Human Health and Ecological Risk Assessment, Former Lochaber Mine Site, Lochaber Mines, Nova Scotia

Final Report

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Build Nova Scotia

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Executive Summary

Stantec Consulting Ltd. (Stantec) was commissioned by Build Nova Scotia (BNS) to complete a Human Health and Ecological Risk Assessment (HHERA) on the Former Lochaber Mine Site property located in Halifax Regional Municipality, Nova Scotia (NS), herein referred to as the Site. The objective of the HHERA is to assess if there are unacceptable environmental risks to human and/or ecological receptors as a result of the environmental contamination associated with the historical gold mining operations at the Site.

Human Health Risk Assessment

The purpose of the HHRA was to evaluate the potential that human receptors may be exposed to Chemicals of Potential Concern (COPCs) found at the Site at concentrations in excess of what may represent an acceptable risk.

Maximum soil concentrations were initially screened against human health-based Pathway Specific Standards (PSS) for agricultural land use, which assumes that human receptors of all ages may be present continuously over a lifetime of exposure (i.e., 24 hours a day, 7 days a week, 52 weeks a year, for 80 years). Based on initial conservative screening, a number of COPCs were identified including aluminum, arsenic, cobalt, iron, lead, manganese, and vanadium.

Based on the range and distribution of detected concentrations it was determined that aluminum, arsenic, iron, manganese, and vanadium were not likely associated with the historical mining activities at the Site. Instead, concentrations of these parameters could be reasonably attributed to naturally occurring ambient conditions. Concentrations of other metals were below the applied residential PSS. However, cobalt and lead were present above the applied PSS and at concentrations that exceed naturally occurring background concentrations. Therefore, cobalt and lead were identified as the final human health COPCs in soil and were carried forward for further assessment.

To better assess the more likely human exposures at a remote former mine site, additional secondary screening was completed including exposure scenarios for a potential hiker and recreational visitor. Potentially complete exposure pathways assessed for the hiker and recreational visitor included surface water ingestion, dermal contact with surface water, sediment ingestion/dermal contact, soil ingestion, soil dermal contact and ingestion of food. Receptor-specific contaminant screening was carried out to reflect the characteristics of the hiker (teen or adult who stays on or near the access road/trail) and the recreational visitor (toddler, child, teen or adult who may travel across the Site).

For the hiker, the potential for exposures to cobalt and lead in soil were evaluated based on exceedances of the applied PSS for industrial land use, and the distance from soil sample locations with exceedances to the trail. For the recreational visitor, the potential for exposures in soil were evaluated based on the spatial extent of soil sample locations with exceedances of PSS for commercial land use using the Upper Confidence Limit of the Mean (UCLM) for cobalt and lead as an Exposure Point Concentration (EPC) representative of overall exposure at the Site.

Only cobalt was identified as a COPC in soil for the recreational visitor. Although the 95% UCLM concentration for cobalt is greater than the applied PSS, the UCLM was skewed by the single elevated concentration of 240 mg/kg at LOC23-SA-14. Nearby samples indicated concentrations that were lower and/or non-detect, suggesting a localized exceedance.

No COPCs were identified based on potential exposure to sediment or surface water for either the Hiker or the Recreational Visitor.

The PSS that were used for the screening of COPCs for both the hiker and recreational visitor incorporated conservative assumptions in terms of the assumed exposure frequency (i.e., five days per week, 48 weeks a year). As it is expected that these receptors would not be present at the Site at this frequency, the applied standards were considered very conservative and appropriate for identifying COPCs. Based on the HHRA, risks to potential hikers and recreational visitors were considered negligible.

Recreational visitors (i.e., campers, hunters) may also harvest game to feed their families. However, the area where COPC concentrations in soil are above human health guidelines is small compared to the home range of most prey and compared to the area range where hunting and gathering could occur. Given the limited soil exceedances and their spatial distribution that are not expected to substantially affect the concentrations of COPCs in game that may be consumed, risk via this exposure pathway is also considered negligible.

Terrestrial Ecological Risk Assessment

Based on the habitat and wildlife assessment, potential terrestrial ecological receptors of concern at the Site include:

- Plants (including Boreal Felt Lichen - Atlantic pop*,* Corrugated Shingles Lichen, White-rimmed Shingle Lichen, Blue Felt Lichen).
- Soil Invertebrates
- Mammals (including Mainland Moose)
- Amphibians
- Birds (including Canada Jay, Boreal Chickadee, Pine Siskin, Olive-sided Flycatcher and Southern Twayblade)

The terrestrial ERA screening for soil compared maximum detected concentrations to the Atlantic RBCA Ecological Screening Levels (ESLs), as the lower of the Tier II PSS for Direct Soil Contact or Tier II Soil and Food Ingestion pathway standards based on agricultural land use.

Maximum concentrations of arsenic, cobalt, iron, lead, lithium, manganese, rubidium, selenium, strontium and vanadium were greater than their respective PSS or the detected concentration at the reference location.

Based on the range and distribution of concentrations observed, concentrations of arsenic, iron, manganese, rubidium, selenium, strontium and vanadium do not appear to be associated with historical mining activities at the Site and are instead attributed to natural conditions of the area. However, cobalt and lead are present above one or more PSS and at concentrations above naturally occurring background concentrations. Concentrations of other metals were below the applied PSS. Therefore, cobalt and lead were identified as terrestrial COPCs in soil and were carried forward for further consideration in the ERA.

While cobalt and lead were present above the applied standards for ecological soil contact and/or soil and food ingestion and at concentrations at the reference location, the vegetation present in the impacted area was observed to be in good health and appeared to be vigorous which suggests no unacceptable risk to plants and is considered a stronger line of evidence for potential risk. With regards to the potential for soil and food ingestion by mammals and birds, the spatial extent of contaminant delineation within the area where COPC concentrations in soil are above ecological standards is very small in comparison to the home range of most wildlife (including potential SAR) and as such are unlikely to affect wildlife populations. Therefore, the effects to plants and wildlife from exposure to the cobalt and lead present at the Site are considered negligible.

Aquatic Ecological Risk Assessment

For surface water bodies that represent aquatic habitat (Mines Branch River), the potential aquatic ecological receptors most likely to be exposed to the identified COPCs in sediment and surface water at the Site include:

- Aquatic Plants
- Invertebrates
- Fish

While groundwater is a potential pathway for migration of COPCs originating at the Site to nearby watercourses, groundwater quality was not tested during the Phase II ESA. For the purposes of the risk assessment, surface water data were used directly to evaluate risks from potential groundwater plumes discharging to the Mines Branch River.

The surface water analytical results were compared to the Tier 1 EQS for surface water based on the protection of aquatic life. Surface water concentrations were greater than the applied standards for four parameters including pH, aluminum, copper and iron including the upstream background sample location.

Background water conditions in Nova Scotia are often acidic (i.e., low pH levels) and commonly have elevated concentrations of certain metals including aluminum, iron and manganese. Where pH, aluminum and iron were found to be within the same range at all sample locations it was reasonably assumed that the concentrations could be attributed to background ambient conditions.

While copper was identified in one surface water sample at a concentration slightly exceeding the Tier 1 EQS, it could not be attributed to site conditions based on the absence of significantly elevated soil or sediment concentrations in the area of the exceedance. The concentration was considered to be within the range of analytical variance and the concentration did not represent ambient conditions beyond the immediate area. As such the potential risk to aquatic receptors was determined to be negligible from one slight exceedance in surface water.

Although detected in surface water, PSS are not provided for a number of metals and nutrients (i.e., bismuth, calcium, magnesium, phosphorus, potassium, sodium, tin and titanium). However, the results were found to be within a similar range at all locations and do not appear to be related to Site activities. Generally, observed concentrations of these parameters were considered to represent regional background conditions.

The sediment analytical results were compared to Tier 1 EQS for sediment based on protection of aquatic life. Sediment concentrations were found to be greater than Tier 1 EQS for arsenic, iron, manganese and mercury. Concentrations of arsenic, iron and manganese exceeded their respective Tier 1 EQS at only one of five downstream sample locations (specifically, the farthest location downstream). Two exceedances of mercury were identified in sediment in the ‘mid-stream’ samples. The concentration of mercury is likely attributed to natural conditions or other activities that were completed downstream of the Site since the near stream sample (LOC23-SD-03) did not identify a mercury exceedance.

Although detected in sediment, Tier 1 EQS are not available for a number of metals and nutrients (i.e., aluminum, barium, beryllium, bismuth, boron, cobalt, lithium, molybdenum, rubidium, strontium, thallium, tin, uranium, and vanadium). However, by comparison of these parameters to the local/regional conditions, the results for sediment are generally found to be within a similar range at all locations and do not appear to be related to Site activities and were therefore considered to be representative of background conditions. The only exception was one sediment sample (LOC24-SD-01, Downstream Far Point C), where barium, cobalt and vanadium concentrations are elevated which suggests some localized impacts. These impacts were also co-located with the elevated concentrations of arsenic, iron, manganese and selenium as discussed above. Overall, the elevated concentrations of these parameters do not represent ambient conditions therefore risk to aquatic receptors is considered negligible.

Recommendations

Based on the conclusions presented above, Stantec offers the following recommendations:

1. Further sampling, risk management, or active remediation based on potential risk human or ecological receptors from exposure to COPCs in soil, surface water, or sediment contamination is not recommended at the present time.
2. Stantec has not evaluated risk from the physical hazards present at the site in this report. These hazards should be assessed by a qualified person and recommendations for additional site management be considered.
3. The results of the HHERA should be reassessed should land use at the Site change in the future or be anticipated to change.
4. The results of this HHERA should be provided to NSECC in support of an application for Closure under the CSR.

The statements made in the Executive Summary are subject to the same limitations included in the Closure Section 9.0 and are to be read in conjunction with the remainder of this report.

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Acronyms / Abbreviations

AC CDC	Atlantic Canada Conservation Data Centre
AMO	Abandoned Mine Opening
APEC	Area of Potential Environmental Concern
Atlantic PIRI	Atlantic Partnership in Risk-Based Corrective Action Implementation
BNS	Build Nova Scotia
CCME	Canadian Council of Ministers of the Environment
COPC	Contaminant of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EPC	Exposure Point Concentration
CSR	Contaminated Sites Regulation (Nova Scotia)
EQS	Environmental Quality Standard
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
FCSAP	Federal Contaminated Sites Action Plan
ha	Hectare (10,000 m^2)
HHERA	Human Health and Ecological Risk Assessment
mbgs	Meters Below Ground Surface
NSDNRR	Nova Scotia Department of Natural Resources and Renewables
NSECC	Nova Scotia Environment and Climate Change
PID	Property Identification Number
PPE	Personal Protective Equipment
PSS	Pathway-Specific Standard
ROA	Remedial Options Analysis
SAR	Species at Risk
SOCC	Species of Conservation Concern
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

1 Introduction

Stantec Consulting Ltd. (Stantec) was commissioned by Build Nova Scotia (BNS) to complete a Human Health and Ecological Risk Assessment (HHERA) on the former Lochaber Mine Site located in Lochaber Mines, Nova Scotia (NS), (herein referred to as "the Site", Figure A-1, Appendix A). The HHERA was conducted to support the BNS mandate to assess, remediate and/or manage environmental contamination on properties owned by the Province of Nova Scotia.

This HHERA follows previous environmental investigations completed at the Site by Stantec. A Notification of Free Product or Contamination form (FRM-100) has been prepared based on soil contamination identified during a previous Phase II Environmental Site Assessment (ESA) (Stantec, 2023c). Additional Contaminated Sites Regulations (CSR) documentation is being prepared under a separate cover.

The HHERA will inform BNS with recommendations for potential next steps, including remediation and/or risk management and support an application for site closure under the CSR (NSECC, 2013a).

1.1 Background

The historical records indicate that operations for the Lochaber gold mines started as early as 1883 (Nova Scotia 2015). Small scale mining operations were conducted at the Site in the late 1800s by the Lochaber Gold Mining Company. The Lochaber Mines reportedly produced 4.5 tonnes of ore and 2.3 ounces of gold during its operational phase (Nova Scotia 2015). Mining operations ceased and the Site was abandoned by 1897. Four shafts including one advanced to a depth of 62 feet (19 m) were reported to be present on the Site (M. G. Goudge 1934).

Additional prospecting activities were conducted on the Site in the 1980s by GeoTech Surveys Limited on behalf of Seabright Resources Inc. to determine the potential for gold (GeoTech Surveys Limited 1984). Activities included the advancement of test pits. The report concluded that from the information review the prospects in the Site area should consider further exploration. In 2019, further prospecting surveying activities were completed at the Site including surficial sampling activities but no intrusive exploration.

Following abandonment, the Site remained undeveloped and eventually revegetated with some clearing and access road development (Stantec, 2023a). Remaining mine related features including waste rock piles, mining shafts (abandoned mine openings (AMOs), trenches, foundations and exploration pits) were observed during previous site visits. Mine tailings were identified to the southeast of the AMOs. Several of the AMOs are now flooded (Stantec, 2023a). The spatial extent of the area disturbed by the former mining operations is estimated to be approximately 5,000 m^2 or 0.5 Ha.

1.2 Objective

The objective of the HHERA is to assess the potential risks to human and ecological receptors from exposure to environmental contamination associated with the historical gold mining operations at the Site.

1.3 Scope of Work

The scope of work for the HHERA consisted of the following:

- Document review of previous reports and site investigations.
- Site characterization, including land use, existing biophysical, chemical, habitat presence and suitability for Species at Risk (SAR) and Species of Conservation Concern (SOCC).
- Completion of an HHERA to determine the nature and magnitude of potential risks to both human health and ecological receptors.
- Reporting, including recommendations for additional sampling, risk management, and/or remediation.

2 Site Description

2.1 General

The Site is located in a rural forested area near the community of Lochaber Mines, in the Halifax Regional Municipality (HRM). The general site location and local topography is shown on Figure A-1, Appendix A. Significant site features are provided on Figure A-2, Appendix A.

The Site is located on a relatively small portion of a larger property parcel (PID No. 40751497) which includes a total area of approximately 63.9 hectares (ha) (the Property). The former mine site includes a leased area of approximately 6.1 hectares (ha) (Build Nova Scotia, 2023). The property is owned by the Nova Scotia Department of Natural Resources and Renewables (NSDNRR) and is located along the southern boundary of the Liscomb Game Sanctuary.

The Site is unoccupied and there are no buildings or municipal services present. Other than the mine related surface features, main access road and the smaller ATV trail, ground cover at the Site consists of undeveloped woodland and wetlands. The final kilometre of the access road turns from gravel cover into an unmaintained trail; site access via cars/trucks is assumed to be seasonal, however access to the area via off-highway vehicles and snowmobiles occurs year-round and is unrestricted. This portion of the trail near the Site is used to access ATV trails on other adjoining properties. Signage along the access road and trail notifies visitors of the physical hazards in the area.

There are various standing water pools and streams on and near the Site and the area is designated as a wetland by NSECC. The Mines Branch River flows from north to south and forms the eastern boundary of the Site. Several of the AMOs are flooded but these are isolated and do not provide any significant aquatic habitat.

2.2 Site Services and Groundwater Classification

There are no municipal services at the Site. Based on a review of the Nova Scotia Well Logs Database, there are no reported potable water wells on the Site, or within 5 km of the Site (Nova Scotia Environment, 2023). Given the absence of a central water supply system, the groundwater in the area is classified as potable under the CSR classification scheme.

2.3 Land Use Designation

The land use at the Site has been interpreted to be agricultural as the Site is not occupied but is subject to natural ecological succession. Current and future human use of the Site is expected to be limited to recreational activities such as hiking and camping and possible harvesting of country foods (i.e., hunting, fishing, gathering vegetation for consumption, etc.). No changes in land use are expected in the foreseeable future.

2.4 Topography and Regional Drainage

Stormwater is anticipated to drain by infiltration and/or overland flow. Mines Branch River flows along the east boundary of the Site from the northwest to southeast. Based on available topographic maps and site observations, topography of the Site is complex. There is a local high in the southwestern portion of the site and an apparent topographical divide roughly dividing the Site. On the western 1/3rd of the site, regional undisturbed surface drainage (anticipated shallow groundwater flow direction) is directed toward a wetland in the northwestern corner of the Site which eventually flows into Fifteen Mile Stream to the west. On the eastern 2/3rd of the Site, flow is to the east towards Mines Branch River. In a small portion of the southern section of the Site, surface flows are directed to a wetland along the southern property boundary and further toward White Lake to the south.

2.5 Surficial and Bedrock Geology

Based on available surficial geology mapping, the native surficial soils of the Site consist of stony till plain, which is comprised of a stony, sandy matrix that is derived from local bedrock sources (Stea, 1992). Surficial geology in this area is characterized by its flat to rolling appearance and surface boulders. Underlying depth ranges between 2 and 20 metres below ground surface (mbgs) (MacEachern, 1983).

Based on available bedrock geology mapping, bedrock in the area of the Site consists of slate, minor sandstone and schist of the Halifax Formation (Keppie, 2000). The bedrock and groundwater at the Site are identified to be in a medium to high-risk area for arsenic in bedrock groundwater (Nova Scotia Department of Natural Resources, 2016).

2.6 Adjacent Land Use

Adjacent land uses include mainly undeveloped Crown land to the north, south, east, and west. The Liscomb Game Sanctuary is on adjacent land to the north and east of the Site. Current land use of adjoining properties is summarized in Table 2-1.

Table 2-1 Adjoining Properties – Current Land Use

Direction	Current Land Use	Current Owner
North	Liscomb Game Sanctuary - Undeveloped, forested. No regular human occupancy.	Crown Land Government of Nova Scotia
South	Undeveloped, forested. Land Pending Protection is approximately 250 m from the Site to the southeast. No regular human occupancy.	Crown Land Government of Nova Scotia
East	Liscomb Game Sanctuary - Undeveloped, forested. No regular human occupancy.	Crown Land Government of Nova Scotia
West	Undeveloped, forested. No regular human occupancy.	Crown Land Government of Nova Scotia

3 Site Characterization

3.1 Summary of Previous Investigations

Stantec conducted the following environmental investigations at the Site:

- Phase I ESA (Stantec, 2023a)
- Phase I ESA and Proposed Field Program Memo (Stantec, 2023b)
- Phase II ESA (Stantec, 2023c)
- Remediation Options Analysis (ROA) Memo (Stantec, 2023d)
- Memo – Habitat Assessment (Stantec, 2024 a)
- Updated Phase II ESA (draft) (Stantec, 2024 b)

The Areas of Potential Environmental Concern (APECs) that were assessed during the Phase II ESA field program included:

- APEC 1: Former Mine Workings
- APEC 2: Tailings Area
- APEC 3: Mines Branch River

3.2 Phase II ESA Field Program Summary

Preliminary soil samples were collected on July 18, 2023 and the Phase II ESA field program was completed on September 6 and 7, 2023. Stantec collected and analyzed 25 soil samples, fouir sediment samples and four surface water samples, in addition to four quality control samples during the initial Phase II ESA.

On May 31, 2024, three additional delineation soil samples (LOC-SA24-01, LOC-SA24-02, LOC-SA24-100) to delineate metal impacts at LOC-SA23-09) and two delineation sediment samples (LOC24-SD-01 and LOC24-SD-02) to delineate metal impacts previously identified at LOC23-SD-02 were collected.

Groundwater at the Site was not assessed based on the understanding that the soil, sediment, and surface water analytical results would be used to guide future groundwater assessment, if and when required (Stantec, 2023c). A detailed justification for the classification and assessment of groundwater is provided below.

3.2.1 Groundwater Classification and Assessment

While there is no central water supply and groundwater at the Site is classified as potable under the CSR protocol, Stantec conducted a review of the provincial groundwater mapping to determine risk associated with exposure to groundwater. In this case, the Site is in an area deemed to have medium to high risk of arsenic in bedrock and groundwater (Nova Scotia Department of Natural Resources 2016), which means that naturally occurring arsenic concentrations in groundwater would likely exceed the Tier 1 EQS for potable water. Notably there are areas in the same watershed as the Site that have reported >20 µg/L of arsenic in groundwater (Nova Scotia 2018), compared to the Tier 1 EQS of 10 µg/L.

Differentiation between naturally occurring arsenic and anthropogenically influenced arsenic concentrations would be difficult. In addition, there are no recorded groundwater wells within 5 km of the Site and therefore no human receptors to be directly impacted by groundwater on the Site. Therefore, for the purposes of the Phase II ESA and the HHERA, the applied Tier 1 EQS considered screening guidelines based on non-potable groundwater conditions.

3.2.2 Analytical Results

Analytical data, including sampling methodology and laboratory certificates of analysis, was presented in the Phase II ESA (Stantec, 2023c) and Updated Phase II ESA (Stantec, 2024 b). Analytical results were compared to Nova Scotia Environment and Climate Change (NSECC) Tier 1 Environmental Quality Standards (EQS) for an agricultural site with non-potable groundwater.

The following conclusions were made related to potential environmental contamination associated with historical gold mining operations:

- Exceedances of the Tier 1 EQS for aluminum, arsenic, cobalt, iron, lead, manganese, selenium and/or vanadium were identified in 21 of 26 soil samples collected at the Site.
- Most of the exceedances are considered to be indicative of background soil conditions.
- Bedrock in the Site area is known to be arsenic containing.
- Some soil sample locations were identified as impacted by the former mine operations. These locations were characterized by relatively high concentrations of arsenic, cobalt and/or lead, and elevated concentrations of aluminum, iron, manganese, selenium, and vanadium above background concentrations. The extent of impacted soil has been horizontally delineated; vertical delineation is assumed based on test pit refusal depths.
- Exceedances of arsenic, iron and manganese were identified in one sediment sample in the downstream ‘far-stream’ sample (LOC24-SD-01). As exceedances of arsenic, iron and manganese were not identified in the near stream or mid-stream samples, the concentrations in the ‘far-stream’ sample are generally attributed to natural conditions.

- Two exceedances of mercury were identified in sediment in the 'mid-stream' samples (LOC23-SD-02 and LOC24-SD-02). As the concentration of mercury is likely attributed to natural conditions or other activities that were completed downstream of the Site since the near stream sample (LOC23-SD-03) did not identify a mercury exceedance, no further assessment was recommended to delineate impacts in sediment.
- The sediment impacts were delineated to the Tier 1 EQS by the mid stream and far-stream samples.
- Exceedances of pH, aluminum and iron above the Tier 1 EQS for surface water were identified at all sample locations, including the upgradient sample location (LOC23-SW-04). Background water conditions in Nova Scotia are often acidic (i.e., low pH levels) and commonly have elevated concentrations of aluminum, iron and manganese, and therefore no further assessment was recommended to delineate these parameters in surface water.

3.2.3 Conclusions

Based on the results of the Updated Phase II ESA sampling program, the following was put forward:

- A remedial options analysis should be prepared to identify appropriate and effective options to address contamination present at the Site.
- An HHERA was recommended as the next step for assessment of the Site.

3.3 Species at Risk Habitat Assessment

3.3.1 Desktop Assessment

Stantec submitted a request to the Atlantic Canada Conservation Data Centre (AC CDC) for recorded observations of rare or uncommon plant, bird, mammal, and fish species present within five kilometres of the site (AC CDC, 2024). Data from AC CDC was used to determine the potential for Species at Risk (SAR) and Species of Conservation Concern (SOCC) to be present on or near the Site. These include those designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as endangered, threatened, or of special concern; those listed as endangered or threatened and afforded legal protection by the federal Species at Risk Act (SARA); and/or those listed as endangered or threatened and afforded legal protection under the Nova Scotia Endangered Species Act (Government of Nova Scotia, 2021).

3.3.2 Site Reconnaissance

A site reconnaissance was completed on May 31, 2024. The site reconnaissance consisted of a walkover of the site including impacted versus unimpacted areas of the site to identify the various habitats present. Plant communities present in impacted and adjacent unimpacted areas were identified and described. Forested plant communities on the site were classified and named according to the Nova Scotia Forest Ecosystem Classification System. Plant community boundaries (upland and wetland) were not delineated during this site reconnaissance. An inventory of vascular plants present on the site was not compiled since the site reconnaissance was conducted in late May before many species had developed to the stage where they could be reliably identified. All birds observed or heard on or adjacent to the site were documented. Incidental observations of mammals, reptiles and amphibians present on the site were also recorded.

3.3.3 Conclusions

- Results of the desktop review indicate that nine SAR and ten SOCC have been reported within 5 km of the Site.
- The site reconnaissance identified seven plant communities on the site including six forested plant communities and one tall shrub thicket. Three of the six forested plant communities are wetland plant communities.
- The vegetation present in the area impacted by mining activities was in good health and appeared to be vigorous. The relatively low cover of the tree overstory in the impacted areas is typical of many forested wetlands and is probably not indicative of vegetation stress.
- A variety of wildlife species were observed during the site reconnaissance, including five mammal species, six amphibian species, twenty-eight avian species, and one fish species.
- One SAR (Olive-sided Flycatcher) and two SOCC (Pine Siskin and brook trout) were recorded on site during the site reconnaissance.
- Following site reconnaissance, the nine SAR and ten SOCC that were listed in the AC CDC report were reviewed, and it was determined that six of these species are unlikely to be found on site while ten could potentially be found on site. Not enough information is known about three lichen species to determine if they could potentially be found on Site.

3.4 Ecologically Sensitive and Protected Areas

The following managed or protected ecological areas are reported in the vicinity of the Site, as identified by AC CDC (AC CDC, 2024) and provincial mapping tools (Government of Nova Scotia) (undated).

3.4.1 Liscomb Game Sanctuary

The portion of the Site north of the mine access trail and east of the Mines Branch River is within the boundaries of the Liscomb Game Sanctuary as shown on Figure A-2, Appendix A. The Liscomb Game Sanctuary was established in 1928 and is comprised of approximately 43,000 ha of forest, wetlands, waterbodies, barrens, roads, utility corridors, and other miscellaneous land classifications, of which approximately 13,000 ha are privately owned (Government of Nova Scotia) (undated). Hunting and trapping are prohibited within the sanctuary other than under certain conditions during a six-day period each fall (Government of Nova Scotia, 2013a). Provincial government sources do not describe the purpose of the Liscomb Game Sanctuary; however, secondary sources indicate that provincial game sanctuaries were originally established due to declining populations of animals including moose (Saltwire, 2018).

3.4.2 Cross Lake Nature Reserve

The Cross Lake Nature Reserve is located approximately 500 m downstream of the Site on the eastern shore of Cross Lake, into which Mines Branch River flows after exiting the Site, as shown on Figure A-1, Appendix A. The reserve is comprised of 201 ha including 27 ha that are conditional to lands being acquired by the Province (Government of Nova Scotia, 2013b; Government of Nova Scotia, 2013c); the status of these lands is described as “Pending” by provincial mapping (Government of Nova Scotia) (undated). The area is described as a “good example of Eastern Shore rain forest that has had little human disturbance,” containing “one of the largest concentrations of the nationally and provincially endangered boreal felt lichen” as well as blue felt lichen and “at least two other species of at risk lichens” (Government of Nova Scotia, 2013c). Outdoor recreation values at the Cross Lake Nature Reserve include hunting and fishing (Government of Nova Scotia, 2013c).

3.4.3 Twelve Mile Stream Wilderness Area

The Twelve Mile Stream Wilderness Area is located approximately 2.5 km west of the Site. It is comprised of four tracts of river corridor (approximately 1,800 ha) including “important trout habitat” and pockets of old red spruce, eastern hemlock, sugar maple, white ash, and yellow birch forest. The area is used for hiking, canoeing, angling and hunting. (Government of Nova Scotia).

3.4.4 Toadfish Lakes Wilderness Area

Two instances of the Toadfish Lake Wilderness are within five kilometres of the Site to the north and northeast. The Toadfish Lake Wilderness Area is stated to be part of a provincially significant assemblage of protected river corridors, lakes, and woodlands that provide refuge for species sensitive to disturbance, such as mainland moose. The area is reported to be a destination for angling, canoeing, hunting, and off-highway vehicle use. (Government of Nova Scotia)

4 Risk Assessment Approach

All chemicals (from anthropogenic and natural sources) have the potential to cause toxicological effects. However, the level of effect depends on the receptor (e.g., person or wildlife) being exposed, the route and duration of exposure (e.g., oral exposure for chronic durations), and the hazard (i.e., inherent toxicity) of the chemical. If all three components are present, the possibility of a toxicological risk exists.

Both the human health risk assessment (HHRA) and ecological risk assessment (ERA) portions were conducted according to widely accepted risk assessment methodologies and followed guidance published by regulatory agencies, including Health Canada, CCME, FCSAP, and the US EPA.

Each component of the risk assessment includes a problem formulation, which identifies site-specific receptors, contaminants of potential concern (COPCs) and potential exposure pathways. Exposure pathways that could result in unacceptable risk were further evaluated qualitatively or quantitatively, as appropriate. An Uncertainty Evaluation is provided, as well as conclusions and recommendations.

4.1 Assessment of Physical Hazards

The objective of this HHERA was to evaluate the potential that human and ecological receptors may experience toxicologically induced changes in health due to exposure to COPCs. While signs along the access road and trail notify visitors of the physical hazards in the area, risk from exposure to these physical hazards has not been assessed in this HHERA. It should be noted that the signs warning of physical hazards provides a deterrent via an administrative control which limits exposure to potential chemical hazards at the Site.

5 Human Health Risk Assessment

The purpose of the HHRA is to evaluate the potential that human receptors may be exposed to COPCs found at the Site at concentrations in excess of what may represent an acceptable risk. The primary guidance for conducting the HHRA was that of Health Canada, including:

- Federal Contaminated Site Risk Assessment in Canada: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 3.0 (Health Canada, 2021a)
- Federal Contaminated Site Risk Assessment in Canada: Health Canada Toxicological Reference Values (TRVs), Version 3.0 (Health Canada, 2021b).
- Federal Contaminated Site Risk Assessment in Canada Part V: Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals (DQRAChem; Health Canada, 2010c).

5.1 Problem Formulation

The objective of the problem formulation stage of the HHRA is the development of a focused understanding of which substances constitute COPCs, what human receptors are likely to be present at the Site for exposure, and how COPCs can migrate from the source(s) and ultimately reach, and are taken up by human receptors. This information is summarized in a human health conceptual site model (CSM), which provides a visual depiction of the relevant exposure pathways linking COPCs in various environmental media to the human receptors of interest in the HHRA.

5.2 Receptor Identification

5.2.1 General Site Description

Based on a review of site information including previous environmental reporting (Stantec, 2023a; Stantec, 2023c; Stantec, 2023d) and observations during site visits, the Site is located in an undeveloped forested area and consists of heavily vegetated woodlands. The Site is accessible via a gravel access road which turns into an unmaintained ATV and/or walking trail. Site access via cars/trucks is assumed to be seasonal, however access to the area via off-highway vehicles and snowmobiles occurs year-road and is unrestricted. Warning signs along the access road and trail notifies any visitors of the physical hazards in the area (refer to Appendix F, Photographs). There are no buildings, municipal services or other infrastructure present on the Site, and no regular human occupancy. The spatial extent of the area disturbed by the former mining operations is estimated to be approximately 5,000 m^2 or 0.5 Ha. These site conditions are not expected to change in the foreseeable future.

5.2.2 Existing and Anticipated Future Land Use

Existing and intended land use is an important factor in evaluating the potential for human exposures and estimating risk. It is important that protective assumptions are made about the potential receptors.

Preliminary human health screening compares maximum detected concentrations to conservative screening standards based on direct contact/ingestion for continuous human exposure at an agricultural land use site (i.e., all life stages present with continuous exposure (24 hours/day, 365 days/year for an 80-year lifespan).

5.3 Preliminary Screening for Human Health COPCs

Stantec conducted preliminary human health screening to identify potential risk to human receptors at the Site from exposure to COPCs in soil, surface water and sediment. Analytical data used for the HHRA are presented in various Tables in Appendix B. A summary of the applied preliminary screening standards is provided in Table 5-1.

Table 5-1 Summary of Preliminary Human Health Screening Standards

Soil	Surface Water	Sediment
Tier 2 PSS for Soil Contact/Ingestion	Tier 2 PSS for Potable groundwater (Drinking Water)	Tier 2 PSS for Soil contact/ingestion (Residential land use)[1].

Notes: 1. provides preliminary risk screening for sediment in accordance with Health Canada Guidance (Health Canada, 2017)

If a chemical did not have an applicable screening standard and analytical results were consistently below the limits of detection, the chemical was assumed to not be present at concentrations that would result in unacceptable risks. In these cases, the chemical was not carried forward for further assessment. Where human health screening levels were not available, detected concentrations are discussed in relation to concentrations at the background and/or reference locations and other locations across the Site.

5.3.1 Human Health COPCs in Soil

Maximum soil concentrations were initially screened against human health screening standards for direct contact/ingestion based on continuous exposure. Preliminary screening standards exclude pathway specific standards based on soil vapour migration for protection of the indoor air pathway, and soil leaching to potable groundwater as these exposure pathways are not operable based on our understanding of the existing and expected future use of the Site.

A parameter was eliminated from further consideration in the HHRA if the maximum detected concentration was less than the applied PSS. Soil parameters may be identified as human health COPCs if the maximum concentration exceeded the initial screening standards and the reference concentration (i.e., concentration at LOC23-SA-25, a soil sample collected from an undisturbed area adjacent to the Site).

Preliminary soil screening results are presented in Table B-1, Appendix B. Soil parameters with maximum concentrations greater than one or more of the applied screening criteria are summarized in Table 5-2, along with the frequency of exceedances for each of the applied screening criteria.

Table 5-2 Soil Parameters Exceeding Preliminary Screening Criteria and Frequency of Exceedances

Parameter	Maximum Detected (mg/kg)	Applied Screening Criteria		Frequency of Exceedances	
		PSS_{HH} [1] (mg/kg)	Reference Area Concentration[2] (mg/kg)	# Exceedances of PSS/ # Non-Reference Samples	# Exceedances of Reference/ # Non-Reference Samples
Aluminum	29,000	15,400	29,000	5/26	0/26
Arsenic	54	31	22	4 / 26	5 / 26
Cobalt	240	22	5.5	4 / 26	10 / 26
Iron	65,000	11,000	43,000	17 / 26	2 / 26
Lead	190	140	22	1 / 26	7 / 26
Manganese	3,000	360	710	12 / 26	5 / 26
Vanadium	41	39	22	1 / 26	5 / 26

Notes
Underlined = Greater than PSS_{HH} for Soil Contact/Ingestion
[1] NSECC Tier 2 PSS_{HH} – Agricultural Land Use – Soil Contact/Ingestion (NSECC, 2022b)
[2] Based on analytical results from sample LOC23-SA-25

Figure No. A-3, Appendix A, shows the sample locations that exceed the applied PSS for soil.

5.3.1.1 Discussion and Interpretation

Maximum concentrations of arsenic, cobalt, iron, lead, manganese, and vanadium were greater than the applied PSS_{HH} and the concentration at the reference location. An interpretation of the significance of each of these exceedances (including magnitude and frequency) is discussed below.

Concentrations of arsenic exceeded the applied PSS of 31 mg/kg in four of 26 samples. The magnitude of the maximum exceedances (54 mg/kg) is 1.74 x the applied PSS. While it is possible that some exceedances identified in soil at the Site are attributed to the historical mining-related activities, arsenic is known to be naturally occurring in the area and elevated arsenic concentrations in soil are more likely related to local background conditions (i.e., bedrock geology) (Nova Scotia Department of Natural Resources, 2016).

Concentration of cobalt also exceeded the applied PSS of 22 mg/kg in four of 26 samples. The magnitude of the maximum exceedance (240 mg/kg) is 10.9 x the applied PSS. Samples with cobalt concentrations exceeding the PSS include LOC23-SA-02, -09, -13, and -14, and are located in the vicinity of the mine tailings.

Maximum concentrations of iron and manganese (65,000 mg/kg and 3,000 mg/kg, respectively) are within the same order of magnitude as the NS background concentrations (55,030 mg/kg and 2,300 mg/kg, respectively). Concentrations of iron and manganese exceed background concentrations in two of 26 samples, and one of 26 samples, respectively. Both iron and manganese are naturally occurring and are commonly found at concentrations exceeding the Tier 1 EQS across Nova Scotia for a range of land uses.

The maximum concentration of lead (190 m/kg) exceeded the applied PSS of 140 mg/kg in one of 26 samples. The magnitude of the maximum exceedances is 1.26 x the PSS. The sample with lead exceeding the PSS is LOC23-SA-17 (190 mg/kg) and its duplicate (170 mg/kg) and is located in the vicinity of the mine tailings.

The maximum vanadium concentration only marginally exceeded the applied PSS of 39 mg/kg in one of 26 samples. The magnitude of the maximum exceedance is 1.05 x the PSS.

5.3.1.2 Final COPCs in Soil

Based on the range and distribution of detected concentrations, arsenic, iron, manganese, and vanadium are not likely associated with historical mining activities at the Site. Instead, concentrations of these parameters can be reasonably attributed to naturally occurring ambient conditions. Concentrations of other metals were below the applied PSS.

Cobalt and lead are present above the applied PSS and at concentrations that exceed naturally occurring background concentrations. Therefore, cobalt and lead are identified as the final human health COPCs in soil and are carried forward for further assessment.

5.3.2 Human Health COPCs in Sediment

Stantec also conducted screening to identify potential risk to human health from exposure to COPCs in sediment. In the absence of applicable human health-based sediment quality standards, Health Canada recommends that sediment concentrations be screened against human health-based direct contact soil quality guidelines for Residential land use (Health Canada, 2017). Therefore, preliminary screening for sediment is also based on the Tier 2 PSS for soil direct contact/ingestion pathway (NSECC Table 3B).

A parameter was eliminated from further consideration in the HHRA if the maximum detected concentration was less than the applied PSS. A parameter may be identified as a potential sediment COPC if the maximum concentration was greater than the applied PSS and reference concentration (i.e., concentration at upstream location LOC23-SD-04). Preliminary screening results are presented in Table B-2, Appendix B. Parameters in sediment with maximum concentrations that exceed one or more of the screening criteria are presented in Table 5-3 along with the frequency of exceedances.

