SWAN HILLS TREATMENT CENTRE

2025 ENVIRONMENTAL MONITORING PROGRAM

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1. Introduction

The Swan Hills Treatment Centre (SHTC) *(Appendix A - Figure 1)* is owned by the Alberta Government and operated on their behalf by Veolia Canada Waste Services Inc. (Veolia) under an operating contract with Alberta Infrastructure. The SHTC is located approximately 17 kilometers northeast of the town of Swan Hills *(Appendix A - Figure 2)* and provides comprehensive treatment and disposal for hazardous waste.

The SHTC employs several methods to destroy waste. These include high-temperature incineration, physical and chemical treatments for inorganic liquids like acids and bases, and stabilization/solidification processes to prepare treatment residues before their placement in the facility's engineered landfill.

In accordance with the Alberta Environmental Protection and Enhancement Act Approval (EPEA) No. 1744-03-00, as amended, specifically section 4.10, the SHTC conducts a comprehensive environmental monitoring program to identify, track, and mitigate potential environmental impacts associated with the SHTC operations. The approval, issued on December 19, 2019, to SUEZ Canada Waste Services Inc., now operated by Veolia, is valid until December 14, 2029. Baseline data collection began in 1985, two years before the facility commenced operation in 1987 and has evolved over the years to include both onsite and offsite monitoring for:

- Air Quality
- Soils
- Sediments
- Groundwater
- Surface Water
- Vegetation
- Wildlife
- Fish

The scope of the 2025 Environmental Monitoring Program (EMP) is based on the annual program that has been in place since 2000. The annual monitoring program was rationalized in 2000 to consolidate sampling locations among program components and expand the analytical scope to provide consistent detailed analysis of contaminants of concern in all receptors. The program introduced the concept of “Triggers” at that time which specify additional monitoring requirements in response to events or potential emerging issues.

The SHTC has been in operation for over 30 years and significant changes have been observed in both the quantity and types of wastes processed over that time. In particular, the quantity of PCB wastes has decreased significantly as the inventory of these materials continues to decline in Canada. Under current regulations, the phase-out of any remaining in-service PCBs is to be completed in 2025. As a result; beginning in 2021, operations at SHTC have been scaled back in accordance with a reduced operating model as directed by Alberta Infrastructure. The facility no longer accepts historic waste streams and will continue to focus on waste products that do not have any alternative treatment options. SHTC will continue to accept PCB, biomedical, and other selected waste streams when deemed appropriate. However, a significant reduction in annual waste processing volume is anticipated and appropriate steps have been implemented to accommodate this new operating scenario.

2. Summary of Proposed Changes for 2025

The results of the 2024 monitoring program were reviewed at the technical meeting which was held virtually on February 19, 2025. Participants include members of the Veolia staff, external consultants, representatives from Alberta Infrastructure, Alberta Health, and Alberta Environment and Protected Areas. Based on the findings of the 2024 expanded monitoring year, several scope changes were recommended for future expanded monitoring years and the standard annual monitoring programs. These recommendations were presented and discussed during the meeting and have been incorporated into the proposed 2025 and future monitoring programs.

Overall objectives for the 2025 monitoring program include:

1. Continue with the overall monitoring programs, reducing or expanding where necessary based on objectives and effectiveness.
2. Continue to review and monitor triggers to optimize the effectiveness of the current scope for sampling and analysis.

Table 1. Overview of 2025 standard monitoring year and proposed changes.

Monitoring Program	Existing	Recommended Changes
Air	• Program as specified in EPEA Approval No. 1744-03-00	• No changes proposed for 2025
Groundwater	• Routine water, PCB's, metals and Organic Carbon on all wells • BTEX, F1, AOX, Dioxin and Furan also analyzed on shallow wells	• Sampling of new well sites • Monitoring of road salt runoff around treatment center
Soils and Vegetation	• Labrador Tea at 10 sites • Moss Bags at 15 sites	• Continue to monitor TSP through fly ash emission study • Continue to deploy Moss Bags along fence line at sites 1, 5 and 9 • Move SV117 to expanded monitoring program • Shift MB22 to SV114
Wildlife	• 3 live trapping plots • 6 snap trapping plots	• Plots 110, 117, 123 and 402 be moved to expanded monitoring program
Surface Water, Sediments and Fish	• Annual surface water sampling at 3 locations • Annual fish tissue collection at 2 locations	• Next sediment sampling scheduled to occur in 2026 • Edith Lake: Transition to biannual sampling. • Increase efforts to capture older fish in Chrystina by reducing gill netting and expanding with other methods. • ICES7 subset recommended for future PCB analysis • Community outreach for additional fish head collection
Toxicology	• Based on fish tissue and vole results	• Alberta Health: Consider revising fish consumption advisories (e.g., 150 g/week) for lakes near Swan Hills. • Biannual sampling at Edith Lake due to similar contamination levels to hatchery fish. • Adjust analysis methods to focus on dioxin-like PCBs and ICES7 Marker PCBs

3. Air Quality Monitoring

3.1. Standard Monitoring Program

The location of monitoring plots employed in the program is presented in Appendix A – Figure 3. The air monitoring program is developed in accordance with EPEA Approval No. 1744-03-00 and complies with specific requirements outlined in Section 4.3, which include the following components:

- Meteorological parameters Site 11
- Ambient PCB monitoring at fence line sites (1, 2a, 5a), process area (E1) and offsite location (11)
- VOCs and THC at process area (E1)
- TSP at site 1 and site 9
- PM2.5 at sites 1, 5a and 9
- Mercury CEMS installed and functioning
    - Mercury levels continue to be evaluated

3.2. 2025 Program Changes

No program changes were recommended during the annual technical review meeting. The Air Quality Monitoring program will continue to adhere to conditions outlined in the EPEA Approval.

3.3. Triggers

Table 2. Air Quality Monitoring Triggers.

