820	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F2-F4 Hydrocarbons																												
F2 (C10-C16 Hydrocarbons)	100	ug/L	42	(2)	300	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	1000	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	1100	(18)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Microbiological*																												
Background*	10	CFU/100mL	-	-	-	-	260	970	920	680	160	820	380	1,300	240	760	48,000	16,000	2,100	53,000	5,000	2,800	120,000	63,000	29,000	8,400	5,100	16,000
Fecal coliform*	10	CFU/100mL	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	20	10	<10	10	10	10	13,000	560	2,700	<10	90	240
Total Coliforms*	10	CFU/100mL	100[w]	(3)	10	(16)	**250**	**2,200**	**80**	**640**	<10	**880**	**60**	**740**	10	**460**	**2,500**	**50**	**410**	**640**	**80**	**80**	**85,000**	**11,000**	**2,900**	<10	**280**	**2,600**
*Escherichia coli**	10	CFU/100mL	100	(3)	10	(16)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	**20**	10	<10	10	10	10	**6,100**	**560**	**120**	<10	**50**	**60**
Radionuclides																												
H-3	14	Bq/kg	-	-[u]	-	-[u]	5.25	5.27	21.2	0	10.6	0	10.6	-5.33	0	10.5	42.4	106	5.3	47.8	21.2	5.31	21.1	15.9	26.4	20.9	21.2	21.4
C-14	0.027	Bq/g	-	-[u]	-	-[u]	-0.0512	-0.0205	-0.0241	-0.0326	-0.0199	-0.0397	-0.0303	-0.0403	-0.045	-0.0466	-0.0225	0.0115	-0.0302	0.059	0.241	0.0394	0.79	-0.0228	-0.0289	-0.0217	-0.018	-0.0281
Co-60	0.73	Bq/kg	-	-[u]	-	-[u]	0.16	-0.0244	0.149	0.556	0.0324	0.0915	-0.162	0.0514	0.657	0.171	0.455	0.497	0.0614	0.147	-0.146	0.0696	0.0916	0.316	0.289	0.191	-0.481	0.0691
Cs-134	0.75	Bq/g	-	-[u]	-	-[u]	0.48	0.119	0.111	0.126	0.293	0.292	0.12	-0.043	0.0249	-0.0581	0.244	0.0292	0.117	-0.101	0.128	-0.0169	0.0167	0.143	-0.157	-0.207	0.106	-0.124
Cs-137	0.6	Bq/kg	-	-[u]	-	-[u]	0.297	0.249	-0.21	0.294	-0.0462	0.0572	-0.0213	0.0254	-0.0678	-0.236	-0.228	0.102	-0.0569	0.281	0.0631	0.505	0.0966	0.418	-0.0251	-0.0266	0.0542	-0.0355
I-131	1.2	Bq/kg	-	-[u]	-	-[u]	0.022	0.212	-0.278	-0.565	0.351	-0.143	0.27	0.591	-1.33	0.0523	0.222	1.12	0.485	-0.679	0.882	-0.909	2.66	-0.206	0.0767	-1.08	-0.819	0.661
K-40	7.1	Bq/g	-	-[u]	-	-[u]	1.75	0.525	-0.174	1.37	2.64	-0.946	0.127	0.241	2.24	-0.172	-0.208	0.568	-0.32	-0.392	-1.03	-0.459	0.484	-2.5	2.87	0.242	1.71	0.746

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay			
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Th-Series	1.8	Bq/kg	-	-[u]	-	-[u]	0.452	-1.09	0.245	1.09	1.17	0.367	0.285	-0.0449	-1.42	-0.132	0.332	0.459	-0.57	0.355	-0.329	-0.435	0.392	0.434	0.482	0.851	-0.416	0.125
U-Series	1.5	Bq/kg	-	-[u]	-	-[u]	-0.204	0.116	0.336	0.564	-0.0785	0.702	-0.0708	-0.285	-0.246	-0.00287	0.575	-0.275	0.671	-0.015	-0.024	-0.0357	-0.0261	0.421	-0.0693	0.159	-0.328	0.242
Others Parameters																												
Hydrazine*	0.1	ug/L	2.6	(12)	0.01	(24)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Monomethyl Hydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorophyll a	1.3	ug/L	-	-	-	-	2.80	1.80	1.90	2.90	1.90	2.50	2.40	1.09	2.30	2.30	3.20	2.50	4.30	3.50	3.50	4.80	13.00	10.00	11.00	9.00	6.00	8.00
Morpholine	4	ug/L	4	(3)	1700	(25)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note:

Bold Exceedance of Selected Ecological Screening Criterion

Bold Exceedance of Selected Human Screening Criterion

Bold Exceedance of Selected Ecological and Human Health Screening Criteria

Surface water samples from Lake Ontario were collected at a depth of 0.5 meters (denoted by "S" in the sample name), while bottom samples were taken 0.5 meters above the lakebed (denoted by "B"). Mid-depth samples were collected in Frenchman's Bay, as thermal stratification is unlikely in the shallow
depths observed in this area. LWC1 represents the background location. Sampling locations presented in **Figure 4-3**.
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline/benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (109.2 mg/L), pH (8.23), temperature (21.51°C), alkalinity (103.2 mg/L), and DOC (2.41 mg/L) from summer samples were used.
* Only censored results provided by lab.
† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
[a] The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
[b] Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).
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Table A-4: Screening of Surface Water Quality Parameters in Fall 2024 samples

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																			
							Lake Ontario																Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Field Measurements																										
Field Temperature	N/A	Celsius	-	-[a]	-	-[a]	7.5	6.2	14.3	9.7	13.9	9.6	12.9	9.6	13.6	9.4	31.6	15	9	18.6	18.1	17.8	12.2	13.8	16.9	14.7	12.6	12.5
Field Measured pH	N/A	pH	6.5-8.5	(3)	-	-[a]	7.42	7.54	7.83	7.8	7.6	7.62	7.69	7.65	7.68	7.69	8.12	7.87	7.6	7.61	7.82	7.67	7.56	8.25	8.17	8.13	8.15	7.97
Specific conductivity	N/A	µs/cm	-	-[a]	-	-[a]	203	306	307	304	307	305	306	305	307	304	309	308	307	311	309	314	792	518	495	474	461	470
Conductivity	N/A	µs/cm	-	-[a]	-	-[a]	-	-	-	-	-	-	-	-	-	-	-	249.1	214.4	273	268.1	268.2	598	407.5	418.5	396.2	-	-
Dissolved Oxygen (DO)	N/A	%	-	-[a]	-	-[a]	83.7	81.4	103.8	94	103	94.9	103	94.7	102.3	91.6	102.7	92.8	85	92.6	97.8	95.7	83	97.3	95.8	94.7	102.4	99.3
Dissolved Oxygen (DO)	N/A	mg/L	< 6	(1)	-	-[a]	10.030	10.090	10.560	10.710	10.610	10.790	10.720	10.750	10.620	10.490	7.540	9.350	9.750	9.340	9.200	9.100	8.850	10.050	9.240	9.800	10.930	10.580
Turbidity	N/A	NTU	-	-[a]	-	-[a]	-0.38	-0.43	-0.39	NA	-0.39	0.1	-0.41	-0.24	-0.42	-0.05	0.68	754	754	754	753.6	753.3	754.7	758.3	753.5	754.3	2.58	2.37
Calculated Parameters																										
Dissolved Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	112	108	117	114	119	114	117	115	117	116	106	115	114	113	115	114	166	142	147	138	130	134
Total Un-ionized Ammonia	0.0015	mg/L	0.019	(1)	-	-[a]	0.00075	0.0015	0	0.0015	0	0	0.0014	0.00072	0.00095	0.0011	0.0083	0.0013	0.0011	0	0.0045	0.0033	0.0051	**0.022**	**0.037**	**0.021**	0.013	0.0081
Total Hardness (CaCO3)	0.50	mg/L	-	-[a]	-	-[a]	117	117	117	130	116	115	116	114	116	116	99.3	114	105	91.5	111	112	137	138	140	141	140	141
Inorganics																										
Total Ammonia-N	0.050	mg/L	0.588	(1)	-	-[a]	0.15	0.26	0.0453	0.11	0.0481	0.0154	0.099	0.074	0.067	0.11	0.065	0.055	0.14	0.0249	0.16	0.17	0.53	0.42	**0.67**	0.49	0.35	0.32
Total BOD	2	mg/L	-	-[a]	-	-[a]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Total Chemical Oxygen Demand (COD)	4.0	mg/L	-	-[a]	-	-[a]	5.5	6.2	5.1	3.69	6.2	3.34	6.2	5.8	5.5	1.56	14	0.43	0.77	-0.6	4.6	3.18	18	10	6.6	4.5	12	6.5
Conductivity	1.0	umho/cm	-	-[a]	-	-[a]	310	300	310	310	320	320	320	320	320	310	300	320	320	320	310	320	820	540	500	510	460	480
Total Kjeldahl Nitrogen (TKN)	0.10	mg/L	-	-[a]	-	-[a]	0.42	0.43	0.23	0.16	0.16	0.22	0.24	0.33	0.27	0.18	0.3	0.38	0.33	0.32	0.39	0.27	0.83	0.86	0.72	0.57	0.89	0.65
Dissolved Organic Carbon	0.40	mg/L	-	-[a]	-	-[a]	1.9	1.9	2.1	1.9	2.1	1.9	2.1	1.9	2	1.9	2.3	2.1	2	2	2.2	2.2	5.2	3.9	3.7	3.7	3.3	4.5
Orthophosphate (P)	0.010	mg/L	-	-[a]	-	-[a]	0.0012	0.0009	-0.0014	-0.0016	-0.0016	0.0002	-0.0017	-0.0016	-0.0007	-0.0017	0.0032	0.0005	0.0006	0.0012	-0.0017	-0.0015	0.0029	-0.0005	-0.0033	0.0003	-0.0002	0.0011
pH	N/A	pH	6.5-8.5	(1)	-	-[a]	8.11	8.13	8.1	8.12	8.1	8.13	7.85	8.15	8.06	8.15	8.13	8.15	8.09	8.1	8.16	8.09	8	8.2	8.12	8.21	8.16	8.06
Total Phosphorus	0.020	mg/L	0.02	(3)	-	-[a]	0.0009	0.0003	0.0017	-0.0022	0.007	0.0015	0.0014	-0.0004	0.0056	-0.0003	0.0173	-0.0038	0.0014	0.0029	0.0096	0.005	**0.024**	**0.023**	**0.027**	**0.024**	0.0164	0.019
Total Residual Chlorine	0.003	mg/L	0.002[c]	(3)	-	-[a]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Suspended Solids	1	mg/L	5.2	(1)	-	-[a]	0.2	0.2	0.2	0.4	0.4	0.4	0	0.4	1	5	1	0.6	0.8	1	1	**33**	4	**11**	**35**	**9**	4	5
Turbidity	0.1	NTU	-	-[a]	-	-[a]	0.1	0.1	0.2	0.1	0.2	0.2	0.3	0.1	0.2	0.2	0.9	0.3	0.3	0.2	0.4	0.5	3.4	8.3	9.5	6.2	3	2.9
Alkalinity (Total as CaCO3)	1.0	mg/L	-	-[a]	-	-[a]	98	100	96	96	96	96	95	96	95	92	98	98	99	99	98	96	150	130	120	120	120	120
Nitrite (N)	0.010	mg/L	0.197	(1)	1	(16)	0.0054	0.0035	-0.0124	0.0025	0.0013	0.00036514	0.0018	-0.0000963	0.0012	-0.0003025	0.0044	0.01	0.007	0.0063	0.017	0.013	0.0091	-6E-05	0.00097	0.0028	0.0029	0.0056
Nitrate (N)	0.10	mg/L	13	(1)	10	(16)	0.34	0.34	0.3	0.3	0.3	0.3	0.3	0.28	0.31	0.28	0.19	0.23	0.3	0.3	0.17	0.17	0	0	0	0	0	0
Nitrate + Nitrite (N)	0.10	mg/L	-	-[a]	-	-	0.34	0.34	0.3	0.3	0.3	0.3	0.3	0.28	0.31	0.28	0.19	0.24	0.3	0.3	0.19	0.18	0.0944	0.0141	0.02	0.0181	0.0969	0.0956
Metals																										
Dissolved Aluminum (Al)	0.50	µg/L	75	(3)	2900	(16)	4.23	5.69	4.18	3.99	7.3	3.49	11.9	2.38	24.2	2.89	11.5	10.5	2.42	12.1	13.8	11.5	6.25	6.52	**98.8**	5.24	5.02	14.4
Total Aluminum (Al)	3.00	µg/L	100	(1)	2900	(16)	6.76	7.8	7.82	3.96	12.1	21.7	5.83	2.94	7.77	24.4	20.5	8.6	7.8	8.1	6.03	3.41	34.8	**128**	4.47	54.1	27.4	33
Dissolved Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.128	0.124	0.128	0.127	0.129	0.127	0.125	0.128	0.143	0.135	0.216	0.139	0.134	0.133	0.133	0.128	0.282	0.203	0.203	0.195	0.171	0.19
Total Antimony (Sb)	0.02	µg/L	20	(3)	6	(16,17,18)	0.126	0.126	0.135	0.132	0.133	0.131	0.141	0.13	0.128	0.132	0.194	0.129	0.123	0.102	0.128	0.128	0.229	0.193	0.177	0.188	0.176	0.184
Dissolved Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.783	0.778	0.73	0.709	0.719	0.718	0.728	0.743	0.746	0.731	0.782	0.781	0.768	0.769	0.783	0.799	0.668	0.72	0.852	0.714	0.712	0.742
Total Arsenic (As)	0.02	µg/L	5	(1,3)	10	(16,17)	0.797	0.795	0.734	0.734	0.756	0.79	0.742	0.723	0.738	0.764	0.728	0.756	0.899	0.623	0.702	0.706	0.59	0.773	0.649	0.798	0.744	0.741
Dissolved Barium (Ba)	0.02	µg/L	2300	(12)	1000	(17,18)	19.7	19.4	20.5	20.3	21.1	20.7	20.6	20.3	20.8	20.6	20.6	19.8	19.7	19.7	21.4	21.2	20	18.6	32.6	20.7	21	23.4
Total Barium (Ba)	0.05	µg/L	2300	(12)	1000	(17,18)	22.9	22.2	21.3	20.9	21.3	20.8	20.9	21	21	20.9	19	21.4	20.2	16.1	19.9	20.4	17.4	25.6	20.4	27.8	27.4	29.2
Dissolved Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0.0021	0.0026	0.0048	0.0048	0.0049	0.0034	0.0046	0.006	0.0099	0.0021	0.0022	0	0.0067	-0.0004	0.0001	0.0001	0.0033	0.0011	0.0089	0.006	0.0017	0.0048
Total Beryllium (Be)	0.01	µg/L	1100	(3)	4	(18)	0	0.0012	-0.0009	0.0015	0.0027	0.0051	-0.0008	0.0027	-0.0021	-0.0008	0.003	0.0056	0.0001	0.0019	-0.0005	0.0015	0.0059	0.0095	-0.0015	0.0002	0.0047	-0.0011
Dissolved Bismuth (Bi)	0.01	µg/L	2.5	(15)	-	-[a]	0.0005	0.0004	0.0009	0.0006	0.0012	0.0006	0.0008	0.0005	0.0017	0.0005	0.0001	0.0005	-0.0002	0.0003	0.0012	0.0004	-0.0001	0.0001	0.0029	0.0007	-0.0001	0.0017
Total Bismuth (Bi)	0.01	µg/L	2.5	(15)	-	-[a]	0.0005	0.0003	0.0008	0.0002	0.0011	0.0087	0.0007	-0.0001	0.0011	0.0008	0.002	0.0003	0.0031	0.0002	0.0002	0.0004	0.0022	0.0043	-0.0002	0.0026	0.0011	0.0007
Dissolved Boron (B)	10.00	µg/L	200	(3)	5000	(16,17,18)	23	23	23	23	22	22	22	22	24	23	22	23	23	23	26	25	81	42	42	39	37	37
Total Boron (B)	10.00	µg/L	200	(3)	5000	(16,17,18)	27	26	24	24	25	25	24	23	26	25	20	22	20	20	24	23	68	41	38	39	41	39
Dissolved Cadmium (Cd)	0.01	µg/L	0.18	(1)	5	(17,18)	0.0059	0.0046	0.0063	0.0054	0.0083	0.0057	0.0066	0.0066	0.0084	0.0069	-0.0097	0.0028	0.006	0.0025	-0.0093	-0.0079	0	0.001	-0.0065	0.0026	0.001	0.0047
Total Cadmium (Cd)	0.01	µg/L	0.18	(1)	5	(17,18)	0.0062	0.0058	0.004	0.0038	0.0125	0.0625	0.004	0.0038	0.0035	0.0082	0.001	0.0023	0.0048	0.0031	-0.0086	-0.0091	0.0026	0.0107	-0.0098	0.0027	0.0023	0.0028
Dissolved Calcium (Ca)	10.00	µg/L	11600	(14)	-	-[a]	**31500**	**30300**	**33500**	**32800**	**34200**	**32700**	**33500**	**33000**	**33800**	**33200**	**29400**	**31700**	**31500**	**31600**	**32100**	**32100**	**51500**	**43100**	**44400**	**41500**	**38700**	**40100**
Total Calcium (Ca)	50.00	µg/L	11600	(14)	-	-[a]	**32800**	**32700**	**33100**	**38600**	**32600**	**32500**	**32800**	**32500**	**32800**	**33200**	**27900**	**31600**	**29100**	**25700**	**31800**	**31900**	**42700**	**41500**	**43400**	**41900**	**41200**	**41600**
Dissolved Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.0018	0.0022	0.0028	0.0031	0.0038	0.0036	0.0044	0.0037	0.0039	0.0036	0.0027	0.0025	0.0028	0.0022	0.0043	0.0038	0.001	0.0008	0.0084	0.0017	0.0013	0.0023
Total Cesium (Cs)	0.05	µg/L	315	(15)	1	(20)	0.0027	0.0022	0.0022	0.0031	0.0036	0.0296	0.0027	0.0021	0.0026	0.0037	0.006	0.0024	0.0022	0.0023	0.0014	0.0016	0.0034	0.0117	-0.0002	0.0059	0.003	0.0049
Dissolved Chromium (Cr)	0.10	µg/L	64	(13)	50	(16,17,18)	0.25	0.0988	0.17	0.11	0.15	0.19	0.15	0.17	0.17	0.11	0.084	0.17	0.0916	0.074	0.12	0.13	0.0694	0.0468	0.16	0.0595	0.0514	0.11
Total Chromium (Cr)	0.10	µg/L	64	(13)	50	(16,17,18)	0.0936	0.12	0.12	0.0731	0.0968	0.11	0.13	0.0773	0.11	0.12	0.18	0.087	0.0998	0.072	0.21	0.0567	0.16	0.28	0.0593	0.18	0.0871	0.14
Chromium (VI)[†]	0.50	ug/L	1	(1,3)	25	(18)	0.0965	0.0679	0.1107	0.0873	0.0366	0.0975	0.0602	0.0632	0.1006	0.0027	0.1727	0.0853	0.1378	0.0875	0.2058	0.1775	0.0302	0.0515	0.1556	0.0827	0.0385	0.0588
Total Hexavalent Chromium (Cr 6+)	0.99	µg/L	1	(1,3)	25	(18)	0.59	0.7	0.53	0.62	0.46	**1.3**	0.65	**1.5**	0.34	0.57	0.79	0.62	**1.2**	0.79	0.77	0.81	**2.89**	0.83	0.36	**3.18**	**1.15**	0.67
Chromium (+3)[‡]	0.5	ug/L	8.9	(1,3)	-	-[a]	0.2522	0	0.1726	0.1146	0.149	0.185	0.1457	0.1713	0.1651	0.1089	0	0.1737	0	0	0.1184	0.1345	0	0	0.1593	0	0	0.1076
Unfiltered Chromium (+3)	0.99	ug/L	8.9	(1,3)	-	-[a]	0	0.1192	0.1213	0	0	-1.175	0.1313	-1.45	0.1117	0.1176	0.183	0	-1.24	0	0.2144	0	0.1606	0.2753	0	0.1768	0	0.1446
Dissolved Cobalt (Co)	0.01	µg/L	0.9	(3)	3	(18)	0.0094	0.0096	0.0144	0.0121	0.0165	0.0128	0.0177	0.0113	0.025	0.0128	0.0153	0.0157	0.0106	0.0078	0.0175	0.017	0.0485	0.0303	0.0846	0.0269	0.0231	0.0286
Total Cobalt (Co)	0.01	µg/L	0.9	(3)	3	(18)	0.011	0.0074	0.0139	0.0099	0.0186	0.0403	0.0124	0.0102	0.0144	0.0238	0.026	0.013	**4.14**	0.012	0.0135	0.0114	0.054	0.102	0.0283	0.058	0.0366	0.0407
Dissolved Copper (Cu)	0.05	µg/L	1.5042	(6)	1000	(18)	0.926	0.616	0.734	0.64	0.892	0.602	0.787	0.615	**1.9**	0.642	1.03	0.621	0.59	0.601	0.638	0.698	0.55	0.678	1.04	0.606	1.05	**2.16**
Total Copper (Cu)	0.10	µg/L	1.5042	(6)	1000	(18)	1.47	0.72	0.865	0.684	0.861	0.799	0.802	0.638	0.996	0.937	1.09	0.78	**24**	0.8	0.978	0.623	0.8	1.21	0.8	**1.55**	0.875	**1.72**

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																	
							Lake Ontario													Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
Dissolved Iron (Fe)	1.00	µg/L	300	(1)	-	-[a]	6.5	6.1	3.6	5	6.2	3.9	3.3	3.4	16.1	2.9	4	11.1	1.7	1.2	18.4	19.7	21.2	15.3	262	9.2	10.2	15.8
Total Iron (Fe)	5.00	µg/L	300	(1)	-	-[a]	7.5	8.1	7.6	6.7	14.1	58.1	6	2.5	9.4	35.3	27.8	8.6	10.9	10.8	6.3	1.4	165	297	10.6	170	110	118
Dissolved Lead (Pb)	0.01	µg/L	7.01	(9)	5	(16)	0.0221	0.0145	0.0183	0.0229	0.0458	0.0474	0.037	0.0082	0.367	0.0144	0.0368	0.0847	0.0082	0.004	0.0249	0.0306	0.0171	0.019	0.44	0.0249	0.0191	0.0714
Total Lead (Pb)	0.02	µg/L	4.02	(1)	5	(16)	0.0467	0.018	0.0206	0.0143	0.0637	0.127	0.0207	0.0073	0.0299	0.103	0.108	0.027	0.027	0.03	0.0517	0.0091	0.205	0.49	0.0296	0.389	0.2	0.213
Dissolved Lithium (Li)	0.50	µg/L	14	(14)	8	(21)	1.8	1.87	1.73	1.72	1.76	1.73	1.73	1.75	1.74	1.68	1.5	1.73	1.68	1.74	1.68	1.7	2.9	2.19	2.07	2.14	2.16	2.42
Total Lithium (Li)	0.50	µg/L	14	(14)	8	(21)	1.74	1.74	1.73	1.69	1.7	1.7	1.77	1.7	1.71	1.72	1.4	1.89	1.82	1.52	1.49	1.48	2.57	2.4	1.87	2.51	2.16	2.23
Dissolved Magnesium (Mg)	10.00	µg/L	8200	(14)	-	-[a]	8070	7980	7960	7840	8090	7820	7980	7910	7970	7960	7780	**8700**	**8570**	**8250**	**8390**	**8220**	**9060**	**8270**	**8690**	**8400**	8070	**8360**
Total Magnesium (Mg)	50.00	µg/L	8200	(14)	-	-[a]	**8590**	**8670**	**8260**	**8220**	**8290**	**8230**	**8230**	8090	**8220**	7930	7180	**8470**	7900	6650	7590	7860	7460	**8370**	7750	**8960**	**8940**	**8930**
Dissolved Manganese (Mn)	0.05	µg/L	470	(1)	120	(16)	0.505	0.341	0.669	0.872	0.89	0.483	0.747	0.407	3.19	0.435	3.08	1.61	0.767	0.908	2.29	2.77	49.7	6.11	102	1.08	2.61	4.58
Total Manganese (Mn)	0.10	µg/L	470	(1)	120	(16)	0.75	0.519	0.847	0.545	1.61	2.12	0.781	0.552	1.17	3.57	4.63	1.61	4.72	1.44	0.915	0.686	52.5	86	2.01	81.9	52.4	43.6
Dissolved Mercury (Hg)	0.01	ug/L	0.2	(3)	1	(16,17,18)	0.0018	0.0027	-0.0007	0.0012	0.0016	0.0013	0.0005	0.0007	0.0004	0.0008	0.001	-0.001	-0.0008	0	0.0003	0.0011	-0.0002	-0.0001	0.0002	-0.0011	0.0025	0.0027
Mercury (Hg)	0.01	ug/L	0.026	(1)	1	(16,17,18)	0.001	0.001	0.0011	0.0009	0.0022	0.0024	0.0031	0.0017	0.0016	0.0017	0.00105	0.0004	0.0003	0.0001	0.0007	-0.0003	0.0001	0.0013	0.0004	0.0001	0.0012	0.0023
Dissolved Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.021725	0.018389	0.04274813	0.067	0.1	0.083	0.051	0.07	0.38	0.088	0.066	0.01959	0.0162	0.00609	0.03136	0.00692	0.01149	0.00422	0.01149	0.00568	0.01901	0.027
Total Methyl Mercury	0.050	ng/L	4	(1)	-	-[a]	0.028804	0.027525	0.02317083	0.01911476	0.062	0.02387015	0.067	0.058	0.11	0.02317083	0.1	0.062	0.04105	0.03774	0.02641	0.01135	0.01735	0.23	0.01735	0.03906	0.02638	0.054
Dissolved Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.16	1.15	1.18	1.12	1.18	1.14	1.22	1.13	1.27	1.18	1.13	1.18	1.15	1.18	1.17	1.16	1.1	1.09	1.1	1.12	1.13	1.12
Total Molybdenum (Mo)	0.05	µg/L	40	(3)	70	(18)	1.13	1.17	1.17	1.15	1.22	1.13	1.23	1.12	1.21	1.12	1.08	1.05	1.04	0.935	1.14	1.11	0.886	0.892	1.06	1.02	1.06	1.12
Dissolved Nickel (Ni)	0.02	µg/L	25	(3)	100	(18)	1.14	1.48	0.701	0.791	0.832	0.85	0.876	1.6	1.67	1.26	0.804	0.622	0.588	0.604	0.49	1.57	0.53	0.464	0.635	0.53	0.889	0.602
Total Nickel (Ni)	0.10	µg/L	25	(3)	100	(18)	1.88	0.612	0.73	2.25	6.41	1.16	0.565	0.488	0.81	0.822	0.62	0.64	12	0.84	0.922	0.65	0.69	0.75	0.557	0.74	0.531	0.658
Dissolved Potassium (K)	10.00	µg/L	5300	(14)	-	-[a]	1440	1430	1530	1480	1620	1520	1580	1450	1540	1510	1510	1490	1480	1480	1560	1550	2350	1870	1920	1790	1740	1920
Total Potassium (K)	50.00	µg/L	5300	(14)	-	-[a]	1510	1470	1580	1530	1580	1550	1580	1530	1570	1490	1330	1530	1420	1200	1510	1450	1920	1840	1760	1940	1820	1870
Dissolved Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.123	0.13	0.133	0.132	0.126	0.133	0.134	0.129	0.141	0.127	0.115	0.109	0.117	0.131	0.128	0.119	0.1	0.103	0.109	0.097	0.1	0.106
Total Selenium (Se)	0.04	µg/L	1	(1)	10	(18)	0.118	0.136	0.125	0.155	0.135	0.124	0.133	0.135	0.141	0.131	0.114	0.132	0.197	0.108	0.116	0.105	0.093	0.113	0.092	0.105	0.114	0.102
Dissolved Silicon (Si)	50.00	µg/L	-	-	-	-[a]	561	570	359	388	409	394	354	397	359	412	258	353	450	449	270	294	2660	2480	2890	2380	1800	1620
Total Silicon (Si)	50.00	µg/L	-	-	-	-[a]	561	573	363	471	371	400	366	398	360	436	272	350	412	377	238	265	2330	2630	2550	2520	1940	1710
Dissolved Silver (Ag)	0.01	µg/L	0.1	(3)	100	(18)	0.0003	0.0011	0	0.001	0.001	0.0006	0.0009	0.0001	0.0011	0.0012	0.0014	0.0003	0.0005	0.0004	0.0019	0.0005	0	-0.0002	0.0023	0.0006	0.0003	0.0011
Total Silver (Ag)	0.01	µg/L	0.1	(3)	100	(18)	0.0016	0.0003	0.0012	0.0009	0	0.0068	0.0008	0.0004	0.0012	0.0014	0.005	0.001	**0.448**	0.0004	0.0007	0.0003	0.0014	0.0016	0.0008	0.002	0.0007	0.0019
Dissolved Sodium (Na)	10.00	µg/L	180000	(13)	200000	(18)	12600	12500	13200	12700	13500	13000	13300	12800	13300	12900	12300	14000	13700	13700	13300	13600	84100	42700	38100	39700	33300	36400
Total Sodium (Na)	50.00	µg/L	180000	(13)	200000	(18)	13100	13200	13400	13000	13300	13200	13100	12800	13200	12500	11500	13200	12400	11000	11900	12900	68000	39500	34000	38700	34000	36900
Dissolved Strontium (Sr)	0.05	µg/L	2500	(10)	7000	(16)	164	164	172	164	173	164	170	169	171	172	165	169	172	170	178	178	257	217	225	216	205	226
Total Strontium (Sr)	0.05	µg/L	2500	(10)	7000	(16)	179	173	174	172	174	172	178	171	174	169	145	177	158	134	163	162	210	215	208	218	210	235
Dissolved Thallium (Tl)	0.00	µg/L	0.3	(3)	2	(18)	0.0066	0.0067	0.0069	0.0071	0.0065	0.0075	0.0073	0.0078	0.009	0.0069	0.0062	0.0066	0.0069	0.0064	0.0065	0.0065	0.0007	0.0008	0.0021	0.0011	0.0022	0.0019
Total Thallium (Tl)	0.00	µg/L	0.3	(3)	2	(18)	0.007	0.0072	0.0066	0.0065	0.0076	0.0149	0.0066	0.0078	0.0077	0.0061	0.006	0.0065	0.0066	0.0052	0.0071	0.0067	0.001	0.0021	0.0011	0.0016	0.0025	0.0021
Dissolved Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	-0.0012	-0.002	0.0053	0.0029	0.0058	0.0102	0.0017	0.0023	0.0059	0.0027	0.0061	0.001	-0.001	0.0014	0.0029	0.0039	0.0008	0.0027	0.0206	0.0027	-0.0013	0.0027
Total Thorium (Th)	0.05	µg/L	0.52	(15)	246	(22)	0.0011	0.0023	0.003	0.004	0.201	0.0133	0.004	0.004	0.0054	0.0117	0.02	-0.0028	-0.0008	0.0023	0.0105	0.0136	0.0102	0.0122	0.0096	0.0028	0.0111	0.0136
Dissolved Tin (Sn)	0.20	µg/L	73	(14)	2400	(21)	0.0858	0.0393	0.0199	0.0312	0.0332	0.0242	0.0237	0.1058	0.1092	0.0196	0.0493	0.0275	0.0252	0.0135	0.0119	0.0171	0.0141	0.0093	0.0329	0.0218	0.0518	0.0867
Total Tin (Sn)	0.20	µg/L	73	(14)	2400	(21)	0.0151	0.0491	0.0354	0.0282	0.0323	0.0568	0.0195	0.0266	0.0258	0.0196	0.03	0.0528	0.0395	0.0504	0.2	0.019	0.0517	0.049	0.0219	0.0405	0.0325	0.0302
Dissolved Titanium (Ti)	0.50	µg/L	27.2	(15)	15	(23)	0.1496	0.1823	0.1281	0.2927	0.1622	4.48	0.1076	0.0863	0.2085	0.1269	0.2014	0.2318	0.1048	0.0617	0.5	0.53	0.1304	0.2351	3.84	0.0959	0.379	0.15375
Total Titanium (Ti)	2.00	µg/L	27.2	(15)	15	(23)	0.1842	0.0695	0.1689	0.0932	0.3209	0.1773	0.1649	0.1337	0.1508	0.72	0.694	0.1916	0.2606	0.2042	0.0159	0.0026	1.4158	5.6	0	2.1	1.24	1.72
Dissolved Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.072	0.074	0.082	0.074	0.075	0.072	0.076	0.075	0.079	0.074	0.07	0.071	0.072	0.07	0.074	0.074	0.051	0.063	0.071	0.062	0.066	0.066
Total Tungsten (W)	0.01	µg/L	30	(3)	3.2	(21)	0.068	0.076	0.075	0.073	0.078	0.096	0.076	0.07	0.073	0.078	0.061	0.067	0.068	0.055	0.076	0.071	0.045	0.057	0.065	0.063	0.061	0.071
Dissolved Uranium (U)	0.00	µg/L	5	(3)	20	(16,17,18)	0.317	0.316	0.337	0.327	0.343	0.339	0.336	0.344	0.341	0.34	0.338	0.317	0.325	0.324	0.308	0.302	0.307	0.289	0.286	0.29	0.294	0.301
Total Uranium (U)	0.01	µg/L	5	(3)	20	(16,17,18)	0.339	0.33	0.333	0.327	0.347	0.367	0.335	0.337	0.324	0.324	0.297	0.301	0.376	0.258	0.377	0.409	0.272	0.264	0.356	0.287	0.327	0.32
Dissolved Vanadium (V)	0.20	µg/L	6	(3)	6.2	(18)	0.21	0.26	0.2	0.1335	0.23	0.1477	0.28	0.1369	0.37	0.1513	0.46	0.24	0.23	0.23	0.1981	0.21	0.53	0.54	0.73	0.49	0.4	0.41
Total Vanadium (V)	0.20	µg/L	6	(3)	6.2	(18)	0.1728	0.22	0.1539	0.132	0.21	0.186	0.1526	0.1429	0.1754	0.1854	0.25	0.1666	0.1368	0.1356	0.125	0.1511	0.53	0.76	0.42	0.62	0.5	0.51
Dissolved Zinc (Zn)	0.10	µg/L	24.2	(1)	5000	(18)	2.5	1.01	1.18	0.58	2.48	0.68	1.81	1.2	6.09	0.51	2.58	1.55	0.91	0.52	0.28	1.09	0.67	0.51	1.87	0.51	0.9	5.6
Total Zinc (Zn)	1.00	µg/L	20	(3)	5000	(18)	1.02	1.83	1.49	0.65	2.43	1.23	1.43	0.38	1.16	1.79	2.5	0.7132	1.4	1	1.19	1.06	1.6	3.1	1.72	1.8	1.26	1.51
Dissolved Zirconium (Zr)	0.10	µg/L	4	(3)	0.32	(21)	0.0085	0.0073	0.0165	0.0081	0.0133	0.0149	0.0121	0.0011	0.0152	0.0073	0.0065	0.0118	0.0084	0.006	0.0078	0.0079	0.0198	0.0146	0.0192	0.0098	0.0095	0.0159
Total Zirconium (Zr)	0.10	µg/L	4	(3)	0.32	(21)	0.0056	0.0036	0.0109	0.0175	0.0186	0.0187	0.015	0.0058	0.0195	0.0121	0.015	0.0046	0.0028	0.0083	0.0066	0.0067	0.0319	0.0382	0.0108	0.0177	0.0179	0.0168
Volatile Organics																												
Benzene	0.10	ug/L	100	(3)	1	(17)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14	0	0	0	0
Bromodichloromethane	0.10	ug/L	200	(3)	16	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromoform	0.20	ug/L	60	(3)	25	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloroform	0.10	ug/L	1.8	(1)	25	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.24	0	0	0	0	0
Ethylbenzene	0.10	ug/L	8	(3)	2.4	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0	0	0	0
BTEX & F1 Hydrocarbons																												
F1 (C6-C10)	25	ug/L	167	(2)	820	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F1 (C6-C10) - BTEX	25	ug/L	167	(2)	820	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F2-F4 Hydrocarbons																												
F2 (C10-C16 Hydrocarbons)	100	ug/L	42	(2)	300	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F3 (C16-C34 Hydrocarbons)	200	ug/L	-	-	1000	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F4 (C34-C50 Hydrocarbons)	200	ug/L	-	-	1100	(18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Microbiological*																												
Background*	10	CFU/100mL	-	-	-	-	380	4800	2600	2500	1100	1100	1200	1200	780	1200	60000	440	540	880	880	8000	6600	5200	3200	4000	8000	6200
Fecal coliform*	10	CFU/100mL	-	-	-	-	<10	20	120	<10	20	<10	60	<10	110	<10	650	<10	10	<10	20	10	220	90	20	<10	10	10
Total Coliforms*	10	CFU/100mL	100*	(3)	10	(16)	10	**30**	**470**	**60**	**200**	**60**	**150**	**50**	**260**	**40**	**2400**	**40**	10	10	**120**	**80**	**540**	**640**	**50**	**50**	**50**	**280**
Escherichia coli*	10	CFU/100mL	100	(3)	10	(16)	<10	**20**	<10	<10	<10	<10	<10	<10	<10	<10	**240**	<10	<10	<10	<10	10	**200**	**60**	10	10	<10	10
Radionuclides																												
H-3	14	Bq/kg	-	-[u]	-	-[u]	-10.5	-10.5	10.5	5.27	10.5	5.26	15.8	0	15.8	0	31.7	-10.5	-10.4	10.5	-10.6	-5.24	20.7	30.8	-5.26	31.2	26	21

Parameter	Detection Limit	Units	Ecological screening criteria		Human screening criteria		Station																					
							Lake Ontario																		Frenchman's Bay					
			Selected Ecological Screening Criteria	Reference	Selected Human Health Screening Criteria	Reference	LWC1-S	LWC1-B	LW2403-S	LW2403-B	LW2401-S	LW2401-B	LW2404-S	LW2404-B	LW2402-S	LW2402-B	LW21-M	LW9-S	LW9-B	LW10	FB1-S	FB1-B	LOC3	LOC2	LOC1	PN5-1	PN10	PN9
C-14	0.027	Bq/g	-	-[a]	-	-[a]	-0.00027	-4.3E-05	-0.0000511	-0.0000151	0.00000301	0.0000028	-0.0000364	0.0000857	0.0000191	-0.0000649	1.2E-05	-4E-05	-4E-05	-0.0003	0.0002	0.00033	-0.0002	-6E-05	8.7E-05	-0.0002	-0.0003	3.2E-05
Co-60	0.73	Bq/kg	-	-[a]	-	-[a]	0.309	0.337	0.331	0.229	0.317	-0.121	0.00977	-0.2	0.177	-0.184	0.493	-0.252	-0.0625	0.573	-0.32	0.0024	-0.635	0.325	0.21	0.267	0.332	-0.687
Cs-134	0.75	Bq/kg	-	-[a]	-	-[a]	0.233	0.116	-0.187	-0.544	0.128	0.269	-0.261	0.027	0.0443	0.184	0.0442	-0.174	0.262	-0.27	-0.448	-0.0034	0.493	0.0312	0.0359	0.234	0.128	-0.139
Cs-137	0.6	Bq/kg	-	-[a]	-	-[a]	0.265	-0.0635	-0.12	0.203	0.261	-0.521	-0.582	-0.263	-0.283	-0.37	0.265	-0.0345	0.41	0.0321	0.224	-0.646	0.42	-0.201	-0.0762	-0.308	0.0623	0.0672
I-131	1.2	Bq/kg	-	-[a]	-	-[a]	0.318	0.0444	0.457	1.32	0.738	-0.272	-0.0151	-0.672	-0.69	0.169	2.19	-0.507	-0.564	0.127	-0.159	0.386	-0.142	0.0859	0.131	0.0322	0.346	0.415
K-40	7.1	Bq/kg	-	-[a]	-	-[a]	2.28	2.15	-1.73	-2.32	-7.45	-0.279	0.36	-5.01	-0.371	-0.387	2.49	4.7	-4.69	-1.4	0.177	-0.912	-0.0788	0.781	1.07	-0.483	1.42	1.81
Th-Series	1.8	Bq/kg	-	-[a]	-	-[a]	-1.14	-1.32	0.672	-0.581	0.226	-1.08	-0.495	0.0944	-0.941	0.693	-1.42	0.509	0.925	0.484	-0.314	0.859	1.1	-0.0161	-0.269	1.26	0.261	-0.737
U-Series	1.5	Bq/kg	-	-[a]	-	-[a]	0.0513	1.77	-0.469	-0.884	-0.11	0.018	-0.621	0.292	0.0091	0.196	1.01	0.845	0.174	-0.137	-0.335	0.744	0.0954	0.351	0.377	0.215	0	0.299
Others Parameters																												
Hydrazine*	0.1	ug/L	2.6	(12)	0.01	(24)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Monomethyl Hydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	(12)	-	-	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorophyll a	1.3	ug/L	-	-	-	-	0.422842	0.147997	0.2740521	0.55080149	0.4215531	0.46522195	0.40497547	0.29566935	0.67823894	0.5404548	0.81781	2.6	1.8	1.20619	3	4.5	5.9	12	12	8.5	9.9	11
Morpholine	4	ug/L	4	(3)	1700	(25)	0	0	0	0	0	0	0	0	0	0	2.53	0	0	0	0	0	0	0	0	0	0	0

Note:

Bold	Exceedance of Selected Ecological Screening Criterion
Bold	Exceedance of Selected Human Screening Criterion
Bold	Exceedance of Selected Ecological and Human Health Screening Criteria

Surface water samples from Lake Ontario were collected at a depth of 0.5 meters (denoted by "S" in the sample name), while bottom samples were taken 0.5 meters above the lakebed (denoted by "B"). Mid-depth samples were collected in Frenchman's Bay, as thermal stratification is unlikely in the shallow
depths observed in this area. LWC1 represents the background location. Sampling locations presented in **Figure 4-3**.
The symbol '-' denotes the parameter was not listed by the source, and/or no guideline/benchmark was provided.
For guidelines that require input parameters to determine the applicable water quality guideline, average values of total hardness (120.17 mg/L), pH (7.79), temperature (13.61°C), alkalinity (104.91 mg/L), and DOC (2.58 mg/L) from fall samples were used.
* Only censored results provided by lab.
† Chromium (VI) by EPA Method 7199 is determined using ion chromatography with post-column derivatization, providing greater selectivity and lower susceptibility to interferences. Total Hexavalent Chromium by Standard Methods 3500-Cr B is determined by a colorimetric diphenylcarbazide method without chromatographic separation and is generally used for routine analysis.
‡ Unfiltered Chromium (III) by calculation represents trivalent chromium estimated by subtracting measured hexavalent chromium from total unfiltered chromium, and includes both dissolved and particulate fractions. Chromium (III) by calculation represents trivalent chromium estimated from dissolved chromium only and excludes particulate-bound chromium.
[a] The parameter is not considered an ecological or human health concern, and therefore no screening is necessary.
[b] Radionuclides are not screened as their levels should be as low as reasonably achievable (ALARA).

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Table A-5: Hydrazine Concentrations in Water samples from 2025 Hydrazine Monitoring Program

Parameter	Detection Limit	Units	Selected Ecological Screening Criteria	Selected Human Health Screening Criteria	Spring 2025							
					LWC1-T	LWC1-B	LW21	FB1-T	FB1-B	LW9-T	LW9-B	LW10
Hydrazine*	0.1	ug/L	2.6	0.01	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Monomethyl Hydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Parameter	**Detection Limit**	**Units**	**Selected Ecological Screening Criteria**	**Selected Human Health Screening Criteria**	**Summer 2025**							
					FB1-S	**FB1-B**	**LW10-S**	**LW9-B**	**LW9-S**	**LW21-S**	**LWC1-B**	**LWC1-S**
Hydrazine*	0.1	ug/L	2.6	0.01	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Monomethyl Hydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Parameter	**Detection Limit**	**Units**	**Selected Ecological Screening Criteria**	**Selected Human Health Screening Criteria**	**Fall 2025**							
					FB1-B	**FB1-S**	**LW10**	**LW9-B**	**LW9-S**	**LW21**	**LWC1-B**	**LWC1-S**
Hydrazine*	0.1	ug/L	2.6	0.01	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Monomethyl Hydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dimethylhydrazine*	0.25	ug/L	2.6	0.01	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25

Note:
Sampling locations presented in **Figure 4-3.**

A.2.1.2 Sediment Quality

Concentrations of parameters in sediment samples were compared against the selected screening criteria. Selection of the applicable sediment screening criteria followed the hierarchical decision-tree presented in **Figure A-3** and summarized below:

- The most conservative value between:
    - Ontario Provincial Sediment Quality Guidelines (PSQG; MOEE, 1993) or;
    - CCME Sediment Quality Guidelines (CCME, 2001); or,
- Guidelines from other sources and toxicological literature; or,
- Sediment background concentrations derived from known crustal abundance values:
    - Dragun & Chiasson, 1991. *Elements in North American Soils* (Dragun and Chiasson, 1991).

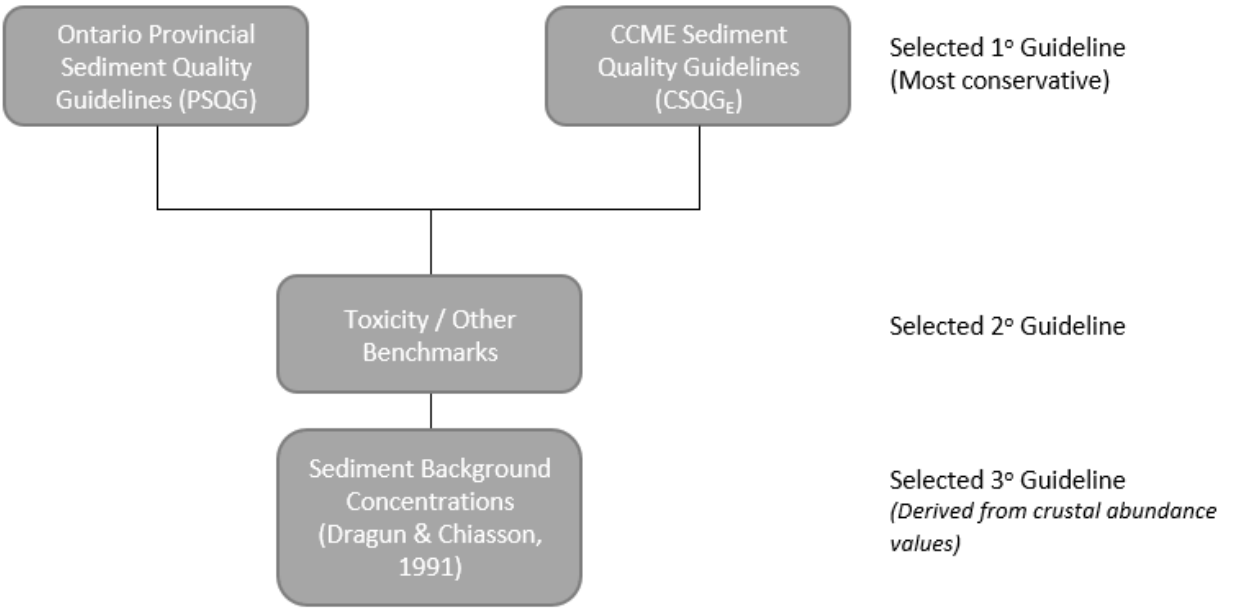


Figure A-3: Hierarchy of Screening Criteria for Non-Radiological Constituents in Sediment

Nearshore Lake Ontario

Estimated maximum copper concentrations in sediment near the PN outfall based on water concentrations in 2015 slightly exceeded benthic invertebrate benchmarks, though mean concentrations did not. However, this exceedance was not anticipated to impact the invertebrate community and should be interpreted with caution as the substrate in the area is transient and primarily comprised of coarse sand (Hart and Petersen, 2013). Both maximum and mean sediment concentrations of other parameters were below their respective ecological benchmarks.

The only parameter to exceed its associated screening criterion from the 2024 sediment samples collected in the Infill and Shoreline Erosion Mitigation Study Areas was total phosphorous (**Table A-6**). The Ontario Sediment Quality Guideline (600 mg/kg) was exceeded at two locations (Infill-03 and Infill-06; **Figure 4-4**). However, this guideline is not based on toxic effects to ecological receptors, but rather represents a nutrient effect on benthic community composition (MECP, 2008). Additionally, the elevated levels of phosphorus are probably a result of agricultural and urban inputs into Lake Ontario. Therefore, these exceedances most likely do not indicate facility-related impacts and are not associated with adverse impacts on aquatic invertebrates. The results from this sampling program cannot be directly compared to the 2015 estimates as the sampling stations were not in proximity to the outfall.

No exceedances of applicable screening criteria were found in the samples collected from the Cutoff Wall Study Area in 2025 (**Table A-7**).

Frenchman's Bay

The fall 2024 sediment program focused on Frenchman's Bay as it is the closest location to the PN site where sediment is likely to accumulate.

The concentrations of metals including aluminum, cadmium, chromium, copper, manganese, nickel, thallium, and tin in sediment samples from 2015 were found to exceed the established screening levels. These exceedances were anticipated, as Frenchman's Bay is highly influenced by urban runoff. Additionally, the levels of total organic carbon (TOC) were greater than the MECP guideline of 10,000 mg/kg (or 1%). However, as highlighted earlier, MECP guidelines for nutrients such as TOC are not based on toxic effects to ecological receptors. Additionally, wetland locations often exceed this screening criterion as organic matter content and nutrient levels may be naturally high in wetlands, which the guideline does not account for as it was established based on a Great Lakes dataset.

In 2024, the list of metals that exceeded their screening criteria (**Table A-7**) and the degree of exceedance of these criteria is comparable to the results from 2015. The only exceptions were aluminum, thallium, and tin, which exceeded screening criteria in 2015 but were below these criteria in 2024. Of the parameters that were quantified for the first time in 2024, certain PAHs and petroleum hydrocarbons, and Aroclor 1260 exceeded their respective sediment quality guidelines. As previously noted, these exceedances can be attributed to the ongoing impact of urban runoff. In line with the 2015 samples, TOC concentrations exceeded the MECP guideline at all locations in Frenchman's Bay. Unlike in 2015, all sediment samples collected from Frenchman's Bay exceeded the MECP guideline for Total Kjeldahl Nitrogen (TKN; 550 mg/kg). The exceedances of TOC and TKN are likely due to the naturally elevated organic content of wetland ecosystems and are not associated with toxic effects. The elevated nutrient levels are probably a result of agricultural and urban inputs, rather than being linked to PNGS operations.

