REPORT

Human Health and Ecological Risk Assessment

Former Burgeo Rifle Range, Burgeo, NL

Submitted to:

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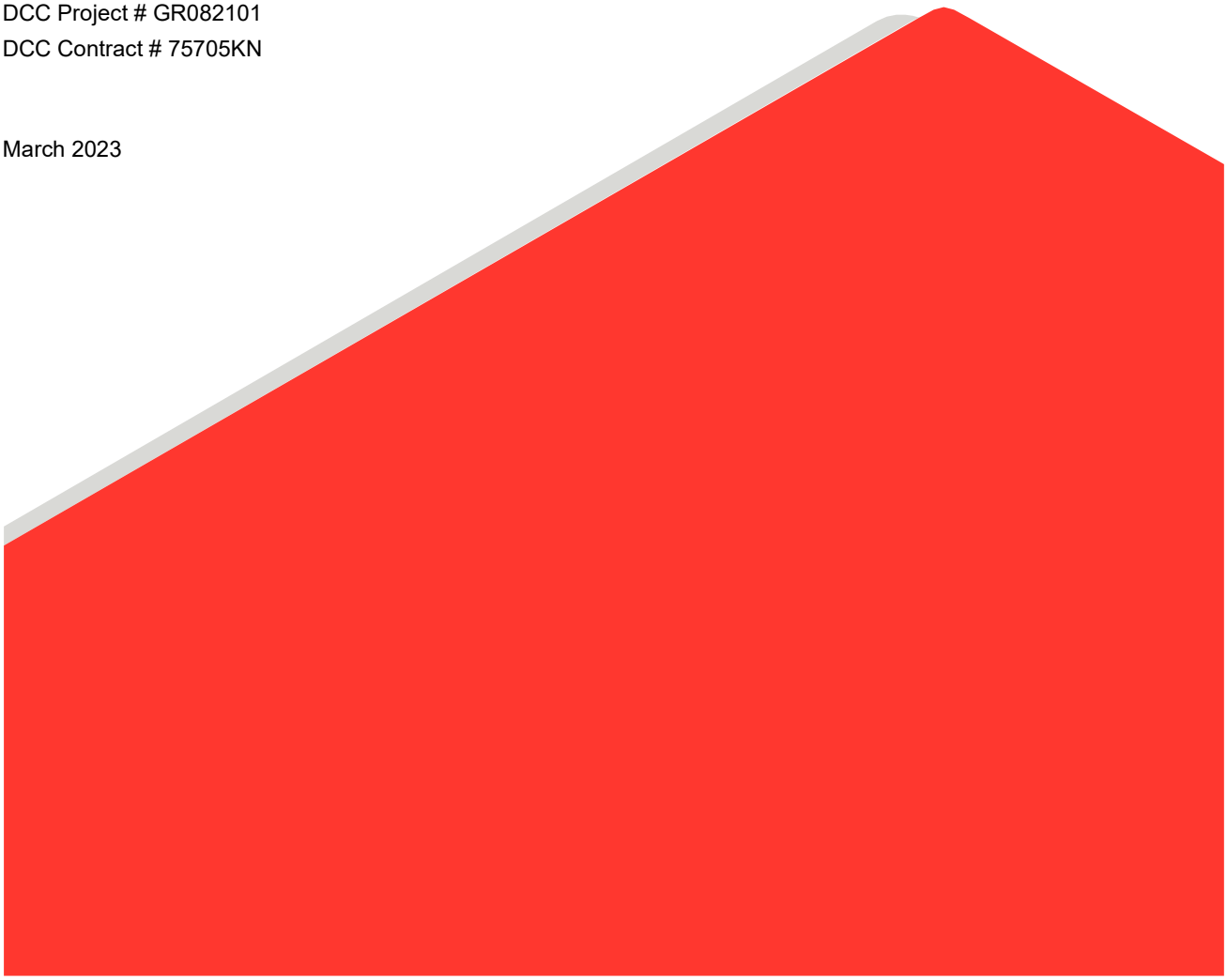
WSP Project # 22532464

DCC Project # GR082101

DCC Contract # 75705KN

March 2023



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Executive Summary

WSP Canada Inc. (WSP), formerly Golder Associates, was retained by Defence Construction Canada (DCC) on behalf of Department of National Defence (DND) to complete a Human Health and Ecological Risk Assessment (HHERA) for the Former Burgeo Range in Burgeo, Newfoundland.

DND leased Crown lands from the Government of Newfoundland and Labrador (NL) for use by the 5th Canadian Ranger Patrol Group (5CRPG) in 2008 (the "Site"). However, the activities associated with the Former Burgeo Range took place on lands directly south of the Site (the "Additional Proposed Leased Lands" or "Firing Area"). The Site includes two distinct areas identified as Location 1 and Location 2. The Firing Area is adjacent to Location 1. Location 1 has been divided into three zones based on the expected level of risk from former/current activities associated with the Firing Area – high (Zone 1), medium (Zone 2), and low (Zone 3). Therefore, the lands evaluated as part of the HHERA include the Firing Area and Zone 1 (collectively referred to as "the RA Property" as shown on Figure 1). Concentrations of contaminants of concern (COCs) in Zone 2 and Zone 3 were associated with natural background concentrations.

It is DND's intent to decommission the Site and the Additional Proposed Leased Lands and obtain closure from the Province of NL, if required. To achieve site closure the following was recommended following the extensive testing program (*Steps 5 to 7 of the Federal Approach to Contaminated Sites*; WSP 2023):

- Remediation of soil around the backstop/bullet catch and wooden targets (found to contain hazardous concentrations of leachable lead) within the Firing Area through source removal.
- Remediation of surface water and sediment in Pond 1 and Pond 2 located adjacent to the backstop/bullet catch and found to have lead concentrations over 5 times higher than the other waterbodies on the RA Property.
- Risk management of the remaining areas of RA Property where widespread and marginal exceedances of COCs have been identified.

To support the Remedial and Risk Management Strategy for the RA Property, the objectives of the HHERA were to:

- Assess the potential for health risks to human and ecological receptors which may be exposed to COCs in soil, groundwater, sediment, and surface water on the RA Property (outside of the proposed remedial areas) based on the current and future land use.
- Identify Risk Management Measures (RMMs) to mitigate unacceptable levels of risk identified by the HHERA, if necessary.

For the identification of COCs, environmental quality criteria associated with agricultural land use, non-potable groundwater, and coarse-grained soil are applicable to the RA Property. Both federal and regional criteria from CCME, FCSAP, and Atlantic RBCA were considered (collectively referred to as "screening values"). To protect against impacts to the provincially protected watershed that is hydraulically connected to the Town of Burgeo's water supply, drinking water criteria from Health Canada and NL were also considered. Maximum concentrations of chemicals were compared to their respective screening values. Site-specific background concentrations were also considered for identifying COCs related to site activities. Based on this initial screening, the following COCs were identified that required further assessment in the HHERA:

- Aluminium, lead, manganese, tin, and vanadium in soil

- Aluminium, copper, lead, and zinc in groundwater
- Arsenic and lead in sediment
- Lead in surface water

The conclusions and recommendations of the HHRA are as follows:

- The HHRA evaluated potential risks to a Recreational User from direct contact with soil, sediment, and surface water, as well as the consumption of country foods.
- Based on screening against human health criteria, direct contact with soil was retained for further assessment of potential risks from soil COCs (aluminium, manganese, vanadium)
- Risks were negligible for a Recreational User; therefore, RMMs are not required for these receptors.
- Potential off-site health risks to the provincially protected watershed were also negligible as no COCs were identified in surface water above drinking water criteria.
- It is possible that a Subsurface Worker, who may be involved in future construction or other intrusive work, may also be exposed to COCs on the RA Property. However, no planned intrusive work is proposed outside of the remedial areas and there are no development plans that may require intrusive work. As any potential exposures are short-term and are mitigated through an industry standard HASP, this receptor was not evaluated in the HHRA.

The conclusions and recommendations of the ERA are as follows:

- Primary producers (terrestrial plants), soil invertebrates, mammals, birds, and amphibians were identified as receptor groups for the terrestrial ecosystem. No terrestrial species at risk (SAR) were identified as a receptor of concern (ROC).
- Primary producers (aquatic plants, algae), pelagic invertebrates, benthic invertebrates, fish, and amphibians were identified as receptor groups for the aquatic ecosystem (collectively referred to as aquatic life). Fish SAR were identified as ROCs (American eel and banded killfish).
- Based on screening against ecological criteria, terrestrial plants and soil invertebrates were retained for further assessment of potential risks from soil COCs (tin), and aquatic life were retained for further assessment of potential risks from sediment and surface water COCs (lead).
- Protection goals included maintenance of communities of ecological receptors that are similar to reference areas and protection of individual SAR.
- Several lines of evidence (LOEs) were used to characterize risks to terrestrial and aquatic ecosystems. These LOEs included hazard quotients (HQs; where COC concentrations are compared to literature-based toxicity information), site-specific toxicity studies, and site-specific biological studies.
- Risks to terrestrial plants and soil invertebrates from soil COCs were found to be negligible based on a vegetation health and community study.
- Risks to aquatic life from sediment COCs were found to be negligible based on HQs that considered average concentrations and site-specific toxicity testing.
- Risks to aquatic life from surface water COCs were found to be negligible based on site-specific toxicity testing.
- Based on these results, no further work or RMMs are recommended for ecological receptors.

The Remedial and Risk Management Strategy Report for the Site should be updated based on the findings of the HHERA.

Study Limitations

This report (the “Report”) was prepared for the exclusive use of DCC and DND for the express purpose of providing advice with respect to the environmental condition of the Site. In evaluating the Site, WSP Canada Inc. has relied in good faith on information provided by others as noted in the Report. We have assumed that the information provided is factual and accurate. We accept no responsibility for any deficiency, misstatement or inaccuracy contained in this Report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

Any use which a third party makes of this Report, or any reliance on or decisions to be made based on it, are the sole responsibility of the third parties. If a third party require reliance on this Report, written authorization from WSP is required. Failing such authorization, WSP disclaims responsibility to third parties of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The scope and the period of WSP’s assessment are described in this Report, and are subject to the restrictions, assumptions and limitations described herein. Except as noted herein, the work was conducted in accordance with the scope of work and terms and conditions within WSP’s proposal. WSP did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site referenced in the Report. Conditions may therefore exist which were not detected given the limited nature of the assessment WSP was retained to undertake with respect to the Site and additional environmental studies and actions may be required. In addition, it is recognized that the passage of time affects the information provided in the Report. WSP’s opinions are based upon information that existed at the time of the writing of the Report. It is understood that the services provided for in the scope of work allowed WSP to form no more than an opinion of the actual conditions at the Site at the time the Site was visited, and cannot be used to assess the effect of any subsequent changes in any laws, regulations, the environmental quality of the Site or its surroundings. If a service is not expressly indicated, do not assume it has been provided.

The results of an assessment of this nature should in no way be construed as a warranty that the Site is free from any and all contamination from past or current practices.

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APPENDICES

1.0 INTRODUCTION

WSP Canada Inc. (WSP; formerly Golder Associates Ltd. [Golder]) was retained by Defence Construction Canada (DCC) on behalf of the Department of National Defence (DND) to complete a Human Health and Ecological Risk Assessment (HHERA) for the Former Burgeo Range in Burgeo, Newfoundland.

DND leased Crown lands from the Government of Newfoundland and Labrador (NL) for use by the 5th Canadian Ranger Patrol Group (5CRPG) in 2008, herein referred to as the "Site". However, the activities associated with the Former Burgeo Range took place on lands directly south of the Site, herein referred to as the "Additional Proposed Leased Lands" or "Firing Area". The Firing Area can be generally described as the immediate vicinity around the firing points and bullet catches used to fire shotguns. The Site and the Additional Proposed Leased Lands/Firing Area are identified on Figure 1.

The DND is responsible for the Site and the Additional Proposed Leased Lands. Use of the Site and the Additional Proposed Leased Lands was discontinued by 5CRPG in approximately 2010. DND was contacted by the Province of NL (Water Resources Division) when it became apparent that the Site encroached on the provincially protected watershed that forms part of the Town of Burgeo's municipal water supply (as shown on Figure 1). It is DND's intent to decommission the Site and the Additional Proposed Leased Lands and obtain closure from the Province of NL, if required.

As shown on Figure 1, the Site includes two distinct areas identified as Location 1 and Location 2. The Firing Area (or Additional Proposed Leased Lands) are adjacent to Location 1. Location 1 has been divided into three zones based on the expected level of risk from former/current activities associated with the Firing Area – high (Zone 1), medium (Zone 2), and low (Zone 3). Therefore, the lands evaluated as part of the HHERA include the Firing Area and Zone 1, herein referred to as the "RA Property". There are several locations associated with the Firing Area that have been assessed as part of previous environmental investigations, including the 5CRPG target practice shooting location/firing point, the local residents' clay target shooting area/firing point, the backstop/bullet catch, the former wooden targets used by local residents, and the set-up for local residents to shoot across a waterbody.

The HHERA was completed in accordance with the scope of work outlined in the report "Preliminary Remedial and Risk Management Strategy," dated March 2022 (Golder, 2022). The HHERA was completed to support the Remedial and Risk Management Strategy for the Site and the Additional Proposed Leased Lands as per the Contaminated Site Management Working Group's Federal Approach to Contaminated Sites (FACS).

Environmental assessment work completed at the RA Property (*i.e.,* Firing Area and Location 1 – Zone 1) from 2020 to 2022 indicate soil, groundwater, sediment and/or surface water impacts for various metals and polycyclic aromatic hydrocarbons (PAHs) in comparison to applicable environmental quality criteria and natural background (WSP, 2023). The main contaminant of concern (COC) is lead based on the previous site activities and high localized concentrations around the backstop and wooden targets. Based on the distance to the Firing Area and low metal concentrations, the remaining areas of the Site (*i.e.,* Location 1 - Zone 2 and 3 and the western portion of Location 2) were considered to represent natural background conditions.

The overall objective for the RA Property is to address contamination to support DND in receiving regulatory closure of the RA Property from Government of NL (provincial regulator).

1.1 Remedial and Risk Management Strategy

The extent of impacted media is widespread across the RA Property. The identified impacts in soil, surface water, and sediment were found up to 1.2 km from the firing points. Given the widespread contamination, significant investigative effort would be required to delineate impacts and a full-scale remediation of impacts to meet applicable criteria would be a large and unsustainable undertaking (>$50M effort, ecosystem/habitat destruction, *etc.*).

Metals and PAH exceedances found in impacted media, outside of the immediate vicinity of the Firing Area, marginally exceed the applicable criteria. In addition, it appears as though impacts in soil are localized and heterogenous, as opposed to being found in consistent concentrations across wider areas.

Based on the above factors, full-scale remediation is not practical or cost-effective. Therefore, to achieve site closure the following was recommended (WSP, 2023):

- Remediation of soil around the backstop/bullet catch and wooden targets (found to contain hazardous concentrations of leachable lead) within the Firing Area through source removal. These areas have been horizontally and vertically delineated.
- Remediation of surface water and sediment in Pond 1 and 2 located adjacent to the backstop/bullet catch (found to have lead concentrations over 5 times higher than anywhere else on the RA Property).
- Risk management of the remaining areas of the RA Property.

1.2 Risk Assessment Objectives

To support the Remedial and Risk Management Strategy for the RA Property (Section 1.1), the objectives of the HHERA are to:

- Assess the potential for health risks to human and ecological receptors which may be exposed to COCs in soil, groundwater, sediment, and surface water on the RA Property (outside of the proposed remedial areas) based on the current land use as a firing range and future land use as Crown land.
- Identify risk management measures (RMMs) to mitigate unacceptable levels of risk identified by the HHERA, if necessary.

1.3 Risk Assessment Framework

Potential risks to human health and the environment associated with the contaminant impacts at the RA Property were evaluated using the federal risk assessment framework endorsed by Federal Contaminated Sites Action Plan (FCSAP), Canadian Council of Ministers of the Environment (CCME), and Health Canada. For there to be a potential risk, the following three conditions must be met:

- A contaminant must be present at a concentration that could be harmful (*i.e.,* a contaminant of concern; COC).
- People, plants, invertebrates, wildlife, or aquatic life (*i.e.,* a receptor) must be present.
- There must be a way by which the receptor can contact the contaminant (*i.e.,* an exposure pathway).

To determine whether these conditions are present, the framework for both human health risk assessment (HHRA) and ecological risk assessment (ERA) typically involves the following four components:

- Problem Formulation – The problem formulation identifies the COCs, human and ecological receptors, and pathways by which exposure may occur. The information from the problem formulation is summarized in a conceptual site model (CSM) which illustrates the sources of COCs, the pathways of exposure, and the receptors that are evaluated in the HHERA.
- Exposure Assessment – The exposure assessment quantifies or categorizes the degree to which a receptor is exposed to a COC for each relevant exposure pathway identified in the problem formulation.
- Effects/Toxicity Assessment – The effects or toxicity assessment provides the basis for assessing what is an acceptable exposure and what level of exposure may adversely affect receptors (expressed as a toxicity reference value [TRV] or a toxicological benchmark). For an ERA, potential effects can also be characterized based on site-specific toxicity and biological assessments.
- Risk Characterization – The final component of the HHERA compares the results of the exposure and toxicity assessments and determines whether there is a potential for COCs to pose a risk to human and ecological receptors. The characterization of risks includes consideration of the uncertainty and conservatism in the HHERA.

A description of the RA Property, including a summary of all site characteristics, previous environmental investigations, and identification of COCs that are pertinent to the understanding and assessment of potential exposures is provided in Section 2.0. The identified COCs are further evaluated for their potential for site-specific human health and ecological risk in Section 3.0 (HHRA) and Section 4.0 (ERA). Finally, the conclusions and recommendations of the HHERA, including identification of appropriate RMMs to mitigate unacceptable levels of risk, is provided in Section 5.0.

1.4 Applicable Environmental Quality Criteria

Environmental quality criteria from all applicable federal and regional jurisdictions were considered for identifying COCs for the HHERA, including:

- Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier I Environmental Quality Standards (EQS_{HH}) and Ecological Tier I Environmental Quality Standards (EQS_{ECO}) (2022)
- CCME Soil Quality Guidelines for the Protection of Environmental and Human Health (SQG) (1999a/2023)
- CCME Canadian Wide Standards for Petroleum Hydrocarbons in Soil (CWS) (2008a)
- CCME Sediment Quality Guidelines for the Protection of Aquatic Life (SeQG) (1999b/2023)
- CCME Water Quality Guidelines for the Protection of Aquatic Life (WQG) (1999c/2023)
- FCSAP Federal Interim Groundwater Quality Guidelines (FIGQG) (2016)

Criteria associated with agricultural land use, non-potable groundwater, and coarse-grained soil are applicable to the RA Property based on:

- The RA Property's remote and naturalized areas with future use as Crown Land once it is returned to the Province of NL. Federal guidance considers agricultural land use criteria appropriate for natural or environmentally sensitive land uses (CCME, 2006).
- No potable wells being found in the vicinity of the RA Property.

- The RA Property's geology of mostly silt to silty sand, with criteria for coarse-grained soil being the most conservative.

As the waterbodies on the RA Property may have hydraulic connection to the provincially protected watershed that forms part of the Town of Burgeo's municipal water supply, drinking water quality guidelines protective of human health were also considered, including the *Guidelines for Drinking Water Quality in Newfoundland & Labrador* (2020) and the *Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ)* (2020).

2.0 SITE CHARACTERIZATION

2.1 Site History and Use

The Site was initially Crown lands and was leased to DND from the Government of NL in 2008 for use as a small arms rifle range by the 5CRPG. However, the activities associated with the Former Burgeo Range took place on lands directly south of the Site (the "Additional Proposed Leased Lands" or "Firing Area"). Use of the Firing Area was discontinued by 5CRPG in approximately 2010. The main features associated with the Former Burgeo Range are shown on Figure 1.

The former 5CRPG's main firing range (or the Firing Area) is located at the end of a gravel entrance road off of the highway, adjacent to Location 1. Location 1 has been divided into three zones based on the expected level of risk from former/current activities associated with the Firing Area – high (Zone 1), medium (Zone 2), and low (Zone 3). Therefore, the lands evaluated as part of the HHERA include the Firing Area and Zone 1, herein referred to as the "RA Property". There are several locations associated with the Firing Area that have been assessed as part of previous environmental investigations, including the 5CRPG target practice shooting location/firing point, the local residents' clay target shooting area/firing point, the backstop/bullet catch, the former wooden targets used by local residents, and the set-up for local residents to shoot across a waterbody.

A second location (Location 2), near Location 1 but across the road to the north and west, was also used as a firing range by 5CRPG. This range was originally put in place by the Local Wildlife Office and 5CRPG planned to use a portion of this range. Location 2 does not have an access road. It was previously accessed directly off the highway, through a small parking lot, however, a ditch was constructed between the highway and parking lot that blocked off vehicle access to Location 2.

Historical information about previous site activities has been limited to anecdotal correspondence between 5CRPG and the Real Property Operations Detachment (Gander) and community members from the Town of Burgeo. It has been indicated that the Site and the Additional Proposed Leased Lands/Firing Area was used by community members as an informal firing range even prior to the 2000s, when it was leased by DND. Also, at the time of this report, the Firing Area was still being used by local hunters and community members from the Town of Burgeo as a target practice area even though 'No Trespassing' and 'Range Closed' signs have been installed in this area.

There is limited infrastructure on the RA Property besides the access road that leads to the Firing Area and there are no engineered controls.

2.2 Natural Setting

Most of the RA Property consists of vacant tundra-type landscape that is vegetated with grasses, shrubs, and small trees. Bedrock outcrops makeup a large portion of the area. A number of ponds/lakes and wetland areas (primarily bogs and fens) are located throughout the RA Property.

2.3 Geology

Based on area mapping, the regional surficial geology is expected to be predominantly exposed bedrock with little or no soil or vegetation cover and with rare patches of till and other surficial soil types. The regional bedrock geology consists of weakly foliated to massive, coarse grained, variably K-feldspar porphyritic, biotite granite and adamellite (Gander Zone, Burgeo Granite) (WSP, 2023).

Based on observations made during intrusive field programs, the surficial geology at the RA Property consisted of dark brown silt to sand, with significant covering of silty peat and bog. Soil depth varied highly from non-existent (bedrock outcrops) to 2.4 metres below ground surface (mbgs) (WSP, 2023).

2.4 Hydrogeology & Hydrology

Non-potable groundwater conditions are applicable as no potable wells are in the vicinity of the RA Property; however, surface water bodies on the RA Property (such as Ponds 1, 2 and 3) are hydraulically connected (through a series of creeks and ponds) to Long Pond, located approximately 1.2 km to the south (Figure 1). Long Pond is the water supply for the Town of Burgeo. Based on topography and site observations, surface water is generally inferred to flow from north to south across the RA Property.

Bedrock groundwater (monitoring wells GW1, GW2, GW3) varied in depth from 1.51 mbgs to 5.82 mbgs. Overburden groundwater (in monitoring well GW4, in the low-lying area adjacent to Pond 1, in the peat bog material) was 1.17 mbgs.

A hydraulic conductivity (rising head) test was conducted at monitoring well GW4 on September 12, 2022. The test consisted of rapidly purging the monitoring well dry and monitoring recharge. The horizontal hydraulic conductivity was determined to be 9.2×10^{-9} m/s.

2.5 Previous Environmental Investigations

Environmental assessment work has been completed at the RA Property (*i.e.,* Firing Area and Location 1 – Zone 1) and at the remaining areas of the Site (*i.e.,* Location 1 - Zone 2 and 3 and Location 2) (Golder, 2021 and WSP, 2023). General findings indicated soil, groundwater, sediment and/or surface water impacts for various metals and/or PAHs in comparison to applicable environmental quality criteria (Section 1.4) and natural background. The results from previous investigations are summarized below.

2.5.1 Golder 2021 Report of Steps 1 to 4 of FACS

The Golder (2021) report entitled “Steps 1 to 4 of the Federal Approach to Contaminated Sites at the Former Burgeo Range, NL” provided an initial testing program, which was primarily focused on the RA Property where firing range activities were known to occur (*i.e.,* Firing Area and Location 1 – Zone 1). Some samples were also collected from Location 1 - Zone 2 and 3 (considered to represent natural background). Based on the findings of the analytical program, the following conclusions were made:

- Petroleum hydrocarbon (PHC) exceedances were identified in soil and sediment. However, additional analyses conducted by the laboratory indicated that these exceedances did not resemble any petroleum products and appeared to be of natural and organic origin.
- Several elevated concentrations of metals were identified in soil, sediment, and surface water, but many were considered naturally occurring due to elevated background concentrations. The concentrations of selenium and cadmium in soil were fairly consistent across both the RA Property and the remaining areas of the Site not

influenced by the Firing Area (i.e., Zone 2 and 3), with some of the higher concentrations located in Zone 3. The concentrations of aluminum and iron in surface water were also fairly consistent across the RA Property and the remaining areas of the Site.

- The presence of lead, tin, and zinc in soil, lead in sediment, and lead and copper in surface water were attributed to bullets and casings from firing activities. These impacts were only found on the RA Property.
- Lead and iron concentrations in surface water above criteria were present in the pond adjacent to the Firing Area (Pond 3), which discharges south towards Long Pond (a drinking water source for the Town of Burgeo).
  - Elevated iron concentrations are noted in the source water database for Long Pond from the Water Resources Management Division (WRMD) Newfoundland and Labrador Water Resources Portal (collected from 1998 to 2018) suggesting iron is associated with background concentrations in the region.
  - Lead concentrations in the Long Pond source water data have been below the Health Canada drinking water guidelines; therefore, lead impacts are associated with site activities.
- Data gaps were identified with regards to site-specific background concentrations, potential leachate from soil to groundwater, and delineation of localized metals contamination in soil, sediment, and surface water. As such, additional assessment was recommended, including collection of soil samples to laterally delineate the identified impacts and installing monitoring wells to evaluate potential leaching into groundwater. Additional soil, sediment, and surface water samples to establish site-specific background concentrations was also recommended. A species at risk public registry search was recommended to be completed to confirm if species at risk (SAR) are documented on or near the RA Property and to identify if the RA Property is considered critical habitat. It was noted that mitigation measures may involve remediation and risk assessment.

2.5.2 WSP 2023 Report of Steps 5 to 7 of the FACS

The WSP (2023) report entitled “Steps 5 to 7 of the Federal Approach to Contaminated Sites at the Former Burgeo Range, NL”, provided an extended testing program for the RA Property that was completed in 2021 and 2022 to delineate the extent of impacts and to better characterize natural background concentrations. It also included an initial assessment at Location 2.

- Based on the findings of the analytical program for **soil**, the following conclusions were made:
  - PHC and PAH concentrations were below the applicable criteria in all soil samples analyzed
  - Exceedances of boron, cadmium, iron, and selenium were found across the RA Property and in site-specific background samples. Concentrations of these metals on the RA Property were generally within the background range. It did not appear that any of these metals showed a correlation with other elevated COCs (*e.g.,* lead) in the Firing Area. As such, exceedances of boron, cadmium, iron, and selenium were inferred to be due to naturally elevated background concentrations
  - Antimony, aluminum, copper, lead, manganese, tin, and zinc exceeded the applicable criteria. The exceedances of these metals were found in Location 1 – Zone 1, with the majority found in the Firing Area.
    - Given their elevated presence in the Firing Area (including the backstops), exceedances of antimony, copper, lead, and zinc are considered to have resulted from firing activities.

- Exceedances of lead outside of the Firing Area (BFR_SS12 and BFR_SS13) may be due to wind deposition of particulate/contaminants from the Firing Area downwind, however, this is not confirmed. Given the distance from the Firing Area, it is possible that firing activity not related to the DND firing range, or other sources (including naturally occurring metals, hunting, *etc.*), may be the source of these exceedances.
- Exceedances of aluminum and manganese are not likely to be associated with firing practices, as they were not found in the backstops; however, they are likely due to human activity in the Firing Area as they were above background concentrations.
- Numerous exceedances of tin and vanadium are found across the RA Property. Concentrations of tin and vanadium are not elevated in the firing backstops or firing points, and are found at roughly the same magnitude. Therefore, it is inferred that tin and vanadium are not likely elevated due to firing activities. The exact source of elevated tin and vanadium is unknown, however may be due to naturally elevated tin and vanadium in the immediate area.
- Two composite samples were collected from the firing backstop to evaluate if the backstop material was considered hazardous (using TCLP results) and if the backstop contained elevated concentrations of propellants. The leachable lead was reported at 283 mg/L and 57.7 mg/L in the two samples, which exceeded the Ontario Reg. 347 Schedule 4[1] standard of 5 mg/L (applied in absence of NL or Atlantic RBCA criteria). The propellant analysis was compared to the Soils Concentrations for Ensuring Military Training Sustainability (SCMTSE) and British Columbia (BC) standards. There were no exceedances of propellants identified.

- Based on the findings of the analytical program for **sediment**, the following conclusions were made:
  - PHC/modified Total Petroleum Hydrocarbon (mTPH) exceedances did not resemble any petroleum products and appeared to be of natural and organic origin.
  - PAH exceedances were identified and it is possible that the source is related to historical activities that occurred at the DND firing range.
  - Chromium, selenium, cadmium, mercury, and iron were found to exceed the applicable criteria; however, the exceedances were marginal (less than 2 times the criteria) and the elevated concentrations were not correlated with lead concentrations. These exceedances were considered to be associated with natural background concentrations and not associated with historical activities.
  - Arsenic and lead exceedances were found in samples collected from waterbodies in the vicinity of the Firing Area and in Location 2. These are considered to have likely resulted from firing activities. The source of the metals exceedances in areas outside the immediate vicinity of the Firing Area may be related to firing area activity (e.g., due to wind deposition of particulate/contaminants downwind), however this cannot be confirmed. Given the distance from the Firing Area, it is also possible that firing activity not related to the DND firing range, or other sources (*e.g.,* locally naturally occurring metals or hunting by local residents) may be the cause of impact

[1] R.R.O. 1990, Reg. 347: GENERAL - WASTE MANAGEMENT under Environmental Protection Act, R.S.O. 1990, c. E.19

- Based on the findings of the analytical program for **surface water**, the following conclusions were made:
  - PHC and PAH concentrations were below the applicable criteria in all surface water samples analyzed.
  - Aluminum, iron, zinc, and mercury were found to exceed the applicable criteria; however, the elevated concentrations were attributed to natural background.
  - Lead and copper exceedances in the Firing Area and to the south of the Firing Area (inferred to be hydraulically downgradient) are considered to have resulted from firing activities. The exceedance of lead farthest away from the Firing Area was found at BFR_L1_SW45 (approximately 800 m away) and may be due to wind deposition of particulate/contaminants downwind, however this cannot be confirmed. Given the distance from the Firing Area, it is possible that firing activity unrelated to the DND firing range or other sources (including naturally occurring metals, hunting, *etc.*) may be the source of this exceedance.
  - The exceedance of lead at Location 2, collected from a waterbody between the firing spot and bullet catch, is considered to have resulted from firing activities associated with the former DND firing range.
- Based on the findings of the analytical program for **groundwater**, the following conclusions were made:
  - PHC, volatile organic carbon (VOC), and PAH concentrations in all groundwater samples analyzed were below the applicable criteria, with most below the reported detection limit (RDL).
  - Aluminum, copper, iron, zinc, cadmium, cobalt, lead, manganese, and zinc exceeded the applicable criteria. Monitoring well, GW4, was installed directly within the silty peat bog, adjacent to Pond 1. This monitoring well was screened within the overburden, which held perched water atop the bedrock. Metals impacts (including lead and copper) were identified here and are considered to have resulted from firing activities.
- It was recommended that elevated concentrations of hazardous and leachable lead in soil, around the backstop and wooden targets of the Firing Area, be remediated through source removal. Lateral and vertical delineation of these areas was achieved. It was also recommended to remediate sediment and surface water in Pond 1 and 2 adjacent to these areas that had lead concentrations up to 770 mg/kg. The remaining impacts in soil, sediment, surface water, and groundwater were recommended to be addressed through a HHERA.

2.6 Contaminants of Concern

A preliminary chemical screening of soil, groundwater, sediment, and surface water data was used to identify COCs on the RA Property that required further evaluation in the HHERA. The data sets were based on the previous environmental assessments summarized in Section 2.5 (WSP, 2023). Figure 2 to 11 summarizes the soil, groundwater, sediment, and surface water sampling locations and analytical results.

As discussed in Section 1.1, the HHERA focused on evaluating the potential risk with COCs located outside of the proposed remedial areas identified in Figure 2C that had hazardous and leachable lead concentrations. Surface water and sediment data from Pond 1 and 2, adjacent to the backstop, was also not considered further as remediation is proposed for these waterbodies. The datasets relied upon in the HHERA are provided in Appendix A and include analysis of metals, PAHs, PHCs, and benzene, toluene, ethylbenzene, and xylene (BTEX) in soil, groundwater, sediment, and surface water.

Samples representative of natural background were also collected as follows:

- Soil: samples from Location 1 - Zone 2 and 3 and the western portion of Location 2 - SS12 to SS16
- Sediment and surface water: samples from Location 1 - Zone 2 and 3 and the western portion of Location 2 - SW1, SW2, SW10

The range of site-specific background concentrations are presented in Appendix A. No background concentrations were collected for groundwater.

The HHERA did not consider data collected from the eastern portion of Location 2 related to former firing activities, including isolated occurrences of PAHs, lead, and arsenic in sediment, and lead in surface water. The concentrations of these parameters were less than those identified on the RA Property, therefore, the results and conclusions for the RA Property will address any potential risk from elevated COC concentrations at Location 2.

For the identification of COCs, environmental quality criteria associated with agricultural land use, non-potable groundwater, and coarse-grained soil are applicable to the RA Property (Section 1.4). Both federal and regional criteria from CCME, FCSAP, Atlantic RBCA, Health Canada, and NL were considered (collectively referred to as "screening values"). Maximum concentrations of chemicals were compared to their respective screening values, where the following approach was used to identify COCs:

- If the maximum concentration exceeded its screening values, the chemical was further evaluated to determine if it was associated with site activities or if it was related to natural background. If the chemical was determined to be related to firing range activities, it was retained as a COC.
- If the maximum concentration was below its screening values, the chemical was not retained as a COC.
- If there was no screening value and the parameter was detected on the RA Property, the chemical was evaluated on a case-by case basis to determine if it should be retained as a COC.
- If there was no screening value and the parameter was not detected on the RA Property, the chemical was retained as a COC.