Trigger	Response
PCB concentration exceeds 150 ng/m^3 at fence line monitoring locations	• Verify result and investigate potential sources of fugitive emissions. Increase frequency of PCB air monitoring to NAPS cycle – once every 6 days if warranted.
VOC exceeds a level of 3 ppm or THC exceeds 5 ppm	• Report individual VOC compounds and compare with appropriate air quality and occupational health and safety guidelines and review trends over the period of record. • If deemed significant, the OTF fugitive emission survey would be triggered if not already conducted
A facility upset resulting in an off-site	• Review meteorological data and conduct dispersion

Trigger	Response
release of significant magnitude to warrant immediate assessment	modeling (if appropriate) to support initial assessment and guidance for environmental monitoring response. • Conduct additional air monitoring as recommended • Implement Emergency Response Plan and compile relevant data regarding the incident to facilitate development of an effective Environmental Monitoring Program response

4. Groundwater Monitoring

4.1. 2025 Standard Monitoring Program

The location of monitoring plots employed in the program is presented in Appendix A – Figure *4*. The scope of the groundwater monitoring program complies with the requirements of Section 4.8 and Table 4.8-A in Approval No. 1744-03-00, which includes the following components:

- All wells sampled for (*Appendix B –Table 8*):
  - Routine Water Analysis (pH, EC, major ions)
  - PCB's
  - Dissolved Metals
  - Dissolved Organic Carbon
- Shallow wells sampled for (*Appendix B –Table 8*):
  - BTEX, F1
  - Adsorbable Organic Halide (AOX)
  - Use as a monitoring tool to screen for chlorinated compounds

4.2. 2025 Program Changes

The newly completed replacement wells will be purged and sampled as part of the ongoing monitoring program to assess groundwater conditions. AECOM (2023) evaluated the well network's integrity, and the replacement wells are strategically located, particularly upgradient of the SHTC, to assess background groundwater parameters. The inclusion of these replacement wells ensures that the monitoring program continues to yield reliable data, particularly in relation to background groundwater quality.

Chlorine levels at shallow well (07-SH) and intermediate well (07-IN) have been increasing in recent years. It is suspected that surface runoff, potentially from road salt in the parking lot and surrounding roads, may be contributing to this increase. As part of the 2024 monitoring program, samples were collected during runoff periods near the Swan Hills Treatment Center parking lot and in the ditch near well 07. In 2025, the monitoring program will continue to focus on surface runoff during these periods to determine if elevated chlorine levels can be attributed to road salt. Furthermore, sampling will be extended to areas farther from the treatment center to investigate the source of elevated chlorine.

The 2024 expanded program served as the final baseline year for monitoring dioxins/furans in select shallow wells. The resulting concentrations were well below the applicable guidelines, and the frequency of monitoring will be adjusted to every five years, during the expanded monitoring program. In the event of any disturbances caused by SHTC operations, any further adjustments to the scope can be done to address potential emerging concerns.

4.3. Triggers

Table 3. Groundwater Monitoring Triggers.

Trigger	Response
Statistically significant increase in key parameter (e.g. PCBs).	• Implement Response Plan and conduct follow up sampling to verify and assess results
A significant facility upset resulting in on-site spill of significant magnitude to warrant immediate assessment	• Incorporate additional monitoring as recommended by the Response Plan

5. Soils and Vegetation Monitoring

5.1. 2025 Standard Monitoring Program

The 2025 annual monitoring program will continue with standard monitoring program locations. The location of monitoring plots employed in the program is presented in Appendix A – Figure 5. The standard program includes the following components:

- Labrador Tea sampled and analyzed annually at 9 sites
- Live moss sampled and analyzed biennially in years 1, 3 and 5 at 10 sites
- Moss bags deployed at 15 standard and 3 fence line sites for a 1-year exposure
- Lichen site monitoring at 15 sites
- Analytical includes routine parameters, metals, PCB's, Dioxins and Furans

5.2. 2025 Program Changes

In the event of any disturbances caused by SHTC operations, any further adjustments to the scope can be done to address potential emerging concerns. Plot 117 will be transitioned to the expanded monitoring program due to its decreasing exposure to PCB emissions and its remote location. Historical PCB concentrations at the site have steadily decreased over the past decade with no significant concerns. Recent emissions modelling further supports this change, as it shows that Plot 117 is situated too far east to be impacted by emissions from the SHTC, with plots closer to the SHTC (such as Plot 4 and Plot 114) better positioned to capture peak downwind emissions.

Plot MB22, located outside the primary emissions zone to the south of the SHTC, will be removed from the sampling program. The site has shown consistent metal concentrations similar to background levels since the acid washing step was introduced in 2019. Given its location and limited impact from SHTC emissions, it is recommended to discontinue monitoring at MB22. A new moss bag will be established at Plot 114, where monitoring is expected to be more beneficial due to recent increases in arsenic and cadmium concentrations observed in the area.

5.3. Triggers

Table 4. Soil and Vegetation Monitoring Triggers.

Trigger	Response
Total TEQ increases above 75th percentile (last 10 years data) in the Labrador tea at plots (4, 11, 109, 114)	• Analyze archived live moss samples. • If levels are elevated in both Labrador tea and live moss, expand monitoring scope in following year to include both Labrador tea and live moss from 10 Plots
A facility upset resulting in off-site emissions of significant magnitude to warrant immediate assessment	• Soil and vegetation monitoring to proceed at selected sites immediately following the incident. • The number/location of sites and analytical scope would be based on meteorological conditions and the nature of the release.

6. Wildlife Monitoring

6.1. 2025 Standard Monitoring Program

The location of monitoring plots employed in the program is presented in Appendix A – Figure 6.

- 3 live trapping plots for population monitoring
- 6 snap trapping plots to collect vole tissue for contaminant analysis

Analytical parameters to the “standard” program scope are outlined in Appendix B – Table 10.