Mid-depth Study Area

The concentrations of metals, PAHs, PCBs, pesticides and herbicides measured in samples from the Mid-Depth Study Area were below their respective guidelines.

Some petroleum hydrocarbon fractions exceeded their respective sediment quality guidelines in two samples (MD-02 and MD-03; **Table A-7**). However, as these exceedances were limited to a small number of samples and are not expected to be associated with PNGS operations, they are not anticipated to pose a sustained risk to wildlife in the area. These exceedances will be further evaluated as part of the 2027 PN ERA.

Radiological Concentrations in Sediment

Frenchman's Bay, which is characterized by the presence of fine-grained sediments and relatively high concentrations of TOC is the nearest depositional area for sediment that is suitable for radiological analyses. Sediments present in the Nearshore areas (primarily coarse sand) are not appropriate for the accumulation of radiological contaminants (Hart and Peterson, 2013), and were thus not analyzed for these parameters.

Sediment samples collected from Frenchman's Bay during the 2015 sampling program were analyzed for radionuclides, including C-14, Co-60, Cs-134, and Cs-137 (Ecometrix and Golder, 2018). In addition, sediment from Frenchman's Bay is sampled every five years to identify possible radionuclide accumulation over time in support of OPG's EMP, with the most recent sampling conducted in 2024 (OPG, 2025a). The same radionuclides analyzed in the 2015 program were assessed in the EMP sampling, with the addition of K-40. Sediment samples collected as a part of the 2024 environmental studies in support of this PERA were also analyzed for the same radionuclides as the 2015 program, with the addition of tritium, K-40, I-131, Thorium-series, and Uranium-series radionuclides.

Across all three sampling events, the majority of sediment samples exhibited concentrations of Co-60 and Cs-134 well below detection limits. Cs-137 was generally detectable in samples from all three events, with similar results being observed; however, its presence cannot be confirmed to be the result of OPG operations. C-14 concentrations across all three sampling events were either low or below detection limits. Concentrations in samples collected in 2024 in support of the PERA (**Table A-4**) were low and comparable to those measured in 2015, while samples collected in 2024 in support of the EMP were below detection limits. Though tritium, K-40, I-131, Thorium-series and Uranium-series radionuclides were all detectable in the samples from the 2024 environmental studies, the concentrations are low.

A.2.1.3 Stormwater Runoff

Stormwater runoff from the PN site is collected by a drainage system and directed south to Lake Ontario. Runoff entering the discharge channels is estimated at 270 m^3/day for PNGS Units 1-4 and 262 m^3/day for PNGS Units 5-8, based on an annual precipitation of 872 mm. The 2017 ERA (Ecometrix and Golder, 2018) included results from a 2015–2016 stormwater sampling campaign to characterize the quality of stormwater. Final concentrations in the discharge channels and in Lake Ontario were compared to relevant water quality screening criteria, and no exceedances of the selected benchmarks were identified.

Consistent with the requirements of CSA N288.6:22 clause 11.1 to periodically review changes to the facility, the expansion of PWMF Phase II will likely result in changes to the stormwater catchments in the East Complex. The appropriate stormwater outfalls in the East Complex should be reviewed and sampled accordingly to be representative of the catchment areas after the completion of the PWMF Phase II expansion. Gross beta-gamma in stormwater was monitored and reported quarterly over the 2016-2020 period; however, in 2021 OPG determined that no routine monitoring is required given the robust design of the used fuel dry

storage containers (DSCs) and absence of liquid inside the DSCs during dry storage (OPG, 2021a). Following their review of the 2017 ERA, CNSC and ECCC recommended that a stormwater sampling plan be included in future ERA submissions. OPG plans to carry out this recommendation after the completion of the PWMF Phase II expansion and results from the stormwater sampling will be included in the subsequent routine updates of the ERA.

Table A-6: Screening of Sediment Quality Parameters in Samples from the Infill, Shoreline Erosion Mitigation, Mid-depth, and Cutoff Wall Study Areas, 2024-2025

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
Calculated Parameters																									
Total (Dry Wt) Methyl Mercury	ng/g	0.084 - 0.24	-	-	-	-	-	-	-	-	-	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.46	0.18	0.10	0.09	0.13	0.00
Total (Wet Wt) Methyl Mercury	ng/g	0.05	-	-	-	-	-	-	-	-	-	0.16	0.05	0.05	0.02	0.03	0.05	0.03	0.21	0.29	0.13	0.07	0.07	0.09	0.03
Inorganics																									
Moisture	%	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen (N)	%	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/kg	500	10000 [a]	100000 [a]	-	-	-	-	-	10000	(1)	2500.00	459.00	1100.00	483.00	670.00	860.00	630.00	2300.00	8500.00	2200.00	5000.00	3000.00	2900.00	0.01
Calculated Total Kjeldahl Nitrogen	µg/g	100	550	4800	-	-	-	-	-	550	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus (P)	mg/kg	10	600	2000	-	-	-	-	-	600	(1)	**986.00**	528.00	**619.00**	459.00	429.00	**979.00**	491.00	-	-	-	-	-	-	-
Nitrite (N)	µg/g	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (N)	µg/g	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite (N)	µg/g	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
< -1 Phi (2 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	100.00	100.00	99.00	100.00	100.00	0.82	1.02	0.99	1.37	1.76	0.91	0.00
< 0 Phi (1 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	100.00	99.00	98.00	100.00	100.00	-	-	-	-	-	-	-
< +1 Phi (0.5 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	100.00	96.00	89.00	100.00	99.00	-	-	-	-	-	-	-
< +2 Phi (0.25 mm)	%	0.1	-	-	-	-	-	-	-	-	-	96.00	94.00	83.00	28.00	47.00	78.00	70.00	-	-	-	-	-	-	-
< +3 Phi (0.12 mm)	%	0.1	-	-	-	-	-	-	-	-	-	45.00	30.00	11.00	1.50	3.10	27.00	2.50	-	-	-	-	-	-	-
< +4 Phi (0.062 mm)	%	0.1	-	-	-	-	-	-	-	-	-	12.00	1.60	1.30	0.60	0.63	0.97	0.58	-	-	-	-	-	-	-
< +5 Phi (0.031 mm)	%	0.1	-	-	-	-	-	-	-	-	-	4.70	1.10	0.96	0.52	0.42	0.75	0.52	-	-	-	-	-	-	-
< +6 Phi (0.016 mm)	%	0.1	-	-	-	-	-	-	-	-	-	2.90	0.63	0.69	0.35	0.42	0.65	0.48	-	-	-	-	-	-	-
< +7 Phi (0.0078 mm)	%	0.1	-	-	-	-	-	-	-	-	-	1.70	0.60	0.50	0.35	0.34	0.52	0.40	-	-	-	-	-	-	-
< +8 Phi (0.0039 mm)	%	0.1	-	-	-	-	-	-	-	-	-	1.20	0.56	0.55	0.38	0.37	0.49	0.33	-	-	-	-	-	-	-
< +9 Phi (0.0020 mm)	%	0.1	-	-	-	-	-	-	-	-	-	1.20	0.37	0.41	0.26	0.29	0.51	0.34	-	-	-	-	-	-	-
Gravel	%	0.1	-	-	-	-	-	-	-	-	-	0.12	0.00	0.00	0.46	0.53	0.00	0.00	-	-	-	-	-	-	-
Sand	%	0.1	-	-	-	-	-	-	-	-	-	88.00	98.00	99.00	99.00	99.00	99.00	99.00	-	-	-	-	-	-	-
Silt	%	0.1	-	-	-	-	-	-	-	-	-	11.00	1.00	0.80	0.22	0.25	0.48	0.25	-	-	-	-	-	-	-
Clay	%	0.1	-	-	-	-	-	-	-	-	-	1.20	0.56	0.55	0.38	0.37	0.49	0.33	-	-	-	-	-	-	-
Physical testing																									
Moisture-Subcontracted	%	0.3	-	-	-	-	-	-	-	-	-	19.00	19.00	19.00	18.00	19.00	18.00	20.00	-	-	-	-	-	-	-
Metals																									
Total Aluminum (Al)	mg/kg	100.00	-	-	-	-	58030	(3)	-	58030	(3)	1760.00	1070.00	1240.00	992.00	1160.00	1460.00	1120.00	1400.00	1800.00	1200.00	1000.00	1400.00	1600.00	1100.00
Total Antimony (Sb)	mg/kg	0.10	-	-	-	-	2	(6)	-	2	(6)	0.04	0.02	0.03	0.03	0.03	0.04	0.02	0.03	0.06	0.01	0.02	0.02	0.05	0.03
Total Arsenic (As)	mg/kg	0.20	6	33	5.9	17	-	-	-	5.9	(2)	1.50	1.37	1.34	1.29	1.39	2.63	1.41	1.30	1.40	1.40	1.30	1.20	1.40	1.30
Total Barium (Ba)	mg/kg	0.10	-	-	-	-	-	-	10 - 5000	10 - 5000	(7)	10.40	6.11	6.26	6.13	6.40	7.35	6.17	7.60	13.00	7.70	5.80	8.60	8.30	6.10
Total Beryllium (Be)	mg/kg	0.20	-	-	-	-	-	-	<1.0 - 15	<1.0 - 15	(7)	0.13	0.07	0.16	0.10	0.10	0.12	0.11	0.09	0.11	0.08	0.08	0.09	0.10	0.10
Total Bismuth (Bi)	mg/kg	0.10	-	-	-	-	-	-	<10 - 15	<10 - 15	(7)	0.02	0.01	0.01	0.01	0.01	0.02	0.01	-	-	-	-	-	-	-
Total Boron (B)	mg/kg	1.00	-	-	-	-	-	-	<20 - 300	<20 - 300	(7)	3.30	2.10	3.70	3.10	2.70	2.90	2.60	1.42	2.36	1.06	1.24	0.97	1.57	1.34
Hot Water Ext. Boron (B)	µg/g	0.05	-	-	-	-	1.5	(8)	-	1.5	(8)	0.27	0.06	0.08	0.04	0.05	0.05	0.04	0.21	1.10	0.11	0.05	0.09	0.08	0.05
Total Cadmium (Cd)	mg/kg	0.05	0.6	10	0.60	3.50	-	-	-	0.6	(2)	0.04	0.02	0.04	0.03	0.04	0.05	0.02	0.06	0.07	0.02	0.02	0.02	0.06	0.03
Total Calcium (Ca)	mg/kg	100	-	-	-	-	-	-	100 - 320,000	100 - 320000	(7)	79100.00	76100.00	79900.00	76000.00	81000.00	83000.00	81500.00	-	-	-	-	-	-	-
Total Cesium (Cs)	mg/kg	1	-	-	-	-	-	-	0.25 - 25	0.25 - 25	(7)	0.14	0.07	0.08	0.08	0.10	0.10	0.10	-	-	-	-	-	-	-
Total Chromium (Cr)	mg/kg	0.5	26	110	37.3	90	-	-	-	26	(1)	8.32	3.64	4.11	4.04	3.41	6.95	3.85	4.40	6.00	3.70	3.60	5.10	6.00	5.00
Total Cobalt (Co)	mg/kg	0.1	-	-	-	-	50	(4)	-	50	(4)	2.24	1.17	1.40	1.27	1.31	1.87	1.37	1.60	2.00	1.30	1.20	1.80	1.70	1.40
Total Copper (Cu)	mg/kg	0.5	16	110	35.7	197	-	-	-	16	(1)	3.27	1.65	1.70	1.53	1.83	2.46	1.56	2.40	4.60	5.30	2.10	3.90	3.10	2.20
Total Iron (Fe)	mg/kg	100	20000 [a]	40000 [a]	-	-	-	-	-	20000	(1)	13200.00	5470.00	6880.00	7400.00	5440.00	12000.00	6710.00	6100.00	8300.00	5600.00	5500.00	7600.00	8500.00	7900.00

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
Total Lead (Pb)	mg/kg	0.1	31	250	35	91.3	-	-	-	31	(31)	2.52	1.85	1.91	1.80	2.14	2.23	1.98	2.10	2.80	2.00	1.70	2.10	2.10	2.00
Total Lithium (Li)	mg/kg	0.5	-	-	-	-	-	-	<5.0 - 140	<5.0 - 140	(7)	2.53	1.67	1.96	1.81	2.14	2.21	1.87	-	-	-	-	-	-	-
Total Magnesium (Mg)	mg/kg	100	-	-	-	-	-	-	50 - >100,000	50 - >100000	(7)	4320.00	3280.00	3340.00	2670.00	2790.00	3740.00	2820.00	3500.00	4200.00	3000.00	2800.00	3600.00	4600.00	3700.00
Total Manganese (Mn)	mg/kg	0.2	460	1100	-	-	-	-	-	460	(1)	185.00	129.00	148.00	131.00	142.00	161.00	138.00	150.00	190.00	130.00	120.00	150.00	150.00	140.00
Total Mercury (Hg)	mg/kg	0.05	0.2	2	0.17	0.486	-	-	-	0.17	(2)	0.00	0.00	0.03	0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00
Total Molybdenum (Mo)	mg/kg	0.1	-	-	-	-	13.8	(5)	-	13.8	(5)	0.19	0.10	0.14	0.16	0.12	0.16	0.12	0.11	0.14	0.11	0.12	0.13	0.12	0.09
Total Nickel (Ni)	mg/kg	0.5	16	75	-	-	-	-	-	16	(1)	4.30	2.33	2.77	2.50	2.90	3.34	2.50	3.40	4.20	2.70	2.50	3.10	3.20	2.60
Total Potassium (K)	mg/kg	100	-	-	-	-	-	-	50 - 63,000	50 - 63000	(7)	291.00	169.00	192.00	177.00	214.00	232.00	185.00	230.00	320.00	196.50	175.85	220.00	250.00	184.66
Total Selenium (Se)	mg/kg	0.5	-	-	-	-	1.9	(5)	-	1.9	(5)	0.08	0.03	0.08	0.04	0.05	0.04	0.04	0.06	0.15	0.07	0.05	0.08	0.08	0.03
Total Silver (Ag)	mg/kg	0.05	-	-	-	-	0.5	(4)	-	0.5	(4)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Sodium (Na)	mg/kg	100	-	-	-	-	-	-	<500 - 100,000	<500 - 100000	(7)	112.00	78.58	92.54	82.24	80.98	103.00	75.45	-	-	-	-	-	-	-
Total Strontium (Sr)	mg/kg	0.1	-	-	-	-	-	-	<5 - 3000	<5 - 3000	(7)	125.00	118.00	127.00	117.00	125.00	131.00	125.00	-	-	-	-	-	-	-
Total Thallium (Tl)	mg/kg	0.05	-	-	-	-	-	-	<0.25 - 10	<0.25 - 10	(7)	0.05	0.03	0.03	0.03	0.03	0.03	0.02	0.01	0.03	0.01	0.01	0.02	0.03	0.01
Total Thorium (Th)	mg/kg	0.1	-	-	-	-	-	-	2.2 - 31	2.2 - 31	(7)	1.78	1.34	1.42	0.90	1.95	1.43	1.02	-	-	-	-	-	-	-
Total Tin (Sn)	mg/kg	0.1	-	-	-	-	-	-	<0.1 - 10	<0.1 - 10	(7)	0.35	0.16	0.21	0.19	0.17	0.27	0.18	-	-	-	-	-	-	-
Total Titanium (Ti)	mg/kg	1	-	-	-	-	-	-	70 - 20,000	70 - 20000	(7)	276.00	132.00	183.00	158.00	121.00	252.00	150.00	-	-	-	-	-	-	-
Total Tungsten (W)	mg/kg	0.5	-	-	-	-	-	-	<100 - 1000	<100 - 1000	(7)	0.21	0.13	0.11	0.12	0.11	0.16	0.14	-	-	-	-	-	-	-
Total Uranium (U)	mg/kg	0.05	-	-	-	-	104.4	(5)	-	104.4	(5)	0.45	0.26	0.37	0.31	0.26	0.41	0.34	0.29	0.35	0.30	0.25	0.30	0.37	0.32
Total Vanadium (V)	mg/kg	1	-	-	-	-	35.2	(5)	-	35.2	(5)	24.20	8.80	11.30	13.00	8.50	21.80	10.90	9.80	14.00	8.70	9.20	14.00	16.00	14.00
Total Zinc (Zn)	mg/kg	1	120	820	123	315	-	-	-	120	(1)	16.80	9.40	10.30	8.80	11.70	13.30	10.30	17.00	20.00	11.00	9.90	13.00	16.00	12.00
Total Zirconium (Zr)	mg/kg	0.5	-	-	-	-	-	-	<20 - 2000	<20 - 2000	(7)	1.36	0.96	1.24	0.99	1.05	1.51	1.06	-	-	-	-	-	-	-
PCBs																									
Aroclor 1016	µg/g	0.02	0.007	53	-	-	-	-	-	0.007	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1221	µg/g	0.02	-	-	-	-	0.12	(3)	-	0.12	(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1232	µg/g	0.02	-	-	-	-	0.6	(3)	-	0.6	(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1242	µg/g	0.02	-	-	-	-	0.17	(3)	-	0.17	(3)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1248	µg/g	0.02	0.03	150	-	-	-	-	-	0.03	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1254	µg/g	0.02	0.06	34	-	-	-	-	-	0.06	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1260	µg/g	0.02	0.005	24	-	-	-	-	-	0.005	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aroclor 1262	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aroclor 1268	µg/g	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PCB	µg/g	0.02	0.07	530	-	-	-	-	-	0.07	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Polyaromatic Hydrocarbons																									
Anthracene	µg/g	0.01	0.22	370	0.0469	0.2450	-	-	-	0.0469	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzo(a)anthracene	µg/g	0.01	0.32	1480	0.0317	0.3850	-	-	-	0.0317	(2)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Benzo(a)pyrene	µg/g	0.01	0.37	1440	0.0319	0.7820	-	-	-	0.0319	(2)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Benzo(g,h,i)perylene	µg/g	0.01	0.17	320	-	-	-	-	-	0.17	(1)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Benzo(k)fluoranthene	µg/g	0.01	0.24	1340	-	-	-	-	-	0.24	(1)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chrysene	µg/g	0.01	0.34	460	0.0571	0.8620	-	-	-	0.0571	(2)	-	-	-	-	-	-	-	0.01	0.01	0.01	0.00	0.01	0.00	0.00
Dibenzo(a,h)anthracene	µg/g	0.01	0.06	130	0.0062	0.1350	-	-	-	0.00622	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluoranthene	µg/g	0.01	0.75	1020	0.1110	2.3550	-	-	-	0.111	(2)	-	-	-	-	-	-	-	0.01	0.02	0.02	0.01	0.01	0.01	0.01
Fluorene	µg/g	0.01	0.19	160	0.0212	0.1440	-	-	-	0.0212	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indeno(1,2,3-cd)pyrene	µg/g	0.01	0.2	320	-	-	-	-	-	0.2	(1)	-	-	-	-	-	-	-	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Phenanthrene	µg/g	0.01	0.56	950	0.0419	0.5150	-	-	-	0.0419	(2)	-	-	-	-	-	-	-	0.00	0.01	0.02	0.00	0.00	0.00	0.00
Pyrene	µg/g	0.01	0.49	850	0.0530	0.8750	-	-	-	0.053	(2)	-	-	-	-	-	-	-	0.01	0.02	0.01	0.01	0.01	0.01	0.01

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
BTEX & F1 Hydrocarbons																									
Benzene	µg/g	0	-	-	-	-	1.24	(9)	-	1.24	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Toluene	µg/g	0	-	-	-	-	1.4	(9)	-	1.4	(9)	-	-	-	-	-	-	-	0.00	0.96	0.00	0.00	0.00	0.00	0.00
Ethylbenzene	µg/g	0	-	-	-	-	1.16	(9)	-	1.16	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
o-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p+m-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Xylenes	µg/g	0	-	-	-	-	1.28	(9)	-	1.28	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F1 (C6-C10)	µg/g	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aliphatic C6-C8	µg/g	-	-	-	-	-	14	(9)	-	14	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aliphatic C>8-C10	µg/g	-	-	-	-	-	10.5	(9)	-	10.5	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aromatic C>8-C10	µg/g	-	-	-	-	-	11.6	(9)	-	11.6	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F1 (C6-C10) - BTEX	µg/g	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F2-F4 Hydrocarbons																									
F2 (C10-C16 Hydrocarbons)	µg/g	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	36.00	8.70	0.00	0.00	0.00
Aliphatic C>10-C12	µg/g	-	-	-	-	-	8.7	(9)	-	8.7	(9)	-	-	-	-	-	-	-	0.00	0.00	**12.96**	3.13	0.00	0.00	0.00
Aliphatic C>12-C16	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	-	-	-	-	-	-	-	0.00	0.00	15.84	3.83	0.00	0.00	0.00
Aromatic C>10-C12	µg/g	-	-	-	-	-	5.7	(9)	-	5.7	(9)	-	-	-	-	-	-	-	0.00	0.00	3.24	0.78	0.00	0.00	0.00
Aromatic C>12-C16	µg/g	-	-	-	-	-	2.5	(9)	-	2.5	(9)	-	-	-	-	-	-	-	0.00	0.00	**3.96**	0.96	0.00	0.00	0.00
F3 (C16-C34 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	100.00	85.00	0.00	0.00	0.00	0.00
Aliphatic C>16-C21	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	-	-	-	-	-	-	-	0.00	56.00	47.60	0.00	0.00	0.00	0.00
Aliphatic C>21-C34	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	-	-	-	-	-	-	-	0.00	24.00	20.40	0.00	0.00	0.00	0.00
Aromatic C>16-C21	µg/g	-	-	-	-	-	1.7	(9)	-	1.7	(9)	-	-	-	-	-	-	-	0.00	**14.00**	**11.90**	0.00	0.00	0.00	0.00
Aromatic C>21-C34	µg/g	-	-	-	-	-	5.4	(9)	-	5.4	(9)	-	-	-	-	-	-	-	0.00	**6.00**	5.10	0.00	0.00	0.00	0.00
F4 (C34-C50 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aliphatic C>34	µg/g	-	-	-	-	-	98.8 [c]	(9)	-	98.8	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aromatic C>34	µg/g	-	-	-	-	-	0.4 [c]	(9)	-	0.4	(9)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calculated Parameters																									
Aldrin + Dieldrin	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlordane (Total)	µg/g	0.004	0.007	6	0.0045	0.00887	-	-	-	0.0045	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heptachlor + Heptachlor epoxide	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o,p-DDT + p,p-DDT	µg/g	0.004	0.008	71	0.00119	0.00477	-	-	-	0.00119	(2)	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pesticides & Herbicides																									
Aldrin	µg/g	0.004	0.002	8	-	-	-	-	-	0.002	(1)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
a-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
g-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dieldrin	µg/g	0.004	0.002	91	0.00285	0.00667	-	-	-	0.002	(1)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lindane	µg/g	0.004	-	-	0.00094	0.00138	-	-	-	0.0094	(2)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Endrin	µg/g	0.004	0.003	130	0.00267	0.0624	-	-	-	0.00267	(2)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor	µg/g	0.004	-	-	0.0006	0.00274	-	-	-	0.0006	(2)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor epoxide	µg/g	0.004	0.005	5	-	-	-	-	-	0.005	(1)	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
alpha-BHC	µg/g	0.004	0.006	10	-	-	-	-	-	0.006	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
beta-BHC	µg/g	0.004	0.005	21	-	-	-	-	-	0.005	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
delta-BHC	µg/g	0.004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Infill Area					Shoreline Erosion Mitigation Area		Mid-depth Study Area					Cutoff Wall Study Area	
												INFILL-01	INFILL-02	INFILL-03	INFILL-04	INFILL-05	INFILL-06	INFILL-07	MD-01	MD-02	MD-03	MD-04	MD-05	COW-02	COW-03
Mirex	µg/g	0.004	0.007	130	-	-	-	-	-	0.007	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radionuclides																									
Co-60	Bq/kg	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs-134	Bq/kg	0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs-137	Bq/kg	0.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I-131	Bq/kg	2.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
K-40	Bq/kg	1.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Th-Series	Bq/kg	0.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U-Series	Bq/kg	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H-3	Bq/kg	24.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C-14	Bq/g	0.0096	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note:

Bold Exceeded selected screening criteria

The symbol '-' denotes no value was determined and/or required.

Highlighting and bold font denotes that the maximum concentration of a parameter exceeds the relevant screening criteria value.

Sampling locations are presented in **Figure 4-4**.

* The concentrations of PHC subfractions were obtained by dividing the concentration of total fraction (eg: F2, F3, F4) by the ratios of the subfractions provided in CCME (2008). The concentrations of the subfractions were then compared to their equivalent guidelines from Atlantic PIRI (2012).

a - Converted from % to mg/kg.

b - Sediment criteria could not be calculated based on a toxic endpoint to aquatic species due to the low solubility of the fraction in water, resulting in a low potential for migration to or accumulation in sediment.

c - based on the Chronic benchmarks for aliphatic C19-C36 and aromatic C16-C36 calculated by Atlantic PIRI (2012) using the model developed by DiToro and McGrath (2000) using the benchmarks from Batelle (2007)

LEL - Lowest Effect Level

SEL- Severe Effect Level

ISQG- Interim Sediment Quality Guidelines

PEL- Probable Effects Level

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Table A-7: Screening of Sediment Quality Parameters in Frenchman's Bay Samples, 2024

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																	
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
Calculated Parameters																													
Total (Dry Wt) Methyl Mercury	ng/g	0.084 - 0.24	-	-	-	-	-	-	-	-	-	-	0.35	0.00	-	0.00	-	-	-	0.17	-	0.00	0.00	-	-	-	-	0.24	-
Total (Wet Wt) Methyl Mercury	ng/g	0.05	-	-	-	-	-	-	-	-	-	-	0.07	0.03	-	0.01	-	-	-	0.06	-	0.01	0.04	-	-	-	-	0.06	-
Inorganics																													
Moisture	%	1	-	-	-	-	-	-	-	-	-	44	80	40	74	77	78	77	61	59	77	78	48	67	48	72	56	77	61
Nitrogen (N)	%	0.01	-	-	-	-	-	-	-	-	-	0.17	0.89	0.18	0.63	0.78	0.81	0.74	0.41	0.31	0.67	0.66	0.18	0.40	0.16	0.55	0.29	0.76	0.34
Total Organic Carbon	mg/kg	500	10000 [a]	100000 [a]	-	-	-	-	-	10000	(1)	**14000.00**	**94000.00**	**19000.00**	**76000.00**	**75000.00**	**100000.00**	**86000.00**	**46000.00**	**24000.00**	**66000.00**	**60000.00**	**14000.00**	**36000.00**	**13000.00**	**53000.00**	**26000.00**	**65000.00**	**21000.00**
Calculated Total Kjeldahl Nitrogen	µg/g	100	550	4800	-	-	-	-	-	550	(1)	**1700.00**	**8900.00**	**1800.00**	**6300.00**	**7800.00**	**8100.00**	**7400.00**	**4100.00**	**3100.00**	**6700.00**	**6600.00**	**1800.00**	**4000.00**	**1600.00**	**5500.00**	**2900.00**	**7600.00**	**3400.00**
Total Phosphorus (P)	mg/kg	10	600	2000	-	-	-	-	-	600	(1)	**787.00**	**869.00**	**782.00**	**1000.00**	**884.00**	**875.00**	**1050.00**	**1040.00**	**800.00**	**951.00**	**935.00**	**604.00**	**870.00**	597.00	**1110.00**	**808.00**	**1030.00**	**815.00**
Nitrite (N)	µg/g	0.5	-	-	-	-	-	-	-	-	-	0.02	0.09	0.00	0.04	0.07	0.07	0.00	0.04	0.36	0.16	0.05	0.02	0.04	0.01	0.03	0.01	0.21	0.01
Nitrate (N)	µg/g	2	-	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrate + Nitrite (N)	µg/g	3	-	-	-	-	-	-	-	-	-	0.28	0.46	0.17	0.11	0.41	0.34	0.28	0.15	1.61	0.48	0.35	0.36	0.36	0.24	0.36	0.26	0.47	0.61
< -1 Phi (2 mm)	%	0.1	-	-	-	-	-	-	-	-	-	100.00	100.00	99.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	98.00	100.00	100.00	100.00	100.00
< 0 Phi (1 mm)	%	0.1	-	-	-	-	-	-	-	-	-	99.00	100.00	97.00	100.00	100.00	99.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	96.00	100.00	100.00	100.00	100.00
< +1 Phi (0.5 mm)	%	0.1	-	-	-	-	-	-	-	-	-	98.00	99.00	94.00	99.00	100.00	99.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	93.00	100.00	99.00	100.00	100.00
< +2 Phi (0.25 mm)	%	0.1	-	-	-	-	-	-	-	-	-	96.00	97.00	88.00	98.00	100.00	99.00	100.00	99.00	99.00	100.00	99.00	93.00	99.00	80.00	99.00	94.00	100.00	98.00
< +3 Phi (0.12 mm)	%	0.1	-	-	-	-	-	-	-	-	-	83.00	89.00	69.00	96.00	99.00	97.00	99.00	96.00	88.00	99.00	97.00	52.00	93.00	46.00	91.00	59.00	99.00	86.00
< +4 Phi (0.062 mm)	%	0.1	-	-	-	-	-	-	-	-	-	55.00	81.00	43.00	95.00	94.00	94.00	98.00	85.00	56.00	93.00	94.00	25.00	71.00	23.00	87.00	42.00	97.00	56.00
< +5 Phi (0.031 mm)	%	0.1	-	-	-	-	-	-	-	-	-	28.00	70.00	27.00	87.00	83.00	82.00	93.00	67.00	39.00	81.00	87.00	17.00	56.00	19.00	74.00	34.00	87.00	39.00
< +6 Phi (0.016 mm)	%	0.1	-	-	-	-	-	-	-	-	-	17.00	59.00	20.00	70.00	67.00	63.00	80.00	45.00	29.00	62.00	75.00	13.00	44.00	15.00	61.00	26.00	69.00	30.00
< +7 Phi (0.0078 mm)	%	0.1	-	-	-	-	-	-	-	-	-	10.00	36.00	13.00	38.00	37.00	35.00	21.00	24.00	20.00	34.00	52.00	9.10	28.00	11.00	40.00	18.00	45.00	21.00
< +8 Phi (0.0039 mm)	%	0.1	-	-	-	-	-	-	-	-	-	8.70	27.00	11.00	26.00	20.00	20.00	11.00	19.00	17.00	20.00	43.00	8.30	24.00	10.00	34.00	15.00	37.00	18.00
< +9 Phi (0.0020 mm)	%	0.1	-	-	-	-	-	-	-	-	-	6.90	12.00	8.70	8.20	7.70	9.60	7.00	7.50	7.10	8.10	24.00	6.50	17.00	7.50	25.00	11.00	22.00	8.20
Gravel	%	0.1	-	-	-	-	-	-	-	-	-	0.05	0.00	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	2.00	0.00	0.00	0.00	0.00
Sand	%	0.1	-	-	-	-	-	-	-	-	-	45.00	19.00	55.00	5.40	5.90	6.30	1.70	15.00	44.00	6.70	5.90	75.00	29.00	75.00	13.00	58.00	2.90	44.00
Silt	%	0.1	-	-	-	-	-	-	-	-	-	46.00	53.00	32.00	68.00	74.00	74.00	87.00	66.00	39.00	73.00	51.00	16.00	47.00	13.00	54.00	27.00	60.00	38.00
Clay	%	0.1	-	-	-	-	-	-	-	-	-	8.70	27.00	11.00	26.00	20.00	20.00	11.00	19.00	17.00	20.00	43.00	8.30	24.00	10.00	34.00	15.00	37.00	18.00
Physical testing																													
Moisture-Subcontracted	%	0.3	-	-	-	-	-	-	-	-	-	-	79.00	40.00	-	77.00	-	-	-	62.00	-	78.00	45.00	-	-	-	-	76.00	
Metals																													
Total Aluminum (Al)	mg/kg	100.00	-	-	-	-	58030	(3)	-	58030	(3)	4210.00	9220.00	5740.00	12300.00	10100.00	9720.00	11300.00	10100.00	6260.00	10600.00	11600.00	3620.00	7000.00	4110.00	11400.00	6170.00	12100.00	5920.00
Total Antimony (Sb)	mg/kg	0.10	-	-	-	-	2	(6)	-	2	(6)	0.26	0.78	0.42	0.93	0.63	0.71	0.64	0.84	0.24	0.49	0.46	0.16	0.33	0.17	0.53	0.23	0.62	0.30
Total Arsenic (As)	mg/kg	0.20	6	33	5.9	17	-	-	-	5.9	(2)	1.22	2.61	1.61	3.05	3.67	3.17	2.44	2.61	2.72	4.07	3.83	2.20	2.97	2.37	4.15	2.88	3.94	2.91
Total Barium (Ba)	mg/kg	0.10	-	-	-	-	-	-	10 - 5000	10 - 5000	(7)	32.00	71.70	37.70	93.10	92.30	80.00	97.30	74.10	50.60	93.40	106.00	28.30	63.80	30.40	95.20	43.80	99.00	49.50
Total Beryllium (Be)	mg/kg	0.20	-	-	-	-	-	-	<1.0 - 15	<1.0 - 15	(7)	0.19	0.44	0.30	0.52	0.44	0.45	0.50	0.43	0.32	0.45	0.49	0.19	0.37	0.21	0.51	0.30	0.53	0.30
Total Bismuth (Bi)	mg/kg	0.10	-	-	-	-	-	-	<10 - 15	<10 - 15	(7)	0.10	0.16	0.11	0.23	0.16	0.15	0.19	0.22	0.08	0.15	0.15	0.04	0.11	0.05	0.18	0.07	0.17	0.08
Total Boron (B)	mg/kg	1.00	-	-	-	-	-	-	<20 - 300	<20 - 300	(7)	4.50	11.10	6.30	10.20	8.20	10.00	9.00	9.00	6.40	9.00	7.40	3.90	6.00	4.40	9.40	6.00	8.90	5.60
Hot Water Ext. Boron (B)	µg/g	0.05	-	-	-	-	1.5	(8)	-	1.5	(8)	0.35	0.31	0.41	0.61	0.22	0.20	0.35	0.35	0.30	0.26	0.24	0.23	0.33	0.29	0.32	0.31	0.24	0.32
Total Cadmium (Cd)	mg/kg	0.05	0.6	10	0.60	3.50	-	-	-	0.6	(2)	0.15	0.39	0.21	0.53	0.47	0.39	0.44	**0.60**	0.36	**0.60**	**0.61**	0.17	0.33	0.24	0.56	0.29	0.54	0.34
Total Calcium (Ca)	mg/kg	100	-	-	-	-	-	-	100 - 320,000	100 - 320000	(7)	56200.00	71000.00	72400.00	92900.00	118000.00	87500.00	97000.00	97100.00	104000.00	122000.00	134000.00	91000.00	106000.00	92100.00	115000.00	94400.00	128000.00	103000.00
Total Cesium (Cs)	mg/kg	1	-	-	-	-	-	-	0.25 - 25	0.25 - 25	(7)	0.29	0.60	0.46	0.82	0.66	0.62	0.65	0.63	0.46	0.62	0.64	0.32	0.53	0.36	0.73	0.46	0.62	0.44
Total Chromium (Cr)	mg/kg	0.5	26	110	37.3	90	-	-	-	26	(1)	11.20	20.40	16.10	**29.80**	23.60	22.80	25.20	**30.10**	15.40	25.20	25.30	9.15	17.60	9.71	**27.40**	14.80	**26.90**	15.50
Total Cobalt (Co)	mg/kg	0.1	-	-	-	-	50	(4)	-	50	(4)	3.24	5.78	5.71	7.91	6.82	6.16	6.75	7.86	5.69	7.18	7.67	4.29	5.69	4.46	8.68	5.56	7.96	5.51
Total Copper (Cu)	mg/kg	0.5	16	110	35.7	197	-	-	-	16	(1)	15.30	**38.60**	**24.30**	**54.10**	**45.20**	**41.40**	**48.50**	**57.10**	**35.80**	**60.40**	**56.00**	**16.10**	**38.60**	**16.60**	**73.90**	**31.80**	**53.30**	**32.60**
Total Iron (Fe)	mg/kg	100	20000 [a]	40000 [a]	-	-	-	-	-	20000	(1)	8660.00	15000.00	12300.00	19800.00	17300.00	16300.00	18800.00	18000.00	13100.00	17900.00	19700.00	8350.00	14100.00	9090.00	19200.00	12000.00	**20200.00**	12500.00

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																	
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
Total Lead (Pb)	mg/kg	0.1	31	250	35	91.3	-	-	-	31	(31)	9.02	24.90	14.60	**33.60**	30.00	25.90	28.30	**31.80**	17.50	**34.60**	**35.20**	10.10	17.90	9.72	**31.90**	17.40	**33.20**	16.60
Total Lithium (Li)	mg/kg	0.5	-	-	-	-	-	-	<5.0 - 140	<5.0 - 140	(7)	4.93	10.30	8.06	14.60	11.60	10.80	13.00	11.80	8.51	12.20	13.00	5.52	9.24	6.27	13.70	8.17	13.20	8.15
Total Magnesium (Mg)	mg/kg	100	-	-	-	-	-	-	50 - >100,000	50 - >100000	(7)	4650.00	5730.00	5940.00	8120.00	6870.00	7150.00	7550.00	9080.00	7710.00	8280.00	8580.00	5320.00	8310.00	5520.00	9920.00	6850.00	8080.00	7370.00
Total Manganese (Mn)	mg/kg	0.2	460	1100	-	-	-	-	-	460	(1)	214.00	369.00	261.00	**522.00**	**538.00**	436.00	**534.00**	**463.00**	423.00	**632.00**	**599.00**	268.00	430.00	296.00	**593.00**	342.00	**616.00**	382.00
Total Mercury (Hg)	mg/kg	0.05	0.2	2	0.17	0.486	-	-	-	0.17	(2)	0.03	0.09	0.04	0.08	0.07	0.06	0.07	0.07	0.05	0.08	0.07	0.03	0.04	0.02	0.07	0.04	0.08	0.04
Total Molybdenum (Mo)	mg/kg	0.1	-	-	-	-	13.8	(5)	-	13.8	(5)	0.28	0.78	0.46	0.91	0.70	0.81	0.80	0.84	0.43	0.76	0.85	0.23	0.64	0.31	0.98	0.44	0.77	0.45
Total Nickel (Ni)	mg/kg	0.5	16	75	-	-	-	-	-	16	(1)	7.13	14.40	11.90	**19.90**	**17.40**	15.60	**17.80**	**19.20**	14.40	**20.00**	**21.80**	9.83	15.10	10.30	**22.40**	13.60	**20.60**	13.30
Total Potassium (K)	mg/kg	100	-	-	-	-	-	-	50 - 63,000	50 - 63000	(7)	530.00	1180.00	859.00	1610.00	1290.00	1230.00	1370.00	1250.00	919.00	1420.00	1520.00	579.00	1090.00	632.00	1590.00	918.00	1410.00	883.00
Total Selenium (Se)	mg/kg	0.5	-	-	-	-	1.9	(5)	-	1.9	(5)	0.23	0.84	0.25	0.77	0.85	0.89	0.66	0.50	0.48	0.95	0.87	0.27	0.56	0.33	0.85	0.42	0.87	0.51
Total Silver (Ag)	mg/kg	0.05	-	-	-	-	0.5	(4)	-	0.5	(4)	0.03	0.08	0.04	0.10	0.10	0.08	0.11	0.11	0.09	0.16	0.18	0.05	0.08	0.04	0.17	0.07	0.13	0.08
Total Sodium (Na)	mg/kg	100	-	-	-	-	-	-	<500 - 100,000	<500 - 100000	(7)	221.00	**513.00**	349.00	429.00	385.00	427.00	**521.00**	**503.00**	260.00	401.00	403.00	169.00	281.00	167.00	400.00	240.00	452.00	228.00
Total Strontium (Sr)	mg/kg	0.1	-	-	-	-	-	-	<5 - 3000	<5 - 3000	(7)	95.60	139.00	123.00	172.00	207.00	167.00	180.00	174.00	187.00	233.00	237.00	161.00	196.00	159.00	223.00	166.00	224.00	180.00
Total Thallium (Tl)	mg/kg	0.05	-	-	-	-	-	-	<0.25 - 10	<0.25 - 10	(7)	0.07	0.15	0.12	0.20	0.20	0.16	0.17	0.19	0.15	0.21	0.18	0.13	0.15	0.12	0.22	0.15	0.20	0.16
Total Thorium (Th)	mg/kg	0.1	-	-	-	-	-	-	2.2 - 31	2.2 - 31	(7)	1.48	1.97	1.76	**2.47**	**2.23**	2.01	**2.33**	**2.28**	2.06	**2.41**	**2.48**	1.50	2.01	1.53	**2.61**	1.92	**2.44**	1.86
Total Tin (Sn)	mg/kg	0.1	-	-	-	-	-	-	<0.1 - 10	<0.1 - 10	(7)	0.91	2.00	1.34	2.94	2.25	2.15	2.41	3.75	1.35	2.66	2.41	0.76	1.59	0.80	2.36	1.21	2.49	1.24
Total Titanium (Ti)	mg/kg	1	-	-	-	-	-	-	70 - 20,000	70 - 20000	(7)	271.00	286.00	260.00	333.00	295.00	312.00	260.00	331.00	256.00	325.00	285.00	202.00	267.00	203.00	358.00	277.00	314.00	267.00
Total Tungsten (W)	mg/kg	0.5	-	-	-	-	-	-	<100 - 1000	<100 - 1000	(7)	0.22	0.48	0.32	0.68	0.40	0.44	0.49	0.80	0.22	0.35	0.37	0.12	0.24	0.15	0.38	0.17	0.42	0.22
Total Uranium (U)	mg/kg	0.05	-	-	-	-	104.4	(5)	-	104.4	(5)	0.36	0.62	0.41	0.58	0.54	0.66	0.54	0.54	0.50	0.62	0.64	0.38	0.55	0.40	0.64	0.49	0.58	0.47
Total Vanadium (V)	mg/kg	1	-	-	-	-	35.2	(5)	-	35.2	(5)	13.60	21.10	16.80	26.30	23.70	23.20	22.80	23.20	17.10	24.00	23.40	11.50	18.30	12.00	25.60	17.00	25.20	17.10
Total Zinc (Zn)	mg/kg	1	120	820	123	315	-	-	-	120	(1)	81.60	**161.00**	119.00	**240.00**	**171.00**	**170.00**	**211.00**	**271.00**	104.00	**156.00**	**162.00**	51.90	105.00	60.10	**177.00**	82.70	**199.00**	95.20
Total Zirconium (Zr)	mg/kg	0.5	-	-	-	-	-	-	<20 - 2000	<20 - 2000	(7)	0.73	2.15	0.92	1.93	1.80	2.05	2.12	2.00	1.42	2.20	1.91	1.02	1.41	0.77	2.15	1.39	2.36	1.29
PCBs																													
Aroclor 1016	µg/g	0.02	0.007	53	-	-	-	-	-	0.007	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1221	µg/g	0.02	-	-	-	-	0.12	(3)	-	0.12	(3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1232	µg/g	0.02	-	-	-	-	0.6	(3)	-	0.6	(3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1242	µg/g	0.02	-	-	-	-	0.17	(3)	-	0.17	(3)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1248	µg/g	0.02	0.03	150	-	-	-	-	-	0.03	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1254	µg/g	0.02	0.06	34	-	-	-	-	-	0.06	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.011	0.000	0.017	0.000	0.000	0.000
Aroclor 1260	µg/g	0.02	0.005	24	-	-	-	-	-	0.005	(1)	0.003	**0.012**	0.000	**0.024**	**0.019**	**0.013**	**0.019**	**0.016**	0.000	**0.019**	**0.036**	**0.009**	**0.010**	**0.006**	**0.016**	0.000	**0.017**	**0.011**
Aroclor 1262	µg/g	0.02	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aroclor 1268	µg/g	0.02	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total PCB	µg/g	0.02	0.07	530	-	-	-	-	-	0.07	(1)	0.000	0.012	0.000	0.024	0.019	0.013	0.020	0.016	0.000	0.019	0.036	0.018	0.011	0.000	0.033	0.000	0.017	0.011
Polyaromatic Hydrocarbons																													
Anthracene	µg/g	0.01	0.22	370	0.0469	0.2450	-	-	-	0.0469	(2)	0.040	0.022	0.029	0.034	0.029	0.030	0.033	0.019	0.021	0.024	0.028	0.016	0.027	0.008	0.022	0.018	0.028	0.023
Benzo(a)anthracene	µg/g	0.01	0.32	1480	0.0317	0.3850	-	-	-	0.0317	(2)	**0.150**	**0.088**	**0.190**	**0.170**	**0.130**	**0.150**	**0.140**	**0.140**	**0.074**	**0.073**	**0.078**	**0.050**	**0.081**	0.022	**0.077**	**0.048**	**0.130**	**0.069**
Benzo(a)pyrene	µg/g	0.01	0.37	1440	0.0319	0.7820	-	-	-	0.0319	(2)	**0.210**	**0.150**	**0.260**	**0.300**	**0.230**	**0.260**	**0.240**	**0.210**	**0.093**	**0.110**	**0.140**	**0.065**	**0.110**	0.030	**0.110**	**0.062**	**0.230**	**0.095**
Benzo(g,h,i)perylene	µg/g	0.01	0.17	320	-	-	-	-	-	0.17	(1)	**0.180**	0.160	**0.210**	**0.290**	**0.220**	**0.230**	**0.230**	**0.190**	0.076	0.110	0.150	0.046	0.089	0.027	0.096	0.050	**0.210**	0.073
Benzo(k)fluoranthene	µg/g	0.01	0.24	1340	-	-	-	-	-	0.24	(1)	0.120	0.089	0.140	0.180	0.130	0.150	0.130	0.120	0.055	0.065	0.091	0.042	0.065	0.017	0.070	0.035	0.130	0.054
Chrysene	µg/g	0.01	0.34	460	0.0571	0.8620	-	-	-	0.0571	(2)	**0.210**	**0.140**	**0.280**	**0.290**	**0.210**	**0.220**	**0.240**	**0.210**	**0.093**	**0.093**	**0.120**	**0.093**	**0.110**	0.030	**0.110**	**0.065**	**0.210**	**0.090**
Dibenzo(a,h)anthracene	µg/g	0.01	0.06	130	0.0062	0.1350	-	-	-	0.00622	(2)	**0.035**	**0.026**	**0.044**	**0.045**	**0.036**	**0.037**	**0.040**	**0.035**	**0.016**	**0.020**	**0.024**	**0.010**	**0.017**	0.000	**0.017**	**0.009**	**0.038**	**0.013**
Fluoranthene	µg/g	0.01	0.75	1020	0.1110	2.3550	-	-	-	0.111	(2)	**0.460**	**0.300**	**0.580**	**0.580**	**0.430**	**0.510**	**0.470**	**0.460**	**0.200**	**0.220**	**0.240**	**0.220**	**0.230**	0.066	**0.220**	**0.140**	**0.430**	**0.200**
Fluorene	µg/g	0.01	0.19	160	0.0212	0.1440	-	-	-	0.0212	(2)	**0.064**	0.015	**0.026**	0.015	0.017	0.019	0.016	0.011	0.009	0.000	0.010	0.011	0.010	0.004	0.009	0.007	0.014	0.010
Indeno(1,2,3-cd)pyrene	µg/g	0.01	0.2	320	-	-	-	-	-	0.2	(1)	0.180	0.150	**0.210**	**0.270**	**0.220**	**0.220**	**0.220**	0.180	0.077	0.110	0.150	0.047	0.089	0.027	0.090	0.051	**0.210**	0.076
Phenanthrene	µg/g	0.01	0.56	950	0.0419	0.5150	-	-	-	0.0419	(2)	**0.230**	**0.073**	**0.220**	**0.140**	**0.110**	**0.130**	**0.140**	**0.130**	**0.064**	**0.054**	**0.060**	**0.190**	**0.084**	0.018	**0.065**	**0.047**	**0.110**	**0.077**
Pyrene	µg/g	0.01	0.49	850	0.0530	0.8750	-	-	-	0.053	(2)	**0.360**	**0.260**	**0.480**	**0.510**	**0.380**	**0.420**	**0.410**	**0.390**	**0.180**	**0.200**	**0.220**	**0.180**	**0.210**	**0.063**	**0.210**	**0.130**	**0.390**	**0.180**

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
BTEX & F1 Hydrocarbons																													
Benzene	µg/g	0	-	-	-	-	1.24	(9)	-	1.24	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Toluene	µg/g	0	-	-	-	-	1.4	(9)	-	1.4	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.000	0.000	0.000	0.000	0.000
Ethylbenzene	µg/g	0	-	-	-	-	1.16	(9)	-	1.16	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p+m-Xylene	µg/g	0	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Xylenes	µg/g	0	-	-	-	-	1.28	(9)	-	1.28	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F1 (C6-C10)	µg/g	10	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aliphatic C6-C8	µg/g	-	-	-	-	-	14	(9)	-	14	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aliphatic C>8-C10	µg/g	-	-	-	-	-	10.5	(9)	-	10.5	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aromatic C>8-C10	µg/g	-	-	-	-	-	11.6	(9)	-	11.6	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F1 (C6-C10) - BTEX	µg/g	11	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F2-F4 Hydrocarbons																													
F2 (C10-C16 Hydrocarbons)	µg/g	7	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.000	0.000	0.000	0.000	8.100	0.000	0.000
Aliphatic C>10-C12	µg/g	-	-	-	-	-	8.7	(9)	-	8.7	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.520	0.000	0.000	0.000	2.916	0.000	0.000
Aliphatic C>12-C16	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.080	0.000	0.000	0.000	3.564	0.000	0.000
Aromatic C>10-C12	µg/g	-	-	-	-	-	5.7	(9)	-	5.7	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.630	0.000	0.000	0.000	0.729	0.000	0.000
Aromatic C>12-C16	µg/g	-	-	-	-	-	2.5	(9)	-	2.5	(9)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.770	0.000	0.000	0.000	0.891	0.000	0.000
F3 (C16-C34 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	160.000	160.000	360.000	350.000	170.000	56.000	200.000	500.000	140.000	56.000	67.000	130.000	120.000	120.000	300.000	170.000	190.000	150.000
Aliphatic C>16-C21	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	89.600	89.600	201.600	196.000	95.200	31.360	112.000	280.000	78.400	31.360	37.520	72.800	67.200	67.200	168.000	95.200	106.400	84.000
Aliphatic C>21-C34	µg/g	-	-	-	-	-	1000 [b]	(9)	-	1000 [b]	(9)	38.400	38.400	86.400	84.000	40.800	13.440	48.000	120.000	33.600	13.440	16.080	31.200	28.800	28.800	72.000	40.800	45.600	36.000
Aromatic C>16-C21	µg/g	-	-	-	-	-	1.7	(9)	-	1.7	(9)	**22.400**	**22.400**	**50.400**	**49.000**	**23.800**	**7.840**	**28.000**	**70.000**	**19.600**	**7.840**	**9.380**	**18.200**	**16.800**	**16.800**	**42.000**	**23.800**	**26.600**	**21.000**
Aromatic C>21-C34	µg/g	-	-	-	-	-	5.4	(9)	-	5.4	(9)	**9.600**	**9.600**	**21.600**	**21.000**	**10.200**	3.360	**12.000**	**30.000**	**8.400**	3.360	4.020	**7.800**	**7.200**	**7.200**	**18.000**	**10.200**	**11.400**	**9.000**
F4 (C34-C50 Hydrocarbons)	µg/g	50	-	-	-	-	-	-	-	-	-	110.000	98.000	290.000	270.000	120.000	0.000	160.000	420.000	82.000	0.000	0.000	0.000	61.000	0.000	160.000	76.000	140.000	69.000
Aliphatic C>34	µg/g	-	-	-	-	-	98.8 [c]	(9)	-	98.8	(9)	88.000	78.400	**232.000**	**216.000**	96.000	0.000	**128.000**	**336.000**	65.600	0.000	0.000	0.000	48.800	0.000	**128.000**	60.800	**112.000**	55.200
Aromatic C>34	µg/g	-	-	-	-	-	0.4 [c]	(9)	-	0.4	(9)	**22.000**	**19.600**	**58.000**	**54.000**	**24.000**	0.000	**32.000**	**84.000**	**16.400**	0.000	0.000	0.000	**12.200**	0.000	**32.000**	**15.200**	**28.000**	**13.800**
Calculated Parameters																													
Aldrin + Dieldrin	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chlordane (Total)	µg/g	0.004	0.007	6	0.0045	0.00887	-	-	-	0.0045	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor + Heptachlor epoxide	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o,p-DDT + p,p-DDT	µg/g	0.004	0.008	71	0.00119	0.00477	-	-	-	0.00119	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pesticides & Herbicides																													
Aldrin	µg/g	0.004	0.002	8	-	-	-	-	-	0.002	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
a-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
g-Chlordane	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
o,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p,p-DDT	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000
Dieldrin	µg/g	0.004	0.002	91	0.00285	0.00667	-	-	-	0.002	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lindane	µg/g	0.004	-	-	0.00094	0.00138	-	-	-	0.0094	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Endrin	µg/g	0.004	0.003	130	0.00267	0.0624	-	-	-	0.00267	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor	µg/g	0.004	-	-	0.0006	0.00274	-	-	-	0.0006	(2)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heptachlor epoxide	µg/g	0.004	0.005	5	-	-	-	-	-	0.005	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
alpha-BHC	µg/g	0.004	0.006	10	-	-	-	-	-	0.006	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
beta-BHC	µg/g	0.004	0.005	21	-	-	-	-	-	0.005	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
delta-BHC	µg/g	0.004	-	-	-	-	-	-	-	-	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Parameter	Units	Detection Limit	PSQG - LELs (1)	PSQG - SELs (1)	CCME SQG - ISQG (2)	CCME SQG - PEL (2)	Guideline/Benchmark from Other Sources (3-6, 8-9)		Background Concentration (Dragun & Chiasson, 1991) (7)	Selected Screening Criteria	Reference	Frenchman's Bay																	
												FB-2	Location 3	FB-4	FB-5	FB-7	FB-8	FB-9	FB-10	PN-1-1	PN-2-1	PN-5-1	PN-6-1	PN-7-1	PN-8-1	PN-9-1	PN-10-1	DUP-1	DUP-2
Mirex	µg/g	0.004	0.007	130	-	-	-	-	-	0.007	(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Radionuclides																													
Co-60	Bq/kg	0.09	-	-	-	-	-	-	-	-	-	0.050	0.527	0.171	0.622	0.586	0.146	0.076	0.158	0.211	0.447	0.728	-0.022	-0.029	0.415	0.082	-0.192	0.091	0.104
Cs-134	Bq/kg	0.18	-	-	-	-	-	-	-	-	-	0.155	-0.029	0.209	-0.381	0.009	0.128	0.176	0.252	-0.051	0.073	0.265	0.089	0.076	-0.090	0.344	-0.126	0.127	0.054
Cs-137	Bq/kg	0.16	-	-	-	-	-	-	-	-	-	0.625	0.563	0.823	1.470	1.450	1.130	0.967	0.731	2.200	1.890	2.420	1.240	2.230	1.550	2.190	1.270	1.380	2.390
I-131	Bq/kg	2.70	-	-	-	-	-	-	-	-	-	-0.785	-1.850	3.310	-0.337	-0.426	3.390	3.070	-1.630	1.040	0.479	-0.850	1.100	0.773	0.790	-0.797	0.362	-1.120	0.218
K-40	Bq/kg	1.30	-	-	-	-	-	-	-	-	-	353.000	105.000	106.000	138.000	106.000	104.000	117.000	207.000	202.000	110.000	117.000	236.000	192.000	237.000	152.000	235.000	128.000	202.000
Th-Series	Bq/kg	0.51	-	-	-	-	-	-	-	-	-	7.720	-0.366	4.560	0.256	-3.670	0.677	5.230	-0.561	5.620	4.830	4.840	1.250	5.750	4.800	6.000	6.780	6.150	5.570
U-Series	Bq/kg	0.33	-	-	-	-	-	-	-	-	-	8.740	3.810	4.200	6.680	4.850	3.350	5.530	7.340	5.670	4.510	6.310	5.860	7.030	5.330	5.330	6.350	5.260	6.620
H-3	Bq/kg	24.00	-	-	-	-	-	-	-	-	-	227.000	99.500	94.800	177.000	28.500	20.500	20.600	68.600	22.300	19.600	30.400	20.700	29.000	28.800	26.800	30.500	70.700	30.700
C-14	Bq/g	0.0096	-	-	-	-	-	-	-	-	-	0.008	-0.016	-0.003	0.002	-0.013	0.012	-0.011	-0.003	-0.009	0.002	-0.002	-0.003	-0.009	-0.008	-0.001	0.003	-0.004	-0.004

Note:

Bold Exceeded selected screening criteria

The symbol '-' denotes no value was determined and/or required.