Table 5-3 Sediment Parameters Exceeding Preliminary HH Screening Criteria and Frequency of Exceedances

Parameter	Maximum (mg/kg)	Applied Screening Criteria		Frequency of Exceedances	
		PSS $_{HH}$[1] (mg/kg)	Reference (Upstream)[2] (mg/kg)	# Exceedances of PSS $_{HH}$/ # Non-Reference Samples	# Exceedances of Reference/ # Non-Reference Samples
Arsenic	170	31	2.3	1 / 5	4 / 5
Cobalt	140	22	1.5	1 / 5	4 / 5
Iron	110,000	11,000	3,800	1 / 5	2 / 5
Manganese	6,600	360	72	1 / 5	3 / 5

Notes

Underlined = Greater than PSS_{HH} (Soil Contact/ingestion)

[1] NSECC Tier 2 PSS – Agricultural/Residential Land Use – Human Soil Contact/Ingestion (NSECC, 2022b) applied as per Health Canada guidance (Health Canada, 2017)

[2] Sample LOC23-SD-04

5.3.2.1 Discussion and Interpretation

Concentrations of arsenic, cobalt, iron, and manganese exceeded their respective PSS_{HH} at one of five downstream sediment locations (LOC24-SD-01, Downstream Far Point C, the furthest downstream non-reference sample location) Refer to Figure A-4, Appendix A.

As with soil, concentrations of iron and manganese in sediment are believed to be associated with natural conditions of the area. Where concentrations of arsenic and cobalt were below PSS_{HH} or not detected in the near stream or mid-stream samples, it is likely that these concentrations represent natural conditions or are attributed to other activities completed downstream of the Site. If contamination of the sediment was attributed to the former mine operations, higher concentrations of these metals would be expected in the near and mid-stream samples. As concentrations of these metals exceeding $PSS_{HH,}$ are located in a single downstream sediment sample and where the parameters are not likely related to the former mine, these appear to represent localized impacts. Based on the above, no sediment COPCs were carried forward for further evaluation in the HHRA.

5.3.3 Human Health COPCs in Surface Water

Groundwater and surface water on or near the Site are not expected to be used for potable water supply purposes. However, it is possible that water could be collected from the nearby Mines Branch River, boiled/filtered, and used to supplement drinking water supply on a hiking or camping trip. Therefore, surface water concentrations were compared to the following drinking water guidelines (in order of preference):

- Nova Scotia Tier II PSS for Potable Groundwater (i.e., drinking water)
- Health Canada. 2022. Guidelines for Canadian Drinking Water Quality Summary Table, Maximum acceptable concentrations (MACs)

- United States Environmental Protection Agency (USEPA) Regional Screening Level (RSL) for residential land use – ingestion of tapwater (USEPA 2020).

The drinking water standards represent continuous ingestion of water as drinking water in a residential setting. The potential short-term intake of surface water collected on a hiking or camping trip would represent considerably less exposure, thus the comparison and identification of COPCs using drinking water guidelines is very conservative. Comparison of surface water concentrations from Mines Branch River with the selected drinking water standards is presented in Table B-3, Appendix B. Maximum site concentrations were greater than guidelines for the following contaminants:

- Aluminum and Iron with concentrations exceeded the potable water standards in all samples.
- pH was also found to be outside the recommended range in all samples.

Background water conditions in Nova Scotia are often acidic (i.e., low pH levels) and commonly have elevated concentrations of certain metals including aluminum, iron and manganese. Where pH was found to be within the same range at all sample locations it can reasonably be attributed to background ambient conditions.

While concentrations exceed the drinking water standard for aluminum, the standard is based on an Operational Guideline (OG) established to minimize the potential for the accumulation and release of metals in water distribution systems and to avoid other operational and aesthetic issues. While the detected concentrations exceed the OG, they did not exceed the Maximum Acceptable Concentration (MAC) based on potential for negative human health effects (2,900 µg/L).

While concentrations also exceed the Tier II PSS for iron, the applied drinking water standard is based on taste and staining of laundry and plumbing fixtures. Health Canada notes that no evidence exists of dietary iron toxicity for iron in the general population.

Although detected in surface water, PSS and/or guidelines from the Health Canada and /or USEPA are not available for a number of metals and nutrients (i.e., bismuth, calcium, magnesium, phosphorus, potassium, silver or titanium). However, by comparison of these parameters to the site conditions at each of the APECs, the results are within a similar range at all locations and do not appear to be related to former mining activities at the Site. Generally, observed concentrations of these parameters are considered to represent background conditions within the region and are not considered further in the HHRA. No other exceedances of drinking water standards were detected. Based on the preliminary screening, risk from human exposure to surface water was not considered further in this HHRA.

5.4 Site-Specific Receptor Selection

Based on the current and anticipated future land use at the Site, potential human receptors likely to be present at the Site can broadly be classed as one of two receptor types:

1) A hiker (passing through the area on foot via existing access roads and trails)
2) A recreational visitor (e.g., camping, hunting or fishing, potentially accessing any area of the Site)

For the purposes of this HHRA, the hiker is characterized as a teen or adult that may be hiking in the area. Due to the remote nature of the Site and the number of physical hazards in the area, infants, toddlers, and children are not expected to be present as hikers. The hiker is expected to stay on or close to existing access roads and trails (i.e., generally within 5 to 10 metres), especially given the presence of signage warning of hazardous areas with open holes and other physical hazards.

A recreational visitor is characterized as a child, teen or adult who may be traversing anywhere across the Site while camping, hunting or fishing. It is considered unlikely that an infant or toddler would be included on hunting or wilderness camping trips, especially given the presence of signage warning of numerous physical hazards in the area. Thus, infants and toddlers were not evaluated explicitly as recreational visitors.

Construction workers were not evaluated for the Site as future building construction is not expected. Remediation workers were not evaluated for the Site as it is expected that remediation workers would develop specific health and safety plans to mitigate or manage risks per applicable occupational regulations (i.e., Occupational Safety General Regulations (Government of Nova Scotia, 1999)).

While other receptor groups could be present at the Site on occasion (i.e., forestry workers, and/or those involved in recreational vehicle excursions passing through the Site to other locations), these groups were considered to be less exposed than either the hiker or the recreational visitor. Based on the above, receptor selection is expected to be conservative, and the level of uncertainty is low.

5.5 Hiker Receptor

Maximum soil concentrations were initially screened against soil contact standards for agricultural land use, which assumes that human receptors of all ages may be present continuously over a lifetime of exposure (i.e., 24 hours a day, 7 days a week, 52 weeks a year, for 80 years).

To better assess the potential exposure of a hiker and recreational visitor, additional screening was carried out to better evaluate the probability of exposure or determine if the potential magnitude of exposure is negligible.

5.5.1 Secondary COPC Screening

To better reflect the hiker exposure scenarios, additional pathways specific screening can be carried out to guidelines that better reflect potential exposures for a hiker moving through the area. For the hiker, which is a teen or adult, it is not reasonable to assume that the receptor will be present at the Site continuously. Guidelines for industrial land use are protective of adults and assume receptors are present 5 days a week, 48 weeks per year, and are considered appropriately conservative for identifying COPCs for hikers. This additional screening for parameters that were carried forward in the HHRA (cobalt and lead) is provided in Table 5-4.

Table 5-4 Maximum Soil Concentrations Compared to Industrial PSS for the Hiker

Parameter	Human Health PSS – Industrial, Direct Contact/ingestion [1] (mg/kg)	Maximum Detected Site Concentration (mg/kg)
Cobalt	250	240
Lead	8,200	190

Notes
Underlined = Greater than industrial guideline
[1] NSECC Tier 2 PSS – Industrial Land Use – Soil Contact/Ingestion (NSECC, 2022b)

Based on this additional screening, no COPCs are identified for the hiker receptor. Furthermore, for the hiker, who is characterized as a receptor that is expected to remain close to the trail, the likelihood of exposure to a COPC in soil considers the distance from sample locations with exceedances to the trail.

5.5.2 Site Specific Exposure Assessment

The exposure assessment is used to confirm and describe how a COPC can move from impacted media (e.g., soil) to a point where it can contact and enter the human body. The likelihood of exposure is determined through consideration of the properties of individual hazards that control chemical mobility, and the various pathways through which the hazard could move to contact the receptor, or through which the receptor could move to contact the hazard. The exposure analysis also considers the possible mechanisms through which a hazard can be introduced to a human receptor (i.e., ingestion, dermal contact, and inhalation). Pathways for which the probability of exposure is very low, or the potential magnitude of exposure is negligible, were not carried forward for further assessment. A summary of the exposure pathways assessed for the hiker is provided in Table 5-5.

Table 5-5 Exposure Pathway Assessment – Hiker Receptor

Exposure Pathway	Potentially Complete	Carried Forward	Justification
Ingestion of soil	Yes	No	No COPCs in soil were higher than industrial PSS that are protective of an adult receptor that is present for five days a week, 48 weeks per year. Hikers are also expected to stay on the trail while passing through the area. The maximum concentrations are located at a distance greater than 10 m from the trail and therefore it is considered unlikely that a hiker would have significant exposure to these soil concentrations. Furthermore, given the presence of signs warning of hazardous areas with open holes, hikers are unlikely to wonder from the trail or spend prolonged periods of time in direct contact with soil within the impacted portion of the Site. Therefore, ingestion or dermal contact of metals in soil is considered negligible.
Dermal contact with soil	Yes	No	

Table 5-5 Exposure Pathway Assessment – Hiker Receptor

Exposure Pathway	Potentially Complete	Carried Forward	Justification
Inhalation of soil particles	No	No	Dust levels are expected to be low as much of the impacted soil is covered with vegetation and construction activities that could release dust are not expected. Therefore, this was pathway was not evaluated further.
Inhalation of soil vapour (indoors)	No	No	COPCs detected in soil are not volatile and there are no occupied buildings on or near the Site. As such, inhalation of vapours via indoor air is not operable and therefore is not considered further.
Inhalation of soil vapour (outdoors)	No	No	Substances detected in soil are not volatile. Furthermore, exposure to potential vapours volatilizing from soil is normally considered to be a relatively insignificant pathway due to the dilution that occurs in outdoor air. As such, inhalation of vapours in outdoor air is not considered further.
Ingestion of groundwater	No	No	Groundwater is not used as a source of potable water. Therefore, this exposure pathway was not carried forward.
Ingestion of surface water	No	No	It is possible that a hiker could supplement their drinking water supply with surface water collected from the Mines Branch River. However, COPCs detected in surface water do not exceed PSS for potable water supplies which are very conservative. As such this pathway is not considered further.
Dermal contact with surface water	No	No	There are no shoreline or beach areas at the Site where high-contact recreational activities would be expected (i.e., picnicking, shoreline play). A hiker may wade through a shallow surface water body that intercepts the trail or take a swim in one of the water bodies, but contact would be limited to short periods and, based on the concentrations observed, risks are considered to be negligible.
Ingestion of sediments	Yes	No	Concentrations in sediment above the applied PSSs were identified in a single sample representing a comparatively small portion of Mines Branch River and are not likely associated with the former mine operations. Regular or prolonged human contact with sediment is not anticipated as swimming or wading in the watercourses other than occasional and brief events is not anticipated based on difficult access and lack of attractive swimming holes or beaches. This pathway was not considered further.
Dermal contact with sediments	Yes	No	

Table 5-5 Exposure Pathway Assessment – Hiker Receptor

Exposure Pathway	Potentially Complete	Carried Forward	Justification
Ingestion of plants exposed to impacted soil	Yes	No	It is possible that hikers may pick and consume berries while hiking on the trail. However, this is expected to be opportunistic consumption (i.e., limited to berries present close to the trail) and therefore unlikely to represent a significant source of exposure. Also, elevated concentrations in soil were observed at distances greater than 10 m from the trail and therefore berries near the trail, if present, are unlikely to be affected by uptake of COPCs. Therefore, this exposure pathway was not evaluated further.
Ingestion of fish exposed to impacted sediment	Yes	No	Hikers are not expected to fish for food within Mines Branch River while passing through the Site. Fishing by non-hiker recreational visitors is discussed in the following section.
Ingestion of hunted animals exposed to impacted soil and/or sediment	Yes	No	Hikers are not expected to hunt for food on the Site. Hunting by non-hiker recreational visitors is discussed in the following section.

5.5.3 Risk Summary for Hiker

No COPCs were higher than screening levels that are considered protective of the hiker receptor for the pathways evaluated. Furthermore, based on the locations where elevated concentrations were observed, the probability of exposure for the hiker receptor is low, either directly (through ingestion, dermal contact, or inhalation of particulate) or indirectly (through inhalation of vapours or ingestion of food).

Given the presence of signage warning of hazardous areas with open holes, hikers are unlikely to spend prolonged periods of time in direct contact with soil within the impacted portion of the Site which are greater than 10 m from existing access roads/trails. Therefore, human health risks from exposure to COPCs for the hiker are negligible.

5.6 Recreational Visitor Receptor

To better reflect recreational visitor exposure scenario (i.e., a visitor for camping, hunting or fishing in the area), additional screening can be carried out to guidelines that better reflect potential exposures. As with the hiker, it is not reasonable to assume that the recreational visitor will be present at the Site continuously. For the recreational visitor, which is characterized as a teen or adult, commercial guidelines, which are protective and assume receptors are present 5 days a week, 48 weeks per year, are considered appropriately conservative for identifying COPCs.

5.6.1 Secondary COPC Screening

As the recreational visitor may be walking over much of the Site and surrounding area, maximum concentrations are not considered representative of their likely exposure. As a result, an exposure point concentration (EPC) better reflects the likelihood of significant exposure. EPCs represent the exposure of a receptor over an exposure area during a period of time. The 95% Upper Confidence Limit of the Mean (UCLMs) for the final COPCs were calculated using the USEPA ProUCL Version 5.2 statistical software. Per guidance provided in the ProUCL Technical Guide (USEPA 2022), data were considered sufficient to calculate 95% UCLMs when sample size exceeded ten (i.e., n ≥ 10) and at least four samples exceeded the reportable detection limit. In all other cases (i.e., n<10 and/or number of detected samples <4), the maximum observed concentration or reported detection limit (RDL) was selected. Where data were less than the RDL, it was assessed as the full RDL value. This additional screening for the final COPCs that were carried forward from initial screening (cobalt and lead) is provided in Table 5-6. The 95% UCLM concentration outputs are provided in Appendix C.

Table 5-6 Maximum Soil Concentrations Compared to Commercial PSS for the Recreational Visitor

Parameter	PSS for Soil Contact – Commercial[1] (mg/kg)	95% UCLM Surface Soil Concentration (Maximum Concentration Excluded) (mg/kg)
Cobalt	22	40.05 (21.44)
Lead	260	53.7 (41.16)

Notes
Underlined = Greater than industrial guideline
[1] NSECC Tier 2 PSS – Industrial Land Use – Soil Contact/Ingestion (NSECC, 2022b)

Based on the additional screening presented in Table 5-6, only cobalt was identified as a COPC in soil for the recreational visitor. Although the 95% UCLM concentration for cobalt is greater than the applied PSS, the UCLM is skewed by the single elevated concentration of 240 mg/kg at LOC23-SA-14. Nearby samples indicated concentrations that were lower and/or non-detect, suggesting a localized exceedance. Among 26 soil samples analyzed for cobalt, 22 samples indicated concentrations that were less than the PSS, including 7 samples where cobalt was not detected. The 95% UCLM meets the applied PSS if the maximum concentration is excluded. The sample locations where metals exceed the applied PSS are shown on Figure A-5, Appendix A.

5.6.2 Site Specific Exposure Assessment

A summary of the relevant exposure pathways evaluated for the recreational visitor is provided in Table 5-7.

Table 5-7 Exposure Pathway Assessment – Recreational Visitor Receptor

Exposure Pathway	Potentially Complete	Carried Forward	Justification
Ingestion of soil	Yes	No	While the Site is not occupied, recreational visitors which may include adults and teenagers could access any portion of the Site including impacted and non-impacted areas. Although the 95% UCLM concentration for cobalt is greater than the applied PSS, the UCLM is skewed by the single elevated concentration of 240 mg/kg at LOC23-SA-14. Nearby samples indicated concentrations that were lower and/or non-detect, suggesting a localized exceedance.
Dermal contact with soil	Yes	No	Toddlers who may potentially ingest soil during play are not expected to be brought to the Site. Given the presence of signage warning of hazardous areas with open holes, recreational visitors are unlikely to spend prolonged periods of time in direct contact with soil within the portion of the Site with impacted soil above commercial PSS. Therefore, ingestion or dermal contact with soil with metals above PSS is considered unlikely and risk is considered low.
Inhalation of soil particles	No	No	Dust levels are expected to be low as much of the soil is covered with vegetation and construction activities that could release large volumes of dust are not expected. Therefore, this exposure pathway was not evaluated further.
Inhalation of soil vapour (indoors)	No	No	Substances detected in soil are not volatile and there are no buildings on the Site. As such, inhalation of vapours is considered very unlikely.
Inhalation of soil vapour (outdoors)	No	No	Substances detected in soil are not volatile. Furthermore, exposure to potential vapours volatilizing from soil is normally considered to be a relatively insignificant pathway due to the dilution that occurs in outdoor air. As such, inhalation of vapours in outdoor air is not considered further.
Ingestion of surface water	No	No	It is possible that a recreational visitor could supplement their drinking water supply with surface water collected from the Mines Branch River. However, COPCs detected in surface water do not exceed PSS for potable water supplies. As such this pathway is not considered further.

Table 5-7 Exposure Pathway Assessment – Recreational Visitor Receptor

Exposure Pathway	Potentially Complete	Carried Forward	Justification
Dermal contact with surface water	No	No	There are no shoreline or beach areas at the Sites where high-contact recreational activities would be expected (i.e., picnicking, shoreline play). A recreational visitor may occasionally wade through a shallow surface water body that intercepts the trail or take a swim in one of the water bodies, but contact would be limited to short periods and based on the observed concentrations, risks are considered to be negligible.
Ingestion and dermal contact with sediment	Yes	No	As above, wading or swimming in surface water at the Sites may occur; however, these activities are expected to be brief (i.e., not a regular, sustained activity) and exposures to sediment would be incidental. Concentrations in sediment above the applied PSS were identified in a single sample representing a comparatively small portion of Mines Branch River within the Site and are not likely associated with the former mine operations. Regular or prolonged human contact with sediment is not anticipated as swimming or wading in the watercourses other than occasional and brief events is not anticipated based on difficult access and lack of attractive swimming holes or beaches. Risks from potential exposure to sediment are negligible.
Ingestion of groundwater	No	n/a	Groundwater is not used as a potable source. Therefore, this exposure pathway was not considered further.
Ingestion of food (berries, game)	Yes	No	The area where COPC concentrations in soil are above human health guidelines is small compared to the home range of most game and compared to the area around the site where hunting could occur. The limited soil exceedances are not expected to substantially affect the concentrations of COPCs in game. Similarly, harvesting and ingestion of plants exposed to the relatively small area of impacted soil within the Site (i.e., from areas in the vicinity of historical mining activities i.e., <0.5 Ha) is considered unlikely given difficult access and signage warning of hazards. Therefore, this pathway was not assessed further.

5.6.3 Risk Summary for Recreational Visitor

Only the EPC for cobalt was higher than screening levels that are considered protective of the recreational visitor receptor. Furthermore, based on the locations where elevated concentrations were observed, the probability of exposure for the recreational visitor is low, either directly (through ingestion, dermal contact, or inhalation of particulate) or indirectly (through inhalation of vapours or ingestion of food).

Given the presence of signage warning of hazardous areas with open holes, recreational visitors are unlikely to spend prolonged periods of time in direct contact with soil within the impacted portion of the Site (<0.5 Ha). Therefore, human health risks from exposure to COPCs in soil for the recreational visitor is negligible.

5.7 Conceptual Site Model

The CSM for human health is presented as Figure D-1, Appendix D.

5.8 Risk Characterization Summary

The purpose of the human health risk assessment was to evaluate the potential that human receptors (e.g., hikers and recreational visitors) may experience exposures to COPCs found at the Site in excess of what may be considered acceptable. Various metals were identified as COPCs in soil as their maximum concentrations were higher than human-health based values for a residential land use scenario.

Potentially complete exposure pathways assessed for the hiker and recreational visitor included surface water ingestion, dermal contact with surface water, sediment ingestion/dermal contact, soil ingestion, soil dermal contact and ingestion of food. Receptor-specific contaminant screening was carried out to reflect the characteristics of the hiker (teen or adult who stays on or near the access road/trail) and the recreational visitor (child, teen or adult who may travel across the Site).

For COPCs identified for the hiker, the potential for exposures were evaluated based on the distance from soil sample locations with exceedances of human health guidelines to the trail. For COPCs that were retained for the recreational visitor, the potential for exposures were evaluated based on the spatial extent of soil sample locations with exceedances.

No COPCs were identified for the Hiker and only cobalt was identified as a COPC in soil for the Recreational Visitor. Although the 95% UCLM concentration for cobalt is greater than the applied PSS, the UCLM is skewed by the single elevated concentration of 240 mg/kg at LOC23-SA-14. Nearby samples indicated concentrations that were lower and/or non-detect, suggesting a localized exceedance.

Based on the assessment, human health risks were considered negligible.

5.9 Uncertainty Evaluation

Potential sources of COPCs were identified as part of the previous environmental site assessments and sampling locations were selected to cover areas of historical mining activities that were identified based on the Phase I ESA and site visits. Given the available information, it was assumed that the targeted sampling locations included the maximum or near maximum concentrations of COPCs tested. The data used were sufficiently representative of the Site for use in the HHRA and was likely biased high.

The PSS used for the initial screening were human health-specific guidelines based on an exposure scenario that includes a permanent residence, which is more conservative than the exposure scenarios anticipated for the Site. Receptors that are most likely expected to frequent the Site now or in the foreseeable future were considered in the HHRA based on the information available. Other receptors could frequent the Site but were considered to be less exposed. Receptor selection is likely conservative and the level of uncertainty is low.

The PSS that were used for the screening of COPCs for both the hiker and recreational visitor incorporate conservative assumptions in terms of the assumption of soil contact for five days per week, 48 weeks a year. As it is expected that these receptors will not be at the Site this frequently, the applied guidelines are considered conservative and appropriate for identifying COPCs.

Recreational visitors (i.e., campers, hunters) may also harvest game to feed their families. However, the area where COPC concentrations in soil are above human health guidelines is small compared to the home range of most prey and compared to the area range where hunting and gathering could occur. The limited soil exceedances are not expected to substantially affect the concentrations of COPCs in game that may be consumed.

5.10 HHRA Recommendations

While risk from exposure to chemical hazards identified at the site is considered negligible, ongoing risk management or remediation is recommended to address the range of physical hazards present at the Site. Ongoing risk management includes the use of warning signage to limit exposure and/or warnings for site users. Remedial options may include fencing or capping of areas where concentrations exceed the applied PSS.

The physical hazards (excavations and open pits) at the Site should be assessed and, if recommended, remedial measures implemented to eliminate risk of physical injury to people who may attend the site.

6 Terrestrial Ecological Risk Assessment

The purpose of the terrestrial ERA is to evaluate the potential that terrestrial ecological receptors (e.g., plants, soil invertebrates, mammals, and birds) may experience toxicologically induced changes in health from exposure to COPCs identified at the Site. The risk assessment methodology for this ERA follows guidance from the following documents:

- CCME Ecological Risk Assessment Guidance (CCME, 2020).
- FCSAP Ecological Risk Assessment Guidance (FCSAP, 2012).

6.1 Problem Formulation

The objective of the Problem Formulation stage of the terrestrial ERA is the development of a focused understanding of the terrestrial ecological receptors that are likely to be present at the Site; how COPCs migrate from the source(s) and ultimately reach and are taken up by ecological receptors; and which chemicals constitute ecological COPCs.

6.2 Receptor Identification

The site reconnaissance identified seven plant communities on the site including six forested plant communities and one tall shrub thicket. Three of the six forested plant communities are wetland plant communities. The vegetation present in the area impacted by mining activities was in good health and appeared to be vigorous. The relatively low cover of the tree overstory in the impacted areas is typical of many forested wetlands and is probably not indicative of vegetation stress (Stantec, 2024 a).

A variety of wildlife species were observed during the site reconnaissance, including five mammal species, six amphibian species, twenty-eight avian species, and one fish species. Nine SAR and ten SOCC were also listed in the AC CDC report to be present within 5 km of the site. One SAR (Olive-sided Flycatcher) and two SOCC (Pine Siskin and brook trout) were recorded on-site during the site reconnaissance (Stantec, 2024 a).

Following site reconnaissance, the nine SAR and ten SOCC that were listed in the AC CDC report were reviewed, and it was determined that six of these species are unlikely to be found on-site while nine terrestrial species could potentially be found on or near the site including: Canada Jay (*perisoreus canadensis*), Boreal Chickadee (*Poecile hudsonicus)*, Southern Twayblade (*Neottia bifolia),* Boreal Felt Lichen - Atlantic pop *(Erioderma pedicellatum (Atlantic pop.),* Corrugated Shingles Lichen *(Fuscopannaria ahlneri),* White-rimmed Shingle Lichen *(Fuscopannaria leucosticte),* Blue Felt Lichen *(Pectenia plumbea),* and Mainland Moose *(Alces alces americana).* Not enough information was known about three lichen species to determine if they could potentially be found on-site (Stantec, 2024 a).

Based on the habitat and wildlife assessment described above, terrestrial ecological receptors of concern at the Site include:

- Plants (including Boreal Felt Lichen - Atlantic pop*,* Corrugated Shingles Lichen, White-rimmed Shingle Lichen, Blue Felt Lichen).
- Soil Invertebrates
- Mammals (including Mainland Moose)
- Amphibians
- Birds (including Canada Jay, Boreal Chickadee, Pine Siskin, Olive-sided Flycatcher and Southern Twayblade)

6.3 Identification of COPCs for Terrestrial Receptors

The terrestrial ERA focuses on exposure of terrestrial receptors to COPCs in soil. Exposure pathways related to surface water and sediment are addressed in the aquatic ERA (Section 7).

Direct exposure of terrestrial receptors to soil contaminants relates predominantly to “surface” soil. FCSAP (2012) considers the top 1.5 m of soil (i.e., 0 to 1.5 mbgs) to be the main rooting zone for plants and the main burrowing zone for small mammals. Below 1.5 m, the soil contact pathway for ecological receptors is considered to be incomplete. For the purposes of screening soil concentrations against soil contact standards PSS_{Eco}, soil samples within 1.5 mbgs were considered applicable.

The terrestrial ERA screening for soil is presented in Table B-6 in Appendix B. The ecological screening involved comparing maximum concentrations to the Atlantic RBCA Ecological Screening Levels (ESLs) – as the lower of the Tier II PSS for Direct Soil Contact or Soil and Food Ingestion pathway standards (Agricultural Land Use) (Atlantic PIRI, 2023). Where ESLs were not available, concentrations are discussed in relation to concentrations at the background or reference locations and across the Site.

A parameter was eliminated from further consideration in the ERA if the maximum detected concentration was less than the applied PSS. A parameter was identified as a potential soil COPC for the terrestrial ERA if concentrations were greater than the applied PSS and the reference concentration (i.e., concentration at LOC23-SA-25 as discussed below). Analytes with maximum concentrations greater than the applied PSS are summarized in Table 6-1. Figure A-6 and Figure A-7, Appendix A show the sample locations that exceed for Eco Soil Contact pathway and Soil and Food Ingestion Pathway, respectively.

Table 6-1 Soil Parameters Exceeding Preliminary Eco Screening Criteria and Frequency of Exceedances Parameters in Soil

Parameter	Maximum (mg/kg)	PSS Ecological (mg/kg)	Reference[3] (mg/kg)	# Exceedances of PSS/ # Non-Reference Samples	# Exceedances of Reference/ # Non-Reference Samples
Aluminum	27,000	-	29,000	-	0/26
Arsenic	54	17[1]	22	7 / 26	5 / 26
Cobalt	240	20[1]	5.5	4 / 26	10 / 26
Iron	65,000	-	43,000	-	2 / 26
Lead	190	300[1]/70[2]	22	3 / 26	7 / 26
Manganese	3,000	-	710	1 / 26	5 / 26
Selenium	4.0	1[1/] 4.5[2]	2.7	5 / 26	1 / 26
Strontium	15	-	<5.0	-	12/26
Vanadium	41	130[1]/18[2]	22	6 / 26	5 / 26

Notes: Underlined – Concentrations exceeds applied PSS

[1] Ecological Soil Contact (mg/kg)

[2.] Soil and Food Ingestion – Mammals and Birds (mg/kg)

[3.] Based on analytical results from sample LOC23-SA-25

6.3.1 Discussion and Interpretation

Maximum concentrations of arsenic, cobalt, iron, lead, lithium, manganese, rubidium, selenium, strontium and vanadium were greater than their respective PSS and local background conditions.

Concentrations of arsenic exceeded the applied PSS of 17 mg/kg in four of 26 samples. The magnitude of the maximum exceedances (54 mg/kg) is 3.17 x the applied PSS and 2.5 x the reference sample. While it is possible that some exceedances identified in soil at the Site are attributed to the historical mining-related activities, arsenic is known to be naturally occurring in the area and elevated arsenic concentrations in soil are more likely related to local background conditions (i.e., bedrock geology) (Nova Scotia Department of Natural Resources, 2016).

Lithium and rubidium were detected in soil at the Site, but no ecological guidelines are available. Lithium occurs naturally in soil but at relatively low concentrations with an average lithium concentration of approximately 25 mg/kg in soil (Shahzad, 2016). Lithium concentrations in soils have been reported to range from 0.002 to 63 mg/kg (Vergara-Edwards, 1986). The lithium concentration collected from the reference sample collected near the Site was 28 mg/kg. Literature suggests that lithium is not essential or beneficial for plant growth or development and may replace magnesium or calcium in the metabolic processes in plants (Shahzad, 2016). Lithium is toxic to plants grown in soils with high concentrations of lithium (Shahzad, 2016).

Strontium occurs naturally in the earth's crust with average concentrations of approximately 200 – 370 mg/kg (World Health Organization , 2010). Although strontium is not required for plant growth or reproduction, it is readily absorbed from the soil into plants (ATSDR, 2004). Strontium uptake into plants is least in soils with high clay or organic matter content or in soils with high calcium concentrations. The concentrations of strontium measured in soil at the Site (maximum concentration of 15 mg/kg) is well below the naturally occurring range, thus strontium was not retained as a COPC for the ERA.

While concentrations of lithium, rubidium, and strontium were measured in soil at the Site (maximum concentrations of 36, 21 and 15 mg/kg, respectively), no corresponding PSS is provided for ecological health. However, these parameters are known to be naturally occurring and are not expected to drive the remediation or management issues at this Site. By comparison of these parameters to the local conditions, the results are within a similar range at all locations and do not appear to be related specifically to historically mining activities. Generally, observed concentrations of these parameters are considered to represent background conditions within the region and are not considered further in the terrestrial ERA.

Maximum concentrations of iron on the Site exceed the generic Tier 1 EQS; as iron is naturally occurring and not apparently associated with historical mining activities, it is not carried forward further in the ERA.

The maximum concentration of lead (190 mg/kg) did not exceed the PSS for direct soil contact, however the maximum concentration does exceed the PSS for Soil and Food Ingestion by birds and mammals and is therefore carried forward for additional assessment.

The maximum concentration of manganese is in the same order of magnitude as the NS background concentrations; concentrations of manganese exceed the PSS and the NS background concentration in one out of 26 samples. Like iron, manganese is commonly found to be naturally occurring at high levels in soil in Nova Scotia and is not known to be associated with historical mining activities.

While selenium exceeded the PSS for soil contact, selenium is known to be naturally occurring and is not expected to drive the remediation or management issues at this Site. By comparison of these parameters to the local conditions, the results are within a similar range at many locations including the reference location and do not appear to be related specifically to historically mining activities. Generally, observed concentrations of these parameters are considered to represent background conditions within the region and are not considered further in the terrestrial ERA.

Concentrations of vanadium exceeded the PSS (18 mg/kg) and the reference concentration (22 mg/kg) at six and five samples out of 26, respectively. According to the CCME, natural mean concentrations of vanadium in Canadian soils range from 38 to 42 mg/kg, with concentrations tending to increase with depth. Minimum values are 10 mg/kg and maximum are 90 mg/kg. Soil samples collected throughout Ontario from undisturbed old urban and rural parklands not impacted by local point sources of pollution were analyzed to determine average background vanadium concentrations. The 98th percentiles of the sample population analyzed were 71 mg/kg for old urban parkland and 77 mg/kg for rural parkland (OMEE, 1993). Vanadium concentrations in shallow Nova Scotia soil (0-0.05 m) range between 7 mg/kg and 116 mg/kg, while concentrations in the A-Horizon (0.0 - 0.30 m) range between 3 mg/kg and 160 mg/kg (Stea, 1992). The consistent range of detected concentrations of vanadium on-site and in the

reference sample suggests vanadium is likely naturally occurring. Based on the relatively low magnitude of the maximum exceedance (2x the guideline), risk from exposure to vanadium to birds and mammals at the Site is not expected to result in significant risk above background.

Based on the range and distribution of concentrations observed, concentrations of arsenic, iron, lithium, manganese, rubidium, selenium, strontium and vanadium do not appear to be associated with historical mining activities at the Site and are instead attributed to natural conditions of the area. Cobalt and lead are present above one or more PSS and at concentrations above naturally occurring background concentrations in Nova Scotia. Concentrations of other metals were below the applied PSS. Therefore, cobalt and lead are identified as terrestrial COPCs in soil and are carried forward for further consideration in the ERA.

6.4 Secondary Screening for Birds and Mammals

The initial soil screening guidelines selected were protective of soil invertebrates, plants, mammals and birds. For the COPCs that were identified for mammals and birds based on screening against the lowest ecological soil contact guideline, an additional screening is carried out against ESLs based on PSS for soil and food ingestion by mammals and birds.

Only lead exceeded the PSS for soil and food ingestion pathway (birds and mammals) (70 mg/kg) at three of 26 sample locations. Detected concentrations ranged from 110 mg/kg to 190 mg/kg (i.e., 1.57 x to 2.7 x the PSS). Lead impacts were delineated within the area of mine tailings (refer to Table B-6, Appendix B and Figure A-7, Appendix A)

FCSAP ERA guidance (FCSAP, 2012) recommends the use of the maximum concentrations for screening COPCs for immobile receptors but considers that this approach is too conservative for mobile receptors and recommends the use of percentiles or UCLMs when sufficient data are available. The 95% UCLM concentrations were used to screen COPCs for mammals and birds.

Table 6-2 presents the EPC concentration (95% UCLMs) compared to the applied ESLs for Soil and Food Ingestion to identify whether the concentrations may present an unacceptable risk. The 95% UCLM concentration outputs are provided in Appendix C.

Table 6-2 Soil EPCs Compared to PSS for Soil and Food Ingestion

Parameter	PSS Soil and Food Ingestion by Birds and Mammals (mg/kg)	95% UCLM Surface Soil Concentration (mg/kg)
Lead	70	53.7

Notes
Underlined = Greater than applied PSS

Based on the secondary screening using 95% UCLMs, no COPCs are identified for protection of mammals and birds.

6.5 Exposure Pathway Assessment

An exposure pathway describes the movement of a COPC from the source in the environment to the eventual point of intake (exposure) by an ecological receptor. Identifying the potential exposure pathways involves consideration of several factors. The life history traits of the receptors (e.g., habitat, diet), site features (e.g., biota, habitat suitability) and environmental fate and transport properties of each COPC are components considered when identifying potential exposure pathways.

Exposure pathways are considered “complete” if a COPC is present and there is a route of exposure by which a receptor of concern (ROC) comes into contact with a COPC (CCME, 2020). The chemical exposure pathways to be considered in the terrestrial ERA, and the rationale for the exposure pathway being included or excluded in the assessment, are found in Table 6-3 which includes a qualitative evaluation of each pathway and a discussion about whether the pathways are complete and/or carried forward. Exposure pathways relating to the aquatic environment, including surface water and sediment contact, are included in the aquatic ecological risk assessment (Section 7).

In determining if spatial extent of impacted terrestrial habitat is significant (i.e., of sufficient size to support wildlife populations), ASTM (2014) as cited in Atlantic PIRI user guidance (Atlantic PIRI, 2022) considers areas less than 1 ha (10,000 m^2) as a small area from a biological perspective. While such smaller areas may contain individual foraging and breeding areas of small mammals, birds, and herptiles, this spatial scale usually does not support local populations of wildlife. Impacted areas of the Site are less than 0.5 ha and do not include indications of special habitats.

The foraging ranges of the terrestrial animal SAR/SOCC are comparatively large compared to the size of the impacted soil on the Site (less than 0.5 ha). The foraging range of the Mainland Moose is 460 to 26,200 ha (FCSAP, 2012b). The foraging range of the Barn Swallow is 80 to 450 ha (FCSAP, 2012b); the foraging ranges of the other bird SAR/SOCC are not available from provincial or federal sources but are considered likely to also be comparatively large.

Table 6-3 Exposure Pathway Assessment – Ecological Receptors

Exposure Pathway	Potentially Complete	Carried Forward	Justification
Direct exposure to soil	Yes	No	Terrestrial plant and invertebrate communities may be directly exposed to metals in soil, however the vegetation present in the area impacted by mining activities was in good health and appeared to be vigorous. Plant SAR are generally not in direct contact with soil, being lichens that grow on trees; tree health did not appear to be impacted on the Site, with many mature trees present and stressed lichens or other vegetation not observed. If plant SAR were present, this would indicate the impacted soil was not affecting their growth or reproduction. Given these observations and the small area of impacted surface soil (less than 0.5 ha), risk to terrestrial communities from direct exposure to soil (including plant SAR) is considered negligible.
Ingestion of soil	Yes	No	Wildlife receptors from upper trophic levels (mammals, birds, and herptiles) may come into direct contact with soil, and may ingest soil through food items, grooming or other related behaviors. Only lead exceeded the PSS for the soil and food ingestion pathway. However, lead was only detected above the PSS for soil and food ingestion at three sample locations within the area of suspected mine tailings. Given the limited spatial extent of impacted terrestrial habitat (less than 0.5 ha), the area is not of sufficient size to support wildlife populations (ASTM (2014) as cited in Atlantic PIRI user guidance (2022)). Wildlife observed or reported at the Site includes mammals and birds with comparatively large foraging ranges, that are therefore unlikely to ingest or come into contact with significant qualities of impacted soil. As such, risk to terrestrial animal populations and to individual SAR/SOCC from exposure to metals in soil from these areas is considered negligible.
Dermal contact with soil	Yes	No	Dermal absorption is not expected to provide a relevant source of exposure due in most part to the presence of fur and feathers, which can substantially reduce available skin surface area.
Inhalation	No	No	Inhalation of vapours and dust is possible, however, are considered less important than soil ingestion. Air is often not justified as an exposure medium in ecological risk assessment as vapours are dispersed rapidly.
Uptake of groundwater by plants	No	No	While groundwater was not assessed, the vegetation present in the area impacted by mining activities was in good health and appeared to be vigorous which suggests negative effects from exposure to groundwater are negligible.
Contact with groundwater by soil invertebrates	No	No	

Table 6-3 Exposure Pathway Assessment – Ecological Receptors

Exposure Pathway	Potentially Complete	Carried Forward	Justification
Ingestion of terrestrial plant and animal tissue: terrestrial vegetation, invertebrates, or prey exposed to contaminated soil	Yes	No	While animal receptors from upper trophic levels (mammals, birds, and herptiles) may ingest terrestrial plants, invertebrates, or prey that have been exposed to contaminated soil, the spatial extent of contaminant delineation affects the area where COPC concentrations in soil are above ecological guidelines is small in comparison to the home range of mammals and birds (including potential SAR). Risk to wildlife from ingesting terrestrial plants, invertebrates, or prey that have been exposed to metals in soil from these areas is considered negligible. The area where COPC concentrations in soil are above PSS is very small compared to the home range of most mammals and birds where foraging may occur. The limited soil exceedances are not expected to substantially affect the concentrations of COPCs in mammals and birds that may be consumed as prey. Similarly, the area of soil impacts is limited, and may not coincide with the specific location that berries or other plants could be consumed.