6.2. 2025 Program Changes

As part of the 2025 monitoring program, plots 110, 117, 123, and 402 will be transitioned to the expanded monitoring program. As such, only six plots will be included in the standard monitoring this year. This adjustment follows the observation of a significant declining trend in vole tissue contaminant concentrations across all sites in recent years. Levels of PCBs, dioxins, and furans have consistently remained below the threshold of concern, with elevated levels only detected at sites closest to the SHTC. Additionally, no correlation has been found between contaminant levels and population trends. Given the continued decrease in contaminant concentrations (PCBs, dioxins, and furans) across all plots, the reduced number of sites will

focus on areas where these concentrations have historically been highest—specifically, Plots 4, 11, 109, 114, 70, and 71.

In the event of any disturbances caused by SHTC operations, any further adjustments to the scope can be done to address potential emerging concerns.

6.3. Triggers

Table 5. Wildlife Monitoring Triggers.

Trigger	Response
Statistically significant change in June vole population levels correlated with the April/May tissue contaminant levels	• Collect and analyze September vole tissue from population monitoring plots (11, 114 and 70) for PCBs, dioxins and furans
Elevated Total TEQ in live moss and Labrador tea is observed	• Expand vole tissue collection to 10 plots consistent with the Soil and Vegetation program
A facility upset resulting in off-site emissions of significant magnitude to warrant immediate assessment	• Additional sampling of vole tissue. Timing, sample locations and analytical scope would be determined based on meteorological conditions and the nature of the release.

7. Surface Water, Sediments and Fish Monitoring

7.1. 2025 Standard Monitoring Program

- Annual surface water sampling
    - 3 Sample Locations: S5A Coutts River, S12 Chrystina Lake, Edith Lake (Appendix A – Figure 7)
    - Parameters (Appendix A – Table 11): Routine Water analysis (dissolved solids and ions), Nutrients (total and dissolved), Metals
- Biennial (next monitoring period – 2026) sediment sampling
    - 4 Sample Locations: S5A Coutts River, S12 Chrystina Lake, Edith Lake, S6 Unnamed tributary (Appendix A – Figure 7)
    - Parameters (Appendix A – Table 11): Metals, Organics (PCB's, dioxins and furans)

- Annual fish tissue analysis from Edith and Chrystina Lake to be analyzed for a range of compounds including metals and organic contaminants (PCBs, dioxins and furans)
- Brook trout will continue to be tagged and sampled for age analysis

7.2. 2025 Program Changes

In the proposed 2024 Environmental Monitoring Report (Intricate 2024), a community-led initiative will begin in 2025 to improve sample size and age accuracy for Brook Trout in Chrystina Lake. This effort aims to enhance understanding of population dynamics and potential contaminants by gathering more comprehensive age distribution data. Unlike Edith Lake, Chrystina Lake experiences higher sport fishing activity, which can impact age distribution analysis. Since the current sampling program is limited to specific periods and may not provide a fully representative sample, public participation will help address these gaps.

With declining total TEQ and PCB concentrations in Edith Lake, the sampling program will transition to a biannual schedule, along with sampling occurring in expanded program years or if triggered by changes in water quality, sediment, or fish tissue contamination levels. In non-sampling years, efforts will focus on capturing older fish in Chrystina Lake to address data gaps in older age classes. Additionally, varied sampling methods will be implemented to improve the diversity of age groups collected.

If any disturbances arise from SHTC operations, further adjustments can be made to address emerging concerns.

7.3. Triggers

Table 6. Surface Water, Sediment, and Fish Monitoring Triggers.

Trigger	Response
Contaminant levels exceed the 95th percentile value in Chrystina Lake sediments	• Verify result and include sediment sampling in both Chrystina and Edith lakes during the next annual program if warranted
Contaminant levels exceed 95th percentile value and/or the Interim Sediment Quality Guidelines (ISQG) in stream sediment samples	• Verify results and initiate additional downstream sampling in following sampling period if warranted

Trigger	Response
Organic contaminant levels in Chrystina Lake brook trout exceed the recommended toxicity trigger	• Analyze any archived samples to verify results • Sample Edith Lake brook trout in the following year
A facility upset resulting in off-site emissions of significant magnitude to warrant immediate assessment	• Initiate immediate water quality, sediment and fish tissue sampling as recommended.

8. Toxicology Monitoring

8.1. 2025 Standard Monitoring Program

Tissue contaminant levels are assessed annually, with this program incorporating assessments for adult, child, toddler, and adolescent based on the current fish consumption advisory established by Alberta Health (PCB tolerable daily intake [TDI] of 0.00001mg/kg/day). The following components are conducted during “standard” monitoring:

- Toxicity exposure limits will be reviewed to ensure toxicity assessments and human health risk assessments (HHRA) results and recommendations remain valid
- An abbreviated HHRA will be prepared based on the annual fish tissue results

8.2. 2025 Program Changes

To enhance monitoring efficiency, the 2025 FTMP will adopt the ICES-7 subset as an indicator of overall PCB concentrations, alongside the 12 coplanar PCBs for TEQ assessment. To ensure consistency, three samples will be analyzed using both the current and proposed methods in 2025. Additionally, the 2018 model will be applied to estimate total PCB concentrations for samples collected from 2019 to 2024, allowing a comparison between modelled and reported values.

Worley (2025) has proposed to Alberta Health the revision of fish consumption advisories for lakes near SHTC, based on a new PCB TDI of 150 g/week. Changes to the TDI liability measures may be incorporated into the 2025 monitoring program. In the event of any disturbances caused by SHTC operations, adjustments to the scope can be made to address potential emerging concerns.

8.3. Triggers

Table 7. Toxicology Monitoring Triggers.

Trigger	Response
New toxicity information becomes available (i.e. significant change in end-point toxicity of the compounds of interest – PCBs, PCDD/F)	• Conduct full HHRA on fish tissue results • Re-evaluate vole toxicity assessment
Chrystina Lake fish tissue level exceeds Toxicity Trigger	• Conduct full HHRA and assess fish tissue levels in Edith Lake
Any new compounds are identified at elevated levels (e.g. heavy metals) in animal or fish tissue.	• Assess vole toxicity • Expand HHRA to incorporate new compounds of interest

9. References

(AECOM) Groundwater Monitoring Well Network Condition Report and Sandstone Groundwater Monitoring Well Replacement Plan. April 2023.