Highlighting and bold font denotes that the maximum concentration of a parameter exceeds the relevant screening criteria value.

Sampling locations are presented in **Figure 4-4**.

* The concentrations of PHC subfractions were obtained by dividing the concentration of total fraction (eg: F2, F3, F4) by the ratios of the subfractions provided in CCME (2008). The concentrations of the subfractions were then compared to their equivalent guidelines from Atlantic PIRI (2012).

a - Converted from % to mg/kg.

b - Sediment criteria could not be calculated based on a toxic endpoint to aquatic species due to the low solubility of the fraction in water, resulting in a low potential for migration to or accumulation in sediment.

c - based on the Chronic benchmarks for aliphatic C19-C36 and aromatic C16-C36 calculated by Atlantic PIRI (2012) using the model developed by DiToro and McGrath (2000) using the benchmarks from Batelle (2007)

LEL - Lowest Effect Level

SEL- Severe Effect Level

ISQG- Interim Sediment Quality Guidelines

PEL- Probable Effects Level

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A.3 Aquatic Environment

A.3.1 Fish

A.3.1.1 Fish Community

Deepwater Fish Community Study

Assessment of the fish community in the proposed area of the intake cap followed a similar approach to that used at DNNP for intake siting (Ecometrix, 2021). The initial 2024 Deepwater Study Area encompassed an area of approximately 1 km^2, divided into 333 m x 333 m grids (labelled S1 to S9; **Figure 4-5**)**.** This area centered on the originally proposed intake cap location at 1,500 m offshore, and comprised the 12 m to 20 m depth contours. To encompass the alternate intake cap location, the study area was expanded to include an additional 0.33 km^2 closer to shore (grids S10- S12; **Figure 4-5**). The complete deepwater study area comprised 1.33 km^2, extending from the 9 m to 20 m depth contours.

The gillnets used for fish community sampling were consistent with the Ontario Ministry of Natural Resources and Forestry (MNRF) *Lake Ontario Fish Community Index Netting Protocol* (MNRF, 2018) as well as with past studies conducted for OPG at Darlington Nuclear Generating Station (DNGS) (Ecometrix, 2021). The program comprised of three sampling events in the spring, summer, and fall of 2024. During each event in 2024, net sets were deployed in one of nine sampling grids (S1-S9) using the the fixed-sequential-random design, where three net grids were fixed (one per depth stratum 12-14, 14-16 and 16-18 m), three were sequential (one per depth stratum; randomly assigned, excluding the fixed locations), and three were set at random grid locations. In 2025, one net set was deployed in each grid-square (S10-S12) in the extended Deepwater Study Area during each of the spring, summer, and fall. During these sampling events, all nets were set within the 9-12 m depth stratum.

This study design focused on variation in depth. Thus, while specific grids pertaining to the DWI structure (grid S5 and S2) may not have been sampled in some cases, the broader results for the various depths are considered representative of the community within that depth stratum throughout the study area. The expected fish community metrics at these locations will also be discussed based on the results of the depth and substrate statistical analyses below.

Across both the 2024 and 2025 fish community studies, all fish caught were identified and enumerated. Weight (in grams), length (in cm or mm), sex (where external determination was possible) and external condition (e.g., fin clips, eroded fins, deformities, lamprey scars) were also assessed for up to 30 individuals per species per season. Representative photos were taken of each fish species collected in the gillnets. Live fish from gillnet catches were released. Eight individual fish from up to three abundant species were used for tissue burden assessment in the spring and fall sampling events in 2024 (see **Section A.2.1**).

Species composition of fish caught during the spring, summer, and fall sampling events are summarized in **Figure A-4** for 2024 and **Figure A-5** for 2025. Additional calculated parameters,

including total count, species richness, Catch Per Unit Effort (CPUE), and Biomass Per Unit Effort (BPUE) from the 2024 and 2025 studies are provided in **Table A-8** and **Table A-9**, respectively.

Across all three sampling events in 2024, a standardized total (corrected for net length) of 1912.33 fish from 13 different species were captured across S1-S9 sampling grids. Species composition by season is depicted in **Figure A-4**. Alewife comprised >97% of the standardized catch in the spring and summer, while Lake Trout and Lake Whitefish dominated the fall catch. This seasonal shift in the dominant species captured is reflective of the migratory nature of Alewife, which make seasonal spawning migrations to the nearshore zone to spawn in the late spring. As detailed earlier, one Lake Sturgeon was caught and released during the deepwater fish community studies in the fall sampling event, marking the first observation of this species near PN in nearly two decades. Lake Sturgeon are generally uncommon in the main lake as they typically inhabit the cool, bottom waters of lakes and large streams, preferring sand and silt substrates (Holm et al., 2021). Of the nine sampling grids defined in the deepwater area for this study, S1 and S6 had the highest number of fish and species (8) collected during individual net sets across all three sampling events. In contrast, S3 had the fewest fish (49) and lowest species count (1) among sampling events.

In 2025, a standardized total of 618 fish across 9 species were caught in the S10-S12 grids. Species composition by season is depicted in **Figure A-5**. In the spring, Lake Trout was the most abundant species, representing approximately 62% of the standardized catch, followed by Round Whitefish and Brown Trout. In the summer, Alewife became the dominant species (>92% of the standardized catch), while Atlantic Salmon, Round Goby, and White Sucker comprised smaller proportions of the catch. In the fall, Round Goby emerged as the dominant species, comprising approximately 49% of the standardized catch, followed by Alewife at nearly 39%. Round Goby is an invasive benthic forage fish species that is abundant near the PN site and throughout Lake Ontario. In addition, Atlantic Salmon, Brown Bullhead, and Smallmouth Bass were also captured. As highlighted earlier, the Atlantic Salmon that were caught during this study are not considered individuals of the native Lake Ontario population, which is considered extinct by the COSEWIC. The current population is the result of Ontario's restoration program and New York State's put-grow-take program and are not assigned either a COSEWIC or SAR conservation status.

To determine if and how the deepwater fish catch varied through water depth, season, and substrate, a set of generalized linear models (GLMs) were run for metrics of species richness, diversity, and abundance (CPUE and BPUE) using data collected during 2024 and 2025. Results of the GLMs are detailed in **Table A-10** and **Table A-11**.

For the deepwater fish community as a whole, model results indicated no significant influence of depth on any of the evaluated fish metrics; however, CPUE and diversity were significantly influenced by season (**Figure A-6; Table A-10**). CPUE was similar between spring and fall but was significantly higher during the summer. Species diversity was significantly higher in the fall relative to the spring and summer, with no significant difference observed between the spring and summer sampling events. When analyses were limited to small-bodied fish (i.e., Alewife and Round Goby), both CPUE and BPUE were significantly affected by season. These metrics differed

significantly among all three seasons, with the highest values observed in summer, followed by spring, and the lowest values in fall.

Diversity also varied by substrate classification. Sites with *Mixed–Hard* substrate (S10, S11, S12, S13, S14, and S15) showed significantly higher diversity than those characterized by *Cobble/Gravel/Sand* substrates (S1, S4, and S7) (**Figure A-7**; **Table A-11**). No other significant differences were observed among the remaining substrate classes.

The proposed intake locations, S2 and S5, were classified as *Mixed–Soft* and *Cobble/Gravel*, respectively. Fish CPUE, BPUE, richness, and diversity at these substrate types did not differ significantly from any other substrate class. This indicates that the fish community at the proposed intake locations is consistent with the broader study area, with no meaningful ecological differences detected.

Overall, the fish community composition in the Deepwater Study Area, including the proposed DWI structure (i.e., grids S2 and S5), is generally consistent with previous fish community characterization studies conducted in the area (Ecometrix, 2018, 2020; Golder, 2007; MNRF, 2023), which also identified Alewife as having the highest CPUE. Golder (2007a) also noted the seasonal differences in the fish communities in the general study area, which can either be driven by foraging opportunities or spawning requirements that are both influenced by seasonal and local conditions. For example, Alewife make seasonal spawning migrations to nearshore zones to spawn in the late spring. In contrast, Lake Trout can only forage closer to shore when colder water temperatures are present due to season or wind-driven upwellings of colder lake water. However, prey availability during these periods may vary, as prey species may avoid the area during cold shock events or become cold shock stressed.

Notable differences in the results of the 2024-2025 Deepwater Fish Community study relative to previous studies included higher abundances of Lake Whitefish and the capture of a single Lake Sturgeon during the Fall 2024 event. The high catch of Lake Whitefish 2024 is likely due to this species preference for cooler water temperatures, such as those observed during the Fall 2024 netting program. The higher numbers of Lake Whitefish in Fall 2024 compared to other fish community studies in the area may also indicate fall spawning activity in the general vicinity of the Deepwater Study Area; previous fall studies were not likely completed when water temperatures were appropriate to make this determination. To address this uncertainty, a fall spawning assessment was conducted in 2025 (see below). In addition, a Species at Risk assessment for Lake Sturgeon (see below) was completed to evaluate whether additional individuals are present in the study area.

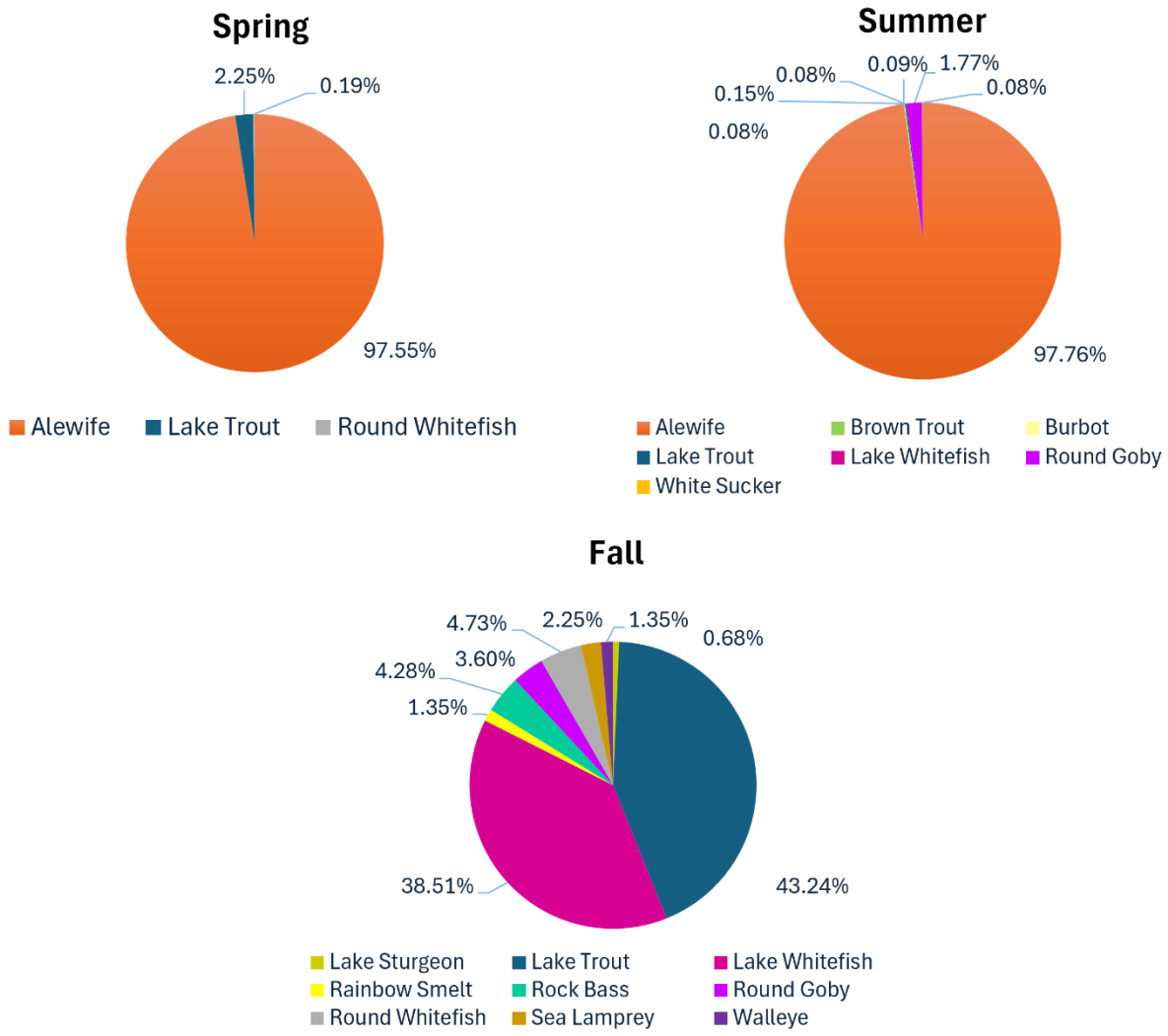


Figure A-4: Fish Species Composition of Fish Caught in Monitoring Nets During the Spring, Summer, and Fall Sampling Events of the 2024 Deepwater Fish Community Study

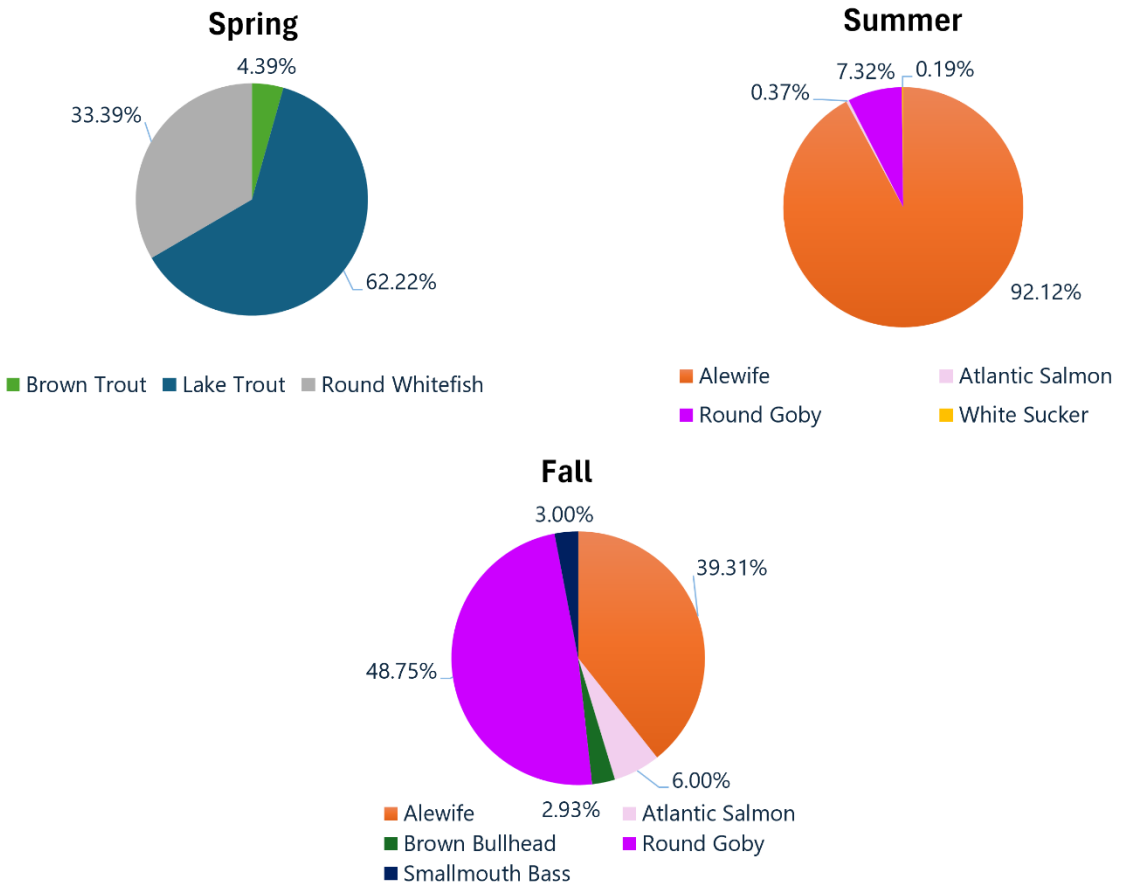


Figure A-5: Fish Species Composition of Fish Caught in Monitoring Nets During the Spring, Summer, and Fall Sampling Events of the 2025 Extended Deepwater Area Fish Community Study

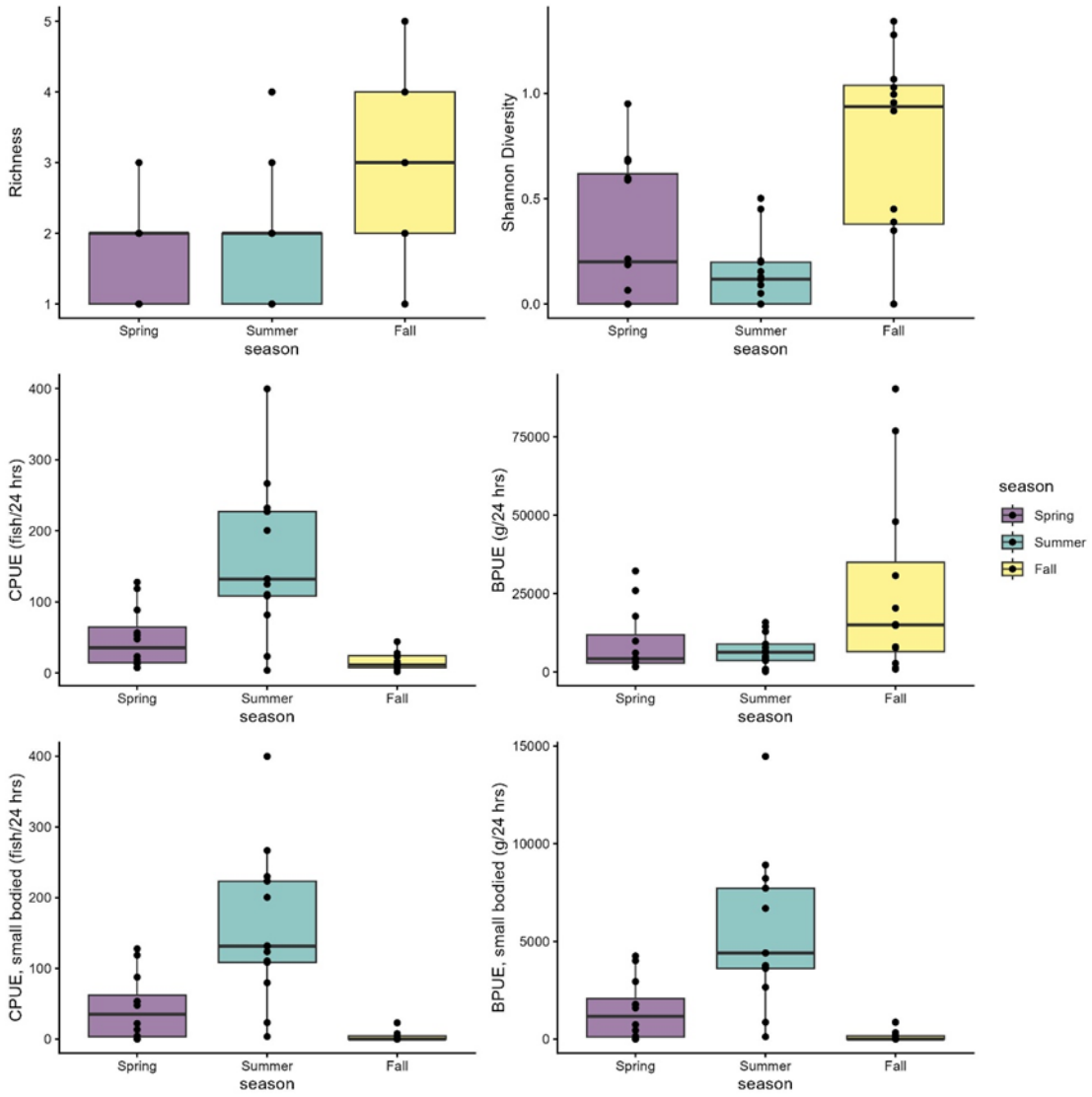


Figure A-6: Boxplots and Raw Data (points) of Fish Endpoints Expressed by Season from the 2024 and 2025 Deepwater Fish Community Study

Note: CPUE – Catch-per-unit effort, BPUE – Biomass-per-unit effort. Boxplots are a common and useful when visually depicting variation of the raw data (black dots): the box spans the interquartile range (IQR; 25th percentile to 75th percentile), the horizontal line within the box is the median, the vertical lines extend outwards to the furthest datapoint within 1.5 x IQR, and any points outside of this vertical line are beyond 1.5 x IQR.

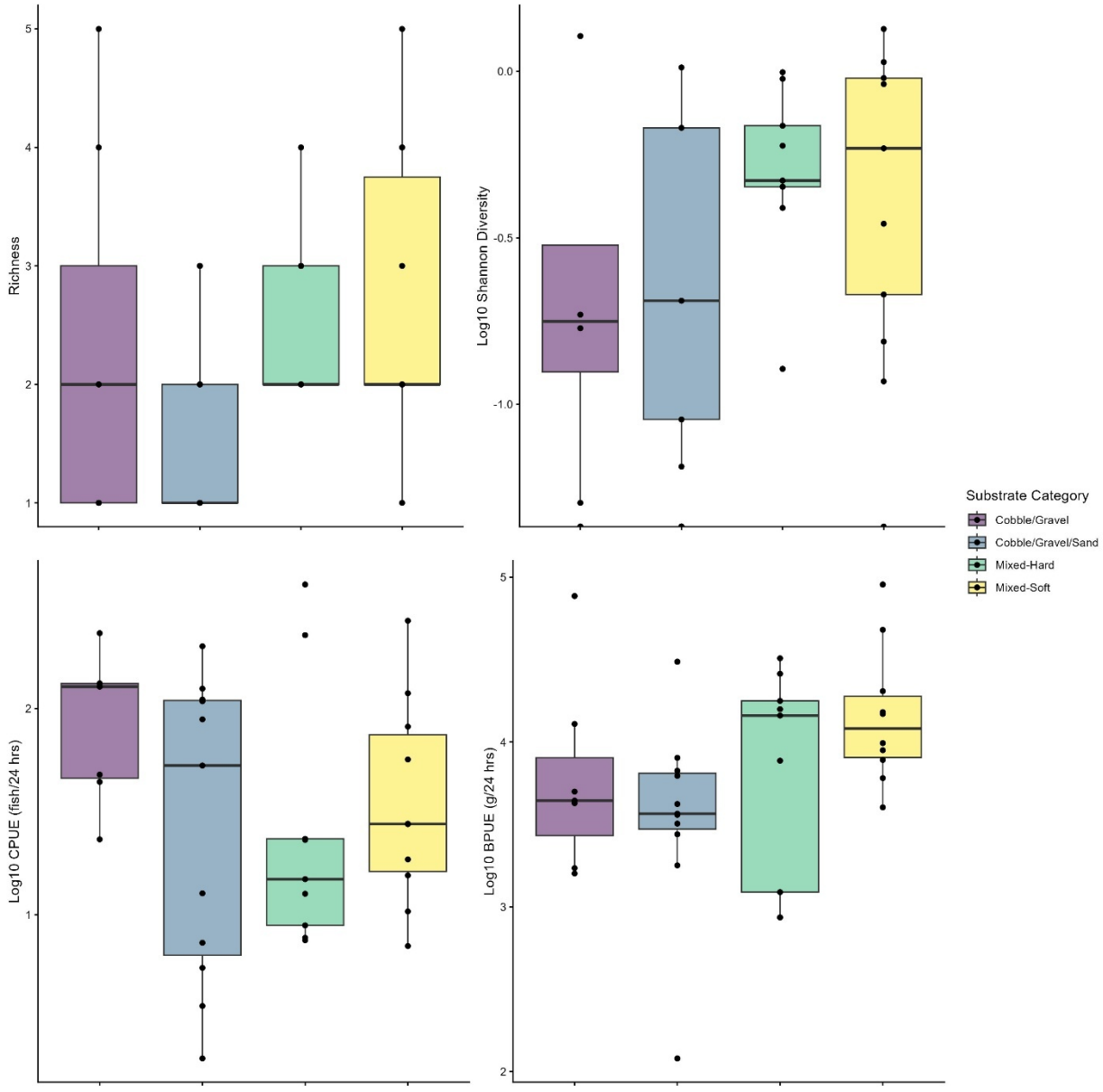


Figure A-7: Boxplots and Log10 Transformed Data (points) of Fish Endpoints Expressed by Substrate Classification

Note: CPUE – Catch-per-unit effort, BPUE – Biomass-per-unit effort. Boxplots are a common and useful when visually depicting variation of the raw data (black dots): the box spans the interquartile range (IQR; 25th percentile to 75th percentile), the horizontal line within the box is the median, the vertical lines extend outwards to the furthest datapoint within 1.5 x IQR, and any points outside of this vertical line are beyond 1.5 x IQR.

Table A-8: Total Catch, CPUE, BPUE, and weight of fish caught during 2024 Deepwater Fish Community Study

Sampling grid	Species	Total Catch*	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring						
S2	Alewife*	109.7	119.64	100.00%	4,047.6	3,710.3
S3	Alewife*	120.0	128.76	100.00%	4,293.0	4,000.8
S3 (DUP)	Alewife*	43.3	48.19	100.00%	1,606.5	1,444.7
S4	Alewife*	83.0	88.27	98.81%	2,970.1	2,792.7
	Round Whitefish	1.0	1.06	1.19%	1,260.3	1,185.0
S4 (DUP)	Alewife*	53.0	53.33	100.00%	1,798.2	1,787.0
S5	Alewife*	21.0	22.32	95.45%	745.7	701.7
	Lake Trout	1.0	1.06	4.55%	977.7	920.0
S7	Alewife*	4.3	4.33	59.09%	146.0	146.0
	Lake Trout	3.0	3.00	40.91%	3,051.0	3,051.0
S8	Alewife*	51.7	53.91	94.51%	1,775.3	1,701.4
	Lake Trout	3.0	3.13	5.49%	8,080.7	7,744.0
S9	Alewife*	13.3	13.57	72.73%	452.4	444.5
	Lake Trout	5.0	5.09	27.27%	5,592.1	5,495.0
Total		512.3	545.7	-	36796.6	35124.2
Summer						
S1	Alewife*	94.0	120.32	95.59%	3,621.3	2,829.1
	Brown Trout	1.0	1.28	1.02%	2,464.0	1,925.0
	Round Goby*	3.3	4.27	3.39%	179.2	140.0
S1 (DUP)	Alewife*	185.3	202.18	98.23%	6,741.6	6,179.8
	Round Goby*	3.3	3.64	1.77%	129.1	118.3
S2	Alewife*	206.7	259.23	96.42%	2,067.1	6,890.3
	Round Goby*	7.7	9.62	3.58%	346.8	276.5
S4	Alewife*	110.7	111.44	100.00%	3,702.1	3,676.3
S5	Alewife*	113.0	132.29	99.12%	4,438.1	3,790.9
	Lake Whitefish	1.0	1.17	0.88%	597.1	510.0

Sampling grid	Species	Total Catch*	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
S6	Alewife*	122.0	133.09	100.00%	4,446.2	4,075.7
S6 (DUP)	Alewife*	205.0	224.49	95.94%	7,501.3	6,850.1
	Burbot	1.0	1.10	0.47%	4,955.1	4,525.0
	Round Goby*	6.7	7.30	3.12%	288.4	263.3
	White Sucker	1.0	1.10	0.47%	191.6	175.0
S7	Alewife*	110.0	109.39	100.00%	3,647.1	3,667.4
S8	Alewife*	78.3	80.28	97.51%	2,677.3	2,612.2
	Lake Trout	2.0	2.05	2.49%	5,129.7	5,005.0
Total		1252.0	1404.2		53123.1	53510.1
Fall						
S1	Lake Whitefish	6.0	5.52	100.00%	8,018.0	8,714.0
S2	Lake Trout	4.0	4.03	57.14%	11,369.4	11,298.3
	Round Whitefish	2.0	2.01	28.57%	1,937.1	1,925.0
	Walleye	1.0	1.01	14.29%	1,871.7	1,860.0
S2 (DUP)	Lake Trout	6.0	5.96	38.30%	17,956.3	18,081.0
	Lake Whitefish	3.0	2.98	19.15%	2,104.4	2,119.0
	Rock Bass	3.3	3.31	21.28%	149.0	150.0
	Sea Lamprey	3.3	3.31	21.28%	149.0	150.0
S4	Lake Trout	5.0	5.29	41.67%	20,124.6	19,034.5
	Lake Whitefish	5.0	5.29	41.67%	7,897.8	7,470.0
	Round Whitefish	2.0	2.11	16.67%	2,685.5	2,540.0
S4 (DUP)	Lake Whitefish	2.0	2.01	100.00%	2,754.6	2,745.0
	Lake Trout	15.0	16.00	36.29%	47,531.8	44,561.1
	Lake Whitefish	17.0	18.13	41.13%	25,656.7	24,053.1
	Rock Bass	3.0	3.20	7.26%	794.7	745.0
	Round Goby*	5.3	5.69	12.90%	233.6	128.0

Sampling grid	Species	Total Catch*	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
	Walleye	1.0	1.07	2.42%	2,688.0	2,520.0
S8	Lake Sturgeon[1]	1.0	1.10	4.00%	34,902.4	31,751.5
	Lake Trout	16.0	17.59	64.00%	44,766.8	40,725.3
	Lake Whitefish	5.0	5.50	20.00%	8,134.6	7,400.2
	Rainbow Smelt	1.0	1.10	4.00%	22.0	20.0
	Round Whitefish	2.0	2.20	8.00%	2,506.3	2,280.0
S9	Lake Trout	17.0	15.64	56.67%	33,224.0	36,108.0
	Lake Whitefish	11.0	10.12	36.67%	13,875.5	15,080.0
	Rainbow Smelt	1.0	0.92	3.33%	18.4	20.0
	Round Whitefish	1.0	0.92	3.33%	837.3	910.0
S9 (DUP)	Lake Trout	1.0	1.15	11.11%	2,384.6	2,070.0
	Lake Whitefish	8.0	9.22	88.89%	12,408.2	10,771.0
Total		148.0	152.4	-	307002.0	295230.1

Note:
Sampling locations are presented in **Figure 4-5**
Individual fish not measured in the field were assigned average species weight values for BPUE calculations.
1 To prevent undo harm, the Lake Sturgeon was removed from the gillnet and returned to the water without measurement and the size was estimated.
* Standardized fish counts are based on an extrapolated catch from the 15 m 1 ½" mesh panel to the standard 50 m length and therefore fish counts can result in partial number.

Table A-9: Total Catch, CPUE, BPUE, and weight of fish caught in Expanded Deepwater Study Area during 2025 Deepwater Fish Community Study

Sampling grid	Species	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring						
S10	Lake Trout	5	9.02	71.43%	21,663.2	12,005.0
	Round Whitefish	2	3.61	28.57%	4,285.7	2,375.0
S11	Lake Trout	5	8.26	55.56%	23,438.4	14,190.0
	Round Whitefish	4	6.61	44.44%	8,779.1	5,315.0
S12	Brown Trout	1	1.55	20.00%	6,150.7	3,980.0
	Lake Trout	3	4.64	60.00%	9,573.7	6,195.0
	Round Whitefish	1	1.55	20.00%	2,039.9	1,320.0
Total		21	35.2	-	75930.7	45380
Summer						
S10	Alewife*	156.7	192.49	84.08%	6,942.4	5,649.4
	Atlantic Salmon	2.0	2.46	1.07%	5,702.0	4,640.0
	Round Goby*	26.7	32.76	14.31%	1,358.3	1,105.3
	White Sucker	1.0	1.23	0.54%	1,892.5	1,540.0
S11	Alewife*	16.7	19.61	83.33%	707.1	601.0
	Round Goby*	3.3	3.92	16.67%	162.5	138.2
S12	Alewife*	346.7	391.84	97.20%	14,131.9	12,500.8
	Round Goby*	10.0	11.30	2.80%	468.6	414.5
Total		563.0	655.6	-	31365.3	26589.2
Fall						
S10	Round Goby*	6.7	7.77	86.96%	332.4	285.0
	Brown Bullhead	1.0	1.17	13.04%	898.0	770.0
S11	Alewife*	3.3	3.87	16.67%	129.8	111.7
	Round Goby*	16.7	19.37	83.33%	740.0	636.7
S12	Alewife*	3.3	3.97	52.63%	137.1	115.0
	Atlantic Salmon	2.0	2.38	31.58%	5,925.5	4,970.0
	Smallmouth Bass	1.0	1.19	15.79%	1,639.3	1,375.0
Total		34.0	39.7	-	9802.0	8263.3

Note:
Sampling locations are presented in **Figure 4-5**.

Table A-10: Summary of GLM modelling results for 2024 and 2025 Deepwater Fish Community Study (Depth and Season)

Parameter	R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
					Season	Mean	Lower Confidence Limit	Upper Confidence Limit				
Richness	0.10	Depth	0.592	No	Spring	1.7	1.1	2.7	-	-	-	-
		Season	0.148	No	Summer	2.1	1.4	3.0	-	-		
					Fall	2.9	2.1	4.1	-	-		
CPUE - log10(x + 1)	0.46	Depth	0.522	No	Spring	31.8	17.2	57.9	Spring	Summer	0.014	(Spring = Fall) <Summer
		Season	<0.001	Yes	Summer	107.2	60.6	189.2	Spring	Fall	0.085	
					Fall	12.3	6.4	23.0	Summer	Fall	<0.001	
BPUE - log10(x+1)	0.14	Depth	0.246	No	Spring	5,609.8	2,610.0	12,055.8	-	-	-	-
		Season	0.136	No	Summer	4,411.1	2,114.6	9,200.4	-	-		
					Fall	12,046.7	5,604.7	25,891.6	-	-		
Diversity - Shannon, log10(x+1)	0.33	Depth	0.896	No	Spring	0.3	0.1	0.5	Spring	Summer	0.391	Fall > (Summer = Spring)
		Season	<0.001	Yes	Summer	0.1	0.0	0.3	Spring	Fall	0.037	
					Fall	0.7	0.4	0.9	Summer	Fall	0.001	
CPUE SB - log10(x+1)	0.58	Depth	0.958	No	Spring	15.3	5.9	37.5	Spring	Summer	0.008	Summer > Spring > Fall
		Season	<0.001	Yes	Summer	106.9	46.2	245.6	Spring	Fall	0.005	
					Fall	1.1	-0.1	3.9	Summer	Fall	<0.001	
BPUE SB - log10(x+1)	0.51	Depth	0.896	No	Spring	218.1	44.9	1,043.7	Spring	Summer	0.035	Summer > Spring > Fall
		Season	<0.001	Yes	Summer	3,554.8	791.6	15,951.4	Spring	Fall	0.008	
					Fall	5.8	0.4	31.3	Summer	Fall	<0.001	

Note:
Shaded cells indicates p-value < 0.05, which was considered significant.
CPUE – Catch-per-unit effort, BPUE – biomass-per-unit effort, SB – small-bodied. These comparisons are shown in **Figure A-7**.
Depending on the metric, a different error distribution family of GLM was used appropriate to the data and model fit (richness: Poisson; diversity, BPUE, and CPUE: Gaussian with log10(x+1)). Residual plots were examined to assess model fit. Analysis of Deviance (analysis to ANOVA in classic regression) tables were used to determine overall effects of depth and season at the p = 0.1 statistical significance level. Post-hoc Tukey multiple comparisons were used to determine if and how seasons were statistically different. For consistency across model types, the Cox and Snell pseudo-R^2 GLMs used as an assessment of the proportion of variation explained by the depth and season effects. For non-gaussian GLMs, although pseudo R^2 are analogous to R^2 in regression, they are not directly interpretable as the proportion of explained variance. GLMs for CPUE and BPUE were run on a small-bodied fish species (i.e., here, only Alewife and Round Goby) using the same approach above as it is anticipated they may be more susceptible to impingement.

Table A-11: Summary of GLM modelling results for 2024 and 2025 Deepwater Fish Community Study (Substrate and Season)

Parameter	R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
					Substrate	Mean	Lower Confidence Limit	Upper Confidence Limit				
Richness	0.16	Season	0.189	No	Cobble/Gravel	2.43	1.48	3.98	-	-	-	-
		Substrate	0.461	No	Cobble/Gravel/Sand	1.61	1.01	2.57	-	-	-	-
					Mixed-Hard	2.39	1.57	3.64	-	-	-	-
					Mixed-Soft	2.5	1.68	3.71	-	-	-	-
CPUE - log10(x + 1)	0.55	Season	<0.001	Yes	Cobble/Gravel	61.6	28.8	130.5	-	-	-	-
		Substrate	0.101	No	Cobble/Gravel/Sand	23	12.4	42.3	-	-	-	-
					Mixed-Hard	26.3	13.4	51	-	-	-	-
					Mixed-Soft	48.4	25.5	91	-	-	-	-
BPUE - log10(x+1)	0.22	Season	0.213	No	Cobble/Gravel	6,760.60	2,476.00	18,456.30	-	-	-	-
		Substrate	0.32	No	Cobble/Gravel/Sand	3,724.40	1,680.00	8,255.20	-	-	-	-
					Mixed-Hard	6,604.40	2,763.40	15,782.30	-	-	-	-
					Mixed-Soft	12,557.00	5,403.80	29,177.40	-	-	-	-
Diversity - Shannon, log10(x+1)	0.48	Season	<0.001	Yes	Cobble/Gravel	0.25	0.06	0.49	Cobble/Gravel/Sand	Cobble/Gravel	0.95	Mixed-Hard > Cobble/Gravel/ Sand
		Substrate	0.035	Yes	Cobble/Gravel/Sand	0.18	0.03	0.36	Cobble/Gravel/Sand	Mixed-Hard	0.051	
					Mixed-Hard	0.55	0.33	0.8	Cobble/Gravel	Mixed-Soft	0.644	
					Mixed-Soft	0.43	0.24	0.65	Cobble/Gravel	Mixed-Hard	0.254	
									Cobble/Gravel/Sand	Mixed-Soft	0.24	
									Mixed-Hard	Mixed-Soft	0.866	

Note:
Shaded cells indicates p-value < 0.05, which was considered significant.
CPUE – Catch-per-unit effort, BPUE – biomass-per-unit effort, SB – small-bodied. These comparisons are shown in **Figure A-7**.
Depending on the metric, a different error distribution family of GLM was used appropriate to the data and model fit (richness: Poisson; diversity, BPUE, and CPUE: Gaussian with log10(x+1)). Residual plots were examined to assess model fit. Analysis of Deviance (analysis to ANOVA in classic regression) tables were used to determine overall effects of depth and season at the p = 0.05 statistical significance level. Post-hoc Tukey multiple comparisons were used to determine if and how seasons were statistically different. For consistency across model types, the Cox and Snell pseudo-R2 GLMs used as an assessment of the proportion of variation explained by the depth and season effects. For non-gaussian GLMs, although pseudo R2 are analogous to R2 in regression, they are not directly interpretable as the proportion of explained variance. GLMs for CPUE and BPUE were run on a small-bodied fish species (i.e., here, only Alewife and Round Goby) using the same approach above as it is anticipated they may be more susceptible to impingement.
Means and Confidence Limits for parameters that have been log10 transformed were back-transformed ((10^x)-1) for ease of interpretation.

Mid-depth Fish Community Study

Fish community surveys were conducted in the Mid-depth Study Area (**Figure 4-5**) during the spring, summer, and fall of 2025 to assess the fish community stratum of the previously proposed dredged channel and dock. This study area is inclusive of the 3 m to 9 m depth stratum from the southern extent of the Infill area, to the northern extent of the Deepwater study area. Each sampling event employed three sets of MNRF small mesh broadscale monitoring (BSM) nets and three sets of experimental (EXP) long gillnets. These nets were deployed randomly through the study area, capturing depths from 2 to 7.9 m, depending on water depth at each location. Consistent with the Deepwater Fish Community Study, all fish caught were identified and enumerated, and fish morphometrics were assessed for up to 30 individuals per species per season. Additionally, species composition, species richness, CPUE, and a morphometric summary were calculated.

Species composition of fish caught during the spring, summer, and fall sampling events are summarized in **Figure A-8**. Total catch, species richness, CPUE, and BPUE are provided in **Table A-12**.

A total of 1246 fish across 10 species were caught in the EXP and BSM nets across the 2025 Mid-depth Fish Community Study. Only six fish were captured during the spring sampling event, including 2 Lake Trout, 2 Round Goby, and 1 Rainbow Smelt in the EXP net, and 1 Rainbow Smelt in the BSM net. During the summer sampling event, 1196 fish were captured across the EXP and BSM nets, with Alewife and Round Goby comprising the majority of the catch. Other species captured included Atlantic Salmon and Rainbow Trout. Fish abundance declined in the fall sampling event, with a total of 44 fish captured. Round Goby dominated the catch in both the EXP and BSM nets. Species not observed during the spring or summer events, including White Bass, Northern Pike, and Yellow Perch, were captured in the EXP nets.