The identification of COCs to be assessed in the HHERA is discussed below for each environmental media.

2.6.1 Soil

For parameters in soil, the Atlantic RBCA Tier 1 EQS_{HH} / EQS_{ECO} (2022) , the CCME SQGs (1999a/2023), and the CCME CWS for PHCs (2008a) were applied as screening values. Criteria for agricultural land use, coarse soil, and non-potable groundwater were considered. Where applicable, guidelines based on an incremental lifetime cancer risk (ILCR) of 10^{-5} for human receptors were selected as this risk level is acceptable for receptors on federal properties (Health Canada, 2021a).

2.6.1.1 Metals

Appendix A - Table 1 presents the screening results for metals in soil. A summary of the metal parameters above screening values and the identified COCs retained for further assessment in the HHRA and ERA is provided in Table 1 below.

Concentrations of aluminium, boron, cadmium, iron, lead, manganese, selenium, tin, and vanadium on the RA Property exceeded the applicable screening values. However, only aluminium, lead, manganese, tin, and vanadium were retained as COCs.

The concentrations measured for cadmium and iron were within the range of site-specific background concentrations; therefore, they were not retained as COCs.

Exceedances of boron and selenium were found throughout the RA Property and background samples. The exceedances were also not correlated with exceedances of lead, a COC known to be associated with site-activities. Further, the average concentrations of these parameters on the RA Property were not statistically different from the average concentration found within the background samples. [2] Therefore, boron and selenium were not retained as COCs.

Table 1: Summary of Metal Parameters above Screening Values and Identified COCs - Soil

Parameters Above Screening Values (1)	Screening Value Exceedance (1)			Concentrations within Background Range	Identified as a COC for HHRA? (2)	Identified as a COC for ERA? (3)
	Atlantic RBCA EQS_{HH}	Atlantic RBCA EQS_{ECO}	CCME SQG HH and ECO			
Aluminium	√				**Yes**	No
Boron			√	√(4)	No	No
Cadmium	√		√	√	No	No
Iron	√			√	No	No
Lead		√	√		**Yes**	**Yes**
Manganese	√				**Yes**	**Yes**(5)
Selenium		√	√	√(4)	No	No
Tin		√	√		**Yes**	**Yes**
Vanadium	√	√			**Yes**	**Yes**

Notes:

(1) Refer to Table 1 in Appendix A for detailed screening of maximum and sample-specific metal concentrations on the RA Property against the applicable screening values and background range

(2) Identified as a COC for the HHRA if maximum measured concentration exceeded the Atlantic RBCA EQS_{HH} or CCME SQGs and the background range

(3) Identified as a COC for the ERA if maximum measured concentration exceeded the Atlantic RBCA EQS_{Eco} or CCME SQGs and the background range

(4) Considered naturally occurring as on-site versus background concentrations were not statistically different (see text for further discussion).

(5) Manganese was also identified as a COC for the ERA in absence of ecological criteria

2.6.1.2 PAHs

Appendix A - Table 2 presents the screening results for PAHs in soil. For PAHs, the CCME (2010) presents soil quality guidelines protective of ecological receptors (SQG_E) for several PAHs, and a single human health soil quality guideline (SQG_{HH}) protective of carcinogenic PAHs via direct contact pathways that is expressed as the benzo[a]pyrene total potency equivalent (B[a]P TPE). The B[a]P TPE is the sum of the estimated cancer potency relative to B[a]P for carcinogenic PAHs. The B[a]P TPE for a soil sample is calculated by multiplying the concentration of each of these PAHs in the sample by its B[a]P potency equivalence factor (PEF) and summing these products on the basis that the PAHs have similar modes of toxic action but different potencies. The PEFs are

[2] Based on two-sample hypothesis testing for non-parametric populations (i.e., Wilcoxon Mann-Whitney test) using ProUCL (US EPA, 2022). For concentrations based on a reported detection limit (RDL), ½ the detection limit was considered. For duplicate samples, only the highest concentration was considered.

order of magnitude estimates of carcinogenic potency relative to benzo(a)pyrene outlined in the CCME (2010) factsheet on PAH guidelines. CCME provides PEFs for benz[a]anthracene, benzo[b/j]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene. Therefore, these PAHs were assessed for only carcinogenic effects for human health through the B[a]P TPE.

All PAH parameters were below the screening values; therefore, PAHs were not identified as COCs in soil.

2.6.1.3 PHCs/BTEX

Appendix A - Table 3 presents the screening results for PHCs/BTEX, including mTPH, in soil. All BTEX parameters were below the RDLs. PHC/mTPH exceedances were identified in soil. However, additional analyses conducted by the laboratory to remove biogenic organics (i.e., silica gel clean-up) indicated that these exceedances did not resemble any petroleum products and appeared to be of natural and organic origin (WSP, 2023). Therefore, PHCs/mTPH were not identified as COCs in soil.

2.6.2 Groundwater

For parameters in groundwater, the Atlantic RBCA Tier 1 EQS_{ECO} (discharge to fresh water, <10m from surface water) (2022) and the FCSAP Tier 1 FIGQGs (agricultural land use, coarse soil) (2016) were applied as screening values.

2.6.2.1 Metals and Inorganics

Appendix A - Table 5 presents the screening results for metals in groundwater. A summary of the metal parameters above screening values and the identified COCs retained for further assessment in the ERA is provided in Table 2 below. As groundwater at the RA Property is non-potable, no COCs were retained for the HHRA.

Concentrations of aluminium, cadmium, cobalt, copper, iron, lead, manganese, and zinc on the RA Property exceeded the applicable screening values. However, only aluminium, copper, lead, manganese, tin, and zinc were retained as COCs in groundwater.

The highest concentrations of iron were found in the shallowest monitoring well screened into bog (peat) material (GW4). The anoxic condition of peat reduces iron into more soluble forms as Fe(II). The deepest groundwater monitoring wells screened into bedrock had the lowest iron concentrations, likely because of the more oxidizing conditions as compared to the peat material. Iron was also considered naturally occurring in soil. Therefore, iron in groundwater is also considered naturally occurring and is not retained as a COC.

The elevated cadmium, cobalt, and manganese concentrations are not co-located with any elevated lead concentrations, a COC known to be associated with site-activities. The only lead exceedance was at GW4, the shallowest monitoring well screened into overburden, and cadmium and cobalt concentrations were below the RDL at this location and manganese had the lowest concentration at this location. The only cadmium, cobalt, and manganese exceedances were found in bedrock monitoring wells where lead was below the RDL. Therefore, cadmium, cobalt, and manganese in groundwater are considered naturally occurring and are not retained as COCs.

Table 2: Summary of Metal Parameters above Screening Values and Identified COCs - Groundwater

Parameters Above Screening Values (1)	Screening Value Exceedance		Identified as a COC for HHRA?	Identified as a COC for ERA? (2)
	Atlantic RBCA EQS$_{ECO}$	FCSAP FIGQG		
Aluminium	√	√	Not applicable, GW is non-potable	**Yes**
Cadmium	√	√		No [3]
Cobalt	√			No [3]
Copper	√	√		**Yes**
Iron	√	√		No [3]
Lead	√	√		**Yes**
Manganese		√		No [3]
Zinc	√			**Yes**

Notes:

(1) Refer to Table 5 in Appendix A for detailed screening of maximum and sample-specific metal concentrations on the RA Property against the applicable screening values and background range

(2) Identified as a COC for the ERA if the maximum measured concentration exceeded the Atlantic RBCA EQS or CCME WQGs and was related to site-activities

(3) Elevated concentrations are considered naturally occurring (refer to text for details)

Appendix A - Table 4 presents the screening results for inorganics in groundwater. These parameters are not associated with site activities, rather, they provide information on the physical/chemical parameters that influence the environmental fate and toxicity of the COCs. The low levels of pH were determined to be naturally occurring because of the acidic, bog conditions found on the RA Property.

2.6.2.2 PAHs

Appendix A - Table 6 presents the screening results for PAHs in groundwater. All PAH parameters were below the RDLs and therefore were not identified as COCs.

2.6.2.3 PHCs/BTEX

Appendix A - Table 7 presents the screening results for PHCs/BTEX in groundwater. All PHC and BTEX parameters were below the RDLs and therefore were not identified as COCs.

2.6.3 Sediment

For parameters in sediment, the Atlantic RBCA Tier 1 EQS$_{ECO}$ (2022) and the CCME SeQGs (1999b/2023) were applied as screening values. Criteria specific to freshwater were considered. The CCME guidelines are divided into interim sediment quality guidelines (ISQGs) and probable effect levels (PELs). The ISQGs and PELs represent the lower and upper range of sediment concentrations associated with adverse biological effects.

2.6.3.1 Metals

Appendix A - Table 9 presents the screening results for metals in sediment. A summary of the metal parameters above screening values and the identified COCs retained for further assessment in the HHRA and ERA is provided in Table 3 below.

Concentrations of arsenic, cadmium, chromium, iron, lead, mercury, and selenium on the RA Property exceeded the applicable screening values. However, only arsenic and lead were retained as COCs.

The concentrations measured for chromium were within the range of site-specific background concentrations; therefore, chromium was not retained as a COC.

Cadmium and mercury exceeded the CCME ISQG, but not the Atlantic RBCA EQS or the CCME PELs (which were adopted by Atlantic RBCA). The elevated concentrations of cadmium and mercury are marginal, 1.7 to 1.8 times higher than the ISQG. The exceedances are also not correlated with exceedances of lead, a COC known to be associated with site activities. For example, the highest concentrations of lead in sediment were within the samples proposed for remediation (250 to 770 m/kg of lead; reported in WSP 2023) and cadmium concentrations within these samples were below RDLs (<0.3 mg/kg). Further, the sediment concentrations of cadmium and mercury measured on the RA Property are within the range of soil concentrations measured on the RA Property, which were associated with natural background. Therefore, cadmium and mercury in sediment are also considered naturally occurring and were not retained as COCs.

Selenium exceeded the Atlantic RBCA EQS (there are no CCME guidelines for selenium) across the RA Property and background locations. The elevated concentrations of selenium are marginal, 3.5 times higher than the EQS. The exceedances are also not correlated with exceedances of lead, a COC known to be associated with site activities. Further, the sediment concentrations measured on the RA Property are within the range of soil concentrations measured on the RA Property, which were associated with natural background. Therefore, selenium in sediment is also considered naturally occurring and was not retained as a COC.

Iron exceeded the Atlantic RBCA EQS (there are no CCME guidelines for iron). The elevated concentrations of iron are marginal, 1.7 times higher than the EQS and the maximum background concentration. Only one sediment sample exceeded the EQS and the maximum background concentration across the RA Property. The highest iron concentrations in sediment are also not corelated to the highest lead concentrations, a COC known to be associated with site activities. Instead, it likely that elevated iron concentrations (measured as an acid extractable form) are correlated with anoxic environments, where iron is reduced to more soluble forms as Fe(II) under low oxygen conditions. The iron exceedance in sediment (73,600 mg/kg at sample SED30) was collected from a boat in the middle of a large pond, whereas the sample collected along the shoreline from the same pond was much lower (17,200 mg/kg at sample SED 31). The higher iron concentrations found within the middle of the pond is likely because it is deeper and more suspectable to anoxic conditions. It is also noted that the only exceedance for iron was from the deepest sample collected as part of the environmental assessments. Elevated iron concentrations in soil were also associated with natural background. Therefore, iron in sediment is also considered naturally occurring and was not retained as a COC.

Table 3: Summary of Metal Parameters above Screening Values and Identified COCs - Sediment

Parameters Above Screening Values [1]	Screening Value Exceedance			Concentrations within Background Range	Identified as a COC for HHRA? [2]	Identified as a COC for ERA? [2]
	Atlantic RBCA EQS	CCME ISQG	CCME PEL			
Arsenic	√	√	√		**Yes**	**Yes**
Cadmium		√		√[3]	No	No
Chromium		√		√	No	No
Iron	√			√[4]	No	No
Lead	√	√	√		**Yes**	**Yes**
Mercury		√		√[3]	No	No
Selenium	√			√[3]	No	No

Notes:

(1) Refer to Table 9 in Appendix A for detailed screening of maximum and sample-specific metal concentrations on the RA Property against the applicable screening values and background range

(2) Identified as a COC for the HHRA and ERA if the maximum measured concentration exceeded the Atlantic RBCA EQS or CCME ISQGs and the background range

(3) Considered naturally occurring as on-site concentrations are not correlated with lead concentrations and are within the natural background range of soil (see text for further details)

(4) Considered naturally occurring as on-site concentrations are not correlated with lead concentrations and exceedances are associated with anoxic conditions (see text for further details)

As presented in Appendix A – Table 9, there were several metal parameters without screening values that were detected on the RA Property above the site-specific background range. Each of these were evaluated on a case-by-case basis to determine if they are considered COCs:

- Boron and Strontium: The maximum measured concentration in sediment is comparable to soil, which was established to be associated with natural background. Therefore, these parameters are also considered naturally occurring in sediment.
- Thallium, Tin, Uranium, and Vanadium: The maximum measured concentration in sediment is within 30% of the maximum measured concentration of background samples. This is within the acceptable range of analytical and field variability (CCME, 2016). Therefore, these parameters are considered naturally occurring in sediment.

2.6.3.2 PAHs

Appendix A - Table 10 presents the screening results for PAHs in sediment. Chrysene, fluoranthene, and pyrene exceeded the CCME ISGGs, but not the Atlantic RBCA EQSs or the CCME PELs (which were adopted by Atlantic RBCA). The elevated concentration of PAHs is marginal with chrysene 2 times higher than the ISQG and exceedances in 2 out of 52 analysed samples, fluoranthene 1.4 times higher than the ISQG and exceedances in 1 out of 52 samples, and pyrene 2 times higher than the ISQG and exceedances in 3 out of 52 analysed samples. The concentration of PAHs found in sediment is also higher than in soil, indicating that anthropogenic activities associated with the RA Property are unlikely contributing to elevated sediment concentrations. It is likely that the elevated PAH concentrations are natural from primary or secondary by-products of plant and microbial metabolism (CCME, 2008b). The on-site waterbodies are generally characterized as having moderate to abundant aquatic vegetation with organic substrates (WSP, 2023). Therefore, the elevated PAH concentrations in sediment are considered naturally occurring and PAHs are not retained as COCs in sediment.

There were also elevated concentrations of perylene detected on the RA Property. Elevated perylene is common in sediment, and generally has greater abundance than other PAHs (Grice and Eiserbeck, 2014). It is considered a biomarker for fungi processes (Grice and Eiserbeck, 2014) and not retained as a COC in sediment.

2.6.3.3 PHCs/BTEX

Appendix A - Table 11 presents the screening results for PHCs/BTEX in sediment. All BTEX parameters were below the RDLs. mTPH exceeded the Atlantic RBCA EQSs for most samples collected on the RA Property, as well as the background samples. However, additional analyses conducted by the laboratory to remove biogenic organics (i.e., silica gel clean-up) indicated that these exceedances did not resemble any petroleum products and appeared to be of natural and organic origin (WSP, 2023). Therefore, PHCs/mTPH were not identified as COCs in sediment.

2.6.3.4 Surface Water

For parameters in surface water, the Atlantic RBCA Tier 1 EQS_{ECO} (2022) and the CCME WQGs (1999c/2023) for freshwater aquatic life were applied as screening values.

As the ponds on the RA Property may have hydraulic connection to the Town of Burgeo's water supply (*i.e.,* Long Pond), drinking water quality criteria protective of human health from NL (2020) and Health Canada (2020) were also considered. Where available, the maximum acceptable concentration (MAC) was used.

2.6.3.5 Metals and Inorganics

Appendix A - Table 13 presents the screening results for metals in surface water. A summary of the metal parameters above screening values and the identified COCs retained for further assessment in the HHRA and ERA is provided in Table 4, below.

Concentrations of aluminium, iron, lead, and mercury on the RA Property exceeded the applicable screening values. However, only lead was retained as a COC.

Aluminium and iron exceeded the screening values in most samples across the RA Property and background locations. Maximum aluminium concentrations on the RA Property were only 1.2 times higher than the maximum background concentrations. Maximum iron concentrations on the RA Property were 2 times higher than the maximum background concentrations; however, the iron exceedances identified are considered background concentrations for the region based on the source water data for Long Pond from the WRMD's Newfoundland and Labrador Water Resources Portal, where 14 out of 28 samples between 1988 and 2018 exceeded the CCME WQG for iron (WSP 2023). These parameters were also not identified as COCs in soil or sediment. Therefore, aluminium and iron in surface water is considered naturally occurring and were not retained as COCs.

Mercury exceeded the CCME WQG and Atlantic RBCA EQS across the RA Property and background locations. The elevated concentrations of mercury on the RA Property are marginal, 2 times higher than the WQG/EQS and 1.2 times higher than the maximum background concentration in surface water. The exceedances are also not correlated with exceedances of lead, a COC known to be associated with site activities. Elevated concentrations of mercury in soil were also associated with natural background. Therefore, mercury in surface water is considered naturally occurring and was not retained as a COC.

Table 4: Summary of Metal Parameters above Screening Values and Identified COCs – Surface Water

Parameters Above Screening Values (1)	Screening Value Exceedance				Concentrations within Background Range	Identified as a COC for HHRA? (2)	Identified as a COC for ERA? (3)
	Atlantic RBCA EQS	CCME WQG	Guidelines for DW Quality in NL	Health GCDWQ			
Aluminium	√	√			√(4)	No	No
Iron	√	√	√	√	√(4)	No	No
Lead	√	√				No	**Yes**
Mercury	√	√			√(4)	No	No

Notes:

(1) Refer to Table 13 in Appendix A for detailed screening of maximum and sample-specific metal concentrations on the RA Property against the applicable screening values and background range

(2) Identified as a COC for the HHRA if the maximum measured concentration exceeded the Guidelines for Drinking Water Quality in NL or the Health Canada GCDWQG and the background range

(3) Identified as a COC for the ERA if the maximum measured concentration exceeded the Atlantic RBCA EQS or CCME WQGs and the background range

(4) Maximum concentration is considered naturally occurring (see text for further discussion)

As presented in Appendix A – Table 13, there were metal parameters in surface water without screening values that were detected on the RA Property above the site-specific background range. Each of these were evaluated on a case-by-case basis to determine if they are considered COCs:

- Tin: one out of 55 samples on the RA Property was detected above the RDL (4 mg/L vs <2 mg/L). The detected concentration was not co-located with any other COC exceedances in surface water or sediment. Therefore, tin in surface water is considered naturally occurring.
- Titanium: the maximum measured concentration in surface water on the RA Property is within 30% of the maximum measured concentration of background samples. This is within the acceptable range of analytical and field variability (CCME, 2016). Therefore, titanium in surface water is considered naturally occurring.

Appendix A - Table 13 presents the chemical screening results for several inorganics in surface water. These parameters are not associated with the Firing Area activities, rather, they provide information on the physical/chemical parameters that influence the environmental fate and toxicity of the COCs. The low levels of pH were determined to be naturally occurring because of the acidic, bog conditions found on the RA Property.

2.6.3.6 PAHs

Appendix A - Table 14 presents the screening results for PAHs in surface water. All PAH parameters were below the RDLs, except for fluoranthene with a detected concentration that was below the screening values. Therefore, PAHs were not identified as COCs.

2.6.3.7 PHCs/BTEX

Appendix A - Table 15 presents the screening results for PHCs/BTEX in surface water. All PHC and BTEX parameters were below the RDLs and therefore were not identified as COCs.

2.6.4 Summary

A summary of the COCs retained for further assessment in the HHRA and ERA is provided below (Table 5).

Table 5: Summary of COCs for RA Property

Media	COCs for HHRA	COCs for ERA
Soil	Aluminium, Lead, Manganese, Tin Vanadium	Lead, Manganese, Tin, Vanadium
Groundwater	None	Aluminium, Copper, Lead, Zinc
Sediment	Arsenic, Lead	Arsenic, Lead
Surface Water	None	Lead

3.0 HUMAN HEALTH RISK ASSESSMENT

The purpose of the HHRA is to evaluate potential risks to human receptors under current conditions at the RA Property and foreseeable future conditions. The future use of the RA Property is Crown land. The HHRA was completed using an approach consistent with guidance from Health Canada provided in the document entitled *Federal Contaminated Site Assessment in Canada: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 3.0* (Health Canada, 2021a).

3.1 Problem Formulation

The first stage of the HHRA framework is problem formulation; the purpose of the problem formulation is to identify the potential human receptors that may use the RA Property, the pathways that may expose the human receptors to COCs (i.e., exposure pathways), and the COCs that are present at concentrations that may be harmful to human health. The potential for unacceptable risk is predicted on the coexistence of these three elements. Receptors must be present, there must be a way for receptors to contact the COCs, and the COCs must be present at potentially harmful levels. Additionally, exposure pathways are also evaluated for their significance with respect to overall exposure. In some cases, complete exposure pathways are considered negligible with respect to their potential for human health risk and are not carried forward for further evaluation in the HHRA. The information from the problem formulation is summarized in a CSM, which illustrates the potential links between sources of COCs, exposure pathways, and receptors. The details of the problem formulation for the RA Property are provided below.

3.1.1 Receptors of Concern

The RA Property is located within naturalized areas that may be used for hiking, hunting, or fishing. At the time of this report, the Firing Area was still being used by local hunters and community members from the Town of Burgeo for target practice even though ‘No Trespassing’ and ‘Range Closed’ signs have been installed in this area. There is limited infrastructure on the RA Property other than the access road to the Firing Area and there are no engineered controls. The RA Property is proposed to be returned to the Province of NL as Crown land. The HHRA was completed based on these current and future land uses.

The following human receptors were considered in the HHRA:

- **Recreational User:** The Recreational User is considered a person that may visit the RA Property for recreational activities, such as hunting, fishing, or hiking. They may also harvest edible plants such as blueberries, small cranberry, and to a lesser extent cloudberry, which were widespread and abundant throughout the RA Property (WSP, 2023). They are assumed to visit the RA Property during the spring, summer,

and fall (approximately 40 weeks per year) for two days per week. It is assumed that all members of a family may participate in recreational activities; therefore, an adult (≥ 20 years) accompanied by a toddler (0.5 to 5 years) were evaluated as receptors. The Recreational User is also assumed to use the on-site ponds for swimming or fishing, which may expose them to surface water and sediment.

A Subsurface Worker was not considered in the HHRA. The Subsurface Worker is an adult that may be involved in future construction or other intrusive work that would expose the worker to the subsurface environment. However, no subsurface works outside of the remedial area are proposed, neither is any installation of infrastructure on the RA Property. As any potential exposures would be short-term and mitigated through industry standard Health and Safety Plans (HASP), this receptor was not retained for further evaluation in the HHRA.

Potential for exposure to off-site receptors, specifically the Town of Burgeo's drinking water supply at Long Pond, is discussed in Section 3.3.2.

3.1.2 Exposure Pathways of Concern

Exposure pathways are how a receptor comes into contact with the COCs identified at the RA Property. The following exposure pathways were considered complete and were evaluated in the HHRA:

- Direct contact with soil (incidental ingestion, dermal contact, inhalation of soil particulates)
- Ingestion of country foods, specifically edible plants, that have accumulated COCs from soil
- Direct contact with sediment (incidental ingestion and dermal contact)

The following exposure pathways were considered negligible and were not further evaluated:

- Ingestion of country foods, specifically wild game, that have accumulated COCs from soil, sediment, or surface water
  - None of the identified COCs tend to biomagnify in food chains and wild game have large home ranges, which greatly reduces exposure to isolated areas where elevated concentrations are measured. Evaluation of direct contact is considered protective of this exposure pathway.
- Ingestion of country foods, specifically fish, that have accumulated COCs from surface water or sediment
  - None of the identified COCs tend to biomagnify and fish are mobile, which greatly reduces exposure to isolated areas where elevated concentrations are measured. Evaluation of direct contact is considered protective of this exposure pathway.
- Direct contact with surface water (incidental ingestion and dermal contact) as no COCs were identified based on screening against drinking water criteria (Section 2.6.4).

The following pathways were considered incomplete:

- Inhalation of vapours in indoor air and outdoor air as no volatile COCs were identified
- Ingestion of groundwater as the aquifer at the RA Property and surrounding area is not used as a potable water source

3.1.3 Identification of Contaminants of Concern for HHRA

A secondary screening process was used to identify COCs to be further evaluated in the HHRA. The COCs identified in Section 2.6 were based on the lowest environmental quality criteria provided by federal (*i.e.,* CCME and FCSAP) and regional (*i.e.,* Atlantic RBCA) agencies. In this section, these COCs were further screened against pathway-specific, human health criteria to identify COCs applicable to the human receptors (Section 3.1.1) and exposure pathways (Section 3.1.2) retained for assessment in the HHRA.

The following approach was used to identify COCs for the HHRA:

- Maximum concentrations of COCs were compared to their respective pathway-specific, human health criteria. If the maximum concentration of a COC exceeded its human health criteria, it was retained as a COC for further evaluation in the HHRA. If the maximum concentration was below the human health criteria, it was not retained.
- If no pathway-specific, human health criteria were available, the COC was evaluated on a case-by-case basis to determine if it poses a potential human health risk.

Comparison to human health criteria was considered a conservative evaluation of the potential risks to human receptors. Human health criteria represent a concentration to which a receptor can be exposed to via a specific exposure pathway without experiencing adverse effects. Therefore, COCs with concentrations below the human health criteria were considered to pose negligible risks to human receptors and COCs with concentrations above the human health criteria were retained for quantitative evaluation in the HHRA to determine potential risks to human receptors. The screening results for each media is provided in the following sections.

3.1.3.1 Soil

Direct Soil Contact

A Recreational User may be exposed to COCs in soil through direct contact (soil ingestion, dermal contact, and inhalation of soil particulates). To evaluate potential risks from this exposure pathway, maximum concentrations of COCs in soil were compared to direct contact criteria for agricultural land use provided under the Atlantic RBCA Human Health-Based Tier II Pathway Specific Standards (PSS) (2022) and the CCME SQG_{HH} (1999a/2003).

For the identified COCs, the direct contact criteria provided by Atlantic RBCA and CCME are based on soil ingestion and dermal contact exposures only. This is because exposure through inhalation of soil particulates is considered negligible in comparison to soil ingestion and dermal contact (CCME, 2006). Human health criteria protective of inhalation of soil particulates, provided under the US EPA Regional Screening Levels (RSLs) for Resident Soil (2022b), was considered to confirm if potential exposures from soil inhalation are negligible. As shown in Table 6, the criteria for inhalation of soil are at least one order of magnitude higher than ingestion/dermal contact criteria.

The COC screening for direct contact with soil is presented in Table 6. Aluminium, manganese, and vanadium were retained for further evaluation in the HHRA for direct contact exposures from soil ingestion and dermal contact. No COCs were retained for inhalation of soil particulates.

Table 6: Identification of COCs for Human Health Direct Contact - Soil

Contaminant of Concern	Soil Ingestion/Dermal Contact - Agricultural		Inhalation of Soil Particulates	Maximum	Retain as COC for Soil Ingestion/ Dermal Contact?	Retain as COC for Inhalation of Soil Particulates?
	Atlantic RBCA [1]	CCME SQG_{HH} [2]	US EPA RSL [3]			
Aluminium	**15,400**	-	1,420,000	16,900	**Yes**	No
Lead	140	140	4,800[4]	120	No	No
Manganese	**360**	-	14,200	566	**Yes**	No
Tin	9400	-	-	16	No	No
Vanadium	**39**	-	2,800	62	**Yes**	No

Notes: All units are in milligram per kilogram (mg/kg); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds human health criteria

1 Atlantic Risk Based Corrective Action (RBCA) Human Health-Based Tier II Pathway Specific Standards (PSS) (2022)

2 Canadian Council and Ministers of the Environment (CCME) Soil Quality Guidelines for Human Health (SQG_{HH}) (1999a/2023)

3 US EPA Regional Screening Levels (RSLs) for Resident Soil (2022). The RSL based on non-cancer hazards was divided by 5 to account for a target hazard quotient of 0.2.

4 Based on carcinogenic exposures to the most conservative lead compound (*i.e.,* lead acetate)

Consumption of Country Foods

Consumption of edible plants is a potential pathway for Recreational Users. Blueberries *(Vaccinium angustifolium)*, small cranberry *(Vaccninium oxycoccus)*, and to a lesser extent cloudberry *(Rubus chamaemorus)*, were widespread and abundant throughout the RA Property (WSP, 2023). To address potential exposures through food consumption, the CCME SQGs include "Produce, Meat and Milk" human health criteria; however, this only applies to contaminants that have the potential to biomagnify through the food chain (*e.g.,* non-polar organics) and the CCME recommends that metals be evaluated on a site-specific basis (CCME, 2006). For the COCs identified for direct soil contact above, the potential for their accumulation into plants was evaluated as follows:

- Aluminium: In three cultured crop species, the concentration of aluminium in plants was around one-hundredth the concentration of aluminium exposed under hydroponic conditions, with bioconcentration factors (BCFs) for aluminium ranging from 0.01 to 0.02 (Negreanu-Pirjol *et al.*, 2019).
- Manganese: On average, the concentration of manganese in plants is less than one-tenth the concentration of vanadium in soil, with a soil BCF for manganese of 0.079 (US EPA, 2007).
- Vanadium: On average, the concentration of vanadium in plants is one-tenth the concentration of vanadium in soil, with a soil BCF for vanadium of 0.1 (CCME, 1997).

Therefore, plants do not bioaccumulate these metals to any significant degree and no COCs were retained for further evaluation of consumption of country foods.

3.1.3.2 Groundwater

No groundwater COCs were retained for further evaluation in the HHRA as groundwater is not used as a potable drinking water source.

3.1.3.3 Sediment

Direct Sediment Contact

A Recreational User may be exposed to COCs in sediment through direct contact (soil ingestion and dermal contact) while fishing or swimming in the water bodies on the RA Property. To evaluate potential risks from this exposure pathway, maximum concentrations of COCs in sediment were compared to direct contact criteria for soil (agricultural land use) provided under the Atlantic RBCA Human Health-Based Tier II PSS and the CCME SQG_{HH}. As per Health Canada (2017), soil was applied as a surrogate for evaluating sediment exposures in absence of sediment-based criteria protective of human health

The COC screening for direct contact with sediment is presented in Table 7. No COCs were retained for further evaluation of this exposure pathway.

Table 7: Identification of COCs for Human Health Direct Contact - Sediment

Contaminant of Concern	Direct Soil Contact Criteria- Agricultural		Maximum	Retain as COC for Direct Contact with Sediment?
	Atlantic RBCA [1]	CCME SQG_{HH}[2]		
Arsenic	31	31[3]	18	No
Lead	140	140	140	No

Notes: All units are in milligram per kilogram (mg/kg); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds human health criteria

1 Atlantic Risk Based Corrective Action (RBCA) Human Health-Based Tier II Pathway Specific Standards (PSS) (2022)

2 Canadian Council and Ministers of the Environment (CCME) Soil Quality Guidelines for Human Health (SQG_{HH}) (1999a/2023)

3 CCME SQG based on a 1 in 100,000 ILCR (EC, 1999)

3.1.3.4 Surface Water

No surface water COCs were retained for further evaluation in the HHRA because the concentrations of measured parameters in surface water were below the applicable drinking water quality criteria protective of human health (Section 2.6.4).

3.1.4 Human Health Conceptual Site Model

A CSM was developed for human receptors to summarize the results of the problem formulation. The CSM is presented in Appendix B and illustrates the potential links between sources of COCs, exposure pathways, and human receptors.

Based on the screening for receptors, exposure pathways, and COCs presented in Section 3.1.1 to 3.1.3, the following exposure pathways are considered complete and retained for further evaluation in the HHRA for a Recreational User:

- Direct contact (incidental ingestion and dermal contact) with soil

The following exposure pathways are considered complete, but were not retained for further evaluation in the HHRA because they contribute to negligible exposure relative to direct contact exposures, or because the concentrations of COCs were below human health criteria protective of these exposure pathways, and therefore present no unacceptable risk:

- Inhalation of soil particulates

- Direct contact (incidental ingestion and dermal contact) with sediment
- Direct contact (incidental ingestion and dermal contact) with surface water
- Ingestion of country foods that have accumulated COCs from soil, surface water, or sediment

3.2 Exposure Assessment

The exposure assessment estimates the potential doses that human receptors may receive from each COC and exposure pathway carried forward for quantitative evaluation in the HHRA. The subsequent sections present the receptor characteristics, exposure assumptions, and models applied to estimate human health exposures.

The exposure assessment was completed for direct contact (incidental ingestion and dermal contact) with soil by a Recreational User from aluminium, manganese, and vanadium.

3.2.1 Receptor Characterization

3.2.1.1 Recreational User

Receptor characteristics for the Recreational User were obtained from Health Canada (2021a) and are summarized in Table 8. Site-specific exposure assumptions were considered, where it was assumed that a Recreational User could be present on the RA Property for 2 days per week during the spring, summer, and fall (approximately 40 weeks per year).

With respect to threshold (non-carcinogenic) COCs, toddlers are evaluated as they are considered the most sensitive life stage as this age group tends to have the highest potential exposure per kilogram of body weight (associated with higher incidental soil ingestion rates). As discussed in Section 3.2.2, no dose averaging is applied in this HHRA when assessing non-carcinogenic COCs (i.e., an exposure term of 1 is applied).

None of the COCs are considered non-threshold (carcinogenic) (Section 3.3.1); therefore, a composite receptor who may be exposed during their entire lifetime was not future evaluated.