(AECOM) 2024 Groundwater Monitoring Report – Swan Hills Treatment Centre. March 2025.

(MONTROSE) 2024 Soil and Vegetation Monitoring Program Report – Swan Hills Treatment Centre. Montrose Environmental Inc. March 2025.

(CPP) 2024 Surface Water and Sediment Quality Monitoring Report. Charette Pell Poscente (CPP) Environmental. March 2025.

(WORLEY) 2024 Fish Tissue Monitoring Program – Swan Hills Treatment Centre. Worley Consulting. March 2025a.

(WORLEY) 2024 Human Health Risk Assessment Through Consumption of Fish near Swan Hills Treatment Centre – Based on 2024 Fish Monitoring Data. Worley Consulting. March 2025b.

(WILDLAND) 2024 Wildlife Monitoring Report. Wildland Management Consultants Ltd. March 2025.

APPENDIX A

Figure 1. Swan Hills Treatment Centre Facility

Figure 2. Swan Hills Treatment Centre Location

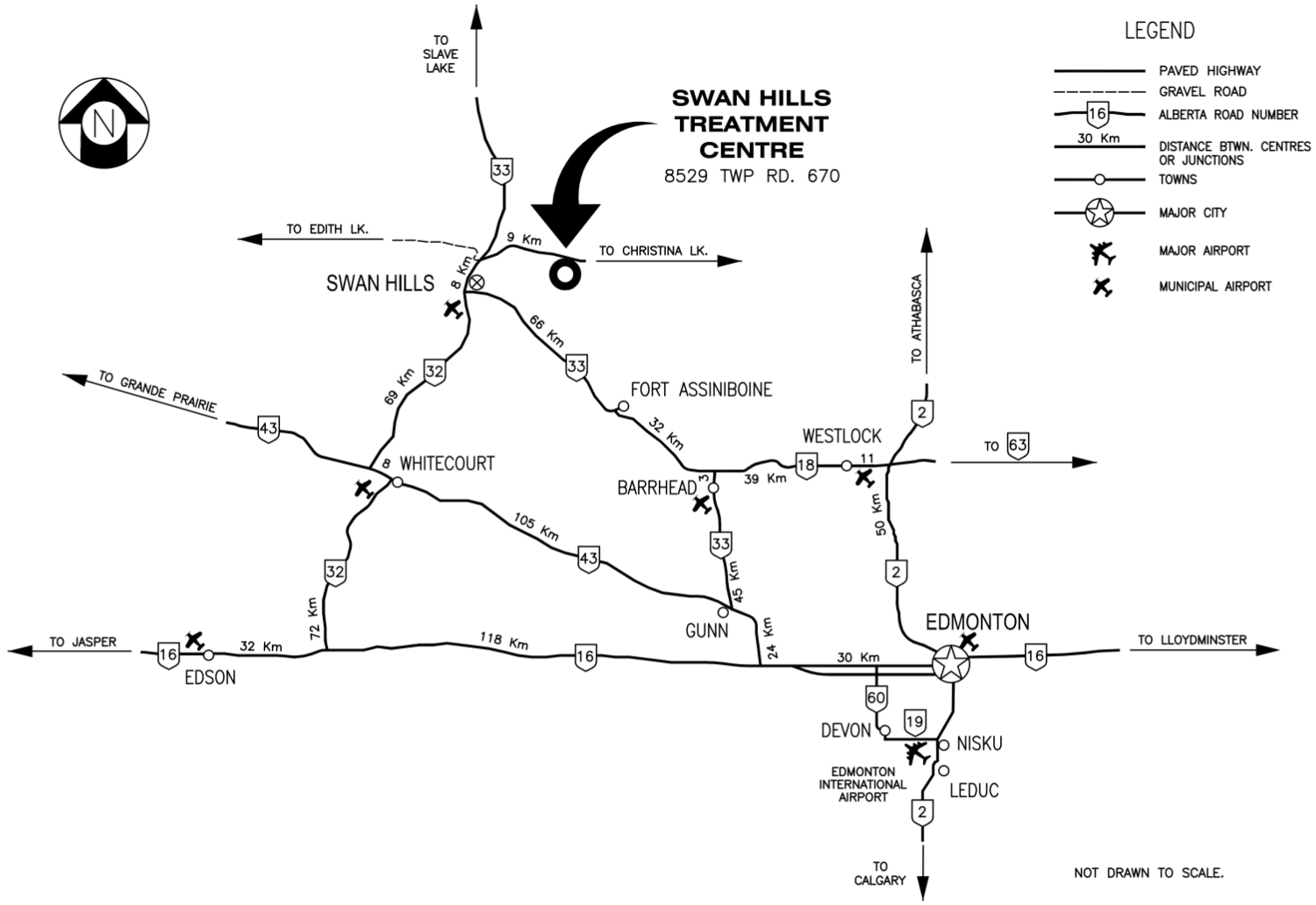


Figure 3. Air Quality Monitoring Sites.