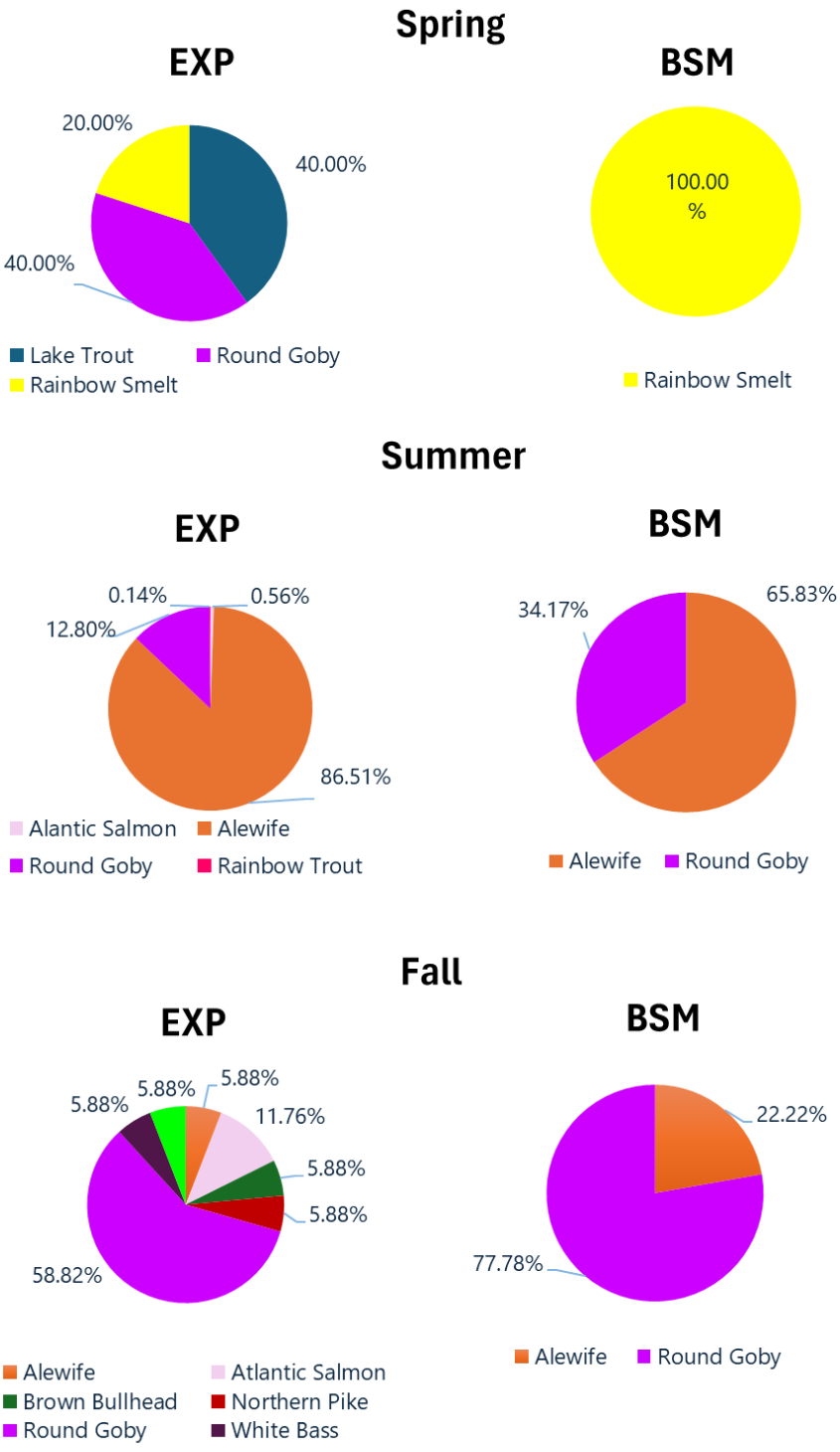


Figure A-8: Fish Species Composition Caught in Experimental (EXP) Nets and Broad Scale Monitoring (BSM) in the Mid-depth Study Area During the Spring, Summer, and Fall 2025 Sampling Events

Table A-12: Total Catch, CPUE, BPUE, and weight of fish caught in Mid-depth Study Area during 2025 Mid-depth Fish Community Study

Species	Total Catch	CPUE (fish caught/24h)	% Composition	BPUE (g of fish/24h	Total Weight of Fish Caught (g)
Spring					
EXP Net					
Lake Trout	2	1.0	40.0%	2684.5	5505.0
Round Goby	2	1.0	40.0%	10.0	20.5
Rainbow Smelt	1	0.5	20.0%	13.9	28.5
Total	5	2.4	100.0%	2708.4	5554.0
BSM Net					
Rainbow Smelt	1	0.5	100.0%	8.1	17.0
Total	1	0.5	100.0%	8.1	17.0
Summer					
EXP Net					
Alantic Salmon	4	1.5	0.6%	1097.1	2860.0
Alewife	622	238.6	86.5%	8538.3	22258.8
Round Goby	92	35.3	12.8%	513.8	1339.4
Rainbow Trout	1	0.4	0.1%	270.4	705.0
Total	719	275.8	100.0%	10419.6	27163.2
BSM Net					
Alewife	314	137.9	65.8%	2991.2	6809.2
Round Goby	163	71.6	34.2%	658.9	1499.9
Total					
Fall					
EXP Net					
Alewife	1	0.4	5.9%	13.8	36.1
Atlantic Salmon	2	0.8	11.8%	915.0	2397.5
Brown Bullhead	1	0.4	5.9%	209.9	550.0
Northern Pike	1	0.4	5.9%	1085.8	2845.0
Round Goby	10	3.8	58.8%	73.3	192.0
White Bass	1	0.4	5.9%	13.0	34.0
Yellow Perch	1	0.4	5.9%	28.2	74.0
Total	17	6.5	100.0%	2339.0	6128.6
BSM Net					
Alewife	6	2.4	22.2%	40.0	102.0
Round Goby	21	8.2	77.8%	125.8	320.7

Species	Total Catch	CPUE (fish caught/24h)	% Composition	BPUE (g of fish/24h	Total Weight of Fish Caught (g)
Total	27	10.6	100.0%	165.8	422.7

Note:
Sampling locations are presented in **Figure 4-5**.

Nearshore Fish Community Study

For the nearshore fish community study, existing fish community data were collected in the

the Cutoff Wall Study Area to understand the fish community in the area of cutoff wall in the spring, summer, and fall of 2025. Fish community data were also collected previously for other proposed structures which have since been excluded from the project plans including the Infill and Shoreline Erosion Mitigation Study Areas during the spring, summer, and fall of 2024. Though these structures are no longer being considered, the results are presented because they represent the nearshore fish community.

One EXP and one BSM net was used in each sampling event for the Cutoff Wall Study Area. In the Infill and Shoreline Erosion Mitigation Study Areas, each sampling event employed two sets of BSM nets and one EXP net. These nets were deployed approximately perpendicular to shore, capturing depths from 3 to 5.2 m in the Cutoff Wall Study Area, and 1.2 to 3 m in the Infill and Shoreline Erosion Mitigation Study Areas, depending on water depth at each location. Consistent with the fish community study in the Deepwater Study Area, all fish were collected and enumerated. Fish morphometrics were assessed for up to 30 individuals per species per season. Additionally, species composition, species richness, CPUE, and a morphometric summary were calculated.

Cutoff Wall Study Area

Species composition across the three sampling events is depicted in **Figure A-9**. Total fish counts, species richness, CPUE, and BPUE for the Cutoff Wall Study Area are provided in **Table A-15**. Across the spring, summer, and fall 2025 sampling events, a total of 321 fish across 10 species were captured in the EXP and BSM nets. In the spring, 13 fish were captured, with the majority collected in EXP nets. Rainbow Smelt accounted for the largest portion of the catch in EXP nets, while Round Goby dominated the BSM net catch. Other species captured in the EXP nets included Atlantic Salmon, Common Carp, Lake Trout, Longnose Sucker, and White Sucker. During the summer, 283 fish were captured, primarily in BSM nets. Alewife overwhelmingly dominated the catch, with Round Goby observed in small numbers. Species captured in the EXP nets included Brown Bullhead, Rock Bass, and White Sucker. In the fall, a total of 25 fish were captured, with Round Goby and Alewife the most abundant species in EXP nets, and Yellow Perch dominating the BSM net catch. Other species captured included Brown Bullhead, Brown Trout, Chinook Salmon, and White Sucker.

Infill and Shoreline Erosion Mitigation Study Areas

Species composition across the three sampling events in the Infill and Shoreline Erosion Mitigation Study Areas is depicted in **Figure A-10** and **Figure A-11**, respectively. Total fish counts and species richness, CPUE, and BPUE for the Infill Study Area and the Shoreline Erosion Mitigation Study Area are provided in **Table A-13** and **Table A-14**, respectively. .

Across both Study Areas, 574 fish from 20 different species were caught in the BSM and EXP nets across the spring, summer, and fall sampling events. Alewife and Round Goby consistently dominated the catch, accounting for >95% of the total catch in both the Infill and Shoreline Erosion Mitigation Study Areas in the spring and summer. Other species captured in the BSM nets included the Rainbow Trout, Brown Trout, and Atlantic Salmon, which like the Alewife, make seasonal spawning migrations into the nearshore zone. In the fall, species distributions varied more noticeably across the two net types and nearshore study areas. Round Goby continued to dominate the BSM net catch in both nearshore study areas; however, the Shoreline Erosion Mitigation Study Area exhibited greater species richness. Unlike the Infill Study Area, fish captured here included benthic species such as Brown Bullhead, Yellow Perch, Logperch, Longnose Sucker, and Mottled Sculpin, all of which are common along the Lake Ontario shoreline. In the EXP nets, White Sucker and Walleye were commonly captured in these two nearshore areas.

Nearshore Fish Community Summary

The differences in fish community composition between these three study areas are likely driven by differences in substrate and other aquatic habitat characteristics (see **Section A.3.4**).

The Cutoff Wall study area was almost entirely sandy substrate with large areas of dense macrophyte growth. Species observed here, such as Atlantic Salmon, Common Carp, Lake Trout, Round Goby, and White Sucker in spring, and Brown Bullhead, Rock Bass, and Alewife in summer and fall, reflect the preferences of fish that favor calmer waters, vegetated habitat for shelter, and softer substrates suitable for foraging and spawning. Overall, the Cutoff Wall area shows indications that it is relatively protected from strong wave action and erosion, while the other areas show evidence of strong wave action throughout the year. This may greatly influence preferred spawning locations, as wave-driven disturbance in shallow areas has been shown to significantly reduce the survival of eggs and newly hatched larvae (Great Lakes Fishery Commission, 2021). The Infill Study Area had roughly even proportions of sand, gravel, and cobble, with some boulder as well. This area's diverse substrate and moderate structural complexity likely provide a range of foraging opportunities for a mix of pelagic and benthic species. The Shoreline Erosion Mitigation Study Area consisted primarily of gravel, cobble, and boulder, with sandy patches nearshore, and a substantial presence of macrophytes. This area supported fish such as Alewife, Brown Trout, Rainbow Trout, Gizzard Shad, and Round Goby in spring, with more benthic oriented species like Walleye, Longnose Sucker, and Log Perch appearing in fall. The combination of coarse substrate and dense macrophytes likely provides some spawning areas, shelter from predators, supporting both pelagic and benthic species.

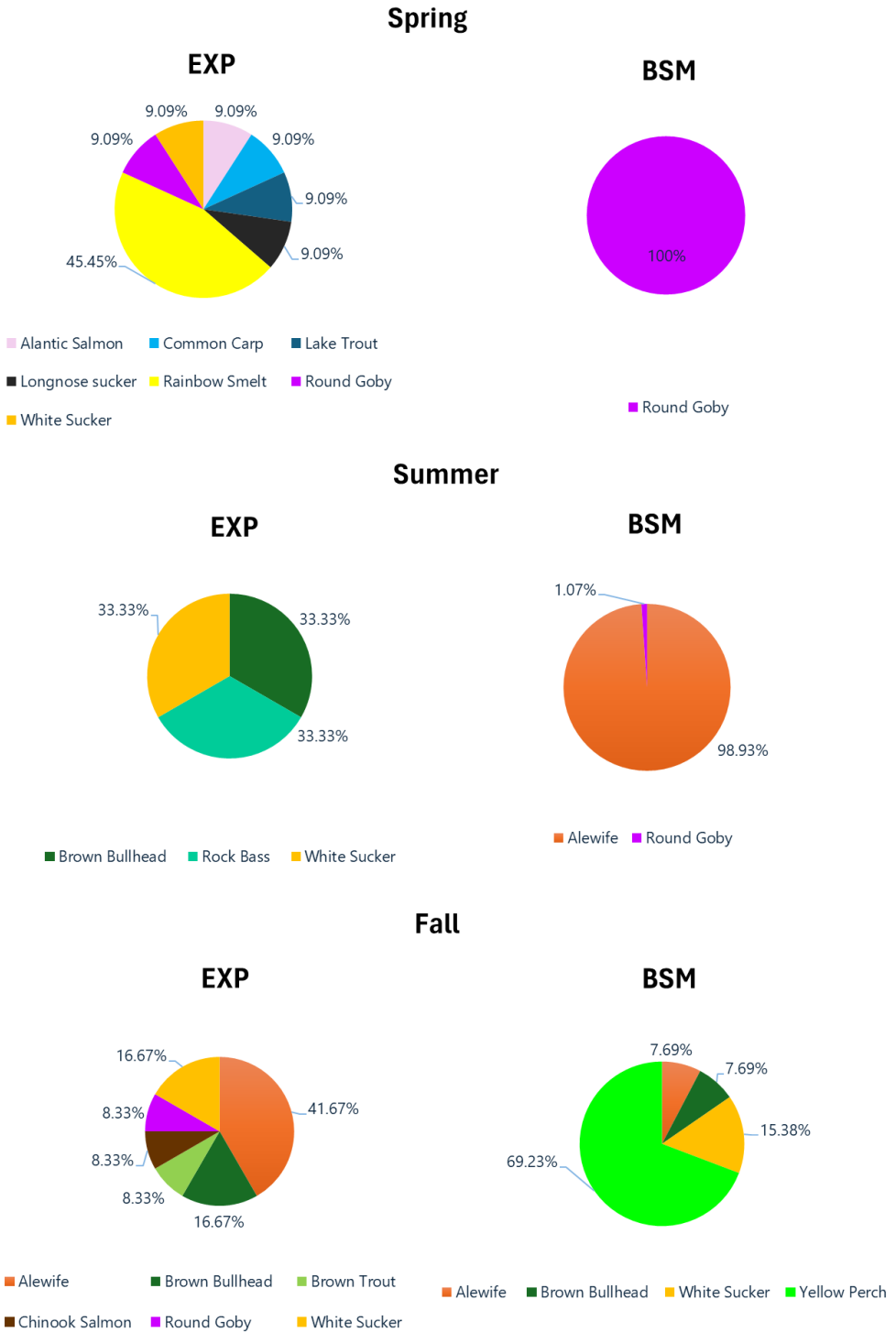


Figure A-9: Fish Species Composition Caught in Experimental (EXP) and Broad Scale Monitoring (BSM) Nets in the Cutoff Wall Study Area, 2025

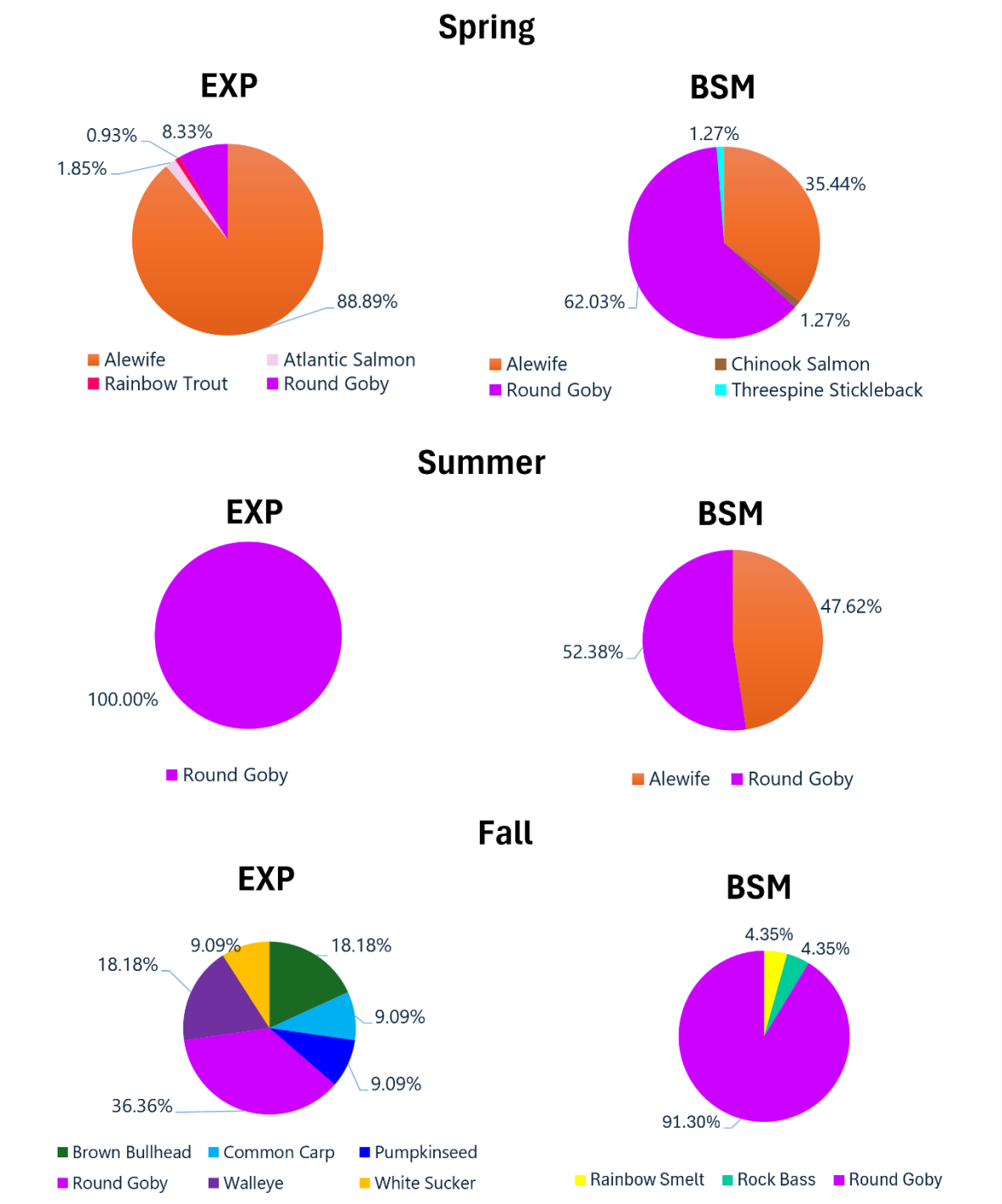


Figure A-10: Fish Species Composition Caught in Experimental (EXP) and Broad Scale Monitoring (BSM) Nets in the Infill Study Area, 2024

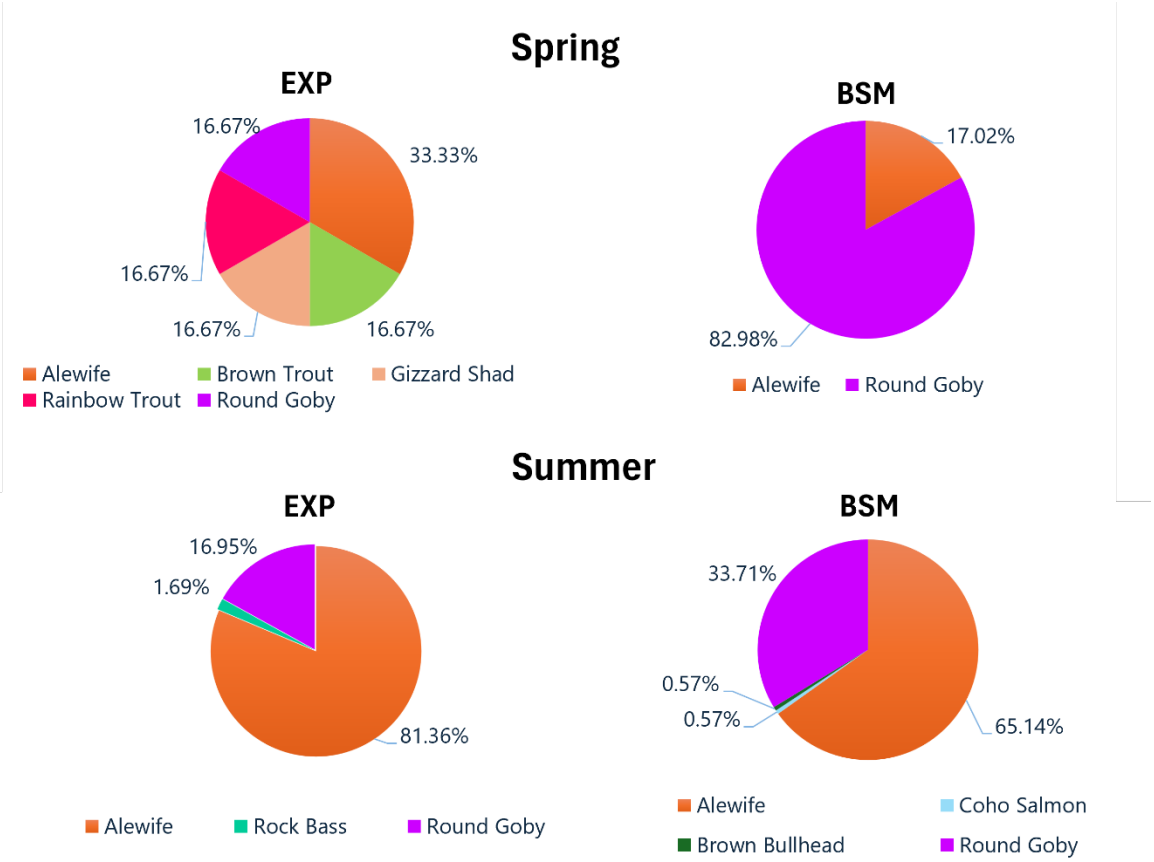


Figure A-11: Fish Species Composition Caught in Experimental (EXP) and Broad Scale Monitoring (BSM) Nets in the Shoreline Erosion Mitigation Study Area, 2024

Table A-13: Total Catch, CPUE, BPUE, and weight of fish caught in Infill Area during 2024 Nearshore Fish Community Study

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring					
EXP Nets					
Alewife	96	128.6	88.89%	4257.4	3178.3
Atlantic Salmon	2	2.7	1.85%	3851.2	2875.0
Rainbow Trout	1	1.3	0.93%	1640.9	1225.0
Round Goby	9	12.1	8.33%	151.4	113.1
Total	108	144.7	100%	9900.9	7391.3
BSM Nets					
Alewife	28	19.0	35.44%	539.2	795.7
Chinook Salmon	1	0.7	1.27%	4.1	6.0
Round Goby	49	33.2	62.03%	350.9	517.9
Threespine Stickleback	1	0.7	1.27%	1.0	1.5
Total	79	53.5	100%	895.2	1321.1
Summer					
EXP Nets					
Round Goby	1	1.1	100.00%	11.8	11.0
Total	1	1.1	1	11.8	11.0
BSM Nets					
Alewife	20	10.9	47.62%	281.2	517.2
Round Goby	22	12.0	52.38%	81.7	150.3
Total	42	22.8	100%	362.8	667.5
Fall					
EXP Nets					
Brown Bullhead	2	2.1	18.18%	556.9	524.0
Common Carp	1	1.1	9.09%	4973.6	4680.0
Pumpkinseed	1	1.1	9.09%	45.7	43.0
Round Goby	4	4.3	36.36%	41.4	39.0
Walleye	2	2.1	18.18%	6535.8	6150.0
White Sucker	1	1.1	9.09%	201.9	190.0
Total	11	11.7	100%	12355.3	11626.0
BSM Nets					

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Rainbow Smelt	1	0.5	4.35%	18.6	36.0
Rock Bass	1	0.5	4.35%	6.2	12.0
Round Goby	21	10.9	91.30%	197.0	381.0
Total	23	11.9	100%	221.8	429.0

Note:
Sampling locations are presented in **Figure 4-5**.

Table A-14: Total Catch, CPUE, BPUE, and weight of fish caught in Shoreline Erosion Mitigation Study Area during 2024 Nearshore Fish Community Study

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring					
EXP Nets					
Alewife	2	3.1	33.33%	118.5	76.5
Brown Trout	1	1.5	16.67%	5809.5	3752.0
Gizzard Shad	1	1.5	16.67%	2160.0	1395.0
Rainbow Trout	1	1.5	16.67%	1432.3	925.0
Round Goby	1	1.5	16.67%	13.9	9.0
Total	6	9.3	100%	9534.2	6157.5
BSM Nets					
Alewife	8	5.8	17.02%	192.9	265.2
Round Goby	39	28.4	83.0%	254.2	349.6
Total	47	34.2	100%	447.1	614.8
Summer					
EXP Nets					
Alewife	48	55.1	81.36%	1847.2	1609.9
Rock Bass	1	1.1	1.69%	281.1	245.0
Round Goby	10	11.5	16.95%	152.9	133.2
Total	59	67.7	100%	2281.2	1988.2
BSM Nets					
Alewife	114	66.6	65.14%	1852.1	3170.4
Coho Salmon	1	0.6	0.57%	NA	NA
Brown Bullhead	1	0.6	0.57%	134.4	230.0
Round Goby	59	34.5	33.71%	309.6	530.0
Total	175	102.2	100%	2296.1	3930.5
Fall					
EXP Nets					
Brown Trout	1	1.1	25.00%	1507.2	1345.0
Longnose Sucker	1	1.1	25.00%	NA	NA
Walleye	1	1.1	25.00%	1025.4	915.0
White Sucker	1	1.1	25.00%	784.4	700.0
Total	4	4.5	100%	3317.0	2960.0

Samling Season and Net Type	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
BSM Nets					
Alewife	3	1.6	15.79%	23.6	44.5
Brown Bullhead	1	0.5	5.26%	28.1	53.0
Largemouth Bass	1	0.5	5.26%	5.8	11.0
Log Perch	1	0.5	5.26%	1.1	2.0
Longnose Sucker	2	1.1	10.53%	16.5	31.0
Rock Bass	1	0.5	5.26%	6.4	12.0
Round Goby	9	4.8	47.37%	20.2	38.0
Yellow Perch	1	0.5	5.26%	4.2	8.0
Total	19	10.1	100%	105.9	199.5

Note:
Sampling locations are presented in **Figure 4-5**.

Table A-15: Total Catch, CPUE, BPUE, and weight of fish caught in Cutoff Wall Study Area during 2025 Nearshore Fish Community Study

Species	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
Spring					
EXP Nets					
Atlantic Salmon	1	1.9	9%	2793.6	1455.0
Common Carp	1	1.9	9%	14899.2	7760.0
Lake Trout	1	1.9	9%	4857.6	2530.0
Longnose Sucker	1	1.9	9%	2841.6	1480.0
Rainbow Smelt	5	9.6	45%	169.4	88.2
Round Goby	1	1.9	9%	24.8	12.9
White Sucker	1	1.9	9%	1152.0	600.0
Total	11	21.1	100%	26738.2	13926.1
BSM Nets					
Round Goby	2	4.0	100%	77.7	39.3
Total	2	4.0	100%	77.7	39.3
Summer					
EXP Nets					
Brown Bullhead	1	1.2	33%	145.6	121.0
Rock Bass	1	1.2	33%	174.4	145.0
White Sucker	1	1.2	33%	60.8	50.5
Total	3	3.6	100%	380.8	316.5
BSM Nets					
Alewife	277	338.0	99%	7768.7	6366.0
Round Goby	3	3.7	1%	53.2	43.6
Total	2	341.7	100%	7821.9	6409.6
Fall					
EXP Nets					
Alewife	5	6.2	42%	151.3	121.9
Brown Bullhead	2	2.5	17%	16.1	13.0
Brown Trout	1	1.2	8%	3190.3	2570.0
Chinook Salmon	1	1.2	8%	5561.4	4480.0
Round Goby	1	1.2	8%	53.4	43.0

Species	Total Catch	CPUE (fish/24-hr)	% Composition	BPUE (g/24-hr)	Total Weight of Fish Caught (g)
White Sucker	2	2.5	17%	34.8	28.0
Total	12	14.9	100%	9007.3	7255.9
BSM Nets					
Alewife	1	1.1	8%	39.1	36.1
Brown Bullhead	1	1.1	8%	12.5	11.5
White Sucker	2	2.2	15%	NA	NA
Yellow Perch	9	9.8	69%	100.2	92.4
Total	13	14.1	100%	151.7	139.9

Note:
Sampling locations are presented in **Figure 4-5**.

Fall Spawning Assessment

Detailed meristic results of the fish caught in the 2025 Fall Spawning Assessment are in **Table A-17**.

Table A-16: Meristics Data for Fish Collected and Measured from Nets Set during the Fall 2025 Spawning Assessment

Set Date	Collected Date	Week	Site	Season	Depth	Mesh Size	Common Name	Fork Length (cm)	Total Length (cm)	Weight (g)	Sex	Gonad Class
11/14/2025	11/15/2025	Week1	SEMSA	FA	3.7	50.8	Brown Trout	62.8	63.9	3035	M	-
11/14/2025	11/15/2025	Week1	SEMSA	FA	3.7	76.2	Chinook Salmon	57.2	61	2250	M	-
11/14/2025	11/15/2025	Week1	S14	FA	7.9	76.2	Chinook Salmon	-	-	-	M	-
11/14/2025	11/15/2025	Week1	S5	FA	16.5	50.8	Lake Whitefish	41.3	45.2	770	M	Mature
11/14/2025	11/15/2025	Week1	S5	FA	16.5	76.2	Lake Whitefish	42.3	47.1	785	M	Mature
11/14/2025	11/15/2025	Week1	S5	FA	16.5	63.5	Lake Trout	58.4	64.2	2660	M	Running
11/14/2025	11/15/2025	Week1	S5	FA	16.5	76.2	Lake Trout	602	660	3195	M	Running
11/14/2025	11/15/2025	Week1	S5	FA	16.5	50.8	Lake Trout	-	-	-	-	-
11/14/2025	11/15/2025	Week1	S3	FA	10	63.5	Lake Whitefish	45	48.9	1010	M	Ripe
11/14/2025	11/15/2025	Week1	S3	FA	10	88.9	Lake Whitefish	45.5	50.5	1350	F	Mature
11/14/2025	11/15/2025	Week1	S3	FA	10	101.6	Lake Whitefish	41.4	45.7	765	M	Mature
11/14/2025	11/15/2025	Week1	S3	FA	10	76.2	Lake Trout	-	-	-	-	-
11/19/2025	11/20/2025	Week2	S1	FA	11.9	76.2	Lake Whitefish	41	45.7	750	M	Mature
11/19/2025	11/20/2025	Week2	S1	FA	11.9	76.2	Lake Whitefish	39	43	635	M	Ripe
11/19/2025	11/20/2025	Week2	S4	FA	16.5	76.2	Lake Trout	83.5	90	7870	M	Ripe
11/19/2025	11/20/2025	Week2	S4	FA	16.5	63.5	Lake Trout	75.2	81.6	5630	M	Ripe
2025-11-19	2025-11-20	Week2	SEMSA	FA	3.6	101.6	Common Carp	63.8	69.5	4995	-	-
2025-11-19	2025-11-20	Week2	SEMSA	FA	5.3	101.6	Northern Pike	67.2	71	3025	-	-
2025-11-19	2025-11-20	Week2	SEMSA	FA	5.3	50.8	Brown Trout	-	67.5	4695	F	-
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	76.2	Atlantic Salmon	56.2	59.5	2435	-	-
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	101.6	Lake Whitefish	49	54.3	14.95	F	Running
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	50.8	Brown Trout	27.5	28.7	230	M	-
2025-11-19	2025-11-20	Week2	COWSA	FA	2.4	101.6	Chinook Salmon	62.2	67	2580	M	-

Set Date	Collected Date	Week	Site	Season	Depth	Mesh Size	Common Name	Fork Length (cm)	Total Length (cm)	Weight (g)	Sex	Gonad Class
2025-11-19	2025-11-20	Week2	S18	FA	7.1	101.6	Lake Whitefish	47.4	51	1365	F	Ripe
2025-11-19	2025-11-20	Week2	S18	FA	7.1	101.6	Lake Whitefish	43	47.3	860	M	Ripe
2025-11-19	2025-11-20	Week2	S12	FA	10	101.6	Lake Whitefish	47.4	52.4	1140	M	Ripe
2025-11-19	2025-11-20	Week2	S12	FA	10	101.6	Walleye	45.4	47.3	1490	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	5.3	76.2	Northern Pike	83.4	86.7	4790	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	5.3	63.5	White Sucker	27.7	29.4	250	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	3.5	63.5	White Sucker	21.1	23.3	125	-	-
11/24/2025	11/25/2025	Week3	SEMSA	FA	3.5	88.9	Brown Trout	55	57	2790	-	-
11/24/2025	11/25/2025	Week3	COWSA	FA	3.9	63.5	Brown Trout	60.1	61	3085	-	-
11/24/2025	11/25/2025	Week3	COWSA	FA	3.9	101.6	Brown Trout	-	53.4	1610	F	-
11/24/2025	11/25/2025	Week3	COWSA	FA	3.9	101.6	Lake Whitefish	45.2	49.6	1345	F	Running
11/24/2025	11/25/2025	Week3	S12	FA	9.8	88.9	Lake Trout	61	66.1	2520	M	Ripe
11/24/2025	11/25/2025	Week3	S12	FA	9.8	101.6	Round Whitefish	46.3	49.8	1165	M	Mature
11/24/2025	11/25/2025	Week3	S15	FA	8.3	88.9	Round Whitefish	51.4	54.9	1690	F	Ripe
11/24/2025	11/25/2025	Week3	S8	FA	17.9	88.9	Lake Trout	68.4	74.6	3745	M	Ripe
11/24/2025	11/25/2025	Week3	S3	FA	10.9	88.9	Lake Whitefish	51	56.3	1600	M	Spent
11/24/2025	11/25/2025	Week3	S3	FA	10.9	88.9	Lake Whitefish	39.4	43.6	700	M	Spent
11/24/2025	11/25/2025	Week3	S3	FA	10.9	101.6	Lake Whitefish	44	48.6	970	M	Spent
12/1/2025	12/2/2025	Week4	S1	FA	10.2	50.8	Eel Slime	-	-	-	-	-
12/1/2025	12/2/2025	Week4	SEMSA	FA	5.4	63.5	Cisco	24.3	27.5	150.00	-	-
12/1/2025	12/2/2025	Week4	S7	FA	17.8	76.2	Lake Whitefish	39.6	44	695	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	42.1	46.7	870	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	41.8	46.7	756	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Round Whitefish	46.6	51	1025	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	45.6	50.4	1000	M	Ripe

Set Date	Collected Date	Week	Site	Season	Depth	Mesh Size	Common Name	Fork Length (cm)	Total Length (cm)	Weight (g)	Sex	Gonad Class
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	43.3	47.2	1025	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	41	45.1	825	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	41.3	46	810	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	40.3	44.2	740	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	40.2	44.5	710	M	Spent
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	38.6	42.9	635	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	101.6	Lake Whitefish	49	45.2	755	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	42.7	46.7	785	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	44	48.4	940	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	38.1	42.4	668	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	40.5	44.6	685	M	Spent
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	39.2	43.6	605	M	Ripe
12/1/2025	12/2/2025	Week4	S6	FA	10.6	88.9	Lake Whitefish	44	48.7	965	M	Ripe

Note:
"-" the parameter was not measured, or that the sex was not identified possibly because fish were not in spawning condition or lethally sampled. Sampling locations are presented in **Figure 4-6**.
S1-S12 indicate that the fish was caught in a net set in the Deepwater Study Area, S13-16 in the Mid-depth Study Area, COWSA – Cutoff Wall Study Area, SEMSA – Shoreline Erosion Mitigation Study Area.

Larval Fish and Eggs

Detailed results of the 2025 Ichytoplankton studies are presented below.

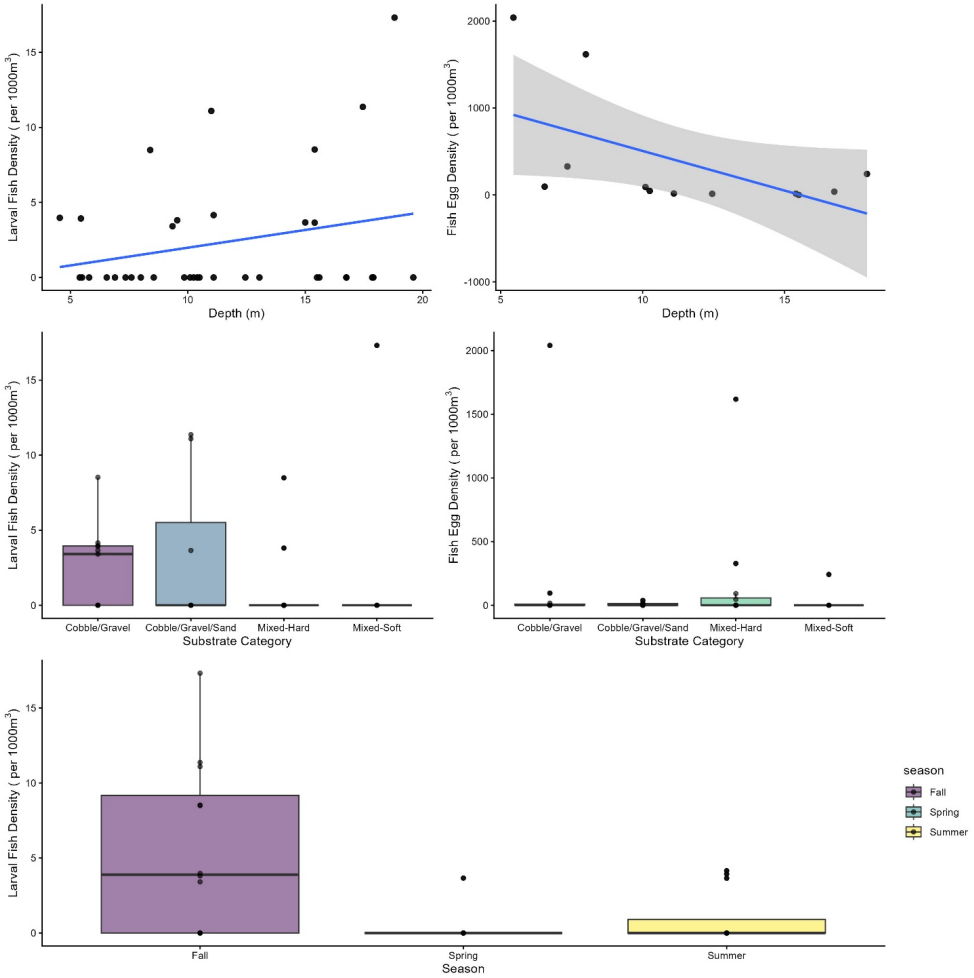


Figure A-12: Scatterplots and Boxplots of Larval Fish Density (Individuals per 1000m^3) Expressed by Depth, Substrate, and Season.

Note:
The box spans the interquartile range (IQR; 25th percentile (bottom of box) to 75th percentile (top of box)), the horizontal line within the box is the median, the vertical lines extend outwards to the furthest datapoint within 1.5 x IQR, and any points outside of this vertical line are beyond 1.5 x IQR.

Table A-17: Larval Fish and Egg Total and Proportional Catch in Horizontal Tows by Matrix, 2025

Spring													
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S2**	**S4**	**S6**	**S8**	**S9**	**S11**	**S12**	**S13**	**S15**	**S17**	**S18**
Count	Larval Fish	Lake Whitefish	0	0	0	1	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Proportion (%)	Larval Fish	Lake Whitefish	0	0	0	100	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Summer														
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S3**	**S4**	**S6**	**S7**	**S9**	**S11**	**S12**	**S14**	**S15**	**S16**	**S18**
Count	Larval Fish	Round Goby	0	1	1	0	0	0	0	0	0	0	0	1
	Eggs	spiny-rayed fishes (Alewife or Gizzard Shad)	4	4	4	0	11	63	21	13	413	79	24	519
Proportion (%)	Larval Fish	Round Goby	0	33.3	33.3	0	0	0	0	0	0	0	0	33.3
	Eggs	spiny-rayed fishes (Alewife or Gizzard Shad)	0.35	0.35	0.35	0	0.95	5.45	1.82	1.13	35.8	6.84	2.08	44.9
Fall														
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S3**	**S4**	**S6**	**S7**	**S9**	**S11**	**S12**	**S13**	**S14**	**S16**	**S17**
Count	Larval Fish	Burbot	3	1	0	2	3	5	0	1	2	0	0	1
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Proportion (%)	Larval Fish	Burbot	16.7	5.56	0	11.1	16.7	27.8	0	5.56	11.1	0	0	5.56
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0

Note:
Highlighted cells indicate where larval fish or eggs were caught.
Sampling areas are presented in **Figure 4-7**.

Table A-18: Larval Fish and Total Eggs Caught in Vertical Tows by Matrix, 2025

Spring													
Metric	**Life Stage**	**Species**	**Grid No.**										
			S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S1**	**S11**	**S12**
Count	Larval Fish	NA	0	0	0	0	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0
Summer														
Metric	**Life Stage**	**Species**	**Grid No.**											
			S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**
Count	Larval Fish	Clupeidae	0	3	0	0	0	0	0	0	0	0	0	0
	Eggs	Clupeidae	0	0	0	0	0	0	1	0	0	0	0	0
Fall														
Metric	**Life Stage**	**Species**	**Grid No.**											
			S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**
Count	Larval Fish	NA	0	0	0	0	0	0	0	0	0	0	0	0
	Eggs	NA	0	0	0	0	0	0	0	0	0	0	0	0

Note:
Highlighted cells indicate where larval fish or eggs were caught.
Sampling areas are presented in **Figure 4-7**.

Table A-19: Horizontal Tow Information, Habitat Descriptions, and Summary Statistics for Larval Fish and Eggs Caught in Spring, Summer, and Fall 2025 Sampling Events

Grid	Date	Tow Length (m)	Average Tow Depth (m)	Sample Volume (m^3)	Larval Fish Species Richness	Larval Fish Density (per 1000m^3)	Egg Species Richness	Egg Density (per 1000m^3)	Dominant Matrix Substrate	Substrate (% Cobble)
Spring										
S1	13-Apr-25	293.89	11.1	259.54	0	0	0	0	gravel/cobble/boulder	89.9%
S2 (Intake location option)	13-Apr-25	314.31	13.1	277.58	0	0	0	0	gravel/cobble/boulder	55.1%
S4	13-Apr-25	273.95	16.8	241.93	0	0	0	0	gravel/cobble	76.0%
S6	13-Apr-25	309.00	15.0	272.88	1	3.665	0	0	gravel/cobble	96.3%
S8	13-Apr-25	246.39	17.9	217.60	0	0	0	0	gravel/cobble	47.3%
S9	13-Apr-25	298.08	19.6	263.24	0	0	0	0	gravel/cobble	28.9%
S11	13-Apr-25	289.44	10.4	255.61	0	0	0	0	sand/gravel/cobble	75.0%
S12	13-Apr-25	302.87	10.5	267.47	0	0	0	0	sand/gravel/cobble	73.5%
S13	12-Apr-25	310.80	8.6	274.48	0	0	0	0	sand/gravel/cobble	68.7%
S15	13-Apr-25	298.03	7.6	263.19	0	0	0	0	sand/gravel/cobble/boulder	75.0%
S17	12-Apr-25	302.44	5.4	267.09	0	0	0	0	sand/gravel/cobble	95.1%
S18	12-Apr-25	311.56	5.8	275.15	0	0	0	0	gravel/cobble/boulder	100.0%
Minimum	--	**246.39**	**5.40**	**217.60**	**0.00**	**0.00**	**0.00**	**0.00**	--	**28.9%**
Median	--	**300.26**	**10.80**	**265.17**	**0.00**	**0.00**	**0.00**	**0.00**	--	**75.0%**
Mean	--	**295.90**	**11.80**	**261.31**	**0.08**	**0.31**	**0.00**	**0.00**	--	**73.4%**
Standard Deviation	--	**19.21**	**4.70**	**16.96**	**0.29**	**1.06**	**0.00**	**0.00**	--	**21.3%**
Q25	--	**292.78**	**8.31**	**258.56**	**0.00**	**0.00**	**0.00**	**0.00**	--	**65.3%**
Q75	--	**309.45**	**15.44**	**273.28**	**0.00**	**0.00**	**0.00**	**0.00**	--	**91.2%**
Maximum	--	**314.31**	**19.60**	**277.58**	**1.00**	**3.66**	**0.00**	**0.00**	--	**100.0%**

Grid	Date	Tow Length (m)	Average Tow Depth (m)	Sample Volume (m^3)	Larval Fish Species Richness	Larval Fish Density (per 1000m^3)	Egg Species Richness	Egg Density (per 1000m^3)	Dominant Matrix Substrate	Substrate (% Cobble)
Summer										
S1	23-Jul-25	345.45	12.6	305.08	0	0.0	1	13.1	gravel/cobble/boulder	88.6%
S3	23-Jul-25	272.54	10.6	240.68	1	4.2	1	16.6	gravel/cobble	99.4%
S4	23-Jul-25	309.99	15.7	273.76	1	3.7	1	14.6	gravel/cobble/boulder	45.4%
S6	23-Jul-25	282.21	15.3	249.23	0	0.0	0	0.0	gravel/cobble	77.5%
S7	23-Jul-25	329.45	17.2	290.95	0	0.0	1	37.8	gravel/cobble	85.6%
S9	23-Jul-25	294.97	18.0	260.49	0	0.0	1	241.9	gravel/cobble	60.4%
S11	23-Jul-25	259.73	10.1	229.37	0	0.0	1	91.6	sand/gravel/cobble	74.4%
S12	23-Jul-25	317.33	10.4	280.24	0	0.0	1	46.4	gravel/cobble/boulder	71.8%
S14	23-Jul-25	289.07	7.7	255.29	0	0.0	1	1617.8	gravel/cobble/boulder	75.0%
S15	22-Jul-25	272.65	8.5	240.79	0	0.0	1	328.1	sand/gravel/cobble	75.0%
S16	23-Jul-25	285.56	5.9	252.19	0	0.0	1	95.2	sand/gravel/cobble	92.9%
S18	22-Jul-25	288.07	5.7	254.40	1	3.9	1	2040.1	gravel/cobble/boulder	98.3%
Minimum	--	**259.73**	**5.70**	**229.37**	**0.00**	**0.00**	**0.00**	**0.00**	--	**45.4%**
Median	--	**288.57**	**10.50**	**254.84**	**0.00**	**0.00**	**1.00**	**68.97**	--	**76.2%**
Mean	--	**295.58**	**11.48**	**261.04**	**0.25**	**0.98**	**0.92**	**378.59**	--	**78.7%**
Standard Deviation	--	**25.29**	**4.27**	**22.33**	**0.45**	**1.77**	**0.29**	**690.66**	--	**15.7%**
Q25	--	**279.82**	**8.30**	**247.12**	**0.00**	**0.00**	**1.00**	**16.12**	--	**73.8%**
Q75	--	**311.83**	**15.40**	**275.38**	**0.25**	**0.91**	**1.00**	**263.41**	--	**89.7%**
Maximum	--	**345.45**	**18.00**	**305.08**	**1.00**	**4.15**	**1.00**	**2040.10**	--	**99.4%**

Grid	Date	Tow Length (m)	Average Tow Depth (m)	Sample Volume (m^3)	Larval Fish Species Richness	Larval Fish Density (per 1000m^3)	Egg Species Richness	Egg Density (per 1000m^3)	Dominant Matrix Substrate	Substrate (% Cobble)
Fall										
S1	6-Nov-25	306.13	11.0	270.35	1	11.097	0	0	gravel/cobble	61.2%
S3	6-Nov-25	331.64	9.4	292.88	1	3.414	0	0	gravel/cobble	97.8%
S4	6-Nov-25	292.46	15.6	258.28	0	0	0	0	sand/gravel/cobble	75.3%
S6	6-Nov-25	265.62	15.4	234.57	1	8.526	0	0	gravel/cobble/boulder	78.8%
S7	6-Nov-25	298.81	17.5	263.88	1	11.369	0	0	gravel/cobble/boulder	77.7%
S9	6-Nov-25	326.97	18.8	288.76	1	17.316	0	0	sand/gravel/cobble	53.8%
S11	6-Nov-25	300.93	9.9	265.76	0	0	0	0	gravel/cobble/boulder	74.4%
S12	6-Nov-25	297.14	9.6	262.41	1	3.811	0	0	gravel/cobble/boulder	74.0%
S13	6-Nov-25	266.66	8.4	235.49	1	8.493	0	0	sand/gravel/cobble	74.4%
S14	6-Nov-25	337.66	6.9	298.20	0	0	0	0	gravel/cobble/boulder	75.0%
S16	6-Nov-25	315.01	5.5	278.20	0	0	0	0	gravel/cobble	84.9%
S17	6-Nov-25	285.01	4.6	251.70	1	3.973	0	0	gravel/cobble	98.4%
Minimum	--	**265.62**	**4.55**	**234.57**	**0.00**	**0.00**	**0.00**	**0.00**	--	**53.8%**
Median	--	**299.87**	**9.70**	**264.82**	**1.00**	**3.89**	**0.00**	**0.00**	--	**75.1%**
Mean	--	**302.00**	**11.03**	**266.71**	**0.67**	**5.67**	**0.00**	**0.00**	--	**77.1%**
Standard Deviation	--	**23.25**	**4.71**	**20.53**	**0.49**	**5.67**	**0.00**	**0.00**	--	**12.7%**
Q25	--	**290.60**	**8.03**	**256.63**	**0.00**	**0.00**	**0.00**	**0.00**	--	**74.3%**
Q75	--	**318.00**	**15.45**	**280.84**	**1.00**	**9.17**	**0.00**	**0.00**	--	**80.3%**
Maximum	--	**337.66**	**18.80**	**298.20**	**1.00**	**17.32**	**0.00**	**0.00**	--	**98.4%**

Note:
Sampling locations are presented in **Figure 4-7**.

Table A-20: Date, Time, Grid Location, Substrate, Depth, and Estimated Volume of Vertical Ichthyoplankton Tows Conducted During Spring, Summer, and Fall 2025

Date	Time	Grid	Substrate	Water Depth (m)	Volume sampled (m^3)	Catch
Spring						
04/12/2025	1:55	S1	Cobble	11.4	4.42	-
04/12/2025	1:27	S2	Gravel/Cobble	12.8	4.42	-
04/12/2025	1:09	S3	Cobble/Boulder	10.9	4.42	-
04/11/2025	23:50	S4	Cobble	16.9	4.42	-
04/12/2025	0:20	S5	Cobble	16.4	4.42	-
04/12/2025	0:47	S6	Cobble	15.8	4.42	-
04/11/2025	23:22	S7	Gravel/Cobble	18.7	4.42	-
04/11/2025	22:55	S8	Sand	18.8	4.42	-
04/11/2025	22:26	S9	Sand	18.7	4.42	-
04/12/2025	2:16	S10	Cobble	9.9	4.37	-
04/12/2025	2:37	S11	Cobble	11.4	4.42	-
04/12/2025	2:57	S12	Cobble	9.8	4.33	-
Summer						
07/16/2025	2:15	S1	Cobble	11.5	4.42	-
07/16/2025	1:53	S2	Gravel/Cobble	12.0	4.42	3 Clupeidae Larvae 0.90 larvae /m^3
07/16/2025	1:30	S3	Cobble/Boulder	11.0	4.42	-
07/16/2025	1:04	S4	Cobble	16.0	4.42	-
07/16/2025	12:35	S5	Cobble	16.0	4.42	-
07/16/2025	12:06	S6	Cobble	15.6	4.42	-
07/15/2025	11:38	S7	Gravel/Cobble	18.5	4.42	1 Clupeidae egg

Date	Time	Grid	Substrate	Water Depth (m)	Volume sampled (m^3)	Catch
						0.23 eggs/m^3
07/15/2025	11:24	S8	Sand/Cobble	18.5	4.42	-
07/15/2025	10:29	S9	Sand	19.0	4.42	-
07/16/2025	3:18	S10	Cobble	10.0	4.42	-
07/16/2025	3:00	S11	Cobble	10.5	4.42	-
07/16/2025	2:40	S12	Cobble	10.0	4.42	-
07/16/2025	2:15	S1	Cobble	11.5	4.42	-
Fall						
09/25/2025	23:02	S1	Cobble	11.0	4.42	-
09/25/2025	22:50	S2 (intake location option)	Gravel/Cobble	12.0	4.42	-
09/25/2025	22:38	S3	Cobble/Boulder	10.0	4.42	-
09/25/2025	21:57	S4	Cobble	15.2	4.42	-
09/25/2025	22:10	S5 (Intake location option)	Cobble	15.6	4.42	-
09/25/2025	22:25	S6	Cobble	15.0	4.42	-
09/25/2025	21:43	S7	Gravel/Cobble	17.4	4.42	-
09/25/2025	21:25	S8	Sand	17.5	4.42	-
09/25/2025	21:05	S9	Sand	18.5	4.42	-
09/25/2025	23:15	S10	Cobble	9.4	4.15	-
09/25/2025	23:25	S11	Cobble	10.2	4.42	-
09/25/2025	23:36	S12	Cobble	9.5	4.20	-

Note:
Sampling locations are presented in **Figure 4-7**.