6.6 Risk Characterization Summary

Based on the range and distribution of COPC concentrations observed, and the observations documented during the site visit, with the exception of cobalt and lead, the identified COPCs do not appear to be associated with historical mining activities and can reasonably be attributed to natural conditions of the area.

While cobalt and lead are present above one or more PSS and at concentrations above local background concentrations, the vegetation present in the impacted area was in good health and appeared to be vigorous which is a stronger line of evidence with respect to potential risk to plants. Furthermore, the spatial extent of contaminant effects within the area where COPC concentrations in soil are above ecological standards is very small in comparison to the home range of wildlife (including potential SAR). Therefore, the effects to plants and wildlife are considered to be negligible.

6.7 Uncertainty Evaluation

Sources of uncertainty associated with the Problem Formulation step of the ERA tend to focus on the following:

- The identification of relevant chemicals of potential concern
- The identification of appropriate ecological receptors
- The identification of significant exposure pathways

The primary concern regarding the selection of COPCs is that relevant contaminants will have been overlooked and thus omitted from consideration within the ERA. Sampling locations were selected to focus on areas of historical mining impacts that were identified based on the Phase I ESA and site visits. Given the available information, it was assumed that the targeted sampling locations included the maximum or near maximum concentrations of chemicals tested. The data used were considered to be sufficiently representative of the Sites for use in the ERA and were likely biased high.

For some of the COPCs, there remains some uncertainty as to the effect of localized exceedances (i.e., cobalt) and the EPCs that would be representative of the area impacted across the Site . The extent of contaminant delineation affects the area where COPC concentrations in soil are above ecological guidelines, in comparison to the home range of the mammals and birds that could be present at the Site. The smaller the area of impact compared to the home range, the lower the proportion of total diet that is consumed from the impacted area. The extent of impacts is also important for the assessment of potential effects at the population level (e.g., the impacts may affect 100% of the home range of a meadow vole, but if the impacted area represents the home range of only one meadow vole, this would not be considered an unacceptable risk to the population of meadow voles). Information on relevant ecological receptors was based on previously conducted field studies and ACCDC documentation. There is some uncertainty as to the specific species of mammals and birds that are present at the Site, however, uncertainty is low.

6.8 Terrestrial ERA Recommendations

No further assessment of risk to terrestrial receptors from COPCs identified in soil at the site is recommended.

7 Aquatic Ecological Risk Assessment

The purpose of the aquatic ERA was to evaluate the potential that aquatic receptors may experience toxicologically induced changes in health from exposure to COPCs found in the adjacent sections of the Mines Branch River.

7.1 Problem Formulation

The objective of the Problem Formulation stage of the aquatic ERA was the development of a focused understanding of:

- Which chemicals constitute ecological COCs,
- What aquatic ecological receptors are likely to be present at the Sites, and
- How COCs migrate from the source(s) and ultimately reach the aquatic ecological receptors at the Site.

7.2 Receptor Identification

For surface water bodies that represent aquatic habitat (Mines Branch River), the potential aquatic ecological receptors most likely to be exposed to the identified COPCs in sediment and surface water include:

- Aquatic Plants
- Invertebrates
- Fish

These aquatic receptors are assessed as groups rather than selecting surrogate species as representatives, which reflects both the measure of exposure and the available toxicity data. The majority of dose-response data from toxicity tests for these organisms relate to observed effects to the chemical concentration in the media (sediment, surface water), and not a dose, as is commonly used for assessment of risk to birds and mammals. As a result, exposure is based on the chemical concentration in the media and does not rely on multi-pathway exposure modelling.

7.3 Exposure Pathway Assessment

As previously discussed, a detailed assessment of exposure pathways is not necessary for aquatic receptors since their exposure is based on the chemical concentration reported in the sediment or surface water.

Based on the available data, aquatic receptors within the Mines Branch River may be exposed to concentrations of metals in sediment and surface water.

7.4 Identification of Aquatic COPCs

Surface water on or near the Site was sampled including Mines Branch River (located approximately 100 m from the boundary of the disturbed area of the Site). The COPCs for aquatic receptors were identified by screening COPC concentrations in surface water and sediment data from the Mines Branch River against applicable ecological screening levels for the protection of aquatic life (i.e., Tier 1 EQS for surface water and Tier1 EQS for sediment). If a chemical did not have an applicable ESL and was consistently below the limits of detection, the chemical was assumed to not be present at concentrations that would result in unacceptable risks. In these cases, the chemical was not carried forward for further assessment.

While groundwater is a potential pathway for migration of COPCs originating at the Site to nearby watercourses, groundwater quality was not tested during the Phase II ESA. For the purposes of this assessment, surface water data are used directly to evaluate risks from potential groundwater plumes discharging to the Mines Branch River.

7.4.1 Surface Water

The surface water analytical results are compared to the Tier 1 EQS for the protection of aquatic life and are presented in Table B-7, Appendix B. Surface water concentrations were greater than the applied aquatic life standards for the following parameters:

- pH, aluminum, copper and iron.

Sample locations exceeding the Tier 1 EQS for surface water are shown on Figure A-4, Appendix A.

Background water conditions in Nova Scotia are often acidic (i.e., low pH levels) and commonly have elevated concentrations of certain metals including aluminum, iron and manganese. Where pH, aluminum and iron were found to be within the same range at all sample locations, they can reasonably be attributed to background ambient conditions.

While copper was identified in one surface water sample (3.5 µg/L at LOC23-SW-01) at a concentration slightly exceeding the Tier 1 EQS of 2.0 µg/L, it cannot be determined if the concentration is attributable to site conditions based on the absence of significantly elevated soil or sediment concentrations in the area of the exceedance. The concentration is considered to be within the range of analytical variance and the concentration does not represent ambient conditions beyond the immediate area. As such the potential risk to aquatic receptors is expected to be negligible from one slight exceedance and therefore is not carried forward for further evaluation in the aquatic ERA.

Although detected in surface water, PSS are not provided for a number of metals and nutrients (i.e., bismuth, calcium, magnesium, phosphorus, potassium, sodium, tin and titanium). However, by comparing these parameters to the nearby regional conditions, the results were found to be within a similar range at all locations and do not appear to be related to site activities. Generally, observed concentrations of these parameters are considered to represent background conditions within the region and are not considered further in the aquatic ERA.

7.4.2 Sediment

The sediment screening results are presented in Table B-8, Appendix B. The sediment results are compared to Tier 1 EQS for protection of aquatic life. Sediment concentrations at the Sites were greater than Tier 1 EQS for the following contaminants:

- arsenic, iron, manganese and mercury

Sample locations exceeding the Tier 1 EQS for sediment are shown on Figure A-4, Appendix A.

Concentrations of arsenic, iron and manganese exceeded their respective Tier 1 EQS at one of five downstream (i.e., non-reference) locations (LOC-SD24-01, Downstream Far Point C). Refer to Figure A-8, Appendix A. This is the furthest downstream sample location. As with soil, concentrations of arsenic, iron and manganese in sediment are likely associated with natural conditions of the area. Where arsenic, iron and manganese were below PSS or not detected in the near stream or mid-stream samples, it is likely that they represent natural conditions or are attributed to other sources. If contamination of the sediment was attributed to the former mine operations, higher concentrations of these metals would be expected in the near and mid-stream samples. As concentrations of these metals exceeding PSS are located in a single downstream sediment sample and where the parameters are not likely related to the former mine, arsenic, iron and manganese are not carried forward for further evaluation in the ERA.

Two exceedances of mercury were identified in sediment in the ‘mid-stream’ samples (LOC23-SD-02 and LOC24-SD-02). As the concentration of mercury is likely attributed to natural conditions or other activities that were completed downstream of the Site since the near stream sample (LOC23-SD-03) did not identify a mercury exceedance, these slight exceedances of mercury are not considered further in the aquatic ERA.

Although detected in sediment, Tier 1 EQS are not available for a number of metals and nutrients (i.e., aluminum, barium, beryllium, bismuth, boron, cobalt, lithium, molybdenum, rubidium, strontium, thallium, tin, uranium, and vanadium). However, by comparison of these parameters to the local/regional conditions, the results for sediment are generally found to be within a similar range at all locations and do not appear to be related to site activities and can therefore, reasonably be attributable to background conditions. The only exception is one sediment sample location (LOC-SD24-01, Downstream Far Point C), where barium, cobalt and vanadium concentrations are elevated which may indicate some localized impacts. These impacts are co-located with the elevated concentrations of arsenic, iron, manganese and selenium as discussed above. Overall, the elevated concentrations of these parameters do not represent ambient conditions and cannot be attributed to the historical activities at the Site. Therefore, risk to aquatic receptors is considered negligible and these impacts were not considered further in the aquatic ERA.

7.5 Risk Characterization Summary

Elevated concentrations of copper in one surface water sample (LOC23-SW-01) and concentrations of arsenic, iron and manganese in one sediment sample location (LOC24-SD-01), exceeding the Tier 1 EQS, are localized and do not represent ambient conditions within the Mines Branch River. These impacts cannot be clearly attributed to historical activities at the site. Potential risk to aquatic receptors from exposure to these COPCs in surface water and sediment are considered to be negligible based on their concentrations and spatial distribution. Therefore, these COPCs are not considered further in the aquatic ERA.

7.6 Uncertainty Evaluation

One key uncertainty has been identified with respect to the assessment of risks to aquatic receptors:

- Potential for natural sources – while maximum concentrations from the Site were higher than the maximum concentrations from the background locations; exceedances were observed in surface water and sediment locations areas where no clear site related source of metals was identified. Metals are ubiquitous in nature and therefore it is important to confirm whether the observed concentrations are related to historical site activities or background conditions.

7.7 Aquatic ERA Recommendations

No further assessment of risk to aquatic receptors from COPCs identified in surface water and/or sediment within the Mines Branch River is recommended.

8 HHERA Conclusions and Recommendations

8.1 Human Health Risk Assessment

The purpose of the HHRA was to evaluate the potential that human receptors may be exposed to COPCs found at the Site at concentrations in excess of what may represent an acceptable risk.

Maximum soil concentrations were initially screened against human health-based Pathway Specific Standards (PSS) for agricultural land use, which assumes that human receptors of all ages may be present continuously over a lifetime of exposure (i.e., 24 hours a day, 7 days a week, 52 weeks a year, for 80 years). Based on initial conservative screening, a number of COPCs were identified including aluminum, arsenic, cobalt, iron, lead, manganese, and vanadium.

Based on the range and distribution of detected concentrations it was determined that aluminum, arsenic, iron, manganese, and vanadium were not likely associated with the historical mining activities at the Site. Instead, concentrations of these parameters could be reasonably attributed to naturally occurring ambient conditions. Concentrations of other metals were below the applied residential PSS. However, cobalt and lead were present above the applied PSS and at concentrations that exceed naturally occurring background concentrations. Therefore, cobalt and lead were identified as the final human health COPCs in soil and were carried forward for further assessment.

To better assess the more likely human exposures at a remote former mine site, additional secondary screening was completed including exposure scenarios for a potential hiker and recreational visitor. Potentially complete exposure pathways assessed for the hiker and recreational visitor included surface water ingestion, dermal contact with surface water, sediment ingestion/dermal contact, soil ingestion, soil dermal contact and ingestion of food. Receptor-specific contaminant screening was carried out to reflect the characteristics of the hiker (teen or adult who stays on or near the access road/trail) and the recreational visitor (toddler, child, teen or adult who may travel across the Site).

For the hiker, the potential for exposures to cobalt and lead in soil were evaluated based on exceedances of the applied PSS for industrial land use, and the distance from soil sample locations with exceedances to the trail. For the recreational visitor, the potential for exposures in soil were evaluated based on the spatial extent of soil sample locations with exceedances of PSS for commercial land use using the Upper Confidence Limit of the Mean (UCLM) for cobalt and lead as an Exposure Point Concentration (EPC) representative of overall exposure at the Site.

Only cobalt was identified as a COPC in soil for the recreational visitor. Although the 95% UCLM concentration for cobalt is greater than the applied PSS, the UCLM is skewed by the single elevated concentration of 240 mg/kg at LOC23-SA-14. Nearby samples indicated concentrations that were lower and/or non-detect, suggesting a localized exceedance.

No COPCs were identified based on potential exposure to sediment or surface water for either the Hiker or the Recreational Visitor.

The PSS that were used for the screening of COPCs for both the hiker and recreational visitor incorporated conservative assumptions in terms of the assumed exposure frequency (i.e., five days per week, 48 weeks a year). As it is expected that these receptors would not be present at the Site at this frequency, the applied standards were considered very conservative and appropriate for identifying COPCs. Based on the HHRA, risks to potential hikers and recreational visitors were considered negligible.

Recreational visitors (i.e., campers, hunters) may also harvest game to feed their families. However, the area where COPC concentrations in soil are above human health guidelines is small compared to the home range of most prey and compared to the area range where hunting and gathering could occur. Given the limited soil exceedances and their spatial distribution that are not expected to substantially affect the concentrations of COPCs in game that may be consumed, risk via this exposure pathway is also considered negligible.

8.2 Terrestrial Ecological Risk Assessment

Based on the habitat and wildlife assessment, terrestrial ecological receptors of concern at the Site include:

- Plants (including Boreal Felt Lichen - Atlantic pop*,* Corrugated Shingles Lichen, White-rimmed Shingle Lichen, Blue Felt Lichen)
- Soil Invertebrates
- Mammals (including Mainland Moose)
- Amphibians
- Birds (including Canada Jay, Boreal Chickadee, Pine Siskin, Olive-sided Flycatcher and Southern Twayblade)

The terrestrial ERA screening for soil compared maximum detected concentrations to the Atlantic RBCA Ecological Screening Levels (ESLs), as the lower of the Tier II PSS for Direct Soil Contact or Tier II Soil and Food Ingestion pathway standards based on agricultural land use.

Maximum concentrations of arsenic, cobalt, iron, lead, lithium, manganese, rubidium, selenium, strontium and vanadium were greater than their respective PSS or the detected concentration at the reference location.

Based on the range and distribution of concentrations observed, concentrations of arsenic, iron, manganese, rubidium, selenium, strontium and vanadium do not appear to be associated with historical mining activities at the Site and are instead attributed to natural conditions of the area. However, cobalt and lead are present above one or more PSS and at concentrations above naturally occurring background concentrations. Concentrations of other metals were below the applied PSS. Therefore, cobalt and lead were identified as terrestrial COPCs in soil and were carried forward for further consideration in the ERA.

While cobalt and lead were present above the applied standards for ecological soil contact and/or soil and food ingestion and at concentrations at the reference location, the vegetation present in the impacted area was observed to be in good health and appeared to be vigorous which suggests no unacceptable risk to plants and is considered a stronger line of evidence for potential risk. With regards to the potential for soil and food ingestion by mammals and birds, the spatial extent of contaminant delineation within the area where COPC concentrations in soil are above ecological standards is very small in comparison to the home range of most wildlife (including potential SAR) and as such are unlikely to affect wildlife populations. Therefore, the effects to plants and wildlife from exposure to the cobalt and lead present at the Site are considered negligible.

8.3 Aquatic Ecological Risk Assessment

For surface water bodies that represent aquatic habitat (Mines Branch River), the potential aquatic ecological receptors most likely to be exposed to the identified COPCs in sediment and surface water at the Site include:

- Aquatic Plants
- Invertebrates
- Fish

While groundwater is a potential pathway for migration of COPCs originating at the Site to nearby watercourses, groundwater quality was not tested during the Phase II ESA. For the purposes of the risk assessment, surface water data were used directly to evaluate risks from potential groundwater plumes discharging to the Mines Branch River.

The surface water analytical results were compared to the Tier 1 EQS for the protection of aquatic life. Surface water concentrations were greater than the applied aquatic life standards for four parameters including pH, aluminum, copper and iron including the upstream background sample location.

Background water conditions in Nova Scotia are often acidic (i.e., low pH levels) and commonly have elevated concentrations of certain metals including aluminum, iron and manganese. Where pH, aluminum and iron were found to be within the same range at all sample locations it was reasonably assumed that the concentrations could be attributed to background ambient conditions.

While copper was identified in one surface water sample at a concentration slightly exceeding the Tier 1 EQS, it could not be attributed to site conditions based on the absence of significantly elevated soil or sediment concentrations in the area of the exceedance. The concentration was considered to be within the range of analytical variance and the concentration did not represent ambient conditions beyond the immediate area. As such the potential risk to aquatic receptors was determined to be negligible from one slight exceedance in surface water.

Although detected in surface water, PSS are not provided for a number of metals and nutrients (i.e., bismuth, calcium, magnesium, phosphorus, potassium, sodium, tin and titanium). However, the results were found to be within a similar range at all locations and do not appear to be related to Site activities. Generally, observed concentrations of these parameters were also considered to represent regional background conditions.

The sediment analytical results were compared to Tier 1 EQS for sediment based on protection of aquatic life. Sediment concentrations were found to be greater than Tier 1 EQS for arsenic, iron, manganese and mercury.

Concentrations of arsenic, iron and manganese exceeded their respective Tier 1 EQS at only one of five downstream sample locations (specifically, the farthest location downstream). Two exceedances of mercury were identified in sediment in the 'mid-stream' samples. The concentration of mercury is likely attributed to natural conditions or other activities that were completed downstream of the Site since the near stream sample (LOC23-SD-03) did not identify a mercury exceedance.

Although detected in sediment, Tier 1 EQS are not available for a number of metals and nutrients (i.e., aluminum, barium, beryllium, bismuth, boron, cobalt, lithium, molybdenum, rubidium, strontium, thallium, tin, uranium, and vanadium). However, by comparison of these parameters to the local/regional conditions, the results for sediment are generally found to be within a similar range at all locations and do not appear to be related to Site activities and were therefore considered to be representative of background conditions. The only exception was one sediment sample (LOC-SD24-01, Downstream Far Point C), where barium, cobalt and vanadium concentrations are elevated which suggests some localized impacts. These impacts were also co-located with the elevated concentrations of arsenic, iron, manganese and selenium as discussed above. Overall, the elevated concentrations of these parameters do not represent ambient conditions therefore risk to aquatic receptors is considered negligible.

8.4 Recommendations

Based on the conclusions presented above, Stantec offers the following recommendations:

1. Further sampling, risk management, or active remediation based on potential risk human or ecological receptors from exposure to COPCs in soil, surface water, or sediment contamination is not recommended at the present time.
2. Stantec has not evaluated risk from the physical hazards present at the site in this report. These hazards should be assessed by a qualified person and recommendations for additional site management be considered.
3. The results of the HHERA should be reassessed should land use at the Site change in the future or be anticipated to change.
4. The results of this HHERA should be provided to NSECC in support of an application for Closure under the CSR.

9 Closure

This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This report provides an evaluation of selected environmental conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

The opinions in this report can only be relied upon as they relate to the condition of the portion of the identified property that was assessed at the time the work was conducted. Activities at the property subsequent to Stantec's assessment may have significantly altered the property's condition. Stantec cannot comment on other areas of the property that were not assessed.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report, and are based solely on the scope of work described in the report, the limited data available and the results of the work. They are not a certification of the property's environmental condition. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities or claims, howsoever arising, from third party use of this report.

The locations of any utilities, buildings and structures, and property boundaries illustrated in or described within this report, if any, including pole lines, conduits, water mains, sewers and other surface or sub-surface utilities and structures are not guaranteed. Before starting work, the exact location of all such utilities and structures should be confirmed and Stantec assumes no liability for damage to them.

The conclusions are based on the site conditions encountered by Stantec at the time the work was performed at the specific testing and/or sampling locations, and conditions may vary among sampling locations. Factors such as areas of potential concern identified in previous studies, site conditions (e.g., utilities) and cost may have constrained the sampling locations used in this assessment. In addition, analysis has been carried out for only a limited number of chemical parameters, and it should not be inferred that other chemical species are not present. Due to the nature of the investigation and the limited data available, Stantec does not warrant against undiscovered environmental liabilities nor that the sampling results are indicative of the condition of the entire site. As the purpose of this report is to identify site conditions which may pose an environmental risk; the identification of non-environmental risks to structures or people on the site is beyond the scope of this assessment.

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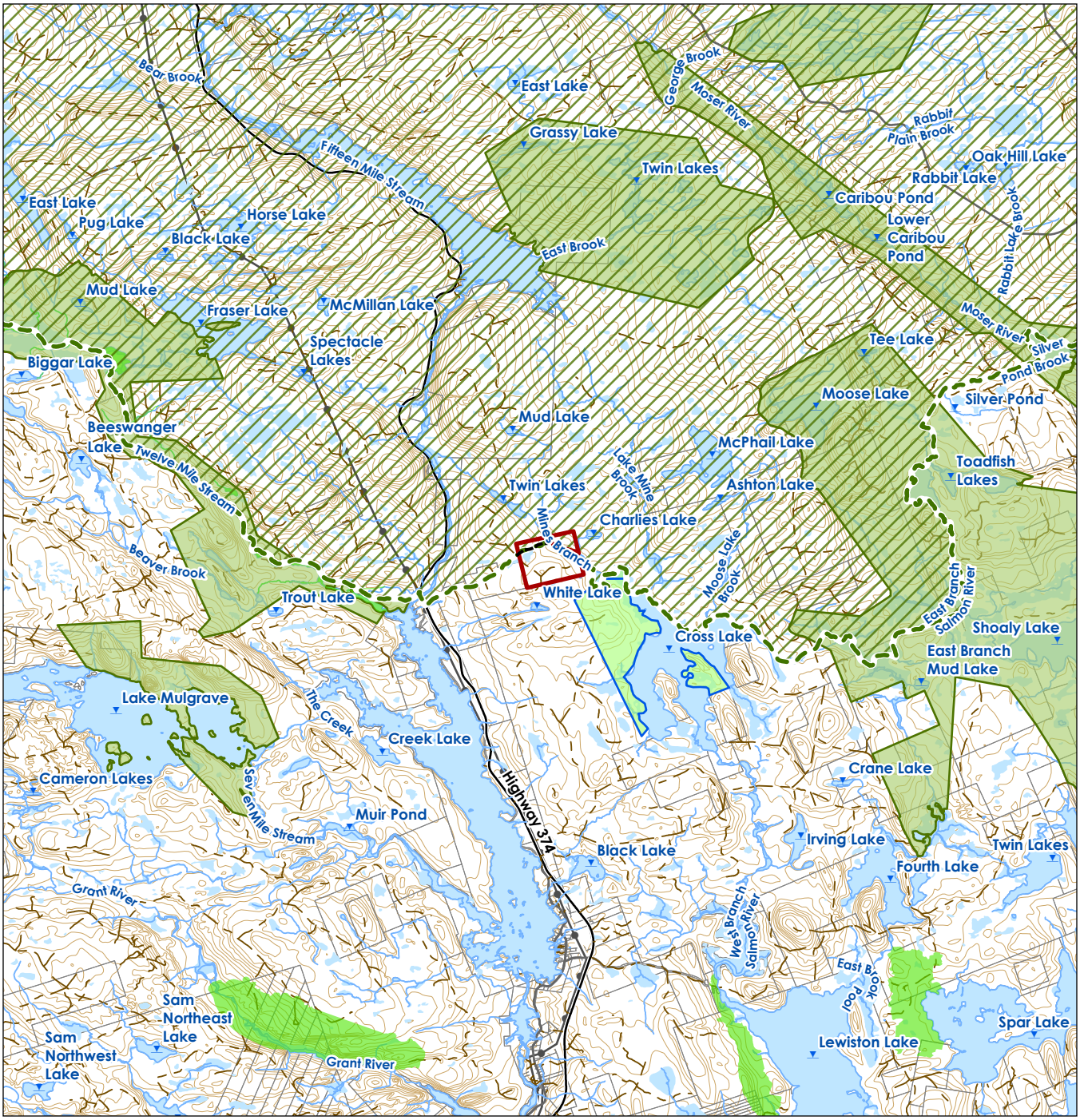
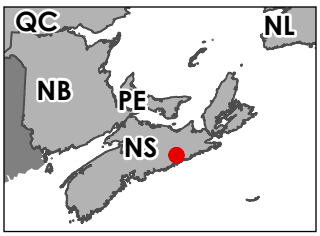
Appendices

Appendix A Figures





- Highway
- Road
- Resource Road
- NS Power Lines
- Contours (5m)
- Watercourses
- Lochaber Property
- NS Properties
- Liscomb Game Sanctuary
- NSECC Protected Areas System
- NS Lands Pending Protection
- NS Significant Habitat
- Waterbodies

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Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNova, Nova Scotia Government
3. Background: GeoNova

Stantec

Project Location
Lochaber Mines, Nova Scotia
Atlantic Canada

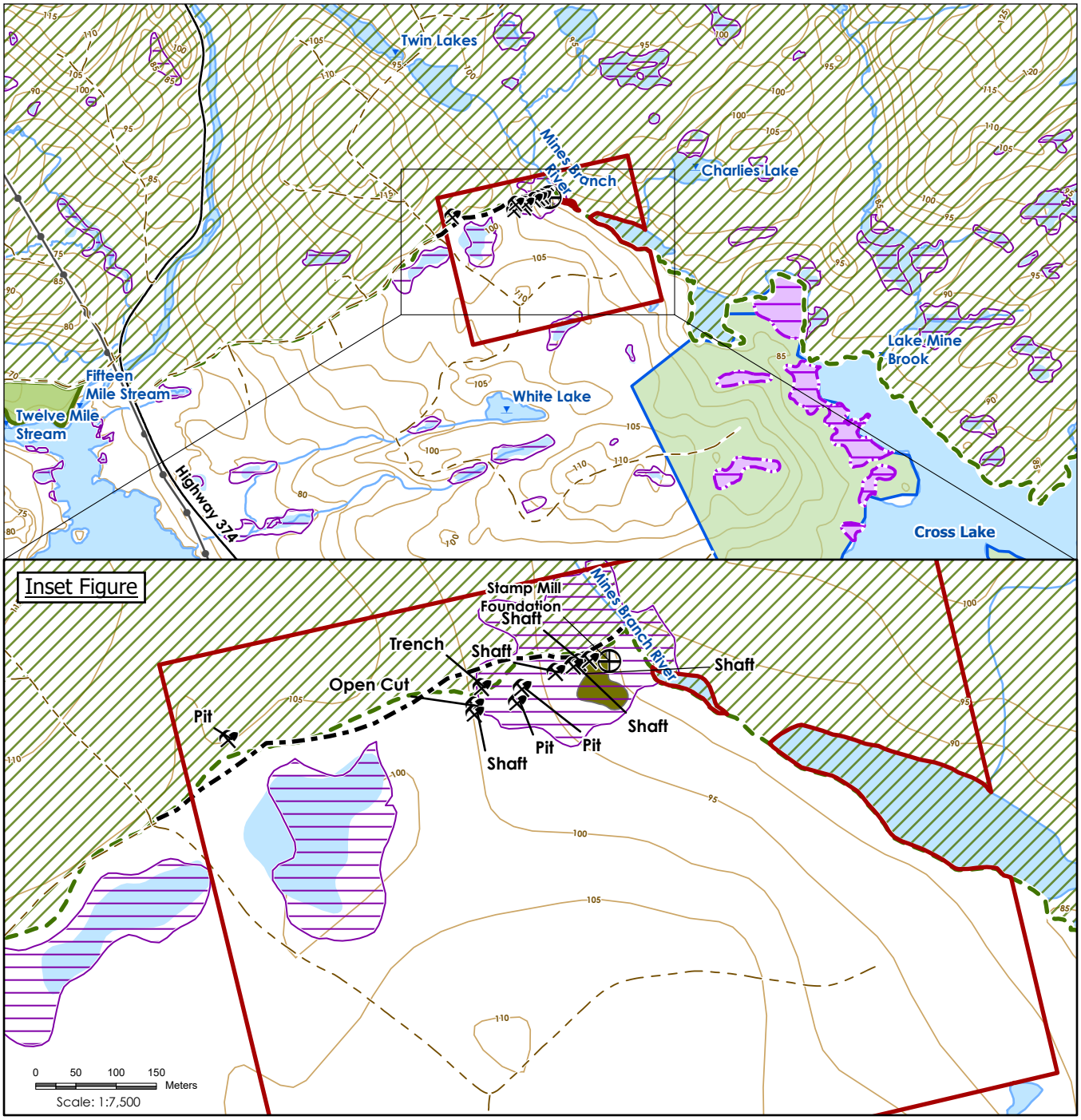
Prepared by SC on 2023-10-12
QR by NW on 2023-10-17
IR by PT on 2023-11-15

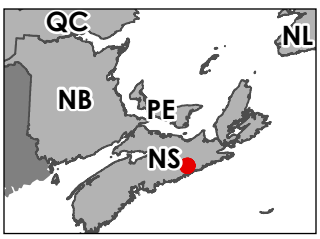
Client/Project
Former Lochaber Mines Updated Phase I/II Environmental Site Assessment

12148211_002

Figure No.
A-1

Title
Site Location Former Lochaber Gold Mines





Notes
1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNova, Nova Scotia Government
3. Background: GeoNova

- Mine Feature
- Highway
- Road
- Resource Road
- Power Lines
- Contours (5m)
- Mine Access Trail
- Watercourses
- Lochaber Property
- Potential Mine Tailings
- Liscomb Game Sanctuary
- NSECC Protected Areas System
- NS Lands Pending Protection
- Wetlands Special Significance
- NS Wetlands
- Waterbodies

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Stantec

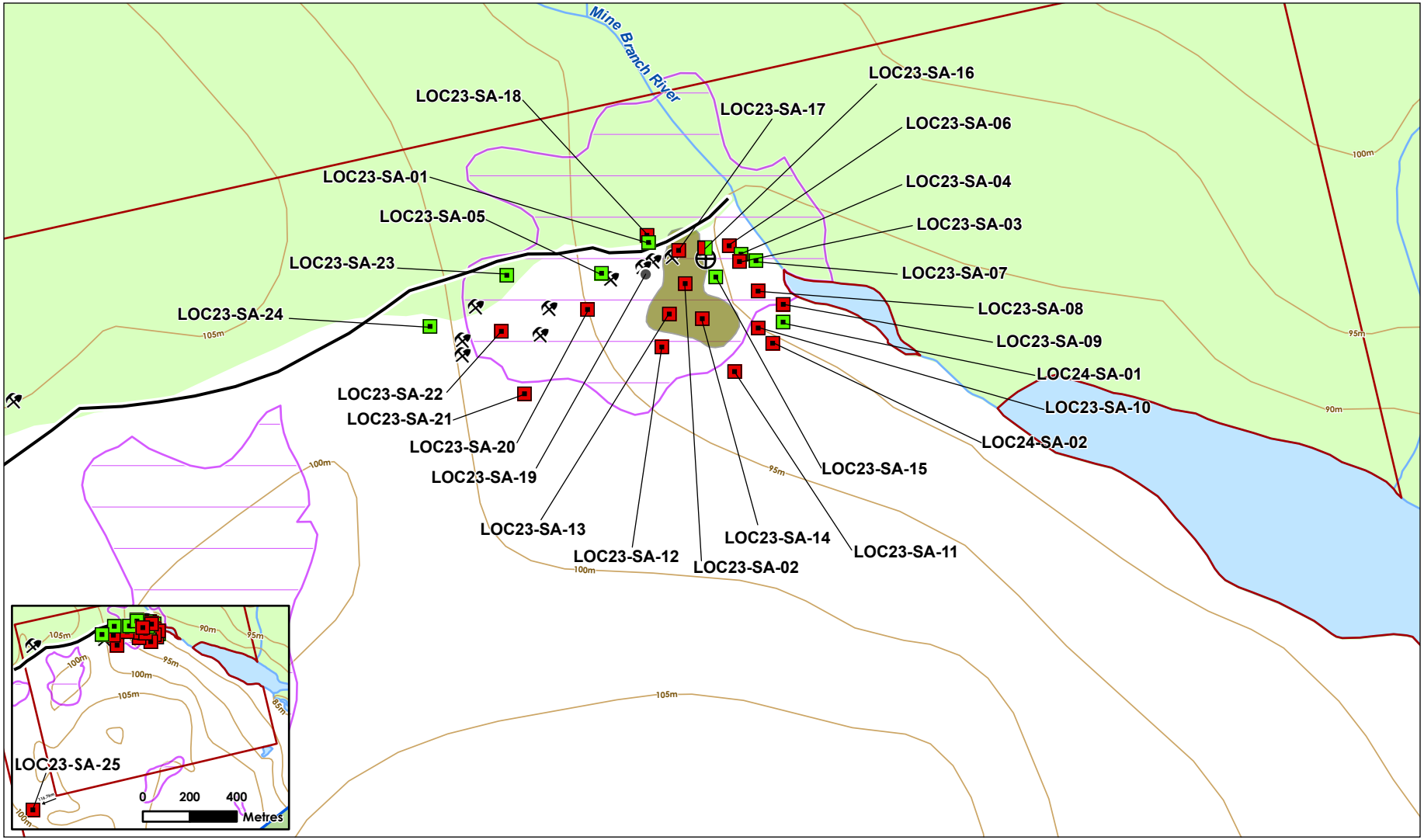
Project Location
Lochaber Mines, Nova Scotia
Atlantic Canada

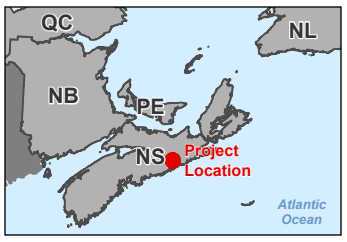
Prepared by SC on 2023-10-12
QR by NW on 2023-10-17
IR by PT on 2023-11-15

Client/Project 121418211_003
Former Lochaber Mines Updated Phase I/II Environmental Site Assessment

Figure No.
A-2

Title
Site Overview Former Lochaber Gold Mines





- Soil Sample - Test Pit Representing two sample depths
- Soil Sample (Below Guideline Criteria)
- Soil Sample (Exceeds Guideline Criteria)
- Probe Location
- Stamp Mill Foundation
- Mine Features
- Mine Access Trail
- Potential Mine Tailings
- Lochaber Property
- Contour (5m)
- Liscomb Game Sanctuary
- Watercourse
- Waterbody
- Wetland (NSECC)

N

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(At original document size of 8.5x11)
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Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNova, Nova Scotia Government
3. Background: Soil, sediment and surface water analytical results were compared against the applicable NSECC Tier 1 Environmental Quality Standard.