Table 8: Receptor Characteristics and Exposure Assumptions for the Recreational User

Toddler Recreational User	
Receptor Characteristics[1]	
Age	6 mo to <5 yr
Body weight (kg)	16.5
Soil ingestion rate (kg/day)	0.00008
Skin surface area (cm^2) *Hands* *Arms (upper and lower)[2]* *Legs (upper and lower)[2]*	 430 890 1,690
Soil loading rate for exposed skin (kg/cm^2) *Hands* *Surfaces other than hands[2]*	 0.0000001 0.00000001
Exposure Assumptions (Site-Specific)	
Days per week exposed (d/wk)	2 [3]
Weeks per year exposed (wk/yr)	40 [3]

Toddler Recreational User	
Total years exposed (yr; for carcinogens only)	Not Applicable
Life expectancy (yr; for carcinogens only)	Not Applicable

Notes: < - less than; mo – months; yr – years; kg – kilograms; kg/day – kilograms per day; cm^2 – centimetre squared; kg/m^2 – kilograms per centimetre cubed; d/wk – days per week; wk/yr – weeks per year.

1 Receptor characteristics are from Health Canada (2021a).

2 Surfaces other than hands includes arms and legs.

3 Although this represents the maximum amount that a Recreational User will likely reside on the RA Property, no dose averaging is applied as discussed in Section 3.2.2.

3.2.1.2 Pregnant Female

Aluminum is considered to have developmental health effects from fetal exposures (Section 3.3.2); therefore, potential exposures by a pregnant female was also considered to assess potential health effects on the developing fetus.

Receptor characteristics for the pregnant female are based on the default values for an adult, obtained from Health Canada (2021a) and summarized in Table 9. No dose averaging is applied when assessing developmental (fetal) exposures as it is possible that the effects can occur following a single or short exposure duration during a specific developmental period (or window of susceptibility) (Health Canada, 2021a).

Table 9: Receptor Characteristics and Exposure Assumptions for the Pregnant Recreational User

Pregnant Recreational User	
Receptor Characteristics [1]	
Age	>20 years
Body weight (kg)	70.7
Soil ingestion rate (kg/day)	0.00002
Skin surface area (cm^2) *Hands* *Arms and Legs (upper and lower)*[2]	 890 8220
Soil loading rate for exposed skin (kg/cm^2) *Hands* *Surfaces other than hands*[2]	 0.0000001 0.00000001
Exposure Assumptions (Site-Specific)	
Days per week exposed (d/wk)	Not Applicable
Weeks per year exposed (wk/yr)	Not Applicable
Total years exposed (yr; for carcinogens only)	Not Applicable
Life expectancy (yr; for carcinogens only)	Not Applicable

Notes: < - less than; mo – months; yr – years; kg – kilograms; kg/day – kilograms per day; cm^2 – centimetre squared; kg/m^2 – kilograms per centimetre cubed; d/wk – days per week; wk/yr – weeks per year.

1 Receptor characteristics are from Health Canada (2021a).

2 Surfaces other than hands includes arms and legs.

3.2.2 Dose Averaging

Dose averaging (or exposure amortization) refers to the averaging of the exposure dose over a given exposure period (*i.e.,* averaging exposure that occurs in a short period of time over a longer period of time assumed in the development of the TRV, or an exposure term less than one). Dose averaging is applied on a chemical- specific basis after careful consideration of: exposure durations assumed for the receptors relative to the available TRVs, developmental (fetal) toxicity, and toxicokinetics. However, this HHRA follows Health Canada (2021a) guidance, whereby potential risks for non-carcinogenic chemicals are initially assessed by comparing unadjusted daily exposures (*i.e.,* without dose averaging and using an exposure term of "1") with a chronic TRV.

3.2.3 Exposure Point Concentrations

Measured concentrations of COCs in soil were used to estimate exposure for direct contact pathways. Where data are sufficiently numerous, Health Canada (2021a) recommends use of the 95% upper confidence limit of the mean (UCLM) to represent the exposure point concentrations (EPCs). In the current assessment, ProUCL Version 5.2 (US EPA, 2022a) was used to calculate 95% UCLMs. The software uses a "goodness of fit" test to determine normality, log normality, or gamma distribution of the data set and provides standard summary descriptive statistics (*e.g.,* mean, median, etc.). Five parametric UCLMs and ten non-parametric UCLMs are computed and assessed by the program, and a recommendation as to the UCLM best suited to the data is provided.

For the Recreational User, it was assumed that the receptor would spend approximately equal proportions of time across all areas of the RA Property; therefore, the use of a 95% UCLM as the EPC based on data collected across the RA Property was considered appropriate.

To calculate the 95% UCLM for the HHRA, the following steps were taken:

- Only data collected from the most surficial sample (*i.e.,* 0 to 0.15 m) at a single location on the RA Property (*i.e.,* borehole or test pit) was considered to avoid over-representation of a sample location. At some locations, an additional depth sample from 0.15 to 0.3 m was also collected. However, as the contaminant source is from aerial deposition, the surficial samples have the highest concentration and potential exposure to COCs.
- The average measured concentration from a duplicate set was included to avoid over-representation of a sampling location.

ProUCL inputs and outputs are provided in Appendix C. The 95% UCLM recommended by the program was used as the EPC. The EPCs assumed for COCs in soil are presented in Table 10.

Table 10: Soil Summary Statistics for Evaluating Direct Soil Contact for a Recreational User [1]

Contaminant of Concern	n (Total)	n (Detect)	Minimum	Maximum	95% UCLM	Distribution
Aluminium	77	77	519	15,600	6,719	95% Student's-t UCL
Manganese	77	74	<2	566	155	KM H-UCL
Vanadium	77	74	<2	79	23	KM H-UCL

Notes: All concentrations reported in milligram per kilogram (mg/kg); n = number of samples; UCLM = upper confidence limit of the mean

1 Considers data collected from 0 to 0.15 m on the RA Property

3.2.4 Bioavailability Assessment

Bioavailability describes the amount of contaminant that is absorbed by the body following exposure. A relative absorption factor (RAF) is used to account for differences in absorption under environmental exposure conditions versus conditions in the TRV study.

In accordance with Health Canada (2021b), the relative absorption for the ingestion and inhalation route is assumed to be 100% (i.e., RAF value of 1) as TRVs specific to these exposure routes are available. As dermal TRVs are rarely available, dermal exposure associated with a contaminant is typically assessed in relation to an oral TRV by incorporating a dermal absorption factor (RAF_{dermal}). RAF_{dermal} values were preferentially obtained from Health Canada (2021b), followed by the Ontario Ministry of the Environment (OMOE, 2011). The OMOE was selected as a secondary source as they completed a detailed assessment of appropriate RAF_{dermal} based on *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessmen*t (US EPA, 2004) and reviewed other agencies when estimates and advice was not provided by US EPA. The RAF_{dermal} considered in the HHRA are provided in Table 11. Where a RAF_{dermal} was not provided for a COC, a value of 1 was applied.

Table 11: Dermal Relative Absorption Factors (RAF_{dermal})

Contaminant of Concern	RAF_{dermal}	Source
Aluminium	1	Default
Manganese	0.10	MECP, formerly OMOE[1]
Vanadium	0.10	OMOE 2011

Notes:

1 Ontario Ministry of the Environment, Conservation and Parks. 2021. Human Health Toxicity Reference Values (TRVs) Selected for Use at Contaminated Sites in Ontario. May 2021.

3.2.5 Exposure Estimation

The exposure equations used to estimate the doses of COCs from direct soil contact are based on Health Canada (2021a) and are presented in Appendix D, along with sample calculations. The resulting exposure estimates for the Recreational User are summarized in Table 12.

Table 12: Non-Carcinogenic Exposure Estimates for Direct Contact with Soil by a Recreational User

Contaminant of Concern	Dermal Contact Dose	Incidental Ingestion Dose	Direct Contact Dose
Toddler			
Aluminium	2.8E-02	3.3E-02	6.1E-02
Manganese	6.5E-05	7.5E-04	8.2E-04
Vanadium	9.6E-06	1.1E-04	1.2E-04
Pregnant Female			
Aluminium	1.6E-02	1.9E-03	1.8E-02

Notes: All doses are in milligram per kilogram of body weight per day (mg/kg BW/d)

3.3 Toxicity Assessment

Toxicity assessment involves the classification of the potential toxic effects of a chemical and the determination of the amount of chemical that can be taken into the body without experiencing adverse health effects (expressed as a toxicity reference value [TRV]). Toxicity assessment is conducted for all COCs retained for quantitative evaluation in the HHRA and considers possible modes of toxicity associated with different routes and durations of exposure, and sensitive receptors.

The toxicity assessment was completed in consideration of oral and dermal exposures only, as no COCs were retained for further evaluation of inhalation exposures.

3.3.1 Classification of Chemicals Based on Toxicological Action

Regulatory agencies classify contaminants based on their mode of action (*i.e.,* threshold versus non-threshold substances). For substances exhibiting a threshold for toxicity, an acceptable level of exposure at or below which no adverse effects are anticipated is established. For non-threshold substances, any level of exposure is assumed to theoretically pose a potential risk, and a cancer slope factor is used to predict risks from estimated exposures. Carcinogenic substances which act through a mechanism involving damage to the genetic material (i.e., DNA) are usually considered to be non-threshold substances.

The carcinogenicity classifications from the Canadian Environmental Protection Agency (CEPA) (Health Canada, 2021b), US EPA Integrated Risk Information System (IRIS) (US EPA, 2023a), and the International Agency for Research on Cancer (IARC, 2023) are presented in Table 13. If US EPA IRIS did not provide an assessment for a COC, the assessments provided under the Provisional Peer Reviewed Toxicity Values (PPRTV) (US EPA, 2023b) were also consulted. No COCs were identified for carcinogenic assessment.

Table 13: Carcinogenic Classifications

Contaminant of Concern	CEPA	US EPA	IARC	Assessed as a Carcinogen?
Aluminium	not assessed	Inadequate information to assess carcinogenic potential (based on PPRTV)	not assessed	No
Manganese	not assessed	Group D, not classifiable as to human carcinogenicity (based on IRIS)	not assessed	No
Vanadium	not assessed	not assessed	Group 2B, possibly carcinogenic to humans (based on vanadium pentoxide)	No

Notes: CEPA – California Environmental Protection Agency; US EPA – United States Environmental Protection Agency; IRIS – Integrated Risk Information System; IARC – International Agency for Research on Cancer; PPRTV – Provisional Peer Reviewed Toxicity Values

3.3.2 Toxicity Reference Values

TRVs provide an estimate of how much chemical exposure may occur without unacceptable health effects and provides a basis to interpret exposure estimates. TRVs are developed based on threshold (or non-carcinogenic) and non-threshold (or carcinogenic) health effects and for different routes of exposure. TRVs are often only provided for oral and inhalation exposure routes. In the absence of dermal TRVs, oral TRVs are adopted to assess dermal exposures as per Health Canada (2021b).

For non-carcinogenic effects from oral exposures, the TRV is expressed as a tolerable daily intake (TDI) or reference dose (RfD). In this HHRA, chronic TRVs were considered, which estimate the potential toxicity from exposure over a lifetime (or a significant portion of a lifetime).

TRVs used in the HHRA were preferentially selected from Health Canada (2021b). Where Health Canada does not provide a TRVs the following sources, listed in order of priority, were used:

- US EPA IRIS
- US EPA PPRTV
- Agency for Toxic Substances and Disease Registry (ATSDR)
- World Health Organization (WHO)
- California Environmental Protection Agency (CalEPA)

Table 14 provides a list of the TRVs and their toxicological endpoints for the COCs quantitively assessed in the HHRA.

Table 14: Summary of Human Health Toxicity Reference Values – Oral and Dermal Exposures

Contaminant of Concern	Oral Reference Dose (mg/kg/day)	Toxicological Endpoint	Source
Aluminium	1.0E+00	Minimal neurotoxicity in the offspring of mice during gestational exposure	US EPA PPRTV 2006
Manganese	2.5E-02	Neuro-developmental toxicity during neonatal exposure	Health Canada 2021b
Vanadium	9.0E-03	Decreased hair cystine	US EPA IRIS 1988

3.4 Risk Characterization

The risk characterization stage of the HHRA compares the exposures estimated for each receptor with the identified TRVs to determine if site-related exposures are above the health-protective limits. Because of the differences in the biological mechanisms of action between non-carcinogenic and carcinogenic chemicals, the potential hazards/risks are determined differently. The characterization of hazards associated with exposure to non-carcinogenic COCs are presented in the following sections. None of the COCs were identified for carcinogenic assessment.

3.4.1 Quantitative Interpretation of Health Risks

3.4.1.1 Quantifying Hazards for Non-Carcinogenic Chemicals

For non-carcinogenic chemicals, the potential for exposures to result in harmful human health effects is based on the ratio between the estimated exposure and the health based TRV. This ratio is called a hazard quotient (HQ) and is calculated as shown below. The HQ provides an indication of whether estimated exposures are large enough to be of concern for human health. Typically, a HQ of less than 1 indicates that exposures would not be expected to result in harmful human health effects. Given the conservative assumptions used by regulatory agencies in the development of TRVs, HQ values greater than 1 do not mean that adverse human health effects will occur, but the likelihood that an adverse effect will occur increases as the HQ value rises above 1.

$$HQ = \frac{Estimated\ Exposure}{TRV}$$

Where:

HQ = Hazard Quotient (unitless)
Exposure Estimate = Exposure Dose (mg/kg/d)
TRV = RfD/TDI (mg/kg/d)

Since this assessment has only considered exposures from site-related sources, the HQ benchmark of 0.2 recommended by Health Canada has been used for all COCs. This allows for 80% of exposures to come from off-site sources and activities.

3.4.1.2 Direct Soil Contact

Predicted risks from direct contact with soil (incidental ingestion and dermal contact) are presented for the Recreational User in Table 15. There were no unacceptable levels of risk as all HQs were below the target of 0.2.

Table 15: Hazard Quotients for Direct Contact with Soil (Dermal Contact and Incidental Ingestion) for the Recreational User

Contaminant of Concern	Hazard Quotient (HQ)
Toddler	
Aluminium	6.1E-02
Manganese	3.3E-02
Vanadium	1.3E-02
Pregnant Female	
Aluminium	1.8E-02

Note: **Bolded** = HQ > 0.2

3.4.2 Interpretation of Off-Site Human Health Risks

Potential off-site health risks to the provincially protected watershed, hydraulically connected to the Town of Burgeo's drinking water supply (*i.e.,* Long Pond), is negligible as no COCs were identified in surface water above drinking water criteria protective of human health.

3.4.3 Uncertainty Assessment

Numerous assumptions were made in the HHRA. The most significant assumptions and their implications on the risk conclusions are presented in Table 16. In general, the assumptions are conservative and overestimate risk.

Table 16: Uncertainty Assessment for the HHRA

Assumption	Uncertainty	Over/Under Estimate of Risk	Rationale
Problem Formulation			
A subsurface worker was not retained for evaluation in the HHRA	Low	Neutral	It is unlikely that a subsurface worker will be on the RA Property (outside of the remedial areas assessed by the HHRA) as there is no underground infrastructure and the future land use is Crown land. Any potential exposures would be short-term and are mitigated through an industry standard HASP.
Exposure through the ingestion of country foods was considered negligible and not retained for evaluation in the HHRA.	Low	Neutral	None of the identified COCs are bioconcentrating or biomagnifying.
COCs were identified based on human health criteria from CCME and Atlantic RBCA.	Low	Overestimate	Comparison to human health criteria was considered a conservative evaluation of the potential risks to human receptors. Agricultural land use criteria were applied, that consider continuous exposure to a toddler for non-carcinogens and an adult for carcinogens.
Exposure Assessment			
Receptor characteristics	Low	Overestimate	Assumptions were based on those provided by Health Canada. The use of the Health Canada assumptions is conservative.
Exposure assumptions	Low	Overestimate	It was assumed that a Recreational User may visit the RA Property for 2 days per week and 40 weeks per year. However, dose averaging was not considered in the HHRA as a conservative evaluation.
The 95% UCLMs of COCs in soil were used to estimate EPCs.	Low	Overestimate	Health Canada (2021a) allows the use of the 95% UCLM to calculate the EPC when data are sufficiently numerous and rigorous. Sufficient samples were collected to calculate a 95% UCLM for all COCs. The 95% UCLMs are conservative estimates of exposure given that samples are concentrated in areas associated with contaminating activities.
Toxicity Assessment			
Toxicity reference values used in the assessment were from Health Canada and the US EPA	Low	Overestimate	TRVs used in the assessment were preferentially selected from Health Canada, followed by the US EPA. These TRVs are derived based on extensive toxicological reviews to establish the most sensitive endpoints. Uncertainty factors are applied to the TRV derived from the studies to account for inter- and intra-species variability as well as other factors, such as database deficiencies.

Assumption	Uncertainty	Over/Under Estimate of Risk	Rationale
Toxicity of mixtures	Low	May Underestimate	Combined toxic effects may occur due to exposure to interacting COCs. Combined effects may be additive, synergistic, or antagonistic. These combined effects could arise because two or more COCs target the same organs or tissues in the body, affect each other's bioavailability, or disturb biological processes in a similar manner. To assess these combined effects quantitatively, however, detailed studies of the interactions between COCs are required, and little scientific literature is available in this regard. Therefore, potential toxic interactions were not incorporated into the HHRA.

Notes: HHRA = human health risks assessment; COC = contaminant of concern; CCME = Canadian Council of Ministers of the Environment; RBCA = Risk Based Corrective Action; TRV = toxicity reference value; UCLM = upper confidence limit of the mean; EPC = exposure point concentrations; HASP – health and safety plan.

3.5 Summary of Potential Risks Requiring Risk Management

An HHRA was completed to evaluate the potential risks to human receptors under current conditions at the RA Property and foreseeable future conditions. The future use of the RA Property is Crown land. A Recreational User was identified as a receptor for the assessment and was evaluated from potential exposures to metal COCs in soil, surface water, and sediment. The HHRA evaluated potential exposure to concentrations of COCs measured on the RA Property outside of the proposed remedial areas (Section 1.1).

There were no unacceptable risks identified for the Recreational User; therefore, there are no further recommendations with respect to remediation and/or risk management for the COCs measured outside of the proposed remedial areas.

Potential off-site health risks to the provincially protected watershed that is hydraulically connected to the Town of Burgeo's water supply (*i.e.,* Long Pond) were also negligible as no COCs were identified in surface water above drinking water criteria protective of human health.

It is possible that a Subsurface Worker, who may be involved in future construction or other intrusive work, may also be exposed to COCs on the RA Property. However, no planned intrusive work is proposed outside of the remedial areas and there are no development plans that may require intrusive work. As any potential exposures are short-term and are mitigated through an industry standard HASP, this receptor was not evaluated in the HHRA.

4.0 ECOLOGICAL RISK ASSESSMENT

The purpose of the ERA is to evaluate potential risks to ecological receptors under current conditions at the RA Property and foreseeable future conditions. The future use of the RA Property is Crown land. The ERA was completed using an approach that is consistent with the CCME *Ecological Risk Assessment Guidance Document* (2020). The ERA is based on a weight-of-evidence (WOE) approach, using multiple lines of evidence (LOEs) to characterize the potential risks to the terrestrial and aquatic ecosystems. The LOEs included comparison of environmental quality data to literature-based toxicity thresholds, site-specific biological assessments, and site-specific toxicity assessments.

4.1 Problem Formulation

The first stage of the ERA framework is problem formulation; the purpose of the problem formulation is to identify the potential ecological receptors that may be present on the RA Property, the exposure pathways that may expose the ecological receptors to the COCs, and the COCs that are present at concentrations that may be harmful to ecological health. The potential for unacceptable risk is predicted on the coexistence of these three elements. Receptors must be present, there must be a way for receptors to be exposed to the COCs, and the COCs must be present at potentially harmful levels. Additionally, exposure pathways are also evaluated for their significance with respect to overall exposure. In some cases, complete exposure pathways are considered to be negligible with respect to their potential for ecological risk and are not carried forward for evaluation in the ERA. The information from the problem formulation is summarized in a CSM, which illustrates the potential links between sources of COCs, exposure pathways, and receptors.

The problem formulation also outlines the approach that will be used to assess risks, including the LOEs that will be used and how the results will be evaluated under a WOE approach. The details of the problem formulation for the RA Property are provided below.

4.1.1 Receptors of Concern

A receptor of concern (ROC) is any non-human individual, species, population, community, habitat, or ecosystem that may be potentially exposed to COCs (CCME 2020). A ROC should be ecologically relevant to a site and should have a reasonable potential to be found on a site. The identification of ROCs begins with the compilation of relevant site information, such as basic site characteristics, habitat types, and species present on the site, including species at risk (SAR).

Once the site has been characterized with respect to its ecological attributes and receptor types, surrogate ROCs for each receptor type are selected for assessment in the ERA. The selection of receptor types and surrogate ROCs is based on many criteria (Section 4.1.1.3) and considers the degree to which the ROC is representative and/or protective of other species that may be present on the site. The identification of ROCs to be evaluated by the ERA is described further in the following sections.

4.1.1.1 Description of Terrestrial and Aquatic Habitats and Species

WSP completed a site-specific *Terrestrial and Aquatic Habitat, Plant Health, and Species at Risk Assessment* for the RA Property (presented in WSP 2023). The assessment included a field survey across the RA Property in September 2022. To conduct the habitat assessment, most of the RA Property was walked, using an area search method. Aquatic features were not surveyed by boat, but an attempt was made to walk the shorelines of most waterbodies, where habitat observations were made. The field survey was conducted near the end of the growing season for many plants and outside the survey windows for most wildlife. However, all wildlife observed utilizing the RA Property were documented, as well as any notable behaviours. Aquatic sampling was not conducted; however, an attempt was made to collect visual observations of aquatic plants and animals where possible. In shallow littoral zones, observations were made visually using polarized glass, and debris such as rocks and wood were lifted to assess for presence of aquatic invertebrates. An effort was also made to identify potential habitat for wildlife species, both terrestrial and aquatic species. The results of these assessments with respect to the types of habitat and species present are described further below.

Terrestrial Habitat

Overall, the RA Property has plant communities typical of coastal barrens, including a mosaic of bedrock barrens, low and tall shrub thickets, as well as small patches of meadow and stunted treed areas. The terrain was complex, with bedrock areas of higher elevations, sometimes with steep slopes, as well as some valleys, lowland areas, and gentle slopes. Substrate ranged from bare or almost bare bedrock to boulders and cobbles, shallow silt and sand, and organic peat ranging from shallow to deep. Rocky and open areas contain lichens, liverworts mosses, and a variety of low shrubs, forbs, and graminoids such as black crowberry (*Empetrum nigrum*), creeping juniper (*Juniperus horizontalis*), Canada burnet (*Sanguisorba canadensis*), bunchberry (*Cornus canadensis*), sedges (*Carex* spp.), and oat grasses (*Danthonia* spp.). In some areas, such as along valleys, and other areas with deeper soils, taller woody vegetation dominates, including shrubs and trees such as green alder (*Alnus alnobetula*), American mountain ash (*Sorbus americana*), mountain holly (*Ilex mucronata*), serviceberry (*Amelanchier* sp.), white birch (*Betula papyrifera*), black spruce (*Picea glauca*), and balsam fir (*Abies balsamea*). No true forests occur, although moderately larger trees are found scattered and in patches, particularly along north facing slopes.

Wetland Habitat Description

Wetlands are common throughout the RA Property, although because of the rocky soil, and plant species present, the boundary between wetland and upland is sometimes hard to discern. Wetlands on the RA Property are dominated by bogs and fens, with the bog areas being hydrologically isolated, and the fens associated with the permanent and intermittent streams and other waterbodies on the RA Property. Additional shallow water marshy areas occur in the shallow portions of some of the lakes on the RA Property. The bogs and fens are somewhat similar in their plant community, with a variety of wetland species present such as sphagnum moss *(Sphagnum spp.)*, Labrador tea *(Rhododendron groenlandicum)*, small cranberry *(Vaccinium oxycoccos)*, sundews *(Drosera spp.)*, pitcher plant *(Sarracenia purpurea)*, bog aster *(Oclemena nemoralis)*, and bog buckbean *(Menyanthes trifoliata)*.

Aquatic Habitat Description

The RA Property contains several surface water features, including many small to medium sized lakes, ponds, and wetland pools. There are also a few streams, both intermittent and permanent, that hydrologically connect many of the lakes and ponds together. Some of the smaller lakes and ponds on the RA Property appear to be hydrologically isolated, particularly those smaller ponds that are associated with the wetlands on the RA Property.

None of these waterbodies were surveyed by boat, so maximum depth, and habitat characteristics of deeper portions of the basins is not known. However, those areas that could be observed and accessed from shore were assessed. In the larger waterbodies, depths ranged from 0.2 m to over 5 m, and substrate was a mixture of bedrock, boulders, cobbles, sand, and silt, with some areas of shallow organics. Within some of the larger waterbodies are shallow bays where aquatic vegetation persists, including emergent, submergent, and floating plants such as spadderdock (*Nuphar variegata*), pipewort (*Eriocaulon aquaticum*), floating heart (*Nymphoides* sp.), and common bladderwort (*Utricularia vulgaris*). There are also algae present throughout most waterbodies and streams. Where measured, in these larger waterbodies, water temperature ranged from 17 to 19.5 ºC, pH ranged from 6.2 to 7.0, and dissolved oxygen ranged from to 7.1 to 8.3 mg/L. Green frogs (*Lithobates clamitans*) were also in and adjacent to several waterbodies throughout the RA Property. Many of these waterbodies are fish habitat, confirmed by actual observations of fish, or inferred due to hydrological connections with other waterbodies. However, surface water connections could not be confirmed for all of these waterbodies. Small-bodied fish including small salmonids were observed in several of these water features, although no large schools of fish were observed.

The streams include larger more permanent streams, with a series of riffles, runs, and pools, where fish occur or are assumed to occur. Smaller, intermittent streams also occur, sometimes flowing through the wetland features. The source of some of these smaller streams is unknown, but they appear to be primarily fed through rain and snow melt, and no springs or seeps were identified. Some aquatic invertebrates (*e.g.,* caddisfly larva), were observed in the permanent streams, as well as small-bodied fish, including salmonids.

The smaller isolated wetland pools ranged from 0.1 m to over 2 m deep. These pools were typical of bog pools and on average were more acidic than the larger connected waterbodies, with pH ranging from 5.8 to 6.3. These pools are unlikely to support fish, however green frogs were observed utilizing them as habitat.

Representative Waterbodies on the RA Property

Two waterbodies, relatively close to the Firing Area, were identified as representative waterbodies for the HHERA. This includes the waterbody where surface water stations BFR-L1-SW60 and -61 were collected (Pond 3), and the waterbody where surface water stations BFR-L1-SW58 and -59 were collected (Pond 4). These ponds also contained the highest concentrations of lead in sediment, outside of the proposed remedial area.

Pond 3 is a moderately sized lake near the southern edge of the RA Property. It ranges in depth from 0.1 m along the shoreline to > 2 m further out in the main basin. The substrate is a mixture of bedrock, cobbles, and coarse sand, with some organics observed. There is at least one shallow bay at the eastern edge of the basin, where aquatic vegetation is relatively abundant. At the time of the field survey, the water temperature was 18.7 °C, the pH was 6.9, and dissolved oxygen was 7.69 mg/L (taken along the shoreline). A few individual small-bodied fish were observed, along with caddisfly larva and whirligig beetles. This waterbody has at least one permanent stream that flows into it, which appears connected with other waterbodies both on and off the RA Property. A small flock of Canada geese (*Branta canadensis*), as well as a few individual green frogs, were observed loafing here during the survey.

Pond 4 is a smaller lake near the western edge of the RA Property. It ranges in depth from 0.1 m along the shoreline to > 2 m further out. The substrate is similar to Pond 3, but with more boulders and organics observed. A moderate amount of aquatic vegetation was observed throughout, especially in the shallower littoral zone. At the time of the field survey, the water temperature was 18.1 °C, the pH was 6.2, and dissolved oxygen was 7.18 mg/L (taken from the shoreline). No fish were observed at this pond, but whirligig beetles were. It appears that this waterbody is hydrologically isolated from other adjacent waterbodies, at least during the time of the field survey.

Although no two waterbodies will ever be exactly alike, these two waterbodies appear to be representative of most of the aquatic conditions encountered throughout the RA Property.

Aquatic and Terrestrial Wildlife

Wildlife activity and evidence on the RA Property during the field survey was relatively low, except for a few species. This is likely partly due to the timing of the survey *(i.e.*, outside the breeding window for birds), but also potentially due to the habitat present. A few species of birds were observed foraging on and flying over the RA Property. This included moderate numbers of savannah sparrow (*Passerculus sandwichensis*), a small flock of Canada geese, and scattered individuals of American black duck *(Anas rubripes),* American robin (*Turdus migratorius*), American crow (C*orvus brachyrhynchos)*, common yellowthroat (*Geothlypis trichas*), hermit thrush (*Catharus guttatus*), and yellow-rumped warbler (*Setophaga coronata*). Very little evidence of mammals was present. However, a few tracks and trails of what appeared to be moose (*Alces alces*) and/or boreal woodland caribou (*Rangifer tarandus caribou*) did occur sporadically. Both species are known to occur in the region. A single meadow vole (*Microtus*

pennsylvanicus) was observed, but it's likely that this species only occurs in small numbers due to minimal available habitat (*i.e.,* grassy areas). Herptile activity was limited to several green frogs seen throughout many of the waterbodies on the RA Property. Terrestrial invertebrates seen included several mourning cloak (*Nymphalis antiopa*) and American lady (*Vanessa virginiensis*) butterflies, a few unidentified dragonflies, and numbers of ants.

Aquatic species observed included small unidentified salmonids in the larger lakes and streams on the RA Property, including one brook trout (*Salvelinus fontinalis*) and a few individual three-spined stickleback (*Gasterosteus aculeatus).* In addition, aquatic invertebrates were observed, such as caddisfly larva *(Trichoptera)*, dragonfly nymphs *(Odonata)*, stonefly nymphs *(Plecoptera)*, whirligig beetles *(Gyrinidae)*, and a single leach *(Hirudinea)*.

4.1.1.2 Species at Risk Assessment

A desktop SAR assessment was completed that identified four SAR as having a moderate to high likelihood of occurrence at the RA Property (Table 17). Although taxa-specific surveys within the appropriate timing windows were not completed for these SAR, except for boreal felt lichen, habitat information was collected during the field survey, and the SAR assessment was updated based on this. Table 17 includes all the SAR originally assessed as having a moderate to high likelihood of occurrence, as well as the updated likelihood based-on field observations. No actual SAR were observed during the field survey. The one SAR that had its likelihood of occurrence updated was the boreal felt lichen. Given that this species is conspicuous and present all year round, it was searched for and not found. Potential suitable habitat for other SAR species was confirmed to be present during the field survey.

Table 17: Updated SAR Assessment

Common Name	Scientific Name	COSEWIC[a]	SARA[b]	ESA[c]	Updated Likelihood of Occurrence on the RA Property, after Habitat Surveys.
Boreal felt lichen	*Erioderma pedicellatum*	Endangered	Endangered	Vulnerable	Low – this species was searched for during the field survey and not observed.
Short-eared owl	*Asio flammeus*	Special Concern	Special Concern	Vulnerable	Moderate– the open areas that make up the majority of the RA Property provide suitable foraging and nesting habitat for this species.
American eel	*Anguilla rostrata*	Threatened	No Status	Vulnerable	Moderate – larger waterbodies, connected by streams on the RA Property, may be suitable habitat for this species.
Banded killifish	*Fundulus diaphanus*	Special Concern	Special Concern	Vulnerable	Moderate – several of the waterbodies on the RA Property are suitable habitat for this species.

Notes:

[a] Committee on the Status of Endangered Wildlife in Canada

[b] Canada *Species at Risk Act* (Schedule 1)

[c] Newfoundland and Labrador *Endangered Species Act* (ESA)

4.1.1.3 Selection of Receptors of Concern for ERA

ROCs were selected for the ERA based on the following criteria:

- Species and habitats observed on the RA Property during completion of field surveys, as discussed in Section 4.1.1.1;
- Potential for species to be present on the RA Property based on the habitat;

- Representation of all major plant and animal groups present on the RA Property (or on adjacent properties that could use the RA Property or be affected by COCs on the RA Property);
- Potential for exposure (*i.e.,* diet, habitat preferences, and behaviours that make the species likely to contact the COCs) and sensitivity to COCs;
- Species that play important roles in community structure and function (*e.g.,* major herbivores and top predators in terrestrial ecosystems);
- Inclusion of the various trophic levels (*e.g.,* primary producer, herbivore, carnivore) for species that could potentially use the RA Property;
- The availability of information on the species, including exposure-related and ecotoxicological data;
- SAR with moderate to high potential of being on the RA Property; and,
- Species recommended for assessment for ERA (as per FCSAP, 2012).

Terrestrial and aquatic habitats are present within the RA Property; therefore, ROCs for terrestrial and aquatic ecosystems were selected. The selected ROCs and rationale for selection are presented in Tables 18 and 19 for the terrestrial and aquatic ecosystems, respectively.

The ROCs retained for further assessment in the terrestrial ERA include:

- Terrestrial plant communities
- Soil invertebrates
- Mammalian herbivores (meadow vole) and insectivores (common shrew)
- Avian herbivores (spruce grouse) and omnivores (American robin)
- Amphibians (wood frog)

The ROC retained for further assessment in the aquatic ERA include:

- Aquatic life communities, including plants, pelagic invertebrates, benthic invertebrates, fish, and aquatic phase amphibians (*i.e.,* embryonic, larval, and tadpoles life stages)
- Fish SAR (American eel and banded killfish)
- Mammalian omnivores (muskrat)
- Avian omnivore (mallard duck)

Table 18: Receptors of Concern for the Terrestrial Ecosystem

Terrestrial Receptor Group	Terrestrial Receptor Type	Included in ERA? (Yes/No)	Surrogate ROC	Rationale
Primary Producer (Plant)	**Moss/Grass/ Shrub/Tree/ Forb/Crop**	**Yes**	**Plant community**	Several plant communities have been identified on the RA Property. As primary producers, plants play a critical role in terrestrial ecosystems. High potential for exposure to COCs because of direct root contact with soil. Food source for wildlife.
Invertebrates	**Ground-dwelling**	**Yes**	**Earthworms**	Play a vital role in soil fertility. High potential for exposure to COCs in soil because they both live and feed in soil. Toxicological data and laboratory toxicity testing are readily available for earthworms. Food source for wildlife.
	Aerial	No	n/a	Have lower exposure rates than ground-dwelling invertebrates.
Mammal	**Herbivorous**	**Yes**	**Meadow vole** *(Microtus pennsylvanicus)*	Meadow vole documented on the RA Property. Recommended for assessment by FCSAP (2012). High potential for exposure to COCs due to feeding habits (consumes plants in large amounts relative to body weight). Plays a key role in the food web (component of the diet of larger mammals and birds of prey). Life history information is readily available.
	Insectivorous	**Yes**	**Common shrew** *(Sorex cinereus)*	Recommended for assessment by FCSAP (2012). High potential for exposure to COCs due to feeding habits (consumes plants in large amounts relative to body weight). Plays a key role in the food web (component of the diet of larger mammals and birds of prey). Life history information is readily available.
	Carnivorous	No	n/a	The identified COCs do not biomagnify and exposure would be less than that for herbivorous and insectivorous mammals given the large home ranges of carnivorous.
	Omnivorous	No	n/a	Evaluation of herbivores and insectivores protective of omnivores.
Bird	**Herbivorous**	**Yes**	**Spruce grouse** *(Dendragapus canadensis)*	Herbivorous birds have been documented on the RA Property (Canada goose). Spruce grouse recommended for assessment by FCSAP (2012). Life history information is readily available.