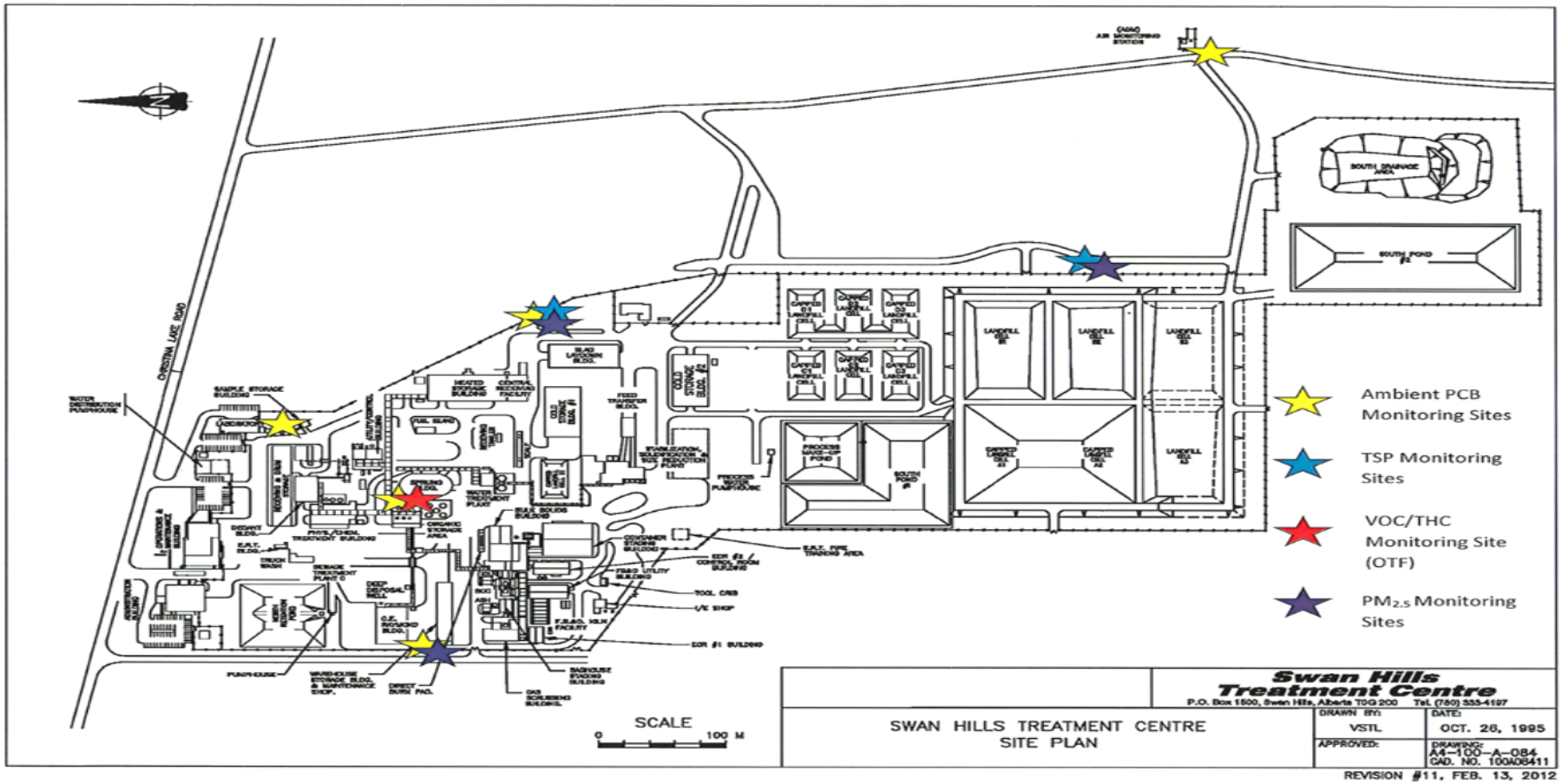
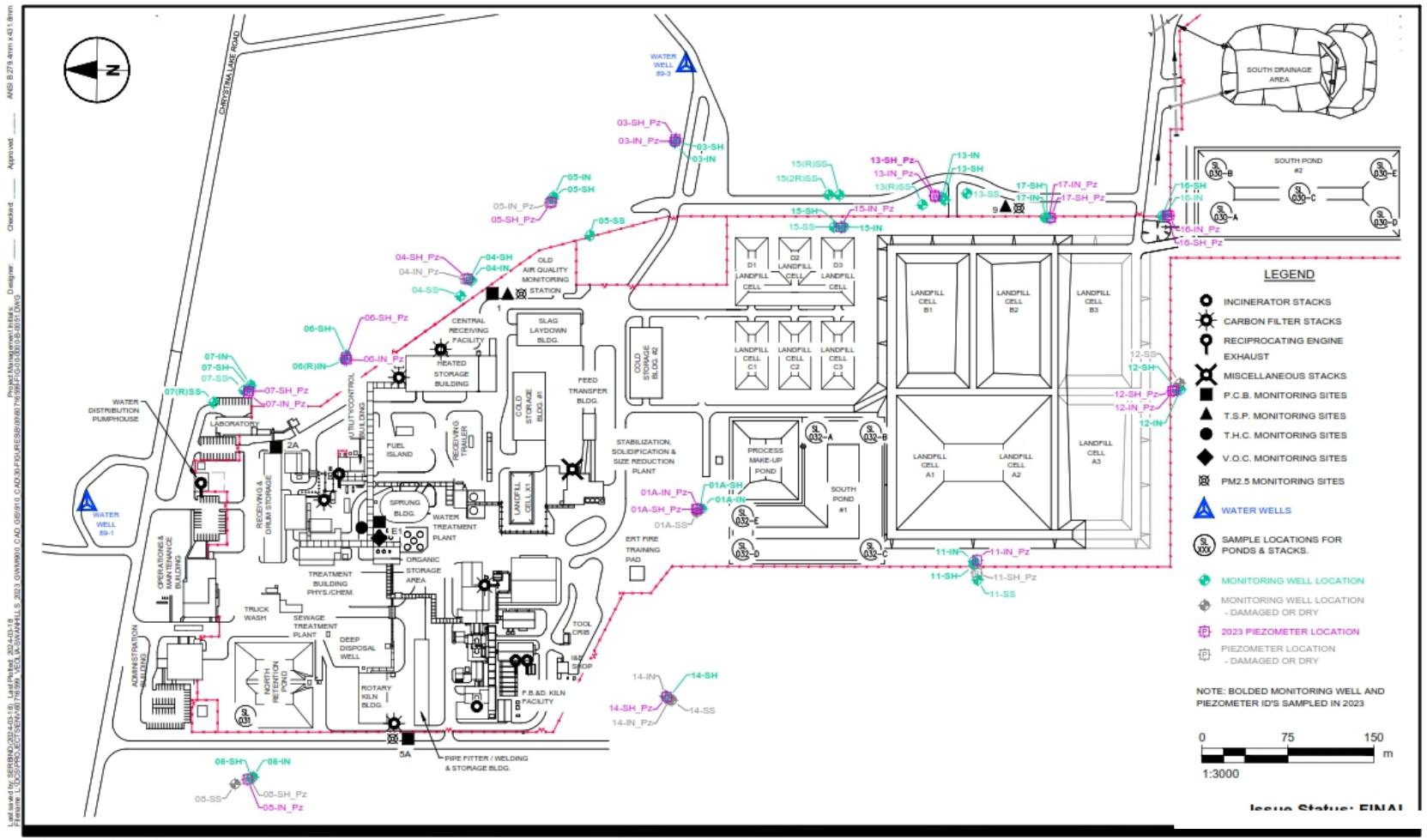


Figure 4. Groundwater Monitoring Sites.