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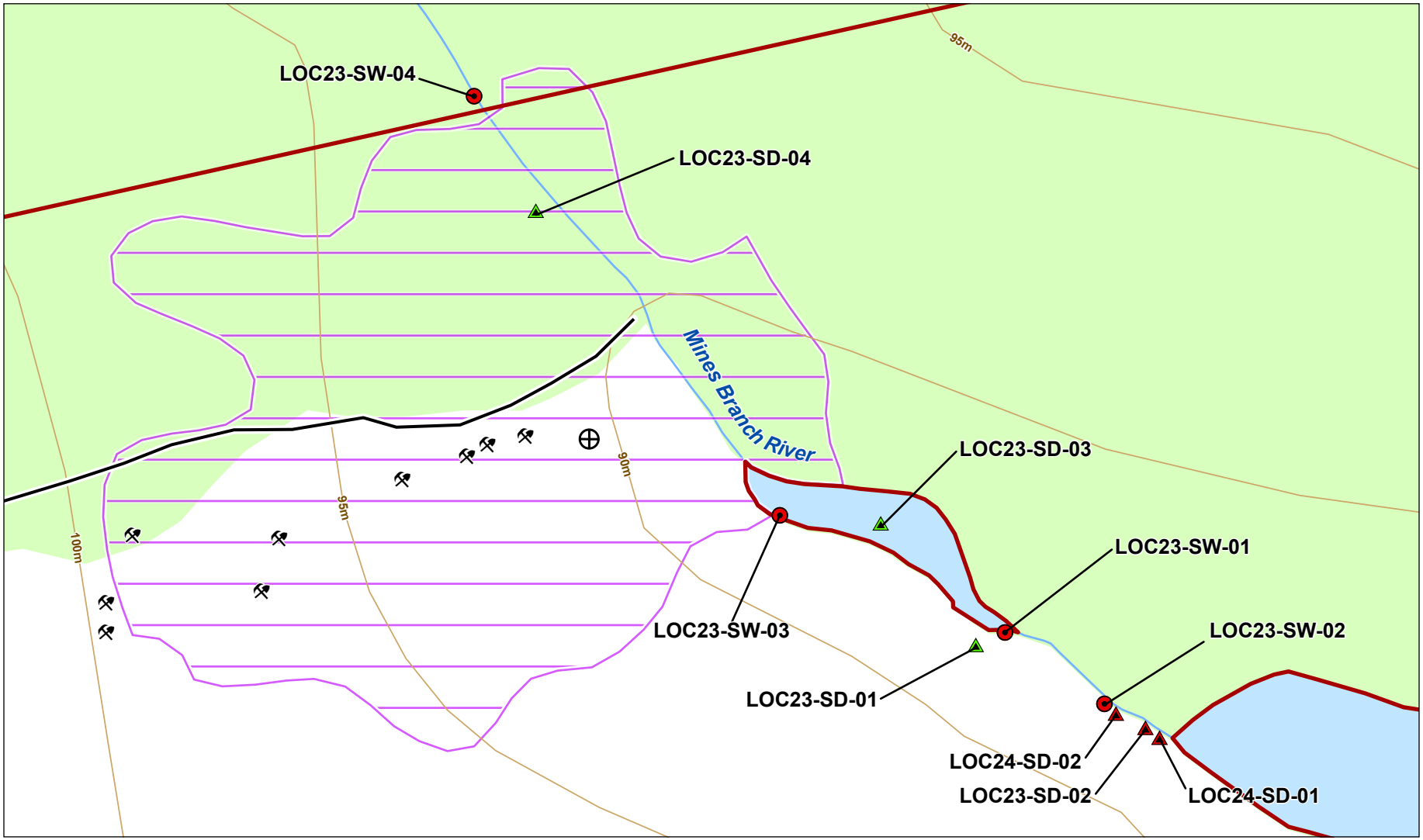
Project Location
Lochaber Mines, NS
Atlantic Canada

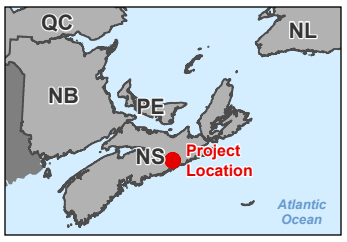
Prepared by SC on 2024-10-16
QR by DC on 2024-08-19
IR by GJ on 2024-09-05

Client/Project 121418211_003
Former Lochaber Mines Phase I/II
Human Health and Ecological Risk Assessment

Figure No.
A-3

Title
Soil Sample Locations showing Exceedances of Human Health Tier2 PSS (Agricultural, Non-potable)





- Sediment Criteria (Exceeds Guideline Criteria)
- Sediment Sample (Below Guideline Criteria)
- Surface Water Sample (Exceeds Guideline Criteria)
- Stamp Mill Foundation
- Mine Feature
- Mine Access Trail
- Lochaber Property
- Contour (5m)
- Liscomb Game Sanctuary
- Watercourse
- Waterbody
- Wetland (NSECC)

N

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Notes
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IR by GJ on 2024-09-05

Client/Project
Former Lochaber Mines Phase I/II
Human Health and Ecological Risk Assessment

121418211_005

Figure No.
A-4

Title
Surface Water and Sediment Samples Exceeding Tier 1 EQS

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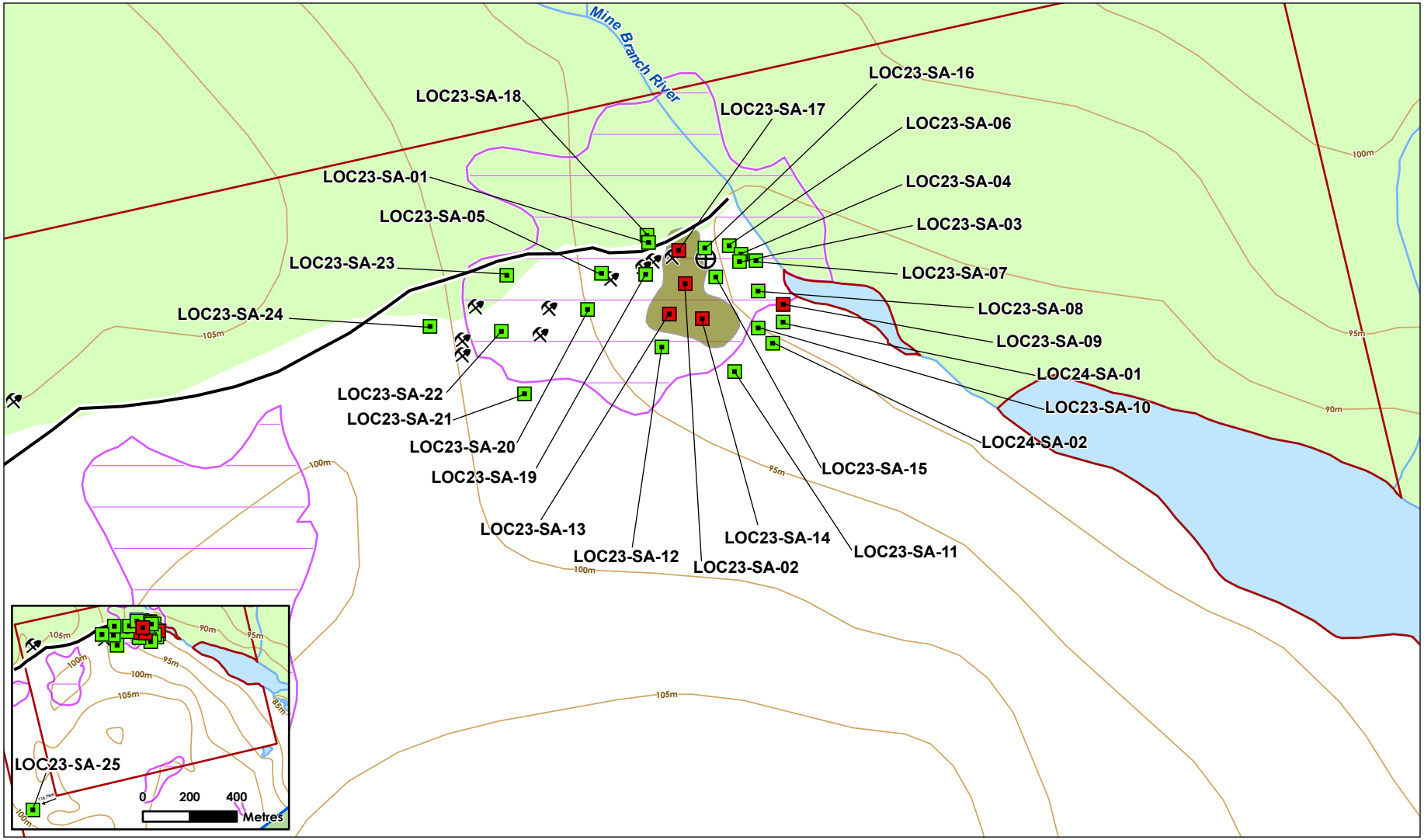

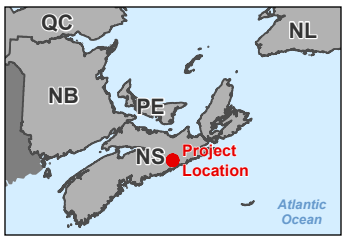

- Soil Sample (Below Guideline Criteria)
- Soil Sample (Exceeds Guideline Criteria)
- Stamp Mill Foundation
- Mine Features
- Mine Access Trail
- Potential Mine Tailings
- Lochaber Property
- Contour (5m)
- Liscomb Game Sanctuary
- Watercourse
- Waterbody
- Wetland (NSECC)

N

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(At original document size of 8.5x11)
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Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 20N
2. Data Sources: GeoNova, Nova Scotia Government
3. Background: Soil, sediment and surface water analytical results were compared against the applicable NSECC Tier 1 Environmental Quality Standard.

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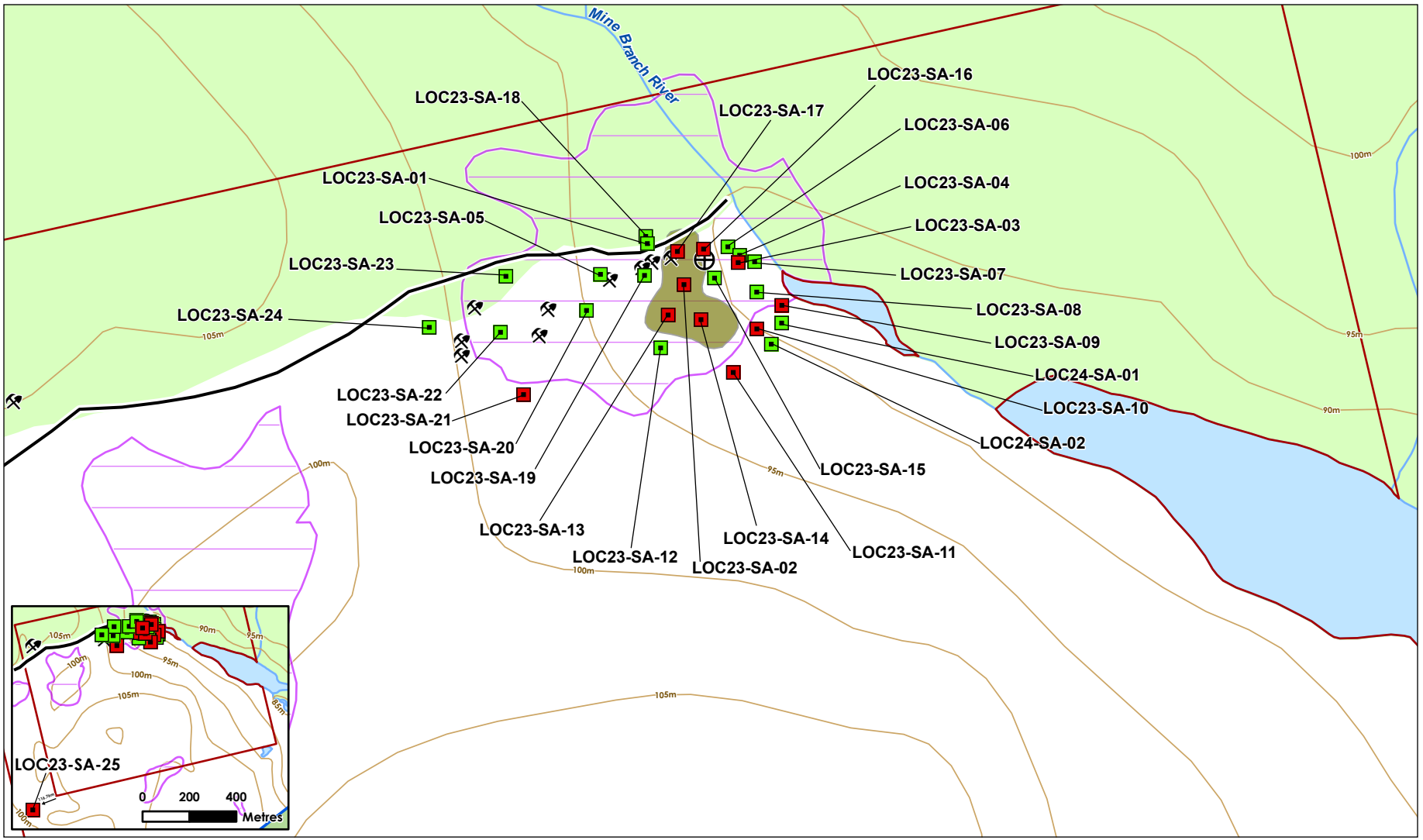
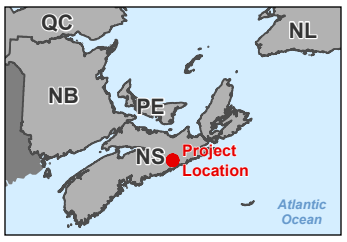
Former Lochaber Mines Phase I/II
Human Health and Ecological Risk Assessment

121418211_008

Figure No.
A-5

Title
Soil Samples with Metals Exceeding PSS for the Recreational Visitor





- Soil Sample (Below Guideline Criteria)
- Soil Sample (Exceeds Guideline Criteria)
- Stamp Mill Foundation
- Mine Features
- Mine Access Trail
- Potential Mine Tailings
- Lochaber Property
- Contour (5m)
- Liscomb Game Sanctuary
- Watercourse
- Waterbody
- Wetland (NSECC)

N

0 50 100 150 Metres

(At original document size of 8.5x11)
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Notes

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2. Data Sources: GeoNova, Nova Scotia Government
3. Background: Soil, sediment and surface water analytical results were compared against the applicable NSECC Tier 1 Environmental Quality Standard.

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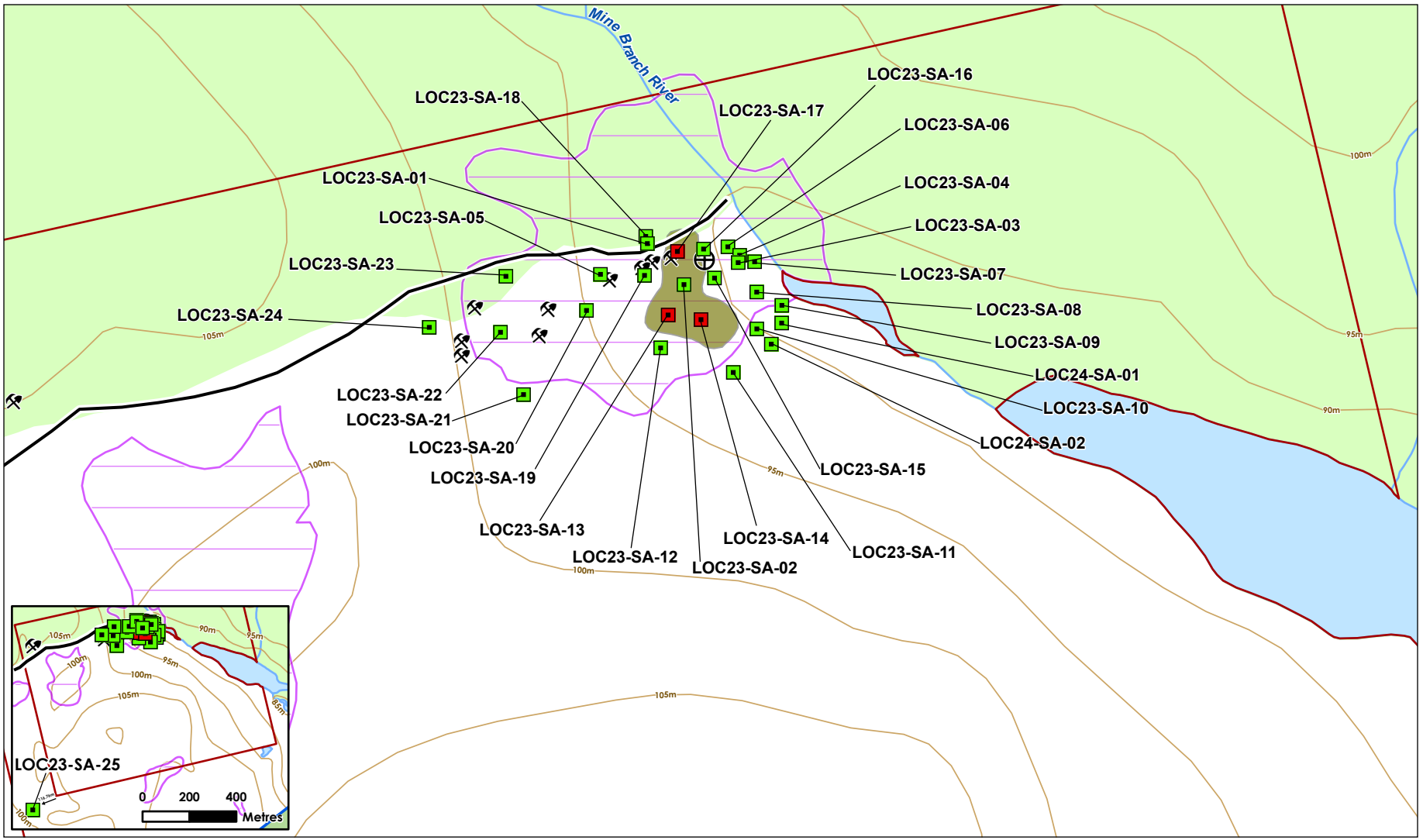
IR by GJ on 2024-09-05

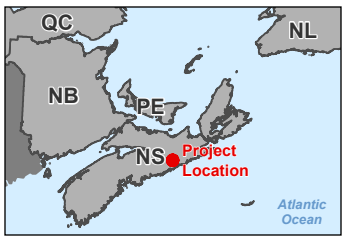
Client/Project
Former Lochaber Mines Phase I/II
Human Health and Ecological Risk Assessment

121418211_009

Figure No.
A-6

Title
Soil Samples with metals Exceeding Pathway Specific Standards for Ecological Soil Contact





- Soil Sample (Below Guideline Criteria)
- Soil Sample (Exceeds Guideline Criteria)
- Stamp Mill Foundation
- Mine Features
- Mine Access Trail
- Potential Mine Tailings
- Lochaber Property
- Contour (5m)
- Liscomb Game Sanctuary
- Watercourse
- Waterbody
- Wetland (NSECC)

N

0 50 100 150 Metres

(At original document size of 8.5x11)
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Notes

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Client/Project
Former Lochaber Mines Phase I/II
Human Health and Ecological Risk Assessment

121418211_010

Figure No.
A-7

Title
Soil Samples with Lead Exceeding Pathway Specific Standards for Ecological Soil and Food Ingestion Pathway

Appendix B Analytical Data Tables

Table B-1: Preliminary Surface Soil Screening for Human Health COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{HH}$	Maximum	LOC23-SA01	LOC23-SA02	LOC23-SA03	LOC23-SA04	LOC23-SA05	LOC23-SA-06	LOC23-SA-07	LOC23-SA-08	LOC23-SA-09	LOC23-SA-09 Lab-Dup	LOC23-SA-10	DUP-SA-01	LOC23-SA-11
APEC				APEC 1	APEC 2	APEC 1	APEC 1	APEC 1	APEC 1	APEC 3	APEC 2	APEC 3	Lab Duplicate	APEC 2	Field Duplicate	APEC 2
Bureau Veritas ID				WMP728	WMP729	WMP730	WMP731	WMP732	WYM565	WYM566	WYM567	WYM997	WYM997	WYM568	WYM591	WYM569
Sampling Date				7/21/2023	7/21/2023	7/21/2023	7/21/2023	7/21/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023
COC Number				48157	48157	48157	48157	48157	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	15,400	29,000	5,600	14,000	**20,000**	6,700	7,000	9,500	9,400	11,000	5,000	4,700	23,000	**19,000**	14,000
Antimony (Sb)	mg/kg	7.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	54	4.6	**48**	**54**	3.5	<2.0	13	4.1	3.8	23	21	32	**34**	15
Barium (Ba)	mg/kg	6,800	190	5.1	17	45	18	9.8	21	20	43	180	160	26	24	13
Beryllium (Be)	mg/kg	75	<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
Bismuth (Bi)	mg/kg	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	4,300	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	1.4	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	220	36	4.9	17	22	4.2	11	12	13	17	5.9	5.5	30	26	17
Cobalt (Co)	mg/kg	22	240	<1.0	**25**	19	<1.0	3.4	6.3	4.7	10	**120**	**110**	11	12	1.6
Copper (Cu)	mg/kg	1,100	50	<2.0	49	50	2.6	<2.0	15	2.1	3.5	7.7	6.9	8.8	8.3	5.3
Iron (Fe)	mg/kg	11,000	65,000	5,800	**24,000**	**30,000**	1,900	10,000	**14,000**	9,700	**18,000**	**13,000**	**12,000**	**65,000**	**60,000**	**32,000**
Lead (Pb)	mg/kg	140	190	9.0	66	58	11	8.5	35	16	11	20	19	15	15	16
Lithium (Li)	mg/kg	nv	36	2.1	21	25	4.5	9.9	19	15	20	6.7	6.7	23	19	9.9
Manganese (Mn)	mg/kg	360	3,400	73	**1,100**	**870**	63	150	**410**	150	**520**	**800**	**760**	**3,000**	**3,400**	300
Mercury (Hg)	mg/kg	6.6	1.2	<0.10	1.1	0.42	<0.10	<0.10	1.2	0.10	<0.10	<0.10	<0.10	0.18	0.14	0.11
Molybdenum (Mo)	mg/kg	110	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	200	35	<2.0	27	35	<2.0	10	20	12	28	14	13	6.2	5.7	6.8
Rubidium (Rb)	mg/kg	nv	21	2.1	4.4	9.1	5.3	8.3	5.2	5.0	5.3	3.5	3.6	12	9.0	6.3
Selenium (Se)	mg/kg	80	4	<0.50	0.52	0.79	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.0	1.8	0.85
Silver (Ag)	mg/kg	77	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	9,400	15	<5.0	7.9	12	<5.0	5.7	8.6	15	13	7.0	6.9	<5.0	<5.0	<5.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	0.61	0.62	0.12	0.11	<0.10
Tin (Sn)	mg/kg	9,400	1.3	<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
Uranium (U)	mg/kg	23	2.5	0.31	1.7	1.4	0.40	0.44	0.84	0.45	0.50	0.44	0.43	0.73	0.60	0.45
Vanadium (V)	mg/kg	39	41	14	13	18	4.6	7.5	8.7	8.9	10	7.3	6.4	31	28	27
Zinc (Zn)	mg/kg	10,000	75	6.4	49	75	5.6	23	42	22	46	36	33	25	24	19

Notes:

PSS_{HH} = NSECC Tier 2 Pathway Specific Standards (PSS) - Agricultural Land Use - Human Health - Soil Contact/Ingestion

Bold and Shaded = Value Exceeds applied PSS

nv = no value

Table B-1: Preliminary Surface Soil Screening for Human Health COPC
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{HH}$	Maximum	LOC23-SA-12	LOC23-SA-13	LOC23-SA-14	LOC23-SA-15	LOC23-SA-16 A	LOC23-SA-16B	LOC23-SA-17	LOC23-SA-17 Lab-Dup	LOC23-SA-18	LOC23-SA-19	LOC23-SA-20	LOC23-SA-21	LOC23-SA-22
APEC				APEC 2	APEC 2	APEC 2	APEC 2	APEC 1	APEC 1	APEC 1	Lab Duplicate	APEC 1	APEC 1	APEC 1	APEC 1	APEC 1
Bureau Veritas ID				WYM570	WYM571	WYM572	WYM573	WYM574	WYM595	WYM575	WYM575	WYM576	no	WYM577	WYM578	WYM579
Sampling Date				9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	soil	9/6/2023	9/6/2023	9/6/2023
COC Number				C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	recovered	C3R8276	C3R8276	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	15,400	29,000	8,400	**23,000**	**21,000**	3,200	**27,000**	8,000	9,000	8,900	5,600	-	13,000	15,000	6,400
Antimony (Sb)	mg/kg	7.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	54	5.0	18	**54**	<2.0	9.4	<2.0	19	19	13	-	14	9.1	2.9
Barium (Ba)	mg/kg	6,800	190	15	120	190	5.5	20	9.3	8.9	8.4	7.5	-	23	11	24
Beryllium (Be)	mg/kg	75	<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
Bismuth (Bi)	mg/kg	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0
Boron (B)	mg/kg	4,300	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	<50
Cadmium (Cd)	mg/kg	1.4	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	-	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	220	36	13	36	36	2.8	25	4.5	13	13	6.3	-	16	20	9.2
Cobalt (Co)	mg/kg	22	240	3.3	59	**240**	<1.0	4.9	1.0	5.6	5.4	4.9	-	7.7	2.2	1.4
Copper (Cu)	mg/kg	1,100	50	2.3	12	12	<2.0	15	2.5	23	22	3.1	-	6.9	9.7	<2.0
Iron (Fe)	mg/kg	11,000	65,000	**16,000**	**18,000**	**56,000**	2,500	**24,000**	4,600	**20,000**	**19,000**	**14,000**	**-**	20,000	**34,000**	**13,000**
Lead (Pb)	mg/kg	140	190	13	110	130	5.7	22	3.6	**190**	**170**	15	-	31	16	14
Lithium (Li)	mg/kg	nv	36	12	36	18	<2.0	18	7.7	14	14	4.1	-	22	11	5.2
Manganese (Mn)	mg/kg	360	3,400	**380**	**420**	**1,200**	30	300	57	**610**	**610**	**480**	**-**	390	200	120
Mercury (Hg)	mg/kg	6.6	1.2	<0.10	0.29	0.29	<0.10	0.39	<0.10	0.19	0.17	0.11	-	<0.10	0.16	<0.10
Molybdenum (Mo)	mg/kg	110	3.9	<2.0	2.2	2.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	3.9	<2.0	<2.0
Nickel (Ni)	mg/kg	200	35	11	16	14	<2.0	11	<2.0	16	15	4.2	-	13	7.1	6.1
Rubidium (Rb)	mg/kg	nv	21	5.0	21	12	<2.0	7.4	3.1	3.5	3.2	6.4	-	7.9	5.6	6.0
Selenium (Se)	mg/kg	80	4	<0.50	2.6	4.0	<0.50	1.8	<0.50	<0.50	<0.50	<0.50	-	0.68	1.3	<0.50
Silver (Ag)	mg/kg	77	0.62	<0.50	0.54	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	9,400	15	<5.0	7.1	5.5	<5.0	5.5	<5.0	5.9	5.4	<5.0	-	<5.0	<5.0	6.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	0.35	0.43	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Tin (Sn)	mg/kg	9,400	1.3	<1.0	1.3	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	23	2.5	0.46	2.5	2.5	0.18	0.94	0.23	0.65	0.61	0.36	-	0.87	0.68	0.29
Vanadium (V)	mg/kg	39	41	10	27	**41**	11	19	9.4	10	9.5	13	-	17	23	13
Zinc (Zn)	mg/kg	10,000	75	27	47	35	<5.0	32	8.2	35	35	11	-	31	20	9.6

Notes:

PSS_{HH} = NSECC Tier 2 Pathway Specific Standards (PSS) - Agricultural Land Use - Human Health - Soil Contact/Ingestion

Bold and Shaded = Value Exceeds applied PSS

nv = no value

Table B-1: Preliminary Surface Soil Screening for Human Health COPC
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{HH}$	Maximum	DUP-SA-02	LOC23-SA-23	LOC23-SA-24	LOC-SA24-01	LOC-SA24-02	LOC-SA24-100	LOC23-SA-25
APEC				Field Duplicate	APEC 1	APEC 1	APEC 1	APEC 1	Field Duplicate	Reference
Bureau Veritas ID				WYM592	WYM580	WYM581	ZJH626	ZJH627	ZJH628	WYM582
Sampling Date				9/6/2023	9/6/2023	9/6/2023	5/31/2024	5/31/2024	5/31/2024	9/6/2023
COC Number				C3R8276	C3R8276	C3R8276	C4H0077	C4H0077	C4H0077	C3R8276
Metals	**Units**									
Aluminum (Al)	mg/kg	15,400	29,000	7,000	4,500	1,500	2,300	6,800	3,200	**29,000**
Antimony (Sb)	mg/kg	7.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	54	2.8	<2.0	<2.0	<2.0	6.2	2.5	22
Barium (Ba)	mg/kg	6,800	190	24	12	9.8	21.0	18.0	16.0	18
Beryllium (Be)	mg/kg	75	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	mg/kg	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	4,300	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	1.4	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	220	36	9.6	5.5	<2.0	3.1	7.1	3.4	29
Cobalt (Co)	mg/kg	22	240	1.4	<1.0	<1.0	<1.0	1.7	<1.0	5.5
Copper (Cu)	mg/kg	1,100	50	<2.0	<2.0	<2.0	2.8	3.2	<2.0	24
Iron (Fe)	mg/kg	11,000	65,000	**14,000**	1,600	1,100	1,700	12,000	3,300	**43,000**
Lead (Pb)	mg/kg	140	190	8.5	10	2.3	7.5	9.8	6.1	22
Lithium (Li)	mg/kg	nv	36	5.9	3.8	<2.0	<2.0	4.5	<2.0	28
Manganese (Mn)	mg/kg	360	3,400	130	47	5.4	30	170	52.0	**710**
Mercury (Hg)	mg/kg	6.6	1.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19
Molybdenum (Mo)	mg/kg	110	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	200	35	5.8	2.3	<2.0	<2.0	7.1	2.2	13
Rubidium (Rb)	mg/kg	nv	21	6.5	3.3	2.6	3.2	5.5	3.0	7.7
Selenium (Se)	mg/kg	80	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.7
Silver (Ag)	mg/kg	77	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	9,400	15	5.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	mg/kg	9,400	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	23	2.5	0.30	0.39	<0.10	0.15	0.25	0.14	0.88
Vanadium (V)	mg/kg	39	41	13	5.2	8.3	7.4	14	7.7	22
Zinc (Zn)	mg/kg	10,000	75	9.9	<5.0	<5.0	<5.0	13	<5.0	42

Notes:

PSS_{HH} = NSECC Tier 2 Pathway Specific Standards (PSS) - Agricultural Land Use - Human Health - Soil Contact/Ingestion

Bold and Shaded = Value Exceeds applied PSS

nv = no value

Table B-2: Preliminary Sediment Screening for Human Health COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID				LOC23-SD-04	LOC23-SD-03	DUP-SD-01	LOC23-SD-01	LOC23-SD-02	LOC-SD24-01	LOCSD-24-100	LOC-SD24-01 Lab-Dup	LOCSD-24-02
APEC				APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3
Description		PSS_{HH}	Maximum	Background (Upstream)	Downstream Near Point	Field Duplicate	Downstream Midpoint	Downstream Far Point B	Downstream Far Point C	Field Duplicate	Lab Duplicate	Downstream Far Point A
Bureau Veritas ID				WYM586	WYM585	WYM593	WYM583	WYM584	ZJH629	ZJH631	ZJH629	ZJH630
Sampling Date				7-Sep-23	7-Sep-23	7-Sep-23	7-Sep-23	7-Sep-23	31-May-24	31-May-24	31-May-24	31-May-24
COC Number				C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C4H0077	C4H0077	C4H0077	C4H0077
Metals	**Units**											
Aluminum (Al)	mg/kg	15,400	7,300	3,000	2,800	2,700	6,000	5,500	6,900	5,600	7,300	3,500
Antimony (Sb)	mg/kg	7.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	**170**	2.3	<2.0	<2.0	2.4	14	**170**	**120**	**170**	9.9
Barium (Ba)	mg/kg	6,800	56	19	12	12	32	22	52	47	56	28
Beryllium (Be)	mg/kg	75	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	mg/kg	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	4,300	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	1.4	<0,3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	220	10	3.6	<2.0	<2.0	<2.0	5.9	9.7	7.2	10.0	3.4
Cobalt (Co)	mg/kg	22	**150**	1.5	<1.0	<1.0	2.6	3.6	**140**	**110**	**150**	2.1
Copper (Cu)	mg/kg	1,100	6	2.6	3.3	2.1	6.0	5.5	5.5	5.1	6.1	3.4
Iron (Fe)	mg/kg	11,000	**110,000**	3,800	440	470	870	9,200	110,000	68,000	110,000	3,400
Lead (Pb)	mg/kg	140	73	14	3.3	3.1	11	17	72	63	73	11
Lithium (Li)	mg/kg	nv	5	4.7	<2.0	<2.0	<2.0	3.5	5.0	2.9	4.8	3.2
Manganese (Mn)	mg/kg	360	**6,900**	72	13	15	34	220	**6,600**	**3,800**	**6,900**	150
Mercury (Hg)	mg/kg	6.6	1	<0.10	<0.10	<0.10	0.23	0.81	0.25	0.21	0.27	0.54
Molybdenum (Mo)	mg/kg	110	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	200	7	3.1	<2.0	<2.0	5.6	3.8	6.5	5.0	6.6	4.2
Rubidium (Rb)	mg/kg	nv	5	2.8	<2.0	<2.0	<2.0	4.5	3.6	3.0	4.2	3.6
Selenium (Se)	mg/kg	80	2	<0.50	<0.50	<0.50	1.4	0.70	2.0	1.5	2.0	0.57
Silver (Ag)	mg/kg	77	<0,5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	9,400	16	5.3	<5.0	<5.0	13	6.9	11	8.9	12	16
Thallium (Tl)	mg/kg	1	<0,1	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	0.15	0.15	<0.10
Tin (Sn)	mg/kg	9,400	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Uranium (U)	mg/kg	23	1	0.19	0.29	0.24	0.77	0.74	0.58	0.55	0.60	0.55
Vanadium (V)	mg/kg	39	34	4.6	<2.0	<2.0	2.5	7.9	33	24	34	3.9
Zinc (Zn)	mg/kg	10,000	50	50	<5.0	<5.0	<5.0	8.9	14	13	14	12

Notes:

PSS_{HH} = From NSECC Tier 2 Pathway Specific Standards (PSS) for Soil (Residential/Parkland) for direct contact

Bold and Shaded = Value Exceeds applied PSS

nv = no value

Table B-3: Surface Water Screenig for Human Health COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		Tier II PSS (Potable Groundwater)	LOC23-SW-01	LOC23-SW-02	LOC23-SW-03	LOC23-SW-04	DUP-SW-01
APEC			APEC 3	APEC 3	APEC 3	APEC 3	APEC 3
Description			Downstream Midpoint	Downstream Far Point	Downstream Nearest	Background (Upstream)	Field Duplicate
Bureau Veritas ID			WYM587	WYM588	WYM589	WYM590	WYM594
Sampling Date			9/7/2023	9/7/2023	9/7/2023	9/7/2023	9/7/2023
COC Number			C3R8276	C3R8276	C3R8276	C3R8276	C3R8276
Calculated Parameters	**Units**						
Anion Sum	me/L	nv	0.0700	0.0800	0.120	0.110	0.0700
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	nv	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	mg/L	nv	11	12	13	12	11
Carb. Alkalinity (calc. as CaCO3)	mg/L	nv	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	nv	0.250	0.260	0.240	0.240	0.230
Hardness (CaCO3)	mg/L	nv	4.3	4.1	4.2	4.0	4.0
Ion Balance (% Difference)	%	nv	56.3	52.9	33.3	37.1	53.3
Langelier Index (@ 20C)	N/A	nv	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A	nv	NC	NC	NC	NC	NC
Nitrate (N)	mg/L	45	<0.050	<0.050	0.10	<0.050	<0.050
Saturation pH (@ 20C)	N/A	nv	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A	nv	NC	NC	NC	NC	NC
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	nv	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Chloride (Cl-)	mg/L	120	2.4	2.8	3.9	3.8	2.4
Colour	TCU	n/a	340	310	340	360	370
Nitrate + Nitrite (N)	mg/L	n/a	<0.050	<0.050	0.10	<0.050	<0.050
Nitrite (N)	mg/L	3	<0.010	0.011	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	ug/L	n/a	<0.050	0.21	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	n/a	27	25	28	29	29
Orthophosphate (P)	mg/L	n/a	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	7.0 - 10.5	**4.77**	**4.67**	**4.91**	**4.57**	**4.77**
Reactive Silica (SiO2)	mg/L	n/a	3.3	3.4	3.7	3.6	3.3
Dissolved Sulphate (SO4)	mg/L	n/a	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	n/a	0.40	0.51	0.50	0.42	0.30
Conductivity	uS/cm	n/a	29	33	30	29	29
Metals							
Total Aluminum (Al)	ug/L	100/2900	**400**	**370**	**390**	**380**	**390**
Total Antimony (Sb)	ug/L	6	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	10	<1.0	<1.0	<1.0	1.0	<1.0
Total Barium (Ba)	ug/L	1,000	4.5	4.5	4.7	4.1	4.1
Total Beryllium (Be)	ug/L	4	<0.10	<0.10	<0.10	<0.10	<0.10
Total Bismuth (Bi)	ug/L	-	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	5,000	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	5	0.020	0.019	0.018	0.019	0.019
Total Calcium (Ca)	ug/L	-	1,100	1,000	1,100	980	990
Total Chromium (Cr)	ug/L	50	2.6	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L	3.8	0.59	0.78	0.65	0.52	0.50
Total Copper (Cu)	ug/L	2,000	3.5	<0.50	1.6	<0.50	<0.50
Total Iron (Fe)	ug/L	300	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Total Lead (Pb)	ug/L	5	0.77	0.73	0.94	0.74	0.72
Total Magnesium (Mg)	ug/L	-	380	370	380	370	360
Total Manganese (Mn)	ug/L	120	52	84	55	41	42
Total Mercury (Hg)	ug/L	1	<0.013	<0.013	<0.013	<0.013	<0.013
Total Molybdenum (Mo)	ug/L	70	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	100	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L	-	<100	<100	<100	<100	<100
Total Potassium (K)	ug/L	-	380	340	380	360	380
Total Selenium (Se)	ug/L	50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Silver (Ag)	ug/L	-	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L	200,000	2,200	2,200	2,200	2,100	2,100
Total Strontium (Sr)	ug/L	2,400	8.5	8.6	9.1	7.7	8.2
Total Thallium (Tl)	ug/L	2	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L	2,400	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L	-	6.7	6.3	6.1	5.7	6.4
Total Uranium (U)	ug/L	20	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L	6.2	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	5,000	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

Tier 2 PSS for Potable Groundwater = Tier II Pathway Specific Standards (PSS) for Potable Groundwater (drinking water) Remediation Levels Protocol (Table 6A)

Bold and Shaded = Value Exceeds Tier II PSS (Drinking Water Standard)

nv = no value

NC = Not calculated

Table B-4: Surface Soil Screening for the Hiker
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{Ind}$	Maximum	LOC23-SA01	LOC23-SA02	LOC23-SA03	LOC23-SA04	LOC23-SA05	LOC23-SA-06	LOC23-SA-07	LOC23-SA-08	LOC23-SA-09	LOC23-SA-09 Lab-Dup	LOC23-SA-10	DUP-SA-01	LOC23-SA-11
APEC				APEC 1	APEC 2	APEC 1	APEC 1	APEC 1	APEC 1	APEC 3	APEC 2	APEC 3	Lab Duplicate	APEC 2	Field Duplicate	APEC 2
Bureau Veritas ID				WMP728	WMP729	WMP730	WMP731	WMP732	WYM565	WYM566	WYM567	WYM997	WYM997	WYM568	WYM591	WYM569
Sampling Date				7/21/2023	7/21/2023	7/21/2023	7/21/2023	7/21/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023
COC Number				48157	48157	48157	48157	48157	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	220,000	29,000	5,600	14,000	20,000	6,700	7,000	9,500	9,400	11,000	5,000	4,700	23,000	19,000	14,000
Antimony (Sb)	mg/kg	63	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	**54**	4.6	**48**	**54**	3.5	<2.0	13	4.1	3.8	23	21	**32**	**34**	15
Barium (Ba)	mg/kg	130,000	190	5.1	17	45	18	9.8	21	20	43	180	160	26	24	13
Beryllium (Be)	mg/kg	1,400	<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
Bismuth (Bi)	mg/kg	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	24,000	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	2,090	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	6,700	36	4.9	17	22	4.2	11	12	13	17	5.9	5.5	30	26	17
Cobalt (Co)	mg/kg	250	240	<1.0	25	19	<1.0	3.4	6.3	4.7	10	120	110	11	12	1.6
Copper (Cu)	mg/kg	20,000	50	<2.0	49	50	2.6	<2.0	15	2.1	3.5	7.7	6.9	8.8	8.3	5.3
Iron (Fe)	mg/kg	164,000	65,000	5,800	24,000	30,000	1,900	10,000	14,000	9,700	18,000	13,000	12,000	65,000	60,000	32,000
Lead (Pb)	mg/kg	8,299	190	9.0	66	58	11	8.5	35	16	11	20	19	15	15	16
Lithium (Li)	mg/kg	-	36	2.1	21	25	4.5	9.9	19	15	20	6.7	6.7	23	19	9.9
Manganese (Mn)	mg/kg	5,200	3,400	73	1,100	870	63	150	410	150	520	800	760	3,000	3,400	300
Mercury (Hg)	mg/kg	690	1.2	<0.10	1.1	0.42	<0.10	<0.10	1.2	0.10	<0.10	<0.10	<0.10	0.18	0.14	0.11
Molybdenum (Mo)	mg/kg	1,200	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	5,100	35	<2.0	27	35	<2.0	10	20	12	28	14	13	6.2	5.7	6.8
Rubidium (Rb)	mg/kg	-	21	2.1	4.4	9.1	5.3	8.3	5.2	5.0	5.3	3.5	3.6	12	9.0	6.3
Selenium (Se)	mg/kg	4,050	4	<0.50	0.52	0.79	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.0	1.8	0.85
Silver (Ag)	mg/kg	490	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	140,000	15	<5.0	7.9	12	<5.0	5.7	8.6	15	13	7.0	6.9	<5.0	<5.0	<5.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	0.61	0.62	0.12	0.11	<0.10
Tin (Sn)	mg/kg	140,000	1.3	<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
Uranium (U)	mg/kg	510	2.5	0.31	1.7	1.4	0.40	0.44	0.84	0.45	0.50	0.44	0.43	0.73	0.60	0.45
Vanadium (V)	mg/kg	160	41	14	13	18	4.6	7.5	8.7	8.9	10	7.3	6.4	31	28	27
Zinc (Zn)	mg/kg	270,000	75	6.4	49	75	5.6	23	42	22	46	36	33	25	24	19

Notes:

NSECC Tier 2 PSS $_{HH}$ = Nova Scotia Environment and Climate Change (NSECC) Tier 2 Pathway Specific Standard for Direct Soil Contact/Ingestion Industrial Land Use site with non-potable groundwater.