Terrestrial Receptor Group	Terrestrial Receptor Type	Included in ERA? (Yes/No)	Surrogate ROC	Rationale
Bird	Insectivorous	No	n/a	No insectivorous birds were observed on the RA Property. Birds that consume mostly soil invertebrates are not expected on the RA Property, given the abundant availability of fruiting shrubs. During the fall, songbirds would consume mostly fruit and sparrows mostly seeds. Soil invertebrates would be consumed mostly in the spring/summer. Potential exposures from invertebrate prey are evaluated though the omnivorous ROC.
	Carnivorous	No	n/a	A short-eared owl was identified as a SAR with moderate potential of being present on the RA Property. However, potential exposures are negligible given that the identified COCs do not biomagnify. Carnivorous also have large home ranges and would not be expected to exclusively forage at the RA Property.
	Omnivorous	**Yes**	**American robin** *(Turdus migratorius)*	Several omnivorous species were observed on the RA Property, including savannah sparrow, common yellowthroat, American robin, hermit thrush, yellow-rumped warbler. American robin recommended for assessment by FCSAP (2012). Life history information is readily available.
Amphibian	**Carnivorous**	**Yes**	**Wood Frog** *(Lithobates sylvatica)*	Amphibians (green frogs) have been documented on the RA Property. Wood frog recommended for assessment by FCSAP (2012). Life history information is readily available.
Reptile	Carnivorous	No	n/a	Reptiles have not been documented on the RA Property.

Notes: COC - contaminant of concern; ROC – receptor of concern; n/a – not applicable

Bold indicates receptor retained for further evaluation in the ERA.

Table 19: Receptors of Concern for the Aquatic Ecosystem

Aquatic Receptor Group	Aquatic Receptor Type	Included in ERA? (Yes/No)	Surrogate ROC	Rationale
Primary Producer (Plant)	**Phytoplankton** **Periphyton** **Macrophyte**	**Yes**	**Aquatic Plant Community**	As primary producers, plants play a critical role in aquatic ecosystems. High potential for exposure to COCs because of direct contact with surface water (phytoplankton) and sediment (periphyton and macrophytes) Food source for wildlife.
Pelagic Invertebrate	**Zooplankton**	**Yes**	**Aquatic Invertebrate Community**	High potential for exposure to COCs because of direct contact with surface water. Food source for wildlife.

Aquatic Receptor Group	Aquatic Receptor Type	Included in ERA? (Yes/No)	Surrogate ROC	Rationale
Benthic Invertebrate	**Epifauna**	**Yes**	**Benthic Invertebrate Community**	High potential for exposure to COCs because of direct contact with sediment. Food source for wildlife.
	Infauna			
Fish	**Benthivorous**	**Yes**	**Fish Community** **American Eel** *(Anguilla rostrata)* **Banded killfish** *(Fundulus Diaphanous)*	Fish, including salmonids, were identified in the on-site waterbodies. The American Eel and banded killifish were identified as SAR with a moderate potential of being on the RA Property High potential for exposure to COCs because of direct contact with surface water. Benthivores, such as eels, have high potential exposure to sediment. Food source for wildlife.
	Planktivorous			
	Piscivorous			
Mammal	Herbivorous	No	n/a	Evidence of moose was found on the RA Property; however, given their large home ranges exposure would be minimal. Exposure from dietary intake of aquatic plants evaluated through the omnivore ROC.
	Piscivorous	No	n/a	The identified COCs do not biomagnify, uptake into fish would be less than that of aquatic plants and invertebrates that are in direct contact with sediment and surface water.
	Omnivorous	**Yes**	Muskrat *(Ondatra zibethicus)*	Muskrats are common to wetlands. Recommended for assessment by FCSAP (2012) with a diet of primarily aquatic plants and some aquatic invertebrates. Life history information is readily available.
Bird	Herbivorous	No	n/a	Omnivorous aquatic birds were only observed on-site. Exposure from dietary intake of aquatic plants and invertebrates evaluated through the omnivore ROC.
	Insectivorous	No	n/a	
	Piscivorous	No	n/a	The identified COCs do not biomagnify; uptake into fish would be less than that of aquatic plants and invertebrates that are in direct contact with sediment and surface water.
	Omnivorous	**Yes**	**Mallard Duck** *(Anas platyrhynchos)*	American black duck was observed on the RA Property; diet is primarily aquatic plants outside of breeding season and aquatic plants during the breeding season. Mallard duck recommended for assessment by FCSAP (2012) with a diet of aquatic plants or invertebrates depending on the season. Life history information is readily available.

Aquatic Receptor Group	Aquatic Receptor Type	Included in ERA? (Yes/No)	Surrogate ROC	Rationale
Amphibian	**Carnivorous**	**Yes**	**Aquatic phase amphibian community** (i.e., embryonic, larval, tadpole life stages).	Exposure to contaminants through direct contact with water is considered a major pathway for amphibians during aquatic life stages. Embryo and larval stages appear to be more susceptible to contaminants than the adult stage. Most WQGs, including those provided by CCME, provide adequate protection of amphibians (FCSAP 2019).
Reptile	Omnivorous	No	n/a	Reptiles have not been documented on the RA Property.

Notes: COC - contaminant of concern; ROC – receptor of concern, n/a – not applicable
Bold indicates receptor retained for further evaluation in the ERA.

4.1.2 Exposure Pathways of Concern

Exposure pathways are the way by which receptors contact COCs. The ERA focuses on the exposure pathways of greatest concern (*i.e.,* exposure pathways that account for most of the exposure to a COC). If no potential risks are determined for these exposure pathways, it is unlikely that there would be potential risks for other exposure pathways. Incomplete and negligible exposure pathways were not evaluated in the ERA. Rationale for the inclusion or exclusion of exposure pathways for each receptor group is provided in Tables 20 and 21 for terrestrial and aquatic ecosystems, respectively.

Table 20: Exposure Pathway Selection for the Terrestrial Ecosystem

Receptor Group	Exposure Pathway	Included (yes/no)	Rationale
Primary Producer (Plant)	**Direct Contact (Soil)**	**Yes**	Terrestrial plants may be exposed to COCs in soil.
	Direct Contact (Groundwater)	**Yes**	Terrestrial plants may be exposed to COCs in groundwater; groundwater levels at the RA Property <1.5 mbgs.
Invertebrate	**Direct Contact (Soil)**	**Yes**	Soil invertebrates may be exposed to COCs in soil.
	Direct Contact (Groundwater)	No	Invertebrates typically avoid saturated soil.
Mammal	**Water Consumption**	**Yes**	COCs were identified in surface water
	Food consumption and incidental soil ingestion	**Yes**	Mammals are expected to forage at the RA Property.

Receptor Group	Exposure Pathway	Included (yes/no)	Rationale
Mammal	Dermal Exposure	No	This pathway is expected to be negligible because the presence of fur on mammals limits dermal contact with COCs (US EPA, 2005; Sample and Suter, 1994). Furthermore, the data necessary to evaluate dermal contact exposure is often lacking (US EPA, 1993; Sample and Suter, 1994), or if available, based on studies in which the chemical is applied directly to the skin by shaving the fur from laboratory rodents (US EPA, 2005), a type of exposure that would not occur in the natural environment.
	Inhalation	No	None of the COCs are volatile.
Birds	**Water Consumption**	**Yes**	COCs were identified in surface water
	Food consumption and incidental soil ingestion	**Yes**	Birds are expected to forage at the RA Property
	Dermal Exposure	No	Presence of feathers on birds limits dermal contact water (refer to mammals for more details).
	Inhalation	No	None of the COCs are volatile.
Amphibians	Water Consumption	No	Water ingestion rates have not been identified for amphibians and reptiles as they rely on their skin for rehydration and are not known to drink water through the mouth (US EPA, 1993; FCSAP, 2019). This exposure pathway is expected to be negligible in comparison to direct surface water contact by aquatic life. Evaluation of direct contact with surface water by aquatic life, including larval and tadpole life stages on amphibians, will be protective of surface water exposures to adult amphibians.
	Food consumption and incidental soil ingestion	**Yes**	Amphibians are expected to forage at the RA Property, adult life stages primarily consume terrestrial invertebrates.
	Dermal Exposure	No	Amphibians absorb water in the soil when burrowing to remain hydrated in the terrestrial environment. However, this dermal uptake is particularly important for organic parameters such as VOCs, pesticides, and petroleum compounds (US EPA, 2005), rather than metals. There are also knowledge gaps remain regarding amphibian exposure to contaminants in soil, primarily due to a lack of published toxicity data (FCSAP, 2019). This exposure pathway is expected to be negligible in comparison to direct sediment contact by terrestrial plants and soil invertebrates. Evaluation of direct contact with sediment by these receptors will be protective of dermal soil exposures to amphibians.
	Inhalation	No	None of the COCs are volatile.

Notes: **Bold** indicates exposure pathway retained for further evaluation in the ERA.

Table 21: Exposure Pathway Selection for the Aquatic Ecosystem

Receptor Group	Exposure Pathway	Included (yes/no)	Rationale
Primary Producer (Plant)	**Direct Contact (Surface Water)**	**Yes**	Aquatic plants may be exposed to COCs in surface water.
	Direct Contact (Sediment)	**Yes**	Aquatic plants may be exposed to COCs in sediment.
Pelagic Invertebrate	**Direct Contact (Surface Water)**	**Yes**	Pelagic invertebrates may be exposed to COCs in surface water.
Benthic Invertebrate	**Direct Contact (Sediment)**	**Yes**	Benthic invertebrates may be exposed to COCs in sediment.
Fish	**Direct Contact (Surface Water)**	**Yes**	Fish may be exposed to COCs in surface water.
	Direct Contact (Sediment)	**Yes**	Fish may be exposed to COCs in sediment.
	Food consumption and incidental sediment ingestion.	No	This exposure pathway is expected to be negligible as none of the COCs identified at the RA Property are bioaccumulating; evaluation of direct contact is considered protective of this exposure pathway.
Mammal	**Water Consumption**	**Yes**	COCs identified in surface water
	Food consumption and incidental sediment ingestion	**Yes**	Mammals are expected to forage on aquatic life at the RA Property
Bird	**Water Consumption**	**Yes**	COCs identified in surface water
	Food consumption and incidental sediment ingestion	**Yes**	Birds are expected to forage on aquatic life at the RA Property
Amphibian	**Direct Contact (Surface Water)**	**Yes**	COCs identified in surface water, this is considered a major exposure pathway for amphibians during their aquatic life stages (*e.g.,* larvae and tadpoles).
	Water Consumption	No	Water ingestion rates have not been identified for amphibians as they rely on their skin for rehydration and are not known to drink water through the mouth (US EPA, 1993; FCSAP, 2019). Evaluation of direct contact with surface water is protective of this exposure pathway.
	Food consumption and incidental sediment ingestion	No	Amphibians consume mostly terrestrial prey (*e.g.,* insects, spiders, snails, slugs) in their adult life stages (FCSAP, 2012).

Notes: **Bold** indicates exposure pathway retained for further evaluation in the ERA.

4.1.3 Identification of Contaminants of Concern for ERA

A secondary screening process was used to identify COCs to be further evaluated in the ERA. The COCs identified in Section 2.6 were based on the lowest environmental quality criteria provided by federal (*i.e.,* CCME and FCSAP) and regional (*i.e.,* Atlantic RBCA) agencies. In this section, these COCs are further screened against receptor-specific, ecological health criteria to identify COCs applicable to the receptors (Section 4.1.1) and exposure pathways (Section 4.1.2) retained for assessment in the ERA.

The following approach was used to identify COCs for the ERA:

- Maximum concentrations of COCs were compared to their respective receptor-specific, ecological health criteria. If the maximum concentration of a COC exceeded its ecological health criteria, it was retained as a COC for further evaluation in the HHRA. If the maximum concentration was below the ecological health criteria, it was not retained.
- If no receptor-specific, ecological health criteria were available, the COC was evaluated on a case-by-case basis to determine if it poses a potential ecological health risk.

Comparison to ecological health criteria was considered a conservative evaluation of the potential risks to ecological receptors. Ecological health criteria represent a concentration to which a receptor can be exposed to without experiencing adverse effects. Therefore, COCs with concentrations below the ecological health criteria were considered to pose negligible risks to ecological receptors, and COCs with concentrations above the ecological health criteria were retained for quantitative evaluation in the HHRA to determine potential risks to ecological receptors. The screening results for each media is provided in the following sections.

4.1.3.1 Soil

Direct Contact by Terrestrial Plants and Soil Invertebrates

Terrestrial plants and soil invertebrates may be exposed to COCs in soil through direct contact. To identify potential risks from this exposure pathway, maximum concentrations of COCs in soil were compared to soil contact criteria protective of terrestrial plants and soil invertebrates for agricultural land use provided under the Atlantic RBCA Ecological Tier II PSS (2022) and the CCME SQG_{ECO} (1999a/2003).

The COC screening for terrestrial plants and soil invertebrates from soil exposures is presented in Table 22. Manganese and tin exceeded the soil contact criteria and was retained for further assessment in the ERA.

Table 22: Identification of COCs for Terrestrial Plants and Soil Invertebrates - Soil

Contaminant of Concern	Soil Contact Criteria - Agricultural		Maximum	Retain as COC?
	Atlantic RBCA [1]	CCME SQG_{ECO} [2]		
Lead	300	300	120	No
Manganese	**220 (plants) / 450 (soil invertebrates)[3]**		**566**	**Yes**
Tin	**5**	**5**	**16**	**Yes**
Vanadium	130	130	62	No

Notes: All units are in milligram per kilogram (mg/kg); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds ecological health criteria

1 Atlantic Risk Based Corrective Action (RBCA) Ecological Tier II Pathway Specific Standards (PSS) (2022)

2 Canadian Council and Ministers of the Environment (CCME) Soil Quality Guidelines for Ecological Health (SQGECO) (1999a/2023)

3 In absence of criteria for manganese, the US EPA Ecological Screening Levels (Eco-SSLs) were considered (US EPA, 2007)

Soil and Food Ingestion by Wildlife

Wildlife (mammals, birds, reptiles, amphibians) may be exposed to COCs in soil via incidental ingestion of soil and via consumption of food items (plants and/or prey) that have accumulated COCs from soil. To identify potential risks from this exposure pathway, concentrations of COCs in soil were compared to soil and food ingestion criteria protective of mammals and birds for agricultural land use under the Atlantic RBCA Ecological Tier II PSS (2022) and the CCME SQG_{ECO} (1999a/2003).

CCME and Atlantic RBCA do not provide criteria protective of wildlife for tin. Therefore, the Risk Assessment Information System (RAIS) Ecological Benchmark Tool for Chemicals was searched for alternative screening values from other jurisdictions (RAIS, 2023). An ecological criterion for tin protective of mammals is provided by the US EPA Region 4, which was considered for COC screening.

As wildlife are mobile receptors, comparison against the maximum soil concentration is highly conservative, and therefore CCME (2020) recommends the use of the 95% UCLM to identify COCs. The 95% UCLM was calculated based on the approach outlined in Section 3.2.3, and the results are provided in Appendix C.

The COC screening for wildlife from soil exposures is presented in Table 23. Vanadium marginally exceeded the Atlantic RBCA criteria for mammals and birds, where the 95% UCLM for vanadium was 1.3 times higher than the criteria. However, the source of vanadium is uncertain (WSP, 2023). Elevated concentrations of vanadium are found across the RA Property ranging from 2 to 79 mg/kg. Most of the exceedances of vanadium are not co-located with lead exceedances, a known COC associated with site activities, and the highest concentrations of vanadium are not co-located with the highest concentrations of lead around the bullet catch. Further, the Atlantic RBCA criteria was adopted from the Ontario MECP (2011), which is based on exposure to an American woodcock assumed to consume 100% earthworms. Earthworms have a high uptake of metals from soil because they both live and feed on soil. But the presence of earthworms on the RA Property is expected to be limited due to the widespread presence of wetlands (bogs and fens) that are characterized by acidic soils, which limits the presence of earthworms (Curry, 2004; Hlava *et al.,* 2013). Birds that consume mostly soil invertebrates throughout the year are also not expected on the RA Property given the abundant availability of fruiting shrubs. For example, songbirds like the American robin that was observed on the RA Property, consume mostly berries and fruit during the fall migratory period (FCSAP, 2012). Finally, none of the SAR identified for the RA Property consume soil invertebrates.

Therefore, potential risks from elevated vanadium at the RA Property is considered negligible and vanadium was not retained as COC for the ERA.

Table 23: Identification of COCs for Mammals and Birds - Soil

Contaminant of Concern	Soil Contact Criteria - Agricultural		95% UCLM[4]	Retain as COC?
	Atlantic RBCA [1]	CCME SQG_{ECO} [2]		
Lead	70	70	24	No
Manganese	4,000 (mammals) / 4,300 (birds) [5]		566 (maximum)	No
Tin	7.6 [3]		4.4	No
Vanadium	18	-	23	No (see text)

Notes: All units are in milligram per kilogram (mg/kg); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds ecological health criteria

1 Atlantic Risk Based Corrective Action (RBCA) Ecological Tier II Pathway Specific Standards (PSS) (2022)

2 Canadian Council and Ministers of the Environment (CCME) Soil Quality Guidelines for Ecological Health (SQG_{ECO}) (1999a/2023)

3 In absence of criteria from Atlantic RBCA and CCME, the ecological criterion for tin protective of mammals provided by the US EPA Region 4 was considered (RAIS , 2023).

4 95% Upper Confidence Level of the Mean (UCLM) (refer to Appendix C for associated ProUCL inputs and outputs)

5 In absence of criteria from Atlantic RBCA and CCME, the ecological criteria provided by the US EPA Ecological Screening Levels (EcoSSLs) were considered (US EPA , 2007).

4.1.3.2 Groundwater

For ecological receptors, concerns with COCs in groundwater relate to root uptake by terrestrial plants and discharge to surface water resulting in direct contact by aquatic life. Chemical screening of surface water (presented in Section 4.1.3.4) was considered to address potential concerns regarding groundwater discharge to downgradient waterbodies. Concentrations in ambient water account for potential attenuation during groundwater transport and for dilution effects, and therefore are more representative of the concentrations that aquatic life may be exposed to. Therefore, screening of groundwater COCs was only completed for root update of shallow groundwater by terrestrial plants, discussed in detail below.

Root Uptake of Shallow Groundwater by Terrestrial Plants

To identify potential risks from direct contact with groundwater by terrestrial plants, maximum concentrations of COCs in groundwater were compared to groundwater criteria protective of irrigation under the FIGQGs for agricultural land use (FCSAP, 2016). The irrigation criteria are protective of crop species and were applied as a surrogate to assess native terrestrial plants given that crop species tend to be more sensitive.

The COC screening for terrestrial plants from groundwater exposures is presented in Table 24. No COCs were retained for further evaluation of this exposure pathway.

Table 24: Identification of COCs for Terrestrial Plants and Soil Invertebrates - Groundwater

Contaminant of Concern	Irrigation Criteria - Agricultural	Maximum	Retain as COC?
	FCASP FIGQG [1]		
Aluminium	5000	348	No
Copper	200[2]	32	No
Lead	200	2.7	No
Zinc	1000[3]	11	No

Notes: All units are in microgram per liter (µg/L); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds ecological health criteria

1 Federal Contaminated Sites Action Plan (FCSAP) Federal Interim Groundwater Quality Guidelines (FIGQGs) – Table 1 for agricultural land use and coarse soil (2016).

2 Adopted from CCME, based on exposure to most sensitive crop species

3 Adopted from CCME, based on pH levels < 6.5

4.1.3.3 Sediment

Direct Contact by Aquatic Life

Aquatic life (algae, aquatic plants, benthic invertebrates, fish) may be exposed to COCs in sediment through direct contact. To identify potential risks from direct contact with sediment by aquatic life, maximum concentrations of COCs in sediment were compared to freshwater aquatic life criteria from the Atlantic RBCA Ecological Tier II PSS (2022) and the CCME ISQGs/PELs (1999b/2023). The ISQG represent a concentration below which any biological effects are unlikely to occur, whereas the PELs represent a concentration above which biological effects are likely to occur.

The COC screening for aquatic life from sediment exposures is presented in Table 25. Lead was retained in sediment for further evaluation in the ERA.

Arsenic was only 1.1 times above the CCME PEL and the Atlantic RBCA PSS, a threshold above which only 12% of field-collected sediments have been associated with adverse effects to benthic invertebrates (CCME, 1999e). Further, only one sample exceeded these sediment criteria and the maximum background range of 7 mg/kg. The potential exposures and risk associated with elevated arsenic in sediment is negligible and arsenic was not retained as a COC for the ERA.

Table 25: Identification of COCs for Aquatic Life - Sediment

Contaminant of Concern	Freshwater Aquatic Life Criteria			Maximum	Retain as COC?
	Atlantic RBCA [1]	CCME ISQG[2]	CCME PEL[2]		
Arsenic	17	5.9	17	18	No (see text)
Lead	**91.3**	**35**	**91.3**	**140**	**Yes**

Notes: All units are in milligram per kilogram (mg/kg); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds ecological criteria

1 Atlantic Risk Based Corrective Action (RBCA) Ecological Tier II Pathway Specific Standards (PSS) (2022)

2 Canadian Council and Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQG) and Probable Effect Levels (PEL) (1999b/2023)

Sediment and Food Ingestion by Wildlife

Wildlife (mammals, birds, reptiles, amphibians) may be exposed to COCs in sediment via incidental ingestion of sediment and via consumption of food items (aquatic plants and/or prey) that have accumulated COCs from sediment. To identify potential risks from this exposure pathway, concentrations of COCs in sediment were compared to the soil and food ingestion criteria protective of mammals and birds for agricultural land use under the Atlantic RBCA Human Health-Based Tier II PSS (2022) and the CCME SQG_{ECO} (1999a/2003). Soil screening values were used as a surrogate for sediment in absence of sediment-based criteria for wildlife.

As wildlife are mobile receptors, comparison against the maximum soil concentration is highly conservative, and therefore CCME (2020) recommends the use of the 95% UCLM to identify COCs. The 95% UCLM was calculated based on the approach outlined in Section 3.2.3, and the results are provided in Appendix C.

The COC screening for wildlife from sediment exposures is presented in Table 26. No COCs were retained for further evaluation of this exposure pathway.

Table 26: Identification of COCs for Wildlife - Sediment

Contaminant of Concern	Direct Soil Contact Criteria- Agricultural		95% UCLM [3]	Retain as COC?
	Atlantic RBCA [1]	CCME SQG_{ECO} [2]		
Arsenic	380	380	4.6	No
Lead	70	70	38	No

Notes: All units are in milligram per kilogram (mg/kg); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds human health criteria

1 Atlantic Risk Based Corrective Action (RBCA) Ecological Tier II Pathway Specific Standards (PSS) (2022)

2 Canadian Council and Ministers of the Environment (CCME) Soil Quality Guidelines for Ecological Health (SQG_{ECO}) (1999a/2023)

3 95% Upper Confidence Level of the Mean (UCLM) (refer to Appendix C for associated ProUCL inputs and outputs)

4.1.3.4 Surface Water

Direct Contact by Aquatic Life

Aquatic life (algae, aquatic plants, pelagic invertebrates, fish, aquatic phase amphibians) may be exposed to COCs in surface water through direct contact. To identify potential risks from direct contact with surface water by aquatic life, maximum concentrations of COCs in surface water were compared to freshwater aquatic life criteria from the Atlantic RBCA Ecological Tier II PSS (2022) and the CCME WQGs (1999c/2003).

The COC screening for aquatic life from surface water exposures is presented in Table 27. Lead was retained as a COC for surface water for further evaluation in the ERA.

Table 27: Identification of COCs for Aquatic Life – Surface Water

Contaminant of Concern	Freshwater Aquatic Life Criteria		Maximum	Retain as COC?
	Atlantic RBCA [1]	CCME WQG[2]		
Lead	**1**[3]	**1**[3]	**4.1**	**Yes**

Notes: All units are in microgram per litre (µg/L); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds ecological criteria

1 Atlantic Risk Based Corrective Action (RBCA) Ecological Tier II Pathway Specific Standards (PSS) (2022)

2 Canadian Council and Ministers of the Environment (CCME) Water Quality Guidelines (WQG) (1999c/2023)

3 Based on a site-specific average water hardness of 2.5 mg/L

Surface Water Ingestion by Wildlife

Wildlife (mammals and birds) may be exposed to chemicals in surface water through drinking. To identify potential risks from ingestion of surface water by wildlife, maximum concentrations of COCs in surface water were compared to criteria protective of livestock watering under the CCME Water Quality Guidelines for the Protection of Agriculture (1999d/2003).

The COC screening for wildlife from surface water exposures is presented in Table 28. No COCs were retained for further assessment of this exposure pathway.

Table 28: Identification of COCs for Wildlife – Surface Water

Contaminant of Concern	Livestock Watering Criteria	Maximum	Retain as COC?
	CCME WQG[1]		
Lead	100	4.1	No

Notes: All units are in microgram per litre (µg/L); - = no applicable screening criteria; COC = Contaminant of Concern

Bold – indicates maximum concentration exceeds ecological criteria

1 Canadian Council and Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Agriculture (WQG) (1999d/2023)

4.1.4 Ecological Conceptual Site Model

A CSM was developed for ecological receptors to summarize the results of the problem formulation. The CSM is presented in Appendix B and illustrates the potential links between sources of COCs, exposure pathways, and ecological receptors.

Based on the screening for ROCs, exposure pathways, and COCs presented in Section 4.1.1 to 4.1.3, the following exposure pathways are considered complete and retained for further evaluation in the ERA:

- Direct contact with soil by terrestrial plants and soil invertebrates
- Direct contact with sediment by aquatic life (aquatic plants, benthic invertebrates, fish)
- Direct contact with surface water by aquatic life (algae, aquatic plants, pelagic invertebrates, fish, aquatic phase amphibians)

The following exposure pathways are considered complete, but were not retained for further evaluation in the ERA because they contribute to negligible exposure relative to direct contact exposures, or because the concentrations

of COCs were below ecological criteria protective of these exposure pathways, and therefore present no unacceptable risk:

- Soil and food ingestion by terrestrial wildlife
- Root update of shallow groundwater by terrestrial plants
- Sediment and food ingestion by aquatic wildlife
- Water ingestion by terrestrial and aquatic wildlife
- Dermal contact with soil by terrestrial wildlife

4.1.5 Protection Goals, Assessment/Measurement Endpoints, Lines of Evidence, Decision Criteria and Weightings

The protection goals for the RA Property are as follows:

- Maintenance of populations and communities of ecological receptors that are similar to reference areas
- No adverse organism-level effects to SAR.

Table 29 summarizes the assessment endpoints, measurement endpoints, LOEs, decision criteria, and weighting of each LOE to be used in the ERA. The weighting of the LOE (low, moderate, or high) was completed in consideration of:

- whether the LOE is reflective of site-specific factors that influence bioavailability and toxicity;
- whether the LOE is reflective of population and community level effects versus effects on individuals; and
- ecological relevance of the LOE.

The low, moderate, and high weightings are defined as follows:

- LOW: The LOE is not reflective of site-specific factors that influence bioavailability and toxicity, the LOE measures organism-level effects rather than population or community level effects and the LOE has low ecological relevance.
- MODERATE: The LOE is reflective of site-specific factors that influence bioavailability and toxicity, the LOE measures organism-, population, or community level effects and the LOE has moderate ecological relevance.
- HIGH: the LOE is the only LOE for the receptor group, or, the LOE is reflective of site-specific factors that influence bioavailability and toxicity, the LOE measures population or community level effects and the LOE has high ecological relevance.

Table 29: Lines of Evidence for Ecological Risk Assessment

Receptor Group(s)	Assessment Endpoint	Lines of Evidence (LOE)		
		LOE Group	Use of Measurement Endpoints for Specific LOEs, Decision Criteria	Weighting/Rationale
Soil COCs				
Terrestrial Plants and Soil Invertebrates	Community structure and ecological function, including as a food source for fish and wildlife	LOE 1 – Soil chemistry	▪ COC concentrations – comparison of COC concentrations in soil to literature-based toxicological benchmarks for effects on survival, growth, and reproduction. ▪ HQ≤1 will be considered to represent a negligible risk. HQ>1 will be considered to represent a potential risk and a more detailed evaluation of risk will be undertaken using other LOEs.	▪ LOW ▪ Literature-based toxicological benchmarks are derived from laboratory tests using sensitive species and bioavailable forms of contaminants. ▪ Measures organism-level effects rather than community level effects. ▪ Less ecologically relevant than site-specific endpoints (see LOE 2).
		LOE 2 – Vegetation community and health assessment	▪ Comparison of the growth, density, health, and types of plant species within exposure and reference areas using vegetative surveys. ▪ Differences in health and composition of plant species between exposure and reference areas will be considered to represent a potential risk. ▪ Adverse effects on invertebrates would be manifested through effects on plants given their importance in nutrient cycling and soil fertility.	▪ HIGH ▪ Considers site-specific factors that influence bioavailability and toxicity. ▪ Protective of plant communities rather than individual plants. ▪ Highly ecologically relevant.
Sediment COCs				
Aquatic Life (plants, benthic invertebrates, fish)	Community structure and ecological function, including as a food source for fish and wildlife.	LOE 1 – Sediment chemistry	▪ COC concentrations – comparison of COC concentrations in sediment to literature-based toxicological benchmarks for effects on survival, growth and reproduction. ▪ HQ≤1 will be considered to represent a negligible risk. HQ>1 will be considered to represent a potential risk and a more detailed evaluation of risk will be undertaken using other LOEs.	▪ LOW ▪ Literature-based toxicological benchmarks are derived from laboratory tests using sensitive species and bioavailable forms of contaminants. ▪ Measures organism-level effects rather than community level effects. ▪ Less ecologically relevant than site-specific endpoints (see LOE 2).

Receptor Group(s)	Assessment Endpoint	Lines of Evidence (LOE)		
		LOE Group	Use of Measurement Endpoints for Specific LOEs, Decision Criteria	Weighting/Rationale
Aquatic Life (plants, benthic invertebrates, fish)		LOE 2 – Sediment toxicity testing	▪ Amphipod *(Hyalella azteca)* and midge *(Chironomus dilutes)* survival and growth – comparison of survival and growth between exposure and reference areas, relative to control. ▪ Statistically significant reduction in survival and/or growth relative to reference areas will be considered to represent a potential risk. ▪ Potential risks to benthic invertebrates are inferred to represent potential risks to aquatic plants and fish as they spend their entire lifecycle in direct contact with sediment.	▪ MODERATE ▪ Considers site-specific factors that influence bioavailability and toxicity. ▪ Measures organism-level effects rather than community level effects. ▪ More ecologically relevant than LOE 1
Surface Water COCs				
Aquatic Life (algae, plants, pelagic invertebrates, fish, aquatic phase amphibians)	Community structure and ecological function, including as a food source for fish and wildlife. .	LOE 1 – Surface water chemistry	▪ COC concentrations – comparison of COC concentrations in surface water to literature-based toxicological benchmarks for effects on survival, growth and reproduction. ▪ HQ≤1 will be considered to represent a negligible risk. HQ>1 will be considered to represent a potential risk and a more detailed evaluation of risk will be undertaken using other LOEs.	▪ LOW ▪ Literature-based toxicological benchmarks are derived from laboratory tests using sensitive species and bioavailable forms of contaminants. ▪ Measures organism-level effects rather than community level effects. ▪ Less ecologically relevant than site-specific endpoints (see LOE 2).
		LOE 2 – Surface water toxicity testing	▪ Fathead minnow *(Pimephales promelas),* cladoceran *(Ceriodaphnia dubia),* and algae *(Pseudokirchneriella subcapitata)* survival and growth – comparison of survival and growth between exposure and reference areas ▪ Relative percent differences of greater than 30% between exposure and reference areas is considered to represent a potential risk.	▪ MODERATE ▪ Considers site-specific factors that influence bioavailability and toxicity. ▪ Measures organism-level effects rather than community level effects. ▪ More ecologically relevant than LOE 1

Notes: COC = contaminant of concern; HQ = hazard quotient

4.2 Exposure Assessment

The exposure assessment estimates the amount of a COC that ROCs are exposed to via each complete exposure pathway retained for further evaluation in the ERA.

For calculating HQs, exposure was determined by direct measurement of COC concentrations in media (water and sediment). This permits the evaluation of exposure relative to toxicity thresholds derived based on an effect observed at a measured concentration in water or sediment (Section 4.3). The exposure estimates used in the assessment of terrestrial plants, soil invertebrates and aquatic life are provided in the following sections.

Categorical measures of exposure (*i.e.,* on site versus reference areas or concentration gradients) were also considered for the ERA to evaluate the site-specific toxicity and biological studies. These are discussed as part of the effect assessment for these LOEs (Section 4.3.2).

4.2.1 Terrestrial Plants and Soil Invertebrates

Terrestrial plants are sessile and soil invertebrates have small habitat ranges, so they could be exclusively exposed to soil in the areas with the maximum measured concentrations of COCs. Therefore, the maximum concentration of COCs were considered as the RPC. To calculate the maximum concentration, all soil data from the RA Property was considered as it was collected within the top 30 cm of overburden, which is accessible to ecological receptors. The EPCs for terrestrial plants and soil invertebrates are presented in Table 30.