Table A-21: Summary of Generalized Linear Model Results for Larval Fish and Eggs

Parameter	AIC Value	R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
						Season / Area	Mean	Lower Confidence Limit	Upper Confidence Limit				
Fish Density - Depth	207.4	0.012	Depth	0.139	No	--	2.3	0.9	3.7	--	--	--	--
Fish Density - Season	196.9	0.073	Season	<0.001	Yes	Fall	5.7	3.6	7.7	Fall	Spring	0.002	Fall > (Spring = Summer)
						Spring	0.3	-1.7	2.4	Fall	Summer	0.006	
						Summer	1.0	-1.1	3.0	Spring	Summer	0.884	
Fish Density - Substrate	211.7	0.010	Substrate	0.705	No	Cobble/Gravel	2.5	-0.1	5.1	--	--	--	--
						Cobble/Gravel/Sand	3.3	0.2	6.3				
						Mixed-Hard	1.0	-1.5	3.5				
						Mixed-Soft	3.5	-0.4	7.3				
Summer Egg Density - Depth	191.5	0.023	Depth	0.061	Yes	--	378.6	-8.8	766.0	--	--	--	As Depth increases, egg density decreases
Summer Egg Density - Substrate	198.5	0.007	Substrate	0.402	No	Cobble/Gravel	538.0	-342.4	1418.3	--	--	--	--
						Cobble/Gravel/Sand	21.8	-994.7	1038.4				
						Mixed-Hard	521.0	-359.4	1401.3				
						Mixed-Soft	241.9	-1518.9	2002.6				

Note: Shaded cells indicates p-value < 0.1, which was considered significant.

A model comparing density across season was not run for fish eggs as eggs were only found in the summer sample period (July 22-23, 2025). Fish egg density was only compared across depth and substrate for data collected in the summer sample period.

A.3.1.2 Fish Tissue

The screening of metals and radionuclides in fish tissue collected in 2024 to support the protection of human health are presented in **Table A-22**.

Table A-22: Fish Tissue Analysis Results, 2024

Parameter	Units	Detection Limit	Federal guidelines (1,2,3)[a]	Toxicity reference value-derived concentrations (4-7)[b]	Regulatory Dose Limit-derived Concentrations (8)[c]	Selected screening criteria	Nearshore Lake Ontario								Deepwater Intake Area											
							Rainbow Trout		Atlantic Salmon	Walleye					Lake Trout								Alewife					
							RT-1	RT-2	AS-1	WE-1	WE-2	WE-3	WE-4	WE-5	LT-1	LT-2	LT-3	LT-4	LT-5	LT-6	LT-7	LT-8	LWF-1	LWF-2	LWF-3	LWF-4	LWF-5	LWF-6
Metals																												
Aluminum (Al)	mg/kg (wt)	0.2	-	1.18E+03	-	1.18E+03	0.38	0.17665	0.25	0.33	0.27	0.33	0.3	0.12735	0.4	0.14252	0.31	0.26	4.17	0.22	0.19308	0.15673	0.33	0.18528	0.38	0.18974	0.16808	0.12048
Antimony (Sb)	mg/kg (wt)	0.001	-	4.71E-01	-	4.71E-01	0.0002	0.00014	0.00025	0.00024	0.00031	0.00037	0.00033	0.00011	0.00026	0.00025	0.00027	0.00032	0.00045	0.00031	0.00066	0.0018	0.00069	0.00039	0.00036	0.00036	-0.0003	-0.0004
Arsenic (As)	mg/kg (wt)	0.004	8.88E-01	6.55E-02	-	8.88E-01	0.0592	0.0503	0.144	0.095	0.097	0.127	0.132	0.197	0.0802	0.187	0.216	0.176	0.124	0.0991	0.119	0.312	0.145	0.0754	0.114	0.114	0.13	0.0884
Barium (Ba)	mg/kg (wt)	0.01	-	2.24E+02	-	2.24E+02	0.018	0.0087	0.012	0.00429	0.00242	0.00329	0.01	0.00223	0.014	0.00297	0.016	0.018	0.013	0.00486	0.00481	0.00696	0.011	0.00919	0.0095	0.00603	0.01	0.00926
Beryllium (Be)	mg/kg (wt)	0.001	-	2.36E+00	-	2.36E+00	-0.0002	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0004	-0.0005
Bismuth (Bi)	mg/kg (wt)	0.001	-	-	-	-	0.00046	0.00026	0.00028	0.00054	0.00068	0.00056	0.00014	0.00026	0.00021	0.00011	0.00024	0.00039	0.00058	0.00042	0.00049	0.00007	0.0044	0.0018	0.0024	0.0015	0.0015	0.0016
Boron (B)	mg/kg (wt)	0.2	-	3.77E+02	-	3.77E+02	-0.0077	-0.0155	-0.0018	-0.0218	-0.0273	-0.0208	-0.0095	-0.0159	-0.0255	-0.0248	-0.0238	-0.022	-0.0211	-0.0247	0.13142	-0.0244	-0.025	-0.0201	0.25	-0.0144	-0.0126	-0.0347
Cadmium (Cd)	mg/kg (wt)	0.001	-	9.43E-01	-	9.43E-01	0.00057	0.00009	0.00033	0.0001	0.00005	0.00066	0.0011	0.00009	0.00011	-3E-05	0.00006	0.00031	0.00015	-1E-05	-5E-05	0.00002	0.00002	0	0.00011	0.0001	-5E-05	-0.0002
Calcium (Ca)	mg/kg (wt)	2	-	-	-	-	180	138	82.3	116	115	106	209	115	243	71.3	169	173	121	75.9	203	63.6	188	132	181	97.4	122	80.7
Chromium (Cr)	mg/kg (wt)	0.01	-	2.59E+00	-	2.59E+00	0.00663	0.00443	0.00884	0.00744	0.00622	0.0081	0.0078	0.00657	0.00592	0.00784	0.00523	0.011	0.0072	0.00466	0.00495	0.0055	0.00934	0.00716	0.012	0.00796	0.00275	0.00358
Cobalt (Co)	mg/kg (wt)	0.0013	-	1.18E+00	-	1.18E+00	0.0045	0.004	0.0018	0.00052	0.00027	0.00039	0.00051	0.00051	0.002	0.0013	0.0021	0.0021	0.0023	0.0017	0.0019	0.0015	0.0029	0.0133	0.0044	0.0065	0.0057	0.002
Copper (Cu)	mg/kg (wt)	0.01	-	5.02E+02	-	5.02E+02	0.188	0.206	0.297	0.113	0.118	0.133	0.217	0.294	0.23	0.238	0.355	0.293	0.242	0.353	0.264	0.284	0.201	0.192	0.271	0.423	0.181	0.234
Iron (Fe)	mg/kg (wt)	0.25	-	3.54E+03	-	3.54E+03	3.5	2.53	2.58	1.08	0.78	1.09	1.82	2.13	2.14	1.81	3.23	3.4	2.43	2.29	1.71	2.54	2.71	3.54	3.46	6.68	2.83	5.76
Lead (Pb)	mg/kg (wt)	0.001	-	5.89E-01	-	5.89E-01	0.006	0.0014	0.0026	0.00047	0.00016	0.00017	0.00042	0.0011	0.00093	0.00049	0.0021	0.002	0.0066	0.0011	0.00055	0.00076	0.0028	0.001	0.0018	0.00072	0.0012	0.0019
Magnesium (Mg)	mg/kg (wt)	0.4	-	5.89E+03	-	5.89E+03	303	306	305	324	345	348	306	318	280	282	282	281	286	237	272	215	263	276	250	263	222	247
Manganese (Mn)	mg/kg (wt)	0.01	-	2.95E+01	-	2.95E+01	0.109	0.081	0.091	0.087	0.091	0.103	0.081	0.069	0.108	0.077	0.098	0.113	0.095	0.072	0.091	0.067	0.127	0.12	0.131	0.126	0.138	0.118
Mercury (Hg)	mg/kg (wt)	0.002	-	2.36E-01	-	2.36E-01	0.0378	0.0348	0.0509	0.0983	0.156	**0.353**	0.167	**0.267**	0.11	0.0853	0.0777	0.0677	0.095	0.119	0.116	0.191	0.0224	0.0559	0.0196	0.0371	0.0471	0.0397
Molybdenum (Mo)	mg/kg (wt)	0.004	-	3.54E+01	-	3.54E+01	0.00196	0.00155	0.0018	0.00073	0.00102	0.0009	0.00078	0.00062	0.00081	0.00068	0.00089	0.00097	0.00066	0.00131	0.00117	0.00223	0.00097	0.00043	0.00103	0.00101	0.00175	0.00059
Nickel (Ni)	mg/kg (wt)	0.01	-	1.41E+01	-	1.41E+01	0.00944	0.00637	0.00775	0.0056	0.00312	0.00343	0.00528	0.00317	0.00521	0.00788	0.022	0.00545	0.00627	0.0048	0.00461	0.00601	0.00693	0.01	0.00645	0.00577	0.00551	0.00545
Phosphorus (P)	mg/kg (wt)	2	-	2.72E+05	-	2.72E+05	2830	2940	2860	2580	2770	2630	2560	2530	2670	2590	2740	2700	2740	2340	2520	2090	2570	2430	2520	2560	2070	2300
Potassium (K)	mg/kg (wt)	2	-	-	-	-	4680	4990	4690	4790	5060	4760	4430	4520	4220	4070	4160	4080	4650	3920	4090	3420	4080	4000	4170	4260	3660	4150
Selenium (Se)	mg/kg (wt)	0.01	1.70E+00	6.48E+00	-	1.70E+00	0.353	0.502	0.348	0.39	0.459	0.526	0.42	0.395	0.629	0.544	0.416	0.524	0.549	0.33	0.437	0.344	0.636	0.61	0.594	0.62	0.485	0.546
Silver (Ag)	mg/kg (wt)	0.001	-	5.89E+00	-	5.89E+00	0.00003	0.00009	0.00005	0.0001	0	0.00009	0.00004	-5E-05	0.00005	0.00012	0.00006	0.00007	0.00007	0.00012	0.00021	0.00012	0.0002	0.00005	0.00018	0.00003	0.00013	0.00011
Sodium (Na)	mg/kg (wt)	2	-	-	-	-	250	240	260	501	350	373	401	413	260	210	263	215	326	418	440	354	392	397	344	430	522	338
Strontium (Sr)	mg/kg (wt)	0.01	-	7.07E+02	-	7.07E+02	0.216	0.127	0.057	0.051	0.054	0.042	0.117	0.052	0.214	0.042	0.149	0.177	0.083	0.063	0.197	0.055	0.285	0.168	0.313	0.123	0.176	0.105
Thallium (Tl)	mg/kg (wt)	0.0004	-	1.59E-02	-	1.59E-02	0.00818	0.0101	**0.0187**	0.0106	0.0145	**0.0183**	0.0146	0.0118	**0.0389**	**0.0228**	**0.027**	**0.0203**	**0.0213**	0.0107	0.0149	0.012	0.00046	0.00066	0.00106	0.00484	0.00118	0.00222
Tin (Sn)	mg/kg (wt)	0.02	-	3.54E+02	-	3.54E+02	0.00752	0.00247	0.00428	0.00437	0.00365	0.0047	0.00564	0.00122	0.00223	0.00158	0.00301	0.0035	0.00171	0.00169	0.00264	0.0038	0.00104	0.00198	0.00278	0.00273	-0.0017	-0.0026
Titanium (Ti)	mg/kg (wt)	0.02	-	-	-	-	0.296	0.299	0.301	0.294	0.305	0.285	0.265	0.277	0.284	0.269	0.297	0.273	0.309	0.266	0.259	0.243	0.268	0.27	0.272	0.274	0.235	0.237
Uranium (U)	mg/kg (wt)	0.0004	-	7.07E-01	-	7.07E-01	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0004	-0.0005
Vanadium (V)	mg/kg (wt)	0.02	-	3.06E+01	-	3.06E+01	-0.0006	-0.0017	-0.0014	0.00067	0.00008	0.00076	0.00188	0.00114	-0.0009	-0.0003	0.00062	-0.0004	-5E-05	0.00003	0.00069	0.00081	0.00147	0.00179	0.00443	0.00354	-0.0014	0.00034
Zinc (Zn)	mg/kg (wt)	0.04	-	5.66E+02	-	5.66E+02	4.08	3.92	3.77	4.13	3.66	4.22	4.17	3.47	3.48	3.19	3.56	4	3.17	2.89	3.45	2.84	3.31	3.59	3.85	3.65	3.1	3.28
Physical Properties																												
Moisture	%	0.3	-	-	-	-	74	74	72	76	76	76	75	75	77	75	74	76	77	78	78	70	76	68	76	71	74	74
Elements																												
Methyl Mercury	ng/g (wt)	10	33	-	-	33	0.71	0.85	1.06	**81**	**150**	**350**	**110**	**270**	**120**	**66**	**79**	**66**	**80**	**160**	**100**	**210**	16	**39**	16	29	**38**	33
Radionuclides																												
C-14	Bq/kg	0	-	-	7.95E+03	7.95E+03	53.6	55.4	41.1	31	80.8	44.6	50.8	33	33	32	33	41	31	33	42.5	49	41	36	60	33	38	54.7

Parameter	Units	Detection Limit	Federal guidelines (1,2,3)[a]	Toxicity reference value-derived concentrations (4-7)[b]	Regulatory Dose Limit-derived Concentrations (8)[c]	Selected screening criteria	Nearshore Lake Ontario								Deepwater Intake Area											
							Rainbow Trout		Atlantic Salmon	Walleye					Lake Trout								Alewife					
							RT-1	RT-2	AS-1	WE-1	WE-2	WE-3	WE-4	WE-5	LT-1	LT-2	LT-3	LT-4	LT-5	LT-6	LT-7	LT-8	LWF-1	LWF-2	LWF-3	LWF-4	LWF-5	LWF-6
Co-60	Bq/kg	0	-	-	1.36E+03	1.36E+03	0.692	-2.03	0.296	-0.127	0.199	-1.1	-37.1	0.784	-0.25	-0.348	-1.11	-1.52	1	-18.4	1.64	-1.48	-1.69	-0.922	0.915	0.623	1.32	1.09
Cs-134	Bq/kg	0	-	-	2.43E+02	2.43E+02	1.01	0.39	0.21	-2.43	-2.62	1.54	0.959	-1.37	-1.95	-1.43	2.04	0.0973	0.962	-0.99	0.606	-1.42	-0.388	0.105	0.943	-1.96	1.27	3.59
Cs-137	Bq/kg	0	-	-	3.55E+02	3.55E+02	-0.114	0.857	0.677	0.259	1.24	-1.63	0.646	-1.61	0.251	0.132	-0.425	-0.719	0.244	1.55	2.59	-0.3	1.73	1.1	-0.354	1.02	-1.31	-0.281
I-131	Bq/kg	0	-	-	2.10E+02	2.10E+02	0.237	0.682	0.681	2.39	-0.222	0.186	0.811	0.929	0.42	1.62	1.5	-2.02	-1.1	-0.404	-1.46	-0.627	-0.796	-0.701	-0.687	-0.77	0.195	1.65
K-40	Bq/kg	0	-	-	7.44E+02	7.44E+02	182	122	248	298	243	84.3	147	191	192	78.6	148	226	143	-3.61	89	78.7	76.5	-69	64.4	176	123	113
Th-Series	Bq/kg	0	-	-	-	-	-0.701	-1.26	1.92	0.357	0.426	1.7	0.338	-0.143	0.84	1.03	-0.223	-1.21	-1.8	0.118	-0.785	-22.5	-33	3.15	-4.39	1	0.806	1.13
U-Series	Bq/kg	0	-	-	-	-	0.268	1.38	1.18	1.79	0.735	1.71	2.05	2.96	1.29	0.299	1.92	-0.881	3.2	-0.177	-0.225	2.32	-4.44	3.28	-0.356	1.79	-0.499	0.757
H-3	Bq/kg	0	-	-	1.00E+05	1.00E+05	27.5	14.3	9.42	4.03	1.71	7.04	1.37	2.45	1.66	3.08	2.99	2.03	2.1	1.67	3.73	0	1.14	1.96	-2.12	1.65	2.22	0.97
H-3 OBT	-	0	-	-	1.00E+05	1.00E+05	190	902	580	117	43	231	62	48	93.7	137	164	1500	129	204	99	87	58	228	232	223	212	6000
% Moisture	%	0	-	-	-	-	62.64	62.95	61.23	63.88	64.51	65.9	62.89	66.32	61.85	64.51	61.97	54.68	65.11	63.02	58.42	50.87	53.94	60.76	66.05	63.52	59.38	59.89

Note:
Sampling locations are presented in **Figure 4-5**.
Bold Exceeds selected screening criteria
Negative values indicate uncensored values that are less than the detection limit.
"-" does not exist
[a]Where applicable, to compare directly to laboratory results, guidelines in dry weight (dw) were converted to wet weight (ww) based on average moisture concentrations in the samples.
[b]Screening levels were developed using constituent-specific toxicity reference values (TRVs) based on the fish ingestion rate of high consumers of traditional foods in Ecozone 4 (Chan et al., 2014). TRVs were sourced, in order of preference, from Health Canada (2025), MECP (2025), US EPA IRIS (2025), and US ATSDR (2025).
[c]The screening level for a given radionuclide in fish represents the activity or mass concentration which, if consumed as part of a the high consumer's diet year-round, would result in 10% of the public dose limit of 1 millisievert per year (1 mSv/year), following the methodology outlined in CNSC (2023). This approach is appropriate because the public dose limit accounts for contributions from all radionuclides. For metals, each element was assessed individually; a 10% TDI was not applied.

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A.3.1.3 Thermal Effects

Thermal Plume Effects on Fish Eggs and Larvae

The potential effects of the thermal plume on the early life stages of 4 fish species were evaluated in the Aquatic Environment TSD for the EA for the refurbishment and continued operation of PNGS Units 5-8 (Golder, 2007). The species assessed included two warm water fish species (Smallmouth Bass and Emerald Shiner) and two cold water species (Round Whitefish and Lake Trout) based on their abundance in the area, and sensitivity to thermal plume effects. A numerical model was used to delineate the thermal regime in various potential habitat areas within the receiving environment, incorporating seasonal and spatial variations in water temperature. The modelled water Maximum Weekly Average Temperatures (MWATs) within the plume were compared to species-specific Maximum Weekly Average Temperature (MWAT) criteria relevant to spawning and embryo-larval development. These criteria represent the upper bound of suitable temperatures for the biological processes under chronic exposure conditions.

In the timeframe relevant to the two warmwater species (April-May), only the discharge channels had modelled MWAT values marginally above MWAT criteria for embryo-larval development of Emerald Shiner. Given that this exceedance was limited to the discharge channels, it likely does not impact the population as a whole. In the winter period, relevant to the Lake Trout, modelled MWAT values above MWAT criteria were found in the discharge channels and at one lake location near the PNGS Units 5-8 discharge, both of which do not represent Lake Trout habitat. Therefore, it was concluded that temperatures in the thermal plume are unlikely to have adverse effects on fish embryo-larval development.

OPG continuously measures the temperatures within the discharge channels, providing data to assess the degree and frequency with which embryo-larval MWAT criteria are exceeded. In the 2022 PN ERA, the rolling 7-day average temperatures from the PNGS Units 5-8 discharge channels were calculated from the instantaneous daily maximum effluent temperatures between 2016-2020 (OPG, 2017, 2018a, 2019, 2020, 2021b), and those exceeding MWAT criteria for the April-May embryo larval period for Smallmouth Bass (24.3°C) and Emerald Shiner (27°C) were counted. Over this 5 year period, there were no occurrences where the 7-day average exceeded MWAT criteria for Emerald Shiner, and only one occurrence for Smallmouth Bass. The results remained fairly consistent after incorporation of thermal data from 2021-2024 (OPG, 2022, 2023b, 2024b, 2025c) during which there were no exceedances of MWAT criteria for Emerald Shiner, and 3 exceedances for Smallmouth Bass. Additionally, the duration and degree of these exceedances remained consistent with previous years, with no exceedance persisting for more than 2 consecutive days in late May or exceeding 25.2°C. Thus, as concluded by the 2022 PN ERA, these exceedances are likely not detrimental to reproductive performance or embryo/larval development of these species because they occur infrequently, late in the embryo-larval life stages, and are localized to the discharge channel which spans a small area (0.0062 km^2).

In 2013, the potential effects of the PNGS thermal plume on fish spawning and embryo-larval development were qualitatively evaluated by comparing lake temperatures near the PNGS Units 5-8 discharge against the thermal criteria for these physiological processes of 15 species found

in the vicinity of PN (Cooper, 2013). Lake temperatures in reference areas (Thickson Point and Bonnie Brae Point, 20 km east and 26 km east of Pickering Nuclear, respectively) were also compared against these thermal criteria to provide context for natural temperature conditions. Besides MWAT criteria, this study also used Short-Term Daily Maximum (STDM) criteria, which represents upper bound temperatures considered suitable for short periods such as 24 hours. Hazard quotients (HQs) were calculated by taking the measured MWAT or STDM at each location, for the period relevant to each species, and dividing by the MWAT or STDM criterion. HQs are a useful "screening" methodology for thermal effects assessments, where a HQ equal to or greater than 1 indicates the potential for thermal effects.

Of the 15 species evaluated, nine were considered as Valued Ecosystem Components in the 2022 PN ERA. The HQ values relevant to spawning and embryo-larval development for the highest temperature location in the plume area were at least marginally above 1 for five of these species, indicating potential adverse effects from the thermal plume. However, in cases where the HQs were above 1 in the plume area, they were not substantially elevated relative to the reference area. The presence of HQ values above 1 in the reference area may not reflect potential effects in these areas, but rather suggest that some of the thermal criteria used were lower than background levels observed in the lake (possibly due to a general warming trend in the lake since the development of these criteria). Overall, these results indicated that there is no evidence of adverse chronic or acute impacts on fish reproduction and development caused by the thermal plume.

Thermal Increments and Embryo-larval Survival of Round Whitefish

The effects of the thermal plume on embryo survival of Round Whitefish was quantitatively evaluated in 2018 (OPG, 2018b). Round Whitefish were chosen for the study as these fish spawn nearshore on coarse substrate in late fall, with eggs hatching in early spring. The embryos of this species are also particularly sensitive to elevated water temperatures during the winter months, making them susceptible to elevated plume temperatures. Using temperature data from Round Whitefish spawning beds over the 2009-2010, 2010-2011 and 2011-2012 embryo-larval incubation periods (OPG, 2010, 2012, 2013), a thermal survival model was generated to estimate survival losses in Block 1 (i.e., the early incubation period) and Block 3 (i.e., the late incubation period). The estimated survival loss at the plume stations compared to the reference stations (Thickson Point and Bonnie Brae) was below the CNSC threshold no-effect level of 10% for Round Whitefish embryo survival loss in all years. Following this, data from two years of additional monitoring over the winters of 2018-2019 and 2019-2020 was also incorporated into the model (OPG, 2021c). Across both years, the largest relative survival loss observed was well below the 10% survival loss threshold. Therefore, no chronic adverse effects are expected from the thermal plume on Round Whitefish egg survival.

As mentioned by OPG (OPG, 2018b), acute threshold temperatures for Round Whitefish embryos are not available. Although not designed to develop an acute threshold, a study that continuously exposed Round Whitefish embryos to 7°C found no increases in acute mortality in either Block 1 or Block 3 (Griffiths, 1980). However, continuous exposure at 10°C did result in increased mortality in both developmental stages. The study also tested the impacts of

temperature cycles, where the embryos were exposed to 7°C for 18 hours and 10°C for 6 hours each day, which resulted in increased mortality in Block 1 (50% survival after 17 days) and Block 3 (16% survival after 30 days). Though there are limitations to interpreting these findings as the experimental thermal regimes do not necessarily reflect the behavior of the plume, it can be postulated that 50% mortality could occur between 7°C and 10°C provided that the exposure time is of sufficient duration. Accordingly, OPG has chosen a conservative value of 6°C for winter ambient temperatures above which temperature effects could occur. However, both the extent and duration of the exceedance need to be determined. Though short-term exceedances of this temperature were found to occur between December 2018 and March 2019, they were not expected to have any effects on the Round Whitefish development as they were transient and occasional (OPG, 2020b).

Thermal Plume Effects on Juvenile and Adult Fish

As a part of the Aquatic Environment TSD for the EA for the refurbishment and continued operation of the PNGS Units 5-8 (Golder, 2007), the potential effects of the thermal plume on juvenile and adult stages of the 4 species evaluated were also assessed. The modelled water MWATs did not exceed associated criteria for growth of juveniles and adults of Round Whitefish and Lake Trout at the time that they are present in the nearshore area (mid-November to early December for Round Whitefish and mid-November to April for Lake Trout). In contrast, the modelled water MWATs marginally exceeded (by less than 1°C) the criteria for Smallmouth Bass occasionally at one lake location near the PNGS Units 5-8 discharge over the period that these fish would potentially be exposed to the thermal plume. Given that these exceedances occurred only in the surface water and not in the deeper waters where the fish primarily reside, it is unlikely that they would be exposed to temperatures that would negatively impact growth.

As highlighted earlier, OPG continuously measures the temperatures in the discharge channels. The rolling 7-day average temperatures near the PNGS Units 5-8 discharge from 2016-2020 (OPG, 2017, 2018a, 2019, 2020, 2021b) were compared to the MWAT criteria for Smallmouth Bass and Emerald Shiner. There were 18 occurrences between 2016 and 2020 when the 7-day average exceeded the 30°C MWAT criterion for Emerald Shiner, with an average duration of 16 days. Similarly, there were 15 occurrences when the 7-day average exceeded the 32°C MWAT criterion for Smallmouth Bass, with an average event duration of 10 days. Between 2021 and 2024 (OPG, 2022, 2023b, 2024b, 2025c), the number of occurrences exceeding the MWAT criteria for both species remained generally consistent, while the average duration of these exceedances increased slightly. Specifically, there were 12 exceedances of the Emerald Shiner MWAT criterion, with an average duration of approximately 25 days. For Smallmouth Bass, there were 15 exceedances of the MWAT criterion, with the average event lasting around 14 days. However, these exceedances are not considered detrimental channel. Additionally, unlike the for growth of Smallmouth Bass or Emerald Shiner because they are occasional and localized to the discharge embryonic and larval stages, juvenile and adult fish can use behavioural thermoregulatory strategies such as moving in and out of the discharge channel to optimize exposure to these temperatures.

As a part of the quantitative evaluation of the potential effects of the PNGS thermal plume on the 15 species found in the vicinity of PN, the effects on juvenile and adult growth were also assessed (Cooper, 2013). As with the developmental stages, HQs were calculated by taking the measured water MWAT or STDM, for the seasonal period relevant to each species, and dividing by the MWAT or STDM criterion. Of the nine species considered as Valued Ecosystem Components in the 2022 PN ERA, the highest HQs were only marginally above 1 in the plume for Lake Trout. However, these values were less than or equal to the reference values. Therefore, it is unlikely that there are any chronic or acute effects arising from the thermal plume on juvenile or adult stages of any fish species.

Thermal Plume Contribution to Winter Cold Shock

Cold shock in fish can occur either due to natural changes in water temperature, or can be induced by a reduction in temperature when the number of operating units declines, or when fish pass through the thermal plume and encounter a high thermal gradient between plume and ambient conditions. For example, during an outage, thermal additions to receiving water can be rapidly curtailed, such that water temperature in the plume decline more rapidly than fish are able to acclimate to lower temperatures (Coutant, 1977). Unless induced by natural events, cold shock is likely to occur only during a full station outage, which occurs infrequently. Unfortunately, the science is not well established for predicting cold shock events during the winter months using a predictive tool. However, OPG takes into consideration the effects of cold shock in the planning and scheduling of the shutdown of PNGS units and will incorporate appropriate mitigative measures if needed such that the rate of lowering water temperature is unlikely to result in any significant effects to fish. OPG is currently evaluating the potential for natural and operationally induced cold shock at PN and are in discussion with DFO on this topic, and as a precautionary measure, OPG will incorporate a staggered and sequential shutdown of Pickering Units 5-8 during refurbishment to allow for fish acclimation, and to reduce the risk of a cold shock event.

Thermal Stratification in Lake Ontario

During the 2024 and 2025 Fish Community, Benthic Macroinvertebrate Community, Macrozooplankton Community, and Larval Fish and Eggs studies, Temperature measurements were taken at 1 m increments throughout the water column to characterize thermal stratification in the Deepwater Study Area. Thermal profiles generated from data collected during these sampling programs in 2024 and 2025 are shown in **Figure A-13** and **Figure A-14**, respectively.

Temperature profiles at PNGS in 2024 and 2025 highlight clear interannual differences in water temperature regimes. In spring 2024, stratification began to form by mid-May, with a shallow epilimnion and variable mixing, though the thermocline and hypolimnion were only weakly defined. By contrast, spring 2025 remained largely uniform, with minimal temperature variation throughout the upper water column, reflecting the colder conditions and an earlier sampling start in mid-April. The earlier sampling likely captured the lake before stratification typically develops, whereas the warmer mid-May 2024 sampling coincided with the onset of epilimnion formation.

During the summer, 2024 exhibited strong stratification with clearly defined epilimnion, metalimnion, and hypolimnion layers, although a high wind event on July 25 partially disrupted this layering and increased vertical mixing. In 2025, early July showed weaker and more inconsistent stratification, with variable temperatures throughout the water column. By late July (July 25), however, stratification became well established, with a distinct thermocline separating the epilimnion from the metalimnion and gradual cooling into the hypolimnion. These observations indicate that summer stratification in 2025 was delayed relative to 2024 but stabilized once formed.

In fall 2024, stratification persisted into November, with a shallow thermocline and stable metalimnion temperatures. In contrast, fall 2025 was characterized by a largely uniform water column. A shallow epilimnion was observed in September, but below 3 m, mixing was minimal, and by November temperatures had become largely consistent throughout the water column. Minor surface warming likely influenced by PNGS thermal discharges was observed in some profiles.

Overall, 2024 exhibited earlier onset and more persistent stratification, whereas 2025 was characterized by delayed, weaker, and less consistent thermal layering, highlighting interannual variability in lake thermal dynamics driven by seasonal temperatures, meteorological events, and sampling timing.

Across all three seasons in both studies, the temperature at depths of 10.0-12 m (the proposed range for the planned DWI, with the exact depth to be determined) is 3-5°C lower than surface temperatures. The implications of the change in the temperature of water being drawn in through the intake on the thermal plume, and potential effects on aquatic biota are further evaluated in **Section 5.3.3**.

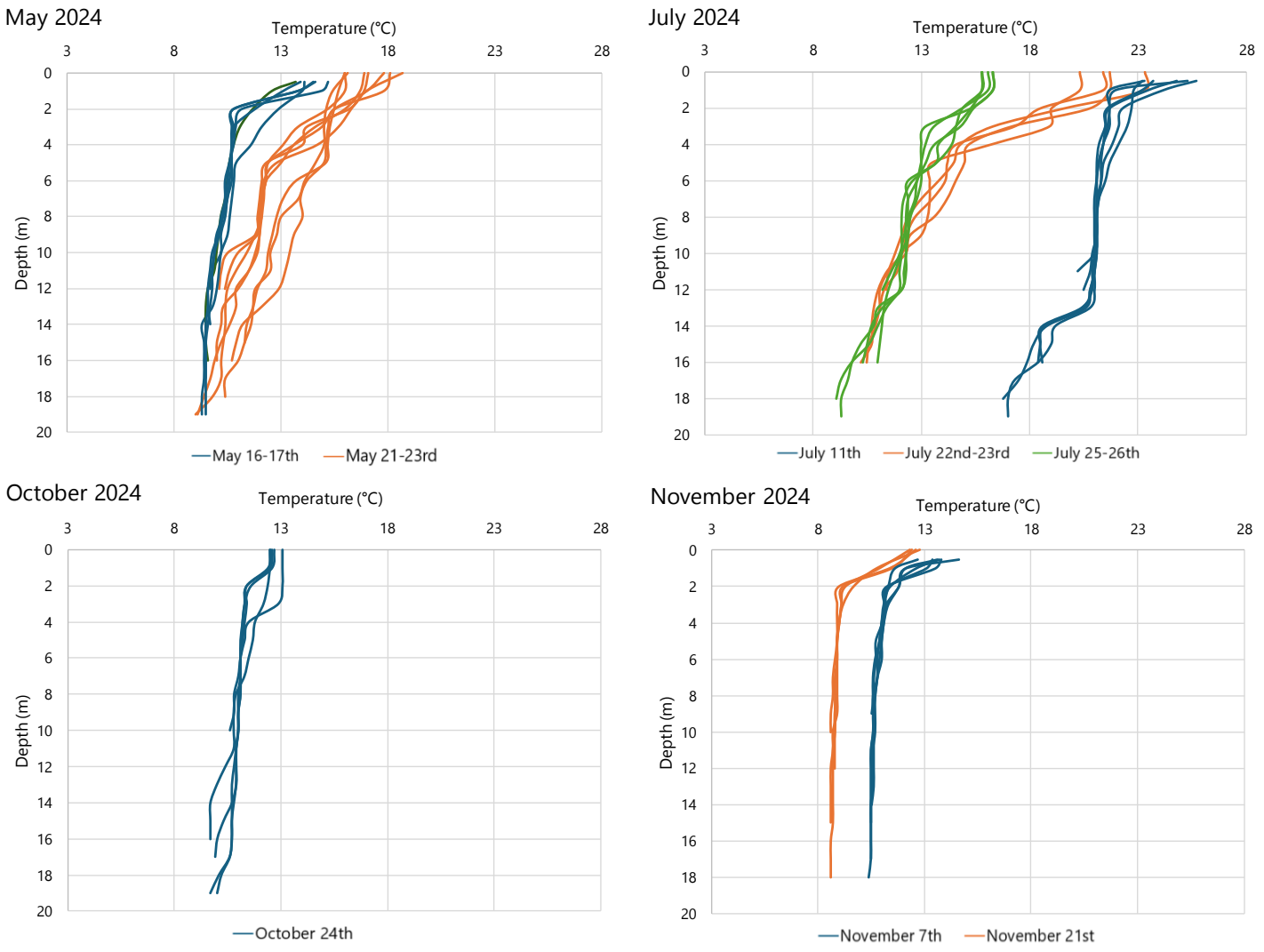


Figure A-13: Temperature Profiles Conducted Throughout the 2024 PNGS Biological Investigations

Note: Blue, orange, and green colours are indicative of separate sampling events in chronological order.

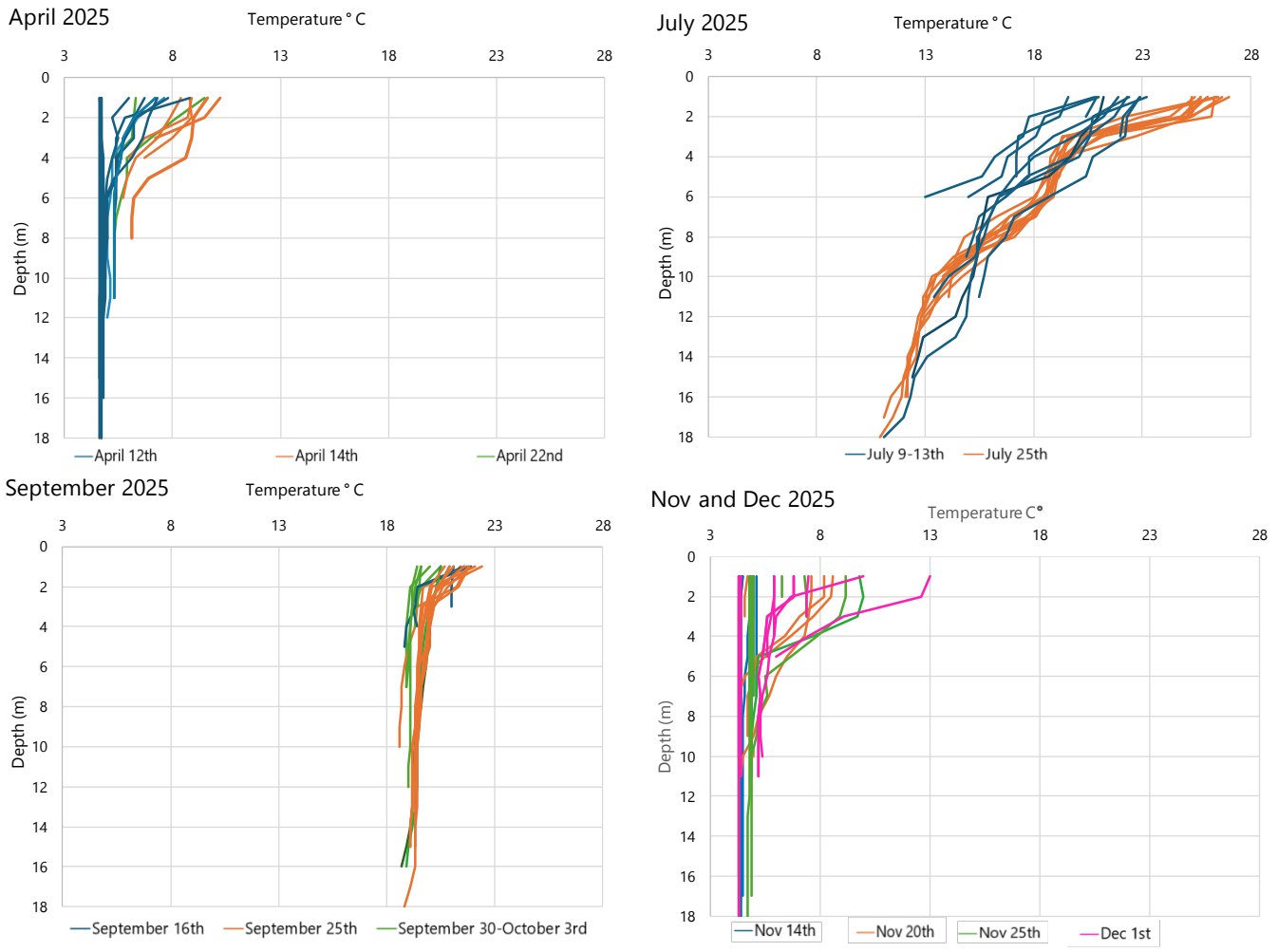


Figure A-14: Temperature Profiles Conducted Throughout the 2025 PNGS Biological Investigations

Note: Blue, orange, and green colours are indicative of separate sampling events in chronological order.

A.3.2 Benthic Macroinvertebrates

A.3.2.1 Deepwater Study Area

In 2024, standard ponar grabs were used to collect a benthic invertebrate sample from each of the following stations within the Deepwater Study Area: S4, S7, S8, and S9. Calculated benthic macroinvertebrate metrics for these samples are presented in **Figure A-15** and **Figure A-16**. Density ranged from 2,462 (S9) to 7,552 (S8) organisms/m^2. Communities in S9, S8, and S7 were dominated by copepods such as O. Harpacticoida, followed by worms from Phylum Nemata for S9, and Oligochaetes for S8 and S7. S4 was dominated by Oligochaetes, closely followed by O. Harpacticoida.

All Cl. Bivalvia organisms were *Dreissena bugensis*, otherwise knowns as the Quagga mussel. This invasive dreissenid mussel species was observed in three of the four samples, but only made up 4.8% to 12.8% of the overall community composition in the samples it was observed. Mussels tend to prefer attachment to hard substrates as opposed to the soft sediments that were targeted by ponar in the Deepwater Study Area.

In 2025, a benthic sled was used to collect benthic macroinvertebrate samples from grids S1, S2, S5, S6, S7, S8, S11, and S12 throughout the Deepwater Study Area to provide additional characterization of benthic conditions. Community composition for these samples is presented in **Figure A-16**. Benthic macroinvertebrate densities were variable across the study area, ranging from 4.18 organisms/m^2 in grid S7 to 58.11 organisms/m^2 in grid S6.

Across all sampled grids, benthic communities were consistently dominated by dreissenid bivalves, which accounted for an average of approximately 40% of the benthic invertebrate community. Hydrobiid snails were also abundant at several locations, particularly in grids S1, S2, S5, S6, and S7, while gammarid amphipods were most prominent in grids S8 and S12. In grid S11, the community was characterized by a high proportion of hydrobiid snails and limnesiid mites. Species richness and diversity varied across the Deepwater Study Area, with higher richness and diversity generally observed in grids with more heterogeneous substrate conditions. Lower evenness values observed across most grids reflect the strong dominance of dreissenid bivalves within the benthic community. Quagga Mussel biomass varied across sampling locations, ranging from 0.28 kg in grid S7 to 3.80 kg in grid S6. The elevated biomass observed at select locations reflects localized areas of high mussel colonization associated with suitable hard substrate.

Station	DW-01 (grid S9)	DW-02 (grid S8)	DW-03 (grid S7)	DW-04 (grid S4)	Average
Density (organisms/m^2)	2,462.14	7,552.28	2,921.41	3,623.05	4,139.72
Richness	21	13	18	14	16.5
Simpson's Diversity	0.59	0.76	0.73	0.84	0.73
Simpson's Evenness	0.12	0.33	0.21	0.45	0.27
P. Nemata	13.99%	8.78%	13.97%	4.23%	10.24%
Cl. Oligochaeta	3.63%	16.22%	17.90%	46.48%	21.06%
O. Harpacticoida	61.92%	42.57%	47.16%	28.17%	44.95%
Cl. Ostracoda	3.89%	9.46%	0.44%	8.45%	5.56%
O. Diptera	7.77%	6.08%	14.85%	11.97%	10.17%
Cl. Bivalvia	5.96%	12.84%	4.80%	0.00%	5.90%
Other	2.85%	4.05%	0.87%	0.70%	2.12%

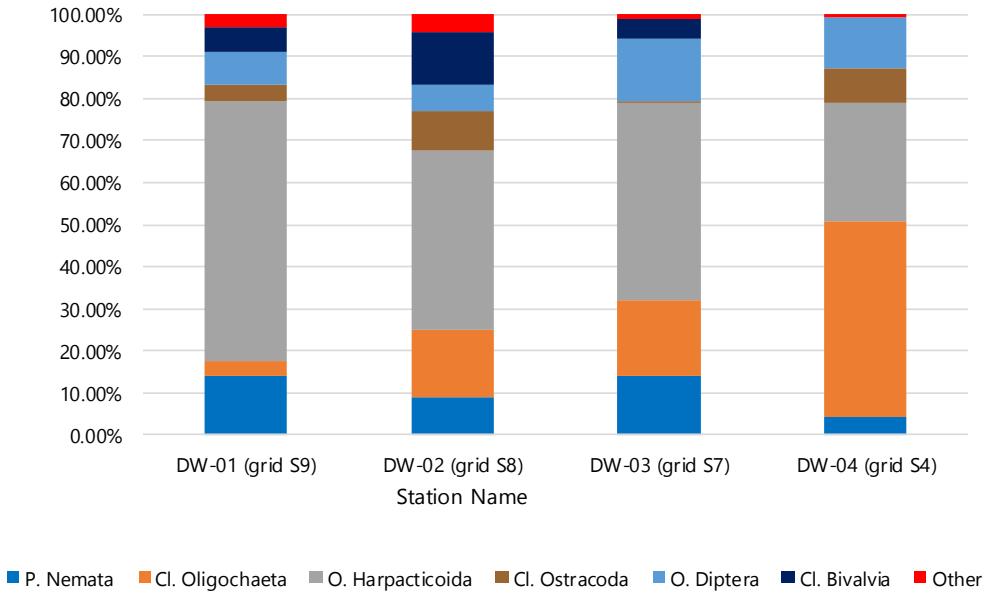


Figure A-15: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Standard Ponar Grab Samples Conducted Throughout the Deepwater Study Area, November 2024

Note:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.
Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.
Sampling locations are presented in **Figure 4-8**.

Matrix Grid	S1	S2	S5	S6	S7	S8	S11	S12	Average
Density (organisms/m^2)	46.65	30.32	11.16	58.11	4.18	10.66	10.96	50.55	27.82
Richness	15	14	16	10	16	18	18	19	15.8
Simpson's Diversity	0.83	0.66	0.70	0.52	0.81	0.71	0.86	0.86	0.74
Simpson's Evenness	0.39	0.21	0.21	0.21	0.34	0.19	0.39	0.38	0.29
Cl. Oligochaeta	17.40%	2.75%	2.37%	1.34%	7.39%	6.37%	9.11%	12.48%	7.40%
Cl. Arachnida	21.30%	11.02%	13.76%	4.03%	24.43%	9.38%	35.99%	19.61%	17.44%
Cl. Ostracoda	2.34%	3.27%	0.43%	0.67%	3.98%	1.06%	1.37%	2.50%	1.95%
O. Amphipoda	10.91%	5.68%	7.96%	5.37%	8.52%	25.84%	9.34%	24.96%	12.32%
Cl. Gastropoda	14.29%	24.96%	32.04%	23.15%	19.89%	7.43%	18.22%	14.80%	19.35%
Cl. Bivalvia	32.47%	51.98%	42.80%	65.44%	32.95%	47.08%	21.87%	23.71%	39.79%
Other	1.30%	0.34%	0.65%	0.00%	2.84%	2.83%	4.10%	1.96%	1.75%

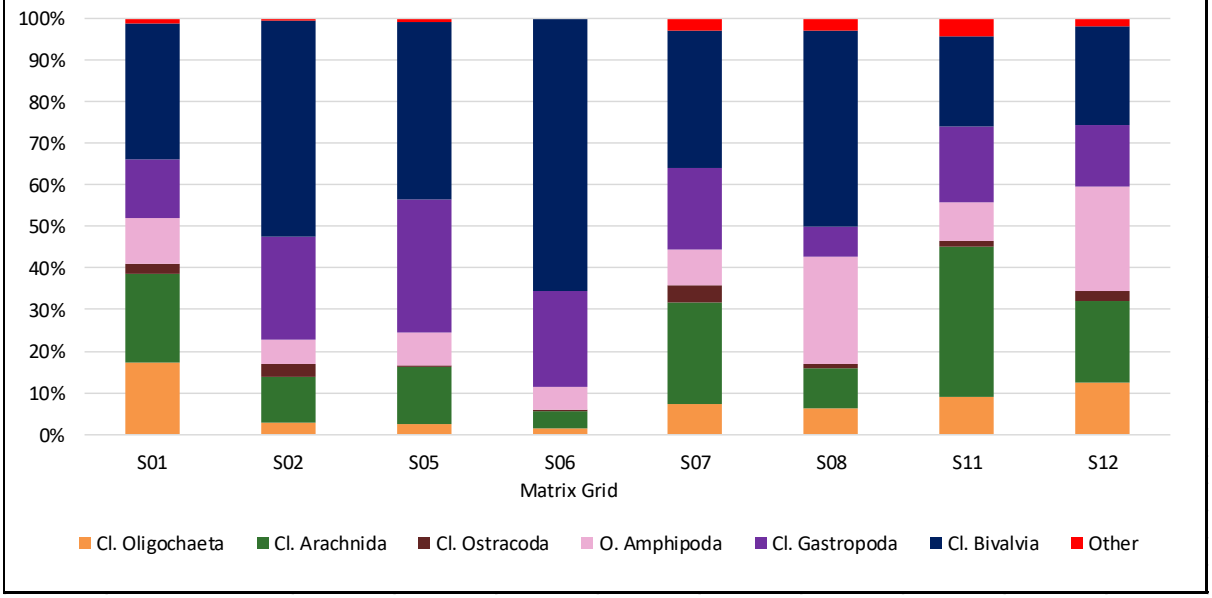


Figure A-16: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Benthic Tows Conducted Throughout the Deepwater Study Area, September 2025

Note:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.
Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.
Sampling locations are presented in **Figure 4-8**.

A.3.2.2 Mid-depth Study Area

Benthic macroinvertebrate samples were collected from stations MD-01, MD-02, MD-03, MD-04, and MD-05 in the Mid-Depth Study Area using a petite ponar in Fall 2025 Community composition for these samples is presented in **Figure A-17**.

In the Mid-Depth Study Area, benthic macroinvertebrate densities ranged from 143.52 organisms/ m^2 at station MD-04 to 3,918.06 organisms/m^2 at station MD-02. Species richness was similarly variable, with the lowest richness observed at MD-04 and the highest at MD-02. Overall community composition in the Mid-Depth Study Area was dominated by oligochaete worms, particularly *Potamothrix moldaviensis*. Oligochaetes were the dominant taxon at stations MD-01, MD-02, MD-04, and MD-05, accounting for an average of approximately two-thirds of the benthic community at these locations. In contrast, no oligochaetes were observed at station MD-03, where the benthic community was instead dominated by dipteran midges, which comprised over 80% of the assemblage.

Arachnid mites were present at most stations and formed a notable component of the benthic community at MD-01, MD-02, MD-03, and MD-05, but were absent from MD-04. Caddisflies, which are often considered indicators of water quality, were observed only at station MD-02 and occurred at low abundance. Dreissenid bivalves were also restricted to station MD-02, where they accounted for approximately 12.5% of the benthic macroinvertebrate community.