Bold and Shaded = Value Exceeds Applied PSS for Industrial Land Use

nv = no value

Table B-4: Surface Soil Screening for the Hiker
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{Ind}$	Maximum	LOC23-SA-12	LOC23-SA-13	LOC23-SA-14	LOC23-SA-15	LOC23-SA-16 A	LOC23-SA-16B	LOC23-SA-17	LOC23-SA-17 Lab-Dup	LOC23-SA-18	LOC23-SA-19	LOC23-SA-20	LOC23-SA-21	LOC23-SA-22
APEC				APEC 2	APEC 2	APEC 2	APEC 2	APEC 1	APEC 1	APEC 1	Lab Duplicate	APEC 1	APEC 1	APEC 1	APEC 1	APEC 1
Bureau Veritas ID				WYM570	WYM571	WYM572	WYM573	WYM574	WYM595	WYM575	WYM575	WYM576	no	WYM577	WYM578	WYM579
Sampling Date				9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	soil	9/6/2023	9/6/2023	9/6/2023
COC Number				C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	recovered	C3R8276	C3R8276	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	220,000	29,000	8,400	23,000	21,000	3,200	27,000	8,000	9,000	8,900	5,600	-	13,000	15,000	6,400
Antimony (Sb)	mg/kg	63	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	**54**	5.0	18	**54**	<2.0	9.4	<2.0	19	19	13	-	14	9.1	2.9
Barium (Ba)	mg/kg	130,000	190	15	120	190	5.5	20	9.3	8.9	8.4	7.5	-	23	11	24
Beryllium (Be)	mg/kg	1,400	<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
Bismuth (Bi)	mg/kg	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0
Boron (B)	mg/kg	24,000	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	<50
Cadmium (Cd)	mg/kg	2,090	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	-	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	6,700	36	13	36	36	2.8	25	4.5	13	13	6.3	-	16	20	9.2
Cobalt (Co)	mg/kg	250	240	3.3	59	240	<1.0	4.9	1.0	5.6	5.4	4.9	-	7.7	2.2	1.4
Copper (Cu)	mg/kg	20,000	50	2.3	12	12	<2.0	15	2.5	23	22	3.1	-	6.9	9.7	<2.0
Iron (Fe)	mg/kg	164,000	65,000	16,000	18,000	56,000	2,500	24,000	4,600	20,000	19,000	14,000	-	20,000	34,000	13,000
Lead (Pb)	mg/kg	8,299	190	13	110	130	5.7	22	3.6	190	170	15	-	31	16	14
Lithium (Li)	mg/kg	-	36	12	36	18	<2.0	18	7.7	14	14	4.1	-	22	11	5.2
Manganese (Mn)	mg/kg	5,200	3,400	380	420	1,200	30	300	57	610	610	480	-	390	200	120
Mercury (Hg)	mg/kg	690	1.2	<0.10	0.29	0.29	<0.10	0.39	<0.10	0.19	0.17	0.11	-	<0.10	0.16	<0.10
Molybdenum (Mo)	mg/kg	1,200	3.9	<2.0	2.2	2.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	3.9	<2.0	<2.0
Nickel (Ni)	mg/kg	5,100	35	11	16	14	<2.0	11	<2.0	16	15	4.2	-	13	7.1	6.1
Rubidium (Rb)	mg/kg	-	21	5.0	21	12	<2.0	7.4	3.1	3.5	3.2	6.4	-	7.9	5.6	6.0
Selenium (Se)	mg/kg	4,050	4	<0.50	2.6	4.0	<0.50	1.8	<0.50	<0.50	<0.50	<0.50	-	0.68	1.3	<0.50
Silver (Ag)	mg/kg	490	0.62	<0.50	0.54	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	140,000	15	<5.0	7.1	5.5	<5.0	5.5	<5.0	5.9	5.4	<5.0	-	<5.0	<5.0	6.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	0.35	0.43	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Tin (Sn)	mg/kg	140,000	1.3	<1.0	1.3	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	510	2.5	0.46	2.5	2.5	0.18	0.94	0.23	0.65	0.61	0.36	-	0.87	0.68	0.29
Vanadium (V)	mg/kg	160	41	10	27	41	11	19	9.4	10	9.5	13	-	17	23	13
Zinc (Zn)	mg/kg	270,000	75	27	47	35	<5.0	32	8.2	35	35	11	-	31	20	9.6

Notes:

NSECC Tier 2 PSS $_{HH}$ = Nova Scotia Environment and Climate Change (NSECC) Tier 2 Pathway Specific Standard for Direct Soil Contact/Ingestion Industrial Land Use site with non-potable groundwater.

Bold and Shaded = Value Exceeds Applied PSS for Industrial Land Use

nv = no value

Table B-4: Surface Soil Screening for the Hiker
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{Ind}$	Maximum	DUP-SA-02	LOC23-SA-23	LOC23-SA-24	LOC-SA24-01	LOC-SA24-02	LOC-SA24-100	LOC23-SA-25
APEC				Field Duplicate	APEC 1	APEC 1	APEC 1	APEC 1	Field Duplicate	Reference
Bureau Veritas ID				WYM592	WYM580	WYM581	ZJH626	ZJH627	ZJH628	WYM582
Sampling Date				9/6/2023	9/6/2023	9/6/2023	5/31/2024	5/31/2024	5/31/2024	9/6/2023
COC Number				C3R8276	C3R8276	C3R8276	C4H0077	C4H0077	C4H0077	C3R8276
Metals	**Units**									
Aluminum (Al)	mg/kg	220,000	29,000	7,000	4,500	1,500	2,300	6,800	3,200	29,000
Antimony (Sb)	mg/kg	63	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	**54**	2.8	<2.0	<2.0	<2.0	6.2	2.5	22
Barium (Ba)	mg/kg	130,000	190	24	12	9.8	21.0	18.0	16.0	18
Beryllium (Be)	mg/kg	1,400	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	mg/kg	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	24,000	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	2,090	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	6,700	36	9.6	5.5	<2.0	3.1	7.1	3.4	29
Cobalt (Co)	mg/kg	250	240	1.4	<1.0	<1.0	<1.0	1.7	<1.0	5.5
Copper (Cu)	mg/kg	20,000	50	<2.0	<2.0	<2.0	2.8	3.2	<2.0	24
Iron (Fe)	mg/kg	164,000	65,000	14,000	1,600	1,100	1,700	12,000	3,300	43,000
Lead (Pb)	mg/kg	8,299	190	8.5	10	2.3	7.5	9.8	6.1	22
Lithium (Li)	mg/kg	-	36	5.9	3.8	<2.0	<2.0	4.5	<2.0	28
Manganese (Mn)	mg/kg	5,200	3,400	130	47	5.4	30	170	52.0	710
Mercury (Hg)	mg/kg	690	1.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19
Molybdenum (Mo)	mg/kg	1,200	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	5,100	35	5.8	2.3	<2.0	<2.0	7.1	2.2	13
Rubidium (Rb)	mg/kg	-	21	6.5	3.3	2.6	3.2	5.5	3.0	7.7
Selenium (Se)	mg/kg	4,050	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.7
Silver (Ag)	mg/kg	490	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	140,000	15	5.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	mg/kg	140,000	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	510	2.5	0.30	0.39	<0.10	0.15	0.25	0.14	0.88
Vanadium (V)	mg/kg	160	41	13	5.2	8.3	7.4	14.0	7.7	22
Zinc (Zn)	mg/kg	270,000	75	9.9	<5.0	<5.0	<5.0	13	<5.0	42

Notes:

NSECC Tier 2 PSS $_{HH}$ = Nova Scotia Environment and Climate Change (NSECC) Tier 2 Pathway Specific Standard for Direct Soil Contact/Ingestion Industrial Land Use site with non-potable groundwater.

Bold and Shaded = Value Exceeds Applied PSS for Industrial Land Use

nv = no value

Table B-5: Surface Soil Screening for the Recreational Visitor
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{HH}$	Maximum	LOC23-SA01	LOC23-SA02	LOC23-SA03	LOC23-SA04	LOC23-SA05	LOC23-SA-06	LOC23-SA-07	LOC23-SA-08	LOC23-SA-09	LOC23-SA-09 Lab-Dup	LOC23-SA-10	DUP-SA-01	LOC23-SA-11
APEC				APEC 1	APEC 2	APEC 1	APEC 1	APEC 1	APEC 1	APEC 3	APEC 2	APEC 3	Lab Duplicate	APEC 2	Field Duplicate	APEC 2
Bureau Veritas ID				WMP728	WMP729	WMP730	WMP731	WMP732	WYM565	WYM566	WYM567	WYM997	WYM997	WYM568	WYM591	WYM569
Sampling Date				7/21/2023	7/21/2023	7/21/2023	7/21/2023	7/21/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023
COC Number				48157	48157	48157	48157	48157	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	15,400	**29,000**	5,600	14,000	**20,000**	6,700	7,000	9,500	9,400	11,000	5,000	4,700	**23,000**	**19,000**	14,000
Antimony (Sb)	mg/kg	7.50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	**54**	4.6	**48**	**54**	3.5	<2.0	13	4.1	3.8	23	21	**32**	**34**	15
Barium (Ba)	mg/kg	10,000	190	5.1	17	45	18	9.8	21	20	43	180	160	26	24	13
Beryllium (Be)	mg/kg	110	<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
Bismuth (Bi)	mg/kg	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	4,300	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	49	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	630	36	4.9	17	22	4.2	11	12	13	17	5.9	5.5	30	26	17
Cobalt (Co)	mg/kg	22	**240**	<1.0	**25**	19	<1.0	3.4	6.3	4.7	10	**120**	**110**	11	12	1.6
Copper (Cu)	mg/kg	4,000	50	<2.0	49	50	2.6	<2.0	15	2.1	3.5	7.7	6.9	8.8	8.3	5.3
Iron (Fe)	mg/kg	11,000	**65,000**	5,800	**24,000**	**30,000**	1,900	10,000	**14,000**	9,700	**18,000**	**13,000**	**12,000**	**65,000**	**60,000**	**32,000**
Lead (Pb)	mg/kg	260	190	9.0	66	58	11	8.5	35	16	11	20	19	15	15	16
Lithium (Li)	mg/kg	-	36	2.1	21	25	4.5	9.9	19	15	20	6.7	6.7	23	19	9.9
Manganese (Mn)	mg/kg	360	**3,400**	73	**1,100**	**870**	63	150	**410**	150	**520**	**800**	**760**	**3,000**	**3,400**	300
Mercury (Hg)	mg/kg	24	1.2	<0.10	1.1	0.42	<0.10	<0.10	1.2	0.10	<0.10	<0.10	<0.10	0.18	0.14	0.11
Molybdenum (Mo)	mg/kg	110	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	310	35	<2.0	27	35	<2.0	10	20	12	28	14	13	6.2	5.7	6.8
Rubidium (Rb)	mg/kg	-	21	2.1	4.4	9.1	5.3	8.3	5.2	5.0	5.3	3.5	3.6	12	9.0	6.3
Selenium (Se)	mg/kg	125	4	<0.50	0.52	0.79	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.0	1.8	0.85
Silver (Ag)	mg/kg	77	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	9,400	15	<5.0	7.9	12	<5.0	5.7	8.6	15	13	7.0	6.9	<5.0	<5.0	<5.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	0.61	0.62	0.12	0.11	<0.10
Tin (Sn)	mg/kg	9,400	1.30	<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
Uranium (U)	mg/kg	33	2.50	0.31	1.7	1.4	0.40	0.44	0.84	0.45	0.50	0.44	0.43	0.73	0.60	0.45
Vanadium (V)	mg/kg	39	**41**	14	13	18	4.6	7.5	8.7	8.9	10	7.3	6.4	31	28	27
Zinc (Zn)	mg/kg	16,000	75	6.4	49	75	5.6	23	42	22	46	36	33	25	24	19

Notes:
NSECC Tier 1 EQS = Nova Scotia Environment and Climate Change (NSECC)
Tier 1 Environmental Quality Standards for Commercial Land Use site
with non-potable groundwater.
Bold and Underlined = Exceeds Applied PSS for Comercial Land Use
nv = no value

Table B-5: Surface Soil Screening for the Recreational Visitor
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{HH}$	Maximum	LOC23-SA-12	LOC23-SA-13	LOC23-SA-14	LOC23-SA-15	LOC23-SA-16 A	LOC23-SA-16B	LOC23-SA-17	LOC23-SA-17 Lab-Dup	LOC23-SA-18	LOC23-SA-19	LOC23-SA-20	LOC23-SA-21	LOC23-SA-22
APEC				APEC 2	APEC 2	APEC 2	APEC 2	APEC 1	APEC 1	APEC 1	Lab Duplicate	APEC 1	APEC 1	APEC 1	APEC 1	APEC 1
Bureau Veritas ID				WYM570	WYM571	WYM572	WYM573	WYM574	WYM595	WYM575	WYM575	WYM576	no	WYM577	WYM578	WYM579
Sampling Date				9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	soil	9/6/2023	9/6/2023	9/6/2023
COC Number				C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	recovered	C3R8276	C3R8276	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	15,400	**29,000**	8,400	**23,000**	**21,000**	3,200	**27,000**	8,000	9,000	8,900	5,600	-	13,000	15,000	6,400
Antimony (Sb)	mg/kg	7.50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	**54**	5.0	18	**54**	<2.0	9.4	<2.0	19	19	13	-	14	9.1	2.9
Barium (Ba)	mg/kg	10,000	190	15	120	190	5.5	20	9.3	8.9	8.4	7.5	-	23	11	24
Beryllium (Be)	mg/kg	110	<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
Bismuth (Bi)	mg/kg	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0
Boron (B)	mg/kg	4,300	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	<50
Cadmium (Cd)	mg/kg	49	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	-	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	630	36	13	36	36	2.8	25	4.5	13	13	6.3	-	16	20	9.2
Cobalt (Co)	mg/kg	22	**240**	3.3	**59**	**240**	<1.0	4.9	1.0	5.6	5.4	4.9	-	7.7	2.2	1.4
Copper (Cu)	mg/kg	4,000	50	2.3	12	12	<2.0	15	2.5	23	22	3.1	-	6.9	9.7	<2.0
Iron (Fe)	mg/kg	11,000	**65,000**	**16,000**	**18,000**	**56,000**	2,500	24,000	4,600	**20,000**	**19,000**	**14,000**	-	**20,000**	**34,000**	**13,000**
Lead (Pb)	mg/kg	260	190	13	110	130	5.7	22	3.6	**190**	**170**	15	-	31	16	14
Lithium (Li)	mg/kg	-	36	12	36	18	<2.0	18	7.7	14	14	4.1	-	22	11	5.2
Manganese (Mn)	mg/kg	360	**3,400**	**380**	**420**	**1,200**	30	300	57	**610**	**610**	**480**	-	**390**	200	120
Mercury (Hg)	mg/kg	24	1.2	<0.10	0.29	0.29	<0.10	0.39	<0.10	0.19	0.17	0.11	-	<0.10	0.16	<0.10
Molybdenum (Mo)	mg/kg	110	3.9	<2.0	2.2	2.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	3.9	<2.0	<2.0
Nickel (Ni)	mg/kg	310	35	11	16	14	<2.0	11	<2.0	16	15	4.2	-	13	7.1	6.1
Rubidium (Rb)	mg/kg	-	21	5.0	21	12	<2.0	7.4	3.1	3.5	3.2	6.4	-	7.9	5.6	6.0
Selenium (Se)	mg/kg	125	4	<0.50	2.6	4.0	<0.50	1.8	<0.50	<0.50	<0.50	<0.50	-	0.68	1.3	<0.50
Silver (Ag)	mg/kg	77	0.62	<0.50	0.54	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	9,400	15	<5.0	7.1	5.5	<5.0	5.5	<5.0	5.9	5.4	<5.0	-	<5.0	<5.0	6.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	0.35	0.43	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10
Tin (Sn)	mg/kg	9,400	1.30	<1.0	1.3	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	33	2.50	0.46	2.5	2.5	0.18	0.94	0.23	0.65	0.61	0.36	-	0.87	0.68	0.29
Vanadium (V)	mg/kg	39	**41**	10	27	**41**	11	19	9.4	10	9.5	13	-	17	23	13
Zinc (Zn)	mg/kg	16,000	75	27	47	35	<5.0	32	8.2	35	35	11	-	31	20	9.6

Notes:
NSECC Tier 1 EQS = Nova Scotia Environment and Climate Change (NSECC) Tier 1 Environmental Quality Standards for Commercial Land Use site with non-potable groundwater.
Bold and Underlined = Exceeds Applied PSS for Comercial Land Use
nv = no value

Table B-5: Surface Soil Screening for the Recreational Visitor
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS $_{HH}$	Maximum	DUP-SA-02	LOC23-SA-23	LOC23-SA-24	LOC-SA24-01	LOC-SA24-02	LOC-SA24-100	LOC23-SA-25
APEC				Field Duplicate	APEC 1	APEC 1	APEC 1	APEC 1	Field Duplicate	Reference
Bureau Veritas ID				WYM592	WYM580	WYM581	ZJH626	ZJH627	ZJH628	WYM582
Sampling Date				9/6/2023	9/6/2023	9/6/2023	5/31/2024	5/31/2024	5/31/2024	9/6/2023
COC Number				C3R8276	C3R8276	C3R8276	C4H0077	C4H0077	C4H0077	C3R8276
Metals	**Units**									
Aluminum (Al)	mg/kg	15,400	**29,000**	7,000	4,500	1,500	2,300	6,800	3,200	**29,000**
Antimony (Sb)	mg/kg	7.50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	31	**54**	2.8	<2.0	<2.0	<2.0	6.2	2.5	22
Barium (Ba)	mg/kg	10,000	190	24	12	9.8	21.0	18.0	16.0	18
Beryllium (Be)	mg/kg	110	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	mg/kg	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	4,300	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	49	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	630	36	9.6	5.5	<2.0	3.1	7.1	3.4	29
Cobalt (Co)	mg/kg	22	**240**	1.4	<1.0	<1.0	<1.0	1.7	<1.0	5.5
Copper (Cu)	mg/kg	4,000	50	<2.0	<2.0	<2.0	2.8	3.2	<2.0	24
Iron (Fe)	mg/kg	11,000	**65,000**	**14,000**	1,600	1,100	1,700	**12,000**	3,300	**43,000**
Lead (Pb)	mg/kg	260	190	8.5	10	2.3	7.5	9.8	6.1	22
Lithium (Li)	mg/kg	-	36	5.9	3.8	<2.0	<2.0	4.5	<2.0	28
Manganese (Mn)	mg/kg	360	**3,400**	130	47	5.4	30	170	52.0	**710**
Mercury (Hg)	mg/kg	24	1.2	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19
Molybdenum (Mo)	mg/kg	110	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	310	35	5.8	2.3	<2.0	<2.0	7.1	2.2	13
Rubidium (Rb)	mg/kg	-	21	6.5	3.3	2.6	3.2	5.5	3.0	7.7
Selenium (Se)	mg/kg	125	4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	2.7
Silver (Ag)	mg/kg	77	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	9,400	15	5.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thallium (Tl)	mg/kg	1	0.62	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	mg/kg	9,400	1.30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	33	2.50	0.30	0.39	<0.10	0.15	0.25	0.14	0.88
Vanadium (V)	mg/kg	39	**41**	13	5.2	8.3	7.4	14.0	7.7	22
Zinc (Zn)	mg/kg	16,000	75	9.9	<5.0	<5.0	<5.0	13	<5.0	42

Notes:
NSECC Tier 1 EQS = Nova Scotia Environment and Climate Change (NSECC)
Tier 1 Environmental Quality Standards for Commercial Land Use site
with non-potable groundwater.
Bold and Underlined = Exceeds Applied PSS for Comercial Land Use
nv = no value

Table B-6: Surface Soil Screening for Ecological COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS_{E-SC} Eco Soil Contact	PSS_{E-SFI} Birds and Mammals	Maximum	LOC23-SA01	LOC23-SA02	LOC23-SA03	LOC23-SA04	LOC23-SA05	LOC23-SA-06	LOC23-SA-07	LOC23-SA-08	LOC23-SA-09	LOC23-SA-09 Lab-Dup	LOC23-SA-10	DUP-SA-01
APEC					APEC 1	APEC 2	APEC 1	APEC 1	APEC 1	APEC 1	APEC 3	APEC 2	APEC 3	Lab Duplicate	APEC 2	Field Duplicate
Bureau Veritas ID					WMP728	WMP729	WMP730	WMP731	WMP732	WYM565	WYM566	WYM567	WYM997	WYM997	WYM568	WYM591
Sampling Date					7/21/2023	7/21/2023	7/21/2023	7/21/2023	7/21/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023
COC Number					48157	48157	48157	48157	48157	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	nv	nv	29,000	5,600	14,000	20,000	6,700	7,000	9,500	9,400	11,000	5,000	4,700	23,000	19,000
Antimony (Sb)	mg/kg	20	25	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	17	380	**54**	4.6	**48**	**54**	3.5	<2.0	13	4.1	3.8	**23**	**21**	**32**	**34**
Barium (Ba)	mg/kg	750	400	190	5.1	17	45	18	9.8	21	20	43	180	160	26	24
Beryllium (Be)	mg/kg	5	13	<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
Bismuth (Bi)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	-	120	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	10	3.8	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	64	160	36	4.9	17	22	4.2	11	12	13	17	5.9	5.5	30	26
Cobalt (Co)	mg/kg	20	180	**240**	<1.0	**25**	19	<1.0	3.4	6.3	4.7	10	**120**	**110**	11	12
Copper (Cu)	mg/kg	63	300	50	<2.0	49	50	2.6	<2.0	15	2.1	3.5	7.7	6.9	8.8	8.3
Iron (Fe)	mg/kg	-	-	65,000	5,800	24,000	30,000	1,900	10,000	14,000	9,700	18,000	13,000	12,000	65,000	60,000
Lead (Pb)	mg/kg	300	70	190	9.0	66	58	11	8.5	35	16	11	20	19	15	15
Lithium (Li)	mg/kg	-	-	36	2.1	21	25	4.5	9.9	19	15	20	6.7	6.7	23	19
Manganese (Mn)	mg/kg	-	-	3400	73	1,100	870	63	150	410	150	520	800	760	3,000	3,400
Mercury (Hg)	mg/kg	12	20	1.2	<0.10	1.1	0.42	<0.10	<0.10	1.2	0.10	<0.10	<0.10	<0.10	0.18	0.14
Molybdenum (Mo)	mg/kg	4	6.9	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	45	528	35	<2.0	27	35	<2.0	10	20	12	28	14	13	6.2	5.7
Rubidium (Rb)	mg/kg	-	-	21	2.1	4.4	9.1	5.3	8.3	5.2	5.0	5.3	3.5	3.6	12	9.0
Selenium (Se)	mg/kg	1	4.5	**4**	<0.50	0.52	0.79	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**2**	**2**
Silver (Ag)	mg/kg	20	-	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	-	-	15	<5.0	7.9	12	<5.0	5.7	8.6	15	13	7.0	6.9	<5.0	<5.0
Thallium (Tl)	mg/kg	1.4	1	0.62	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	0.61	0.62	0.12	0.11
Tin (Sn)	mg/kg	5	-	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	500	33	2.5	0.31	1.7	1.4	0.40	0.44	0.84	0.45	0.50	0.44	0.43	0.73	0.60
Vanadium (V)	mg/kg	130	18	**41**	14	13	18	4.6	7.5	8.7	8.9	10	7.3	6.4	**31**	**28**
Zinc (Zn)	mg/kg	200	540	75	6.4	49	75	5.6	23	42	22	46	36	33	25	24

Notes:

PSS_{E-SC} = Ecological Screening Levels. From Atlantic Partnership in Risk-Based Corrective Action (Atlantic PIRI) Ecological Tier II PSS for Soil Contact - Agricultural Land Use

$PSS_{E\ SFI}$ = Ecological Screening Levels. From Atlantic Partnership in Risk-Based Corrective Action (Atlantic PIRI) Ecological Tier II PSS for Soil and Food Ingestion - Agricultural Land Use

Bold and Underlined = Exceeds PSS for Soil Contact

Bold and Shaded = Exceeds ESL for Soil and Food Ingestion

nv = no value

Table B-6: Surface Soil Screening for Ecological COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS_{E-SC}	PSS_{E-SFI}	Maximum	LOC23-SA-11	LOC23-SA-12	LOC23-SA-13	LOC23-SA-14	LOC23-SA-15	LOC23-SA-16 A	LOC23-SA-16B	LOC23-SA-17	LOC23-SA-17 Lab-Dup	LOC23-SA-18	LOC23-SA-19	LOC23-SA-20
APEC		Eco Soil Contact	Birds and Mammals		APEC 2	APEC 2	APEC 2	APEC 2	APEC 2	APEC 1	APEC 1	APEC 1	Lab Duplicate	APEC 1	APEC 1	APEC 1
Bureau Veritas ID					WYM569	WYM570	WYM571	WYM572	WYM573	WYM574	WYM595	WYM575	WYM575	WYM576	no	WYM577
Sampling Date					9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	soil	9/6/2023
COC Number					C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	recovered	C3R8276
Metals	**Units**															
Aluminum (Al)	mg/kg	nv	nv	29,000	14,000	8,400	23,000	21,000	3,200	27,000	8,000	9,000	8,900	5,600	-	13,000
Antimony (Sb)	mg/kg	20	25	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0
Arsenic (As)	mg/kg	17	380	**54**	15	5.0	**18**	**54**	<2.0	9.4	<2.0	**19**	**19**	13	-	14
Barium (Ba)	mg/kg	750	400	190	13	15	120	190	5.5	20	9.3	8.9	8.4	7.5	-	23
Beryllium (Be)	mg/kg	5	13	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0
Bismuth (Bi)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0
Boron (B)	mg/kg	-	120	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50
Cadmium (Cd)	mg/kg	10	3.8	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	-	<0.30
Chromium (Cr)	mg/kg	64	160	36	17	13	36	36	2.8	25	4.5	13	13	6.3	-	16
Cobalt (Co)	mg/kg	20	180	**240**	1.6	3.3	**59**	**240**	<1.0	4.9	1.0	5.6	5.4	4.9	-	7.7
Copper (Cu)	mg/kg	63	300	50	5.3	2.3	12	12	<2.0	15	2.5	23	22	3.1	-	6.9
Iron (Fe)	mg/kg	-	-	65,000	32,000	16,000	18,000	56,000	2,500	24,000	4,600	20,000	19,000	14,000	-	20,000
Lead (Pb)	mg/kg	300	70	190	16	13	**110**	**130**	5.7	22	3.6	**190**	**170**	15	-	31
Lithium (Li)	mg/kg	-	-	36	9.9	12	36	18	<2.0	18	7.7	14	14	4.1	-	22
Manganese (Mn)	mg/kg	-	-	3400	300	380	420	1,200	30	300	57	610	610	480	-	390
Mercury (Hg)	mg/kg	12	20	1.2	0.11	<0.10	0.29	0.29	<0.10	0.39	<0.10	0.19	0.17	0.11	-	<0.10
Molybdenum (Mo)	mg/kg	4	6.9	3.9	<2.0	<2.0	2.2	2.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	3.9
Nickel (Ni)	mg/kg	45	528	35	6.8	11	16	14	<2.0	11	<2.0	16	15	4.2	-	13
Rubidium (Rb)	mg/kg	-	-	21	6.3	5.0	21	12	<2.0	7.4	3.1	3.5	3.2	6.4	-	7.9
Selenium (Se)	mg/kg	1	4.5	**4**	0.85	<0.50	**3**	**4**	<0.50	**2**	<0.50	<0.50	<0.50	<0.50	-	0.68
Silver (Ag)	mg/kg	20	-	0.62	<0.50	<0.50	0.54	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50
Strontium (Sr)	mg/kg	-	-	15	<5.0	<5.0	7.1	5.5	<5.0	5.5	<5.0	5.9	5.4	<5.0	-	<5.0
Thallium (Tl)	mg/kg	1.4	1	0.62	<0.10	<0.10	0.35	0.43	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10
Tin (Sn)	mg/kg	5	-	1.3	<1.0	<1.0	1.3	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0
Uranium (U)	mg/kg	500	33	2.5	0.45	0.46	2.5	2.5	0.18	0.94	0.23	0.65	0.61	0.36	-	0.87
Vanadium (V)	mg/kg	130	18	**41**	**27**	10	**27**	**41**	11	**19**	9.4	10	9.5	13	-	17
Zinc (Zn)	mg/kg	200	540	75	19	27	47	35	<5.0	32	8.2	35	35	11	-	31

Notes:

PSS_{E-SC} = Ecological Screening Levels. From Atlantic Partnership in Risk-Based Corrective Action (Atlantic PIRI) Ecological Tier II PSS for Soil Contact - Agricultural Land Use

$PSS_{E\ SFI}$ = Ecological Screening Levels. From Atlantic Partnership in Risk-Based Corrective Action (Atlantic PIRI) Ecological Tier II PSS for Soil and Food Ingestion - Agricultural Land Use

Bold and Underlined = Exceeds PSS for Soil Contact

Bold and Shaded = Exceeds ESL for Soil and Food Ingestion

nv = no value

Table B-6: Surface Soil Screening for Ecological COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		PSS_{E-SC} Eco Soil Contact	PSS_{E-SFI} Birds and Mammals	Maximum	LOC23-SA-21	LOC23-SA-22	DUP-SA-02	LOC23-SA-23	LOC23-SA-24	LOC-SA24-01	LOC-SA24-02	LOC-SA24-100	LOC23-SA-25
APEC					APEC 1	APEC 1	Field Duplicate	APEC 1	APEC 1	APEC 1	APEC 1	Field Duplicate	Reference
Bureau Veritas ID					WYM578	WYM579	WYM592	WYM580	WYM581	ZJH626	ZJH627	ZJH628	WYM582
Sampling Date					9/6/2023	9/6/2023	9/6/2023	9/6/2023	9/6/2023	5/31/2024	5/31/2024	5/31/2024	9/6/2023
COC Number					C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C4H0077	C4H0077	C4H0077	C3R8276
Metals	**Units**												
Aluminum (Al)	mg/kg	nv	nv	29,000	15,000	6,400	7,000	4,500	1,500	2,300	6,800	3,200	29,000
Antimony (Sb)	mg/kg	20	25	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	17	380	**54**	9.1	2.9	2.8	<2.0	<2.0	<2.0	6.2	2.5	**22**
Barium (Ba)	mg/kg	750	400	190	11	24	24	12	9.8	21.0	18.0	16.0	18
Beryllium (Be)	mg/kg	5	13	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	-	120	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	10	3.8	<0.3	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	64	160	36	20	9.2	9.6	5.5	<2.0	3.1	7.1	3.4	29
Cobalt (Co)	mg/kg	20	180	**240**	2.2	1.4	1.4	<1.0	<1.0	<1.0	1.7	<1.0	5.5
Copper (Cu)	mg/kg	63	300	50	9.7	<2.0	<2.0	<2.0	<2.0	2.8	3.2	<2.0	24
Iron (Fe)	mg/kg	-	-	65,000	34,000	13,000	14,000	1,600	1,100	1,700	12,000	3,300	43,000
Lead (Pb)	mg/kg	300	70	190	16	14	8.5	10	2.3	7.5	9.8	6.1	22
Lithium (Li)	mg/kg	-	-	36	11	5.2	5.9	3.8	<2.0	<2.0	4.5	<2.0	28
Manganese (Mn)	mg/kg	-	-	3400	200	120	130	47	5.4	30	170	52.0	710
Mercury (Hg)	mg/kg	12	20	1.2	0.16	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.19
Molybdenum (Mo)	mg/kg	4	6.9	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	45	528	35	7.1	6.1	5.8	2.3	<2.0	<2.0	7.1	2.2	13
Rubidium (Rb)	mg/kg	-	-	21	5.6	6.0	6.5	3.3	2.6	3.2	5.5	3.0	7.7
Selenium (Se)	mg/kg	1	4.5	**4**	**1.3**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**2.7**
Silver (Ag)	mg/kg	20	-	0.62	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	-	-	15	<5.0	6.0	5.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thallium (Tl)	mg/kg	1.4	1	0.62	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	mg/kg	5	-	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium (U)	mg/kg	500	33	2.5	0.68	0.29	0.30	0.39	<0.10	0.15	0.25	0.14	0.88
Vanadium (V)	mg/kg	130	18	**41**	**23**	13	13	5.2	8.3	7.4	14.0	7.7	**22**
Zinc (Zn)	mg/kg	200	540	75	20	9.6	9.9	<5.0	<5.0	<5.0	13	<5.0	42

Notes:

PSS_{E-SC} = Ecological Screening Levels. From Atlantic Partnership in Risk-Based Corrective Action (Atlantic PIRI) Ecological Tier II PSS for Soil Contact - Agricultural Land Use

$PSS_{E\ SFI}$ = Ecological Screening Levels. From Atlantic Partnership in Risk-Based Corrective Action (Atlantic PIRI) Ecological Tier II PSS for Soil and Food Ingestion - Agricultural Land Use

Bold and Underlined = Exceeds PSS for Soil Contact

Bold and Shaded = Exceeds ESL for Soil and Food Ingestion

nv = no value

Table B-7: Surface Water Screening for Aquatic COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		Tier 1 EQS Surface water	LOC23-SW-01	LOC23-SW-02	LOC23-SW-03	LOC23-SW-04	DUP-SW-01
APEC			APEC 3	APEC 3	APEC 3	APEC 3	APEC 3
Description			Downstream Midpoint	Downstream Far Point	Downstream Nearest	Background (Upstream)	Field Duplicate
Bureau Veritas ID			WYM587	WYM588	WYM589	WYM590	WYM594
Sampling Date			9/7/2023	9/7/2023	9/7/2023	9/7/2023	9/7/2023
COC Number			C3R8276	C3R8276	C3R8276	C3R8276	C3R8276
Calculated Parameters	**Units**						
Anion Sum	me/L	nv	0.0700	0.0800	0.120	0.110	0.0700
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	nv	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	mg/L	nv	11	12	13	12	11
Carb. Alkalinity (calc. as CaCO3)	mg/L	nv	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	nv	0.250	0.260	0.240	0.240	0.230
Hardness (CaCO3)	mg/L	nv	4.3	4.1	4.2	4.0	4.0
Ion Balance (% Difference)	%	nv	56.3	52.9	33.3	37.1	53.3
Langelier Index (@ 20C)	N/A	nv	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A	nv	NC	NC	NC	NC	NC
Nitrate (N)	mg/L	nv	<0.050	<0.050	0.10	<0.050	<0.050
Saturation pH (@ 20C)	N/A	nv	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A	nv	NC	NC	NC	NC	NC
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	nv	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Chloride (Cl-)	mg/L	120	2.4	2.8	3.9	3.8	2.4
Colour	TCU	nv	340	310	340	360	370
Nitrate + Nitrite (N)	mg/L	nv	<0.050	<0.050	0.10	<0.050	<0.050
Nitrite (N)	ug/L	0.06	<0.010	0.011	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	ug/L	13	<0.050	0.21	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	nv	27	25	28	29	29
Orthophosphate (P)	mg/L	nv	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5 to 9	**4.77**	**4.67**	**4.91**	**4.57**	**4.77**
Reactive Silica (SiO2)	mg/L	nv	3.3	3.4	3.7	3.6	3.3
Dissolved Sulphate (SO4)	mg/L	128	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	nv	0.40	0.51	0.50	0.42	0.30
Conductivity	uS/cm	nv	29	33	30	29	29
Metals							
Total Aluminum (Al)	ug/L	5	**400**	**370**	**390**	**380**	**390**
Total Antimony (Sb)	ug/L	9	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	ug/L	5	<1.0	<1.0	<1.0	1.0	<1.0
Total Barium (Ba)	ug/L	1,000	4.5	4.5	4.7	4.1	4.1
Total Beryllium (Be)	ug/L	0.15	<0.10	<0.10	<0.10	<0.10	<0.10
Total Bismuth (Bi)	ug/L	nv	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	ug/L	1,500	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.09	0.020	0.019	0.018	0.019	0.019
Total Calcium (Ca)	ug/L	nv	1,100	1,000	1,100	980	990
Total Chromium (Cr)	ug/L	8.9	2.6	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	ug/L	1	0.59	0.78	0.65	0.52	0.50
Total Copper (Cu)	ug/L	2.0	3.50	<0.50	1.6	<0.50	<0.50
Total Iron (Fe)	ug/L	300	1,000	1,000	1,000	1,000	1,000
Total Lead (Pb)	ug/L	1	0.77	0.73	0.94	0.74	0.72
Total Magnesium (Mg)	ug/L	nv	380	370	380	370	360
Total Manganese (Mn)	ug/L	430	52	84	55	41	42
Total Mercury (Hg)	ug/L	0.026	<0.013	<0.013	<0.013	<0.013	<0.013
Total Molybdenum (Mo)	ug/L	73	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	ug/L	25	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	ug/L	nv	<100	<100	<100	<100	<100
Total Potassium (K)	ug/L	nv	380	340	380	360	380
Total Selenium (Se)	ug/L	1.0	<0.50	<0.50	<0.50	<0.50	<0.50
Total Silver (Ag)	ug/L	0.25	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	ug/L	nv	2200	2200	2200	2100	2100
Total Strontium (Sr)	ug/L	21,000	8.5	8.6	9.1	7.7	8.2
Total Thallium (Tl)	ug/L	0.8	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	ug/L	nv	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	ug/L	nv	6.7	6.3	6.1	5.7	6.4
Total Uranium (U)	ug/L	15	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	ug/L	120	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	ug/L	7	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