Table 30: Exposure Point Concentrations for COCs in Soil - Terrestrial Plants and Soil Invertebrates

Contaminant of Concern	Maximum	Location with Maximum
Manganese	566	BFR_L1_SS47
Tin	16	BFR_SS6

Notes: All values in milligram per kilogram (mg/kg)

4.2.2 Aquatic Life

Aquatic life, apart from fish, have relatively small home ranges, and therefore were assumed to be exposed to maximum concentrations of COCs in sediment and surface water. However, the average concentrations within a waterbody were also considered as the protection goals for aquatic life are to prevent effects to community structure and ecological function as a source of food for fish and wildlife. Therefore, some exposure to the maximum concentration of COCs that may result in risk to sensitive individuals is deemed acceptable. The average concentration was calculated for those waterbodies with at least three samples collected from them. The EPCs used in the assessment of aquatic are presented in Table 31.

Table 31: Exposure Point Concentrations for COCs in Sediment and Surface Water – Aquatic Life

Contaminant of Concern	EPC	Type	Location
Sediment			
Lead	140	Maximum	SED6 – Pond 4
Lead	52	Average	Pond 3 - SED5, SED28, SED60, SED61
Lead	58	Average	Pond 4 – SED6, SED58, SED59
Surface Water			
Lead	4.1	Maximum	SW60 and SW61 – Pond 3
Lead	3.2	Average	Pond 3 - SW5, SW28, SW60, SW61
Lead	0.5	Average	Pond 4 – SED6, SED58, SED59

Notes: All values in milligram per kilogram (mg/kg)

4.3 Effects Assessment

The effects assessment characterizes the potential effects associated with COCs. It provides a basis for evaluating what is an acceptable exposure and what level of exposure may adversely affect the health of ROCs. This involves identification of the potentially toxic effects of the COCs and determining concentrations that receptors can be exposed to without adverse effects based on literature studies (referred to as a toxicological benchmarks). Toxicological benchmarks are expressed as an acceptable concentration in an environmental media that a ROC can be exposed to. These values are used as thresholds for comparison with exposure concentrations (Section 4.2) during risk characterization (Section 4.3).

Site-specific assessments were also used as LOEs to assess potential effects to ecological receptors. These LOEs included a vegetation community health assessment and aquatic toxicity testing.

The effects measures considered by each LOE are discussed in detail below.

4.3.1 Toxicological Benchmarks

4.3.1.1 Terrestrial Plants and Soil Invertebrates

The first LOE for terrestrial plants and soil invertebrates is comparison of COC concentrations in soil to toxicological benchmarks for effects on survival, growth, and reproduction aimed at the protection of communities. There is no supporting documentation for the toxicological basis of the direct contact criteria from Atlantic RBCA and CCME that was used to screen COCs for terrestrial plants and soil invertebrates. Therefore, toxicological benchmarks for terrestrial plants and soil invertebrates provided by Efroymson *et al.* (1997a,b) were applied in the ERA (Table 32).

Table 32: Toxicological Benchmarks for Soil COCs for the Protection of Terrestrial Plants and Soil Invertebrates

Contaminant of Concern	Toxicological Benchmark (mg/kg)	Basis	Reference
Manganese	220	Plants: Geometric mean of the maximum acceptable toxicant concentration (MATC) values for three species under different test conditions (pH and % organic matter (OM)), equal to 220 mg/kg. Invertebrates: Geometric mean of the EC20 values for three test species under different test conditions (pH and OM%), equal to 450 mg/kg.	US EPA (2007)
Tin	50	Plants: Tin reduced shoot weight of bush beans by 22% at 500 mg/kg and had no effect at 50 mg/kg after 17 days of growth in soil (pH 6). Invertebrates: Arylsulfatase activity in soils was reduced by 2968 mg/kg of tin. The reductions were the least severe in the soil having the highest organic C and clay content. No effects were observed for the highest pH level tested (7.6).	Efroymson *et al.* (1997a,b)

4.3.1.2 Aquatic Life

The first LOE for aquatic life is comparison of COC concentrations in sediment and surface water to literature-based toxicological benchmarks for effects on survival, growth, and reproduction aimed at the protection of communities.

For sediment, the toxicological benchmarks were based on the CCME PELs for the protection of freshwater aquatic life (Table 33). These sediment benchmarks are based on the co-occurrence of effects in benthic invertebrates and the associated concentration of contaminants, in field-based samples. Benthic invertebrates

are the most sensitive species to sediment exposures of non-biomagnifying substances as they are in direct contact with sediment over their entire lifetime (ASTM, 2010) .For surface water, the toxicological benchmarks were based on the CCME WQGs for the protection of freshwater aquatic life derived based on effects to algae, plants, invertebrates, fish, and aquatic phase amphibians (Table 33). Both the sediment and surface water toxicological benchmarks selected for the ERA are the same values adopted by Atlantic RBCA for their Ecological Tier II PSSs protective of aquatic life.

Table 33: Toxicity Reference Values for Sediment COCs for the Protection of Aquatic Life

Contaminant of Concern	Toxicological Benchmark	Basis	Reference
Sediment (mg/kg)			
Lead	91	Concentration above which 42% of field-collected sediments are associated with adverse effects to benthic invertebrates. (1)	CCME 1999f
Surface Water (mg/L)			
Lead	1	Regression equation that corelates water hardness with chronic toxicity to aquatic plants, invertebrates, fish, and aquatic phase amphibians. The selected value is based on the lowest water hardness range given the waterbodies at the RA Property are extremely soft (average water hardness of 2.5 mg/L).	CCREM, 1987

Notes:

(1) Proportion of concentrations based on samples provided in Environment Canada's Biological Effects Database for Sediment (BEDS). TRV is analogous to Probable Effect Levels (PELs).

4.3.2 Site-Specific Assessments

4.3.2.1 Terrestrial Vegetation Community and Health Assessment

The overall health of vegetation communities between areas with high contaminant exposure (*i.e.*, the Firing Area) and surrounding unimpacted areas were assessed during a field survey in September 2022 (as presented in WSP, 2023). A visual inspection of all plants encountered was undertaken, allowing for the assessment of the general condition and vigour of individual plants and plant communities. When large numbers of individual stems were encountered in a small area, overall health of groupings of plants were assessed. The surveyed area is presented in Figure 12.

Most of the RA Property contains native, naturally occurring, plant communities. The plants and plant communities were well established and showing vigour. The only indication of anthropogenically influenced plant communities were very small patches in and around disturbed areas from firing range activities, immediately adjacent to the site access road. In this area, some plants have been knocked over and stunted due to physical disturbance (*e.g.,* vehicular traffic and campfires). The disturbed areas include very small patches of vegetation typical of cultural meadows, such as Timothy grass (*Phleum pratensis*), quack grass (*Elymus repens*), and dandelion (*Taraxacum officinale*). The source of the disturbed plant communities was determined to be from vehicular traffic and other minimal anthropogenic use (*e.g.,* foot traffic, littering, bonfires *etc*). None of these plants within the disturbed area were showing any signs of effects from contamination (*e.g.,* chlorosis, necrosis), and there were no abnormal signs of delayed growth or unusual dieback.

4.3.2.2 Sediment Toxicity Testing

Sediment toxicity sampling was completed on four sediment samples collected from the RA Property (two from Pond 4 – SED58/59 and two from Pond 4 – SED 60/61). These ponds had the highest concentrations of lead in sediment (outside of the remedial areas). Additionally, a field assessment confirmed that these waterbodies are representative of other waterbodies on the RA Property in terms of habitats (Section 4.1.1.1). Three

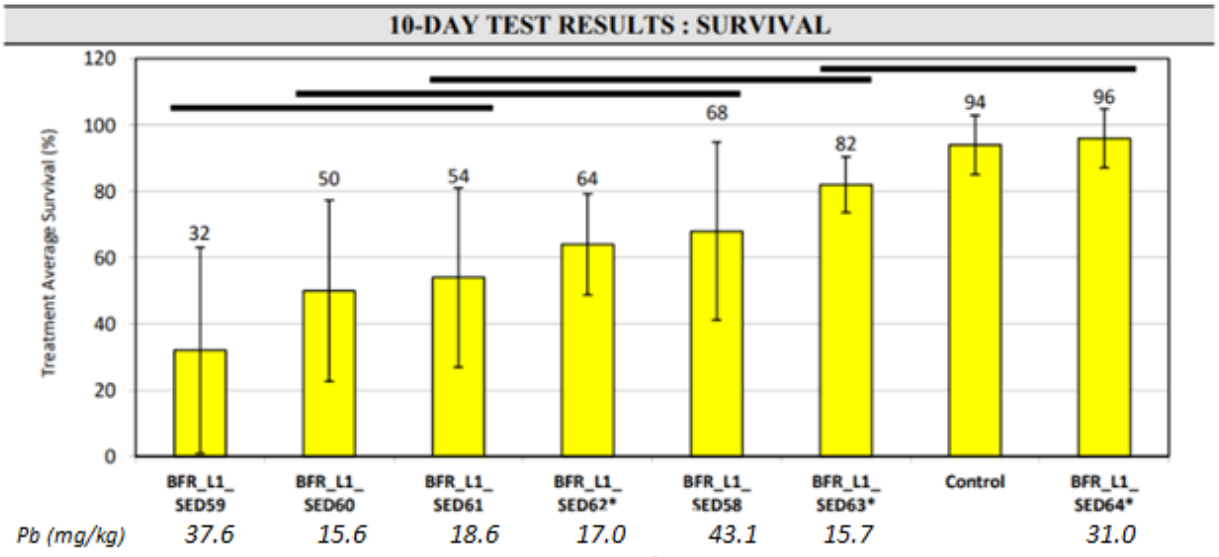
additional sediment samples were collected from reference waterbodies (SED62 to 64). The sampling locations are provided on Figure 5. The samples were analyzed for the following standardized, chronic toxicity tests:

- 14-day *Hyalella azteca* (freshwater amphipod) for survival and growth (EPS 1/RM/33; EC, 2017)
- 10-day *Chironomus dilutus* (freshwater midge) for survival and growth (EPS 1/RM/32; EC, 1997)

Test species were selected as representative surrogate species for aquatic taxa in freshwater lakes, and include an epibenthic *(H.azteca)* and infauna *(C.dilutus)* species. In a study of contaminated Great Lakes sediment, *H. Azteca and C. dilutus* were among the most sensitive and discriminatory of 24 organisms tested (ASTM, 2010).

Detailed sampling methodology and the laboratory certificate of analyses for these tests are provided in WSP (2023). The results and interpretations are summarized below.

C.dilutus survival results are summarized in Figure A, presented below. *C.dilutus* survival was significantly lower in all samples collected from Pond 3 (SED58/59) and Pond 4 (SED60/61) on the RA Property compared to the reference sample SED64 and the laboratory control. SED59 was significantly lower than all reference samples. However, the results are not correlated with COC concentrations. Sample SED58 with the highest lead concentration (43.1 mg/kg; above ISQG) had significantly higher growth than SED59 with a similar lead concentration (37.6 mg/kg; above ISQG) and SED60 with the lowest lead concentration (15.6 mg/kg; below ISQG). It is likely that the differences in results are correlated with other confounding variables, such as pH and anoxia. The samples collected from the RA Property were from deeper waters and described as “black silt, muck” with pH levels in the overlying water less than 4. Samples from the reference waterbodies were shallower, described as “black silt”, and had pH levels in the overlying water an order of magnitude higher (between 4 and 5). Notably, the sample with the lowest survival (SED59) had the lowest pH (3.29). The development of *Chironomus* species has been described as normal at pH values of 5.5 to 6.5, whereas a pH of 4.5 has been shown to cause a 60% reduction in adult emergence and a pH of 3.5 caused 100% mortality of first instars (EC, 1997). The occurrence of *Chironomus* species in the field have been reported at pH ranges of 5 to 9 (EC, 1997). The reduced survival is therefore not attributed to COCs.

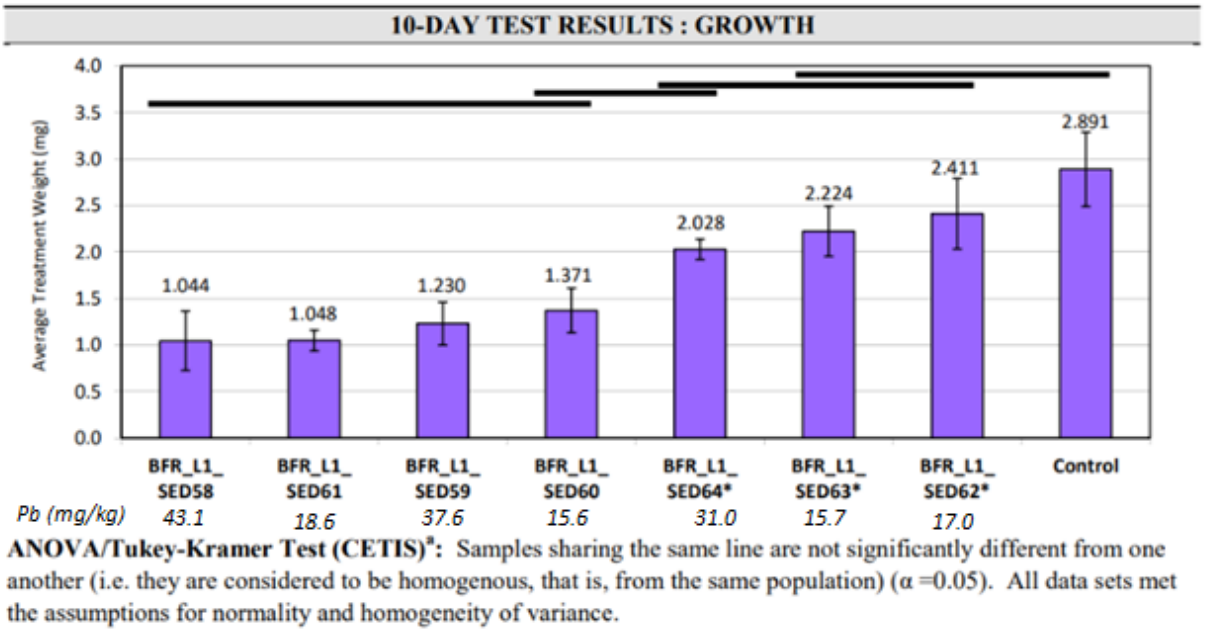


Fisher Exact/Bonferroni-Holm Test (CETIS)[a]: Samples sharing the same line are not significantly different from one another (i.e. they are considered to be homogenous, that is, from the same population) (α =0.05).

Figure A: Sediment Toxicity Results - Survival for *Chironomus dilutes*

* indicates reference sample

C.dilutus growth results are summarized in Figure B, presented below. *C.dilutus* growth was significantly lower in all samples collected from Pond 4 (SED58/59) and Pond 3 (SED60/61) on the RA Property compared to reference samples SED62/63 and the laboratory control. SED58/59/61 were significantly lower than all reference samples. However, the results are not correlated with COC concentrations. There was no significant difference among samples SED58/59 with the highest lead concentrations (43.1 and 37.6 mg/kg; above ISQG) and samples SED60/61 with the lowest lead concentrations (15.6 and 18.0 mg/kg; below ISQG). As discussed above, it is likely that the differences in results are correlated with other confounding variables, such as pH and anoxia. The significantly lower growth observed among the RA Property samples were taken from waterbodies with pH levels less than 4, whereas the pH levels in the reference waterbodies were greater than 4. The reduced growth is therefore not attributed to COCs.

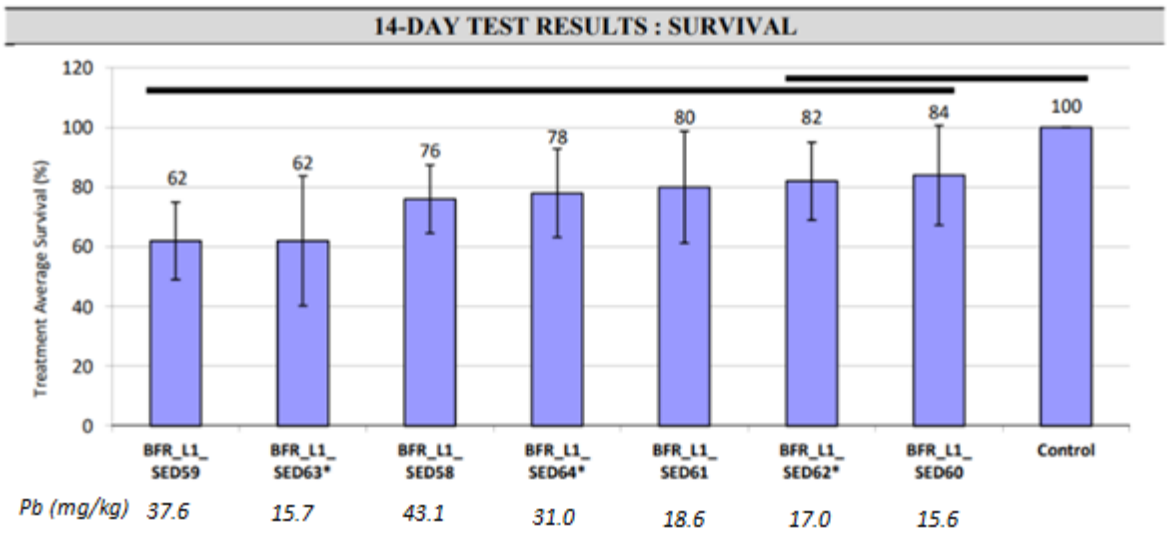


ANOVA/Tukey-Kramer Test (CETIS)[a]: Samples sharing the same line are not significantly different from one another (i.e. they are considered to be homogenous, that is, from the same population) (α =0.05). All data sets met the assumptions for normality and homogeneity of variance.

Figure B: Sediment Toxicity Results - Growth for *Chironomus dilutes*

* indicates reference sample

H.Azteca survival results are summarized in Figure C, presented below. *H.Azteca* survival was not significantly different among all RA Property and reference samples.

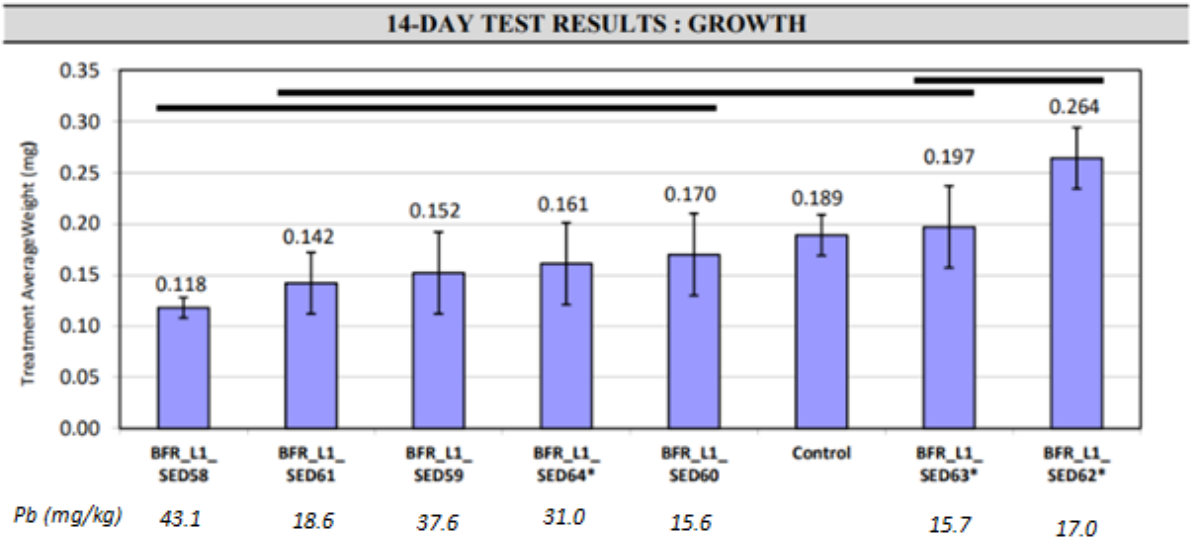


Fisher Exact/Bonferroni-Holm Test (CETIS)[a]: Samples sharing the same line are not significantly different from one another (i.e. they are considered to be homogenous, that is, from the same population) (α =0.05).

Figure C: Sediment Toxicity Results - Survival for *Hyalella Azteca*

* indicates reference sample

H. Azteca growth results are summarized in Figure D, presented below. There were no significant differences in growth among RA Property and reference samples, except for SED58 with significantly lower growth and reference sample SED62 with significantly higher growth. As discussed above, differences in growth were not related to COCs, but are likely the result of confounding variables such as pH and anoxia. The reduced growth is therefore not attributed to COCs.



ANOVA/Tukey-Kramer Test (CETIS)[a]: Samples sharing the same line are not significantly different from one another (i.e. they are considered to be homogenous, that is, from the same population) (α =0.05). All data sets satisfied the assumptions for normality and homogeneity of variance.

Figure D: Sediment Toxicity Results - Growth for *Hyalella Azteca*

* indicates reference sample

Better survival and growth results were observed in *H.Azteca* as compared to *C. dilutes*. This is likely the result of the *H.Azteca being* an epibenthic invertebrate, which would be less influenced by sediment chemistry, as compared to *C. dilutes*, which is an infauna invertebrate directly immersed within the sediment. However, studies have found *H. azteca* to be more sensitive to metal-contaminated sediments than *Chironomus* species (ASTM, 2010; Kemble *et al.,* 2013). Therefore, the higher survival of *H.Azteca* as compared to *C. dilutes* further supports that pH, rather than COC concentrations, are a driver for the reduced mortality and growth observed in the sediment toxicity tests.

4.3.2.3 Surface Water Toxicity Testing

Surface water toxicity sampling was completed on four surface water samples collected on the RA Property (two from Pond 4 – SED58/59 and two from Pond 3 – SED 60/61). These surface water samples were co-located with the sediment samples that had the highest concentrations of lead and Pond 4 has the highest concentrations of lead in surface water (outside of the remedial areas). Additionally, a field assessment confirmed that these waterbodies are representative of other waterbodies on the RA Property in terms of habitats (Section 4.1.1.1). Three additional surface water samples were collected from reference waterbodies (SED62 to SED64). The sampling locations are provided on Figure 8. The samples were analyzed for the following standardized, chronic toxicity tests:

- 6- to 8-day *Ceriodaphnia dubia* (freshwater cladoceran) survival and reproduction (EPS 1/RM/21; EC, 2007a)
- 7-day *Pimephales promelas* (fathead minnow) survival and biomass (EPS 1/RM/22; ECCC, 2011)
- 72-hour *Pseudokirchneriella subcapitata* (unicellular freshwater algae) growth inhibition (EPS 1/RM/25; EC, 2007b).

Test species were selected as representative surrogate species for aquatic taxa in freshwater lakes, and included representative taxa consistent with CCME guidance (*e.g.,* fish, invertebrates, plants).

Detailed sampling methodology and the laboratory certificate of analyses for these tests are provided in WSP (2023). The results and interpretations are summarized below.

C.dubia reproduction and survival results are summarized in Table 34. The LC50 for all samples was 100% or >100%. For reproduction, the IC25 was similar between all RA Property and reference samples (35.6% to 48.8%), except for SW60 that had an IC25 of 0.48% and reference sample SW63 that had an IC25 of >100%. The results are not corelated with COC concentrations. SW60/61 had the highest lead concentrations (both 4.1 mg/L; above WQGs), but the IC25 was 0.48% and 48.8%, respectively. It is likely that the differences are correlated with other confounding variables. *C.dubia* is sensitive to pH, salinity, and extremely hard or soft water (FCSAP, 2010). All samples had low pH (3.29 to 4.78) and extremely soft water hardness (1.7 to 4.4 mg/L). This likely explains the low IC25 values for almost all samples. The lowest IC25 value found at SW60 may have been the result of higher ammonia found in this sample, as shown in Table 34. There was also no strong dose response relationship observed in this sample. The reduced reproduction is therefore not attributed to COCs.

Table 34: Surface Water Toxicity Results for *Ceriodaphnia dubia*

Sample [1]	IC25 (repro.)	Confidence Limits	LC50	Confidence Limits	Field pH	Field DO	Hardness mg/L	Ammonia mg/L	Lead mg/L
SW60	0.48%	0.09% - 37.8%	>100%	-	3.88	7.33	3.4	2.17	4.1
SW58	35.6% Φ	1.16 - 39.2%	100%	33.3% - *	3.71	7.58	1.7	<0.03	<0.5
SW62 (Reference)	36.4% Φ ∞	0.11 - 58.3%	>100%	-	4.78	9.98	4.4	<0.03	0.6

Sample [1]	IC25 (repro.)	Confidence Limits	LC50	Confidence Limits	Field pH	Field DO	Hardness mg/L	Ammonia mg/L	Lead mg/L
SW59	36.9% Φ ∞	0.12 - 45.2%	100%	33.3% - *	3.29	8.8	2.1	0.41	<0.5
SW64 (Reference)	38.3% Φ ∞	0.40 - 55.0%	>100%	-	4.55	8.48	4.1	0.07	0.7
SW61	48.8% ∞	0.30 - 81.6%	>100%	-	3.47	6.71	4.4	<0.03	4.1
SW63 (Reference)	>100%	-	>100%	-	4.28	8.61	4.1	<0.03	0.9

Notes:

[1] Presented in order of lowest to highest IC25

Samples with the same symbol (Φ or ∞) have relative percent differences in IC25 values within 30%

IC25 = concentration (represented as % dilution of the original sample) that causes a 25% reduction in reproduction

LC50 = concentration (represented as % dilution of the original sample) that kills 50% of species

*The usefulness of any LC50 calculated from this data set is questionable because a concentration-effect relationship was not demonstrated over a reasonable range (*i.e.,* <37 to >63 percent dead). A statistically valid upper 95% confidence limit could not be generated. At a confidence level of 95%, the binomial test shows that the LC50 is above 33.3%.

Fathead minnow growth and survival results are summarized in Table 35. LC50 values were >100% for SW60 and all reference samples. For the remaining RA Property samples, the LC50 values ranged from 72 to 79%. For growth, the RA Property samples had lower IC25 values (55 to 61%) as compared to reference samples (74 to >100%). The results are not corelated with COC concentrations. SW58/59 were the only samples with lead concentrations below the RDL, yet they had the lowest IC25 values. pH levels were lower in the RA Property samples as compared to the reference samples, and this likely explains the differences in growth. Fathead minnows are not well adapted to acidic pH and there is evidence of marginal effects of acidic conditions, up to pH 6.6 (EC, 2011). The reduced survival and growth are therefore not attributed to COCs.

Table 35: Surface Water Toxicity Results for Fathead Minnow

Sample [1]	IC25 [1] (growth)	Confidence Limits	LC50	Confidence Limits	Field pH	Field DO	Ammonia mg/L	Lead mg/L
SW58	55.1% ∞	9.72 - 59.2%	72.4% ∞	66.3 - 79.1%	3.71	7.58	<0.03	<0.5
SW59	57.7% ∞	51.0 - 62.6%	78.0% Φ∞	48.8 - 88.6%	3.29	8.8	0.41	<0.5
SW60	58.3% ∞	18.8% - 73.9%	>100%Φ	-	3.88	7.33	2.17	4.1
SW61	60.7% ∞	26.5% - 77.3%	79.4% Φ∞	69.3%- 90.9%	3.47	6.71	<0.03	4.1
SW63 (Reference)	74.4%Φ∞	30.6 - 127%	>100% Φ	-	4.28	8.61	<0.03	0.9
SW62 (Reference)	87.7% Φ	67.3 - 116%	>100% Φ	-	4.78	9.98	<0.03	0.6
SW64 (Reference)	>100% Φ	-	>100% Φ	-	4.55	8.48	0.07	0.7

Notes:

1 Presented in order of lowest to highest IC25

Samples with the same symbol (Φ or ∞) have relative percent differences in IC25 or LC50 values within 30%

IC25 = concentration (represented as % dilution of the original sample) that causes a 25% reduction in biomass (as a measure of growth)

LC50 = concentration (represented as % dilution of the original sample) that kills 50% of species

*The usefulness of any LC50 calculated from this data set is questionable because a concentration-effect relationship was not demonstrated over a reasonable range (*i.e.,* <37 to >63 percent dead). A statistically valid upper 95% confidence limit could not be generated. At a confidence level of 95%, the binomial test shows that the LC50 is above 33.3%.

For *Pseudokirchneriella subcapitata* there were no differences in the IC25 for growth across samples, with all samples having an IC25 of >90.91%.

4.4 Risk Characterization

Risk characterization determines the potential for adverse impacts or risks to ROCs. This is done by first combining the findings of the exposure assessment with the findings of the effects assessment for each LOE to determine potential risks based on each LOE.

For all ROCs, the first LOE included comparison of COC concentrations in exposure media to literature-based toxicological benchmarks for effects on survival, growth, and reproduction to determine HQs. An HQ of less than or equal to one was considered to represent a negligible risk to these ROCs from exposure to the COC. An HQ of greater than one was considered to represent a potential risk to these ROCs from exposure to the COC and a more detailed evaluation of risk was undertaken using site-specific LOEs.

The characterization of risks includes consideration of the uncertainty and conservatism in the ERA. The findings of each LOE are then combined (in consideration of the weighting of each LOE) to draw an overall conclusion regarding the potential for adverse ecological impacts or risks using a WOE approach.

4.4.1 Terrestrial Plants and Soil Invertebrates - Direct Contact with Soil

Terrestrial plants and soil invertebrates may be exposed to COCs through direct contact with soil. As discussed in Section 4.1.5, soil chemistry (LOE 1) and a vegetation community and health assessment (LOE 2) were applied to assess risks to these ROCs.

The results of the vegetation community and health assessment (LOE 2) was used to infer the potential for risks to soil invertebrates. Adverse effects on invertebrates would be manifested through effects on plants given their importance in nutrient cycling and soil fertility.

4.4.1.1 LOE 1 – Soil Chemistry

For this LOE, maximum concentrations of COC in soil (Section 4.2.1) were compared to literature-based toxicological benchmarks for effects on survival, growth, and reproduction of plants and soil invertebrates (Section 4.3.1.1) to determine HQs.

HQs calculated for terrestrial plants and soil invertebrates are presented in Table 36 and were greater than the target of 1 for manganese

Table 36: Hazard Quotients for the Protection of Terrestrial Plants and Soil Invertebrates from Soil

Contaminant of Concern	HQ
Manganese	**2.6**
Tin	0.3

Notes:
Bold = hazard quotient (HQ) greater than 1.

4.4.1.2 LOE 2 – Vegetation Health and Community Assessment

For this LOE, the health of plant species and communities of terrestrial vegetation within the RA Property was evaluated. Observations on plant health and communities was compared between impacted areas and surrounding reference areas.

As discussed in Section 4.3.2.1, the only indication of anthropogenically influenced plant communities were very small patches in and around disturbed areas from firing range activities, immediately adjacent to the site access road (as shown in Figure 12). The source of the disturbed plant communities was determined to be from

vehicular traffic and other minimal anthropogenic use *(e.g.,* foot traffic, littering, bonfires etc). None of these plants within the disturbed area were showing any signs of effects from contamination (*e.g.,* chlorosis, necrosis), and there were no abnormal signs of delayed growth or unusual dieback.

4.4.1.3 Overall Assessment

Based on LOE 1 (soil chemistry), potentially unacceptable risks to terrestrial plants and soil invertebrates was identified for manganese.

Based on LOE 2 (vegetation health and community assessment), no unacceptable risks to terrestrial plants and soil invertebrates were identified from the COCs.

LOE 2 was given higher weighting than LOE 1 because it considers site-specific factors that influence bioavailability and toxicity, which are not accounted for in literature based toxicological reference values, and therefore is more ecologically relevant.

Overall, no unacceptable risks from direct contact with soil COCs were identified for soil invertebrates based on LOE 2, where there were no site-specific effects to plant communities associated with contamination.

4.4.2 Aquatic Life - Direct Contact with Sediment

Aquatic life (including benthic invertebrates, aquatic plants, and fish) may be exposed to COCs through direct contact with sediment. As discussed in Section 4.1.5, sediment chemistry (LOE 1) and sediment toxicity testing (LOE 2) were applied to assess risks to these ROCs.

4.4.2.1 LOE 1 – Sediment Chemistry

For this LOE, maximum and average concentrations of COC in sediment (Section 4.2.2) were compared to literature-based toxicological benchmarks (Section 4.3.1.2) for effects on survival, growth, and reproduction of aquatic life to determine HQs. Sediment HQs for aquatic life are presented in Table 37. The HQ for lead was above the target of 1 based on the maximum concentration identified at Pond 4; however, the elevated concentrations within this pond were isolated to one sample location. HQs were less than one based on the average concentrations found in Pond 3 and 4, which are the closest ponds to the Firing Area outside of the proposed remedial area.

Table 37: Hazard Quotients for the Protection of Aquatic Life from Sediment

Contaminant of Concern	HQ
Lead – Maximum Concentration (Pond 4)	1.5
Lead – Average Concentration for Pond 3	0.6
Lead – Average Concentration for Pond 4	0.6

Notes:

Bold and Shaded = hazard quotient (HQ) greater than 1.

4.4.2.2 LOE 2 – Sediment Toxicity Testing

For this LOE, sediment chronic toxicity testing for amphipod (*H. azteca*) and midge *(C.dilutus)* survival and growth was completed, which are considered the most sensitive species to sediment contamination. Statistically significant differences in survival and/or growth between exposure and reference areas relative to a laboratory control was considered to represent a potential risk to aquatic life at the RA Property. Sediment toxicity sampling was completed on four sediment samples collected from the RA Property (two from Pond 4 – SED58/59 and two from Pond 4 – SED 60/61). These ponds had the highest concentrations of lead in sediment outside of the remedial area. Three additional sediment samples were collected from reference waterbodies (SED62 to 64)

A detailed discussion of the results in provided in Section 4.3.2.2 and is summarized in Table 38. There were significant differences in survival and growth for both species as compared to at least one reference sample. However, significant differences between RA Property samples and all reference samples were only seen for *C.dilutus* survival in SED59 and *C.dilutus* growth in SED58. However, there was no corelation between concentrations of COCs (*i.e.,* lead) and the results. It is likely that the differences in results are correlated with other confounding variables, such as pH and anoxia. The samples collected from the RA Property were from deeper waters and described as “black silt, muck” with pH levels in the overlying waters less than 4. Samples from the reference waterbodies were shallower, described as “black silt”, and had pH levels in the overlying water an order of magnitude higher (between 4 and 5).