2023 Groundwater Monitoring Report
Swan Hills Treatment Centre
VEOLIA
Project No.: 60716599 Date: 2024-03-18

Groundwater Monitoring Well Locations

AECOM

Figure 5.1

Figure 5. Soil and Vegetation Monitoring Sites.

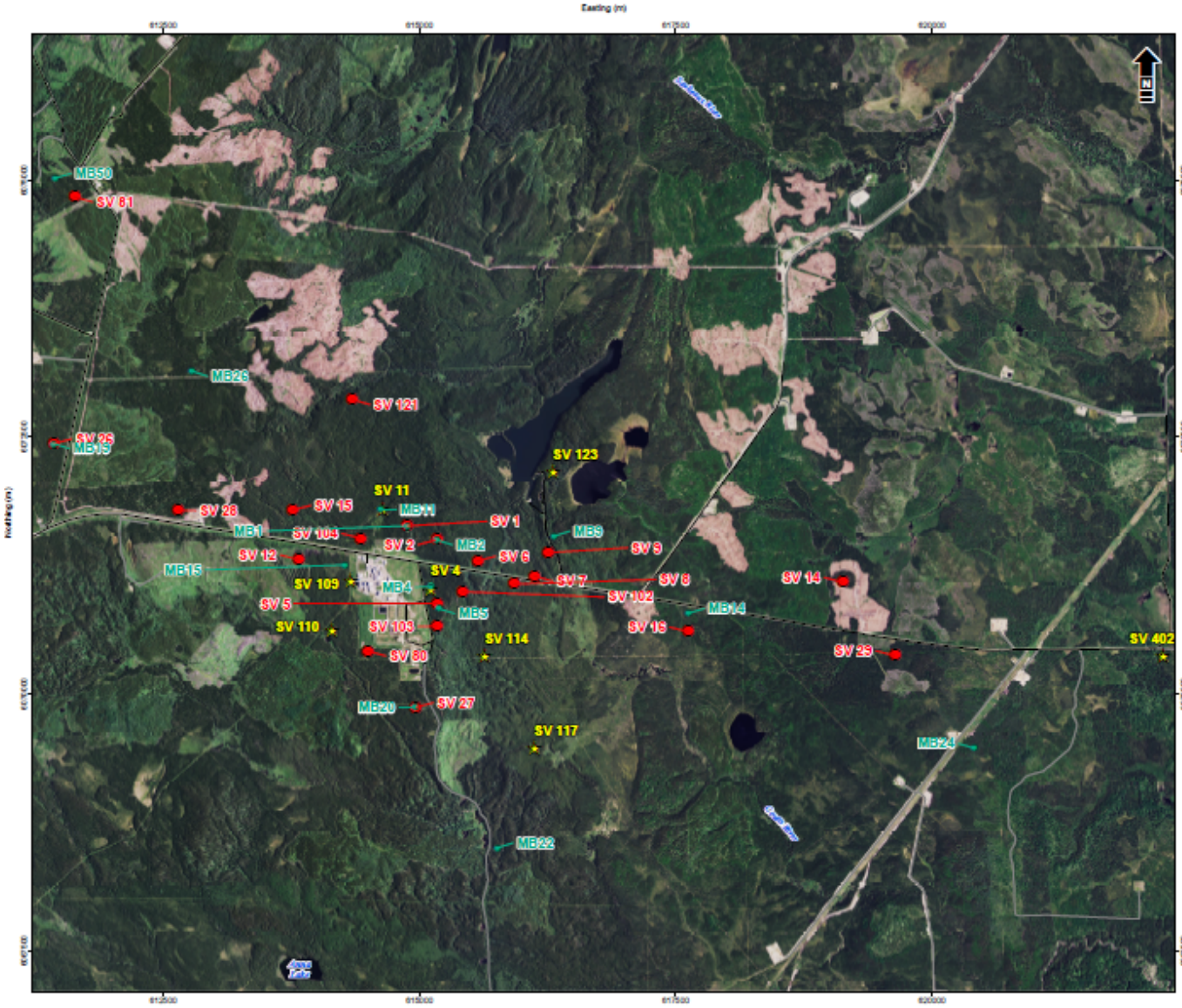


Figure 6. Wildlife Monitoring Sites.