NSECC Tier 1 EQS = Nova Scotia Environment and Climate Change (NSECC) Tier 1 Environmental Quality Standards for freshwater (Based on Protection of Freshwater Aquatic Life)

Bold and Shaded = Exceeds Tier1 EQS

nv = no value

NC = Not calculated

Table B-8: Sediment Screening for Benthic COPCs
Former Lochaber Mines, Lochaber Mines, NS
Stantec Consulting Ltd.
Project Number: 121418211

Sample ID		Tier 1 EQS	LOC23-SD-04	LOC23-SD-03	DUP-SD-01	LOC23-SD-01	LOC23-SD-02	LOC24-SD-01	100	Lab-Dup	LOC24-SD-02
APEC			APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3	APEC 3
Description			Background (Upstream)	Downstream Near Point	Field Duplicate	Downstream Midpoint	Downstream Far Point B	Downstream Far Point C	Field Duplicate	Lab Duplicate	Downstream Far Point A
Bureau Veritas ID			WYM586	WYM585	WYM593	WYM583	WYM584	ZJH629	ZJH631	ZJH629	ZJH630
Sampling Date			7-Sep-23	7-Sep-23	7-Sep-23	7-Sep-23	7-Sep-23	31-May-24	31-May-24	31-May-24	31-May-24
COC Number			C3R8276	C3R8276	C3R8276	C3R8276	C3R8276	C4H0077	C4H0077	C4H0077	C4H0077
Metals	**Units**										
Aluminum (Al)	mg/kg	nv	3,000	2,800	2,700	6,000	5,500	6,900	5,600	7,300	3,500
Antimony (Sb)	mg/kg	25	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic (As)	mg/kg	17	2.3	<2.0	<2.0	2.4	14	**170**	**120**	**170**	9.9
Barium (Ba)	mg/kg	nv	19	12	12	32	22	52	47	56	28
Beryllium (Be)	mg/kg	nv	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	mg/kg	nv	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	mg/kg	nv	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	mg/kg	3.5	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	90	3.6	<2.0	<2.0	<2.0	5.9	9.7	7.2	10.0	3.4
Cobalt (Co)	mg/kg	nv	1.5	<1.0	<1.0	2.6	3.6	140	110	150	2.1
Copper (Cu)	mg/kg	197	2.6	3.3	2.1	6.0	5.5	5.5	5.1	6.1	3.4
Iron (Fe)	mg/kg	43,766	3,800	440	470	870	9,200	**110,000**	**68,000**	**110,000**	3,400
Lead (Pb)	mg/kg	91.3	14	3.3	3.1	11	17	72	63	73	11
Lithium (Li)	mg/kg	nv	4.7	<2.0	<2.0	<2.0	3.5	5.0	2.9	4.8	3.2
Manganese (Mn)	mg/kg	1,100	72	13	15	34	220	**6,600**	**3,800**	**6,900**	150
Mercury (Hg)	mg/kg	0.486	<0.10	<0.10	<0.10	0.23	**0.81**	0.25	0.21	0.27	**0.54**
Molybdenum (Mo)	mg/kg	nv	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	mg/kg	75	3.1	<2.0	<2.0	5.6	3.8	6.5	5.0	6.6	4.2
Rubidium (Rb)	mg/kg	nv	2.8	<2.0	<2.0	<2.0	4.5	3.6	3.0	4.2	3.6
Selenium (Se)	mg/kg	2	<0.50	<0.50	<0.50	1.4	0.70	2.0	1.5	2.0	0.57
Silver (Ag)	mg/kg	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium (Sr)	mg/kg	nv	5.3	<5.0	<5.0	13	6.9	11	8.9	12	16
Thallium (Tl)	mg/kg	nv	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	0.15	0.15	<0.10
Tin (Sn)	mg/kg	nv	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Uranium (U)	mg/kg	nv	0.19	0.29	0.24	0.77	0.74	0.58	0.55	0.60	0.55
Vanadium (V)	mg/kg	nv	4.6	<2.0	<2.0	2.5	7.9	33	24	34	3.9
Zinc (Zn)	mg/kg	315	50	<5.0	<5.0	<5.0	8.9	14	13	14	12

Notes:

NSECC Tier 1 EQS = Nova Scotia Environment and Climate Change (NSECC) Tier 1 Environmental Quality Standards for freshwater sediment

Bold and Shaded = Value Exceeds Tier 1 EQS

nv = no value

Appendix C UCLM Calculations

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/2/2024 11:25:53 AM
From File	121418211- Input All Data, Soil, Cobalt, mg_kg_jr_v2.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (mg/kg)

General Statistics

Total Number of Observations	26	Number of Distinct Observations	19
Number of Detects	20	Number of Non-Detects	6
Number of Distinct Detects	19	Number of Distinct Non-Detects	1
Minimum Detect	1	Minimum Non-Detect	1
Maximum Detect	240	Maximum Non-Detect	1
Variance Detects	3300	Percent Non-Detects	23.08%
Mean Detects	26.69	SD Detects	57.45
Median Detects	5.25	CV Detects	2.153
Skewness Detects	3.203	Kurtosis Detects	10.73
Mean of Logged Detects	2.009	SD of Logged Detects	1.479

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.493	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.868	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.362	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.223	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	20.76	KM Standard Error of Mean	10.12
90KM SD	50.29	95% KM (BCA) UCL	38.51
95% KM (t) UCL	38.04	95% KM (Percentile Bootstrap) UCL	39.24
95% KM (z) UCL	37.4	95% KM Bootstrap t UCL	97.9
90% KM Chebyshev UCL	51.11	95% KM Chebyshev UCL	64.86
97.5% KM Chebyshev UCL	83.95	99% KM Chebyshev UCL	121.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.749	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.803	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.252	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.205	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.498	k star (bias corrected MLE)	0.457
Theta hat (MLE)	53.56	Theta star (bias corrected MLE)	58.41
nu hat (MLE)	19.93	nu star (bias corrected)	18.27
Mean (detects)	26.69		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58					Minimum	0.01				Mean	20.53	
59					Maximum	240				Median	4.05	
60					SD	51.38				CV	2.503	
61					k hat (MLE)	0.275				k star (bias corrected MLE)	0.269	
62					Theta hat (MLE)	74.56				Theta star (bias corrected MLE)	76.25	
63					nu hat (MLE)	14.32				nu star (bias corrected)	14	
64					Adjusted Level of Significance (β)	0.0398						
65					Approximate Chi Square Value (14.00, α)	6.571				Adjusted Chi Square Value (14.00, β)	6.236	
66					95% Gamma Approximate UCL	43.74				95% Gamma Adjusted UCL	46.09	
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69					Mean (KM)	20.76				SD (KM)	50.29	
70					Variance (KM)	2529				SE of Mean (KM)	10.12	
71					k hat (KM)	0.17				k star (KM)	0.176	
72					nu hat (KM)	8.86				nu star (KM)	9.171	
73					theta hat (KM)	121.8				theta star (KM)	117.7	
74					80% gamma percentile (KM)	25.42				90% gamma percentile (KM)	62.53	
75					95% gamma percentile (KM)	110.3				99% gamma percentile (KM)	244.8	
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78					Approximate Chi Square Value (9.17, α)	3.431				Adjusted Chi Square Value (9.17, β)	3.202	
79					95% KM Approximate Gamma UCL	55.49				95% KM Adjusted Gamma UCL	59.46	
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82					Shapiro Wilk Test Statistic	0.926				**Shapiro Wilk GOF Test**		
83					10% Shapiro Wilk Critical Value	0.92				Detected Data appear Lognormal at 10% Significance Level		
84					Lilliefors Test Statistic	0.145				**Lilliefors GOF Test**		
85					10% Lilliefors Critical Value	0.176				Detected Data appear Lognormal at 10% Significance Level		
86	**Detected Data appear Lognormal at 10% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89					Mean in Original Scale	20.59				Mean in Log Scale	1.198	
90					SD in Original Scale	51.35				SD in Log Scale	2.016	
91					95% t UCL (assumes normality of ROS data)	37.79				95% Percentile Bootstrap UCL	38.31	
92					95% BCA Bootstrap UCL	46.12				95% Bootstrap t UCL	83.13	
93					95% H-UCL (Log ROS)	128.3						
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96					KM Mean (logged)	1.545				KM Geo Mean	4.688	
97					KM SD (logged)	1.521				95% Critical H Value (KM-Log)	3.249	
98					KM Standard Error of Mean (logged)	0.306				95% H-UCL (KM -Log)	40.05	
99					KM SD (logged)	1.521				95% Critical H Value (KM-Log)	3.249	
100					KM Standard Error of Mean (logged)	0.306						
101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**									**DL/2 Log-Transformed**		
104					Mean in Original Scale	20.64				Mean in Log Scale	1.385	
105					SD in Original Scale	51.33				SD in Log Scale	1.735	
106					95% t UCL (Assumes normality)	37.84				95% H-Stat UCL	62.29	
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Lognormal Distributed at 10% Significance Level**											

	A	B	C	D	E	F	G	H	I	J	K	L
111												
112	**Suggested UCL to Use**											
113					KM H-UCL	40.05						
114												
115	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
116	**Please verify the data were collected from random locations.**											
117	**If the data were collected using judgmental or other non-random methods,**											
118	**then contact a statistician to correctly calculate UCLs.**											
119												
120	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
121	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
122	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
123												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/2/2024 11:27:54 AM
From File	121418211- Input Max Excluded, Soil, Cobalt, mg_kg_jr.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (mg/kg)

General Statistics

Total Number of Observations	25	Number of Distinct Observations	18
Number of Detects	19	Number of Non-Detects	6
Number of Distinct Detects	18	Number of Distinct Non-Detects	1
Minimum Detect	1	Minimum Non-Detect	1
Maximum Detect	120	Maximum Non-Detect	1
Variance Detects	822.6	Percent Non-Detects	24%
Mean Detects	15.46	SD Detects	28.68
Median Detects	4.9	CV Detects	1.855
Skewness Detects	3.166	Kurtosis Detects	10.57
Mean of Logged Detects	1.826	SD of Logged Detects	1.266

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.527	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.863	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.229	Detected Data Not Normal at 1% Significance Level

Detected Data Not Normal at 1% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	11.99	KM Standard Error of Mean	5.159
90KM SD	25.11	95% KM (BCA) UCL	20.98
95% KM (t) UCL	20.81	95% KM (Percentile Bootstrap) UCL	20.98
95% KM (z) UCL	20.47	95% KM Bootstrap t UCL	46.46
90% KM Chebyshev UCL	27.47	95% KM Chebyshev UCL	34.48
97.5% KM Chebyshev UCL	44.21	99% KM Chebyshev UCL	63.32

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.264	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.787	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.207	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.667	k star (bias corrected MLE)	0.597
Theta hat (MLE)	23.18	Theta star (bias corrected MLE)	25.9
nu hat (MLE)	25.34	nu star (bias corrected)	22.68
Mean (detects)	15.46		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	11.75
Maximum	120	Median	3.4
SD	25.74	CV	2.19
k hat (MLE)	0.314	k star (bias corrected MLE)	0.303
Theta hat (MLE)	37.45	Theta star (bias corrected MLE)	38.81
nu hat (MLE)	15.69	nu star (bias corrected)	15.14
Adjusted Level of Significance (β)	0.0395		
Approximate Chi Square Value (15.14, α)	7.359	Adjusted Chi Square Value (15.14, β)	6.99
95% Gamma Approximate UCL	24.17	95% Gamma Adjusted UCL	25.45

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	11.99	SD (KM)	25.11
Variance (KM)	630.4	SE of Mean (KM)	5.159
k hat (KM)	0.228	k star (KM)	0.227
nu hat (KM)	11.4	nu star (KM)	11.36
theta hat (KM)	52.59	theta star (KM)	52.75
80% gamma percentile (KM)	16.78	90% gamma percentile (KM)	36.18
95% gamma percentile (KM)	59.66	99% gamma percentile (KM)	123

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.36, α)	4.811	Adjusted Chi Square Value (11.36, β)	4.523
95% KM Approximate Gamma UCL	28.32	95% KM Adjusted Gamma UCL	30.12

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**

83	10% Shapiro Wilk Critical Value					0.917	Detected Data appear Lognormal at 10% Significance Level					
84	Lilliefors Test Statistic					0.127	**Lilliefors GOF Test**					
85	10% Lilliefors Critical Value					0.18	Detected Data appear Lognormal at 10% Significance Level					
86	**Detected Data appear Lognormal at 10% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89	Mean in Original Scale					11.83	Mean in Log Scale					1.097
90	SD in Original Scale					25.7	SD in Log Scale					1.747
91	95% t UCL (assumes normality of ROS data)					20.63	95% Percentile Bootstrap UCL					20.88
92	95% BCA Bootstrap UCL					24.43	95% Bootstrap t UCL					42.38
93	95% H-UCL (Log ROS)					49.35						
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96	KM Mean (logged)					1.388	KM Geo Mean					4.005
97	KM SD (logged)					1.327	95% Critical H Value (KM-Log)					2.94
98	KM Standard Error of Mean (logged)					0.273	95% H-UCL (KM -Log)					21.44
99	KM SD (logged)					1.327	95% Critical H Value (KM-Log)					2.94
100	KM Standard Error of Mean (logged)					0.273						
101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**						**DL/2 Log-Transformed**					
104	Mean in Original Scale					11.87	Mean in Log Scale					1.221
105	SD in Original Scale					25.68	SD in Log Scale					1.552
106	95% t UCL (Assumes normality)					20.66	95% H-Stat UCL					31.87
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Lognormal Distributed at 10% Significance Level**											
111												
112	**Suggested UCL to Use**											
113	KM H-UCL					21.44						
114												
115	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
116	**Please verify the data were collected from random locations.**											
117	**If the data were collected using judgmental or other non-random methods,**											
118	**then contact a statistician to correctly calculate UCLs.**											
119												
120	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL											
121	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies											
122	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician											
123												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/2/2024 11:22:17 AM
From File	121418211- Input All Data, Soil, Lead, mg_kg_jr_v2.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (mg/kg)

General Statistics

Total Number of Observations	26	Number of Distinct Observations	22
		Number of Missing Observations	0
Minimum	2.3	Mean	32.52
Maximum	190	Median	15
SD	45.03	Std. Error of Mean	8.83
Coefficient of Variation	1.385	Skewness	2.447

Normal GOF Test

Shapiro Wilk Test Statistic	0.63	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.891	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.199	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	47.6	95% Adjusted-CLT UCL (Chen-1995)	51.57
		95% Modified-t UCL (Johnson-1978)	48.3

Gamma GOF Test

A-D Test Statistic	1.622	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.776	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.256	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.177	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.952	k star (bias corrected MLE)	0.868
Theta hat (MLE)	34.16	Theta star (bias corrected MLE)	37.47
nu hat (MLE)	49.5	nu star (bias corrected)	45.12
MLE Mean (bias corrected)	32.52	MLE Sd (bias corrected)	34.91
		Approximate Chi Square Value (0.05)	30.71
Adjusted Level of Significance	0.0398	Adjusted Chi Square Value	29.93

Assuming Gamma Distribution

95% Approximate Gamma UCL	47.77	95% Adjusted Gamma UCL	49.02

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.933	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.156	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.833	Mean of logged Data	2.872
Maximum of Logged Data	5.247	SD of logged Data	1.058

Assuming Lognormal Distribution

95% H-UCL	53.47	90% Chebyshev (MVUE) UCL	51.47
95% Chebyshev (MVUE) UCL	61.2	97.5% Chebyshev (MVUE) UCL	74.72
99% Chebyshev (MVUE) UCL	101.3		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	47.04	95% BCA Bootstrap UCL	51.47
95% Standard Bootstrap UCL	46.56	95% Bootstrap-t UCL	60.43
95% Hall's Bootstrap UCL	52.44	95% Percentile Bootstrap UCL	47.29
90% Chebyshev(Mean, Sd) UCL	59.01	95% Chebyshev(Mean, Sd) UCL	71.01
97.5% Chebyshev(Mean, Sd) UCL	87.66	99% Chebyshev(Mean, Sd) UCL	120.4

Suggested UCL to Use

95% H-UCL	53.47		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,

	A	B	C	D	E	F	G	H	I	J	K	L
83	**then contact a statistician to correctly calculate UCLs.**											
84												
85	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL											
86	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies											
87	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician											
88												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/2/2024 11:25:09 AM
From File	121418211- Input Max Excluded, Soil, Lead, mg_kg_jr.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (mg/kg)

General Statistics

Total Number of Observations	25	Number of Distinct Observations	21
		Number of Missing Observations	0
Minimum	2.3	Mean	26.22
Maximum	130	Median	15
SD	32.2	Std. Error of Mean	6.441
Coefficient of Variation	1.228	Skewness	2.339

Normal GOF Test

Shapiro Wilk Test Statistic	0.652	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.886	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.201	Data Not Normal at 1% Significance Level

Data Not Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	37.24	95% Adjusted-CLT UCL (Chen-1995)	40.03
		95% Modified-t UCL (Johnson-1978)	37.74

Gamma GOF Test

A-D Test Statistic	1.333	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.769	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.247	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.179	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.16	k star (bias corrected MLE)	1.047
Theta hat (MLE)	22.61	Theta star (bias corrected MLE)	25.04
nu hat (MLE)	57.98	nu star (bias corrected)	52.35
MLE Mean (bias corrected)	26.22	MLE Sd (bias corrected)	25.62
		Approximate Chi Square Value (0.05)	36.73
Adjusted Level of Significance	0.0395	Adjusted Chi Square Value	35.84

Assuming Gamma Distribution

95% Approximate Gamma UCL	37.36	95% Adjusted Gamma UCL	38.29

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.159	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.833	Mean of logged Data	2.777
Maximum of Logged Data	4.868	SD of logged Data	0.961

Assuming Lognormal Distribution

95% H-UCL	41.16	90% Chebyshev (MVUE) UCL	40.99
95% Chebyshev (MVUE) UCL	48.3	97.5% Chebyshev (MVUE) UCL	58.45
99% Chebyshev (MVUE) UCL	78.4		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	36.81	95% BCA Bootstrap UCL	40.05
95% Standard Bootstrap UCL	36.62	95% Bootstrap-t UCL	50.13
95% Hall's Bootstrap UCL	45.83	95% Percentile Bootstrap UCL	37.48
90% Chebyshev(Mean, Sd) UCL	45.54	95% Chebyshev(Mean, Sd) UCL	54.29
97.5% Chebyshev(Mean, Sd) UCL	66.44	99% Chebyshev(Mean, Sd) UCL	90.3

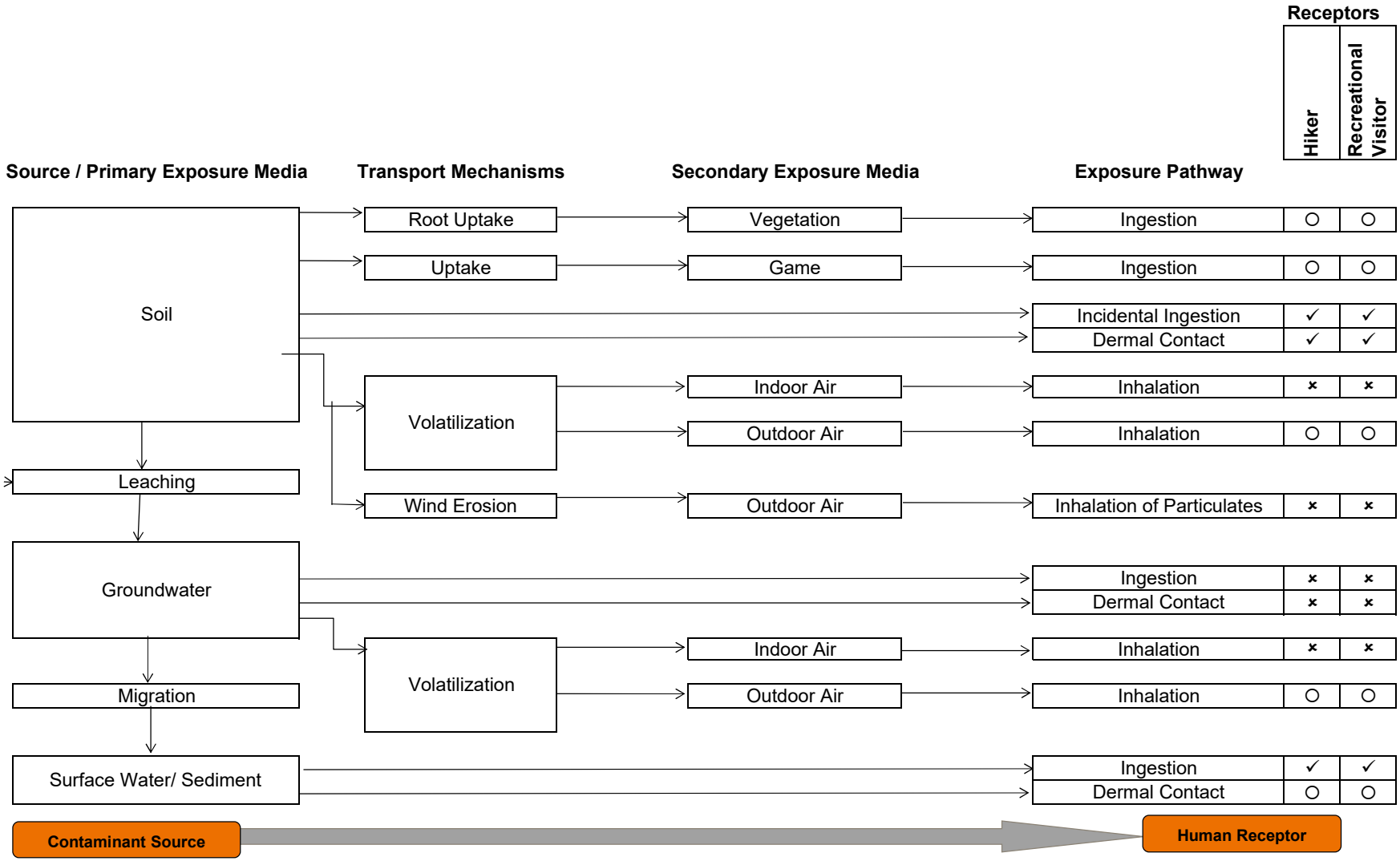
Suggested UCL to Use

95% H-UCL	41.16		

The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
Please verify the data were collected from random locations.
If the data were collected using judgmental or other non-random methods,

	A	B	C	D	E	F	G	H	I	J	K	L
83	**then contact a statistician to correctly calculate UCLs.**											
84												
85	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL											
86	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies											
87	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician											
88												

Appendix D Conceptual Site Model



NOTE:

✓ Exposure pathway complete.

○ Exposure pathway complete, but considered to represent negligible risk.

× Exposure pathway is not complete.

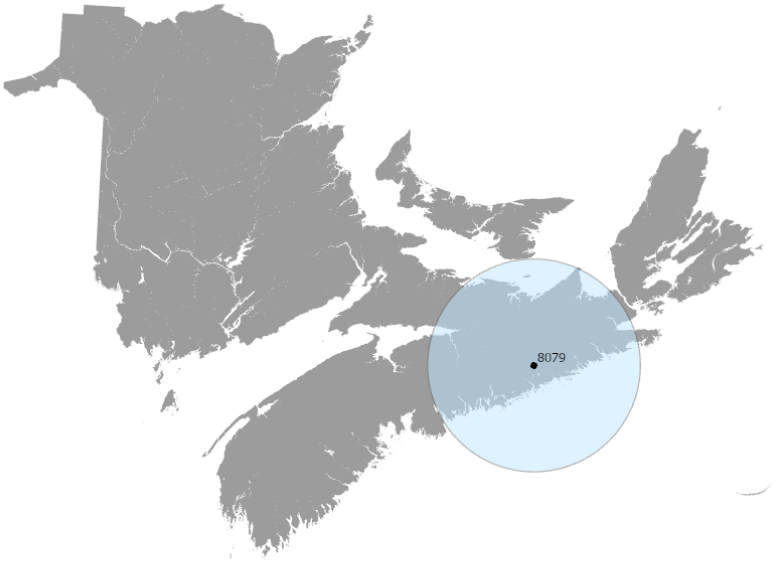
Appendix E Atlantic Canada Conservation Data Centre Report

Atlantic Canada Conservation Data Centre
Centre de données sur la conservation du Canada atlantique

DATA REPORT 8079: Lochaber Mine Site, NS

Prepared 27 May 2024
by K. Tenwolde,
Conservation Data Analyst

CONTENTS OF REPORT



Map 1. A 100 km buffer around the study area

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (AC CDC; www.accdc.com) is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The AC CDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. Although a non-governmental agency, the AC CDC is supported by 6 federal agencies and 4 provincial governments, as well as through outside grants and data processing fees.

Upon request and for a fee, the AC CDC queries its database and produces customized reports of the rare and endangered flora and fauna known to occur in or near a specified study area. As a supplement to that data, the AC CDC includes locations of managed areas with some level of protection, and known sites of ecological interest or sensitivity.

1.1 DATA LIST

Included datasets:

Filename	Contents
LochaberMineNS_8079ob.xls	Rare or legally protected Flora and Fauna in your study area
LochaberMineNS_8079ob100km.xls	A list of Rare and legally protected Flora and Fauna within 100 km of your study area
LochaberMineNS_8079msa.xls	Managed and Biologically Significant Areas in your study area
LochaberMineNS_8079ff_py.xls	Rare Freshwater Fish in your study area (DFO database)

1.2 RESTRICTIONS

The AC CDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By accepting AC CDC data, recipients assent to the following limits of use:

a) Data is restricted to use by trained personnel who are sensitive to landowner interests and to potential threats to rare and/or endangered flora and fauna posed by the information provided.
b) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c) The AC CDC requires Data Users to cease using and delete data 12 months after receipt, and to make a new request for updated data if necessary at that time.
d) AC CDC data responses are restricted to the data in our Data System at the time of the data request.
e) Each record has an estimate of locational uncertainty, which must be referenced in order to understand the record's relevance to a particular location. Please see attached Data Dictionary for details.
f) AC CDC data responses are not to be construed as exhaustive inventories of taxa in an area.
g) The absence of a taxon cannot be inferred by its absence in an AC CDC data response.

1.3 ADDITIONAL INFORMATION

The accompanying Data Dictionary provides metadata for the data provided.

Please direct any additional questions about AC CDC data to the following individuals:

Plants, Lichens, Ranking Methods, All other Inquiries
Sean Blaney
Senior Scientist / Executive Director
(506) 364-2658
sean.blaney@accdc.ca

Animals (Fauna)
John Klymko
Zoologist
(506) 364-2660
john.klymko@accdc.ca

Data Management, GIS
Charity Robicheau
Senior Conservation Data Analyst
(902) 300-3512
charity.robicheau@accdc.ca

Billing
Jean Breau
Financial Manager / Executive Assistant
(506) 364-2657
jean.breau@accdc.ca

Questions on the biology of Federal Species at Risk can be directed to AC CDC: (506) 364-2658, with questions on Species at Risk regulations to: Samara Eaton, Canadian Wildlife Service (NB and PE): (506) 364-5060 or Julie McKnight, Canadian Wildlife Service (NS): (902) 426-4196.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in New Brunswick, please contact Hubert Askanas, Energy and Resource Development: (506) 453-5873.

For provincial information about rare taxa and protected areas, or information about game animals, deer yards, old growth forests, archeological sites, fish habitat etc., in Nova Scotia, please contact Donna Hurlburt, NS DLF: (902) 679-6886. To determine if location-sensitive species (section 4.3) occur near your study site please contact a NS DLF Regional Biologist:

Western: Emma Vost
(902) 670-8187
Emma.Vost@novascotia.ca

Western: Sarah Spencer
(902) 541-0081
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(902) 893-0816
Shavonne.Meyer@novascotia.ca

Central: Kimberly George
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Eastern: Harrison Moore
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Harrison.Moore@novascotia.ca

Eastern: Maureen Cameron-MacMillan
(902) 295-2554
Maureen.Cameron-MacMillan@novascotia.ca

Eastern: Elizabeth Walsh
(902) 563-3370
Elizabeth.Walsh@novascotia.ca

For provincial information about rare taxa and protected areas, or information about game animals, fish habitat etc., in Prince Edward Island, please contact Garry Gregory, PEI Dept. of Communities, Land and Environment: (902) 569-7595.

2.0 RARE AND ENDANGERED SPECIES

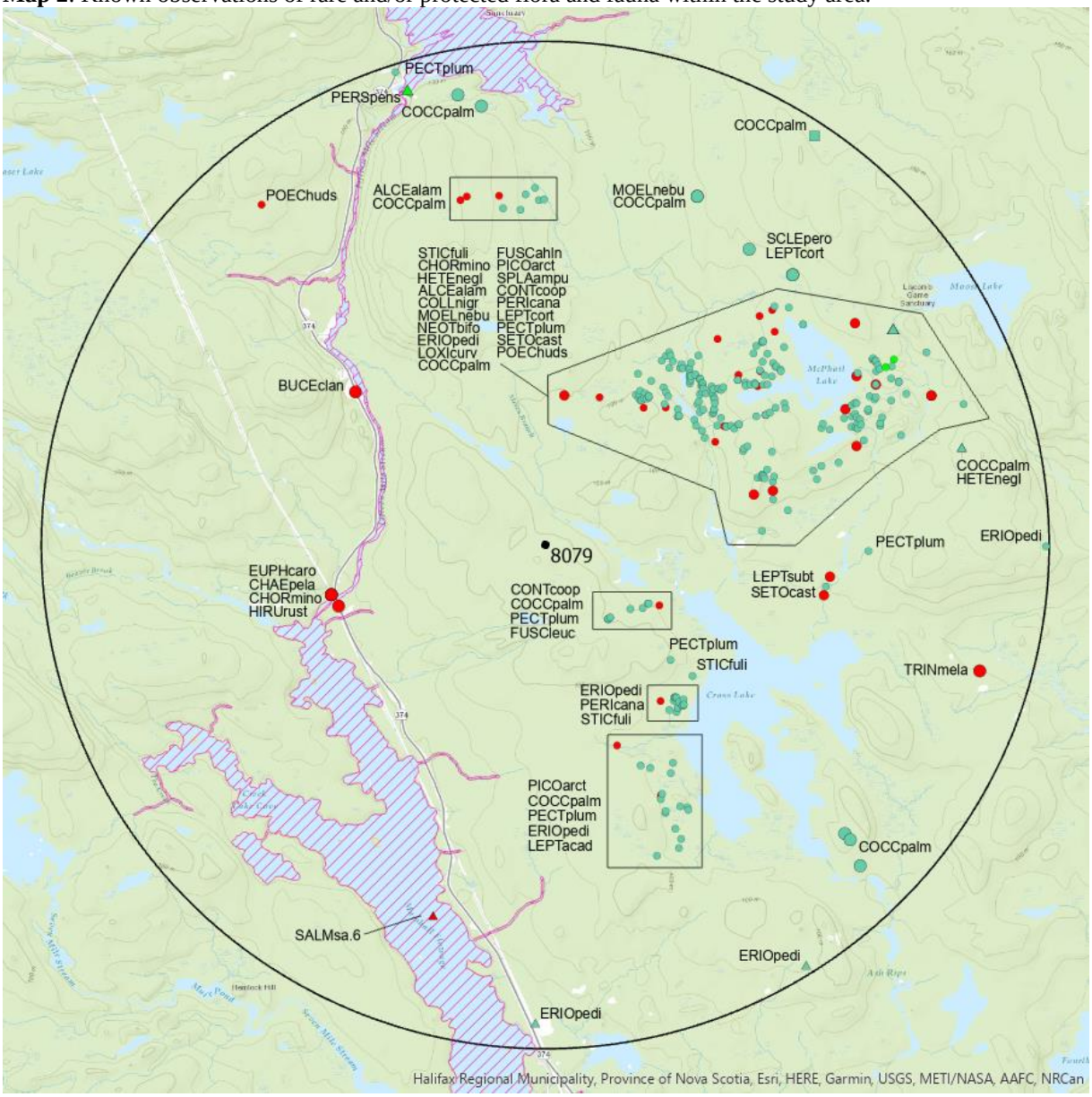
2.1 FLORA

The study area contains 3 records of 2 vascular and 279 records of 14 nonvascular flora (Map 2 and attached: *ob.xls), excluding 'location-sensitive' species.

2.2 FAUNA

The study area contains 45 records of 14 vertebrate and no records of invertebrate fauna (Map 2 and attached data files - see 1.1 Data List), excluding 'location-sensitive species'. Please see section 4.3 to determine if 'location-sensitive' species occur near your study site.

Map 2: Known observations of rare and/or protected flora and fauna within the study area.



RESOLUTION

- 4.7 within 50s of kilometers
- 4.0 within 10s of kilometers
- 3.7 within 5s of kilometers
- 3.0 within kilometers
- 2.7 within 500s of meters
- 2.0 within 100s of meters
- 1.7 within 10s of meters

HIGHER TAXON

- vertebrate fauna
- invertebrate fauna
- vascular flora
- nonvascular flora

3.0 SPECIAL AREAS

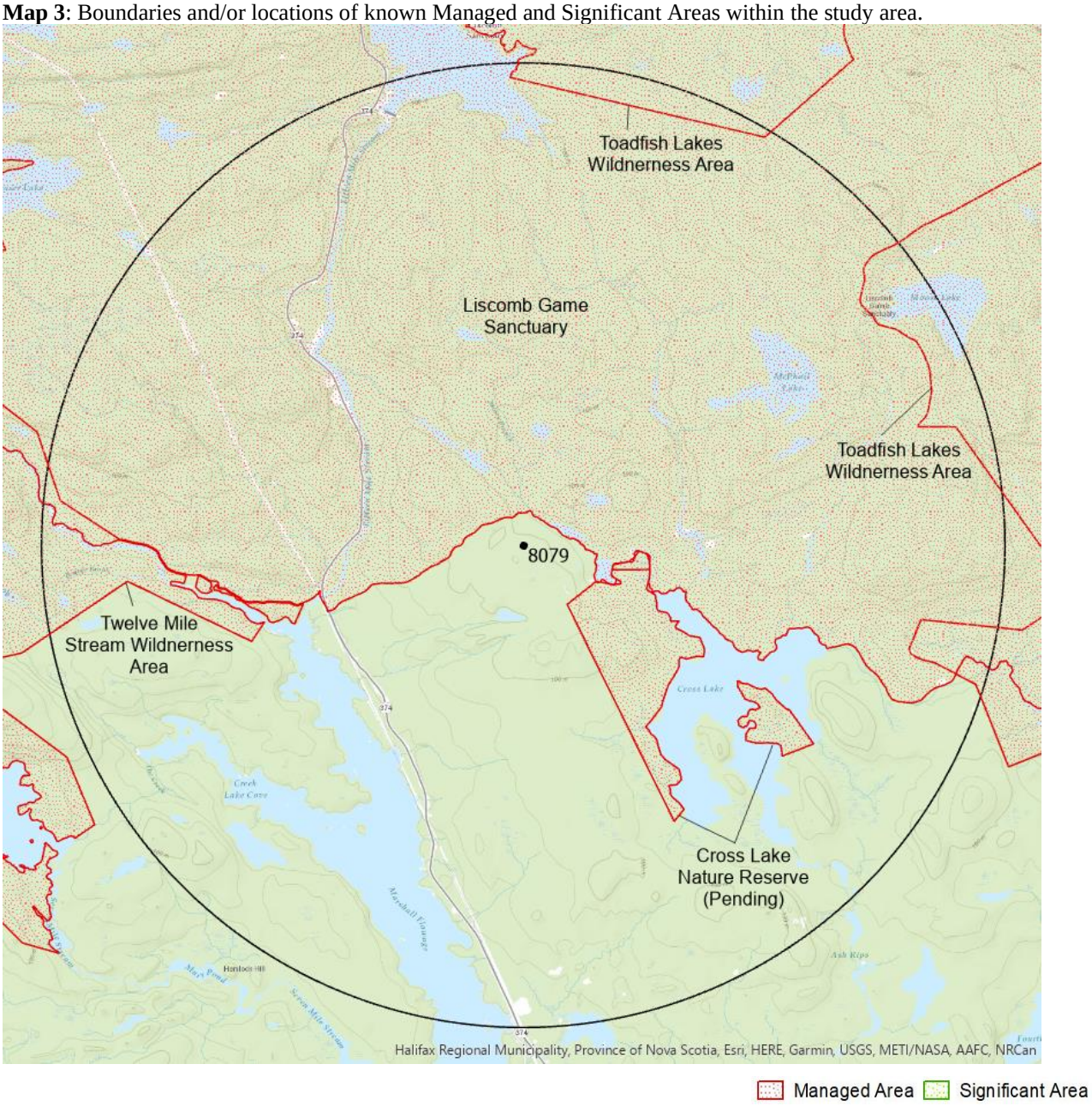
3.1 MANAGED AREAS

The GIS scan identified 5 managed areas in the vicinity of the study area (Map 3 and attached file: *msa.xls).

3.2 SIGNIFICANT AREAS

The GIS scan identified no biologically significant sites in the vicinity of the study area (Map 3).

Map 3: Boundaries and/or locations of known Managed and Significant Areas within the study area.