Better survival and growth results were observed in *H.Azteca* as compared to *C. dilutes*. This is likely the result of the *H.Azteca being* an epibenthic invertebrate, which would be less influenced by sediment chemistry, as compared to *C. dilutes*, which is an infauna invertebrate directly immersed within the sediment. Studies have also found *H. azteca* to be more sensitive to metal-contaminated sediments than *Chironomus* species (ASTM, 2010; Kemble, 2013). Therefore, the better survival of *H.Azteca* as compared to *C. dilutes* further supports that pH, rather than COC concentrations, are a driver for the reduced mortality and growth observed in the sediment toxicity tests.

Table 38: Summary of Sediment Toxicity Results

Toxicity Test	Endpoint	Samples not significantly different from one another	Interpretations and Conclusions
10-day *Chironomus dilutus*	Survival	SED59, SED60, SED61	- SED59 was the only sample significantly lower than all reference samples - Results not correlated with COC concentration, SED58 had the highest Pb concentration (above ISQG) yet not significantly different from two reference samples that had the lowest Pb concentrations (below the ISQG) - Results likely related to pH and anoxia, SED59 had the lowest littoral pH (3.29) and all RA Property samples collected from deeper waters with evidence of anoxic conditions and pH <4.
		SED60,SED61, SED62*, SED58	
		SED61,SED62*, SED58, SED63*	
		SED63*, Control, SED64*	
	Growth	SED58, SED61, SED59, SED60	- Most RA Property samples significantly lower than reference - Results not correlated with COC concentrations, no significant difference among SED58/59 with the highest Pb (43.1 and 37.6 mg/kg; above ISQG) and SED60/61 with the lowest Pb (15.6 and 18.0 mg/kg; below ISQG). - Results likely related to pH and anoxia. Reference samples had pH >4 with no evidence of anoxia, unlike RA Property samples.
		SED60, SED64*	
		SED64*, SED63*, SED62*	
		SED63*, SED62*, Control	
6-day Hyella Azteca	Survival	SED59, SED63*,SED58, SED64*, SED61, SED62*, SED60	- Survival was not significantly different among all RA Property and reference sample -
		SED62*, SED60, Control	

Toxicity Test	Endpoint	Samples not significantly different from one another	Interpretations and Conclusions
6-day Hyella Azteca	Growth	SED58, SED61, SED59, SED64*, SED60	- No significant differences in growth among RA Property, laboratory control, and reference samples, except for SED58 with lower growth and SED62 with higher growth - Results not correlated with COC concentrations
		SED61, SED59, SED64*, SED60, Control, SED63*	
		SED63*, SED64*	

Notes: * indicates reference concentration, Pond 4 samples = SED58/59, Pond 3 samples = SED60/61, COC = contaminant of concern, Pb = lead, ISQG = interim sediment quality guideline

4.4.2.3 Overall Assessment

Based on LOE 1 (sediment chemistry), potential risks to aquatic life were identified for lead in sediments based on the maximum concentration; however, based on the average concentration there was no unacceptable risks.

Based on LOE 2 (sediment toxicity testing), it was concluded that confounding variables, likely pH, were the driver for the reduced mortality and growth observed relative to reference samples rather than the concentrations of COCs (*i.e.,* lead). LOE 2 was given higher weighting than LOE 1 because it considers site-specific factors that influence bioavailability and toxicity, which are not accounted for in literature based toxicological reference values, and therefore is more ecologically relevant.

Overall, no unacceptable risks from direct contact with sediment COCs were identified for aquatic life based on HQs <1 derived from average sediment concentrations and based on the lack of correlation between reduced survival and growth in site-specific toxicity samples and lead concentrations.

4.4.3 Aquatic Life - Direct Contact with Surface Water

Aquatic life (including algae, plants, pelagic invertebrates, fish, and aquatic phase amphibians) may be exposed to COCs through direct contact with surface water. As discussed in Section 4.1.5, surface water chemistry (LOE 1) and toxicity testing (LOE 2) were applied to assess risks to these ROCs.

4.4.3.1 LOE 1 – Surface Water Chemistry

For this LOE, maximum and average concentrations of COC in surface water (Section 4.2.2) were compared to literature-based toxicological benchmarks (Section 4.3.1.2) for effects on survival, growth, and reproduction of aquatic life to determine HQs.

Surface water HQs for aquatic life are presented in Table 39. The HQ for lead was greater than the target of 1 based on the maximum concentration identified at Pond 3. Based on average concentration in Pond 3, the HQ remained above 1. The HQ for Pond 4 based on the average concentration was below 1.

Table 39: Hazard Quotients for the Protection of Aquatic Life from Surface Water

Contaminant of Concern	HQ
Lead – Maximum (from Pond 3)	4.1
Lead – Average from Pond 3	3.2
Lead – Average from Pond 4	0.5

Notes:

Bold and Shaded = hazard quotient (HQ) greater than 1.

4.4.3.2 LOE 2 – Surface Water Toxicity Testing

For this LOE, surface water chronic toxicity testing was completed for a freshwater invertebrate *(C.dubia),* a fish (fathead minnow), and a unicellular algae *(P.subcapitata).* Relative percent differences of greater than 30% between the LC50 and IC25 values derived for reference and RA Property samples is considered to represent a potential risk to aquatic life. Surface water toxicity sampling was completed on four surface water samples collected from the RA Property (two from Pond 4 – SW58/59 and two from Pond 4 – SW60/61). These samples are collocated with the sediment samples that had the highest concentrations of lead and SW60/61 also had the highest concentrations of lead in surface water (outside of the proposed remedial areas). Three additional surface water samples were collected from reference waterbodies (SED62 to 64).

A detailed discussion of the results is provided in Section 4.3.2.3 and is summarized in Table 40. Reduced IC25 values of at least 30% as compared to reference samples were observed for *C.Dubia* at Pond 3 (SW60) and for the fathead minnow at Pond 3 and 4 (all samples). Reduced LC50 values of at least 30% as compared to reference samples were observed for the fathead minnow at Pond 4 (SW58). However, there was no corelation between COC (*i.e.,* lead) concentrations and the results. It is likely that the differences in results are correlated with other confounding variables, such as pH and ammonia.

Table 40: Summary of Sediment Toxicity Results

Toxicity Test	Endpoint	Samples with RPD within 30%	Interpretations and Conclusions
6- to 8-day *Ceriodaphnia dubia*	LC50 (survival)	All samples had LC50 of 100% or >100%	- No differences in survival among all samples
	IC25 (reproduction)	SW58,SW62*, SW59,SW64*	- IC25 was similar between all RA Property and reference samples (35.6% to 48.8%), except for SW60 with IC25 of 0.48% and reference sample SW63 with IC25 of >100% - Results not corelated with COC concentrations, SW60 and SW61 had the highest lead concentrations (both 4.1 mg/L; above WQGs), but the IC25 was 0.48% and 48.8% - Low pH and hardness likely explain the reduced reproduction for almost all samples - Lowest IC25 at SW60 may have been the result of higher ammonia found in this sample
		SW62*,SW59, SW64*,SW61	
7-day *Pimephales promelas* (fathead minnow)	LC50 (survival)	SW58,SW59,SW61	- RA Property LC50s similar to reference samples, except for SW58 - Results not correlated with Pb as SW58 concentrations <0.5 mg/kg
		SW59, SW60, SW61, SW63*, SW62*, SW64*	
	IC25 (growth)	SW58,SW59,SW60, SW61,SW63*	- RA Property had lower IC25 values (55 to 61%) as compared to reference samples (74 to >100%) - Results not correlated with Pb as SW58 and SW59 were the only samples with concentrations <0.5 mg/kg, yet they had the lowest IC25 values - pH levels were an order of magnitude lower in the RA Property samples as compared to the reference samples, and this likely explains the differences in growth
		SW63*, SW62*, SW64*	
72-hour *Pseudokirchneriella subcapitata a*	IC25 (growth)	All samples had IC25 >90.1%	- No differences in growth among all samples

Notes: * indicates reference concentration, Pond 4 samples = SED58/59, Pond 3 samples = SED60/61, COC = contaminant of concern, Pb = lead, WQG = water quality guideline, IC25 = concentration (represented as % dilution of the original sample) that causes a 25% reduction in non-lethal endpoint, LC50 = concentration (represented as % dilution of the original sample) that kills 50% of species

4.4.3.3 Overall Assessment

Based on LOE 1 (surface water chemistry), HQs greater than 1 were identified for lead based on maximum and average concentrations in Pond 3 suggesting potential risks to aquatic life.

Based on LOE 2 (surface water toxicity testing), it was concluded that confounding variables, likely pH and ammonia, were the driver for the reduced mortality, reproduction, and growth observed relative to reference samples rather than COC (*i.e.,* lead) concentrations.

LOE 2 was given higher weighting than LOE 1 because it considers site-specific factors that influence bioavailability and toxicity, which are not accounted for in literature based toxicological reference values and is therefore more ecologically relevant.

Overall, no unacceptable risks from direct contact with surface water COCs were identified for aquatic life based on the lack of correlation between reduced survival, reproduction, and growth in site-specific toxicity samples and lead concentrations.

4.4.4 Uncertainty Assessment

Uncertainties related to each component of the ERA and the potential implications that these uncertainties may have on the interpretation of risks are detailed in Table 41. In general, the uncertainties result in an overestimation of risks to ecological receptors.

Table 41: Uncertainty Assessment for the Ecological Risk Assessment

Source of Uncertainty	Over- / Under-Estimate of Risk
Problem Formulation	
Ecological criteria from the CCME and Atlantic RBCA were used to identify COCs for ecological receptors. In general, these criteria are conservative.	Overestimate
There are no screening values for amphibians; therefore, the results of the screening for mammals and birds were used to identify COCs for amphibians. This approach was appropriate because the US EPA (2008) uses birds as surrogates for terrestrial phase amphibians and reptiles in ERA.	Underestimate, neutral or overestimate
Dermal contact with soil by mammals and birds was considered negligible because the presence of fur and feathers that limits dermal contact with soil.	Underestimate
Dermal contact with soil by amphibians was considered negligible because the COCs were inorganics, rather than organics that have increased skin penetration rates.	Underestimate
Exposure Assessment	
Maximum concentrations were applied as the EPC in soil, sediment, and surface water for assessment of potential risks to terrestrial plants, soil invertebrates, and aquatic life. This is a conservative approach and may overestimate exposure as it does not account for potential exposures to ecological communities (*e.g.,* when only 1 exceedance is measured in a dataset).	Overestimate
Average concentrations were also applied as the EPC in sediment and surface water for assessment of potential risks to aquatic life. This is considered a more realistic estimate of potential exposure to ecological communities where effects would not be driven by isolated areas where maximum measured concentrations were measured.	Neutral
Toxicity Assessment	
The toxicological benchmarks for plants and soil organisms' are based on laboratory studies in which soils are amended with a bioavailable form of the chemical. The soils at the RA Property are likely weathered, and therefore, the bioavailability and toxicity of the chemicals are likely less than that for freshly amended soils used to derive the toxicological benchmarks. Furthermore, for plants and earthworms, many of the toxicity tests are performed in containers. Toxicity can be up to 2-fold higher in studies conducted in containers because plant roots and earthworms cannot avoid the contaminated soil as they do under field conditions.	Overestimate

Source of Uncertainty	Over- / Under-Estimate of Risk
The toxicological benchmark for lead in surface water is based on laboratory studies that correlate water hardness with potential effects to aquatic life. However, several other factors can impact the toxicity in surface water, particularly DOC and pH. The colour units measured in surface water samples were high, above screening values, indicating that DOC levels in surface water are likely high and would help to mitigate toxicity by reducing the bioavailable concentrations.	Overestimate
The 2022 sediment toxicity testing samples collected from the RA Property for LOE 2 had lower concentrations of COCs (*i.e.,* lead) compared to the 2021 sediment samples used to calculate HQs in LOE 1. However, the maximum concentrations were isolated and HQs were less than 1 based on the average concentrations. This uncertainty does not affect the concluisions of the ERA.	Underestimate
Plants were used as a surrogate for invertebrates based on the results of the vegetation health and community assessment. This was considered a reasonable approach given that adverse effects on invertebrates would be manifested through effects on plants given their importance in nutrient cycling and soil fertility.	Neutral

Notes: CCME = Canadian Council of Ministers of the Environment; COC = contaminant of concern; RBCA = Risk Based Corrective Action; LOE = line of evidence; EPC = exposure point concentration

4.5 Summary of Potential Risks Requiring Risk Management

An ERA was completed to evaluate the potential risks to ecological receptors under current conditions at the RA Property and foreseeable future conditions. The future use of the RA Property is Crown land. Terrestrial plants, soil invertebrates, wildlife, and aquatic life were identified as ROCs for the assessment and were evaluated for potential exposures to metal COCs in soil, surface water, and sediment. The ERA was completed in consideration of site-specific LOEs to assess potential risks, including a terrestrial plant community and health assessment, sediment toxicity testing, and surface water toxicity testing. The ERA evaluated potential exposure to concentrations of COCs measured on the RA Property outside of the proposed remedial areas where hazardous, leachable lead concentrations were identified (Figure 2C).

There were no unacceptable risks identified for ecological receptors; therefore, there are no further recommendations with respect to remediation and/or risk management for the COCs measured outside of the proposed remedial areas.

5.0 CONCLUSIONS AND RECOMMENDATIONS

WSP was retained by DCC on behalf of DND to complete a HHERA for the Former Burgeo Range in Burgeo, Newfoundland.

DND leased Crown lands from the Government of NL for use by 5CRPG in 2008 (the “Site”). However, the activities associated with the Former Burgeo Range took place on lands directly south of the Site (the “Additional Proposed Leased Lands” or “Firing Area”). The Site includes two distinct areas identified as Location 1 and Location 2. The Firing Area is adjacent to Location 1. Location 1 has been divided into three zones based on the expected level of risk from former/current activities associated with the Firing Area – high (Zone 1), medium (Zone 2), and low (Zone 3). Therefore, the lands evaluated as part of the HHERA included the Firing Area and Zone 1 (collectively referred to as “the RA Property”). Concentrations of COCs in Zone 2 and Zone 3 were associated with natural background concentrations.

It is DND’s intent to decommission the Site and the Additional Proposed Leased Lands and obtain closure from the Province of NL, if required. To achieve site closure the following was recommended following the extensive testing program (*Steps 5 to 7 of the Federal Approach to Contaminated Sites*; WSP, 2023):

- Remediation of soil around the backstop (bullet catch) and wooden targets within the Firing Area through source removal (found to contain hazardous concentrations of leachable lead). These areas have been horizontally and vertically delineated.
- Remediation of surface water and sediment in Pond 1 and 2 located adjacent to the backstop (bullet catch) (found to have lead concentrations over 5 times higher than anywhere else on the RA Property).
- Risk management of the remaining areas of RA Property where widespread and marginal exceedances of COCs have been identified.

To support the Remedial and Risk Management Strategy for the RA Property, the objectives of the HHERA were to:

- Assess the potential for health risks to human and ecological receptors which may be exposed to COCs in soil, groundwater, sediment, and surface water on the RA Property (outside of the proposed remedial areas) based on the current and future land use.
- Identify RMMs to mitigate unacceptable levels of risk identified by the HHERA, if necessary.

For the identification of COCs, environmental quality criteria associated with agricultural land use, non-potable groundwater, and coarse-grained soil were applicable to the RA Property. Both federal and regional criteria from CCME, FCSAP, and Atlantic RBCA were considered (collectively referred to as “screening values”). To protect against impacts to the provincially protected watershed that is hydraulically connected to the Town of Burgeo’s water supply (*i.e.,* Long Pond), drinking water criteria from Health Canada and NL were also considered. Maximum concentrations of chemicals were compared to their respective screening values. Site-specific background concentrations were also considered for identifying COCs related to site activities. Based on this initial screening the following COCs were identified that required further assessment in the HHERA:

- Aluminium, lead, manganese, tin, and vanadium in soil
- Aluminium, copper, lead, and zinc in groundwater
- Arsenic and lead in sediment
- Lead in surface water

The following summarizes the conclusions and recommendations of the HHRA:

- The HHRA evaluated potential risks to a Recreational User from direct contact with soil, sediment, and surface water, as well as consumption of country foods.
- Based on screening against human health criteria, direct contact with soil was retained for further assessment of potential risks from soil COCs (aluminium, manganese, vanadium)
- Risks were negligible for a Recreational User; therefore, RMMs are not required for these receptors.
- Potential off-site health risks to the provincially protected watershed were also negligible as no COCs were identified in surface water above drinking water criteria.
- It is possible that a Subsurface Worker, who may be involved in future construction or other intrusive work, may also be exposed to COCs on the RA Property. However, no planned intrusive work is proposed outside of the remedial areas and there are no development plans that may require intrusive work. As any potential exposures are short-term and are mitigated through an industry standard HASP, this receptor was not evaluated in the HHRA.

The following summarizes the conclusions and recommendations of the ERA:

- Primary producers (terrestrial plants), soil invertebrates, mammals, birds, and amphibians were identified as receptor groups for the terrestrial ecosystem. No terrestrial SAR were identified as a ROC.
- Primary producers (aquatic plants), pelagic invertebrates, benthic invertebrates, fish, and amphibians were identified as receptor groups for the aquatic ecosystem (collectively referred to as aquatic life). Fish SAR were identified as ROC (American eel and banded killfish).
- Based on screening against ecological criteria, terrestrial plants and soil invertebrates were retained for further assessment of potential risks from soil COCs (tin), and aquatic life were retained for further assessment of potential risks from sediment and surface water COCs (lead).
- Protection goals included maintenance of communities of ecological receptors that are similar to reference areas and protection of individual SAR.
- Several LOEs were used to characterize risks to the terrestrial and aquatic ecosystems. These LOEs included HQs (where COC concentrations are compared to literature-based toxicity information), site-specific toxicity studies, and site-specific biological studies.
- Risks to terrestrial plants and soil invertebrates from soil COCs were found to be negligible based on a vegetation health and community study.
- Risks to aquatic life from sediment COCs were found to be negligible based on HQs that considered average concentrations and site-specific toxicity testing.
- Risks to aquatic life from surface water COCs were found to be negligible based on site-specific toxicity testing.
- Based on these results, no further work or RMMs are recommended for ecological receptors.

The Remedial and Risk Management Strategy Report for the Site should be updated based on the findings of the HHERA.

6.0 SIGNATURE PAGE

We trust that the information provided in this report meets your requirements. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

WSP Canada Inc.

Lindsay Furtado, MSc, RPBio
Environmental Risk Assessor

Mike Z'Graggen, MRM, QPRA
Risk Assessor and Toxicologist

LF/MZ

https://golderassociates.sharepoint.com/sites/164365/project files/6 deliverables/5. risk assessment/21497139_dnd burgeo hhera_27march2023_final.docx

7.0 REFERENCES

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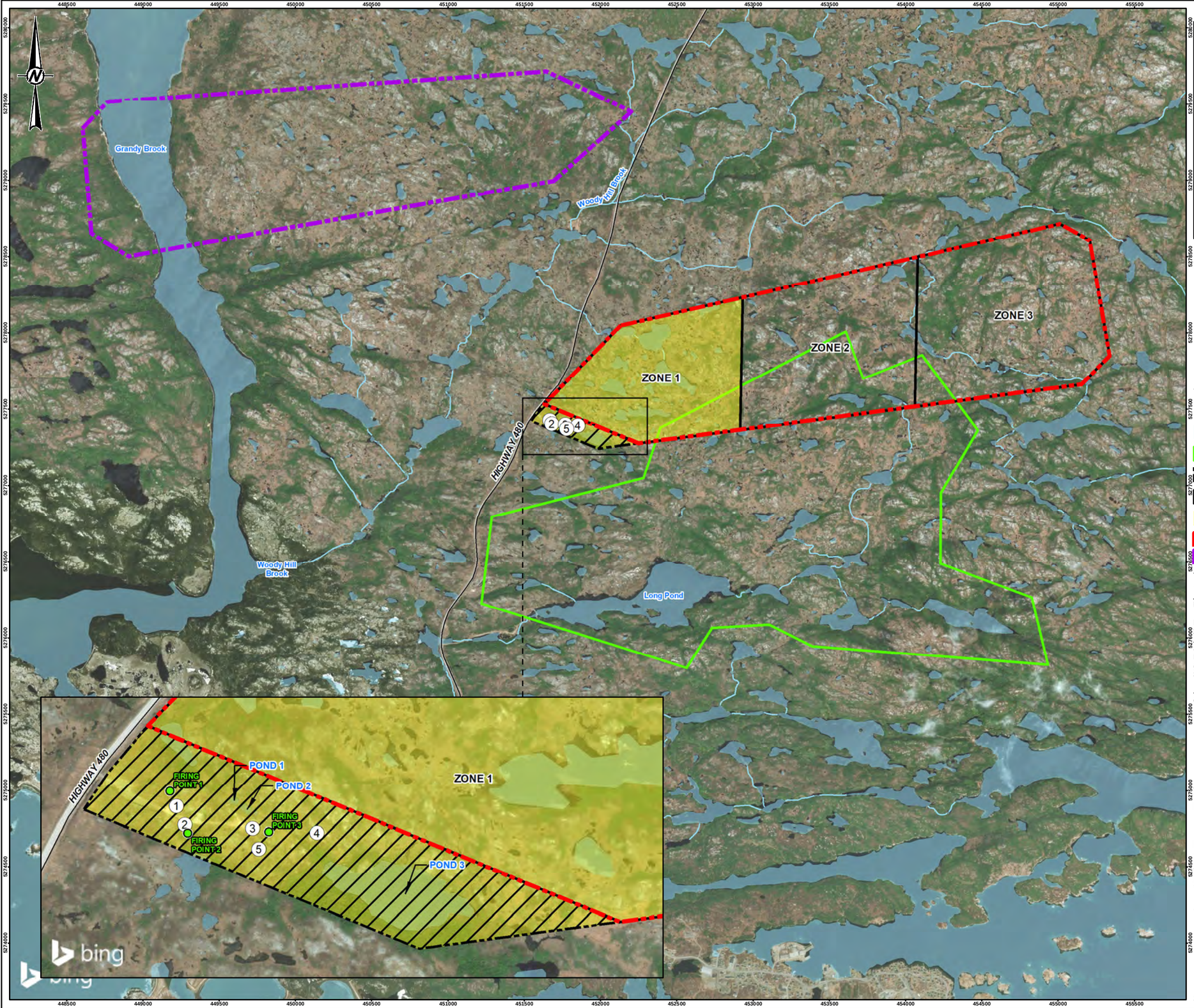
Figures



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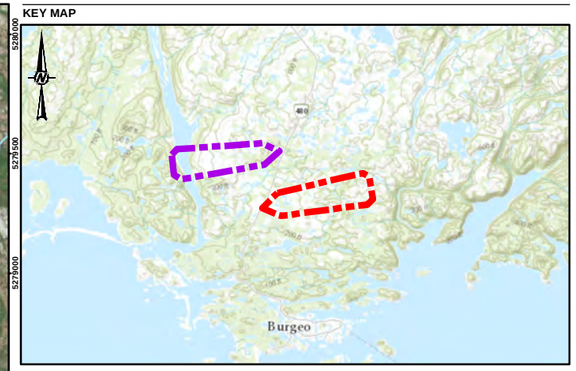

SCALE 1:200,000

LEGEND

1. APPROXIMATE RANGERS TARGET PRACTICE SHOOTING LOCATION
2. APPROXIMATE LOCATION OF LOCAL RESIDENTS' CLAY TARGET SHOOTING AREA
3. APPROXIMATE LOCATION OF BACKSTOP (BULLET CATCH)
4. APPROXIMATE FORMER LOCATION OF WOODEN TARGETS USED BY LOCAL RESIDENTS
5. APPROXIMATE LOCATION WHERE LOCAL RESIDENTS SETUP TO SHOOT ACROSS WATERBODY

ROADWAY
WATERCOURSE
WATERBODY
PROTECTED PUBLIC WATER SUPPLY
ADDITIONAL PROPOSED LEASED LANDS/FIRING AREA
ZONE BOUNDARY
RISK ASSESSMENT AREA
LOCATION 1
LOCATION 2

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

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COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

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1:25,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
SITE PLAN

CONSULTANT

YYYY-MM-DD	2023-02-02
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
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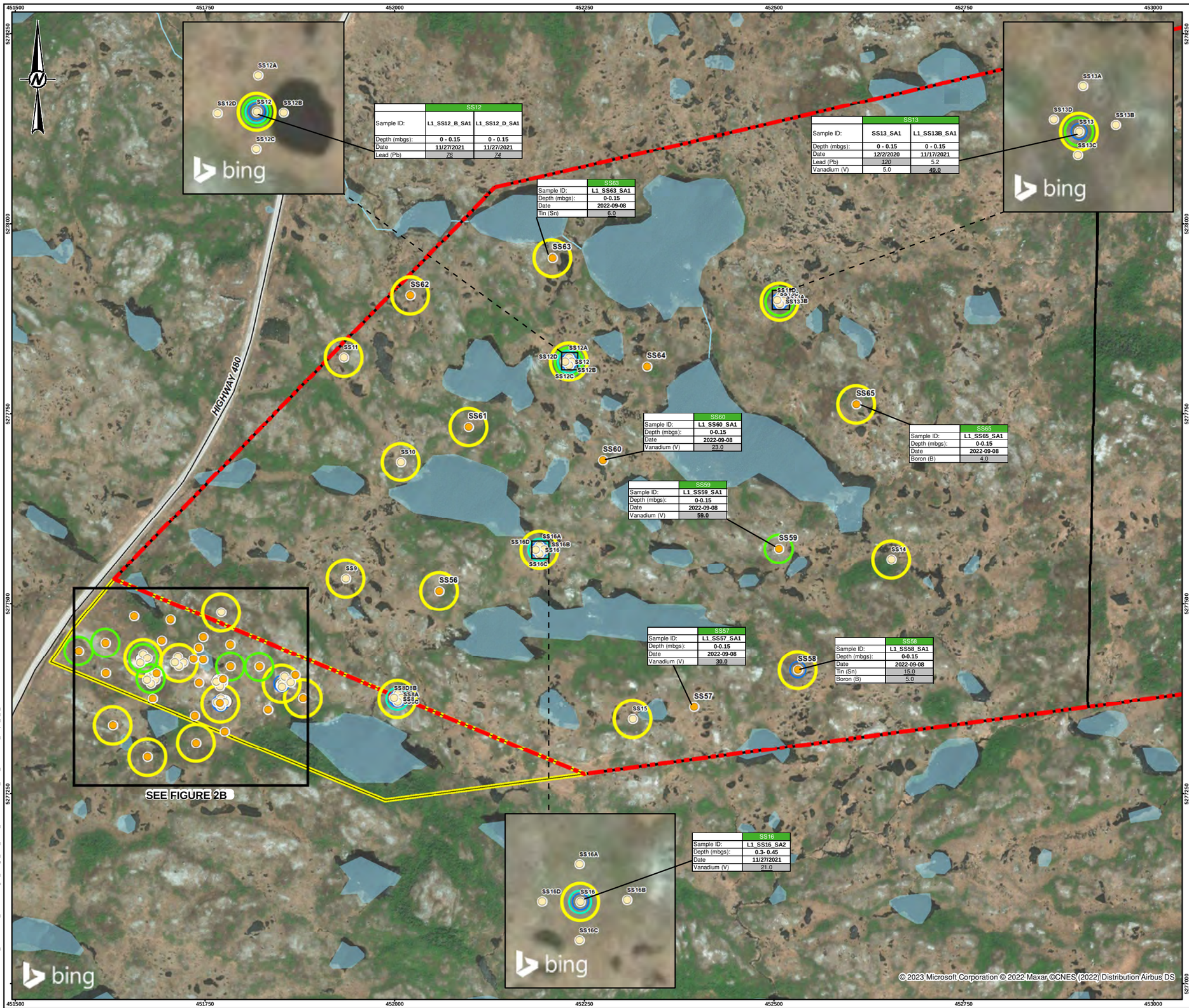

	SS12	
Sample ID:	L1_SS12_B_SA1	L1_SS12_D_SA1
Depth (mbgs):	0 - 0.15	0 - 0.15
Date	11/27/2021	11/27/2021
Lead (Pb)	76	74

	SS13	
Sample ID:	SS13_SA1	L1_SS13B_SA1
Depth (mbgs):	0 - 0.15	0 - 0.15
Date	12/2/2020	11/17/2021
Lead (Pb)	120	5.2
Vanadium (V)	5.0	49.0

	SS63
Sample ID:	L1_SS63_SA1
Depth (mbgs):	0-0.15
Date	2022-09-08
Tin (Sn)	6.0

	SS60
Sample ID:	L1_SS60_SA1
Depth (mbgs):	0-0.15
Date	2022-09-08
Vanadium (V)	23.0

	SS65
Sample ID:	L1_SS65_SA1
Depth (mbgs):	0-0.15
Date	2022-09-08
Boron (B)	4.0

	SS59
Sample ID:	L1_SS59_SA1
Depth (mbgs):	0-0.15
Date	2022-09-08
Vanadium (V)	59.0

	SS57
Sample ID:	L1_SS57_SA1
Depth (mbgs):	0-0.15
Date	2022-09-08
Vanadium (V)	30.0

	SS58
Sample ID:	L1_SS58_SA1
Depth (mbgs):	0-0.15
Date	2022-09-08
Tin (Sn)	15.0
Boron (B)	5.0

	SS16
Sample ID:	L1_SS16_SA2
Depth (mbgs):	0.3- 0.45
Date	11/27/2021
Vanadium (V)	21.0

LEGEND

1. APPROXIMATE RANGERS TARGET PRACTICE SHOOTING LOCATION
2. APPROXIMATE LOCATION OF LOCAL RESIDENTS' CLAY TARGET SHOOTING AREA
3. APPROXIMATE LOCATION OF BACKSTOP (BULLET CATCH)
4. APPROXIMATE FORMER LOCATION OF WOODEN TARGETS USED BY LOCAL RESIDENTS
5. APPROXIMATE LOCATION WHERE LOCAL RESIDENTS SETUP TO SHOOT ACROSS WATERBODY

APPROXIMATE SOIL SAMPLE LOCATION (2022)

APPROXIMATE SOIL SAMPLE LOCATION (2020/21)

NATURALLY OCCURRING EXCEEDANCE OF BORON

NATURALLY OCCURRING EXCEEDANCE OF CADMIUM

NATURALLY OCCURRING EXCEEDANCE OF IRON

NATURALLY OCCURRING EXCEEDANCE OF SELENIUM

ROADWAY

WATERCOURSE

WATERBODY

PROPOSED ADDITIONAL LEASE AREA

ZONE BOUNDARY

SITE

Site Criteria	Atlantic RBCA EQS_{Eco}	Atlantic RBCA EQS_{HH}	CCME SQG	NSE EQS Tier 1
Aluminum (Al)	NGA	15400	NGA	15400
Antimony (Sb)	20	7.5	20	NR
Copper (Cu)	63	1100	63	NR
Lead (Pb)	70	140	70	NR
Manganese (Mn)	NGA	360	NGA	360
Tin (Sn)	5	9400	5	NR
Vanadium (V)	18	39	130	NR
Zinc (Zn)	200	10000	250	NR
Boron (B)	NGA	NGA	NGA	NR

EXCEEDANCE IDENTIFICATION

1. UNDERLINE AND SHADED = EXCEEDANCE OF RBCA ECOLOGICAL TIER 1
2. BOLD AND SHADED = EXCEEDANCE OF RBCA HUMAN HEALTH-BASED TIER 1
3. ITALICISED AND SHADED = EXCEEDANCE OF CCME SQG
4. DOUBLE UNDERLINE AND SHADED = EXCEEDANCE OF NSE TIER 1

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. ALL CONCENTRATIONS IN mg/kg
3. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) SOIL ECOLOGICAL TIER 1 ENVIRONMENTAL QUALITY STANDARDS (EQSECO) FOR SOIL - COARSE AGRICULTURAL SOILS (2021)
4. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) HUMAN HEALTH BASED TIER 1 ENVIRONMENTAL QUALITY STANDARDS (EQSHH) FOR SOIL, AGRICULTURAL LAND USE, NON-POTABLE GROUNDWATER, COARSE-GRAINED SOIL (2021)
5. CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (CCME) SOIL QUALITY GUIDELINES (SQGS) FOR THE PROTECTION OF ENVIRONMENTAL AND HUMAN HEALTH, 2010, FOR POTABLE AND COARSE GRAINED SOIL WITH AGRICULTURAL LAND USE

REFERENCE(S)

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3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200