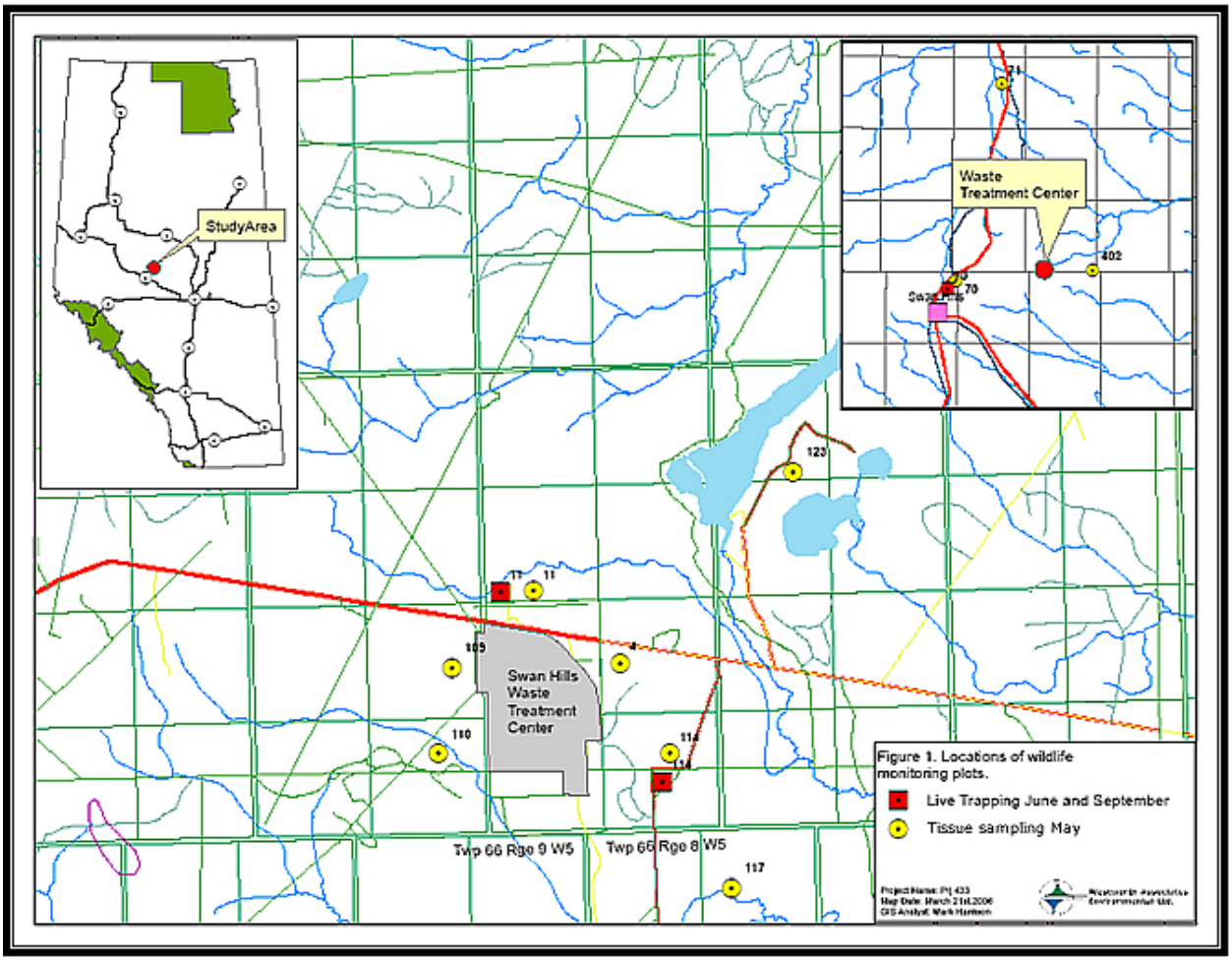
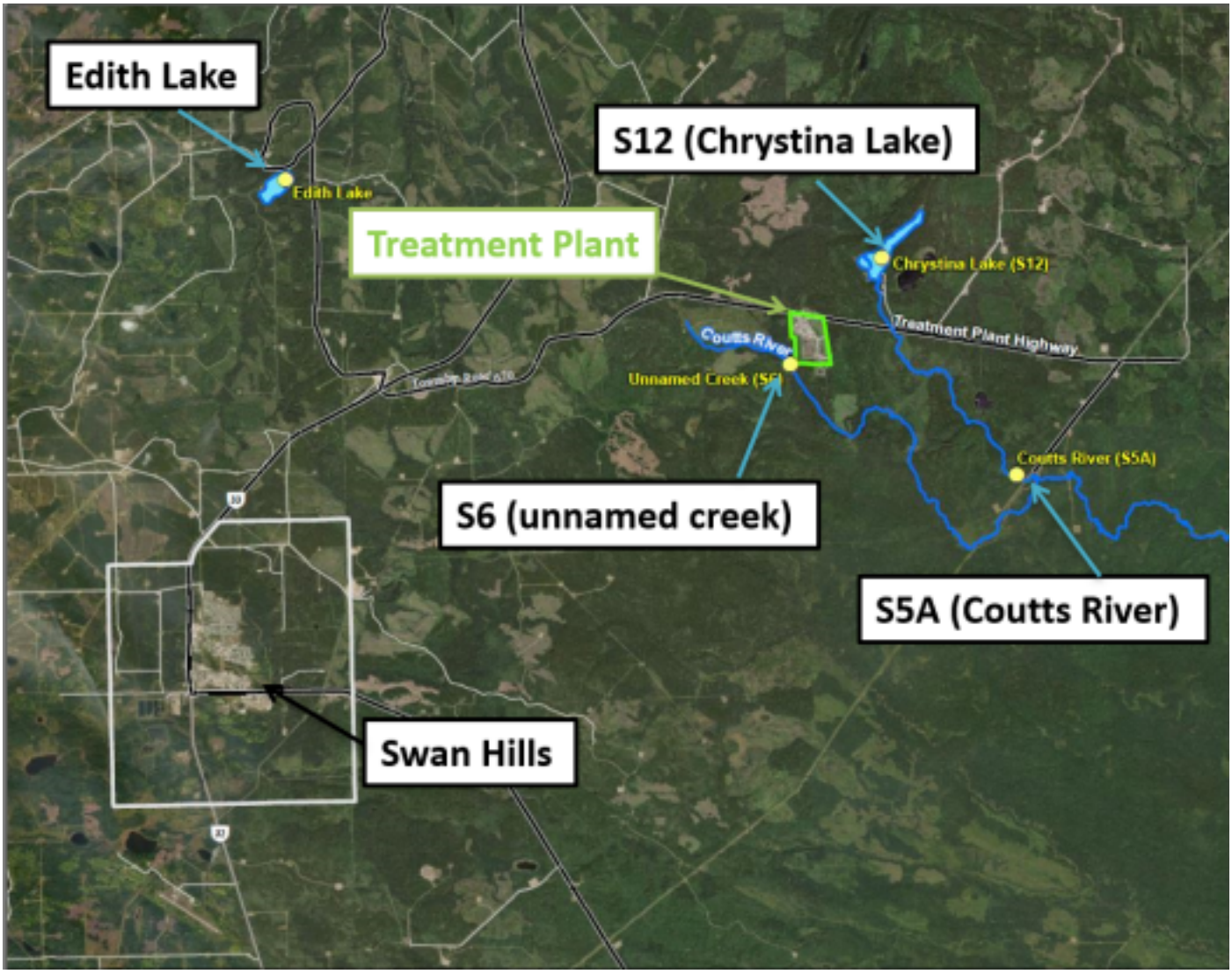


Figure 7. Surface Water, Sediment and Fish Monitoring Sites.