4.0 RARE SPECIES LISTS

Rare and/or endangered taxa (excluding "location-sensitive" species, section 4.3) within the study area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record). [P] = vascular plant, [N] = nonvascular plant, [A] = vertebrate animal, [I] = invertebrate animal, [C] = community. Note: records are from attached files *ob.xls/*ob.shp only.

4.1 FLORA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	117	1.7 ± 0.01
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S3	2	1.0 ± 0.01
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	13	1.0 ± 0.01
N	*Sclerophora peronella (Atlantic pop.)*	Frosted Glass-whiskers (Atlantic population)	Special Concern	Special Concern		S3S4	4	3.6 ± 0.01
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S2S3	6	2.8 ± 0.01
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	1	3.4 ± 0.01
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	1	1.9 ± 0.01
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	1	1.9 ± 0.01
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3S4	3	2.0 ± 0.01
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4	1	3.2 ± 0.01
N	*Scytinium subtile*	Appressed Jellyskin Lichen				S3S4	1	2.8 ± 0.01
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3S4	7	2.2 ± 0.01
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	119	1.0 ± 0.01
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	3	3.5 ± 0.01
P	*Neottia bifolia*	Southern Twayblade				S3	2	3.8 ± 0.01
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3S4	1	4.7 ± 1.0

4.2 FAUNA

	Scientific *Name*	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)
A	*Salmo salar pop. 6*	Atlantic Salmon - Nova Scotia Southern Upland population	Endangered			S1	1	3.8 ± 0.5
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B,S1M	1	2.2 ± 0.15
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	2	2.2 ± 0.15
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened	Endangered	S3B	1	2.1 ± 0.15
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Special Concern	Threatened	S3B	2	2.2 ± 0.15
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Special Concern	Threatened	S3B	5	1.3 ± 0.01
A	*Bucephala clangula*	Common Goldeneye				S2S3B,S5N,S5M	1	2.4 ± 0.2
A	*Perisoreus canadensis*	Canada Jay				S3	5	1.7 ± 0.01
A	*Poecile hudsonicus*	Boreal Chickadee				S3	9	1.6 ± 0.01
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S4M	1	4.5 ± 0.15
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	3	2.1 ± 0.01
A	*Loxia curvirostra*	Red Crossbill				S3S4	1	2.5 ± 0.01
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B,S4S5M	5	2.1 ± 0.05

4.3 LOCATION SENSITIVE SPECIES

The Department of Natural Resources in each Maritimes province considers a number of species "location sensitive". Concern about exploitation of location-sensitive species precludes inclusion of precise coordinates in this report. Those intersecting your study area are indicated below with "YES".

Nova Scotia

Scientific *Name*	Common Name	SARA	Prov Legal Prot	Known within the Study Site?
Alces alces americana	**Mainland Moose**	**Endangered**	**Endangered**	**YES**
Fraxinus nigra	Black Ash		Threatened	No
Emydoidea blandingii	Blanding's Turtle - Nova Scotia pop.	Endangered	Endangered	No
Glyptemys insculpta	Wood Turtle	Threatened	Threatened	No
Falco peregrinus pop. 1	Peregrine Falcon - anatum/tundrius pop.		Vulnerable	No
Bat hibernaculum or bat species occurrence		[Endangered][1]	[Endangered][1]	No

1 *Myotis lucifugus* (Little Brown Myotis), *Myotis septentrionalis* (Long-eared Myotis), and *Perimyotis subflavus* (Tri-colored Bat or Eastern Pipistrelle) are all Endangered under the Federal Species at Risk Act and the NS Endangered Species Act.

4.4 SOURCE BIBLIOGRAPHY

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

# recs	CITATION
116	Neily, T.H. & Pepper, C.; Toms, B. 2013. Nova Scotia lichen location database. Mersey Tobeatic Research Institute, 1301 records.
87	Neily, T.H. & Pepper, C.; Toms, B. 2018. Nova Scotia lichen database [as of 2018-03]. Mersey Tobeatic Research Institute.
53	Neily, T.H. 2017. Nova Scotia lichen records. Mersey Tobeatic Research Institute.
13	Pepper, C. 2013. 2013 rare bird and plant observations in Nova Scotia., 181 records.
12	Neily, T.H. 2012. 2012 Erioderma pedicellatum records in Nova Scotia.
11	Cameron, R.P. 2011. Lichen observations, 2011. Nova Scotia Environment & Labour, 731 recs.
10	Neily, T.H. & Pepper, C.; Toms, B. 2015. Nova Scotia lichen location database [as of 2015-02-15]. Mersey Tobeatic Research Institute, 1691 records.
6	Lepage, D. 2014. Maritime Breeding Bird Atlas Database. Bird Studies Canada, Sackville NB, 407,838 recs.
5	Clayden, S. Digitization of Wolfgang Maass Nova Scotia forest lichen collections, 1964-2004. New Brunswick Museum. 2018.
3	Cameron, R.P. 2017. 2017 rare species field data. Nova Scotia Environment, 64 recs.
2	Benjamin, L.K. (compiler). 2007. Significant Habitat & Species Database. Nova Scotia Dept Natural Resources, 8439 recs.
2	Cameron, R.P. 2009. Erioderma pedicellatum database, 1979-2008. Dept Environment & Labour, 103 recs.
2	Canadian Wildlife Service. 2019. Canadian Protected and Conserved Areas Database (CPCAD). December 2019. ECCC.https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/protected-conserved-areas-database.html.
2	Nova Scotia Department of Lands and Forestry. 2020. NS Lands Proposed or Pending Protection. NSDLF, 231 features. Received via email.
1	Benjamin, L.K. 2012. NSDNR fieldwork & consultant reports 2008-2012. Nova Scotia Dept Natural Resources, 196 recs.
1	Cameron, R.P. 2005. Erioderma pedicellatum unpublished data. NS Dept of Environment, 9 recs.
1	Haughian, S.R. 2018. Description of Fuscopannaria leucosticta field work in 2017. New Brunswick Museum, 314 recs.
1	iNaturalist.ca. 2023. iNaturalist Data Export December 2022. iNaturalist.org; iNaturalist.ca.
1	Munro, Marian K. Nova Scotia Provincial Museum of Natural History Herbarium Database. Nova Scotia Provincial Museum of Natural History, Halifax, Nova Scotia. 2013.
1	Neily, T.H. & Pepper, C. 2020. Nova Scotia SMP lichen surveys 2020. Mersey Tobeatic Research Institute.
1	Neily, T.H. 2019. Tom Neily NS Bryophyte records (2009-2013). T.H. Neily, Atlantic Canada Conservation Data Centre, 1029 specimen records.
1	Nova Scotia Dept Natural Resources, Forestry Branch. 2007. Restricted & Limited Use Land Database (RLUL). , http://www.gov.ns.ca/natr/FORESTRY/rlul/downloadrlul.htm.
1	Pepper, C. 2021. Rare bird, plant and mammal observations in Nova Scotia, 2017-2021.

5.0 RARE SPECIES WITHIN 100 KM

A 100 km buffer around the study area contains 36690 records of 159 vertebrate and 1178 records of 60 invertebrate fauna; 3930 records of 230 vascular and 2509 records of 113 nonvascular flora (attached: *ob100km.xls).

Taxa within 100 km of the study site that are rare and/or endangered in the province in which the study site occurs (including "location-sensitive" species). All ranks correspond to the province in which the study site falls, even for out-of-province records. Taxa are listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation (± the precision, in km, of the record).

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Endangered	S1	51	35.9 ± 5.0	NS
A	*Myotis septentrionalis*	Northern Myotis	Endangered	Endangered	Endangered	S1	3	46.8 ± 0.15	NS
A	*Perimyotis subflavus*	Tricolored Bat	Endangered	Endangered	Endangered	S1	4	76.2 ± 0.2	NS
A	*Salmo salar pop. 1*	Atlantic Salmon - Inner Bay of Fundy population	Endangered	Endangered		S1	18	44.4 ± 0.5	NS
A	*Salmo salar pop. 6*	Atlantic Salmon - Nova Scotia Southern Upland population	Endangered			S1	41	3.8 ± 0.5	NS
A	*Sterna dougallii*	Roseate Tern	Endangered	Endangered	Endangered	S1B	80	19.1 ± 0.5	NS
A	*Charadrius melodus melodus*	Piping Plover melodus subspecies	Endangered	Endangered		S1B	1027	98.6 ± 7.07	PE
A	*Morone saxatilis pop. 2*	Striped Bass - Bay of Fundy population	Endangered			S2S3B,S2S3N	2	75.4 ± 0.5	NS
A	*Icteria virens*	Yellow-Breasted Chat	Endangered	Endangered		SNA	21	60.9 ± 0.15	NS
A	*Lamna nasus*	Porbeagle Shark	Endangered			SNR	1	84.0 ± 1.52	NS
A	*Lasiurus cinereus*	Hoary Bat	Endangered			SUB, S1M	1	76.0 ± 0.5	NS
A	*Lasionycteris noctivagans*	Silver-haired Bat	Endangered			SUB,S1M	1	95.0 ± 0.2	NS
A	*Colinus virginianus*	Northern Bobwhite	Endangered	Endangered			2	66.5 ± 0.15	NS
A	*Asio flammeus*	Short-eared Owl	Threatened	Special Concern		S1B	9	57.4 ± 7.07	NS
A	*Glyptemys insculpta*	Wood Turtle	Threatened	Threatened	Threatened	S2	8350	21.4 ± 1.0	NS
A	*Riparia riparia*	Bank Swallow	Threatened	Threatened		S2S3B	996	91.6 ± 9.5	PE
A	*Chaetura pelagica*	Chimney Swift	Threatened	Threatened	Endangered	S2S3B,S1M	730	10.6 ± 0.15	NS
A	*Limosa haemastica*	Hudsonian Godwit	Threatened			S2S3M	34	69.3 ± 0.5	NS
A	*Acipenser oxyrinchus*	Atlantic Sturgeon	Threatened			S2S3N	2	72.6 ± 0.5	NS
A	*Hydrobates leucorhous*	Leach's Storm-Petrel	Threatened			S3B	73	20.4 ± 7.07	NS
A	*Tringa flavipes*	Lesser Yellowlegs	Threatened			S3M	588	28.9 ± 0.2	NS
A	*Anguilla rostrata*	American Eel	Threatened			S3N	68	17.7 ± 0.2	NS
A	*Sturnella magna*	Eastern Meadowlark	Threatened	Threatened		SHB	3	92.0 ± 0.33	NS
A	*Ixobrychus exilis*	Least Bittern	Threatened	Threatened		SUB	2	98.7 ± 0.2	NS
A	*Hylocichla mustelina*	Wood Thrush	Threatened	Threatened		SUB	36	39.0 ± 7.07	NS
A	*Salmo salar pop. 12*	Atlantic Salmon - Gaspe - Southern Gulf of St. Lawrence population	Special Concern			S1	32	50.6 ± 50.0	NS
A	*Antrostomus vociferus*	Eastern Whip-Poor-Will	Special Concern	Threatened	Threatened	S1?B	9	56.2 ± 7.07	NS
A	*Passerculus sandwichensis princeps*	Ipswich Sparrow	Special Concern	Special Concern		S1B	32	29.7 ± 0.15	NS
A	*Bucephala islandica*	Barrow's Goldeneye	Special Concern	Special Concern		S1N,SUM	22	59.6 ± 0.4	NS
A	*Euphagus carolinus*	Rusty Blackbird	Special Concern	Special Concern	Endangered	S2B	252	2.2 ± 0.15	NS
A	*Hirundo rustica*	Barn Swallow	Special Concern	Threatened		S2B	1120	98.6 ± 7.07	PE
A	*Phalaropus lobatus*	Red-necked Phalarope	Special Concern	Special Concern		S2S3M	7	60.4 ± 0.2	NS
A	*Morone saxatilis pop. 1*	Striped Bass - Southern Gulf of St. Lawrence population	Special Concern			S2S3N	1	77.3 ± 1.0	NS
A	*Histrionicus histrionicus pop. 1*	Harlequin Duck - Eastern population	Special Concern	Special Concern	Endangered	S2S3N,SUM	43	18.7 ± 2.45	NS
A	*Chelydra serpentina*	Snapping Turtle	Special Concern	Special Concern	Vulnerable	S3	183	25.1 ± 0.1	NS
A	*Cardellina canadensis*	Canada Warbler	Special Concern	Threatened	Endangered	S3B	1037	10.5 ± 0.01	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Chordeiles minor*	Common Nighthawk	Special Concern	Special Concern	Threatened	S3B	366	10.1 ± 0.15	NS
A	*Contopus cooperi*	Olive-sided Flycatcher	Special Concern	Special Concern	Threatened	S3B	1043	1.3 ± 0.01	NS
A	*Dolichonyx oryzivorus*	Bobolink	Special Concern	Threatened	Vulnerable	S3B	690	25.4 ± 7.07	NS
A	*Coccothraustes vespertinus*	Evening Grosbeak	Special Concern	Special Concern	Vulnerable	S3B,S3N,S3M	679	7.9 ± 7.07	NS
A	*Podiceps auritus*	Horned Grebe	Special Concern	Special Concern		S3N,SUM	12	23.3 ± 0.2	NS
A	*Contopus virens*	Eastern Wood-Pewee	Special Concern	Special Concern	Vulnerable	S3S4B	794	14.8 ± 7.07	NS
A	*Phocoena phocoena*	Harbour Porpoise	Special Concern			S4	7	26.2 ± 0.2	NS
A	*Phocoena phocoena pop. 1*	Harbour Porpoise - Northwest Atlantic Population	Special Concern			S4	1	81.2 ± 1.95	NS
A	*Chrysemys picta*	Painted Turtle	Special Concern	Special Concern		S4	25	50.3 ± 0.2	NS
A	*Chrysemys picta picta*	Eastern Painted Turtle	Special Concern	Special Concern		S4	109	56.3 ± 10.0	NS
A	*Calidris subruficollis*	Buff-breasted Sandpiper	Special Concern	Special Concern		SNA	5	78.2 ± 0.5	NS
A	*Zonotrichia querula*	Harris's Sparrow	Special Concern			SNA	1	95.9 ± 0.2	NS
A	*Anarhichas lupus*	Atlantic Wolffish	Special Concern	Special Concern		SNR	1	93.5 ± 0.89	NS
A	*Accipiter cooperii*	Cooper's Hawk	Not At Risk			S1?B,SUN,SUM	13	58.2 ± 0.2	NS
A	*Fulica americana*	American Coot	Not At Risk			S1B	43	60.5 ± 0.2	NS
A	*Sterna hirundo*	Common Tern	Not At Risk			S1B	420	98.6 ± 7.07	PE
A	*Chlidonias niger*	Black Tern	Not At Risk			S1B	4	73.8 ± 0.34	NS
A	*Gavia immer*	Common Loon	Not At Risk			S1B,S4M	3	99.7 ± 13.2	PE
A	*Falco peregrinus pop. 1*	Peregrine Falcon - anatum/tundrius	Not At Risk		Vulnerable	S1B,SUM	9	51.6 ± 0.28	NS
A	*Aegolius funereus*	Boreal Owl	Not At Risk			S2?B,SUM	13	45.6 ± 0.2	NS
A	*Globicephala melas*	Long-finned Pilot Whale	Not At Risk			S2S3	3	41.6 ± 100.0	NS
A	*Hemidactylium scutatum*	Four-toed Salamander	Not At Risk			S3	22	32.4 ± 5.0	NS
A	*Megaptera novaeangliae*	Humpback Whale	Not At Risk			S3	1	95.1 ± 0.2	NS
A	*Sialia sialis*	Eastern Bluebird	Not At Risk			S3B	44	37.1 ± 0.2	NS
A	*Buteo lagopus*	Rough-legged Hawk	Not At Risk			S3N	8	58.4 ± 0.2	NS
A	*Accipiter gentilis*	Northern Goshawk	Not At Risk			S3S4	108	11.4 ± 0.01	NS
A	*Glaucomys volans*	Southern Flying Squirrel	Not At Risk			S3S4	1	34.4 ± 0.2	NS
A	*Ammospiza nelsoni*	Nelson's Sparrow	Not At Risk			S3S4B	167	20.4 ± 7.07	NS
A	*Calidris canutus rufa*	Red Knot rufa subspecies	E,SC	Endangered	Endangered	S2M	109	64.8 ± 0.5	NS
A	*Calidris canutus*	Red Knot	E,SC	E,T		S2M	7	66.4 ± 0.2	NS
A	*Morone saxatilis*	Striped Bass	E,SC			S2S3B,S2S3N	10	68.8 ± 0.2	NS
A	*Gadus morhua*	Atlantic Cod	E,SC,DD			SNR	4	60.7 ± 0.2	NS
A	*Salmo salar*	Atlantic Salmon	E,T,SC			S1B,S1N	10	22.1 ± 0.61	NS
A	*Alces alces*	Moose				S1	8	11.2 ± 0.2	NS
A	*Picoides dorsalis*	American Three-toed Woodpecker				S1?	4	34.3 ± 7.07	NS
A	*Uria aalge*	Common Murre				S1?B	6	39.6 ± 0.2	NS
A	*Passerina cyanea*	Indigo Bunting				S1?B,SUM	20	34.3 ± 7.07	NS
A	*Phalacrocorax carbo*	Great Cormorant				S1B	106	98.6 ± 7.07	PE
A	*Nycticorax nycticorax*	Black-crowned Night-heron				S1B	1	87.0 ± 7.07	NS
A	*Oxyura jamaicensis*	Ruddy Duck				S1B	20	64.7 ± 7.07	NS
A	*Gallinula galeata*	Common Gallinule				S1B	8	74.3 ± 0.2	NS
A	*Myiarchus crinitus*	Great Crested Flycatcher				S1B	9	60.9 ± 7.07	NS
A	*Mimus polyglottos*	Northern Mockingbird				S1B	26	54.2 ± 7.07	NS
A	*Toxostoma rufum*	Brown Thrasher				S1B	9	57.4 ± 7.07	NS
A	*Charadrius semipalmatus*	Semipalmated Plover				S1B,S4M	811	28.6 ± 0.24	NS
A	*Calidris minutilla*	Least Sandpiper				S1B,S4M	501	35.9 ± 0.2	NS
A	*Anas acuta*	Northern Pintail				S1B,SUM	55	34.3 ± 7.07	NS
A	*Vireo gilvus*	Warbling Vireo				S1B,SUM	17	43.1 ± 0.15	NS
A	*Vespertilionidae sp.*	bat species				S1S2	85	7.3 ± 0.1	NS
A	*Pooecetes gramineus*	Vesper Sparrow				S1S2B,SUM	19	26.0 ± 0.25	NS
A	*Vireo philadelphicus*	Philadelphia Vireo				S2?B,SUM	38	16.8 ± 7.07	NS
A	*Alca torda*	Razorbill				S2B	7	60.5 ± 0.2	NS
A	*Cepphus grylle*	Black Guillemot				S2B	2	96.4 ± 7.07	PE
A	*Fratercula arctica*	Atlantic Puffin				S2B	4	20.4 ± 7.07	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
A	*Empidonax traillii*	Willow Flycatcher				S2B	19	34.3 ± 7.07	NS
A	*Molothrus ater*	Brown-headed Cowbird				S2B	109	15.4 ± 7.07	NS
A	*Charadrius vociferus*	Killdeer				S2B,S3M	470	98.6 ± 7.07	PE
A	*Larus argentatus*	Herring Gull				S2B,S5N	2	98.6 ± 7.07	PE
A	*Spatula clypeata*	Northern Shoveler				S2B,SUM	25	62.3 ± 0.2	NS
A	*Mareca strepera*	Gadwall				S2B,SUM	39	50.0 ± 0.15	NS
A	*Piranga olivacea*	Scarlet Tanager				S2B,SUM	17	25.2 ± 0.25	NS
A	*Calidris alba*	Sanderling				S2N,S3M	395	28.6 ± 0.32	NS
A	*Martes americana*	American Marten			Endangered	S2S3	1	76.1 ± 0.2	NS
A	*Asio otus*	Long-eared Owl				S2S3	26	20.7 ± 0.15	NS
A	*Rallus limicola*	Virginia Rail				S2S3B	24	64.7 ± 7.07	NS
A	*Rissa tridactyla*	Black-legged Kittiwake				S2S3B	3	73.9 ± 0.2	NS
A	*Petrochelidon pyrrhonota*	Cliff Swallow				S2S3B	215	14.8 ± 7.07	NS
A	*Actitis macularius*	Spotted Sandpiper				S2S3B,S4M	786	96.4 ± 7.07	PE
A	*Cathartes aura*	Turkey Vulture				S2S3B,S4S5M	54	34.4 ± 0.2	NS
A	*Setophaga pinus*	Pine Warbler				S2S3B,S4S5M	40	100.0 ± 0.2	NS
A	*Larus marinus*	Great Black-backed Gull				S2S3B,S5N	2	98.6 ± 7.07	PE
A	*Bucephala clangula*	Common Goldeneye				S2S3B,S5N,S5M	270	15.6 ± 0.15	NS
A	*Icterus galbula*	Baltimore Oriole				S2S3B,SUM	73	6.3 ± 7.07	NS
A	*Pluvialis dominica*	American Golden-Plover				S2S3M	51	65.4 ± 0.2	NS
A	*Numenius phaeopus*	Whimbrel				S2S3M	22	39.2 ± 0.2	NS
A	*Numenius phaeopus hudsonicus*	Whimbrel				S2S3M	103	42.5 ± 0.01	NS
A	*Phalaropus fulicarius*	Red Phalarope				S2S3M	4	60.5 ± 0.36	NS
A	*Perisoreus canadensis*	Canada Jay				S3	543	1.7 ± 0.01	NS
A	*Poecile hudsonicus*	Boreal Chickadee				S3	931	1.6 ± 0.01	NS
A	*Spinus pinus*	Pine Siskin				S3	482	6.3 ± 7.07	NS
A	*Salvelinus fontinalis*	Brook Trout				S3	78	7.2 ± 0.2	NS
A	*Salvelinus namaycush*	Lake Trout				S3	2	21.4 ± 0.5	NS
A	*Pekania pennanti*	Fisher				S3	9	29.0 ± 7.74	NS
A	*Calcarius lapponicus*	Lapland Longspur				S3?N,SUM	9	26.3 ± 0.15	NS
A	*Spatula discors*	Blue-winged Teal				S3B	111	34.3 ± 7.07	NS
A	*Tringa semipalmata*	Willet				S3B	1222	14.8 ± 7.07	NS
A	*Sterna paradisaea*	Arctic Tern				S3B	82	18.7 ± 0.5	NS
A	*Coccyzus erythropthalmus*	Black-billed Cuckoo				S3B	78	16.1 ± 7.07	NS
A	*Tyrannus tyrannus*	Eastern Kingbird				S3B	187	15.4 ± 7.07	NS
A	*Pheucticus ludovicianus*	Rose-breasted Grosbeak				S3B	506	15.4 ± 7.07	NS
A	*Alosa pseudoharengus*	Alewife				S3B	26	16.9 ± 0.5	NS
A	*Somateria mollissima*	Common Eider				S3B,S3M,S3N	968	15.4 ± 7.07	NS
A	*Tringa melanoleuca*	Greater Yellowlegs				S3B,S4M	930	15.4 ± 0.15	NS
A	*Falco sparverius*	American Kestrel				S3B,S4S5M	337	15.4 ± 7.07	NS
A	*Gallinago delicata*	Wilson's Snipe				S3B,S5M	662	15.6 ± 7.07	NS
A	*Corthylio calendula*	Ruby-crowned Kinglet				S3B,S5M	1	98.6 ± 7.07	PE
A	*Setophaga striata*	Blackpoll Warbler				S3B,S5M	170	15.4 ± 7.07	NS
A	*Cardellina pusilla*	Wilson's Warbler				S3B,S5M	132	14.8 ± 7.07	NS
A	*Pinicola enucleator*	Pine Grosbeak				S3B,S5N,S5M	123	7.8 ± 7.07	NS
A	*Setophaga tigrina*	Cape May Warbler				S3B,SUM	224	10.3 ± 0.15	NS
A	*Branta bernicla*	Brant				S3M	1	93.1 ± 0.2	NS
A	*Pluvialis squatarola*	Black-bellied Plover				S3M	662	39.9 ± 0.5	NS
A	*Arenaria interpres*	Ruddy Turnstone				S3M	255	29.1 ± 0.49	NS
A	*Calidris pusilla*	Semipalmated Sandpiper				S3M	688	28.6 ± 0.3	NS
A	*Calidris melanotos*	Pectoral Sandpiper				S3M	92	51.6 ± 0.24	NS
A	*Limnodromus griseus*	Short-billed Dowitcher				S3M	453	49.7 ± 0.2	NS
A	*Chroicocephalus ridibundus*	Black-headed Gull				S3N	71	24.5 ± 0.2	NS
A	*Picoides arcticus*	Black-backed Woodpecker				S3S4	156	11.6 ± 0.01	NS
A	*Loxia curvirostra*	Red Crossbill				S3S4	168	2.5 ± 0.01	NS
A	*Tachycineta bicolor*	Tree Swallow				S3S4B	6	96.4 ± 7.07	PE

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A	*Botaurus lentiginosus*	American Bittern				S3S4B,S4S5M	303	15.8 ± 0.25	NS
A	*Setophaga castanea*	Bay-breasted Warbler				S3S4B,S4S5M	578	10.9 ± 0.01	NS
A	*Leiothlypis peregrina*	Tennessee Warbler				S3S4B,S5M	597	12.0 ± 0.15	NS
A	*Passerella iliaca*	Fox Sparrow				S3S4B,S5M	119	15.6 ± 7.07	NS
A	*Mergus serrator*	Red-breasted Merganser				S3S4B,S5M,S5N	313	20.4 ± 7.07	NS
A	*Calidris maritima*	Purple Sandpiper				S3S4N	61	27.2 ± 10.9	NS
A	*Lanius borealis*	Northern Shrike				S3S4N	3	37.0 ± 0.2	NS
A	*Morus bassanus*	Northern Gannet				SHB	52	25.9 ± 0.2	NS
A	*Aythya americana*	Redhead				SHB	13	50.1 ± 0.82	NS
A	*Leucophaeus atricilla*	Laughing Gull				SHB	12	35.4 ± 0.2	NS
A	*Progne subis*	Purple Martin				SHB	6	34.3 ± 7.07	NS
A	*Eremophila alpestris*	Horned Lark				SHB,S4S5N,S5M	18	25.6 ± 7.07	NS
I	*Bombus bohemicus*	Ashton Cuckoo Bumble Bee	Endangered	Endangered	Endangered	S1	23	42.8 ± 5.0	NS
I	*Danaus plexippus*	Monarch	Endangered	Special Concern	Endangered	S2?B,S3M	444	18.2 ± 0.01	NS
I	*Bombus suckleyi*	Suckley's Cuckoo Bumble Bee	Threatened			SH	2	71.1 ± 5.0	NS
I	*Alasmidonta varicosa*	Brook Floater	Special Concern	Special Concern	Threatened	S3	11	40.4 ± 0.1	NS
I	*Bombus terricola*	Yellow-banded Bumble Bee	Special Concern	Special Concern	Vulnerable	S3	76	6.8 ± 0.2	NS
I	*Coccinella transversoguttata richardsoni*	Transverse Lady Beetle	Special Concern		Endangered	SH	5	65.0 ± 2.5	NS
I	*Gomphurus ventricosus*	Skillet Clubtail	Special Concern	Endangered		SH	1	84.4 ± 0.5	NS
I	*Pachydiplax longipennis*	Blue Dasher				S1	10	90.4 ± 0.2	NS
I	*Polygonia comma*	Eastern Comma				S1?	2	94.9 ± 0.2	NS
I	*Polygonia satyrus*	Satyr Comma				S1?	1	68.4 ± 5.0	NS
I	*Euphyes bimacula*	Two-spotted Skipper				S1S2	2	35.4 ± 0.1	NS
I	*Boloria chariclea*	Arctic Fritillary				S1S2	1	88.4 ± 2.5	NS
I	*Somatochlora brevicincta*	Quebec Emerald				S1S2	1	75.8 ± 0.1	NS
I	*Tharsalea dospassosi*	Maritime Copper				S2	18	77.9 ± 0.1	NS
I	*Satyrium acadica*	Acadian Hairstreak				S2	9	71.2 ± 2.5	NS
I	*Neurocordulia michaeli*	Broad-tailed Shadowdragon				S2	26	25.3 ± 0.05	NS
I	*Coenagrion resolutum*	Taiga Bluet				S2	2	91.9 ± 0.1	NS
I	*Margaritifera margaritifera*	Eastern Pearlshell				S2	118	18.6 ± 0.1	NS
I	*Pantala hymenaea*	Spot-Winged Glider				S2?B	5	33.6 ± 1.0	NS
I	*Nymphalis l-album*	Compton Tortoiseshell				S2S3	13	52.3 ± 0.2	NS
I	*Aglais milberti*	Milbert's Tortoiseshell				S2S3	16	58.0 ± 2.5	NS
I	*Lanthus vernalis*	Southern Pygmy Clubtail				S2S3	8	25.6 ± 0.05	NS
I	*Somatochlora kennedyi*	Kennedy's Emerald				S2S3	2	93.8 ± 1.0	NS
I	*Stylurus scudderi*	Zebra Clubtail				S2S3	4	64.3 ± 0.5	NS
I	*Alasmidonta undulata*	Triangle Floater				S2S3	24	35.2 ± 0.1	NS
I	*Psephenus herricki*	Herrick's Water Penny Beetle				S3	1	48.6 ± 0.2	NS
I	*Carabus serratus*	Serrated Ground Beetle				S3	1	89.2 ± 0.2	NS
I	*Hippodamia parenthesis*	Parenthesis Lady Beetle				S3	1	94.9 ± 0.05	NS
I	*Chrysochus auratus*	Dogbane Leaf Beetle				S3	2	48.1 ± 0.2	NS
I	*Naemia seriata*	Seaside Lady Beetle				S3	4	61.7 ± 0.2	NS
I	*Chilocorus stigma*	Twice-stabbed Lady Beetle				S3	2	73.4 ± 0.2	NS
I	*Myzia pullata*	Streaked Lady Beetle				S3	3	91.0 ± 0.2	NS
I	*Monochamus marmorator*	Balsam Fir Sawyer				S3	3	48.6 ± 0.2	NS
I	*Trachysida aspera*	Rough Flower Longhorn Beetle				S3	1	93.8 ± 0.2	NS
I	*Astylopsis sexguttata*	Six-speckled Long-horned Beetle				S3	2	94.5 ± 0.25	NS
I	*Satyrium calanus*	Banded Hairstreak				S3	11	59.9 ± 2.5	NS
I	*Callophrys lanoraieensis*	Bog Elfin				S3	4	12.0 ± 1.0	NS
I	*Ophiogomphus mainensis*	Maine Snaketail				S3	14	25.3 ± 0.05	NS
I	*Ophiogomphus rupinsulensis*	Rusty Snaketail				S3	55	25.4 ± 0.05	NS

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I	*Epitheca princeps*	Prince Baskettail				S3	9	87.0 ± 0.05	NS
I	*Somatochlora forcipata*	Forcipate Emerald				S3	3	93.8 ± 1.0	NS
I	*Enallagma vernale*	Vernal Bluet				S3	2	72.1 ± 0.1	NS
I	*Polygonia interrogationis*	Question Mark				S3B	74	21.0 ± 0.01	NS
I	*Cecropterus pylades*	Northern Cloudywing				S3S4	27	34.2 ± 0.01	NS
I	*Amblyscirtes hegon*	Pepper and Salt Skipper				S3S4	22	27.9 ± 0.01	NS
I	*Cupido comyntas*	Eastern Tailed Blue				S3S4	3	8.6 ± 0.1	NS
I	*Argynnis aphrodite*	Aphrodite Fritillary				S3S4	23	54.6 ± 100.0	NS
I	*Polygonia faunus*	Green Comma				S3S4	17	28.7 ± 0.01	NS
I	*Oeneis jutta*	Jutta Arctic				S3S4	3	29.0 ± 0.01	NS
I	*Aeshna clepsydra*	Mottled Darner				S3S4	10	26.8 ± 1.0	NS
I	*Aeshna constricta*	Lance-Tipped Darner				S3S4	14	60.1 ± 1.0	NS
I	*Boyeria grafiana*	Ocellated Darner				S3S4	9	21.5 ± 1.0	NS
I	*Gomphaeschna furcillata*	Harlequin Darner				S3S4	10	56.2 ± 0.2	NS
I	*Erythrodiplax berenice*	Seaside Dragonlet				S3S4	6	68.2 ± 0.2	NS
I	*Nannothemis bella*	Elfin Skimmer				S3S4	6	32.8 ± 0.2	NS
I	*Sympetrum danae*	Black Meadowhawk				S3S4	4	47.3 ± 1.0	NS
I	*Amphiagrion saucium*	Eastern Red Damsel				S3S4	2	56.5 ± 0.01	NS
I	*Sphaerophoria pyrrhina*	Violaceous Globetail				SH	1	69.7 ± 5.0	NS
I	*Icaricia saepiolus*	Greenish Blue				SH	3	59.5 ± 2.5	NS
I	*Polygonia gracilis*	Hoary Comma				SH	2	58.0 ± 2.5	NS
N	*Erioderma mollissimum*	Graceful Felt Lichen	Endangered	Endangered	Endangered	S1	30	8.9 ± 0.1	NS
N	*Erioderma pedicellatum (Atlantic pop.)*	Boreal Felt Lichen - Atlantic pop.	Endangered	Endangered	Endangered	S1	545	1.7 ± 0.01	NS
N	*Peltigera hydrothyria*	Eastern Waterfan	Threatened	Threatened	Threatened	S1	19	17.8 ± 0.01	NS
N	*Pannaria lurida*	Wrinkled Shingle Lichen	Threatened	Threatened	Threatened	S2S3	23	52.8 ± 1.0	NS
N	*Anzia colpodes*	Black-foam Lichen	Threatened	Threatened	Threatened	S3	27	15.6 ± 0.5	NS
N	*Fuscopannaria leucosticta*	White-rimmed Shingle Lichen	Threatened			S3	7	1.0 ± 0.01	NS
N	*Heterodermia squamulosa*	Scaly Fringe Lichen	Threatened			S3	8	23.6 ± 0.01	NS
N	*Pectenia plumbea*	Blue Felt Lichen	Special Concern	Special Concern	Vulnerable	S3	203	1.0 ± 0.01	NS
N	*Sclerophora peronella (Atlantic pop.)*	Frosted Glass-whiskers (Atlantic population)	Special Concern	Special Concern		S3S4	29	3.6 ± 0.1	NS
N	*Pseudevernia cladonia*	Ghost Antler Lichen	Not At Risk			S2S3	11	7.7 ± 1.1	NS
N	*Fissidens exilis*	Pygmy Pocket Moss	Not At Risk			S3	5	57.7 ± 0.2	NS
N	*Chaenotheca servitii*	Flexuous Golden Stubble	Data Deficient			S1	1	15.7 ± 1.0	NS
N	*Sematophyllum demissum*	a Moss				S1	1	93.3 ± 2.5	NS
N	*Cyrto-hypnum minutulum*	Tiny Cedar Moss				S1	1	15.5 ± 0.01	NS
N	*Scytinium schraderi*	Wrinkled Jellyskin Lichen				S1	1	84.9 ± 0.05	NS
N	*Lichina confinis*	Marine Seaweed Lichen				S1	2	30.6 ± 2.0	NS
N	*Polychidium muscicola*	Eyed Mossthorns Woollybear Lichen				S1	1	33.9 ± 0.2	NS
N	*Hypogymnia hultenii*	Powdered Honeycomb Lichen				S1	19	28.3 ± 5.0	NS
N	*Jubula pennsylvanica*	a liverwort				S1?	1	39.2 ± 0.2	NS
N	*Tortula obtusifolia*	a Moss				S1?	3	37.0 ± 0.01	NS
N	*Scytinium intermedium*	Forty-five Jellyskin Lichen				S1?	1	82.7 ± 4.0	NS
N	*Sematophyllum marylandicum*	a Moss				S1S2	2	89.2 ± 6.5	NS
N	*Pseudotaxiphyllum distichaceum*	a Moss				S1S2	1	43.8 ± 0.01	NS
N	*Haplocladium microphyllum*	Tiny-leaved Haplocladium Moss				S1S2	1	85.1 ± 5.0	NS
N	*Placidium squamulosum*	Limy Soil Stipplescale Lichen				S1S2	1	38.4 ± 6.0	NS
N	*Cladonia labradorica*	Labrador Lichen				S1S2	1	65.8 ± 0.05	NS
N	*Peltigera ponojensis*	Pale-bellied Pelt Lichen				S1S2	1	53.0 ± 0.5	NS
N	*Parmotrema reticulatum*	Netted Ruffle Lichen				S1S2	1	83.3 ± 0.5	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
N	*Solorina spongiosa*	Blinking Owl Lichen				S1S2	7	68.6 ± 0.2	NS
N	*Parmeliella parvula*	Poor-man's Shingles Lichen				S1S2	22	7.1 ± 0.01	NS
N	*Xylopsora friesii*	a Lichen				S1S3	1	98.9 ± 0.6	NS
N	*Peltigera neckeri*	Black-saddle Pelt Lichen				S1S3	2	44.2 ± 0.01	NS
N	*Stereocaulon grande*	Grand Foam Lichen				S1S3	1	97.8 ± 0.5	NS
N	*Anacamptodon splachnoides*	a Moss				S2	1	98.1 ± 0.2	NS
N	*Sphagnum platyphyllum*	Flat-leaved Peat Moss				S2	2	89.3 ± 3.0	NS
N	*Sphagnum subnitens*	Lustrous Peat Moss				S2	1	47.8 ± 2.0	NS
N	*Nephroma resupinatum*	a lichen				S2	3	70.9 ± 0.5	NS
N	*Placynthium flabellosum*	Scaly Ink Lichen				S2	1	61.4 ± 17.5	NS
N	*Riccardia multifida*	Delicate Germanderwort				S2?	2	44.1 ± 0.01	NS
N	*Atrichum angustatum*	Lesser Smoothcap Moss				S2?	2	69.3 ± 2.5	NS
N	*Drepanocladus polygamus*	Polygamous Hook Moss				S2?	2	23.9 ± 0.01	NS
N	*Kiaeria starkei*	Starke's Fork Moss				S2?	1	56.3 ± 10.0	NS
N	*Philonotis marchica*	a Moss				S2?	2	65.6 ± 0.01	NS
N	*Platydictya jungermannioides*	False Willow Moss				S2?	3	70.0 ± 0.01	NS
N	*Saelania glaucescens*	Blue Dew Moss				S2?	1	88.0 ± 0.1	NS
N	*Cyrtomnium hymenophylloides*	Short-pointed Lantern Moss				S2?	2	88.0 ± 0.1	NS
N	*Platylomella lescurii*	a Moss				S2?	1	99.5 ± 0.2	NS
N	*Oxyrrhynchium hians*	Light Beaked Moss				S2S3	2	57.3 ± 25.0	NS
N	*Moelleropsis nebulosa*	Blue-gray Moss Shingle Lichen				S2S3	60	2.8 ± 0.01	NS
N	*Moelleropsis nebulosa ssp. frullaniae*	Blue-gray Moss Shingle Lichen				S2S3	3	18.5 ± 0.5	NS
N	*Ramalina thrausta*	Angelhair Ramalina Lichen				S2S3	17	17.8 ± 0.5	NS
N	*Collema leptaleum*	Crumpled Bat's Wing Lichen				S2S3	8	37.2 ± 0.2	NS
N	*Usnea rubicunda*	Red Beard Lichen				S2S3	4	36.7 ± 0.24	NS
N	*Ahtiana aurescens*	Eastern Candlewax Lichen				S2S3	7	7.7 ± 0.81	NS
N	*Cetraria muricata*	Spiny Heath Lichen				S2S3	1	73.4 ± 1.7	NS
N	*Cladonia incrassata*	Powder-foot British Soldiers Lichen				S2S3	1	17.8 ± 0.05	NS
N	*Chaenotheca gracilenta*	a lichen				S2S3	1	99.0 ± 0.2	NS
N	*Scytinium tenuissimum*	Birdnest Jellyskin Lichen				S2S3	15	37.0 ± 0.05	NS
N	*Parmelia fertilis*	Fertile Shield Lichen				S2S3	6	18.5 ± 0.5	NS
N	*Hypotrachyna minarum*	Hairless-spined Shield Lichen				S2S3	1	51.1 ± 0.05	NS
N	*Parmeliopsis ambigua*	Green Starburst Lichen				S2S3	4	45.2 ± 0.01	NS
N	*Fuscopannaria sorediata*	a Lichen				S2S3	10	8.3 ± 0.2	NS
N	*Stereocaulon condensatum*	Granular Soil Foam Lichen				S2S3	5	58.4 ± 0.2	NS
N	*Physcia subtilis*	Slender Rosette Lichen				S2S3	1	55.9 ± 0.05	NS
N	*Cladonia coccifera*	Eastern Boreal Pixie-cup Lichen				S2S3	3	16.4 ± 1.5	NS
N	*Ephemerum serratum*	a Moss				S3	2	67.0 ± 0.01	NS
N	*Fissidens taxifolius*	Yew-leaved Pocket Moss				S3	3	62.1 ± 0.01	NS
N	*Anomodon tristis*	a Moss				S3	3	14.0 ± 0.01	NS
N	*Tetraplodon angustatus*	Toothed-leaved Nitrogen Moss				S3	3	25.6 ± 0.01	NS
N	*Rostania occultata*	Crusted Tarpaper Lichen				S3	2	37.0 ± 0.5	NS
N	*Collema nigrescens*	Blistered Tarpaper Lichen				S3	10	3.4 ± 0.01	NS
N	*Solorina saccata*	Woodland Owl Lichen				S3	5	67.1 ± 0.2	NS
N	*Fuscopannaria ahlneri*	Corrugated Shingles Lichen				S3	100	1.9 ± 0.01	NS
N	*Scytinium lichenoides*	Tattered Jellyskin Lichen				S3	29	24.9 ± 1.0	NS
N	*Leptogium milligranum*	Stretched Jellyskin Lichen				S3	1	75.6 ± 3.0	NS
N	*Nephroma bellum*	Naked Kidney Lichen				S3	5	43.5 ± 0.01	NS
N	*Placynthium nigrum*	Common Ink Lichen				S3	2	11.2 ± 10.0	NS
N	*Platismatia norvegica*	Oldgrowth Rag Lichen				S3	2	49.4 ± 0.7	NS