1:5,000 METRES

CLIENT

DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT

BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE

LOCATION 1 - ZONE 1 - OUTLYING AREA - METALS EXCEEDANCES IN SOIL

CONSULTANT

wsp

YYYY-MM-DD	2023-01-26
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	2A

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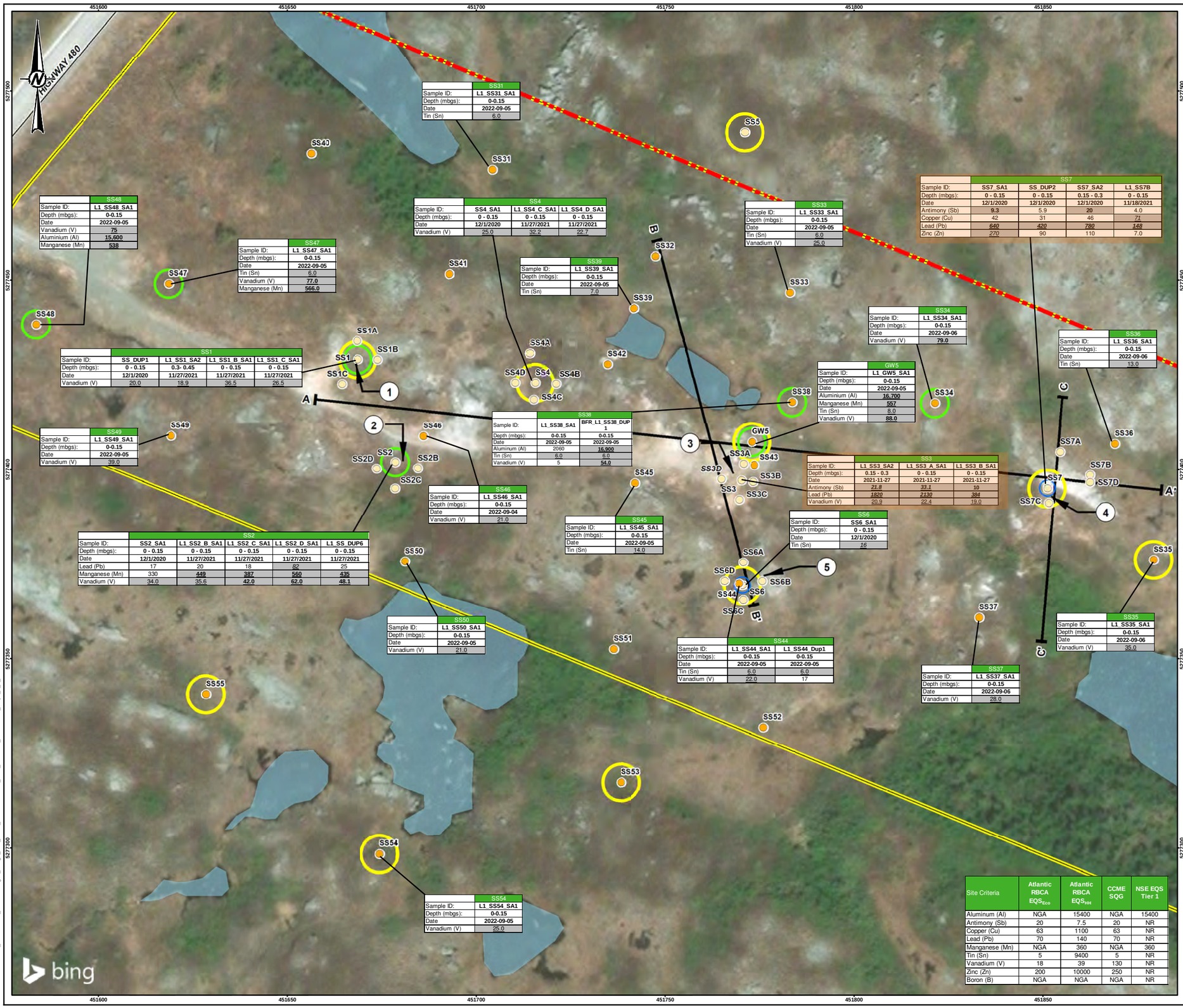

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Sample ID:	L1_SS31_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	6.0

	SS48
Sample ID:	L1_SS48_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	75
Aluminium (Al)	15,600
Manganese (Mn)	538

	SS4		
Sample ID:	SS4_SA1	L1_SS4_C_SA1	L1_SS4_D_SA1
Depth (mbgs):	0 - 0.15	0 - 0.15	0 - 0.15
Date	12/1/2020	11/27/2021	11/27/2021
Vanadium (V)	25.0	32.2	22.7

	SS33
Sample ID:	L1_SS33_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	6.0
Vanadium (V)	25.0

	SS7			
Sample ID:	SS7_SA1	SS_DUP2	SS7_SA2	L1_SS7B
Depth (mbgs):	0 - 0.15	0 - 0.15	0.15 - 0.3	0 - 0.15
Date	12/1/2020	12/1/2020	12/1/2020	11/18/2021
Antimony (Sb)	9.3	5.9	20	4.0
Copper (Cu)	42	31	46	*71*
Lead (Pb)	*640*	*420*	*780*	*148*
Zinc (Zn)	*270*	90	110	7.0

	SS47
Sample ID:	L1_SS47_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	6.0
Vanadium (V)	77.0
Manganese (Mn)	566.0

	SS39
Sample ID:	L1_SS39_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	7.0

	SS34
Sample ID:	L1_SS34_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Vanadium (V)	79.0

	SS36
Sample ID:	L1_SS36_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Tin (Sn)	13.0

	SS1			
Sample ID:	SS_DUP1	L1_SS1_SA2	L1_SS1_B_SA1	L1_SS1_C_SA1
Depth (mbgs):	0 - 0.15	0.3- 0.45	0 - 0.15	0 - 0.15
Date	12/1/2020	11/27/2021	11/27/2021	11/27/2021
Vanadium (V)	20.0	18.9	36.5	26.5

	GW5
Sample ID:	L1_GW5_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Aluminium (Al)	16,700
Manganese (Mn)	557
Tin (Sn)	8.0
Vanadium (V)	88.0

	SS38	
Sample ID:	L1_SS38_SA1	BFR_L1_SS38_DUP 1
Depth (mbgs):	0-0.15	0-0.15
Date	2022-09-05	2022-09-05
Aluminum (Al)	2060	16,900
Tin (Sn)	6.0	6.0
Vanadium (V)	5	54.0

	SS3		
Sample ID:	L1_SS3_SA2	L1_SS3_A_SA1	L1_SS3_B_SA1
Depth (mbgs):	0.15 - 0.3	0 - 0.15	0 - 0.15
Date	2021-11-27	2021-11-27	2021-11-27
Antimony (Sb)	*21.8*	*33.1*	10
Lead (Pb)	*1820*	*2130*	*384*
Vanadium (V)	20.9	22.4	19.0

	SS49
Sample ID:	L1_SS49_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	39.0

	SS46
Sample ID:	L1_SS46_SA1
Depth (mbgs):	0-0.15
Date	2022-09-04
Vanadium (V)	21.0

	SS45
Sample ID:	L1_SS45_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	14.0

	SS6
Sample ID:	SS6_SA1
Depth (mbgs):	0 - 0.15
Date	12/1/2020
Tin (Sn)	*16*

	SS2				
Sample ID:	SS2_SA1	L1_SS2_B_SA1	L1_SS2_C_SA1	L1_SS2_D_SA1	L1_SS_DUP6
Depth (mbgs):	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date	12/1/2020	11/27/2021	11/27/2021	11/27/2021	11/27/2021
Lead (Pb)	17	20	18	*82*	25
Manganese (Mn)	330	*449*	*387*	*560*	*435*
Vanadium (V)	34.0	*35.6*	*42.0*	*62.0*	*48.1*

	SS50
Sample ID:	L1_SS50_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	21.0

	SS44	
Sample ID:	L1_SS44_SA1	L1_SS44_Dup1
Depth (mbgs):	0-0.15	0-0.15
Date	2022-09-05	2022-09-05
Tin (Sn)	6.0	6.0
Vanadium (V)	22.0	17

	SS35
Sample ID:	L1_SS35_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Vanadium (V)	35.0

	SS37
Sample ID:	L1_SS37_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Vanadium (V)	28.0

	SS54
Sample ID:	L1_SS54_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	25.0

Site Criteria	Atlantic RBCA EQS_{Eco}	Atlantic RBCA EQS_{HH}	CCME SQG	NSE EQS Tier 1
Aluminum (Al)	NGA	15400	NGA	15400
Antimony (Sb)	20	7.5	20	NR
Copper (Cu)	63	1100	63	NR
Lead (Pb)	70	140	70	NR
Manganese (Mn)	NGA	360	NGA	360
Tin (Sn)	5	9400	5	NR
Vanadium (V)	18	39	130	NR
Zinc (Zn)	200	10000	250	NR
Boron (B)	NGA	NGA	NGA	NR

LEGEND

1. APPROXIMATE RANGERS TARGET PRACTICE SHOOTING LOCATION
2. APPROXIMATE LOCATION OF LOCAL RESIDENTS' CLAY TARGET SHOOTING AREA
3. APPROXIMATE LOCATION OF BACKSTOP (BULLET CATCH)
4. APPROXIMATE FORMER LOCATION OF WOODEN TARGETS USED BY LOCAL RESIDENTS
5. APPROXIMATE LOCATION WHERE LOCAL RESIDENTS SETUP TO SHOOT ACROSS WATERBODY

SITE

APPROXIMATE SOIL SAMPLE LOCATION (2022)

APPROXIMATE SOIL SAMPLE LOCATION (2020/21)

NATURALLY OCCURRING EXCEEDANCE OF BORON

NATURALLY OCCURRING EXCEEDANCE OF CADMIUM

NATURALLY OCCURRING EXCEEDANCE OF IRON

NATURALLY OCCURRING EXCEEDANCE OF SELENIUM

ROADWAY

WATERCOURSE

CROSS-SECTION LOCATION

WATERBODY

PROPOSED ADDITIONAL LEASE AREA

ZONE BOUNDARY

SAMPLE NOT CONSIDERED IN RA - WITHIN REMEDIAL EXTENTS (FIG 2C)

EXCEEDANCE IDENTIFICATION

1. UNDERLINE AND SHADED = EXCEEDANCE OF RBCA ECOLOGICAL TIER 1
2. BOLD AND SHADED = EXCEEDANCE OF RBCA HUMAN HEALTH-BASED TIER 1
3. ITALICISED AND SHADED = EXCEEDANCE OF CCME SQG
4. DOUBLE UNDERLINE AND SHADED = EXCEEDANCE OF NSE TIER 1

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. ALL CONCENTRATIONS IN mg/kg
3. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) SOIL ECOLOGICAL TIER 1 ENVIRONMENTAL QUALITY STANDARDS (EQSECO) FOR SOIL - COARSE AGRICULTURAL SOILS (2021)
4. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) HUMAN HEALTH BASED TIER 1 ENVIRONMENTAL QUALITY STANDARDS (EQSHH) FOR SOIL, AGRICULTURAL LAND USE, NON-POTABLE GROUNDWATER, COARSE-GRAINED SOIL (2021)
5. CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (CCME) SOIL QUALITY GUIDELINES (SQGS) FOR THE PROTECTION OF ENVIRONMENTAL AND HUMAN HEALTH, 2010, FOR POTABLE AND COARSE GRAINED SOIL WITH AGRICULTURAL LAND USE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 10 20 40

1:1,000 METRES

CLIENT

DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT

BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE

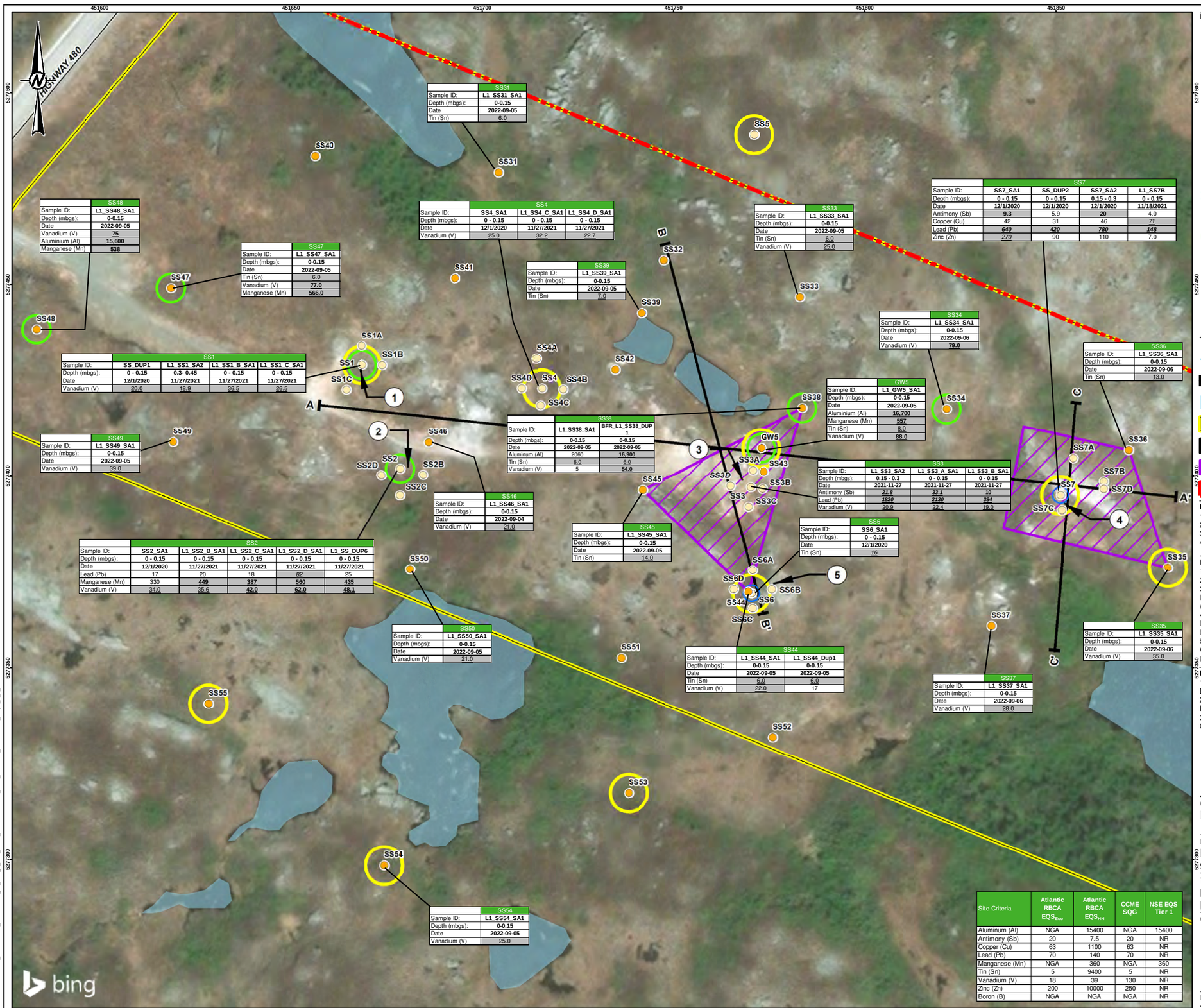
LOCATION 1 - ZONE 1 - FIRING AREA - METALS EXCEEDANCES IN SOIL

CONSULTANT

wsp

YYYY-MM-DD	2023-02-08
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO. 22532464 | CONTROL 0002 | REV. A | FIGURE **2B**



	SS31
Sample ID:	L1_SS31_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	6.0

	SS48
Sample ID:	L1_SS48_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	75
Aluminium (Al)	15,600
Manganese (Mn)	538

	SS4		
Sample ID:	SS4_SA1	L1_SS4_C_SA1	L1_SS4_D_SA1
Depth (mbgs):	0 - 0.15	0 - 0.15	0 - 0.15
Date	12/1/2020	11/27/2021	11/27/2021
Vanadium (V)	25.0	32.2	22.7

	SS47
Sample ID:	L1_SS47_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	6.0
Vanadium (V)	77.0
Manganese (Mn)	566.0

	SS39
Sample ID:	L1_SS39_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	7.0

	SS33
Sample ID:	L1_SS33_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	6.0
Vanadium (V)	25.0

	SS7			
Sample ID:	SS7_SA1	SS_DUP2	SS7_SA2	L1_SS7B
Depth (mbgs):	0 - 0.15	0 - 0.15	0.15 - 0.3	0 - 0.15
Date	12/1/2020	12/1/2020	12/1/2020	11/18/2021
Antimony (Sb)	9.3	5.9	20	4.0
Copper (Cu)	42	31	46	71
Lead (Pb)	640	420	780	148
Zinc (Zn)	270	90	110	7.0

	SS34
Sample ID:	L1_SS34_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Vanadium (V)	79.0

	SS36
Sample ID:	L1_SS36_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Tin (Sn)	13.0

	SS1			
Sample ID:	SS_DUP1	L1_SS1_SA2	L1_SS1_B_SA1	L1_SS1_C_SA1
Depth (mbgs):	0 - 0.15	0.3- 0.45	0 - 0.15	0 - 0.15
Date	12/1/2020	11/27/2021	11/27/2021	11/27/2021
Vanadium (V)	20.0	18.9	36.5	26.5

	GW5
Sample ID:	L1_GW5_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Aluminium (Al)	16,700
Manganese (Mn)	557
Tin (Sn)	8.0
Vanadium (V)	88.0

	SS38	
Sample ID:	L1_SS38_SA1	BFR_L1_SS38_DUP 1
Depth (mbgs):	0-0.15	0-0.15
Date	2022-09-05	2022-09-05
Aluminum (Al)	2060	16,900
Tin (Sn)	6.0	6.0
Vanadium (V)	5	54.0

	SS49
Sample ID:	L1_SS49_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	39.0

	SS3		
Sample ID:	L1_SS3_SA2	L1_SS3_A_SA1	L1_SS3_B_SA1
Depth (mbgs):	0.15 - 0.3	0 - 0.15	0 - 0.15
Date	2021-11-27	2021-11-27	2021-11-27
Antimony (Sb)	21.8	33.1	10
Lead (Pb)	1820	2130	384
Vanadium (V)	20.9	22.4	19.0

	SS46
Sample ID:	L1_SS46_SA1
Depth (mbgs):	0-0.15
Date	2022-09-04
Vanadium (V)	21.0

	SS45
Sample ID:	L1_SS45_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Tin (Sn)	14.0

	SS6
Sample ID:	SS6_SA1
Depth (mbgs):	0 - 0.15
Date	12/1/2020
Tin (Sn)	16

	SS2				
Sample ID:	SS2_SA1	L1_SS2_B_SA1	L1_SS2_C_SA1	L1_SS2_D_SA1	L1_SS_DUP6
Depth (mbgs):	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date	12/1/2020	11/27/2021	11/27/2021	11/27/2021	11/27/2021
Lead (Pb)	17	20	18	82	25
Manganese (Mn)	330	449	387	560	435
Vanadium (V)	34.0	35.6	42.0	62.0	48.1

	SS50
Sample ID:	L1_SS50_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	21.0

	SS44	
Sample ID:	L1_SS44_SA1	L1_SS44_Dup1
Depth (mbgs):	0-0.15	0-0.15
Date	2022-09-05	2022-09-05
Tin (Sn)	6.0	6.0
Vanadium (V)	22.0	17

	SS35
Sample ID:	L1_SS35_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Vanadium (V)	35.0

	SS37
Sample ID:	L1_SS37_SA1
Depth (mbgs):	0-0.15
Date	2022-09-06
Vanadium (V)	28.0

	SS54
Sample ID:	L1_SS54_SA1
Depth (mbgs):	0-0.15
Date	2022-09-05
Vanadium (V)	25.0

Site Criteria	Atlantic RBCA EQS_{Eco}	Atlantic RBCA EQS_{HH}	CCME SQG	NSE EQS Tier 1
Aluminum (Al)	NGA	15400	NGA	15400
Antimony (Sb)	20	7.5	20	NR
Copper (Cu)	63	1100	63	NR
Lead (Pb)	70	140	70	NR
Manganese (Mn)	NGA	360	NGA	360
Tin (Sn)	5	9400	5	NR
Vanadium (V)	18	39	130	NR
Zinc (Zn)	200	10000	250	NR
Boron (B)	NGA	NGA	NGA	NR

LEGEND

1. APPROXIMATE RANGERS TARGET PRACTICE SHOOTING LOCATION
2. APPROXIMATE LOCATION OF LOCAL RESIDENTS' CLAY TARGET SHOOTING AREA
3. APPROXIMATE LOCATION OF BACKSTOP (BULLET CATCH)
4. APPROXIMATE FORMER LOCATION OF WOODEN TARGETS USED BY LOCAL RESIDENTS
5. APPROXIMATE LOCATION WHERE LOCAL RESIDENTS SETUP TO SHOOT ACROSS WATERBODY

- APPROXIMATE SOIL SAMPLE LOCATION (2020/21)
- NATURALLY OCCURRING EXCEEDANCE OF BORON
- NATURALLY OCCURRING EXCEEDANCE OF CADMIUM
- NATURALLY OCCURRING EXCEEDANCE OF IRON
- NATURALLY OCCURRING EXCEEDANCE OF SELENIUM
- ROADWAY
- WATERCOURSE
- CROSS-SECTION LOCATION
- WATERBODY
- PROPOSED ADDITIONAL LEASE AREA
- ZONE BOUNDARY
- PROPOSED DELINEATION AREA
- SITE

EXCEEDANCE IDENTIFICATION

1. UNDERLINE AND SHADED = EXCEEDANCE OF RBCA ECOLOGICAL TIER 1
2. BOLD AND SHADED = EXCEEDANCE OF RBCA HUMAN HEALTH-BASED TIER 1
3. ITALICISED AND SHADED = EXCEEDANCE OF CCME SQG
4. DOUBLE UNDERLINE AND SHADED = EXCEEDANCE OF NSE TIER 1

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. ALL CONCENTRATIONS IN mg/kg
3. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) SOIL ECOLOGICAL TIER 1 ENVIRONMENTAL QUALITY STANDARDS (EQSECO) FOR SOIL - COARSE AGRICULTURAL SOILS (2021)
4. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) HUMAN HEALTH BASED TIER 1 ENVIRONMENTAL QUALITY STANDARDS (EQSHH) FOR SOIL, AGRICULTURAL LAND USE, NON-POTABLE GROUNDWATER, COARSE-GRAINED SOIL (2021)
5. CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (CCME) SOIL QUALITY GUIDELINES (SQGS) FOR THE PROTECTION OF ENVIRONMENTAL AND HUMAN HEALTH, 2010, FOR POTABLE AND COARSE GRAINED SOIL WITH AGRICULTURAL LAND USE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 10 20 40

1:1,000 METRES

CLIENT

DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT

BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE

LOCATION 1 - ZONE 1 - FIRING AREA - SOURCE ZONE REMOVAL AREAS

CONSULTANT

wsp

YYYY-MM-DD	2023-02-22
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	2C

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

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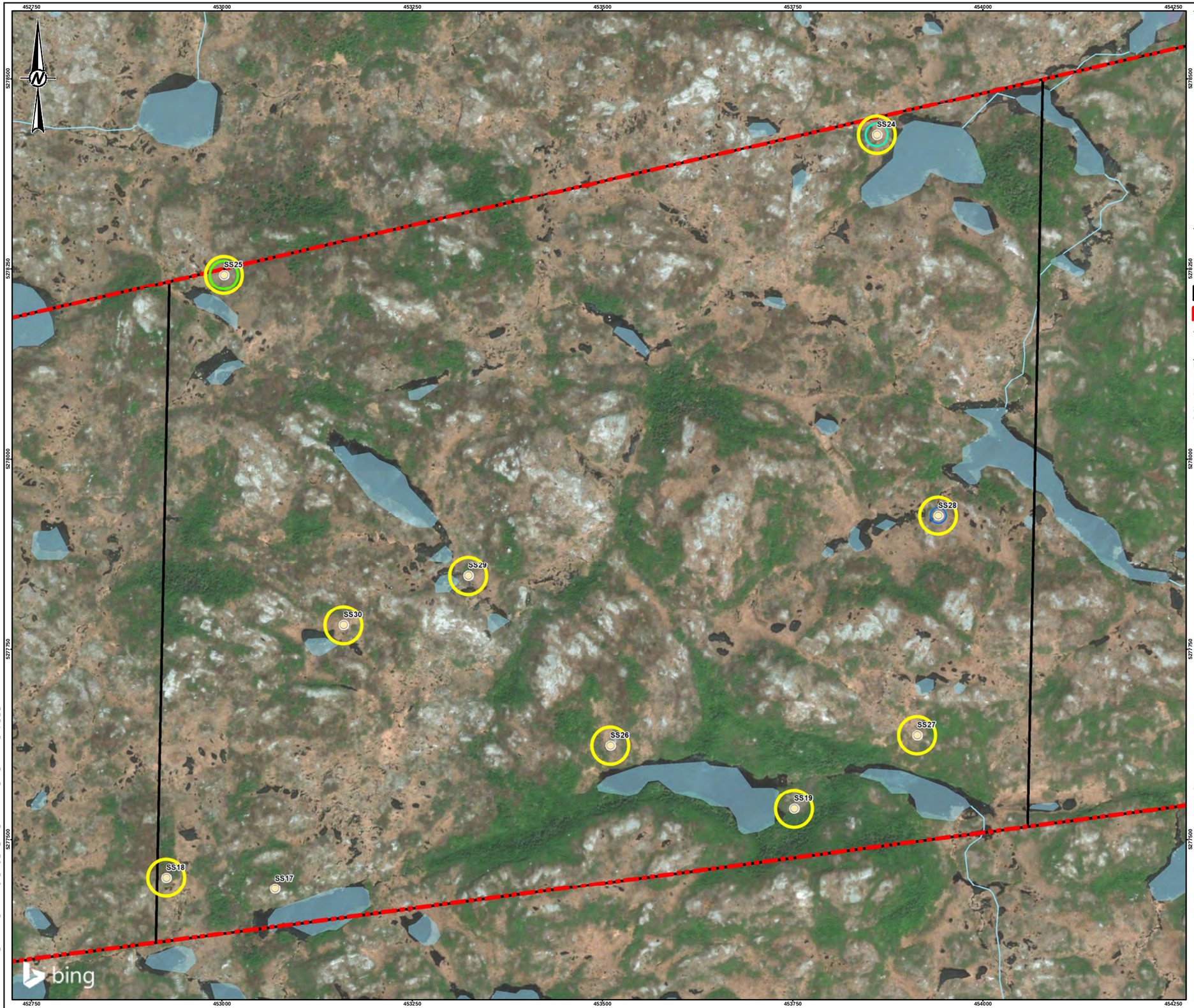

LEGEND

- APPROXIMATE SOIL SAMPLE LOCATION (2020/21)
- NATURALLY OCCURRING EXCEEDANCE OF BORON
- NATURALLY OCCURRING EXCEEDANCE OF CADMIUM
- NATURALLY OCCURRING EXCEEDANCE OF IRON
- NATURALLY OCCURRING EXCEEDANCE OF SELENIUM
- ROADWAY
- WATERCOURSE
- WATERBODY
- ZONE BOUNDARY
- SITE

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200
1:5,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 2 - METALS EXCCEEDANCES IN SOIL

CONSULTANT

wsp

YYYY-MM-DD	2023-01-26
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

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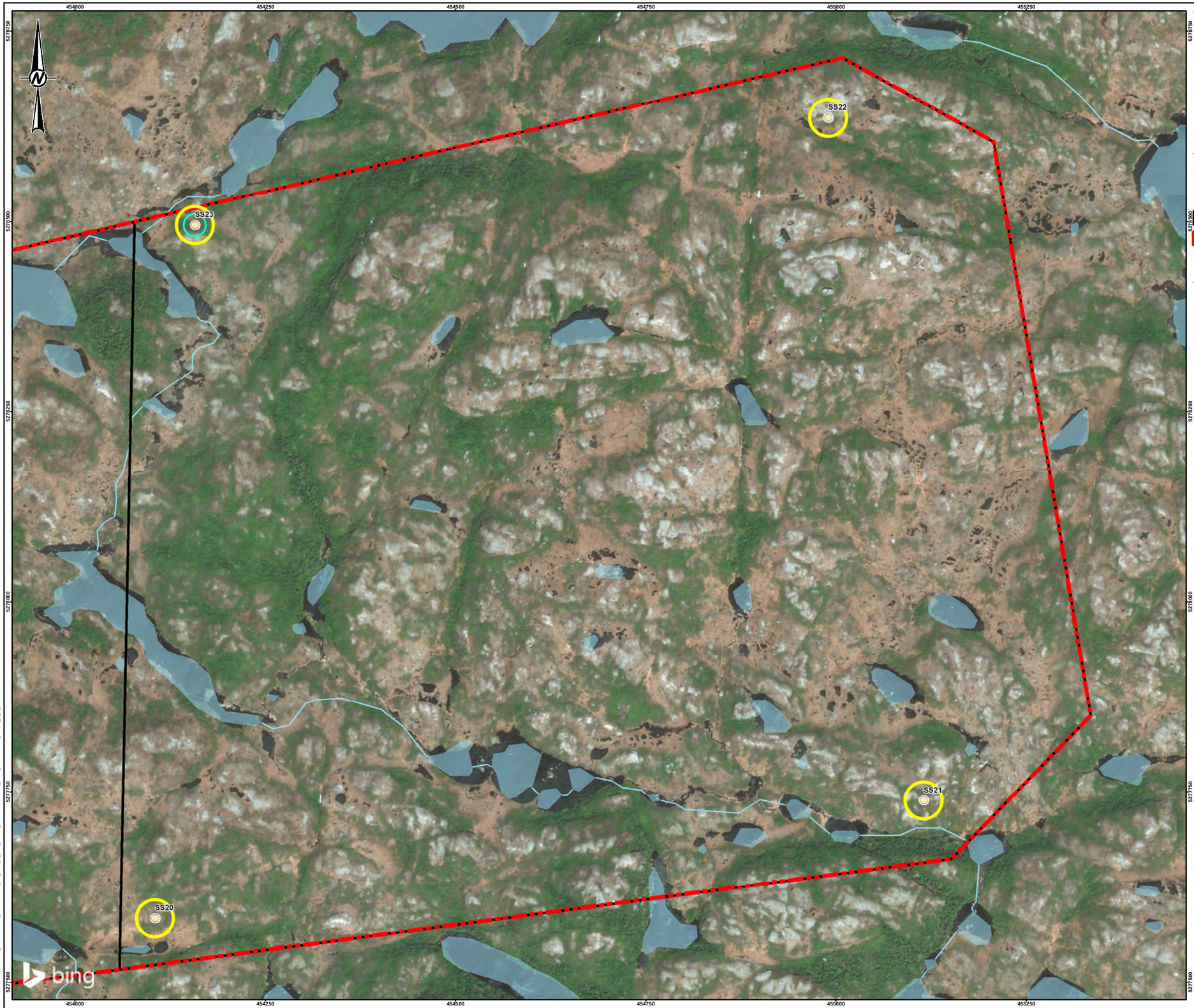


LEGEND

- APPROXIMATE SOIL SAMPLE LOCATION (2020)
- NATURALLY OCCURRING EXCEEDANCE OF CADMIUM
- NATURALLY OCCURRING EXCEEDANCE OF SELENIUM
- ROADWAY
- WATERCOURSE
- WATERBODY
- ZONE BOUNDARY
- SITE

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200

1:5,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 3 - METALS EXCEEDANCES IN SOIL

CONSULTANT

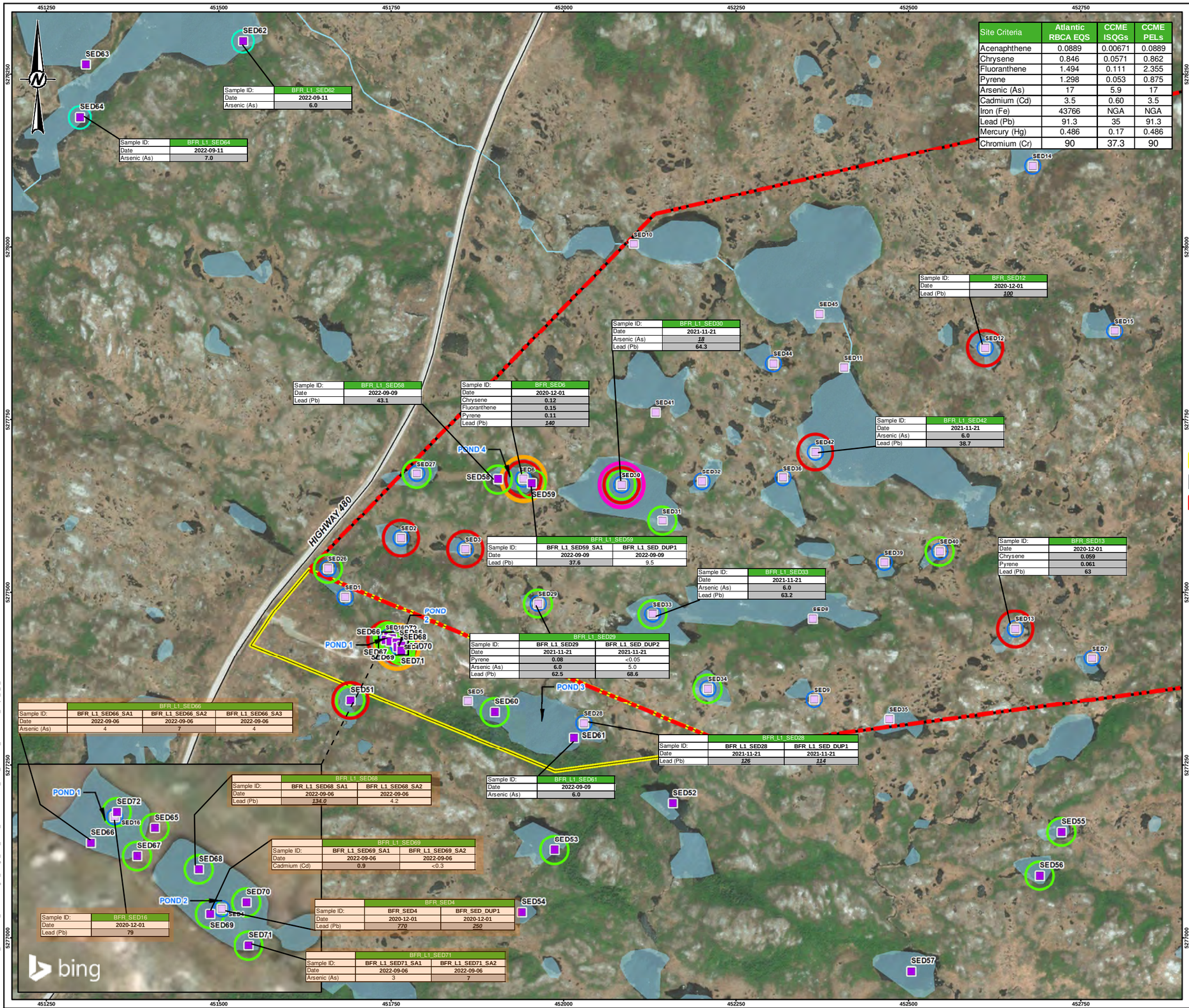
wsp

YYYY-MM-DD	2023-01-26
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	**4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