Station	MD-01	MD-02	MD-03	MD-04	MD-05	Average
Density (organisms/m^2)	545.37	3,918.06	229.63	143.52	688.89	1,105.09
Richness	7	15	6	4	5	7.4
Simpson's Diversity	0.57	0.71	0.64	0.64	0.36	0.58
Simpson's Evenness	0.33	0.23	0.46	0.69	0.31	0.41
Cl. Oligochaeta	65.79%	67.03%	0.00%	60.00%	83.33%	55.23%
O. Amphipoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O. Diptera	13.16%	5.13%	81.25%	40.00%	12.50%	30.41%
Cl. Gastropoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cl. Bivalvia	0.00%	0.00%	12.50%	0.00%	0.00%	2.50%
O. Trichoptera	0.00%	1.10%	0.00%	0.00%	0.00%	0.22%
Cl. Arachnida	15.79%	25.64%	6.25%	0.00%	4.17%	10.37%
Cl. Ostracoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other	5.26%	1.10%	0.00%	0.00%	0.00%	1.27%

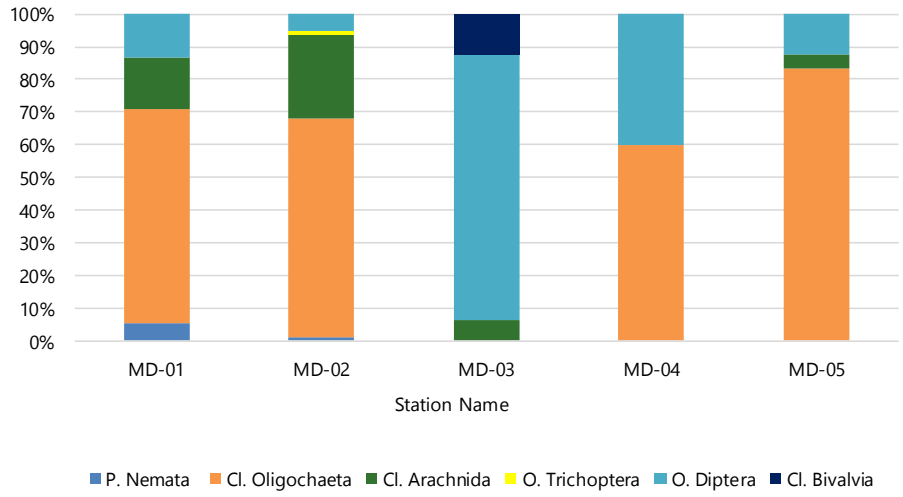


Figure A-17: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grab Samples Conducted Throughout the Mid-Depth Study Area, November 2025

Note:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.

Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL. Sampling locations are presented in **Figure 4-8**.

A.3.2.3 Cutoff Wall Study Area

Samples were collected from stations COW-01, COW-02, and COW-03 in the Cutoff Wall Study Area. The Cutoff Wall benthic macroinvertebrate community data is summarized in **Figure A-18** and discussed below.

Three (3) petite ponar grab samples were collected for the characterization of the Cutoff Wall benthic macroinvertebrate community (COW-01, COW-02, COW-03;). Benthic macroinvertebrate densities in the Cutoff Wall study area ranged from 14.35 organisms/m^2 at COW-03 to 7,922.24 organisms/m^2 at COW-01. LPL richness ranged from 1 species at COW-B3 to 9 species at COW-B1. Diversity and Evenness values for COW-03 were not reported, as only one species was observed at this station. Evenness was low across the samples as the communities across all three samples were comprised predominantly of Oligochaete worms.

Station	COW-01	COW-02	COW-03	Average
Density (organisms/m^2)	7,922.24	5,611.59	14.35	4516.06
Richness	11	5	1	5.7
Simpson's Diversity	0.58	0.42	N/A	0.50
Simpson's Evenness	0.27	0.35	N/A	0.31
Cl. Oligochaeta	84.47%	96.16%	100.00%	93.55%
O. Diptera	10.25%	2.30%	0	4.18%
Cl. Arachnida	5.28%	1.53%	0	2.27%

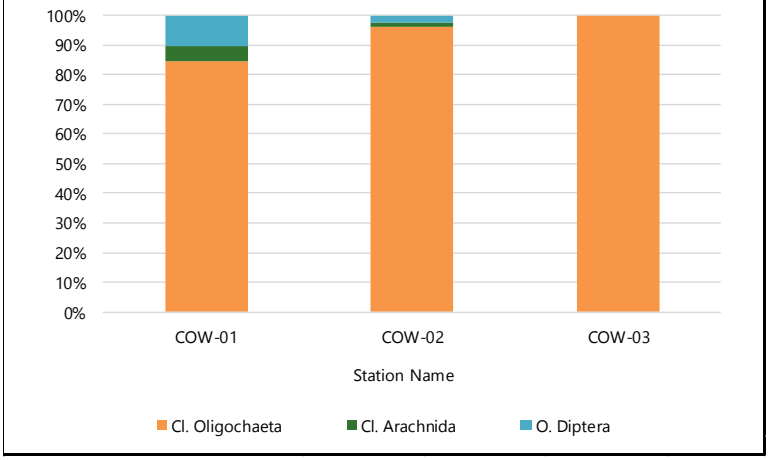


Figure A-18: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grab Samples Conducted Throughout the Cutoff Wall Study Area, September and November 2025

Notes:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).

Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.

Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.

Sampling locations are presented in **Figure 4-8**.

Infill and Shoreline Erosion Mitigation Study Areas

Benthic macroinvertebrate samples were collected using a petite ponar in the Infill and Shoreline Erosion Mitigation Study Areas in 2024. Samples were collected from stations Infill-01, Infill-02, Infill-03, Infill-04, and Infill-05 in the Infill Study Area. The benthic macroinvertebrate community data from this area is summarized in **Figure A-19** and discussed below.

Benthic macroinvertebrate densities in the Infill Study Area ranged from 38.27 organisms/m^2 at Infill-05, to 1,990 organisms/m^2 at Infill-01. LPL richness ranged from two (2) species at Infill-05, to 12 species at Infill-03. Simpson's Diversity at Infill stations were generally in the range of 0.37-0.49, except for Infill-03 which had a diversity of 0.76. Simpson's Evenness was generally low, with all stations other than Infill-05 having evenness values of equal to or less than 0.35.

Infill-01, Infill-02 and Infill-04 had very high proportions of Oligochaetes, whereas Infill-03 had lower proportions of Oligochaetes (~30%) and a high proportion of Quagga Mussel (>45%), and at Infill-05 high there were high proportions of Arachnids and Ostracods and no Oligochaetes observed.

Samples were collected from stations Infill-06, Infill-07, Infill-08, Infill-09, and Infill-10 in the Shoreline Erosion Mitigation Study Area. The benthic macroinvertebrate community data from this area is summarized in **Figure A-20** and discussed below.

Benthic macroinvertebrate densities in the Shoreline Erosion Mitigation Study Area ranged from 19.14 organisms/m^2 at Infill-08, to 248.77 organisms/m^2 at Infill-07. LPL richness was highest at Infill-09 and lowest at Infill-08. Simpson's Diversity was generally high throughout the Shoreline Erosion Mitigation Study Area, with the lowest diversity value observed at Infill-08 (0.67). Evenness was high at stations Infill-06 and Infill-08 due to the low amount of equally represented species at these locations.

The taxa that contributed the highest proportion of total density was Diptera at Infill-06 and Infill-07, and Bivalves at Infill-10. At Infill-08 there was equal representation of Bivalves, Diptera, and Arachnids, and at Infill-09 there was generally an equal distribution of Dipteran and Oligochaete taxa groups.

Station	Infill-01	Infill-02	Infill-03	Infill-04	Infill-05	Average
Density (organisms/m^2)	1,990.13	1,129.01	1,301.24	491.15	38.27	989.96
Richness	10	7	12	9	2	8.0
Simpson's Diversity	0.41	0.45	0.76	0.37	0.49	0.50
Simpson's Evenness	0.17	0.26	0.35	0.18	0.97	0.39
P. Nemata	1.92%	0.56%	3.92%	3.90%	0.00%	2.06%
Cl. Oligochaeta	92.95%	96.61%	31.37%	84.42%	0.00%	61.07%
Cl. Arachnida	0.00%	0.56%	0.00%	0.00%	58.33%	11.78%
Cl. Ostracoda	0.00%	0.00%	7.84%	2.60%	41.67%	10.42%
O. Amphipoda	0.00%	0.00%	0.00%	1.30%	0.00%	0.26%
Cl. Entognatha	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O. Diptera	3.21%	1.69%	9.80%	6.49%	0.00%	4.24%
Cl. Bivalvia	1.92%	0.56%	47.06%	1.30%	0.00%	10.17%

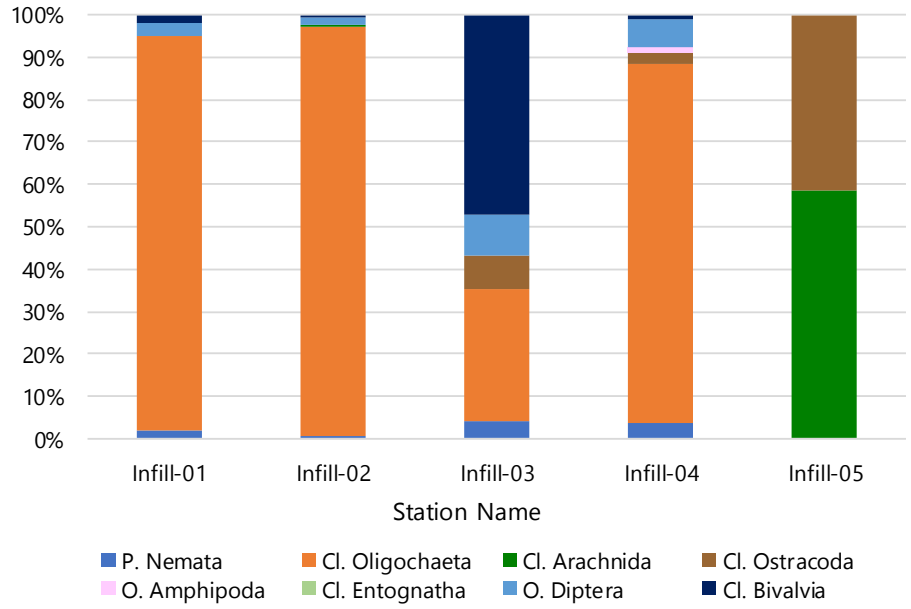


Figure A-19: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grabs Conducted Throughout the Infill Study Area, September 2024

Notes:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.
Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL.

Sampling locations are presented in **Figure 4-8**.

Station	Infill-06	Infill-07	Infill-08	Infill-09	Infill-10	Average
Density (organisms/m^2)	153.09	248.77	19.14	548.56	178.60	229.63
Richness	6.00	10.00	3.00	20.00	7.00	9.2
Simpson's Diversity	0.80	0.81	0.67	0.91	0.75	0.79
Simpson's Evenness	0.84	0.53	1.00	0.55	0.57	0.70
P. Nemata	0.00%	5.13%	0.00%	13.95%	3.57%	4.53%
Cl. Oligochaeta	12.50%	23.08%	0.00%	38.37%	3.57%	15.50%
Cl. Arachnida	8.33%	2.56%	33.33%	2.33%	35.71%	16.45%
Cl. Ostracoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
O. Amphipoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cl. Entognatha	0.00%	2.56%	0.00%	0.00%	0.00%	0.51%
O. Diptera	50.00%	53.85%	33.33%	38.37%	7.14%	36.54%
Cl. Bivalvia	29.17%	12.82%	33.33%	6.98%	50.00%	26.46%

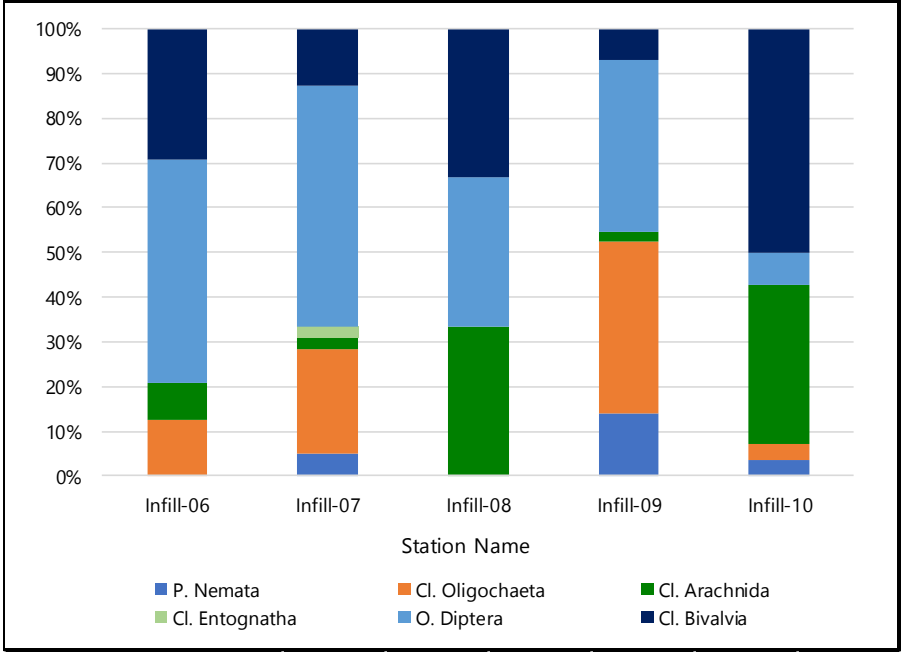


Figure A-20: Benthic Macroinvertebrate Community Composition, Density, LPL Richness, Simpson's Diversity, and Simpson's Evenness in Petite Ponar Grabs Conducted Throughout the Shoreline Erosion Mitigation Study Area, September 2024

Notes:
P. = Phylum, Cl. = Class, O. = Order
LPL = Lowest Practical Level
Total invertebrate density was determined as the total number of individuals of all taxonomic categories collected at a station expressed per unit area (numbers/m^2).
Simpson's Diversity is a measure of the diversity of a biological community. It considers both species richness (the number of different species present) and species evenness (the relative abundance of each species). Calculated at the LPL.

Simpson's Evenness is an expression of how equitably taxa are represented within a given sample. Evenness ranges from zero to one (one representing a sample in which all taxa have the same abundance. Calculated at the LPL. Sampling locations are presented in **Figure 4-8**.

Table A-23: Raw Benthic Macroinvertebrate Community Data (Total Number of Organisms per m^2) at the Lowest Practical Level, Fall 2024

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Study Area				Infill Study Area					Shoreline Erosion Mitigation Study Area				
							DW-01	DW-02	DW-03	DW-04	Infill-01	Infill-02	Infill-03	Infill-04	Infill-05	Infill-06	Infill-07	Infill-08	Infill-09	Infill-10
ROUNDWORMS																				
P. Nemata	-	-	-	-	-	-	344	663	408	153	38	6	51	19	0	0	13	0	77	6
ANNELIDS																				
WORMS																				
P. Annelida	Cl. Oligochaeta	-	-	F. Enchytraeidae	-	-	0	0	13	0	13	0	0	0	0	0	6	0	26	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Dero*	0	0	0	0	0	0	26	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais bretscheri*	0	0	0	0	0	0	0	0	0	0	0	0	70	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais pardalis*	0	0	0	0	0	0	0	0	0	0	26	0	13	0
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais variabilis*	0	0	0	0	0	0	0	6	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Limnodrilus hoffmeisteri*	0	0	0	0	0	0	77	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Limnodrilus udekemianus*	19	0	57	0	0	0	26	0	0	0	0	0	6	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Psammoryctides barbatus*	0	1021	0	657	0	0	0	0	0	0	0	0	6	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Potamothrix moldaviensis*	6	0	0	147	332	319	51	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures with hair chaetae	38	51	364	293	13	0	0	0	0	0	0	0	0	0
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures without hair chaetae	19	51	57	587	1493	772	230	389	0	19	26	0	64	0
P. Annelida	-	-	-	F. Naididae	S.F. Rhyacodrilinae	*Bothrioneurum vejdovskyanum*	0	102	32	0	0	0	0	19	0	0	0	0	26	0
P. Annelida	-	-	-	F. Lumbriculidae	-	*Stylodrilus heringianus*	6	0	0	0	0	0	0	0	0	0	0	0	0	6
ARTHROPODS																				
MITES																				
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	-	-	-	-	0	0	0	0	0	0	0	0	6	0	0	0	0	6
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Hygrobatidae	-	*Hygrobates*	0	0	0	0	0	0	0	0	0	0	0	0	0	13
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Lebertiidae	-	*Lebertia*	0	0	0	0	0	6	0	0	0	0	6	0	0	0
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	F. Limnesiidae	-	*Limnesia*	57	255	13	26	0	0	0	0	19	13	0	6	13	45
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	F. Pionidae	-	indeterminate	0	51	0	0	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS																				
P. Arthropoda	-	-	O. Harpacticoida	-	-	-	1524	3215	1378	1021	0	0	0	0	0	0	0	0	0	0
SEED SHRIMPS																				
P. Arthropoda	Cl. Ostracoda	-	-	-	-	-	96	714	13	306	0	0	102	13	13	0	0	0	0	0
WATER SCUDS																				
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Gammarus*	0	0	0	0	0	0	0	6	0	0	0	0	0	0
SPRINGTAILS																				
P. Arthropoda	Cl. Entognatha	-	O. Collembola	-	-	-	0	0	13	0	0	0	0	0	0	0	6	0	0	0
INSECTS																				
TRUE FLIES																				
MIDGES																				

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Study Area				Infill Study Area					Shoreline Erosion Mitigation Study Area				
							DW-01	DW-02	DW-03	DW-04	Infill-01	Infill-02	Infill-03	Infill-04	Infill-05	Infill-06	Infill-07	Infill-08	Infill-09	Infill-10
Cl. Insecta	O. Diptera	-	-	F. Chironomidae		chironomid pupae	0	0	0	0	13	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Chironomus*	51	0	255	51	13	13	0	0	0	51	0	0	13	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Cryptochironomus*	0	0	0	0	0	0	0	0	0	0	0	6	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Dicrotendipes*	6	0	13	0	13	0	26	6	0	13	89	0	77	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Micropsectra*	26	153	38	204	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Paratanytarsus*	0	0	0	0	0	0	26	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Polypedilum halterale*	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Polypedilum scalaenum*	0	0	0	26	0	0	0	0	0	0	0	0	6	6
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Rheotanytarsus*	0	0	0	0	0	0	77	0	0	0	0	0	51	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Saetheria*	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Sergentia*	32	51	0	0	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Stictochironomus*	6	0	38	51	13	6	0	26	0	13	0	0	32	6
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Tanytarsus*	6	0	13	0	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Diamesinae	*Potthastia*	0	0	38	26	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus*	0	0	0	0	0	0	0	0	0	0	32	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus/Orthocladius*	6	0	0	0	0	0	0	0	0	0	13	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Heterotrissocladius*	32	255	38	77	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Parakiefferiella*	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	indeterminate	13	0	0	0	0	0	0	0	0	0	0	0	0	0
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Prodiamesinae	*Monodiamesa*	13	0	0	0	13	0	0	0	0	0	0	0	0	0
MOLLUSCS																				
SNAILS																				
P. Mollusca	Cl. Gastropoda	-	-	F. Hydrobiidae	-	*Potamopyrgus antipodarum*	13	0	0	0	-	-	-	-	-	-	-	-	-	-
CLAMS																				
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena bugensis*	147	970	140	0	0	0	51	0	0	13	0	0	19	19
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena* immature	0	0	0	0	38	6	561	6	0	32	32	6	19	70
TOTAL DENSITY (org/m²)							**2462**	**7552**	**2921**	**3623**	**1990**	**1129**	**1301**	**491**	**38**	**153**	**249**	**19**	**549**	**179**
TOTAL NUMBER OF TAXA							**21**	**13**	**18**	**14**	**10**	**7**	**12**	**9**	**2**	**6**	**10**	**3**	**20**	**7**

Note:
Sampling locations are presented in **Figure 4-8**.
"-" indicates that the organism was not identified in the sample, or that there is no Class, Subclass, Order, Family, Subfamily, or Species information.

Table A-24: Deepwater Benthic Tow Raw Benthic Invertebrate Community Data at the Lowest Practical Level, Fall 2025

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Matrix Grid							
							S1	S2	S5	S6	S7	S8	S11	S12
ROUNDWORMS														
P. Nemata	-	-	-	-	-	-	-	0.05	-	-	-	0.11	-	-
FLATWORMS														
P. Platyhelminthes	Cl. Turbellaria		O. Tricladida				-	0.10	0.02	-	-	-	-	0.27
P. Platyhelminthes	Cl. Turbellaria		O. Tricladida	F. Dugesiidae		Girardia	0.24	-	-	-	-	-	0.05	-
UNSEGMENTED WORMS														
P. Nemerta						Prostoma	-	-	-	-	-	-	0.05	-
ANNELIDS														
WORMS														
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Chaetogaster diaphanus*	-	-	-	-	-	0.04	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais bretscheri*	0.95	0.10	-	-	0.02	0.04	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais variabilis*	6.68	0.73	0.22	0.78	0.17	0.57	0.80	5.93
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Nais*	-	-	-	-	0.07	-	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Strylaria lacustris*	0.48	-	-	-	0.05	-	0.20	0.09
P. Annelida	-	-	-	F. Naididae	S.F. Naidinae	*Vejdovskyella intermedia*	-	-	0.02	-	-	-	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures with hair chaetae	-	-	-	-	-	0.04	-	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	immatures without hair chaetae	-	-	-	-	-	-	-	-
P. Annelida	-	-	-	F. Lumbriculidae	-	*Stylodrilus heringianus*	-	-	0.02	-	-	-	-	0.26
ARTHROPODS														
MITES														
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	-	-	-	Immature	8.72	1.77	0.86	1.17	0.21	0.26	2.40	8.25
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Hygrobatidae	-	*Hygrobates*	0.24	1.14	0.12	0.59	0.05	-	0.25	0.18
P. Arthropoda	Cl. Arachnida	Subcl. Acari immature	O. Trombidiformes	F. Lebertiidae	-	*Lebertia*	0.73	0.26	0.17	-	0.14	0.15	0.10	0.27
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	F. Limnesiidae	-	*Limnesia*	0.24	0.16	0.36	0.20	0.62	0.38	1.20	1.08
HARPACTICOIDS														
P. Arthropoda	-	-	O. Harpacticoida	-	-	-	-	-	0.02	0.39	-	0.08	-	0.09
SEED SHRIMPS														
P. Arthropoda	Cl. Ostracoda	-	-	-	-	-	-	-	-	-	0.07	0.04	-	-
WATER SCUDS														
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	-	-	-								
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Crangonyctidae	-	*Crangonyx*	0.12	0.26	0.05	-	0.07	0.04	0.05	0.54
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Echinogammarus ischnus*	2.06	0.62	0.62	2.34	0.21	2.49	0.60	6.54
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Gammarus fasciatus*	0.48	0.10	0.02	0.20	0.05	0.15	0.05	0.54

Phylum	Class	Subclass	Order	Family	Subfamily	Species	Deepwater Matrix Grid							
							S1	S2	S5	S6	S7	S8	S11	S12
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*Gammarus immature*	2.42	0.68	0.19	0.59	0.02	0.04	0.50	4.93
P. Arthropoda	Cl. Ostracoda	-	O. Amphipoda	F. Gammaridae	-	*immature*	-	0.05	-	-	-	0.04	0.10	-
AQUATIC SOW BUGS														
P. Arthropoda		-	O. Isopoda	F. Asellidae	-	*Caecidotae*	1.09	0.99	0.05	0.39	0.10	0.08	0.15	1.25
INSECTS														
TRUE FLIES														
MIDGES														
Cl. Insecta	O. Diptera	-	-	F. Chironomidae		chironomid pupae	0.12	-	-	-	0.02	-	-	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Chironomus*	-	-	-	-	-	-	0.05	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Dicrotendipes*	0.12	-	-	-	-	-	0.15	0.27
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Paratanytarsus*	-	-	-	-	0.07	-	-	0.09
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Polypedilum halterale*	-	-	-	-	-	-	-	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Rheotanytarsus*	-	-	-	-	-	0.04	0.05	0.09
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Chironominae	*Stictochironomus*	-	-	-	-	-	-	-	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus/Orthocladius*	0.12	0.05	-	-	-	0.15	-	0.45
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Hydrobaenus*	-	-	0.05	-	0.02	-	0.05	-
Cl. Insecta	O. Diptera	-	-	F. Chironomidae	S.F. Orthocladiinae	*Hydrosmitta*	-	-	0.02	-	-	-	0.05	0.09
MOLLUSCS														
SNAILS														
P. Mollusca	Cl. Gastropoda	-	-	F. Hydrobiidae	-	*Potamopyrgus antipodarum*	6.66	7.54	3.57	13.46	0.83	0.79	2.00	7.44
CLAMS														
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena bugensis*	12.24	9.93	3.38	26.13	1.09	4.11	1.90	8.78
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena* immature	2.91	5.77	1.39	11.90	0.29	0.91	0.50	3.14
TOTAL DENSITY (org/m^2)							**46.65**	**30.32**	**11.16**	**58.11**	**4.18**	**10.66**	**10.96**	**50.55**
RICHNESS							**15**	**14**	**16**	**10**	**16**	**18**	**18**	**19**
SIMPSON'S DIVERSITY							**0.831**	**0.662**	**0.704**	**0.515**	**0.815**	**0.710**	**0.857**	**0.860**
SIMPSON'S EVENNESSS							**0.395**	**0.211**	**0.211**	**0.206**	**0.337**	**0.192**	**0.389**	**0.376**

Note:

"-" indicates that the organism was not identified in the sample, or that there is no Class, Subclass, Order, Family, Subfamily, or Species information.
Sample ID locations are show in **Figure 4-8.**

Table A-25: Raw Benthic Invertebrate Community Data at the Lowest Practical Level, Fall 2025

Phylum		Subclass	Order	Family	Subfamily	Species	Mid-Depth Stations					Cutoff Wall Stations		
							MD-1	MD-2	MD-3	MD-4	MD-5	COW-01	COW-02	COW-03
ROUNDWORMS														
P. Nemata	-	-	-	-	-	-	2	3	-	-	-	-	-	-
ANNELIDS														
WORMS														
P. Annelida	Cl. Oligochaeta	-	-	-	-	-								-
P. Annelida	S.F. Tubificainae	-	-	-	-	-								-
P. Annelida	S.F. Tubificainae	-	-	F. Naididae	S.F. Naidinae	*Nais variabilis*	-	-	-	-	-	44	-	
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Limnodrilus hoffmeisteri*	1	64	-	-	-		-	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*Potamothrix moldaviensis*	3	-	-	-	-	44	56	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*immatures with hair chaetae*	-	9	-	1	2	261	94	-
P. Annelida	-	-	-	F. Naididae	S.F. Tubificinae	*immatures without hair chaetae*	21	110	-	5	38	739	226	1
ARTHROPODS														
MITES														
P. Arthropoda	Cl. Arachnida	-	-	-	-	-								
P. Arthropoda	Cl. Arachnida	Subcl. Acari	O. Trombidiformes	-	-	*Immature*						8		
P. Arthropoda	Cl. Arachnida	-	O. Trombidiformes	F. Hygrobatidae	-	*Hygrobates*	-	3	-	-	-	4	-	-
P. Arthropoda	Cl. Arachnida	-	O. Trombidiformes	F. Limnesiidae	-	*Limnesia*	6	65	-	-	2	56	6	-
P. Arthropoda	Cl. Arachnida	-	O. Trombidiformes	F. Pionidae	-	*indeterminate*	-	1	-	-	-	-	-	-
P. Arthropoda	Cl. Arachnida	-	O. Amphipoda	F. Gammaridae	-	*Immature*	-	1	1	-	-	-	-	-
INSECTS														
CADDISFLIES														
P. Arthropoda	Cl. Insecta	-	O. Trichoptera	F. Hydroptilidae	-	*pupae*	-	3	-	-	-	-	-	-
TRUE FLIES														
MIDGES														
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Chironomus*	*1*	5	-	1	1	72	8	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Cryptochironomus*	*1*	1	-	-	-	-	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Dicrotendipes*	*3*	3	9	-	-	48	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Rheotanytarsus*	-	1	2	-	-	-	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Chironominae	*Stictochironomus*	-	2	1	3	5	8	1	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Diamesinae	*Potthastia*	-	1	-	-	-	-	-	-

Phylum		Subclass	Order	Family	Subfamily	Species	Mid-Depth Stations					Cutoff Wall Stations		
							MD-1	MD-2	MD-3	MD-4	MD-5	COW-01	COW-02	COW-03
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Orthocladiinae	*Cricotopus*	-	-	1	-	-	-	-	-
P. Arthropoda	Cl. Insecta	-	O. Diptera	F. Chironomidae	S.F. Orthocladiinae	*Hydrosmittia*	-	1	-	-	-	-	-	-
MOLLUSCS														
CLAMS														
P. Mollusca	Cl. Bivalvia	-	-	F. Dreissenidae	-	*Dreissena bugensis*	-	-	2	-	-	-	-	-
TOTAL DENSITY (org/m^2)							**545.37**	**3,918.06**	**229.63**	**143.52**	**688.89**	**7,922.24**	**5,611.59**	**14.35**
TOTAL NUMBER OF TAXA							**38.00**	**273.00**	**16.00**	**10.00**	**48.00**	**9.00**	**391.00**	**1.00**
SIMPSON'S DIVERSITY							**7.00**	**15.00**	**6.00**	**4.00**	**5.00**	**0.58**	**5.00**	**1.00**
SIMPSON'S EVENNESSS							**8.00**	**16.00**	**6.00**	**4.00**	**5.00**	**0.27**	**6.00**	**1.00**

Note:
Sampling locations are presented in **Figure 4-8**.
"-" indicates that the organism was not identified in the sample, or that there is no Class, Subclass, Order, Family, Subfamily, or Species information

A.3.3 Results of 2024 Macrozooplankton Community Study

Proportions of major macrozooplankton groups in samples from the spring, summer, and fall sampling events from 2024 are presented in **Table A-26**. A detailed composition of the macrozooplankton community in each sample is provided in **Table A-30**. Of the major groups identified, Cladocera were the most abundant in the spring and summer samples (>82% of total community composition), which is consistent with the findings from previous studies of zooplankton communities in the area (EC, 1998; Barbiero et al., 2001). This was followed by Calanoida, and Cyclopoida. Mysida were the least abundant group in the spring (<1% of total composition) and were not recorded in any of the summer samples. Unlike spring and summer, Calanoida made up the majority of the community in the five out of six samples (56-79% of total community composition) in the fall. The most common cladoceran species in the samples included *Daphnia sp*., *Leptodora sp. Bythotrephes* sp., and *Cercopagis sp*., and the most common calanoidan species included *Skistodiaptomus sp., Leptodiaptomus sicilis* and *Epischura sp.*

A summary of parameters such as density (no. of organisms/L), BPUE, family-level taxa richness, and Simpson's Diversity from the samples collected in the spring, summer, and fall are presented in **Table A-27**, **Table A-28**, and **Table A-29**, respectively. During the summer sampling program, algal mats were present that were inhabited by three species of Cladocera (*Bythotrephes sp., Cercopagis sp., and Leptodora sp.*), which significantly influenced the abundance and biomass of the samples collected. As such, density, biomass per unit effort, and Simpson's Diversity are presented both with and without organisms found in algae in **Table A-28**. To determine if and how the macrozooplankton community varied through time (i.e., season) or by depth within the study area, metrics of richness (lowest-practical-level, or LPL, and family-level), diversity (family-level), and abundance (Density in #/L and Biomass in mg/L) were compared using GLMs. Results are detailed in **Table A-31**, and presented in **Figure A-21**.

Results indicated that, excluding organisms associated with algae, there was no influence from depth on macrozooplankton community metrics; however, all metrics were significantly influenced by season. Specifically, LPL richness was significantly different across all three sampling seasons, and was highest in the summer and lowest in the fall. For family richness, no difference was observed between spring and summer, and both seasons had significantly greater richness than observed in fall. Although density was significantly influenced by seasonal effects and fall had the highest mean density observed, between season comparisons did not show any differences due to high variability between the replicates. Finally, diversity at the family level was significantly highest in the summer, and no difference was observed between spring and fall. The seasonal differences in diversity and richness indicate fluctuations in communities in the Deepwater Study Area throughout the year, potentially due to seasonal variability in the timing of various zooplankton species peaks as well as the influence of lake currents, which are known to affect macrozooplankton distribution. When consideration of organisms associated with algae was given, similar significant seasonal effects were observed in density, biomass, and diversity; however, diversity was also significantly influenced by depth, whereby the metric increased 0.034 at every 1 m depth interval.

The seasonal differences in diversity and richness indicate fluctuations in communities in the deepwater area throughout the year, potentially due to seasonal variability in the timing of various zooplankton species peaks. In addition, lake currents, which are known to affect macrozooplankton distribution, can have a significant influence on species distributions. When organisms associated with algae were considered, similar significant seasonal effects were observed in density, biomass, and diversity. Additionally, macrozooplankton diversity was also significantly influenced by depth. This increase in diversity at depth was driven by the presence of three additional species, and this effect was only apparent though in the summer when algal mats were observed.

Overall, the macrozooplankton community went through seasonal changes as expected, but did not appear to be influenced by depth when algal mats were not present. This would imply that the placement of the deepwater intake does not need to take depth into consideration with regard to macrozooplankton communities.

Table A-26: Proportions of Major Macrozooplankton Groups in Samples from 2024 Macrozooplankton Community Study

Spring						
Group	**S2**	**S3**	**S4**	**S5**	**S7**	**S9**
Cladocera	87.6	95.5	83	81.6	82.1	93.1
Calanoida	11.2	4.5	14.1	15.8	14.3	4.6
Cyclopoida	1.2	0	2.2	2.5	3.2	2.3
Mysida	0	0	0.7	0	0.4	0
Total	100	100	100	100	100	100
Summer						
Group	**S2**	**S3**	**S6**	**S4**	**S8**	**S9**
Cladocera	98.7	97.8	97.7	96.5	97.5	97.1
Calanoida	1	1.2	2	3.5	2.1	1.9
Cyclopoida	0.3	1	0.3	0	0.3	1
Mysida	0	0	0	0	0	0
Total	100	100	100	100	100	100
Fall						
Group	**S1**	**S3**	**S4**	**S5**	**S8**	**S9**
Cladocera	21.43	77.49	34.76	44.3	34.59	35.94
Calanoida	78.57	22.51	65.24	55.7	65.41	64.06
Cyclopoida	0	0	0	0	0	0
Mysida	0	0	0	0	0	0
Total	100	100	100	100	100	100

Table A-27: Summary Statistics of Calculated Macrozooplankton Metrics, Spring 2024

Station	Station Depth (m)	Richness-LPL	Richness-Family	Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family
S3	12.4	5	5	0.0122	0.00006	0.93
S2	14.5	7	7	0.0264	0.00019	0.81
S5	16.9	10	8	0.0423	0.00029	1.24
S4	17.4	8	8	0.0176	0.00019	1.16
S7	19.3	11	9	0.0328	0.00033	1.34
S9	19.4	7	8	0.1488	0.00095	0.79
Minimum	**12.4**	**5**	**5**	**0.0122**	**0.00006**	**0.79**
Median	**17.2**	**8**	**8**	**0.0296**	**0.00024**	**1.04**
Mean	**16.7**	**8.2**	**7.5**	**0.0467**	**0.00033**	**1.04**
Standard Deviation	**2.8**	**2.1**	**1.4**	**0.0511**	**0.00032**	**0.23**
Q25 (First quartile)	**15.1**	**7.3**	**7.3**	**0.0198**	**0.00019**	**0.84**
Q75 (Third quartile)	**18.8**	**9.5**	**8**	**0.04**	**0.00032**	**1.22**
Maximum	**19.4**	**11**	**9**	**0.1488**	**0.00095**	**1.34**

Table A-28: Summary Statistics of Calculated Macrozooplankton Metrics, Summer 2024

Station	Station Depth (m)	Richness-LPL	Richness-Family	No Algae			With Algae		
				Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family	Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family
S3	11.4	14	10	0.1592	0.00254	1.83	0.3665	0.00462	1.17
S2	12.5	11	9	0.2274	0.00193	1.59	0.4686	0.00362	1.33
S6	16.4	15	10	0.1049	0.00092	1.62	0.1645	0.00128	1.31
S4	16.6	12	9	0.337	0.00236	1.74	0.4941	0.00319	1.71
S8	19	15	11	0.1195	0.00093	1.8	0.2022	0.00161	1.57
S9	20	13	10	0.109	0.00092	1.89	0.1752	0.00144	1.63
Minimum	**11.4**	**11**	**9**	**0.1049**	**0.00092**	**1.59**	**0.1645**	**0.00128**	**1.17**
Median	**16.5**	**13.5**	**10**	**0.1394**	**0.00143**	**1.77**	**0.2844**	**0.0024**	**1.45**
Mean	**16**	**13.3**	**9.8**	**0.1762**	**0.0016**	**1.75**	**0.3119**	**0.00263**	**1.45**
Standard Deviation	**3.4**	**1.6**	**0.8**	**0.0912**	**0.00077**	**0.12**	**0.1505**	**0.00138**	**0.21**
Q25 (First quartile)	**13.5**	**12.3**	**9.3**	**0.1116**	**0.00092**	**1.65**	**0.1819**	**0.00148**	**1.32**
Q75 (Third quartile)	**18.4**	**14.8**	**10**	**0.2104**	**0.00225**	**1.82**	**0.4431**	**0.00351**	**1.61**
Maximum	**20**	**15**	**11**	**0.337**	**0.00254**	**1.89**	**0.4941**	**0.00462**	**1.71**

Table A-29: Summary Statistics of Calculated Macrozooplankton Metrics, Fall 2024

Station	Station Depth (m)	Richness-LPL	Richness-Family	Density (#/L)	Biomass (dw mg/L)	Simpson's Diversity-Family
S3	10.5	3	3	0.5203	0.05148	0.58
S1	10.6	5	4	0.1014	0.00514	0.75
S5	15	5	5	0.3107	0.02408	0.94
S4	16.8	4	4	0.2475	0.01462	0.82
S8	18.7	3	3	0.2285	0.01604	0.83
S9	19.7	4	4	0.1868	0.01101	0.89
Minimum	**10**	**3**	**3**	**0.1014**	**0.00514**	**0.58**
Median	**15.5**	**4**	**4**	**0.238**	**0.01533**	**0.83**
Mean	**14.7**	**4**	**3.8**	**0.2659**	**0.02039**	**0.8**
Standard Deviation	**3.9**	**0.9**	**0.8**	**0.1427**	**0.01645**	**0.13**
Q25 (First quartile)	**11.3**	**3.3**	**3.3**	**0.1972**	**0.01191**	**0.77**
Q75 (Third quartile)	**17.5**	**4.8**	**4**	**0.2949**	**0.02207**	**0.87**
Maximum	**19**	**5**	**5**	**0.5203**	**0.05148**	**0.94**

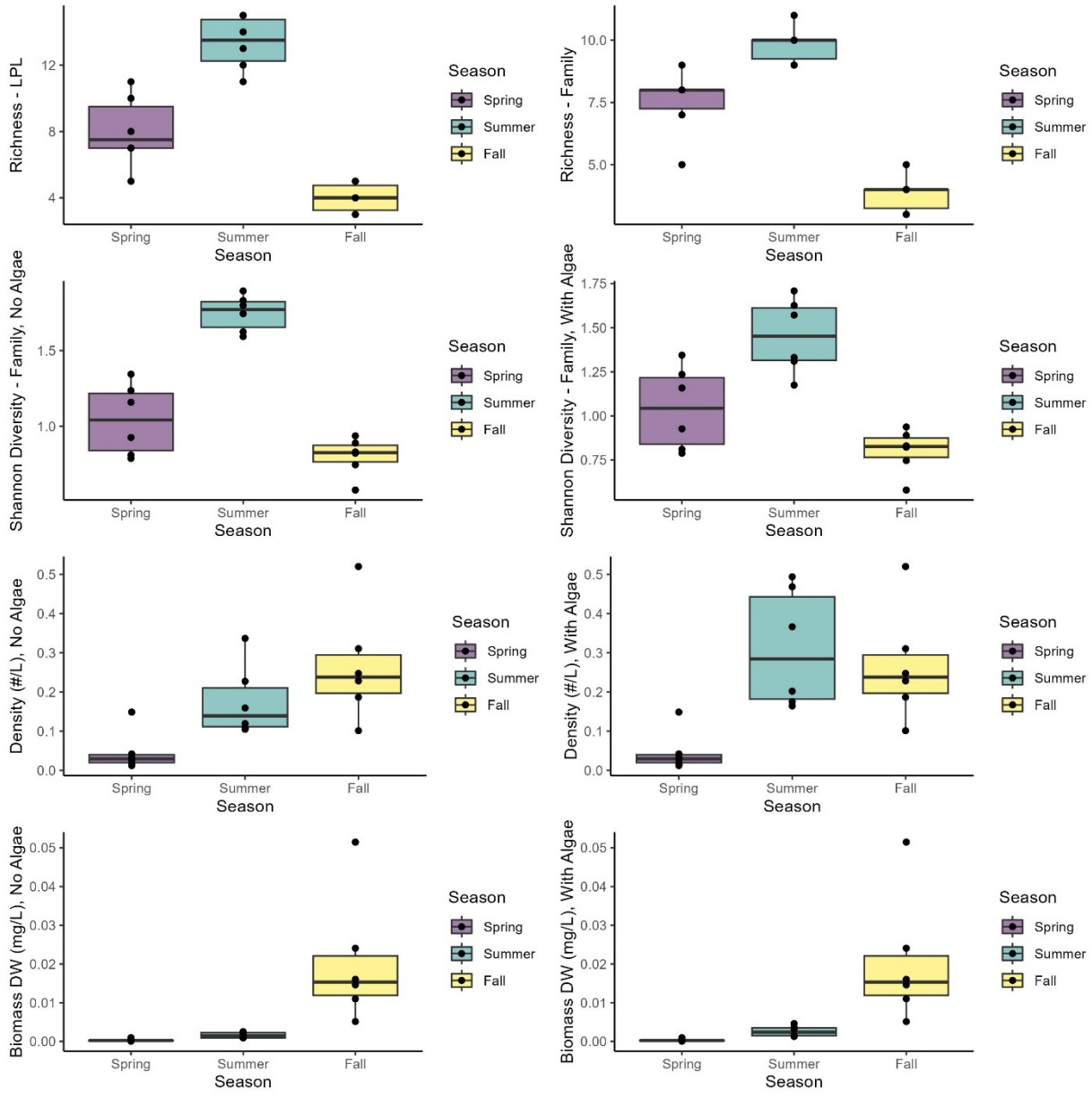


Figure A-21: Boxplots and Raw Data (points) of Macrozooplankton Endpoints Expressed by Season

Note: "No Algae" indicates that zooplankton estimates for those trapped in dense algae were not included whereas "With Algae" indicates they were.

Table A-30: Macrozooplankton Community Composition from samples collected in 2024

Spring								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 5**	**Grid 4**	**Grid 7**	**Grid 9**
		Station Depth (m)	12.4	14.5	16.9	17.4	19.3	19.4
Cladocera	Bosminidae	Bosminidae indet. [1]						X
	Bosminidae	Eubosmina sp.	X	X	X	X	X	
	Cercopagididae	Cercopagis sp.	X	X	X	X	X	X
	Daphniidae	Daphnia sp.	X	X	X	X	X	X
	Leptodoridae	Leptodora sp.	X	X	X	X	X	X
	Polyphemidae	Polyphemus pediculus			X		X	X
	Total Cladocera		**4**	**4**	**5**	**4**	**5**	**4**
Copepoda Calanoida	Centropagidae	Limnocalanus macrurus		X	X	X	X	X
	Diaptomidae	Diaptomidae indet. [1]	X	X	X	X	X	X
	Diaptomidae	Leptodiaptomus sicilis	X	X	X	X	X	X
	Total Calanoida		**1**	**2**	**2**	**2**	**2**	**2**
Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.			X		X	
	Cyclopidae	Diacyclops sp.		X	X	X	X	X
	Cyclopidae	Mesocyclops edax			X		X	
	Total Cyclopoida		**0**	**1**	**3**	**1**	**3**	**1**
Mysida	Mysidae	Mysidae indet.				X	X	
	Total Mysida		**0**	**0**	**0**	**1**	**1**	**0**
Taxa Richness			**5**	**7**	**10**	**8**	**11**	**7**
Overall Richness			**10**					

Summer								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 6**	**Grid 4**	**Grid 8**	**Grid 9**
		Station Depth (m)	11.4	12.5	16.4	16.6	19	20
Cladocera	Bosminidae	Bosmina longirostris					X	
	Bosminidae	Eubosmina coregoni	X	X	X	X	X	X
	Bosminidae	Eubosmina longispina				X	X	
	Cercopagididae	Bythotrephes sp.	X		X		X	X
	Cercopagididae	Cercopagis sp.	X	X	X	X	X	X
	Chydoridae	Acroperus sp.			X			
	Chydoridae	Camptocercus sp.	X	X	X			X
	Chydoridae	Eurycercus sp.	X	X	X	X	X	X
	Chydoridae	Oxyurella sp.	X		X	X	X	X
	Daphniidae	Ceriodaphnia sp.	X	X	X		X	
	Daphniidae	Daphnia sp.	X	X	X	X	X	X
	Holopediidae	Holopedium gibberum	X	X	X	X	X	X
	Leptodoridae	Leptodora sp.	X	X	X	X	X	X
	Polyphemidae	Polyphemus pediculus	X	X	X	X	X	X

Summer								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 6**	**Grid 4**	**Grid 8**	**Grid 9**
		Station Depth (m)	11.4	12.5	16.4	16.6	19	20
Cladocera	Sididae	Sida crystallina					X	
	Total Cladocera		**11**	**9**	**12**	**9**	**13**	**10**
Copepoda Calanoida	Diaptomidae	Diaptomidae indet. [1]					X	X
	Diaptomidae	Leptodiaptomus minutus	X		X	X		
	Diaptomidae	Skistodiaptomus oregonensis				X		
	Temoridae	Epischura sp.	X	X	X	X	X	X
		Calanoida indet. [1]				X		
	Total Calanoida		**2**	**1**	**2**	**3**	**1**	**1**
Summer								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 2**	**Grid 6**	**Grid 4**	**Grid 8**	**Grid 9**
Copepoda Cyclopoida	Cyclopidae	Acanthocyclops sp.	X					X
	Cyclopidae	Diacyclops sp.		X			X	X
	Cyclopidae	Eucyclops sp.			X			
		Cyclopoida indet. [1]	X					X
	Total Cyclopoida		**1**	**1**	**1**	**0**	**1**	**2**
Taxa Richness			**14**	**11**	**15**	**12**	**15**	**13**
Overall Richness			**21**					
Fall								
Major Group	**Family**	**Taxon**	**Grid 3**	**Grid 1**	**Grid 5**	**Grid 4**	**Grid 8**	**Grid 9**
		Station Depth (m)	10.5	10.6	15	16.8	18.7	19.7
Cladocera	Bosminidae	Eubosmina coregoni		X	X			
	Cercopagididae	Bythotrephes sp.	X	X	X	X	X	X
	Daphniidae	Daphnia sp.			X			
	Total Cladocera		**1**	**2**	**3**	**1**	**1**	**1**
Copepoda Calanoida	Centropagidae	Limnocalanus macrurus				X		X
	Diaptomidae	Diaptomidae indet. [1]	X		X	X	X	X
	Diaptomidae	Leptodiaptomus sicilis	X	X	X	X	X	X
	Diaptomidae	Skistodiaptomus oregonensis		X				
	Temoridae	Epischura sp.	X	X	X	X	X	X
		Calanoida indet. [1]	X	X	X		X	X
	Total Calanoida		**2**	**3**	**2**	**3**	**2**	**3**
Total Zooplankton (excluding algae)			**3**	**5**	**5**	**4**	**3**	**4**
Total Unique Taxa			**7**					

Note:

[1] Indet = indeterminant. As there was uncertainty over the identification of these organisms, they were excluded from the richness count.

Sampling grids are presented in **Figure 4-5**.

X – indicates taxon was present in the sample, "-" indicates taxon was not present in the sample. Taxa Richness is calculated for each station individually based on the sum of all the taxa (excluding indets.) present in the column, whereas Overall Richness is the sum of all taxa (excluding indets) across stations.

Table A-31: Summary of GLM Modelling Results to identify effects of season and depth on Macrozooplankton Community Parameters

Parameter		R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
						Season	Mean	Lower Confidence Limit	Upper Confidence Limit				
Richness - LPL		0.77	Depth	0.48	No	Spring	7.9	5.9	10.5	Spring	Summer	0.012	Summer > Spring > Fall
			Season	<0.001	Yes	Summer	13.3	10.6	16.5	Spring	Fall	0.027	
						Fall	4.1	2.7	6.1	Summer	Fall	<0.001	
Richness - Family		0.61	Depth	0.458	No	Spring	7.3	5.5	9.9	Spring	Summer	0.324	Summer = Spring > Fall
			Season	<0.001	Yes	Summer	9.8	7.6	12.6	Spring	Fall	0.043	
						Fall	3.9	2.6	5.9	Summer	Fall	<0.001	
Algae excluded	Diversity - Family	0.9	Depth	0.053	No	Spring	1.024	0.887	1.161	Spring	Summer	<0.001	Summer > Spring = Fall
			Season	<0.001	Yes	Summer	1.742	1.607	1.878	Spring	Fall	0.116	
						Fall	0.826	0.688	0.964	Summer	Fall	<0.001	
	Density	0.58	Depth	0.651	No	Spring	0.047	0.028	0.15	Spring	Summer	0.104	Summer = Spring = Fall
			Season	0.002	Yes	Summer	0.176	0.105	0.554	Spring	Fall	0.063	
						Fall	0.252	0.147	0.882	Summer	Fall	0.725	
	Biomass	0.9	Depth	0.264	No	Spring	0.0003	0.0002	0.0009	Spring	Summer	0.045	Fall > Summer > Spring
			Season	<0.001	Yes	Summer	0.0016	0.001	0.0042	Spring	Fall	0.012	
						Fall	0.017	0.01	0.0554	Summer	Fall	0.02	

Parameter		R^2 for Model	Effect	P-value	Significant Effect	Estimates				Comparison		P-value	Interpretation
						Season	Mean	Lower Confidence Limit	Upper Confidence Limit				
Algae included	Diversity - Family	0.8	Depth	0.006	Yes	Spring	1.014	0.869	1.158	Spring	Summer	0.001	Summer > Spring = Fall
			Season	<0.001	Yes	Summer	1.446	1.304	1.589	Spring	Fall	0.207	
						Fall	0.839	0.693	0.985	Summer	Fall	<0.001	
	Density	0.65	Depth	0.412	No	Spring	0.047	0.028	0.143	Spring	Summer	0.045	Summer > Spring Fall > Spring Fall = Summer
			Season	<0.001	Yes	Summer	0.306	0.184	0.89	Spring	Fall	0.058	
						Fall	0.245	0.147	0.733	Summer	Fall	0.862	
	Biomass	0.88	Depth	0.234	No	Spring	0.0003	0.0002	0.0009	Spring	Summer	0.025	Fall > Summer > Spring
			Season	<0.001	Yes	Summer	0.0026	0.0016	0.007	Spring	Fall	0.012	
						Fall	0.0167	0.0098	0.0552	Summer	Fall	0.032	
						Depth*	0.034	0.01	0.0587	-	-	-	

Note:
Shaded cells indicates p-value < 0.05, which was considered significant.