APPENDIX B

Table 8. Groundwater Analytical Scope.

Parameter	Shallow Till	Intermediate Till	Sandstone Aquifer
General parameters			
pH	✓	✓	✓
Electrical Conductivity	✓	✓	✓
Calcium	✓	✓	✓
Magnesium	✓	✓	✓
Sodium	✓	✓	✓
Potassium	✓	✓	✓
Chloride	✓	✓	✓
Sulphate	✓	✓	✓
Sulphide	✓	✓	✓
Bicarbonate	✓	✓	✓
Nitrate – nitrogen	✓	✓	✓
Nitrite – nitrogen		✓	
Cyanide	✓		
Total Alkalinity		✓	✓
Total Hardness		✓	✓
Total Dissolved Solids (TDS)	✓	✓	✓
Ion Balance	✓		
Metals			
Antimony	✓	✓	✓
Arsenic	✓	✓	✓
Barium	✓	✓	✓
Beryllium	✓	✓	✓
Cadmium	✓	✓	✓
Chromium	✓	✓	✓
Cobalt	✓	✓	✓
Copper	✓	✓	✓
Lead	✓	✓	✓
Mercury	✓	✓	✓
Molybdenum	✓	✓	✓
Nickel	✓	✓	✓
Selenium	✓	✓	✓
Silver	✓	✓	✓
Thallium	✓	✓	✓
Vanadium	✓	✓	✓
Zinc	✓	✓	✓
Organic Parameters			
Dissolved Organic Carbon	✓	✓	✓
BTEX	✓		
Total PCBs	✓	✓	✓

Table 9. Soil and Vegetation Analytical Scope.

Parameter	Vegetation	Soils	Moss Bag
General parameters			
Electrical Conductivity		✓	
pH		✓	
Macronutrients	✓		
Non-Routine			
Aluminum	✓	✓	
Antimony	✓	✓	✓
Arsenic	✓	✓	✓
Barium	✓	✓	
Beryllium	✓	✓	✓
Boron	✓	✓	✓
Cadmium	✓	✓	✓
Calcium	✓	✓	
Chromium	✓	✓	✓
Cobalt	✓	✓	
Copper	✓	✓	✓
Iron	✓	✓	✓
Lead	✓	✓	✓
Lithium	✓	✓	
Magnesium	✓	✓	
Manganese	✓	✓	✓
Mercury	✓	✓	✓
Molybdenum	✓	✓	✓
Nickel	✓	✓	✓
Potassium	✓	✓	
Selenium	✓	✓	✓
Silver	✓	✓	
Sodium	✓	✓	
Strontium	✓	✓	
Sulphur	✓	✓	✓
Thallium	✓	✓	
Tin	✓	✓	✓
Titanium	✓	✓	
Uranium	✓	✓	
Vanadium	✓	✓	✓
Zinc	✓	✓	✓
Zirconium	✓	✓	
Organic Parameters			
Total & Congener PCB	✓	✓	
Dioxin/Furans	✓	✓	

Table 10. Wildlife Analytical Scope.

Parameter	Standard Program	Expanded Program (every 5 years)
Routine Parameters		
Calcium	✓	✓
Magnesium	✓	✓
Potassium	✓	✓
Sodium	✓	✓
Fluoride	✓	✓
Metals[1]		
Antimony		✓
Arsenic		✓
Barium		✓
Beryllium		✓
Cadmium		✓
Chromium		✓
Cobalt		✓
Copper		✓
Lead		✓
Mercury		✓
Molybdenum		✓
Nickel		✓
Selenium		✓
Silver		✓
Thallium		✓
Vanadium		✓
Zinc		✓
Organic Parameters		
Aroclor PCB		✓
Total & Congener PCBs (by HRMS)	✓	✓[2]
Dioxins/Furans/TEQ	✓	✓[2]

[1] Metals analysis in the expanded program, is conducted on samples from the 10 standard program sites only

[2] The organic parameters specified will be included for samples from the 10 standard program sites only

Table 11. Surface Water, Sediment, and Fish Analytical Scope.

Parameter	Surface Water	Sediment[1]	Fish
General Parameters			
pH	✓		
Conductance	✓		
Calcium	✓		
Magnesium	✓		
Potassium	✓		
Sodium	✓		
Chloride	✓		
Sulphate	✓		
Bicarbonate	✓		
Nitrate – nitrogen	✓		
Total Dissolved Solids	✓		
Metals			
Antimony	✓	✓	✓
Arsenic	✓	✓	✓
Barium	✓	✓	✓
Beryllium	✓	✓	✓
Cadmium	✓	✓	✓
Chromium	✓	✓	✓
Cobalt	✓	✓	✓
Copper	✓	✓	✓
Lead	✓	✓	✓
Mercury	✓	✓	✓
Molybdenum	✓	✓	✓
Nickel	✓	✓	✓
Selenium	✓	✓	✓
Silver	✓	✓	✓
Thallium	✓	✓	✓
Vanadium	✓	✓	✓
Zinc	✓	✓	✓
Selected Dissolved Metals (e.g. Al)	✓		
Organic Parameters			
Total Organic Carbon	✓	✓	
Total & Congener PCBs (by HRMS)		✓	✓
Dioxins/Furans		✓	✓
Total Inorganic Carbon	✓		
Dissolved Organic Carbon	✓		
Dissolved Inorganic Carbon	✓		

[1] Sampling collected biannually; next sampling program scheduled for 2026.