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N	*Ephebe lanata*	Waterside Rockshag Lichen				S3	3	33.9 ± 0.2	NS
N	*Phaeophyscia adiastola*	Powder-tipped Shadow Lichen				S3	1	99.0 ± 0.2	NS
N	*Phaeophyscia pusilloides*	Pompom-tipped Shadow Lichen				S3	10	60.5 ± 0.2	NS
N	*Peltigera collina*	Tree Pelt Lichen				S3	27	12.1 ± 0.01	NS
N	*Elodium blandowii*	Blandow's Bog Moss				S3?	2	74.2 ± 3.0	NS
N	*Sphagnum lindbergii*	Lindberg's Peat Moss				S3?	1	38.0 ± 0.01	NS
N	*Sphagnum riparium*	Streamside Peat Moss				S3?	2	25.7 ± 0.01	NS
N	*Cladonia stygia*	Black-footed Reindeer Lichen				S3?	5	28.1 ± 0.05	NS
N	*Dichelyma capillaceum*	Hairlike Dichelyma Moss				S3S4	1	96.3 ± 3.0	NS
N	*Encalypta ciliata*	Fringed Extinguisher Moss				S3S4	1	90.7 ± 2.5	NS
N	*Encalypta procera*	Slender Extinguisher Moss				S3S4	9	79.5 ± 0.01	NS
N	*Myurella julacea*	Small Mouse-tail Moss				S3S4	1	88.0 ± 0.1	NS
N	*Splachnum ampullaceum*	Cruet Dung Moss				S3S4	2	1.9 ± 0.01	NS
N	*Tomentypnum nitens*	Golden Fuzzy Fen Moss				S3S4	1	48.4 ± 2.5	NS
N	*Schistidium agassizii*	Elf Bloom Moss				S3S4	2	40.7 ± 3.0	NS
N	*Enchylium tenax*	Soil Tarpaper Lichen				S3S4	7	64.5 ± 0.01	NS
N	*Sticta fuliginosa*	Peppered Moon Lichen				S3S4	51	2.0 ± 0.01	NS
N	*Arctoparmelia incurva*	Finger Ring Lichen				S3S4	18	42.3 ± 0.01	NS
N	*Scytinium teretiusculum*	Curly Jellyskin Lichen				S3S4	6	41.7 ± 0.01	NS
N	*Leptogium acadiense*	Acadian Jellyskin Lichen				S3S4	13	3.2 ± 0.01	NS
N	*Scytinium subtile*	Appressed Jellyskin Lichen				S3S4	10	2.8 ± 0.01	NS
N	*Vahliella leucophaea*	Shelter Shingle Lichen				S3S4	1	60.5 ± 0.2	NS
N	*Heterodermia speciosa*	Powdered Fringe Lichen				S3S4	18	11.8 ± 0.01	NS
N	*Leptogium corticola*	Blistered Jellyskin Lichen				S3S4	41	2.2 ± 0.01	NS
N	*Melanohalea olivacea*	Spotted Camouflage Lichen				S3S4	2	57.5 ± 0.2	NS
N	*Parmeliopsis hyperopta*	Gray Starburst Lichen				S3S4	3	71.5 ± 1.6	NS
N	*Parmotrema perlatum*	Powdered Ruffle Lichen				S3S4	2	24.0 ± 0.01	NS
N	*Peltigera hymenina*	Cloudy Pelt Lichen				S3S4	1	21.7 ± 1.6	NS
N	*Sphaerophorus fragilis*	Fragile Coral Lichen				S3S4	3	46.2 ± 0.2	NS
N	*Sclerophora peronella*	Frosted Glass-whiskers Lichen				S3S4	1	96.5 ± 0.01	NS
N	*Coccocarpia palmicola*	Salted Shell Lichen				S3S4	811	1.0 ± 0.01	NS
N	*Physcia tenella*	Fringed Rosette Lichen				S3S4	4	29.3 ± 3.5	NS
N	*Anaptychia palmulata*	Shaggy Fringed Lichen				S3S4	63	11.5 ± 0.01	NS
N	*Evernia prunastri*	Valley Oakmoss Lichen				S3S4	9	62.5 ± 0.2	NS
N	*Heterodermia neglecta*	Fringe Lichen				S3S4	58	3.5 ± 0.01	NS
P	*Clethra alnifolia*	Coast Pepper-Bush	Endangered	Threatened	Vulnerable	S2	1	96.8 ± 0.1	NS
P	*Juglans cinerea*	Butternut	Endangered	Endangered		SNA	5	56.8 ± 0.27	NS
P	*Fraxinus nigra*	Black Ash	Threatened		Threatened	S1S2	411	38.6 ± 14.68	NS
P	*Liatris spicata*	Dense Blazing Star	Threatened	Threatened		SNA	2	92.1 ± 0.55	NS
P	*Floerkea proserpinacoides*	False Mermaidweed	Not At Risk			S2S3	3	66.1 ± 7.07	NS
P	*Betula minor*	Dwarf White Birch				S1	1	52.4 ± 0.01	NS
P	*Cochlearia tridactylites*	Limestone Scurvy-grass				S1	11	28.4 ± 0.01	NS
P	*Lobelia spicata*	Pale-Spiked Lobelia				S1	1	92.9 ± 7.07	NS
P	*Hudsonia tomentosa*	Woolly Beach-heath				S1	6	65.2 ± 7.07	NS
P	*Ribes americanum*	Wild Black Currant				S1	2	71.9 ± 5.0	NS
P	*Persicaria careyi*	Carey's Smartweed				S1	1	59.8 ± 3.0	NS
P	*Phytolacca americana*	Common Pokeweed				S1	1	97.2 ± 0.5	NS
P	*Salix myrtillifolia*	Blueberry Willow				S1	1	55.8 ± 0.01	NS
P	*Salix serissima*	Autumn Willow				S1	2	55.6 ± 0.01	NS
P	*Scrophularia lanceolata*	Lance-leaved Figwort				S1	1	87.0 ± 1.5	NS
P	*Carex alopecoidea*	Foxtail Sedge				S1	3	83.9 ± 0.2	NS
P	*Carex garberi*	Garber's Sedge				S1	4	60.5 ± 0.01	NS
P	*Carex plantaginea*	Plantain-Leaved Sedge				S1	4	40.3 ± 0.2	NS
P	*Carex tenuiflora*	Sparse-Flowered Sedge				S1	1	87.8 ± 1.0	NS

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P	*Carex tincta*	Tinged Sedge				S1	2	83.9 ± 0.2	NS
P	*Carex viridula var. saxilittoralis*	Greenish Sedge				S1	4	32.8 ± 0.3	NS
P	*Carex grisea*	Inflated Narrow-leaved Sedge				S1	6	74.4 ± 0.01	NS
P	*Cyperus lupulinus ssp. macilentus*	Hop Flatsedge				S1	18	69.8 ± 0.2	NS
P	*Scirpus atrovirens*	Dark-green Bulrush				S1	1	70.4 ± 0.2	NS
P	*Iris prismatica*	Slender Blue Flag				S1	2	42.2 ± 7.07	NS
P	*Juncus vaseyi*	Vasey Rush				S1	1	62.3 ± 0.02	NS
P	*Malaxis monophyllos var. brachypoda*	North American White Adder's-mouth				S1	1	92.2 ± 7.07	NS
P	*Elymus hystrix*	Spreading Wild Rye				S1	4	41.3 ± 1.6	NS
P	*Potamogeton nodosus*	Long-leaved Pondweed				S1	1	38.4 ± 5.0	NS
P	*Adiantum pedatum*	Northern Maidenhair Fern				S1	2	70.6 ± 0.2	NS
P	*Botrychium lunaria*	Common Moonwort				S1	10	83.1 ± 2.0	NS
P	*Solidago hispida*	Hairy Goldenrod				S1?	2	16.3 ± 7.07	NS
P	*Carex pensylvanica*	Pennsylvania Sedge				S1?	2	66.4 ± 3.0	NS
P	*Allium schoenoprasum*	Wild Chives				S1?	1	97.6 ± 0.2	NS
P	*Allium schoenoprasum var. sibiricum*	Wild Chives				S1?	1	74.8 ± 7.07	NS
P	*Sanicula odorata*	Clustered Sanicle				S1S2	4	57.4 ± 0.01	NS
P	*Ageratina altissima*	White Snakeroot				S1S2	2	78.6 ± 7.07	NS
P	*Proserpinaca intermedia*	Intermediate Mermaidweed				S1S2	1	64.9 ± 0.9	NS
P	*Anemone virginiana var. alba*	Virginia Anemone				S1S2	5	65.9 ± 5.0	NS
P	*Parnassia parviflora*	Small-flowered Grass-of-Parnassus				S1S2	1	81.5 ± 1.5	NS
P	*Carex haydenii*	Hayden's Sedge				S1S2	3	61.7 ± 0.05	NS
P	*Platanthera huronensis*	Fragrant Green Orchid				S1S2	1	60.1 ± 10.0	NS
P	*Carex vacillans*	Estuarine Sedge				S1S3	5	20.9 ± 0.01	NS
P	*Zizia aurea*	Golden Alexanders				S2	42	37.9 ± 1.0	NS
P	*Antennaria parlinii ssp. fallax*	Parlin's Pussytoes				S2	2	78.6 ± 0.01	NS
P	*Rudbeckia laciniata*	Cut-Leaved Coneflower				S2	7	42.5 ± 0.1	NS
P	*Hudsonia ericoides*	Pinebarren Golden Heather				S2	25	96.3 ± 2.7	NS
P	*Desmodium canadense*	Canada Tick-trefoil				S2	20	51.5 ± 0.01	NS
P	*Anemonastrum canadense*	Canada Anemone				S2	6	70.4 ± 0.2	NS
P	*Hepatica americana*	Round-lobed Hepatica				S2	23	49.5 ± 1.5	NS
P	*Ranunculus sceleratus*	Cursed Buttercup				S2	24	80.2 ± 0.05	NS
P	*Comandra umbellata*	Bastard's Toadflax				S2	36	81.9 ± 5.0	NS
P	*Gratiola neglecta*	Clammy Hedge-Hyssop				S2	6	54.5 ± 0.1	NS
P	*Dirca palustris*	Eastern Leatherwood				S2	5	76.2 ± 7.07	NS
P	*Carex gynocrates*	Northern Bog Sedge				S2	2	55.7 ± 0.01	NS
P	*Carex pellita*	Woolly Sedge				S2	10	36.4 ± 10.0	NS
P	*Carex livida*	Livid Sedge				S2	12	37.5 ± 0.01	NS
P	*Juncus greenei*	Greene's Rush				S2	3	83.6 ± 1.5	NS
P	*Luzula spicata*	Spiked Woodrush				S2	1	74.6 ± 0.01	NS
P	*Allium tricoccum*	Wild Leek				S2	9	64.6 ± 0.5	NS
P	*Lilium canadense*	Canada Lily				S2	108	28.7 ± 0.01	NS
P	*Cypripedium parviflorum var. pubescens*	Yellow Lady's-slipper				S2	26	74.7 ± 0.01	NS
P	*Cypripedium parviflorum var. makasin*	Small Yellow Lady's-Slipper				S2	1	93.3 ± 0.01	NS
P	*Cypripedium reginae*	Showy Lady's-Slipper				S2	29	37.9 ± 1.0	NS
P	*Platanthera flava var. herbiola*	Pale Green Orchid				S2	9	64.4 ± 7.07	NS
P	*Platanthera macrophylla*	Large Round-Leaved Orchid				S2	15	49.0 ± 0.2	NS
P	*Bromus latiglumis*	Broad-Glumed Brome				S2	28	40.1 ± 0.01	NS

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P	*Cinna arundinacea*	Sweet Wood Reed Grass				S2	19	46.0 ± 0.01	NS
P	*Elymus wiegandii*	Wiegand's Wild Rye				S2	14	42.2 ± 0.01	NS
P	*Festuca subverticillata*	Nodding Fescue				S2	2	90.5 ± 1.0	NS
P	*Sparganium hyperboreum*	Northern Burreed				S2	2	68.6 ± 0.1	NS
P	*Cuscuta cephalanthi*	Buttonbush Dodder				S2?	9	65.7 ± 1.2	NS
P	*Crataegus submollis*	Quebec Hawthorn				S2?	4	66.6 ± 7.07	NS
P	*Carex peckii*	White-Tinged Sedge				S2?	3	70.1 ± 0.01	NS
P	*Thuja occidentalis*	Eastern White Cedar			Vulnerable	S2S3	1	54.7 ± 0.2	NS
P	*Osmorhiza longistylis*	Smooth Sweet Cicely				S2S3	14	40.8 ± 0.01	NS
P	*Bidens hyperborea*	Estuary Beggarticks				S2S3	1	78.9 ± 1.0	NS
P	*Erigeron philadelphicus*	Philadelphia Fleabane				S2S3	3	35.5 ± 5.0	NS
P	*Lactuca hirsuta*	Hairy Lettuce				S2S3	1	74.7 ± 7.07	NS
P	*Impatiens pallida*	Pale Jewelweed				S2S3	3	56.3 ± 7.07	NS
P	*Caulophyllum thalictroides*	Blue Cohosh				S2S3	49	39.5 ± 0.01	NS
P	*Boechera stricta*	Drummond's Rockcress				S2S3	5	63.2 ± 0.03	NS
P	*Stellaria humifusa*	Saltmarsh Starwort				S2S3	5	31.0 ± 0.1	NS
P	*Oxybasis rubra*	Red Goosefoot				S2S3	5	38.9 ± 2.0	NS
P	*Hypericum majus*	Large St John's-wort				S2S3	2	97.0 ± 7.07	NS
P	*Hypericum x dissimulatum*	Disguised St. John's-wort				S2S3	3	83.1 ± 1.0	NS
P	*Empetrum atropurpureum*	Purple Crowberry				S2S3	1	96.9 ± 7.07	NS
P	*Euphorbia polygonifolia*	Seaside Spurge				S2S3	9	69.0 ± 2.5	NS
P	*Myriophyllum farwellii*	Farwell's Water Milfoil				S2S3	9	42.5 ± 7.07	NS
P	*Hedeoma pulegioides*	American False Pennyroyal				S2S3	4	41.5 ± 5.0	NS
P	*Oenothera fruticosa ssp. tetragona*	Narrow-leaved Evening Primrose				S2S3	3	64.4 ± 7.07	NS
P	*Polygala polygama*	Racemed Milkwort				S2S3	1	99.3 ± 1.0	NS
P	*Polygonum aviculare ssp. buxiforme*	Box Knotweed				S2S3	2	61.8 ± 0.2	NS
P	*Polygonum oxyspermum ssp. raii*	Ray's Knotweed				S2S3	1	85.2 ± 1.0	NS
P	*Rumex triangulivalvis*	Triangular-valve Dock				S2S3	1	66.0 ± 0.5	NS
P	*Primula mistassinica*	Mistassini Primrose				S2S3	17	43.9 ± 7.07	NS
P	*Anemone quinquefolia*	Wood Anemone				S2S3	20	39.2 ± 0.0	NS
P	*Caltha palustris*	Yellow Marsh Marigold				S2S3	7	65.8 ± 0.1	NS
P	*Amelanchier fernaldii*	Fernald's Serviceberry				S2S3	1	89.3 ± 1.0	NS
P	*Potentilla canadensis*	Canada Cinquefoil				S2S3	3	80.7 ± 5.0	NS
P	*Salix pellita*	Satiny Willow				S2S3	3	54.8 ± 0.3	NS
P	*Tiarella cordifolia*	Heart-leaved Foamflower				S2S3	223	38.6 ± 7.07	NS
P	*Agalinis purpurea var. parviflora*	Small-flowered Purple False Foxglove				S2S3	3	45.2 ± 0.2	NS
P	*Boehmeria cylindrica*	Small-spike False-nettle				S2S3	3	77.1 ± 0.01	NS
P	*Carex adusta*	Lesser Brown Sedge				S2S3	4	30.8 ± 5.0	NS
P	*Carex comosa*	Bearded Sedge				S2S3	2	83.1 ± 0.1	NS
P	*Carex houghtoniana*	Houghton's Sedge				S2S3	1	66.4 ± 1.2	NS
P	*Carex hystericina*	Porcupine Sedge				S2S3	2	84.1 ± 0.5	NS
P	*Eleocharis ovata*	Ovate Spikerush				S2S3	4	71.4 ± 0.01	NS
P	*Scirpus pedicellatus*	Stalked Bulrush				S2S3	7	48.6 ± 0.01	NS
P	*Vallisneria americana*	Wild Celery				S2S3	3	63.6 ± 1.0	NS
P	*Goodyera pubescens*	Downy Rattlesnake-Plantain				S2S3	2	67.9 ± 0.2	NS
P	*Spiranthes casei*	Case's Ladies'-Tresses				S2S3	1	40.2 ± 1.89	NS
P	*Spiranthes casei var. novaescotiae*	Case's Ladies'-Tresses				S2S3	3	58.8 ± 0.2	NS
P	*Spiranthes lucida*	Shining Ladies'-Tresses				S2S3	22	52.9 ± 0.05	NS
P	*Potamogeton friesii*	Fries' Pondweed				S2S3	2	69.1 ± 5.0	NS
P	*Botrychium lanceolatum ssp. angustisegmentum*	Narrow Triangle Moonwort				S2S3	4	51.5 ± 0.01	NS
P	*Botrychium simplex*	Least Moonwort				S2S3	3	51.5 ± 0.01	NS
P	*Ophioglossum pusillum*	Northern Adder's-tongue				S2S3	3	75.6 ± 0.01	NS

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P	*Potamogeton pulcher*	Spotted Pondweed			Vulnerable	S3	3	37.8 ± 2.5	NS
P	*Angelica atropurpurea*	Purple-stemmed Angelica				S3	1	50.2 ± 0.01	NS
P	*Conioselinum chinense*	Chinese Hemlock-parsley				S3	2	61.9 ± 5.0	NS
P	*Hieracium robinsonii*	Robinson's Hawkweed				S3	3	69.8 ± 0.5	NS
P	*Senecio pseudoarnica*	Seabeach Ragwort				S3	35	15.4 ± 7.07	NS
P	*Symphyotrichum boreale*	Boreal Aster				S3	3	74.8 ± 7.07	NS
P	*Symphyotrichum ciliolatum*	Fringed Blue Aster				S3	19	46.1 ± 0.01	NS
P	*Betula michauxii*	Michaux's Dwarf Birch				S3	44	5.3 ± 1.5	NS
P	*Betula pumila*	Bog Birch				S3	3	55.6 ± 0.01	NS
P	*Cardamine parviflora*	Small-flowered Bittercress				S3	4	36.1 ± 0.01	NS
P	*Palustricodon aparinoides*	Marsh Bellflower				S3	29	41.8 ± 0.5	NS
P	*Mononeuria groenlandica*	Greenland Stitchwort				S3	4	61.3 ± 7.07	NS
P	*Sagina nodosa*	Knotted Pearlwort				S3	11	32.6 ± 5.0	NS
P	*Sagina nodosa ssp. borealis*	Knotted Pearlwort				S3	7	31.0 ± 0.01	NS
P	*Stellaria longifolia*	Long-leaved Starwort				S3	11	45.6 ± 0.01	NS
P	*Ceratophyllum echinatum*	Prickly Hornwort				S3	3	47.6 ± 0.01	NS
P	*Triosteum aurantiacum*	Orange-fruited Tinker's Weed				S3	112	39.8 ± 1.5	NS
P	*Viburnum edule*	Squashberry				S3	3	68.4 ± 0.01	NS
P	*Empetrum eamesii*	Pink Crowberry				S3	4	96.9 ± 7.07	NS
P	*Halenia deflexa*	Spurred Gentian				S3	1	38.9 ± 1.0	NS
P	*Myriophyllum verticillatum*	Whorled Water Milfoil				S3	1	46.3 ± 0.01	NS
P	*Epilobium strictum*	Downy Willowherb				S3	3	71.1 ± 5.0	NS
P	*Polygala sanguinea*	Blood Milkwort				S3	22	15.8 ± 3.5	NS
P	*Persicaria arifolia*	Halberd-leaved Tearthumb				S3	12	38.0 ± 0.01	NS
P	*Plantago rugelii*	Rugel's Plantain				S3	6	48.1 ± 0.03	NS
P	*Samolus parviflorus*	Seaside Brookweed				S3	13	73.8 ± 1.6	NS
P	*Pyrola minor*	Lesser Pyrola				S3	1	76.4 ± 0.01	NS
P	*Anemone virginiana*	Virginia Anemone				S3	29	53.3 ± 1.0	NS
P	*Cephalanthus occidentalis*	Common Buttonbush				S3	1	98.9 ± 0.2	NS
P	*Galium labradoricum*	Labrador Bedstraw				S3	79	37.0 ± 0.01	NS
P	*Salix pedicellaris*	Bog Willow				S3	55	37.0 ± 0.01	NS
P	*Salix sericea*	Silky Willow				S3	1	87.3 ± 1.0	NS
P	*Lindernia dubia*	Yellow-seeded False Pimperel				S3	11	51.9 ± 0.01	NS
P	*Laportea canadensis*	Canada Wood Nettle				S3	41	40.1 ± 0.01	NS
P	*Pilea pumila*	Dwarf Clearweed				S3	4	56.2 ± 6.0	NS
P	*Viola nephrophylla*	Northern Bog Violet				S3	8	37.9 ± 1.0	NS
P	*Carex bebbii*	Bebb's Sedge				S3	8	64.4 ± 0.01	NS
P	*Carex castanea*	Chestnut Sedge				S3	38	48.4 ± 0.01	NS
P	*Carex cryptolepis*	Hidden-scaled Sedge				S3	7	46.4 ± 0.01	NS
P	*Carex eburnea*	Bristle-leaved Sedge				S3	34	64.6 ± 0.01	NS
P	*Carex hirtifolia*	Pubescent Sedge				S3	33	40.1 ± 0.01	NS
P	*Carex lupulina*	Hop Sedge				S3	29	44.5 ± 0.7	NS
P	*Carex rosea*	Rosy Sedge				S3	16	38.3 ± 4.0	NS
P	*Carex swanii*	Swan's Sedge				S3	1	92.0 ± 0.5	NS
P	*Carex tenera*	Tender Sedge				S3	6	62.0 ± 1.5	NS
P	*Carex tribuloides*	Blunt Broom Sedge				S3	12	41.2 ± 5.0	NS
P	*Carex tuckermanii*	Tuckerman's Sedge				S3	1	65.6 ± 0.05	NS
P	*Eleocharis flavescens var. olivacea*	Bright-green Spikerush				S3	8	49.8 ± 0.01	NS
P	*Eriophorum gracile*	Slender Cottongrass				S3	4	70.9 ± 10.0	NS
P	*Schoenoplectus americanus*	Olney's Bulrush				S3	1	74.6 ± 0.01	NS
P	*Cypripedium parviflorum*	Yellow Lady's-slipper				S3	23	48.4 ± 0.25	NS
P	*Neottia bifolia*	Southern Twayblade				S3	84	3.8 ± 0.01	NS
P	*Platanthera grandiflora*	Large Purple Fringed Orchid				S3	151	22.9 ± 1.0	NS
P	*Platanthera hookeri*	Hooker's Orchid				S3	1	78.5 ± 0.01	NS
P	*Dichanthelium linearifolium*	Narrow-leaved Panic Grass				S3	4	57.4 ± 7.07	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Piptatheropsis canadensis*	Canada Ricegrass				S3	7	59.8 ± 3.0	NS
P	*Potamogeton praelongus*	White-stemmed Pondweed				S3	11	42.5 ± 1.0	NS
P	*Potamogeton richardsonii*	Richardson's Pondweed				S3	5	40.2 ± 1.5	NS
P	*Potamogeton zosteriformis*	Flat-stemmed Pondweed				S3	13	30.0 ± 7.07	NS
P	*Dryopteris fragrans*	Fragrant Wood Fern				S3	5	39.3 ± 0.2	NS
P	*Sceptridium dissectum*	Dissected Moonwort				S3	4	44.3 ± 1.0	NS
P	*Polypodium appalachianum*	Appalachian Polypody				S3	9	39.9 ± 0.01	NS
P	*Persicaria amphibia var. emersa*	Long-root Smartweed				S3?	2	60.6 ± 0.01	NS
P	*Spiranthes ochroleuca*	Yellow Ladies'-tresses				S3?	23	27.6 ± 0.2	NS
P	*Diphasiastrum x sabinifolium*	Savin-leaved Ground-cedar				S3?	4	49.7 ± 1.0	NS
P	*Bidens vulgata*	Tall Beggarticks				S3S4	5	42.3 ± 0.01	NS
P	*Erigeron hyssopifolius*	Hyssop-leaved Fleabane				S3S4	39	62.8 ± 0.01	NS
P	*Hieracium paniculatum*	Panicled Hawkweed				S3S4	7	65.8 ± 0.2	NS
P	*Bidens beckii*	Water Beggarticks				S3S4	11	44.5 ± 0.5	NS
P	*Packera paupercula*	Balsam Groundsel				S3S4	78	52.0 ± 0.01	NS
P	*Atriplex glabriuscula var. franktonii*	Frankton's Saltbush				S3S4	1	94.9 ± 2.5	NS
P	*Vaccinium boreale*	Northern Blueberry				S3S4	8	31.7 ± 1.0	NS
P	*Vaccinium cespitosum*	Dwarf Bilberry				S3S4	54	25.6 ± 0.01	NS
P	*Vaccinium corymbosum*	Highbush Blueberry				S3S4	4	93.0 ± 0.2	NS
P	*Fagus grandifolia*	American Beech				S3S4	342	12.3 ± 0.2	NS
P	*Bartonia virginica*	Yellow Bartonia				S3S4	1	87.3 ± 7.07	NS
P	*Proserpinaca pectinata*	Comb-leaved Mermaidweed				S3S4	2	29.6 ± 1.0	NS
P	*Nuphar microphylla*	Small Yellow Pond-lily				S3S4	1	59.1 ± 2.7	NS
P	*Persicaria pensylvanica*	Pennsylvania Smartweed				S3S4	13	4.7 ± 1.0	NS
P	*Fallopia scandens*	Climbing False Buckwheat				S3S4	31	40.3 ± 0.01	NS
P	*Rumex pallidus*	Seabeach Dock				S3S4	2	62.7 ± 0.01	NS
P	*Pyrola asarifolia*	Pink Pyrola				S3S4	7	32.8 ± 0.2	NS
P	*Endotropis alnifolia*	alder-leaved buckthorn				S3S4	161	37.8 ± 1.0	NS
P	*Amelanchier spicata*	Running Serviceberry				S3S4	4	30.6 ± 0.01	NS
P	*Crataegus succulenta*	Fleshy Hawthorn				S3S4	1	97.7 ± 0.01	NS
P	*Fragaria vesca ssp. americana*	Woodland Strawberry				S3S4	63	34.9 ± 0.05	NS
P	*Fragaria vesca*	Woodland Strawberry				S3S4	8	29.2 ± 0.2	NS
P	*Galium aparine*	Common Bedstraw				S3S4	20	24.8 ± 0.35	NS
P	*Geocaulon lividum*	Northern Comandra				S3S4	20	16.2 ± 5.0	NS
P	*Limosella australis*	Southern Mudwort				S3S4	6	52.2 ± 5.0	NS
P	*Ulmus americana*	White Elm				S3S4	50	25.4 ± 0.05	NS
P	*Verbena hastata*	Blue Vervain				S3S4	120	43.6 ± 0.01	NS
P	*Viola sagittata var. ovata*	Arrow-Leaved Violet				S3S4	6	63.4 ± 0.2	NS
P	*Triglochin gaspensis*	Gaspé Arrowgrass				S3S4	18	30.5 ± 0.01	NS
P	*Juncus acuminatus*	Sharp-Fruit Rush				S3S4	3	61.7 ± 0.01	NS
P	*Juncus subcaudatus*	Woods-Rush				S3S4	16	37.8 ± 5.0	NS
P	*Luzula parviflora ssp. melanocarpa*	Black-fruited Woodrush				S3S4	3	25.7 ± 0.2	NS
P	*Goodyera repens*	Lesser Rattlesnake-plantain				S3S4	1	30.8 ± 0.01	NS
P	*Liparis loeselii*	Loesel's Twayblade				S3S4	6	63.6 ± 0.2	NS
P	*Platanthera obtusata*	Blunt-leaved Orchid				S3S4	7	24.2 ± 0.1	NS
P	*Platanthera orbiculata*	Small Round-leaved Orchid				S3S4	21	51.5 ± 0.2	NS
P	*Alopecurus aequalis*	Short-awned Foxtail				S3S4	8	63.7 ± 1.0	NS
P	*Dichanthelium clandestinum*	Deer-tongue Panic Grass				S3S4	98	27.2 ± 0.01	NS
P	*Koeleria spicata*	Narrow False Oats				S3S4	9	52.1 ± 0.01	NS
P	*Equisetum pratense*	Meadow Horsetail				S3S4	10	64.0 ± 0.01	NS
P	*Diphasiastrum complanatum*	Northern Ground-cedar				S3S4	4	38.1 ± 0.09	NS
P	*Diphasiastrum sitchense*	Sitka Ground-cedar				S3S4	4	38.5 ± 1.0	NS
P	*Huperzia appressa*	Mountain Firmoss				S3S4	4	76.0 ± 5.0	NS
P	*Sceptridium multifidum*	Leathery Moonwort				S3S4	5	53.7 ± 0.01	NS

Taxonomic Group	Scientific Name	Common Name	COSEWIC	SARA	Prov Legal Prot	Prov Rarity Rank	# recs	Distance (km)	Prov
P	*Botrychium matricariifolium*	Daisy-leaved Moonwort				S3S4	5	71.9 ± 0.05	NS
P	*Viola canadensis*	Canada Violet				SH	1	66.1 ± 7.07	NS

5.1 SOURCE BIBLIOGRAPHY (100 km)

The recipient of these data shall acknowledge the AC CDC and the data sources listed below in any documents, reports, publications or presentations, in which this dataset makes a significant contribution.

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1	Docherty, Joanne. 2022. Phone call to John Klymko about Danaus plexippus observation in Nova Scotia. Personal communication.
1	Doucet, D.A. 2007. Lepidopteran Records, 1988-2006. Doucet, 700 recs.
1	Eastman, A. 2019. Snapping Turtle observation at Brookfield, Colchester Co. NS. Halifax Field Naturalists Nova Scotia Nature Archive Facebook Page, 1 record.
1	Golder Associates Ltd. 2021. Black Ash location from Goff's Quarry Expansion Environment Assessment, 2017. Golder Associates Ltd., 1 record.
1	Haughian, S.R. 2018. Description of Fuscopannaria leucosticta field work in 2017. New Brunswick Museum, 314 recs.
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1	Hill, N.M. 2021. Observation of Carex haydenii and black ash near Marshy Hope and Ponhook Lake. pers. comm.
1	Holder, M.L.; Kingsley, A.L. 2000. Kinglsey and Holder observations from 2000 field work.
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1	Klymko, J. Henry Hensel's Butterfly Collection Database. Atlantic Canada Conservation Data Centre. 2016.
1	MacKinnon, D.; Wright, P.; Smith, D. 2014. 2014 Common Tern email report, Eastern Passage, NS. NS Department of Environment.
1	McAlpine, D.F. 1998. NBM Science Collections databases to 1998. New Brunswick Museum, Saint John NB, 241 recs.
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1	NatureServe Canada. 2018. iNaturalist Butterfly Data Export . iNaturalist.org and iNaturalist.ca.
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1	Robinson, C.B. 1907. Early intervale flora of eastern Nova Scotia. Transactions of the Nova Scotia Institute of Science, 10:502-506. 1 rec.
1	Sabine, D.L. 2013. Dwaine Sabine butterfly records, 2009 and earlier.
1	Sabine, D.L. Bombus terricola specimens in Dwayne Sabine's personal collection. pers. comm. 2022.
1	Sabine, M. 2016. NB DNR staff incidental Black Ash observations. New Brunswick Department of Natural Resources.
1	Shortt, R. UNB specimen data for various tracked species formerly considered secure. Connell Memorial Herbarium, UNB, Fredericton NB. 2019.
1	Skevington, Jeffrey H. 2020. Syrphid records used for the Field Guide to the Flower Flies of Northeastern North America. Canadian National Collection of Insects.
1	Stephen Freeman. 2022. New location for Black Ash in Queens County, NS. Personal communication, 2.
1	Whittam, R.M. 2000. Senecio pseudoarnica on Country Island. , Pers. comm. to S. Gerriets. 1 rec.
1	WIlliams, M. Cape Breton University Digital Herbarium. Cape Breton University Digital Herbarium. 2013.

Appendix F Photographs

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Photographic Log

Client:	**Build Nova Scotia**	**Project:**	**Human Health and Ecological Risk Assessment**
Site Name:	**Former Lochaber Mine Site**	**Site Location:**	**Lochaber Mines, Nova Scotia**

Photograph ID: 1

Photo Location:
45° 3' 48.98", 62° 28' 54.84"

Survey Date:
5/31/2024

Comments:
Signage at boundary of Liscomb Game Sanctuary

Photograph ID: 2

Photo Location:
45° 3' 51.51", 62° 28' 46.16"

Survey Date:
5/31/2024

Comments:
Signage near roadway warning of hazardous area with open holes

Client:	**Build Nova Scotia**	**Project:**	**Human Health and Ecological Risk Assessment**
Site Name:	**Former Lochaber Mine Site**	**Site Location:**	**Lochaber Mines, Nova Scotia**

Photograph ID: 3 **Photo Location:** 45° 3' 47.95", 62° 28' 32.96" **Survey Date:** 5/31/2024 **Comments:** Mines Branch River near sample location LOC-SD24-01	
Photograph ID: 4 **Photo Location:** 45° 3' 52.22", 62° 28' 41.83" **Survey Date:** 5/31/2024 **Comments:** Beer can on the Site near Mines Branch River	

Client:	**Build Nova Scotia**	**Project:**	**Human Health and Ecological Risk Assessment**
Site Name:	**Former Lochaber Mine Site**	**Site Location:**	**Lochaber Mines, Nova Scotia**

Photograph ID: 5 **Photo Location:** 45° 3' 48.98", 62° 28' 54.84" **Survey Date:** 5/31/2024 **Comments:** Off-highway vehicle trail leading into the Site	
Photograph ID: 6 **Photo Location:** 45° 3' 48.12", 62° 28' 33.32" **Survey Date:** 5/31/2024 **Comments:** Dense vegetation restricting access to Mines Branch River near sample location LOC-SW24-02