A.3.4 Aquatic Habitat

Substrate types within each sampling grid in the Deepwater Study Area from 2024 and 2025 are detailed in **Table A-32**. Results of underwater video substrate analysis for transects in Shoreline Erosion Mitigation Area and Infill Study Areas are presented in **Table A-33**.

Sediment samples collected from the Deepwater Study Area, Mid-depth Study Area, Cutoff Wall Study Area, Infill and Shoreline Erosion Mitigation Areas were collected and analyzed for grain size to compare with the sidescan sonar–derived substrate classification map (**Figure 4-10**). The results of these grain size analyses are presented in **Figure A-22** to **Figure A-25**.

Table A-32: Substrate Characterization in the Proposed Deepwater Study Area, 2024 and 2025

Sampling grid	Depths (m)	Substrate characterization
S1	10-14	Substrates primarily comprised of sand/gravel/cobble. Other substrate types identified include sand/gravel/cobble, gravel/cobble, and gravel/cobble/boulder. In general, coarser substrates (cobble and infrequent boulder) were observed in the mid and northern section of the grid in depths of approximately 10 to 13m. Finer substrates were observed in deeper areas (12 to 14m), with a large patch of sand/gravel/cobble present in the southwest section of the sampling grid.
S2 (Intake location option)	11-14	Substrates primarily comprised of sand/gravel/cobble. Small sections containing larger substrates (cobble/boulder) are present to the northwest and mid grid to the east. These sections of larger substrates are generally associated with the 12m depth contours. Compared to other grids, S2 has a higher proportion of sand/gravel, which is generally concentrated in the middle of the grid. Grid S3 to the east has coarser substrates (mostly cobble boulder), grid S1 has similar substrates, but with sections of sand/gravel concentrated in the south-west corner, and grid S5 (the other intake option) contains mixed substrates, but with less sand and more cobble than grid S2. The proposed intake location is located at the approximate center of grid S2. This location was identified as mixed sand/gravel/cobble substrate, which was observed in sections throughout the study area.
S3	10-13	Substrates primarily comprised of coarser substrates (gravel/cobble/boulder). Substrate size tends to increase in size from west to east in the sampling grid. The furthest eastern edge of this sampling grid is comprised primarily of cobble and boulder substrates.
S4	14-17	Substrates primarily comprised of sand/gravel/cobble. Finer substrates are found in patches located to the south and southeast between depths of 16 to 17m. Coarser substrates are present along the edge of the southeast section of the sampling grid in 16 to 17 m depths.
S5 (Intake location option)	14-17	Substrates primarily composed of gravel/cobble. These substrates are generally located throughout the northwestern section of the sampling grid. The southern/southeastern section of the sampling grid contains diverse substrate types, containing substrates ranging from sand to boulder in patches throughout the entire southeast section of the sampling grid. When compared to adjacent grids in different depth bands, grid S5 has a higher proportion of sand/gravel which is generally concentrated in the middle of the grid, and grid S8 is much less homogenous than S5, with mixed substrates of sand, gravel, cobble, and boulder found in patches throughout.The proposed intake is located at the

Sampling grid	Depths (m)	Substrate characterization
		boundary between S5 and S2, approximately 100m from the eastern edge of these grids. This location was identified primarily as gravel/cobble, with some boulder substrates, which is common throughout the study area.
S6	11-17	Substrates primarily composed of gravel/cobble and gravel/cobble/boulder. There was a general pattern of less coarse substrates in the southwest and more coarse substrates to the northeast. The largest substrates (cobble/boulder and boulder) within this sampling grid are located in the north-east section between the 11 to 14 m depth contours.
S7	16-19	Substrates primarily composed of gravel/cobble and gravel/cobble/boulder. Finer substrates are generally located to the mid-south (17 to 19 m) sections of the sampling grid, while coarser substrates tend to be located to the east and west, adjacent to the sampling grid extent.
S8	17-20	Substrates are variable throughout the sampling grid, with all substrate types observed. Generally, coarser substrates (gravel/cobble/boulder and cobble/boulder) are present to the west, between the 17 and 18 m depth contours, while patches of finer substrates (sand/gravel) tend to be present throughout the middle and to the east of the sampling grid across all depths.
S9	17-20	The substrate is diverse and comprised of sand/gravel, sand/gravel/cobble, and gravel/cobble, with patches of sand and gravel/cobble/boulder. The finest substrates (sand and sand/gravel) generally occur between the 18 and 19m depth contours, while coarser substrates are present throughout the eastern extent of the sampling grid across all depths.
S10	9-11	Substrate is relatively uniform throughout and composed of gravel/cobble, with small patches of sand/gravel/cobble in the northern extent of the grid between the 9-10 m depth contours, along with some sections of coarser substrates, gravel/cobble/boulder, along the southern extent of the grid, close to the 11 m depth contour.
S11	9-12	Substrate is primarily gravel/cobble, with small patches of sand/gravel/cobble, with a large patch of finer substrates along the southern edge of the sampling grid between the 11-12 m depth contours.
S12	9-11	Substrate is primarily gravel/cobble, with small patches of sand/gravel/cobble. The finer substrates are mostly located within the eastern extent of the sampling grid, between the 9 m and 10 m depth contours

Note:
Sampling area presented in **Figure 4-9**.

Table A-33: Results of Underwater Video Substrate Analysis for transects in Shoreline Erosion Mitigation Area and Infill Study Areas

Infill Area	Transect Number	Transect	Video Title	Image	Direction Travelled	Timestamp (mm:ss)	Distance (m)	Substrate	Substrate Coverage Type	Veg Coverage (%)	Veg Coverage Value	Mussel Coverage (%)	Mussel Coverage Value	Fish Presence (Y/N)
Shoreline Erosion Mitigation Study Area	1	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD1	GX010002	0	East	00:06	0	Sand	2	0	0	0	0	N
				1		00:51	76.72	Sand	2	0	0	0	0	N
				2		01:42	153.44	Sand	2	35	3	0	0	N
				3		02:33	230.16	Sand	2	0	0	0	0	N
				4		03:25	306.88	Sand	2	25	2	0	0	N
				5		04:16	383.6	Sand	2	25	2	0	0	N
				6		05:07	460.32	Sand	2	35	3	0	0	N
				7		05:58	537.04	Sand	2	50	5	0	0	N
				8		06:49	613.76	Sand, Cobbles	3	45	5	0	0	N
				9		07:40	690.48	Sand	2	30	3	0	0	N
				10		08:31	767.2	Cobbles	4	70	7	0	0	N
	2	SHORELINE_EROSION_MITIGATION_AREA__WESTWRD1	GX010003	0	West	00:02	0	Sand, Boulders	5	100	10	0	0	N
				1		00:46	83.29	Gravel, Boulders	5	100	10	0	0	N
				2		01:34	166.58	Sand, Gravel, Boulders	4	90	9	0	0	N
				3		02:20	249.87	Sand, Boulders	5	100	10	0	0	N
				4		03:07	333.16	Cobbles	3	100	10	0	0	N
				5		03:54	416.45	Boulders, Sand, Cobbles	4	100	10	0	0	N
				6		04:41	499.74	Boulders, Sand, Cobbles	4	100	10	0	0	N
				7		05:28	583.03	Sand, Boulders	5	30	3	0	0	N
				8		06:14	666.32	Sand, Boulders	5	40	4	0	0	N
				9		07:01	749.61	Sand	2	10	1	0	0	N
				10		07:48	832.90	Sand, Boulders	5	20	2	0	0	N
	3	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD2	GX010004	0	East	00:03	0.00	Boulders, Cobbles	6	100	100	5	1	N
				1		00:43	88.19	Sand	2	80	8	0	0	N
				2		01:27	176.38	Boulders, Cobbles	6	100	10	0	0	N
				3		02:10	264.57	Boulders, Cobbles	6	100	10	0	0	N
				4		02:54	352.76	Boulders, Cobbles	6	80	8	20	2	N
	3	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD2	GX010004	5	East	03:37	440.95	Boulders, Cobbles	5	90	9	10	1	N
				6		04:21	529.14	Boulders, Cobbles	5	90	9	10	1	N
				7		05:04	617.33	Boulders, Cobbles	5	80	8	5	1	N
				8		05:48	705.52	Boulders, Cobbles	6	80	8	20	2	N
				9		06:31	793.71	Boulders, Cobbles	6	90	9	20	2	N
				10		07:14	881.90	Boulders, Cobbles, Gravel	5	30	3	0	0	N
	4	SHORELINE_EROSION_MITIGATION_AREA__WESTWRD2	GX010005	0	West	00:03	0.00	Cobbles, Boulders	3	100	10	10	1	N
				1		00:52	88.71	Sand, Boulders	2	5	1	0	0	N
				2		01:45	177.42	Cobbles, Boulders	3	100	10	10	1	N
				3		02:37	266.13	Sand	2	5	1	0	0	N
				4		03:30	354.84	Cobbles, Boulders	6	90	9	0	0	N
				5		04:22	443.55	Cobbles, Boulders	6	100	10	30	3	N
				6		05:15	532.26	Cobbles, Boulders	6	80	8	0	0	N
				7		06:07	620.97	Sand, Cobbles, Boulders	6 and 2	50	5	0	0	N

Infill Area	Transect Number	Transect	Video Title	Image	Direction Travelled	Timestamp (mm:ss)	Distance (m)	Substrate	Substrate Coverage Type	Veg Coverage (%)	Veg Coverage Value	Mussel Coverage (%)	Mussel Coverage Value	Fish Presence (Y/N)
				8		07:00	709.68	Boulders, Cobbles	5	90	9	40	4	N
				9		07:52	798.39	Sand	2	0	0	0	0	N
				10		08:45	887.10	Boulders, Cobbles	6	100	10	20	2	N
	5	SHORELINE_EROSION_MITIGATION_AREA__EASTWRD3	GX010006	0	East	00:04	0.00	Boulders, Cobbles, Gravel	4	80	8	50	5	N
				1		00:48	90.44	Boulders, Cobbles, Gravel	4	30	3	0	0	N
				2		01:35	180.88	Sand	2	0	0	0	0	N
				3		02:23	271.32	Sand, Cobbles, Boulders	4	20	2	0	0	N
				4		03:10	361.76	Sand, Cobbles, Boulders	4	10	1	0	0	N
				5		03:58	452.2	Cobbles, Boulders	6	90	9	40	4	N
				6		04:46	542.64	Sand	2	0	0	0	0	N
				7		05:33	633.08	Cobbles, Boulders	6	35	4	15	2	N
				8		06:21	723.52	Boulders, Cobbles	6	70	7	60	6	N
				9		07:08	813.96	Boulders, Cobbles	6	40	4	10	1	N
				10		07:56	904.4	Sand. Boulders	5	5	1	0	0	N
Infill Study Area	1	INFILL_WEST_WESTWRD1	GX010007	0	West	00:09	0	Sand	2	0	0	0	0	N
				1		00:39	64.04	Sand	2	0	0	0	0	N
				2		01:18	128.08	Sand	2	0	0	0	0	N
				3		01:57	192.12	Sand	2	0	0	0	0	N
				4		02:36	256.16	Sand	2	0	0	0	0	N
				5		03:15	320.20	Sand	2	0	0	0	0	N
				6		03:54	384.24	Sand	2	0	0	0	0	N
				7		04:33	448.28	Sand	2	0	0	0	0	N
				8		05:12	512.32	Sand	2	0	0	0	0	N
				9		05:51	576.36	Sand	2	0	0	0	0	N
				10		06:30	640.40	Sand	2	0	0	0	0	N
	2	INFILL_WEST_EASTWRD1	GX010008	0	East	00:09	0.00	Sand	2	0	0	5	0	N
				1		00:37	65.00	Sand	2	0	0	0	0	N
				2		01:14	130.00	Sand	2	0	0	0	0	N
				3		01:51	195.00	Sand	2	0	0	0	0	N
				4		02:29	260.00	Cobbles, Boulders, Gavel, Sand	5	5	1	0	0	N
				5		03:06	325.00	Sand	2	5	1	0	0	N
				6		03:43	390.00	Cobbles, Boulders	6	70	7	20	2	N
				7		04:20	455.00	Boulders, Sand	5	15	2	5	1	N
				8		04:57	520.00	Sand, Boulders	5	0	0	0	0	N
				9		05:34	585.00	Sand	2	5	1	0	0	N
				10		06:11	650.00	Boulders, Sand	5	70	7	10	1	N
	3	INFILL_WEST_WESTWRD2	GX010009	0	West	00:04	0.00	Boulders, Cobbles, Sand	5	80	8	40	4	N
				1		00:40	69.67	Boulders, Cobbles, Sand	5	90	9	5	1	N
				2		01:20	139.34	Sand	2	0	0	0	0	N
				3		01:59	209.01	Boulders, Cobbles, Sand	5	30	3	10	1	N
				4		02:39	278.68	Boulders, Cobbles	6	100	10	60	6	N

Infill Area	Transect Number	Transect	Video Title	Image	Direction Travelled	Timestamp (mm:ss)	Distance (m)	Substrate	Substrate Coverage Type	Veg Coverage (%)	Veg Coverage Value	Mussel Coverage (%)	Mussel Coverage Value	Fish Presence (Y/N)
				5		03:19	348.35	Boulders, Cobbles, Sand	5	40	4	20	2	N
	3	INFILL_WEST_WESTWRD 2	GX010009	6	West	03:59	418.02	Sand	2	0	0	0	0	N
				7		04:39	487.69	Boulders, Cobbles, Sand	5	0	0	0	0	N
				8		05:18	557.36	Sand	2	0	0	0	0	N
				9		05:58	627.03	Sand	2	0	0	0	0	N
				10		06:38	696.70	Sand	2	0	0	0	0	N
	4	INFILL_WEST_EASTWRD2	GX010010	0	East	00:03	0.00	sand	2	0	0	0	0	N
				1		00:38	67.00	Sand	2	0	0	0	0	N
				2		01:15	134.00	Sand	2	0	0	0	0	N
				3		01:53	201.00	Sand	2	0	0	0	0	N
				4		02:31	268.00	Sand	2	0	0	0	0	N
				5		03:08	335.00	Sand	2	0	0	0	0	N
				6		03:46	402.00	Boulders, Cobble, Sand	5	90	9	70	7	N
				7		04:23	469.00	Sand	2	10	1	0	0	N
				8		05:01	536.00	Sand	2	10	1	0	0	N
				9		05:39	603.00	Boulders, Cobbles, Sand	5	90	9	50	5	N
				10		06:16	670.00	Boulders, Cobbles, Sand	5	70	7	40	4	N
	5	INFILL_WEST_WESTWRD 3	GX010011	0	West	00:01	0.00	Boulders, Cobbles, Sand	5	80	8	20	2	N
				1		00:02	62.67	Boulders, Sand	5	80	8	10	1	N
				2		00:04	125.34	Boulders, Sand	5	90	9	10	1	N
				3		00:06	188.01	Boulders, Sand	5	90	9	10	1	N
				4		00:08	250.68	Boulders, Cobbles, Sand	5	95	9	10	1	N
				5		00:10	313.35	Boulders, Cobbles, Sand	5	95	9	10	1	N
				6		00:12	376.02	Sand	2	0	0	0	0	N
				7		00:14	438.69	Sand	2	0	0	0	0	N
				8		00:16	501.36	Sand	2	0	0	0	0	N
				9		00:18	564.03	Sand	2	0	0	0	0	N
				10		00:20	626.70	Sand	2	0	0	0	0	N

Note:

Sampling area presented in **Figure 4-9**.

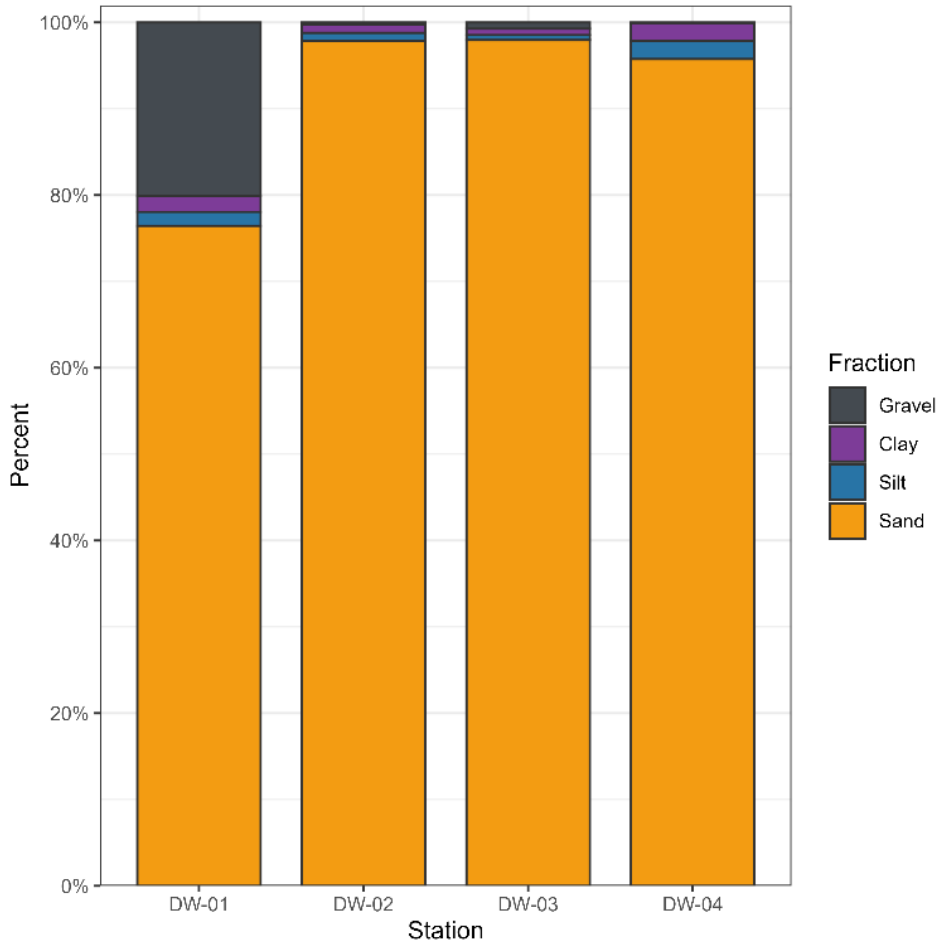


Figure A-22: Grain Size Results for Sediment Samples Collected in the Deepwater Study Area

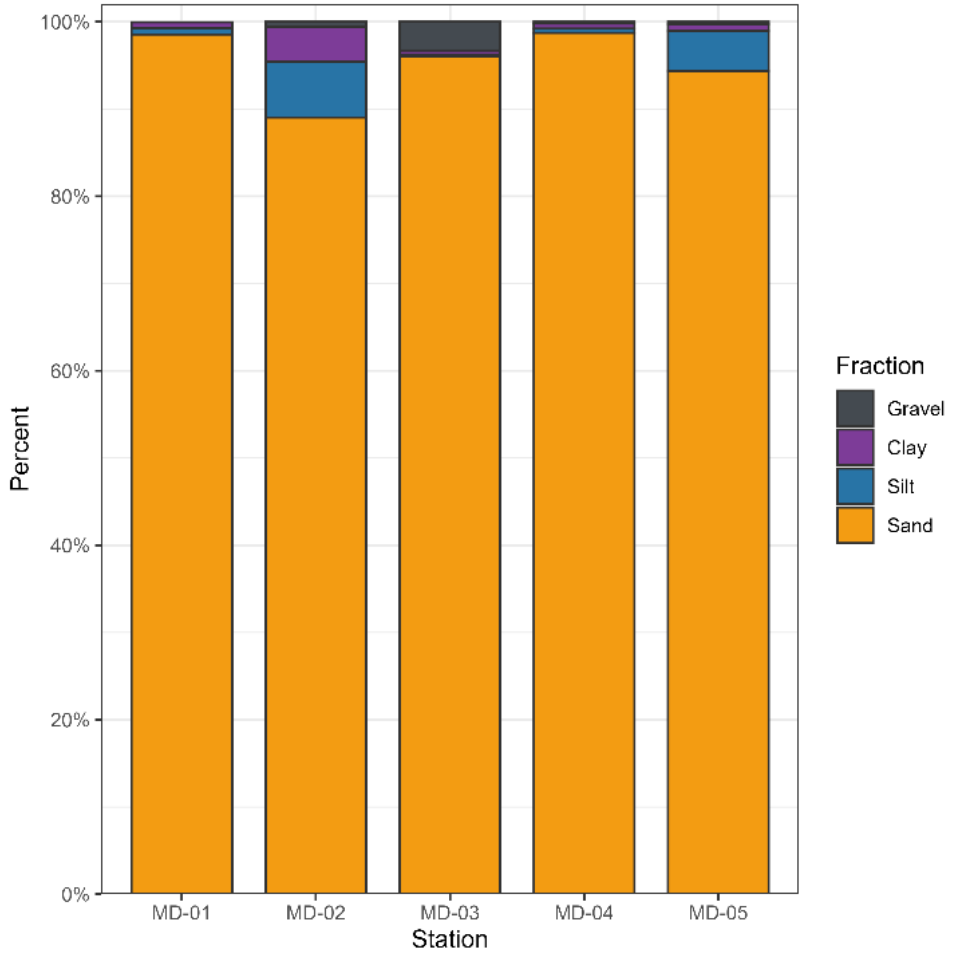


Figure A-23: Grain Size Results for Sediment Samples Collected in the Mid-Depth Study Area

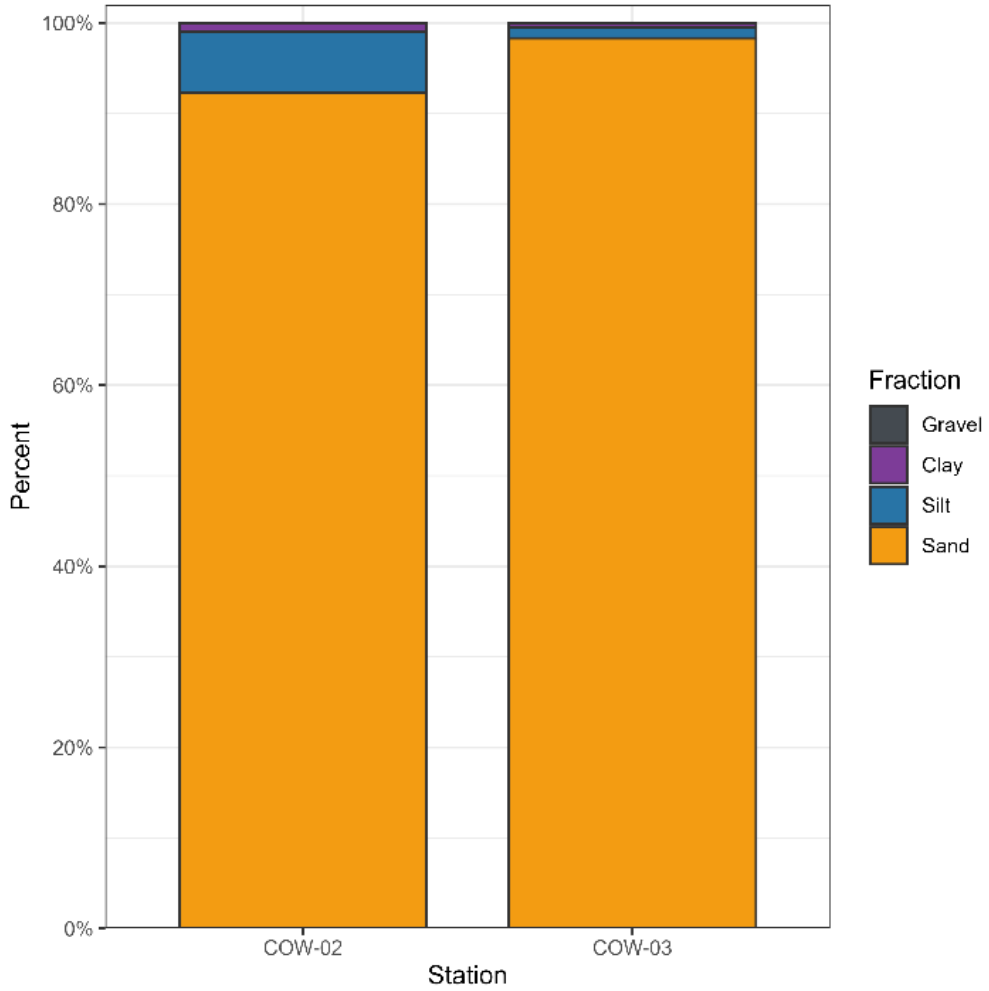


Figure A-24: Grain Size Results for Sediment Samples Collected in the Cutoff Wall Study Area

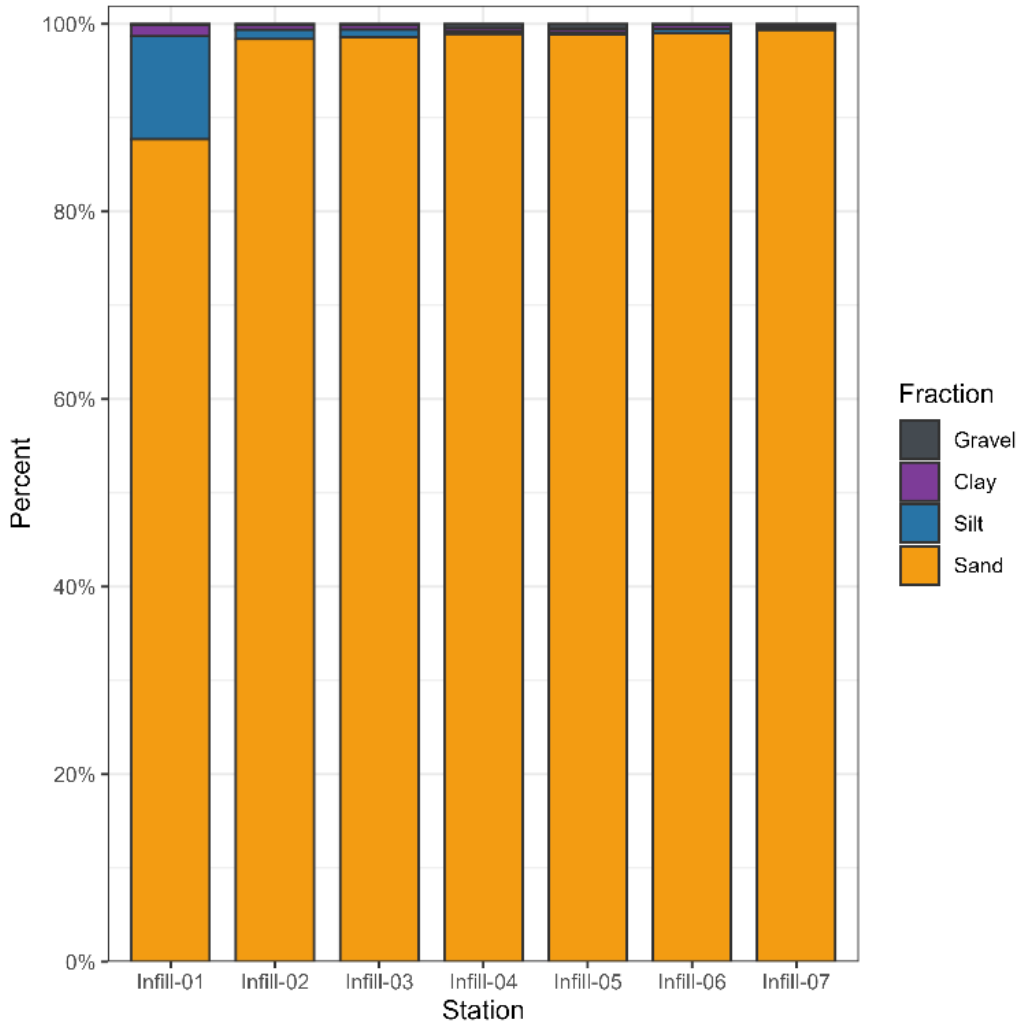


Figure A-25: Grain Size Results for Sediment Samples Collected in the in the Infill Area (Infill 01-05) and Shoreline Erosion Mitigation Area (Infill-06 and 07)

A.4 Geological and Hydrogeological Environment

A.4.1 2015 Soil Sampling Program at the PN Site

The first site-wide soil monitoring program was initiated in 1999 to characterize soil quality at the PN site. As part of the 2014 ERA, soil samples (0-1.5 metres in depth) collected as part of the site-wide monitoring program were compared against newly issued soil standards at the time following the Ontario MECP's update to O. Reg. 153/04. The 2014 ERA had identified a short-list of metals that were found to exceed their respective soil screening criteria. Ultimately, the 2014 ERA concluded that additional monitoring was recommended in areas of the PN site where metal concentrations were found to exceed soil benchmarks to ensure the protection of plants and soil organisms. To address this recommendation, an updated soil monitoring program was conducted in October 2015 in support of the 2017 ERA, focusing on the areas of contamination identified in the 2014 ERA.

The 2017 ERA (Ecometrix and Golder, 2018) and the 2022 PN ERA (Ecometrix, 2023a) documented that surface soil samples (collected in 2015 between 0 to 20 cm in depth) were analyzed for polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), petroleum hydrocarbons (PHC) fractions F1 to F4, metals and inorganics, glycol, tritium (H-3), gamma emitters (i.e., Cs-137, Cs-134, Co-60) and C-14. Concentrations of chemical constituents were compared against soil quality guidelines (SQGs) from the MECP and CCME that are considered protective of various classes of ecological receptors (e.g., plants, soil organisms, birds and mammals). In the 2015 sampling program, the maximum measured on-site concentration of PHC F4 was found to exceed the selected screening criteria and was hypothesized to be related to minor historic spills and impacted surface water runoff. Cadmium, strontium, and thallium, which were assessed as soil COPCs in the 2014 ERA, did not exceed their selected screening criteria based on the 2015 site soil data and were dropped as COPCs in the 2017 and 2022 PN ERAs. As of the most recent 2022 PN ERA, the list of soil COPCs included metals (arsenic, copper, lead and zinc), free cyanide, and PHC F4. Overall, based on the soil samples collected in 2015, exceedances of soil screening criteria were found to be localized and generally limited to the eastern portion of the PN site, suggesting that contamination was not a result of widespread atmospheric deposition and that further accumulation of contaminants in soil was unlikely to occur over time (Ecometrix, 2023a).

A.4.1.1 2024 Soil Monitoring Program

A.4.1.1.1 Chemical Soil COPCs

Non-radiological chemical parameters were screened against the lower of either the MECP's ecological component values (Eco CVs) (MOE, 2011), or the CCME's SQGs for the protection of environmental and human health (CCME, 2010). Where an Eco CV is provided for both plants and soil organisms, and for birds and mammals, the lower of the two values was retained. Where Eco CVs were unavailable, for PAHs and VOCs, the free phase threshold value was used as the screening criteria. Where SQGs were provided for both ecological protection and human health protection, the lower of the two values was retained. Where SQGs were unavailable, interim SQGs from the CCME were retained for the screening assessment. Lastly, in cases where the

selected screening criterion was found to be more conservative than the MECP's Ontario background soil value, the background soil value was retained as the screening criteria since screening criteria should not be set below a reasonable upper end of background (as per Clause 7.2.5.3.2 in CSA N288.6:22).

Based on the results of the recent soil monitoring program, the maximum concentration of zinc (350 µg/g) was found to exceed its selected soil screening criterion (340 µg/g), though this occurred at only one sampling location in an on-site drainage ditch at Site 14-SS6-2 (**Table A-34**). Soils in drainage ditches are likely to represent "worst-case" conditions, as surface runoff during precipitation events is expected to continuously wash metals from nearby surfaces and concentrate them within soils in the drainage ditch. Although this exceedance was observed at this location, it is important to note that the soil concentrations of zinc measured 15 m upstream and 15 m downstream were 110 and 130 µg/g, respectively, both of which meet the soil screening criterion. The maximum concentration of zinc in the 2022 PN ERA (3,200 µg/g) is approximately a full order of magnitude higher than the concentration measured during the recent 2024 sampling event, and zinc concentrations at multiple sampling locations across the site have been decreasing indicating improvement in soil with respect to zinc. Compared with the previous ERAs, arsenic, copper and lead all met their respective soil screening criteria and would no longer be considered soil COPCs. Similarly, cyanide and PHC F4, which exceeded their respective screening criteria in 2015, met these criteria during the 2024 soil sampling event. However, in contrast to the previous soil sampling event, two general soil quality parameters, electrical conductivity and sodium adsorption ratio, exceeded their respective screening criteria at two of the assessed sampling locations.

Table A-34: Screening of Soil Quality Parameters in 2024 samples

Parameters	Units	(1) MECP Eco CV	(2) CCME SQG	(3) ON Background	Selected Soil Screening Criteria	Source	GMS-28-1	GMS-28-2	GMS-28-3	GMS-31-1	GMS-31-2	GMS-31-3	GSM - 26	GSM - 38	SITE 14-SS5- 1	SITE 14-SS5- 2	SITE 14-SS5- 3	SITE 14-SS6- 1	SITE 14-SS6- 2	SITE 14-SS6- 3	SITE 15-1	SITE 15-2	SITE 15-3	SITE 7 - SS4
General Parameters																								
Conductivity	mS/cm	1.4	4	0.57	1.4	(1)	0.075	0.13	0.13	1.2	0.13	0.28	0.19	0.31	**2.6**	**2.3**	0.42	**1.5**	0.091	0.24	0.29	0.26	0.15	0.23
Moisture	%	-	-	-	NA	-	2.3	5.6	3.5	1.5	2.8	9.6	15	13	3.4	4.5	8.1	5.9	2.3	2.6	15	11	7.7	6.5
WAD Cyanide (Free)	ug/g	0.11	8	0.051	0.11	(1)	0.00104	0.00108	0.00203	0.00323	0.00106	0	0	0	0.00093	0.00108	0.00111	0.00219	0.00184	0.00105	0.00228	0.00116	0	0
pH	Unitless	6.0-9.0	6.0-8.0	-	6.0-8.0	(2)	7.78	7.64	7.67	7.94	7.59	7.19	7.34	7.4	8.06	8.02	7.66	8.27	7.78	7.87	7.42	7.39	7.58	7.49
Available (CaCl2) pH	Unitless	6.0-9.0	6.0-8.0	-	6.0-8.0	(2)	7.78	7.64	7.67	7.94	7.59	7.19	7.34	7.4	8.06	8.02	7.66	8.27	7.78	7.87	7.42	7.39	7.58	7.49
Sodium Adsorption Ratio	Unitless	12	12	2.4	12	(1,2)	0.38	0.31	0.3	**13**	0.27	0.24	0.22	3.7	4	7.8	2.5	**31**	0.38	2.2	0.33	0.21	0.26	0.22
Fluoride (F-)	ug/g	-	2000	-	2000	(2)	1.01	0.629	0.6154	0.6895	1.6076	3.1446	9	5	2.2944	1.9249	1.9453	0.9462	0.407	0.5253	2.5341	2.3873	1.6028	1.621
Metals																								
Acid Extractable Aluminum (Al)	ug/g	-	-	-	-	-	2200	3300	3200	3000	6200	16000	19000	18000	3900	3900	2900	2400	3200	2900	4100	7900	6100	7600
Acid Extractable Antimony (Sb)	ug/g	40	40	1.3	40	(1,2)	0.117113	0.55	0.36	0.195417	0.29	0.192684	0.148608	0.17626	0.27	0.9	0.3	0.48	1.1	0.48	0.180305	0.59	0.53	0.185422
Acid Extractable Arsenic (As)	ug/g	40	12	18	18	(3)	1	1.7	1.3	1.7	2.3	2.6	2.2	2.4	1.9	5.3	1.7	2.2	5.1	2.2	1.2	3.6	3.6	1.9
Acid Extractable Barium (Ba)	ug/g	670	2000	220	670	(1)	13	19	23	18	40	84	130	110	30	88	19	24	51	44	25	42	42	48
Acid Extractable Beryllium (Be)	ug/g	8	8	2.5	8	(1,2)	0.118876	0.16675	0.15845	0.151433	0.28	0.65	0.69	0.69	0.199574	0.196886	0.12982	0.121457	0.163851	0.147049	0.195197	0.31	0.25	0.32
Acid Extractable Bismuth (Bi)	ug/g	-	-	-	-	-	0.029566	0.047217	0.0303	0.0455	0.06049	0.104254	0.098957	0.096984	0.062868	0.07582	0.029529	0.053377	0.064478	0.036806	0.047591	0.095557	0.237605	0.078156
Acid Extractable Boron (B)	ug/g	120	-	36	120	(1)	2.229387	6.2	6.7	3.806344	4.862406	5.1	4.580761	6.8	8.3	7.4	3.860754	4.265377	5.2	4.512741	7.2	8.6	6.1	5.7
Hot Water Ext. Boron (B)	ug/g	2	-	0.5	2	(1)	0.069	0.18	0.19	0.55	0.36	0.39	0.19	0.28	0.45	0.51	0.19	0.48	0.25	0.21	0.56	0.7	0.31	0.28
Acid Extractable Cadmium (Cd)	ug/g	1.9	22	1.2	1.9	(1)	0.036642	0.066484	0.052764	0.084144	0.81	0.23	0.18	0.23	0.1	0.22	0.093704	0.12	0.24	0.14	0.066416	0.22	0.15	0.11
Acid Extractable Calcium (Ca)	ug/g	-	-	-	-	-	140000	140000	160000	130000	110000	20000	9600	24000	260000	240000	170000	200000	150000	140000	130000	120000	130000	110000
Acid Extractable Chromium (Cr)	ug/g	160	87	70	87	(2)	7.2	10	8.8	13	19	21	26	28	29	18	8.9	29	23	11	8.4	30	17	18
Chromium (VI)	ug/g	8	1.4	0.66	1.4	(2)	0.03503	0.02075	0.01362	0.03755	0	0	0	0	0.1798	0.07478	0.03997	0.12166	0.05638	0.04933	0	0	0.01845	0
Acid Extractable Cobalt (Co)	ug/g	80	300	21	80	(1)	1.8	2.4	2.6	2.6	5.3	7.2	8.5	8.8	2.6	6.5	3.1	2.9	6.4	3.5	4.3	7.1	5.9	5.3
Acid Extractable Copper (Cu)	ug/g	230	91	92	92	(3)	5.7	11	8.1	9.1	21	16	19	19	13	62	22	25	69	29	26	52	39	14
Acid Extractable Iron (Fe)	ug/g	-	-	-	-	-	8700	11000	9700	9000	15000	21000	24000	23000	9400	11000	9300	9800	15000	11000	8400	16000	14000	15000
Acid Extractable Lead (Pb)	ug/g	32	600	120	120	(3)	2.4	6.8	6.4	5.4	10	15	12	16	11	24	9.5	11	32	17	6.8	40	20	12
Acid Extractable Lithium (Li)	ug/g	-	-	-	-	-	2.9	4.7	4.9	4.3	7.6	14	17	16	6.4	6	3.9	3.4	4.3	4.1	5.6	9.5	7.4	9.2
Acid Extractable Magnesium (Mg)	ug/g	-	-	-	-	-	5300	11000	13000	7400	9400	4800	5400	6200	8900	11000	6200	8700	7000	7700	12000	11000	11000	8700
Acid Extractable Manganese (Mn)	ug/g	-	-	-	-	-	200	240	290	260	360	360	420	560	390	370	210	310	280	240	240	370	340	330
Acid Extractable Mercury (Hg)	ug/g	20	50	0.27	20	(1)	0.003749	0.015629	0.00097	0.014912	0.012471	0.030845	0.042643	0.025467	0.000427	0.004109	0.002183	0.02384	0.006822	0.00806	0.02166	0.03078	0.010828	0.013969
Acid Extractable Molybdenum (Mo)	ug/g	40	40	2	40	(1)	0.224903	0.360788	0.298907	0.33666	0.74	0.446075	0.387123	0.421086	0.61	1.3	0.36203	1.3	3	0.71	0.296694	0.77	0.74	0.51
Acid Extractable Nickel (Ni)	ug/g	270	89	82	89	(2)	3.4	6	6.1	6.6	14	17	19	19	7.5	7.6	5.4	12	13	6.6	47	23	15	12
Acid Extractable Phosphorus (P)	ug/g	-	-	-	-	-	670	660	540	670	700	730	790	1000	500	510	600	510	600	540	680	930	760	820
Acid Extractable Potassium (K)	ug/g	-	-	-	-	-	430	840	990	590	1300	1800	2300	3000	1100	970	660	490	720	720	840	1600	1200	1500
Acid Extractable Selenium (Se)	ug/g	5.5	2.9	1.5	2.9	(2)	0.030076	0.075979	0.046236	0.13598	0.136815	0.281947	0.285436	0.299313	0.073868	0.205447	0.068279	0.063427	0.174247	0.090472	0.155839	0.281874	0.214031	0.130775
Acid Extractable Silver (Ag)	ug/g	40	40	0.5	40	(1,2)	0.016615	0.024994	0.017109	0.029158	0.028906	0.047931	0.06628	0.063013	0.035736	0.066383	0.027501	0.047872	0.103955	0.051165	0.032194	0.073614	0.050657	0.028835
Acid Extractable Sodium (Na)	ug/g	-	-	1300	1300	(3)	99	150	120	790	140	130	150	570	970	1100	250	920	160	220	160	160	170	170
Acid Extractable Strontium (Sr)	ug/g	-	-	-	-	-	180	180	210	180	150	37	25	48	340	360	220	270	200	190	170	170	170	150
Acid Extractable Thallium (Tl)	ug/g	3.6	1	1	1	(2)	0.030258	0.058	0.07	0.05	0.11	0.15	0.16	0.16	0.086	0.066	0.055	0.031143	0.063	0.055	0.056	0.11	0.086	0.12
Acid Extractable Tin (Sn)	ug/g	-	300	-	300	(2)	0.479391	0.677175	0.401801	0.593036	0.865187	0.936885	0.825836	0.867254	0.715216	3.3	1.2	1.5	3.4	1.4	0.747311	2.3	2	4
Acid Extractable Titanium (Ti)	ug/g	-	-	-	-	-	260	250	230	230	320	400	680	660	98	120	230	210	250	220	190	280	280	350
Acid Extractable Uranium (U)	ug/g	33	300	2.5	33	(1)	0.33	0.55	0.3	0.64	0.4	0.53	0.67	0.59	0.37	0.44	0.34	0.34	0.35	0.31	0.49	0.53	0.43	0.48
Acid Extractable Vanadium (V)	ug/g	18	130	86	86	(3)	15	18	15	14	20	33	38	38	13	12	16	13	18	15	13	22	20	22
Acid Extractable Zinc (Zn)	ug/g	340	410	290	340	(1)	28	56	41	39	67	110	66	70	73	270	85	110	**350**	130	46	200	160	140
Petroleum Hydrocarbons + BTEX																								
F1 (C6-C10)	ug/g	320	320	25	320	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F1 (C6-C10) - BTEX	ug/g	320	320	25	320	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F2 (C10-C16 Hydrocarbons)	ug/g	260	260	10	260	(1,2)	0	0	8.5	7	0	0	0	0	0	0	0	0	0	0	0	0	0	9.8
F3 (C16-C34 Hydrocarbons)	ug/g	1700	1700	240	1700	(1,2)	0	53	68	110	70	53	0	55	150	79	200	300	89	78	77	85	83	120

Parameters	Units	(1) MECP Eco CV	(2) CCME SQG	(3) ON Background	Selected Soil Screening Criteria	Source	GMS-28-1	GMS-28-2	GMS-28-3	GMS-31-1	GMS-31-2	GMS-31-3	GSM - 26	GSM - 38	SITE 14-SS5- 1	SITE 14-SS5- 2	SITE 14-SS5- 3	SITE 14-SS6- 1	SITE 14-SS6- 2	SITE 14-SS6- 3	SITE 15-1	SITE 15-2	SITE 15-3	SITE 7 - SS4
F4 (C34-C50 Hydrocarbons)	ug/g	3300	3300	120	3300	(1,2)	0	0	0	130	51	0	0	0	400	140	540	660	170	110	79	97	100	110
Benzene	ug/g	180	0.03	0.02	0.03	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Toluene	ug/g	500	0.37	0.2	0.37	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethylbenzene	ug/g	300	0.082	0.05	0.082	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
o-Xylene	ug/g	350	11	0.05	11	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
p+m-Xylene	ug/g	350	11	0.05	11	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Xylenes	ug/g	350	11	0.05	11	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polycyclic Aromatic Hydrocarbons (PAHs)																								
1-Methylnaphthalene	ug/g	3600	-	0.59	3600	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Methylnaphthalene	ug/g	3600	-	0.59	3600	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acenaphthene	ug/g	46000	-	0.072	46000	(1)	0	0	0	0	0	0	0	0	0	0	0	0.066	0	0	0	0	0	0
Acenaphthylene	ug/g	2900	-	0.093	2900	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthracene	ug/g	32	32	0.16	32	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0.078	0	0	0	0	0	0
Benzo(a)anthracene	ug/g	1	10	0.36	1	(1,2)	0	0	0	0	0	0.003472	0	0.003772	0	0	0	0.081	0	0	0	0.0088	0	0
Benzo(a)pyrene	ug/g	72	72	0.3	72	(1,2)	0	0.0096	0	0	0.0062	0.0071	0.0062	0.011	0	0	0	0.086	0	0	0.0071	0.018	0	0.0065
Benzo(b/j)fluoranthene	ug/g	7600	10	0.47	10	(2)	0	0.013	0.004107	0.038078	0.011	0.013	0.0085	0.014	0	0	0	0.11	0	0	0.012	0.028	0	0.011
Benzo(e)pyrene	ug/g	-	-	-	-	-	0	0.015	0.0055	0	0.01	0.01	0.0073	0.013	0	0	0	0.08	0	0	0.011	0.025	0	0.017
Benzo(g,h,i)perylene	ug/g	13	-	0.68	13	(1)	0.003179	0.009	0	0	0.0072	0.0072	0.0052	0.01	0	0	0.045628	0.073	0	0	0.0095	0.019	0	0.008
Benzo(k)fluoranthene	ug/g	15	10	0.48	10	(2)	0	0	0	0	0	0.003518	0	0.0052	0	0	0	0.040772	0	0	0.004075	0.0081	0	0
Chrysene	ug/g	14	-	2.8	14	(1)	0	0.003636	0	0	0.0061	0.0052	0	0.0051	0	0	0	0.071	0	0	0.004551	0.011	0	0.0062
Dibenzo(a,h)anthracene	ug/g	7600	10	0.1	10	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluoranthene	ug/g	180	180	0.56	180	(1,2)	0	0.0053	0	0.052	0.0099	0.014	0.011	0.015	0	0	0	0.31	0	0	0.01	0.032	0	0.011
Fluorene	ug/g	2800	-	0.12	2800	(1)	0	0	0	0	0	0	0	0	0	0	0	0.07	0	0	0	0	0	0
Indeno(1,2,3-cd)pyrene	ug/g	0.76	10	0.23	0.76	(1)	0	0.004378	0	0	0.004418	0.0059	0.004221	0.0076	0	0	0	0.046121	0	0	0.0057	0.013	0	0.004774
Naphthalene	ug/g	22	22	0.09	22	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perylene	ug/g	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.003828	0	0.003647
Phenanthrene	ug/g	12	50	0.69	12	(1)	0	0.003666	0	0	0.0077	0.0064	0.004688	0.0062	0	0	0	0.42	0	0	0.0056	0.014	0	0.0082
Pyrene	ug/g	99000	100	1	100	(2)	0	0.0069	0	0.045657	0.0095	0.011	0.0096	0.013	0	0	0	0.24	0	0	0.0093	0.027	0	0.009
Volatile Organic Compounds (VOCs)																								
1,1,1,2-Tetrachloroethane	ug/g	4400	-	0.05	4400	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1,1-Trichloroethane	ug/g	35	50	0.05	35	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1,2,2-Tetrachloroethane	ug/g	6700	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1,2-Trichloroethane	ug/g	160	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1-Dichloroethane	ug/g	17	50	0.05	17	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,1-Dichloroethylene	ug/g	100	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,2-Dichlorobenzene	ug/g	6.8	10	0.05	6.8	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,2-Dichloroethane	ug/g	29	50	0.05	29	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,2-Dichloropropane	ug/g	50	50	0.05	50	(1,2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,3-Dichlorobenzene	ug/g	9.6	10	0.05	9.6	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,3-Dichloropropene (cis+trans)	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,4-Dichlorobenzene	ug/g	7.2	10	0.05	7.2	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acetone (2-Propanone)	ug/g	92000	-	0.5	92000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromodichloromethane	ug/g	5500	-	0.05	5500	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromoform	ug/g	11000	-	0.05	11000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bromomethane	ug/g	7300	-	0.05	7300	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Tetrachloride	ug/g	12	50	0.05	12	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlorobenzene	ug/g	12	10	0.05	10	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloroform	ug/g	68	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cis-1,2-Dichloroethylene	ug/g	4600	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
cis-1,3-Dichloropropene	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Parameters	Units	(1) MECP Eco CV	(2) CCME SQG	(3) ON Background	Selected Soil Screening Criteria	Source	GMS-28-1	GMS-28-2	GMS-28-3	GMS-31-1	GMS-31-2	GMS-31-3	GSM - 26	GSM - 38	SITE 14-SS5- 1	SITE 14-SS5- 2	SITE 14-SS5- 3	SITE 14-SS6- 1	SITE 14-SS6- 2	SITE 14-SS6- 3	SITE 15-1	SITE 15-2	SITE 15-3	SITE 7 - SS4
Dibromochloromethane	ug/g	10000	-	0.05	10000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dichlorodifluoromethane (FREON 12)	ug/g	80	-	0.05	80	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene Dibromide	ug/g	2000	-	0.05	2000	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hexane	ug/g	1500	6.5	0.05	6.5	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Ethyl Ketone (2-Butanone)	ug/g	70	-	0.5	70	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Isobutyl Ketone	ug/g	5100	-	0.5	5100	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methyl t-butyl ether (MTBE)	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Methylene Chloride (Dichloromethane)	ug/g	1.6	50	0.05	1.6	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Styrene	ug/g	34	50	0.05	34	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tetrachloroethylene	ug/g	34	0.6	0.05	0.6	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
trans-1,2-Dichloroethylene	ug/g	4600	50	0.05	50	(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
trans-1,3-Dichloropropene	ug/g	50	-	0.05	50	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichloroethylene	ug/g	200	0.01	0.05	0.05	(3)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichlorofluoromethane (FREON 11)	ug/g	32	-	0.25	32	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vinyl Chloride	ug/g	6.8	-	0.02	6.8	(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Radionuclides																								
Carbon-14	Bq/g	-	-	-	-	-	NV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon-14	Bq/kg-C	-	-	-	-	-	< 157	< 200	< 161	< 229	< 170	< 232	1193	904	< 108	< 165	< 182	< 155	< 228	< 175	< 106	215	< 145	258
Cesium-134	Bq/kg	-	-	-	-	-	0.35	0.299	0.197	0.218	0.465	0.801	0.225	0.579	0.284	0.0635	0.0486	0.191	0.126	0.149	0.374	0.3	0.152	0.37
Cesium-137	Bq/kg	-	-	-	-	-	-0.0689	0.231	0.0526	1.27	0.111	2.25	2.95	1.66	0.116	0.702	0.471	0.144	0.321	0.0154	0.13	0.773	0.556	0.671
Cobalt-60	Bq/kg	-	-	-	-	-	0.193	0.876	0.133	0.308	0.299	0.428	0.371	0.455	0.382	0.65	0.0239	0.34	0.162	0.508	1.34	0.0356	0.926	0.0282
Iodine-131	Bq/kg	-	-	-	-	-	-0.528	1.94	1.03	0.26	2.6	0.785	0.865	2.56	1.22	2.38	3.15	0.289	1.43	2.05	0.686	0.905	0.346	0.791
Potassium-40	Bq/kg	-	-	-	-	-	293	286	304	368	447	657	674	682	273	175	236	190	253	236	268	305	310	493
Thorium - Series	Bq/kg	-	-	-	-	-	6.75	8.13	5.52	1.2	13.6	25.2	25.4	24.9	3.8	5.78	5.96	4.5	8.56	4.61	5.03	9.62	11.2	15.5
Tritium (Hydrogen-3)	Bq/kg	-	-	-	-	-	11.8	17.4	16.1	11.1	19.7	32.8	154	140	57.7	30.3	103	133	10.1	9.97	42.3	40.4	30.4	31
Uranium - Series	Bq/kg	-	-	-	-	-	8	9.48	7.77	9.22	15.8	23	22.8	22.9	11	7.38	7.39	5.11	7.08	6.82	8.9	10.3	12.2	16
Other parameters																								
Total Carbon	mg/kg	-	-	-	-	-	42000	55000	57000	42000	53000	41000	41000	45000	76000	79000	50000	71000	57000	57000	72000	68000	60000	59000
Total Organic Carbon	mg/kg	-	-	-	-	-	5600	10000	9300	6800	21000	33000	26000	40000	7200	8700	11000	11000	10000	10000	28000	34000	22000	24000

Note:

Bold Exceeds selected screening criteria

Lowest of the Plants & Soil Organisms or Mammals & Birds Component Values were used from MOE 2011, Table 2 - Full Depth, Potable Water Scenario, Coarse soil, Commercial/Industrial Land Use.
Yellow highlighted values indicate exceedances of selected soil criteria. Sampling locations presented in **Figure 4-11**.
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A.4.1.1.2 Radiological Soil COPCs

Compared with the 2015 soil monitoring event, the maximum measured concentrations of C-14 and H-3 were found to have increased approximately 2.1- and 1.7-times, with the maximum concentrations being measured at the same sampling location (GMS-26) during both the 2015 and the recent 2024 soil monitoring program. Co-60, Cs-134 and Cs-137 were all previously reported as being measured below laboratory detection limits. Although detection limits in 2024 did change slightly, these radionuclides were measured above detection in some of the 2024 soil samples. Cs-137 is not specifically associated with PN operations and exists in the environment mainly as a result of historic atmospheric weapons testing. The maximum measured concentration of K-40 remains comparable between the previous and recent soil sampling events. The maximum concentration of I-131 was reported as below the laboratory detection limit. Lastly, the maximum reported concentrations for the Th-series and U-series naturally occurring radionuclides were 25.4 Bq/kg and 23 Bq/kg, respectively.

In general, K-40 is environmentally abundant and is not associated with station operations. The cesium and cobalt isotopes are included as COPCs to address potential concern about deposition of particulate activity. Only Cs-134 and Co-60 are specific to reactor operations, and these are usually not detected in PN's annual environmental monitoring program (Ecometrix, 2023a). The presence of Cs-137 is primarily due to historic atmospheric weapons test fallout and not reactor operations. However, exposure to Cs-134, Cs-137, and Co-60 in soil are included in the public dose calculations in the interest of public safety.

A.4.2 Groundwater

A.4.2.1 Groundwater Flow

Eight hydrostratigraphic units (HUs) have been identified beneath the PN site. The eight HUs have been grouped into four primary groundwater flow systems. These include the "shallow groundwater system" (HU 1-3); "intermediate overburden groundwater system" (HU 6); "deep overburden groundwater system" (HU 7) and the "shallow bedrock groundwater system" (HU 8). HUs 4 and 5 are not always observed, and where they are observed, are generally thin and are grouped into the shallow groundwater system. The shallow groundwater system is an aquifer, and the intermediate overburden and bedrock groundwater flow systems are considered to be aquitards. The deep overburden groundwater system may represent an aquifer; however, contaminant migration into this HU from overlying HUs is considered to be limited due to the low permeability of the till materials in HU 6.

Groundwater flow within the PN site is significantly influenced by the inactive Turbine Auxiliary Bay foundation drainage system located beneath the deep building foundations. The inactive Turbine Auxiliary Bay foundation drainage system is used to control groundwater beneath the building. Groundwater from the Turbine Auxiliary Bay foundation drains flows into each unit's sump and then is discharged via a monitored pathway to the intake channel via pumping. Groundwater from the granular horizons in the Lower Till and the granular foundation backfill is collected in the foundation drains. The drainage system has locally lowered groundwater levels

below the level of Lake Ontario, creating a hydraulic sink that captures groundwater beneath and immediately adjacent to the PN reactor buildings (SENES, 2007). Measured flow into the Turbine Auxiliary Bay foundation drains is on the order of about 25 and 77 m^3/day for PNGS Units 1-4 and U5-8, respectively. Estimated horizontal flow velocities in groundwater across the site range from 0.3 to 11 m/y (CH2M, 2000).

The vacuum building ramp sump (VBRS) is also a hydraulic sink for the south portion of the PNGS Units 1-4 side. The VBRS is located at the bottom of a truck ramp that is installed at basement elevation of the vacuum building and collects shallow groundwater in the vicinity of the building. During operations the groundwater collected in the VBRS is also discharged via a monitored pathway to the forebay.

Other subsurface features that have the potential to influence groundwater flow at the site include the RLWMS foundation drains and the reactor building (RB) foundation drains. The RLWMS foundation drains and sumps are located at a lower elevation than the TAB foundation drains. The RB foundation drains are installed at a higher elevation and may intercept shallow groundwater.

A.4.2.2 Groundwater Quality

A.4.2.2.1 Chemical COPCs in Groundwater

Screening benchmarks for non-radiological COPCs included Ontario MECP Site Condition Standards (SCS), specifically Table 3 (Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition) or Table 9 (Generic Site Condition Standards for Use within 30 m of a Water Body in a Non-Potable Ground Water Condition) standards (MOE, 2011). For substances without MECP SCS, groundwater data were compared against screening levels based on 10 times (10x) the lowest of the Ontario Provincial Water Quality Objectives (PWQO) and the CCME water quality guidelines. The 10x factor is consistent with the MECP derivation of the groundwater to surface water pathway component values (GW3), which assumes at least 10-fold dilution of groundwater in surface water (MOE, 2011).

A monitored natural attenuation program (MNA) was implemented in the Units 1 to 4 Standby Generators (SG-A) area, SG-A Overflow area, and the Units 5 to 8 Standby Generators (SG-B) area in 2011, following remedial activities. The SG-A area is monitored annually, the other areas are monitored biennially.

In total, within the MNA areas, one (1) monitoring well was sampled in 2021 and twenty-four (24) monitoring wells were sampled in 2022. Six (6) monitoring wells were monitored in 2023; however, consistent with the PN Sampling Analysis Plan and GWMP, none of the wells were sampled as free phase product was found in all six wells. Free phase product thicknesses were measured and were found to be comparable with historical monitoring results in recent years.

Concentrations of PHC F2 and PHC F3 were found to have exceeded their respective MECP SCS in both 2021 and 2022 at three MNA monitoring well locations. Similarly, in both 2021, and 2022, maximum concentrations of dissolved iron were also found to exceed the selected

screening criteria of 3,000 µg/L, derived by multiplying the Ontario PWQO value of 300 µg/L by a factor of 10 as described above. All exceedances were measured in close proximity to PNGS Units 1-4 and occurred in wells drilled to approximately the same depth (~15 m below ground surface). The localized presence of PHCs and iron at concentrations above the groundwater evaluation criteria are expected in these areas, where remediation using a natural monitored attenuation approach is ongoing.

In 2022, one monitoring well associated with each of the East and West Landfills was sampled for the analysis of dissolved iron (MW-024-20 and MW-205-35). Concentrations of iron were found to be 1,000 µg/L and 1,900 µg/L, respectively, and remained within the historical range and below the evaluation criteria of 3,000 µg/L.

Although there are exceedances reported for PHCs and dissolved iron, these chemical constituents are not expected to pose adverse effects to human health and the environment. As noted in the 2022 PN ERA, continued monitoring has shown that PHCs are not migrating from groundwater to the intake channel or Lake Ontario. Human receptors are restricted from accessing the intake channel and recreational activities would occur further out into the lake, away from any potential groundwater inputs to Lake Ontario. Furthermore, the nearest water supply plant (WSP) is situated approximately 7 km east of the PN site in Ajax, Ontario; concentrations of any COPCs in groundwater would thus be subject to considerable dilution before they could migrate to a point of water intake for human consumption. With respect to dissolved iron, no health risks are expected based on the same assumptions provided above. Furthermore, the Ontario PWQO from which the dissolved iron screening criteria is derived is based on the protection of freshwater aquatic life and is considered extremely conservative for assessing risk to humans.

Similarly, groundwater COPCs are not expected to pose any risks to ecological receptors at the PN site. Most terrestrial ecological receptors are unlikely to be exposed to groundwater as there is no reasonable complete exposure pathway. Continued monitoring has shown that aquatic receptors most at-risk of potentially contacting discharged groundwater (e.g., benthic invertebrates, bottom-feeding and pelagic fish in Lake Ontario) are not at risk as any groundwater COPCs discharging into the lake are sufficiently diluted and COPC concentrations within sampled lake water are consistently measured below screening guidelines protective of ecological health.

A.5 References

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Appendix B Hazard Quotients for Atmospheric COPCs for Human Health Air Quality Screening

Table B-1: Hazard Quotients for TSP during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr TSP (Total)	Annual TSP (Total)
		unitless	unitless
R1	Local Harvesting Area 1 [a]	**2.6**	0.4
R2	Local Harvesting Area 2 [a]	**2.4**	0.4
R3	Local Harvesting Area 3 [a]	**2.5**	0.4
R20	Industrial/Commercial Worker	**13.7**	0.8
R21	Sport Fisher	0.8	0.4
R22	Correctional Institute (C2)	**1.0**	0.4
R23	Farm	0.7	0.4
R24	Dairy Farm	0.5	0.4
R25	Urban Resident/Harvester [b] (WNW)	**2.0**	0.4
R26	Urban Resident/Harvester [b] (NW)	**2.2**	0.4
R27	Urban Resident/Harvester [b] (NNW)	**2.5**	0.4

Note:
Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-2: Hazard Quotients for PM_{10} during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr PM10 (Total)
		unitless
R1	Local Harvesting Area 1 [a]	**1.5**
R2	Local Harvesting Area 2 [a]	**1.4**
R3	Local Harvesting Area 3 [a]	**1.4**
R20	Industrial/Commercial Worker	**6.6**
R21	Sport Fisher	0.7
R22	Correctional Institute (C2)	0.8
R23	Farm	0.6
R24	Dairy Farm	0.5
R25	Urban Resident/Harvester [b] (WNW)	**1.2**
R26	Urban Resident/Harvester [b] (NW)	**1.3**
R27	Urban Resident/Harvester [b] (NNW)	**1.4**

Note:
Highlighted cell indicates HQ>1.

[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-3: Hazard Quotients for $PM_{2.5}$ during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr $PM_{2.5}$ (Total)	Annual $PM_{2.5}$ (Total)
		unitless	unitless
R1	Local Harvesting Area 1 [a]	0.9	0.8
R2	Local Harvesting Area 2 [a]	0.8	0.8
R3	Local Harvesting Area 3 [a]	0.9	0.8
R20	Industrial/Commercial Worker	**3.2**	0.9
R21	Sport Fisher	0.5	0.8
R22	Correctional Institute (C2)	0.6	0.8
R23	Farm	0.5	0.8
R24	Dairy Farm	0.4	0.8
R25	Urban Resident/Harvester [b] (WNW)	0.8	0.8
R26	Urban Resident/Harvester [b] (NW)	0.8	0.8
R27	Urban Resident/Harvester [b] (NNW)	0.8	0.8

Note:
Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-4: Hazard Quotients for NO_2 during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	98th-% 1-hr NO_2 (Total)	Max 1-hr NO_2 (Total)	Max 24-hr NO_2 (Total)	Annual NO_2 (Total)
		unitless	unitless	unitless	unitless
R1	Local Harvesting Area 1 [a]	0.8	0.7	0.3	0.5
R2	Local Harvesting Area 2 [a]	0.8	0.7	0.3	0.5
R3	Local Harvesting Area 3 [a]	0.8	0.6	0.3	0.5
R20	Industrial/Commercial Worker	**1.1**	0.7	0.3	0.5
R21	Sport Fisher	**1.7**	0.4	0.4	0.6
R22	Correctional Institute (C2)	0.6	0.4	0.2	0.4
R23	Farm	0.6	0.2	0.1	0.4
R24	Dairy Farm	0.6	0.2	0.1	0.4
R25	Urban Resident/Harvester [b] (WNW)	0.9	0.6	0.3	0.5
R26	Urban Resident/Harvester [b] (NW)	0.8	0.6	0.2	0.5
R27	Urban Resident/Harvester [b] (NNW)	0.8	0.7	0.3	0.5

Note:

Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Table B-5: Hazard Quotients for BaP during PNGS Units 5-8 Refurbishment

Receptor ID	Receptor Name	Max 24-hr BaP (Total)	Annual BaP (Total)
		unitless	unitless
R1	Local Harvesting Area 1 [a]	0.8	**2.0**
R2	Local Harvesting Area 2 [a]	0.8	**2.0**
R3	Local Harvesting Area 3 [a]	0.8	**2.0**
R20	Industrial/Commercial Worker	0.8	**2.0**
R21	Sport Fisher	0.8	**2.0**
R22	Correctional Institute (C2)	0.8	**2.0**
R23	Farm	0.8	**2.0**
R24	Dairy Farm	0.8	**2.0**
R25	Urban Resident/Harvester [b] (WNW)	0.8	**2.0**
R26	Urban Resident/Harvester [b] (NW)	0.8	**2.0**
R27	Urban Resident/Harvester [b] (NNW)	0.8	**2.0**

Note:
Highlighted cell indicates HQ>1.
[a] Represents a location where the Harvester is assumed to engage in traditional harvesting activities.
[b] Represents modelled concentrations experienced by the Urban Resident/Harvester assuming the specified predominant wind direction.

Appendix C Predicted Radiation Dose to Human Receptors

Table C-1: Estimated Radiation Dose by Pathway to Human Receptors

Human Receptor	COPC	Radiological Dose by Pathway during Project Phases (μSv/a)												
		Air (internal)	Air (external)	Water (internal)	Water (external)	Soil (internal)	Soil (external)	Sediment (internal)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total by COPC
Farm NE - Adult	C-14	5.19E-06	5.97E-09	1.32E-06	1.33E-10	8.36E-14	3.78E-12	5.22E-10	2.78E-10	0.00E+00	4.27E-04	8.61E-04	3.55E-04	1.65E-03
	Cs-134	0.00E+00	0.00E+00	6.96E-05	1.40E-05	1.80E-10	5.22E-05	6.50E-06	1.55E-02	0.00E+00	1.29E-02	1.10E-05	1.16E-07	2.85E-02
	HTO	7.71E-02	0.00E+00	2.77E-02	9.03E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.26E-05	5.38E-02	4.25E-03	1.64E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-05	7.03E-03	6.90E-04	7.74E-03
	Total by pathway	7.71E-02	5.97E-09	2.78E-02	9.17E-04	1.80E-10	5.22E-05	6.50E-06	1.55E-02	0.00E+00	1.34E-02	6.17E-02	5.30E-03	2.02E-01
Farm NE - Child 10y	C-14	7.41E-06	5.97E-09	7.22E-07	1.33E-10	1.58E-12	3.78E-12	9.90E-09	2.78E-10	0.00E+00	4.14E-04	8.37E-04	2.69E-04	1.53E-03
	Cs-134	0.00E+00	0.00E+00	2.04E-05	1.40E-05	1.83E-09	5.22E-05	6.58E-05	1.55E-02	0.00E+00	6.67E-03	5.40E-06	4.63E-08	2.23E-02
	HTO	9.17E-02	0.00E+00	1.38E-02	7.52E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.74E-05	4.56E-02	2.92E-03	1.55E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-05	6.79E-03	5.22E-04	7.33E-03
	Total by pathway	9.17E-02	5.97E-09	1.38E-02	7.66E-04	1.83E-09	5.22E-05	6.58E-05	1.55E-02	0.00E+00	7.14E-03	5.33E-02	3.72E-03	1.86E-01
Farm NE - Infant 1y	C-14	5.06E-06	5.97E-09	0.00E+00	5.43E-12	3.52E-12	3.78E-12	2.20E-08	2.78E-10	0.00E+00	2.89E-04	7.10E-04	1.80E-04	1.18E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	5.94E-07	2.31E-09	6.79E-05	8.34E-05	2.02E-02	0.00E+00	2.66E-03	2.81E-06	1.71E-08	2.30E-02
	HTO	6.33E-02	0.00E+00	0.00E+00	3.56E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.76E-05	4.30E-02	2.23E-03	1.09E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-05	5.94E-03	4.06E-04	6.36E-03
	Total by pathway	6.33E-02	5.97E-09	0.00E+00	3.56E-04	2.32E-09	6.79E-05	8.35E-05	2.02E-02	0.00E+00	2.99E-03	4.97E-02	2.82E-03	1.39E-01
Dairy Farm - Adult	C-14	1.56E-06	1.79E-09	1.74E-07	1.28E-10	0.00E+00	0.00E+00	5.22E-10	2.78E-10	0.00E+00	0.00E+00	2.26E-04	5.54E-04	7.82E-04
	Cs-134	0.00E+00	0.00E+00	8.65E-06	1.35E-05	0.00E+00	0.00E+00	6.50E-06	1.55E-02	0.00E+00	0.00E+00	0.00E+00	1.70E-09	1.55E-02
	HTO	2.33E-02	0.00E+00	6.78E-03	4.31E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.86E-03	1.13E-02	4.96E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-03	7.88E-04	1.88E-03
	Total by pathway	2.33E-02	1.79E-09	6.79E-03	4.44E-04	0.00E+00	0.00E+00	6.50E-06	1.55E-02	0.00E+00	0.00E+00	9.18E-03	1.27E-02	6.78E-02
Dairy Farm - Child 10y	C-14	2.22E-06	1.79E-09	9.57E-08	1.28E-10	0.00E+00	0.00E+00	9.90E-09	2.78E-10	0.00E+00	0.00E+00	2.21E-04	6.14E-04	8.37E-04
	Cs-134	0.00E+00	0.00E+00	2.54E-06	1.35E-05	0.00E+00	0.00E+00	6.58E-05	1.55E-02	0.00E+00	0.00E+00	0.00E+00	5.94E-10	1.56E-02
	HTO	2.77E-02	0.00E+00	3.37E-03	3.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.63E-03	1.50E-02	5.31E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-03	7.59E-04	1.82E-03
	Total by pathway	2.77E-02	1.79E-09	3.38E-03	3.72E-04	0.00E+00	0.00E+00	6.58E-05	1.55E-02	0.00E+00	0.00E+00	7.91E-03	1.64E-02	7.13E-02
Dairy Farm - Infant 1y	C-14	1.52E-06	1.79E-09	0.00E+00	9.99E-14	0.00E+00	0.00E+00	2.20E-08	2.78E-10	0.00E+00	0.00E+00	1.64E-04	8.55E-04	1.02E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.34E-05	2.02E-02	0.00E+00	0.00E+00	0.00E+00	4.35E-10	2.02E-02
	HTO	1.91E-02	0.00E+00	0.00E+00	1.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-03	2.83E-02	5.28E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.13E-04	9.92E-04	1.80E-03
	Total by pathway	1.91E-02	1.79E-09	0.00E+00	1.00E-04	0.00E+00	0.00E+00	8.35E-05	2.02E-02	0.00E+00	0.00E+00	6.26E-03	3.01E-02	7.58E-02
FSHR - Adult	C-14	3.71E-06	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.07E-03	0.00E+00	0.00E+00	9.08E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-01	0.00E+00	0.00E+00	2.74E-01
	HTO	5.60E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.03E-04	0.00E+00	0.00E+00	5.69E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.88E-04	0.00E+00	0.00E+00	3.88E-04
	Total by pathway	5.60E-02	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.84E-01	0.00E+00	0.00E+00	3.40E-01
FSHR - Child 10y	C-14	5.29E-06	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.79E-03	0.00E+00	0.00E+00	8.80E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-01	0.00E+00	0.00E+00	1.42E-01
	HTO	6.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.93E-04	0.00E+00	0.00E+00	6.74E-02

Human Receptor	COPC	Radiological Dose by Pathway during Project Phases (μSv/a)												
		Air (internal)	Air (external)	Water (internal)	Water (external)	Soil (internal)	Soil (external)	Sediment (internal)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total by COPC
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.73E-04	0.00E+00	0.00E+00	3.73E-04
	Total by pathway	6.66E-02	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-01	0.00E+00	0.00E+00	2.18E-01
FSHR - Infant 1y	C-14	3.61E-06	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.13E-03	0.00E+00	0.00E+00	6.13E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.64E-02	0.00E+00	0.00E+00	5.64E-02
	HTO	4.59E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.86E-04	0.00E+00	0.00E+00	4.65E-02
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-04	0.00E+00	0.00E+00	2.68E-04
	Total by pathway	4.59E-02	4.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.34E-02	0.00E+00	0.00E+00	1.09E-01
Urban Resident WNW - Adult	C-14	6.05E-05	6.96E-08	5.49E-06	2.30E-10	9.19E-13	4.16E-11	5.22E-10	2.78E-10	0.00E+00	6.35E-06	8.01E-04	6.87E-08	8.73E-04
	Cs-134	0.00E+00	0.00E+00	2.99E-04	2.26E-05	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.92E-04	8.97E-06	5.05E-12	1.66E-02
	HTO	8.88E-01	0.00E+00	1.18E-02	5.66E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.32E-07	2.93E-02	1.91E-06	9.30E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E-07	3.95E-03	4.31E-07	3.95E-03
	Total by pathway	8.88E-01	6.96E-08	1.21E-02	5.89E-04	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.99E-04	3.40E-02	2.41E-06	9.51E-01
Urban Resident WNW - Child 10y	C-14	8.63E-05	6.96E-08	3.01E-06	2.30E-10	1.74E-11	4.16E-11	9.90E-09	2.78E-10	0.00E+00	6.15E-06	7.82E-04	7.29E-08	8.77E-04
	Cs-134	0.00E+00	0.00E+00	8.78E-05	2.26E-05	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	9.92E-05	4.36E-06	2.19E-12	1.64E-02
	HTO	1.06E+00	0.00E+00	5.89E-03	4.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55E-07	2.47E-02	1.72E-06	1.09E+00
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.61E-07	3.83E-03	4.25E-07	3.83E-03
	Total by pathway	1.06E+00	6.96E-08	5.98E-03	4.94E-04	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	1.06E-04	2.93E-02	2.22E-06	1.11E+00
Urban Resident WNW - Infant 1y	C-14	5.89E-05	6.96E-08	0.00E+00	2.63E-11	3.87E-11	4.16E-11	2.20E-08	2.78E-10	0.00E+00	4.29E-06	6.11E-04	1.03E-07	6.75E-04
	Cs-134	0.00E+00	0.00E+00	0.00E+00	3.01E-06	2.55E-08	7.47E-04	8.34E-05	2.02E-02	0.00E+00	3.95E-05	2.05E-06	1.26E-12	2.10E-02
	HTO	7.29E-01	0.00E+00	0.00E+00	2.27E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.10E-07	2.13E-02	2.42E-06	7.50E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E-07	3.10E-03	5.81E-07	3.10E-03
	Total by pathway	7.29E-01	6.96E-08	0.00E+00	2.30E-04	2.55E-08	7.47E-04	8.35E-05	2.02E-02	0.00E+00	4.44E-05	2.51E-02	3.10E-06	7.75E-01
Harvester -Adult	C-14	7.00E-05	8.05E-08	5.49E-06	2.30E-10	9.19E-13	4.16E-11	5.22E-10	2.78E-10	0.00E+00	5.00E-03	6.85E-04	5.38E-03	1.11E-02
	Cs-134	0.00E+00	0.00E+00	2.99E-04	2.26E-05	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.51E-01	1.16E-05	4.92E-04	1.68E-01
	HTO	1.03E+00	0.00E+00	1.30E-02	5.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.98E-04	3.28E-02	2.20E-02	1.10E+00
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E-04	3.28E-03	3.47E-03	6.96E-03
	Total by pathway	1.03E+00	8.05E-08	1.33E-02	6.22E-04	1.98E-09	5.74E-04	6.50E-06	1.55E-02	0.00E+00	1.56E-01	3.68E-02	3.14E-02	1.28E+00
Harvester - Child 10y	C-14	9.99E-05	8.05E-08	3.02E-06	2.30E-10	1.74E-11	4.16E-11	9.90E-09	2.78E-10	0.00E+00	4.84E-03	5.13E-04	3.68E-03	9.13E-03
	Cs-134	0.00E+00	0.00E+00	8.78E-05	2.26E-05	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	7.80E-02	4.64E-06	2.02E-04	9.44E-02
	HTO	1.22E+00	0.00E+00	6.46E-03	4.99E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.37E-04	2.23E-02	1.22E-02	1.26E+00
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-04	2.44E-03	2.08E-03	4.73E-03
	Total by pathway	1.22E+00	8.05E-08	6.55E-03	5.22E-04	2.01E-08	5.74E-04	6.58E-05	1.55E-02	0.00E+00	8.35E-02	2.52E-02	1.81E-02	1.37E+00
Harvester - Infant 1y	C-14	6.82E-05	8.05E-08	0.00E+00	2.63E-11	3.87E-11	4.16E-11	2.20E-08	2.78E-10	0.00E+00	3.37E-03	3.73E-05	2.65E-03	6.13E-03
	Cs-134	0.00E+00	0.00E+00	0.00E+00	3.01E-06	2.55E-08	7.47E-04	8.34E-05	2.02E-02	0.00E+00	3.11E-02	1.93E-07	8.46E-05	5.21E-02
	HTO	8.42E-01	0.00E+00	0.00E+00	2.56E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.23E-04	1.72E-03	9.11E-03	8.53E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E-04	1.83E-04	1.52E-03	1.85E-03
	Total by pathway	8.42E-01	8.05E-08	0.00E+00	2.59E-04	2.55E-08	7.47E-04	8.35E-05	2.02E-02	0.00E+00	3.49E-02	1.94E-03	1.34E-02	9.13E-01
Industrial - Adult	C-14	1.50E-05	1.73E-08	1.52E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.66E-05
	Cs-134	0.00E+00	0.00E+00	8.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.29E-05

Human Receptor	COPC	Radiological Dose by Pathway during Project Phases (µSv/a)												
		Air (internal)	Air (external)	Water (internal)	Water (external)	Soil (internal)	Soil (external)	Sediment (internal)	Sediment (external)	Aquatic plants	Aquatic animals	Terrestrial plants	Terrestrial animals	Total by COPC
	HTO	2.18E-01	0.00E+00	1.24E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total by pathway	2.18E-01	1.73E-08	1.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-01
C2 - Adult	C-14	1.21E-05	1.39E-08	6.61E-06	2.67E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.87E-05
	Cs-134	0.00E+00	0.00E+00	3.61E-04	2.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.63E-04
	HTO	1.79E-01	0.00E+00	5.39E-03	4.57E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total by pathway	1.79E-01	1.39E-08	5.76E-03	4.81E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.85E-01
C2 - Child 10y	C-14	1.73E-05	1.39E-08	3.63E-06	2.67E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.09E-05
	Cs-134	0.00E+00	0.00E+00	1.06E-04	2.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-04
	HTO	2.13E-01	0.00E+00	2.68E-03	3.81E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-01
	OBT	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Total by pathway	2.13E-01	1.39E-08	2.79E-03	4.05E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-01

Table C-2: Concentrations of Radionuclides in Environmental Media

Environmental Media	Location	Unit	Estimated Point Concentrations of Radionuclides			
			C-14	Cs-134	HTO	OBT
Outdoor air	Farm NE	Bq/m3	7.28E-05	0.00E+00	4.32E-01	0.00E+00
	Dairy Farm	Bq/m3	2.18E-05	0.00E+00	1.30E-01	0.00E+00
	Sport Fisher	Bq/m3	5.19E-03	0.00E+00	3.14E+01	0.00E+00
	Urban Resident WNW	Bq/m3	8.47E-04	0.00E+00	4.98E+00	0.00E+00
	Harvester	Bq/m3	9.81E-04	0.00E+00	5.75E+00	0.00E+00
	Industrial	Bq/m3	9.15E-04	0.00E+00	5.30E+00	0.00E+00
	C2	Bq/m3	1.69E-04	0.00E+00	1.00E+00	0.00E+00
	On-Site Worker	Bq/m3	4.49E-03	0.00E+00	2.62E+01	0.00E+00
Loam	Farm NE	Bq/kg(dw)	2.67E-07	1.76E-05	0.00E+00	0.00E+00
	Dairy Farm	Bq/kg(dw)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Urban Resident WNW	Bq/kg(dw)	2.93E-06	1.93E-04	0.00E+00	0.00E+00
	Harvester	Bq/kg(dw)	2.93E-06	1.93E-04	0.00E+00	0.00E+00
	C2	Bq/kg(dw)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Deep Well	Well (11.3) in Farm NE	Bq/L	3.93E-07	0.00E+00	9.97E+00	0.00E+00
	Well (22.2) in Farm NE	Bq/L	3.72E-07	0.00E+00	5.18E+00	0.00E+00
	Well (25.1) in Farm NE	Bq/L	3.67E-07	0.00E+00	4.35E+00	0.00E+00
	Well (40.6) in Farm NE	Bq/L	3.39E-07	0.00E+00	1.72E+00	0.00E+00
Loam PoreWater	Dairy Farm	Bq/L	1.25E-07	0.00E+00	5.92E+00	0.00E+00
	Harvester	Bq/L	5.60E-06	5.22E-07	2.61E+02	0.00E+00
Deep Well	Well (21.6) in Dairy Farm	Bq/L	1.12E-07	0.00E+00	1.62E+00	0.00E+00
	Well (22.1) in Dairy Farm	Bq/L	1.12E-07	0.00E+00	1.57E+00	0.00E+00
	Well (24.7) in Dairy Farm	Bq/L	1.10E-07	0.00E+00	1.35E+00	0.00E+00
Well	Well (9.2) in Harvester	Bq/L	5.35E-06	0.00E+00	1.50E+02	0.00E+00
	Well (10.4) in Harvester	Bq/L	5.32E-06	0.00E+00	1.40E+02	0.00E+00
LakeShore Water	Outfall	Bq/L	4.00E-04	6.00E-04	8.78E+00	0.00E+00
Lake Sediment	Outfall	Bq/kg(dw)	2.00E-02	5.70E+00	0.00E+00	0.00E+00
LakeShore Water	A-WSP	Bq/L	3.00E-05	5.00E-05	7.10E-01	0.00E+00

Table C-3: Concentrations of Radionuclides in Food Items

Food Item	Location	Unit	Estimated Point Concentrations of Radionuclides in Food Items for Human Receptors			
			C-14	Cs-134	HTO	OBT
Beef(meat)	Farm NE	Bq/kg(fw)	6.91E-02	8.51E-07	2.50E+01	1.58E+00
Deer	Farm NE	Bq/kg(fw)	6.96E-02	4.82E-07	1.53E+01	1.05E+00
Poultry(egg)	Farm NE	Bq/kg(fw)	1.45E-02	4.94E-08	1.34E+01	1.31E+00
Poultry(meat)	Farm NE	Bq/kg(fw)	2.26E-02	3.33E-07	1.34E+01	1.57E+00
Fruits	Farm NE	Bq/kg(fw)	1.73E-02	9.75E-06	4.10E+01	1.78E+00
Potatoes	Farm NE	Bq/kg(fw)	3.64E-02	4.79E-06	3.60E+01	3.75E+00
Garden Vegetables	Farm NE	Bq/kg(fw)	1.73E-02	9.75E-06	4.10E+01	1.78E+00
Honey Bee	Farm NE	Bq/kg(fw)	1.73E-01	5.30E-08	1.07E+02	1.05E+01
Beef(meat)	Dairy Farm	Bq/kg(fw)	1.96E-02	0.00E+00	6.14E+00	3.23E-01
Poultry(egg)	Dairy Farm	Bq/kg(fw)	0.00E+00	0.00E+00	1.25E+00	1.09E-01
Poultry(meat)	Dairy Farm	Bq/kg(fw)	0.00E+00	0.00E+00	1.25E+00	1.38E-01
Cow(milk)	Dairy Farm	Bq/kg(fw)	6.33E-03	0.00E+00	7.46E+00	7.41E-02
Fruits	Dairy Farm	Bq/kg(fw)	5.19E-03	0.00E+00	7.25E+00	3.16E-01
Potatoes	Dairy Farm	Bq/kg(fw)	1.09E-02	0.00E+00	6.36E+00	6.63E-01
Garden Vegetables	Dairy Farm	Bq/kg(fw)	5.19E-03	0.00E+00	7.25E+00	3.16E-01
Fruits	Urban Resident WNW	Bq/kg(fw)	2.02E-01	1.04E-04	2.80E+02	1.22E+01
Potatoes	Urban Resident WNW	Bq/kg(fw)	4.24E-01	5.13E-05	2.46E+02	2.56E+01
Garden Vegetables	Urban Resident WNW	Bq/kg(fw)	2.02E-01	1.04E-04	2.80E+02	1.22E+01
Deer	Harvester	Bq/kg(fw)	9.39E-01	5.30E-06	2.04E+02	1.40E+01
Deer Organ	Harvester	Bq/kg(fw)	9.39E-01	4.80E-06	2.04E+02	1.40E+01
Canada Goose	Harvester	Bq/kg(fw)	1.14E+00	2.56E-06	2.06E+02	1.25E+01
Mallard	Harvester	Bq/kg(fw)	1.61E+01	1.00E-01	1.33E+01	8.72E-01
Rabbit	Harvester	Bq/kg(fw)	9.39E-01	5.06E-04	2.01E+02	1.50E+01
Garden Vegetables	Harvester	Bq/kg(fw)	2.02E-01	1.04E-04	2.80E+02	1.22E+01
Freshwater plant	Outfall	Bq/kg(fw)	2.36E+00	1.32E-01	6.59E+00	9.66E-01
Freshwater Invertebrate	Outfall	Bq/kg(fw)	2.24E+00	5.94E-02	6.59E+00	1.23E+00
Walleye	Outfall	Bq/kg(fw)	2.28E+00	2.10E+00	6.59E+00	1.23E+00

Appendix D Sample Calculations

Table D-1: Harvester Adult Radiological Dose for HTO from PN Emissions

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Environmental Media Concentrations					
Well (9.2) Bath	$C_{w(B)}$	-	1.50E+02	Bq/L	Table C-2
Well (10.4) DW	$C_{w(D)}$	-	1.40E+02	Bq/L	Table C-2
Ajax WSP	$C_{w(A)}$	-	7.10E-01	Bq/L	Table C-2
Lakeshore Water (At Beach)	$C_{w(L)}$	-	3.33E+00	Bq/L	Table 6-6
Loam Pore Water	$C_{w(P)}$	-	2.61E+02	Bq/L	Table C-2
Sediment Concentration	$C_{sed(dw)}$	-	0.00E+00	Bq/kg_{dw}	Table C-2
Soil Concentration (dry weight)	$C_{s(dw)}$	-	0.00E+00	Bq/kg_{dw}	Table C-2
Outdoor Air Concentration	C_a	-	5.75E+00	Bq/m^3	Table 6-7
Soil Dry Bulk Density (Loam)	ρ_s	-	1.30E+00	kg_{dw}/L	CSA N288.1:20
Soil Mixing Depth	d	-	2.00E-01	m	CSA N288.1:20
Soil Surface Concentration	C_{ss}	$C_{ss} = C_{s(dw)} * \rho_s * d * 1000\ L/m^3$	0.00E+00	Bq_{dw}/m^2	Calculated
Sediment Mixing Depth	d'	-	5.00E-02	m	Assumed
Polygon Fraction Outdoor Air	Pf_a	-	1.00E+00	Unitless	Assumed
Polygon Fraction Soil	PF_s	-	1.00E+00	Unitless	Assumed
Polygon Fraction Water	PF_w	-	1.00E+00	Unitless	Assumed
Polygon Fraction Lake Sediment in Beach	PF_L	-	1.00E+00	Unitless	Assumed
Air Immersion Dose					
Fraction of Time at Location	f_o	-	1.00E+00	Unitless	Assumed
Outdoor Occupancy Factor	f_u	-	2.00E-01	Unitless	CSA N288.1:20
Building Shielding Factor	S_b	-	5.00E-01	Unitless	CSA N288.1:20
Dose Conversion Factor (Immersion)	DCF_a	-	0.00E+00	$(Sv/a)/(Bq/m^3)$	CSA N288.1:20
Air Immersion Dose	D_a	$D_a = C_a * f_o * (f_u + (1 - f_u) * S_b) * DCF_a * PF_a$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{a'}$	$D_{a'} = D_a * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Air Inhalation Dose					
Inhalation Rate	IR_i	-	5.95E+03	m^3/a	CSA N288.1:20

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Dose Conversion Factor (Inhalation)	DCF_i	-	3.00E-11	Sv/Bq	CSA N288.1:20
Air Inhalation Dose	D_i	$D_i = C_a * IR_i * DCF_i * PF_a$	1.03E-06	Sv/a	Calculated
Unit conversion	$D_{i'}$	$D_{i'} = D_i * 1000$ mSv / Sv	1.03E-03	mSv/a	Calculated
Water Immersion Dose					
Diffusion through Wetted Skin	D_f	-	1.05E+02	$L/m^2/a$	CSA N288.1:20
Skin surface area	S_a	-	2.19E+00	m^2	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Occupancy Factor - Bath Water	OF_B	-	1.40E-02	Unitless	CSA N288.1:20
Occupancy Factor - Pool Water	OF_P	-	2.80E-02	Unitless	CSA N288.1:20
Occupancy Factor - Swimming Surface Water (Beach)	OF_S	-	1.40E-02	Unitless	CSA N288.1:20
Removal Factor (Sedimentation)	ρ	-	1.00E+00	Unitless	CSA N288.1:20
Well (9.2) Bath					
Water Use Fraction - Well (9.2) Bath (Bathing)	F_B	-	1.70E-02	Unitless	Assumed
Water Immersion Dose - Well (9.2) Bath (Bathing)	$D_{w(B)}$	$D_{w(B)} = C_{w(B)} * F_B * D_f * S_a * DCF_f * OF_B * \rho$	1.65E-10	Sv/a	Calculated
Unit Conversion	$D_{w(B)'}$	$D_{w(B)'} = D_{w(B)} * 1000$ mSv / Sv	1.65E-07	mSv/a	Calculated
Ajax WSP					
Water Use Fraction - Ajax WSP (Bathing)	F_A	-	9.79E-01	Unitless	Assumed
Water Use Fraction - Ajax WSP (Pool Swimming)	$F_{A'}$	-	1.00E+00	Unitless	Assumed
Bath Immersion Dose - Ajax WSP	$D_{w(AB)}$	$D_{w(AB)} = C_{w(A)} * F_A * D_f * S_a * DCF_f * OF_B * \rho$	4.48E-11	Sv/a	Calculated
Pool Immersion Dose - Ajax WSP	$D_{w(AP)}$	$D_{w(AP)} = C_{w(A)} * F_{A'} * D_f * S_a * DCF_f * OF_P * \rho$	9.14E-11	Sv/a	Calculated
Water Immersion Dose - Ajax WSP	$D_{w(A)}$	$D_{w(A)} = D_{w(AB)} + D_{w(AP)}$	1.36E-10	Sv/a	Calculated
Unit Conversion	$D_{w(A)'}$	$D_{w(A)'} = D_{w(A)} * 1000$ mSv / Sv	1.36E-07	mSv/a	Calculated
Lakeshore Water					
Water Use Fraction - Lakeshore Water (Beach Swimming)	F_L	-	1.00E+00	Unitless	Assumed
Water Immersion Dose - Lakeshore Water (Beach Swimming)	$D_{w(L)}$	$D_{w(L)} = C_{w(L)} * F_L * D_f * S_a * DCF_f * OF_S$	2.14E-10	Sv/a	Calculated
Unit Conversion	$D_{w(L)'}$	$D_{w(L)'} = D_{w(L)} * 1000$ mSv / Sv	2.14E-07	mSv/a	Calculated

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Loam Pore Water					
Water Use Fraction - Loam Pore Water (Bathing)	$F_{B''}$	-	5.00E-03	Unitless	Assumed
Water Immersion Dose - Loam Pore Water (Bathing)	$D_{w(P)}$	$D_{w(P)} = C_{w(P)} * F_{B''} * D_f * S_a * DCF_f * OF_B * \rho$	8.41E-11	Sv/a	Calculated
Unit Conversion	$D_{w(P)'}$	$D_{w(P)'} = D_{w(P)} * 1000$ mSv / Sv	8.41E-08	mSv/a	Calculated
Total Water Immersion Dose					
Total Immersion Dose from Water	D_w	$D_w = D_{w(B)} + D_{w(A)} + D_{w(L)} + D_{w(P)}$	5.99E-10	Sv/a	Calculated
Unit conversion	$D_{w'}$	$D_{w'} = D_w * 1000$ mSv / Sv	5.99E-07	mSv/a	Calculated
Water Ingestion Dose					
Water Ingestion Rate	IR_w	-	3.80E+02	L/a	CSA N288.1:20
Fraction from Water Source - Well (10.4) DW	F_{ing}	-	8.00E-03	Unitless	Assumed
Fraction from Water Source - Ajax WSP	$F_{ing'}$	-	8.30E-01	Unitless	Assumed
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Water Ingestion Dose	D_{ing}	$D_{ing} = (C_{w(D)} * F_{ing} + C_{w(A)} * F_{ing'}) * IR_w * DCF_f * PF_w$	1.30E-08	Sv/a	Calculated
Unit Conversion	$D_{ing'}$	$D_{ing'} = D_{ing} * 1000$ mSv / Sv	1.30E-05	mSv/a	Calculated
Sediment External Dose					
Shoreline Occupancy Factor	OF_s	-	2.00E-04	Unitless	CSA N288.1:20
Shoreline Width Factor	W	-	3.00E-01	Unitless	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Sediment Dilution Factor	DF_s	-	1.00E+00	Unitless	CSA N288.1:20
Sediment External Dose	D_s	$D_s = C_{sed(dw)} * OF_s * W * DCF_f * DF_s$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{s'}$	$D_{s'} = D_s * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Sediment Ingestion Dose					
Sediment Ingestion Rate	IR_{SD}	-	4.00E-06	kg/a fw	CSA N288.1:20
Sediment Exposure Frequency	EF_{sed}	-	4.50E+01	d/y	CSA N288.1:20
Sediment Dilution Factor	DF_s	-	1.00E+00	Unitless	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Internal Sediment Dose	D_{sed}	$D_{sed} = C_{sed(dw)} * IR_{SD} * EF_{sed} * DCF_f * DF_s$	0.00E+00	Sv/a	Calculated

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Unit conversion	$D_{sed'}$	$D_{sed'} = D_{sed} * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Soil External Dose					
Dose reduction factor from surface roughness and terrain irregularities	f_r	-	6.80E-01	Unitless	CSA N288.1:20
Groundshine Shielding Factor	S_g	-	2.00E-01	Unitless	CSA N288.1:20
Dose Conversion Factor (Soil)	DCF_g	-	0.00E+00	(Sv/a)/(Bq/m2)	CSA N288.1:20
Soil External Dose	D_g	$D_g = C_{ss} * f_o * f_r * (f_u + (1 - f_u) * S_g) * DCF_g * PF_s$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{g'}$	$D_{g'} = D_g * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Soil Ingestion Dose					
Soil Intake Rate	IR_s	-	4.00E-06	kg(dw)/d	CSA N288.1:20
Soil Exposure Frequency	t_d	-	1.35E+02	d/y	CSA N288.1:20
Dose Conversion Factor (Ingestion)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Internal Soil Dose	D_{soil}	$D_{soil} = C_{s(dw)} * IR_s * t_d * DCF_f * PF_s$	0.00E+00	Sv/a	Calculated
Unit conversion	$D_{soil'}$	$D_{soil'} = D_{soil} * 1000$ mSv / Sv	0.00E+00	mSv/a	Calculated
Terrestrial Plants Dose					
Garden Vegetables Concentration	$C_{GV(DF)}$	-	2.80E+02	Bq/kg fw	Table C-3
Food Intake (Terrestrial Plants)	IR_{TP}	-	4.40E+02	kg/a fw	COG 2013
Local Intake Fraction of Garden Vegetables	$IF_{GV(DF)}$	-	1.33E-02	Unitless	Assumed
Dose Conversion Factor (Food)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Ingestion Dose (Terrestrial Plants)	$D_{TP(DF)}$	$D_{TP(DF)} = C_{GV(DF)} * IF_{GV(DF)} * IR_{TP} * DCF_f$	3.28E-08	Sv/a	Calculated
Unit conversion	$D_{TP(DF)'}$	$D_{TP(DF)'} = D_{TP(DF)} * 1000$ mSv / Sv	3.28E-05	mSv/a	Calculated
Aquatic Animals Dose					
Walleye Concentration	C_{WA}	-	6.59E+00	Bq/kg fw	Table C-3
Food Intake (Walleye)	IR_{WA}	-	6.86E+00	kg/a fw	COG 2013
Local Intake Fraction Walleye	IF_{WA}	-	5.51E-01	Unitless	Table 6-5
Dose Conversion Factor (Food)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Ingestion Dose (Walleye)	D_{WA}	$D_{WA} = C_{WA} * IF_{WA} * IR_{WA} * DCF_f$	4.98E-10	Sv/a	Calculated
Unit conversion	$D_{WA'}$	$D_{WA'} = D_W * 1000$ mSv / Sv	4.98E-07	mSv/a	Calculated
Terrestrial Animals Dose					
Canada Goose (meat) Concentration	$C_{CG(DF)}$	-	2.06E+02	Bq/kg fw	Table C-3

Parameter	Symbol	Calculation	HTO		
			Value	Units	Source
Deer Organ (meat) Concentration	$C_{DO(DF)}$	-	2.04E+02	Bq/kg fw	Table C-3
Deer (meat) Concentration	$C_{D(DF)}$	-	2.04E+02	Bq/kg fw	Table C-3
Mallard (meat) Concentration	$C_{M(DF)}$	-	1.33E+01	Bq/kg fw	Table C-3
Rabbit (meat) Concentration	$C_{R(DF)}$		2.01E+02	Bq/kg fw	Table C-3
Food Intake (Terrestrial Animals)	IR_{TA}	-	2.56E+02	kg/a fw	COG 2013
Local Intake Fraction Canada Goose (meat)	$IF_{CG(DF)}$	-	2.30E-03	Unitless	Table 6-5
Local Intake Fraction Deer Organ (meat)	$IF_{DO(DF)}$	-	7.00E-03	Unitless	Table 6-5
Local Intake Fraction Deer (meat)	$IF_{D(DF)}$	-	9.80E-03	Unitless	Table 6-5
Local Intake Fraction Mallard (meat)	$IF_{M(DF)}$	-	1.00E-03	Unitless	Table 6-5
Local Intake Fraction Rabbit (meat)	$IF_{R(DF)}$	-	2.00E-03	Unitless	Table 6-5
Dose Conversion Factor (Food)	DCF_f	-	2.00E-11	Sv/Bq	CSA N288.1:20
Ingestion Dose (Terrestrial Animals)	D_{TA}	$D_{TA(DF)} = (C_{CG(DF)} * IF_{CG(DF)} + C_{DO(DF)} * IF_{DO(DF)} + C_{D(DF)} * IF_{D(DF)} + C_{M(DF)} * IF_{M(DF)} + C_{R(DF)} * IF_{R(DF)}) * IR_{TA} * DCF_f$	2.20E-08	Sv/a	Calculated
Unit conversion	$D_{TA'}$	$D_{TA(DF)'} = D_{TA(DF)} * 1000$ mSv / Sv	2.20E-05	mSv/a	Calculated
Harvester Adult Total Dose					
Total Dose	D_{total}	$D_{total} = D_a + D_i + D_w + D_{ing} + D_s + D_{sed} + D_g + D_{soil} + D_{TP} + D_{WA} + D_{TA}$	1.10E-06	Sv/a	Calculated
Unit conversion	$D_{total'}$	$D_{total'} = D_{total} * 1000$ mSv / Sv	1.10E-03	mSv/a	Calculated