Path: S:\Clients\DeNence_Construction_Canada\Burgeo_Range_Site_NL\99-PROJ\22532464_DCC_Envelo\0002_Steps_5_7_20222253246 4-0002-HS-0012.mxd



LEGEND

- APPROXIMATE SEDIMENT SAMPLE LOCATION (2022)
- APPROXIMATE SEDIMENT SAMPLE LOCATION (2020/21)
- NATURALLY OCCURRING SEDIMENT EXCEEDANCE OF MODIFIED TPH
- NATURALLY OCCURRING EXCEEDANCE OF CHROMIUM
- NATURALLY OCCURRING EXCEEDANCE OF SELENIUM
- NATURALLY OCCURRING EXCEEDANCE OF MERCURY
- NATURALLY OCCURRING EXCEEDANCE OF CADMIUM
- NATURALLY OCCURRING EXCEEDANCE OF IRON
- ROADWAY
- WATERCOURSE
- WATERBODY
- PROPOSED ADDITIONAL LEASE AREA
- ZONE BOUNDARY
- SITE
- SAMPLE NOT CONSIDERED IN RA - WITHIN REMEDIAL EXTENTS

EXCEEDANCE IDENTIFICATION

1. UNDERLINE AND SHADED = EXCEEDANCE OF RBCA ECOLOGICAL TIER 1
2. BOLD AND SHADED = EXCEEDANCE OF CCME ISQGs
3. ITALICISED AND SHADED = EXCEEDANCE OF CCME PELs

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. ALL CONCENTRATIONS IN mg/kg
3. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) ECOLOGICAL TIER I ENVIRONMENTAL QUALITY STANDARDS (EQS) FOR SEDIMENT
4. CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (CCME) INTERIM SEDIMENT QUALITY GUIDELINES (ISQGS) FOR THE PROTECTION OF AQUATIC LIFE, 2010, FOR FRESHWATER. PRESENTED FOR INFORMATIONAL PURPOSES ONLY.
5. CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (CCME) PROBABLE EFFECT LEVELS (PELS) FOR THE PROTECTION OF AQUATIC LIFE, 2010, FOR FRESHWATER
6. ASSUMED TEMPERATURE AND AVERAGE pH USED FOR GUIDELINES WITH LOOKUP TABLE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 100 200 400
1:5,500 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 1 - EXCEEDANCES IN SEDIMENT

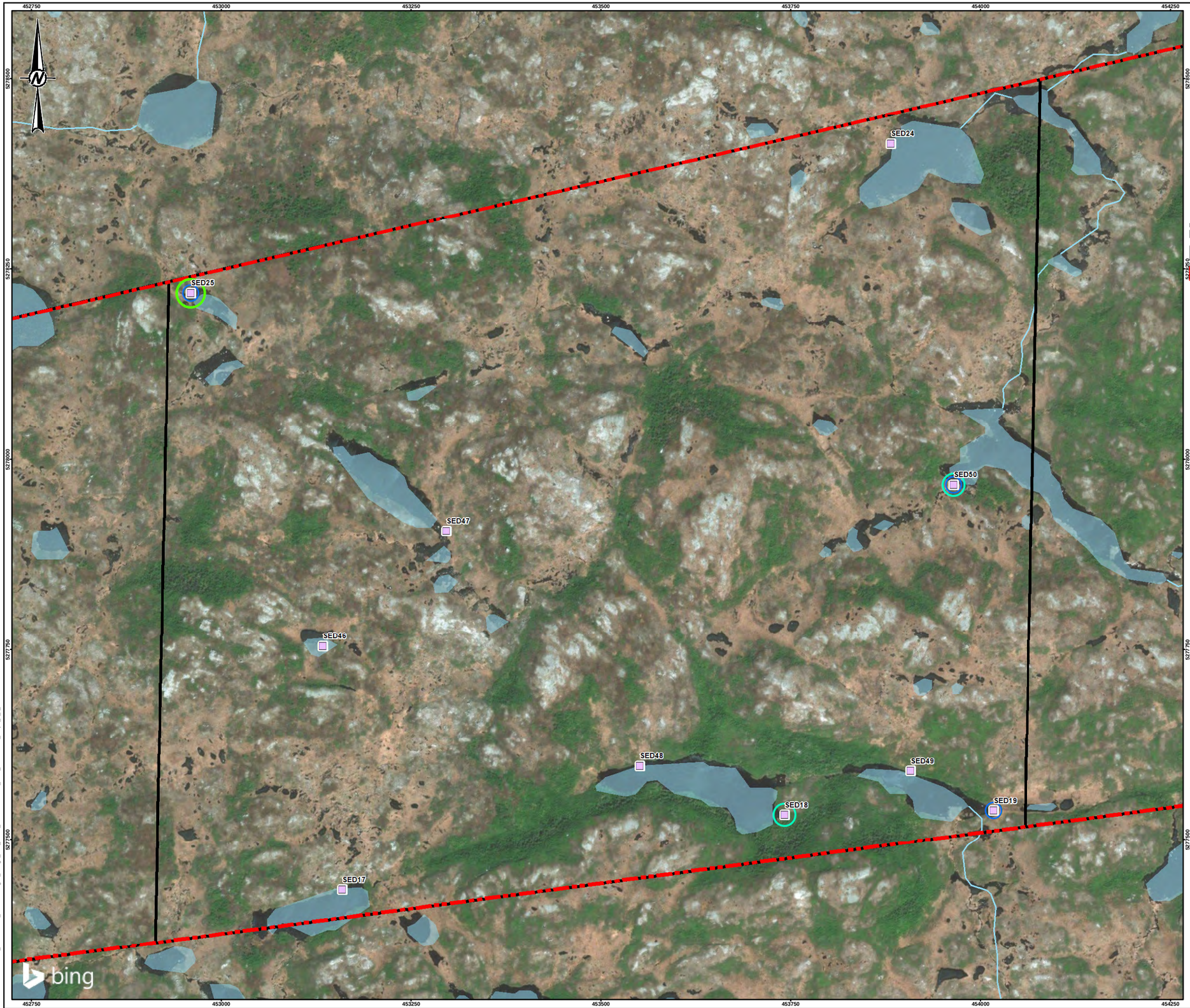
CONSULTANT
wsp

YYYY-MM-DD	2023-02-24
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

Path: S:\Clients\Defence_Construction_Canada\Burgeo_Range_Site_NL\99_PROJ\22532464_DCC_Enviro\40_PROD\0002_Sites_5_7_2022\22532464-0002-HS-0013.mxd



LEGEND

- APPROXIMATE SEDIMENT SAMPLE LOCATION (2020/21)
- NATURALLY OCCURRING SEDIMENT EXCEEDANCE OF MODIFIED TPH
- NATURALLY OCCURRING EXCEEDANCE OF CHROMIUM
- NATURALLY OCCURRING EXCEEDANCE OF SELENIUM
- ROADWAY
- WATERCOURSE
- WATERBODY
- PROPOSED ADDITIONAL LEASE AREA
- ZONE BOUNDARY
- SITE

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)
1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200
1:5,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 2 - EXCEEDANCES IN SEDIMENT

CONSULTANT

YYYY-MM-DD	2023-01-26
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

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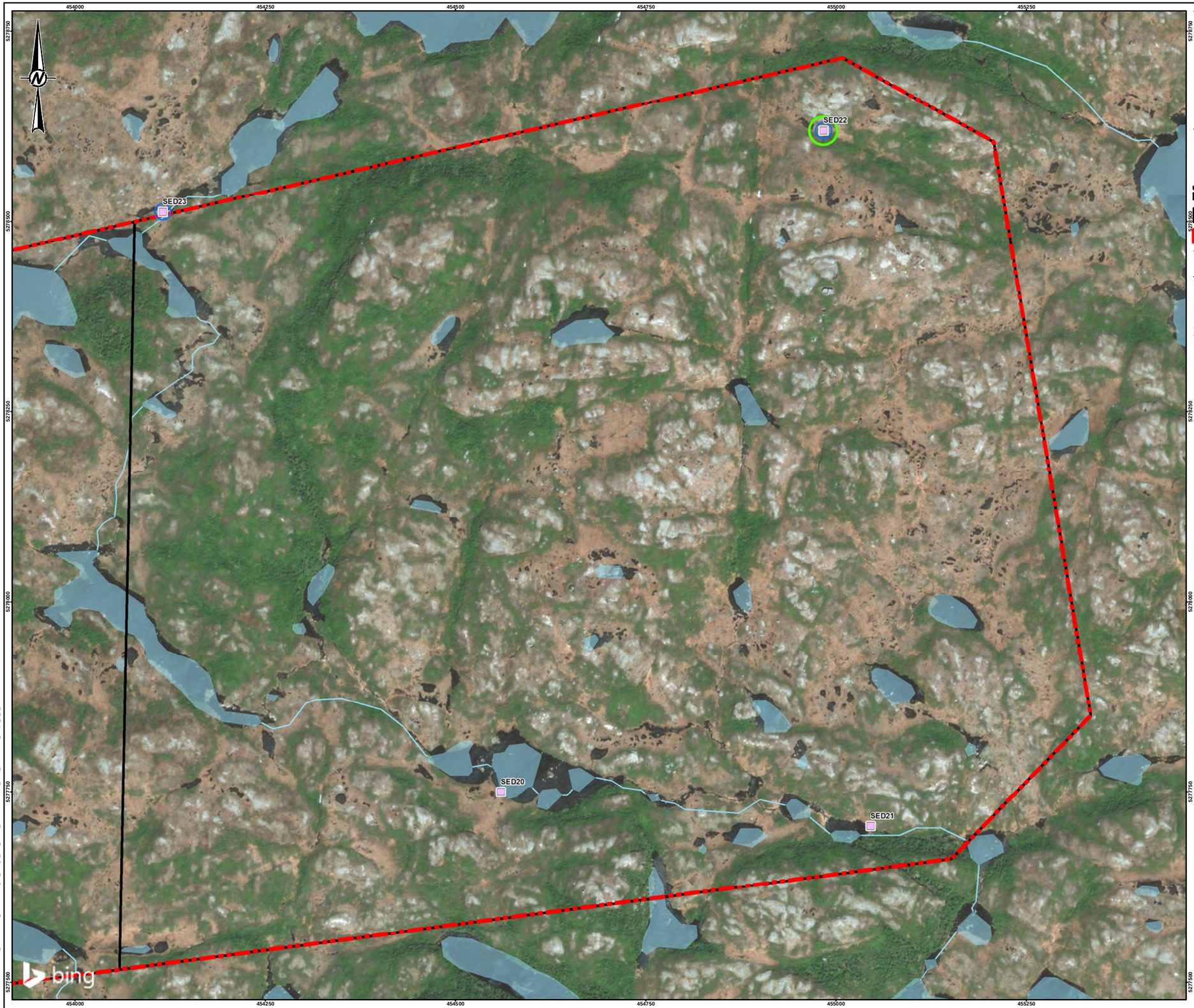

LEGEND

- APPROXIMATE SEDIMENT SAMPLE LOCATION (2020)
- NATURALLY OCCURRING SEDIMENT EXCEEDANCE OF MODIFIED TPH
- NATURALLY OCCURRING EXCEEDANCE OF SELENIUM
- ROADWAY
- WATERCOURSE
- WATERBODY
- PROPOSED ADDITIONAL LEASE AREA
- ZONE BOUNDARY
- SITE

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200

1:5,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 3 - EXCEEDANCES IN SEDIMENT

CONSULTANT

YYYY-MM-DD	2023-01-26
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

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LEGEND

- APPROXIMATE SURFACE WATER SAMPLE LOCATION (2022)
- APPROXIMATE SURFACE WATER SAMPLE LOCATION (2020/21)
- pH BELOW ACCEPTABLE SITE CRITERIA RANGE
- NATURALLY OCCURRING EXCEEDANCE OF ALUMINUM
- NATURALLY OCCURRING EXCEEDANCE OF IRON
- NATURALLY OCCURRING EXCEEDANCE OF MERCURY
- ROADWAY
- WATERCOURSE
- WATERBODY
- PROPOSED ADDITIONAL LEASE AREA
- ZONE BOUNDARY
- SITE
- SAMPLE NOT CONSIDERED IN RA - WITHIN REMEDIAL EXTENTS

Site Criteria	Atlantic RBCA EQS	CCME WQGs
Copper (Cu)	2	2
Lead (Pb)	1	1
Iron (Fe)	300	300
Mercury (Hg)	0.026	0.026
Aluminum (Al)	5	5

EXCEEDANCE IDENTIFICATION
1. UNDERLINE AND SHADED = EXCEEDANCE OF RBCA ECOLOGICAL TIER 1
2. BOLD AND SHADED = EXCEEDANCE CCME WQS

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE
2. ALL CONCENTRATIONS IN µg/L
3. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) ECOLOGICAL TIER I ENVIRONMENTAL QUALITY STANDARDS (EQS) FOR SURFACE WATER (FRESH WATER)
4. CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (CCME) WATER QUALITY GUIDELINES (WQGS) FOR THE PROTECTION OF AQUATIC LIFE (2010) - FRESHWATER, LONG TERM
5. AVERAGE pH AND WATER HARDNESS VALUES USED FOR CALCULATING VARIABLE GUIDELINES
6. NGA = NO GUIDELINE AVAILABLE

REFERENCE(S)
1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 60 120 240
1:6,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 1 - EXCEEDANCES IN SURFACE WATER

CONSULTANT
wsp

YYYY-MM-DD	2023-02-24
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 0 25mm

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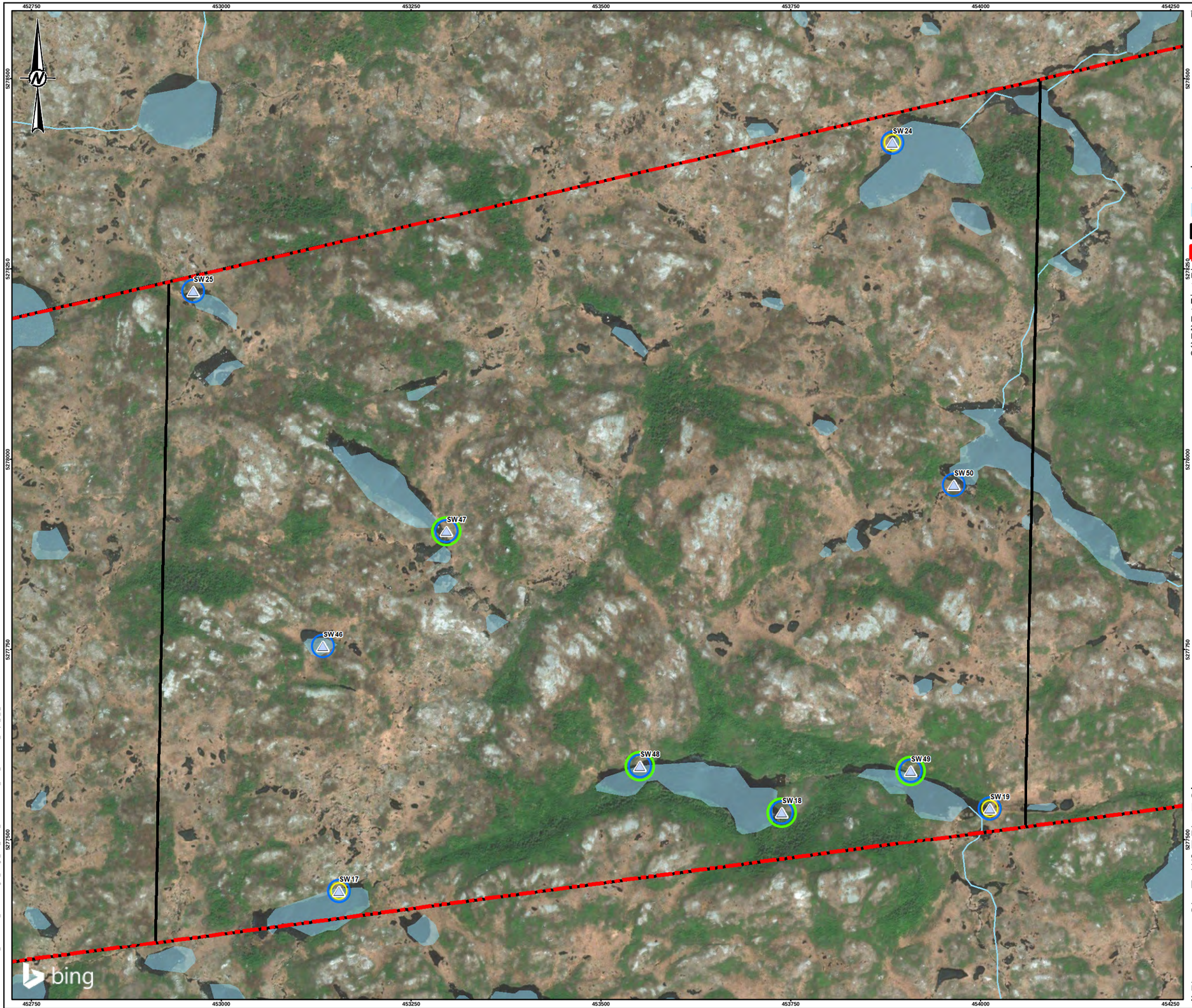

LEGEND

- APPROXIMATE SURFACE WATER SAMPLE LOCATION (2020/21)
- pH BELOW ACCEPTABLE SITE CRITERIA RANGE
- NATURALLY OCCURRING EXCEEDANCE OF ALUMINUM
- NATURALLY OCCURRING EXCEEDANCE OF IRON
- ROADWAY
- WATERCOURSE
- WATERBODY
- ZONE BOUNDARY
- SITE

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200
1:5,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 2 - EXCEEDANCES IN SURFACE WATER

CONSULTANT

YYYY-MM-DD	2023-01-26
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
0 25mm

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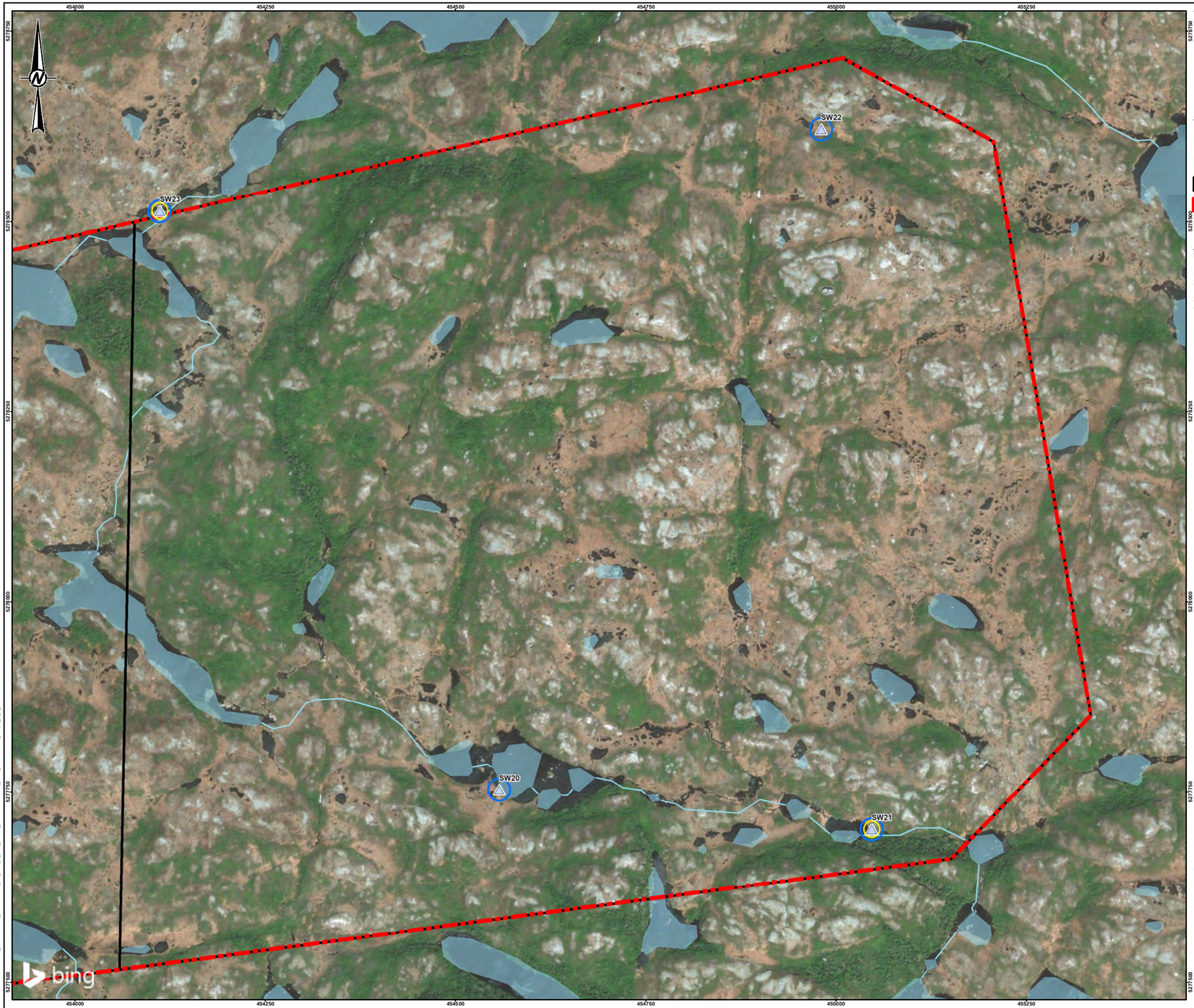


LEGEND

- APPROXIMATE SURFACE WATER SAMPLE LOCATION (2020)
- pH BELOW ACCEPTABLE SITE CRITERIA RANGE
- NATURALLY OCCURRING EXCEEDANCE OF ALUMINUM
- ROADWAY
- WATERCOURSE
- WATERBODY
- ZONE BOUNDARY
- SITE

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200

1:5,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 3 - EXCEEDANCES IN SURFACE WATER

CONSULTANT

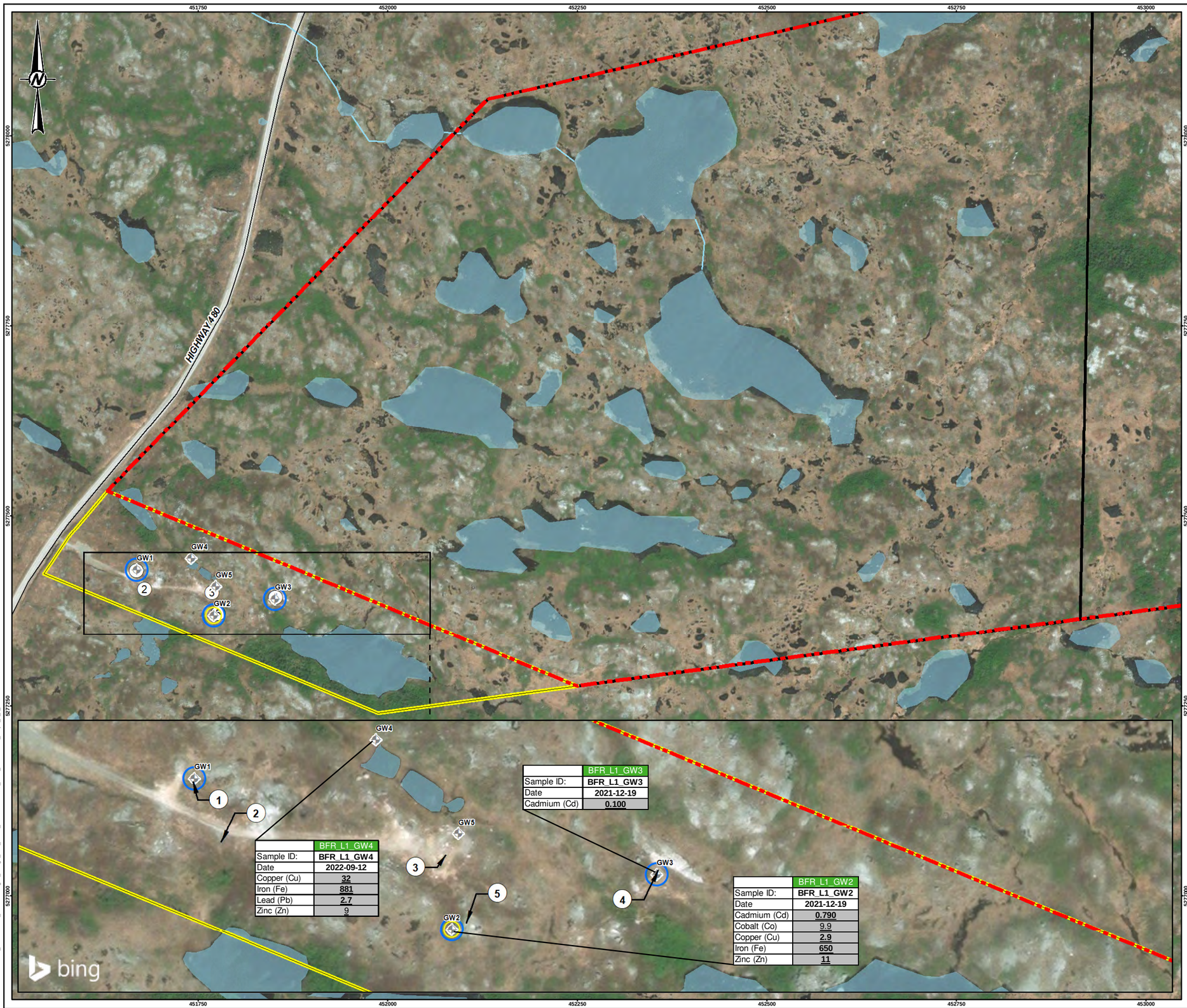
wsp

YYYY-MM-DD	2023-01-26
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	**10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

Path: S:\Clients\DeNence_Construction_Canada\Burgeo_Range_Site_NL\99-PROJ\22532464_DCC_Envelo\0002_Steps_5_7_20222532464-0002-HS-0018.mxd



LEGEND

- APPROXIMATE GROUNDWATER SAMPLE LOCATION (2021)
- pH BELOW ACCEPTABLE SITE CRITERIA RANGE
- EXCEEDANCE OF ALUMINUM SITE CRITERIA
- (1) APPROXIMATE RANGERS TARGET PRACTICE SHOOTING LOCATION
- (2) APPROXIMATE LOCATION OF LOCAL RESIDENTS' CLAY TARGET SHOOTING AREA
- (3) APPROXIMATE LOCATION OF BACKSTOP (BULLET CATCH)
- (4) APPROXIMATE FORMER LOCATION OF WOODEN TARGETS USED BY LOCAL RESIDENTS
- (5) APPROXIMATE LOCATION WHERE LOCAL RESIDENTS SETUP TO SHOOT ACROSS WATERBODY
- ROADWAY
- WATERCOURSE
- WATERBODY
- PROPOSED ADDITIONAL LEASE AREA
- ZONE BOUNDARY
- SITE

Site Criteria	Atlantic RBCA EQS	FIGQGs
Total Cadmium (Cd)	0.09	0.09
Total Cobalt (Co)	1	NGA
Total Copper (Cu)	2	2
Total Iron (Fe)	300	300
Total Zinc (Zn)	7	10
Total Lead (Pb)	1	1

EXCEEDANCE IDENTIFICATION

1. UNDERLINE AND SHADED = EXCEEDANCE OF RBCA ECOLOGICAL TIER 1
2. UNDERLINED AND SHADED = EXCEEDANCE OF FIGQGs

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. ALL CONCENTRATIONS IN µg/L
3. ATLANTIC RISK-BASED CORRECTIVE ACTION (RBCA) ECOLOGICAL TIER 1 ENVIRONMENTAL QUALITY STANDARDS (EQS) FOR GROUNDWATER, DISCHARGE TO FRESH WATER, <10 m FROM SURFACE WATER BODY (2021).
4. FEDERAL INTERIM GROUNDWATER QUALITY GUIDELINES FOR FEDERAL CONTAMINATED SITES, JUNE 2016 V4 – TABLE 3: RESIDENTIAL/PARKLAND LAND, COARSE GRAINED SOIL.
5. NGA = NO GUIDELINE AVAILABLE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 50 100 200
1:5,000 METRES

CLIENT
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT
BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE
LOCATION 1 - ZONE 1 - EXCEEDANCES IN GROUNDWATER

CONSULTANT

YYYY-MM-DD	2023-01-31
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0002	A	11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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LEGEND

- ROADWAY
- WATERCOURSE
- WATERBODY
- DISTURBED AREA
- PROPOSED ADDITIONAL LEASE AREA
- ZONE BOUNDARY
- ECOLOGICAL STUDY AREA
- SITE

0 100 200 400

1:5,500 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BASE DATA - CANVEC PROVIDED BY HIS MAJESTY THE KING IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

CLIENT

DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT

BURGEO FIRING RANGE
9 WING GANDER, NL

TITLE

HABITAT ASSESSMENT

CONSULTANT

wsp

YYYY-MM-DD	2023-02-24
DESIGNED	----
PREPARED	JEM/MG
REVIEWED	----
APPROVED	----

PROJECT NO.	CONTROL	REV.	FIGURE
22532464	0003	A	12

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

APPENDIX A

Analytical Data Relied on for the HHERA

Table 1: Analytical Results - Metals in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location								BFR_SS1						BFR_SS2					
Sample ID	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG [c] (HH and ECO)	Background Range [d] Min	Background Range [d] Max	Maximum	Units	BFR_SS1_SA1	BFR_SS_DUP 1	BFR_L1_SS1_ SA2	BFR_L1_SS1_ A_SA1	BFR_L1_SS1_ B_SA1	BFR_L1_SS1_ C_SA1	BFR_SS2_SA1	BFR_L1_SS2_ B_SA1	BFR_L1_SS2_ C_SA1	BFR_L1_SS2_ D_SA1	BFR_L1_SS_DU P6 (Duplicate of BFR_L1_SS2_D_ SA1)	BFR_SS4_SA1
Sample Depth (mbgs)								0 - 0.15	0 - 0.15	0.15 - 0.30	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2020-12-01	2020-12-01	2021-11-27	2021-11-27	2021-11-27	2021-11-27	2020-12-01	2021-11-27	2021-11-27	2021-11-27	2021-11-27	2020-12-01
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	5500	5700	5210	4520	12100	2640	7800	7800	7310	10900	9880	13000
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	<2.0	<2.0	<0.8	<0.8	<0.8	<0.8	<2.0	<0.8	<0.8	0.9	<0.8	<2.0
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	2.5	3.2	3.0	4.0	3.0	2.0	5.7	7.0	5.0	6.0	7.0	<2.0
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	21	21	19	19	10	38	34	38	28	84	58	15
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	mg/kg	<2.0	<2.0	<0.4	<0.4	<0.4	<0.4	<2.0	0.5	0.4	0.5	0.6	<2.0
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	-	-	-	-	<2.0	-	-	-	-	<2.0
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	<50	<50	<5.0	<5.0	<5.0	<5.0	<50	<5.0	<5.0	<5.0	<5.0	<50
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	<0.30	<0.30	<0.50	<0.50	<0.50	<0.50	<0.30	<0.50	<0.50	<0.50	<0.50	<0.30
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg												
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	2.8	3.1	2.9	2.8	2.5	2.9	5.6	6.6	7.2	9.4	7.9	1
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	4.5	4.9	5.6	5.3	2.9	8.4	12	14.4	12.5	16.7	14.4	4.2
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	8700	9500	8540	8180	**13500**	9550	**16000**	**15000**	**14100**	**20800**	**18000**	5000
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	3.8	4.1	27	6.0	29	30	17	20	18	*82*	25	52
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	130	130	143	125	116	88	330	**449**	**387**	**560**	**435**	47
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	<0.10	<0.10	0.06	0.07	0.14	0.19	<0.10	0.09	0.06	0.05	<0.03	0.17
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	mg/kg	<2.0	<2.0	<0.5	<0.5	0.5	<0.5	<2.0	0.6	0.6	<0.5	<0.5	<2.0
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	6.6	7.3	6.0	6.0	4.0	6.0	11	11	13	14	14	4.5
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	<0.50	<0.50	<0.8	<0.8	*4.2*	*1.9*	<0.50	<0.8	<0.8	<0.8	<0.8	*2.2*
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.5	<0.5	<0.5	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.50
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0	11	9.3	15	14	10	8.0	<5.0
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.10	<0.10	<0.50	<0.50	<0.50	<0.50	0.12	<0.50	<0.50	<0.50	<0.50	<0.10
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	<1.0	<1.0	<1.0	<1.0	2.0	1.0	<1.0	<1.0	<1.0	1.0	1.0	1.4
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	0.68	0.52	0.92	0.74	1.87	1.07	0.95	1.38	1.17	1.32	1.14	2.50
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	**79**	mg/kg	18.0	20.0	18.9	17.8	36.5	26.5	34.0	35.6	**42.0**	**62.0**	**48.1**	25.0
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	14	14	14	14	21	23	38	59	40	62	53	25

Notes:
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Location								BFR_SS4				BFR_SS4		BFR_SS5	BFR_SS6				BFR
Sample ID	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG [c] (HH and ECO)	Background Range [d] Min	Background Range [d] Max	Maximum	Units	BFR_L1_SS4_SA2	BFR_L1_SS_DUP4 (Duplicate of BFR_L1_SS4_SA2)	BFR_L1_SS4_A_SA1	BFR_L1_SS4_B_SA1	BFR_L1_SS4_C_SA1	BFR_L1_SS4_D_SA1	BFR_SS5_SA1	BFR_SS6_SA1	BFR_SS6_SA2	BFR_L1_SS6A	BFR_L1_SS-DUP1 (Duplicate of BFR_L1_SS6_A_SA)	BFR_L1_SS6B
Sample Depth (mbgs)								0.15 - 0.30	0.15 - 0.30	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0.15 - 0.3	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2021-11-27	2021-11-27	2021-11-27	2021-11-27	2021-11-27	2021-11-27	2020-12-01	2020-12-01	2020-12-01	2021-11-18	2021-11-18	2021-11-18
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	4890	7910	5850	2280	12000	7990	840	5800	9700	888	1580	519
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<2.0	<2.0	<2.0	<1.0	<1.0	2.0
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	2.0	2.0	2.0	3.0	2.0	2.0	<2.0	<2.0	<2.0	2.0	3.0	2.0
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	13	14	15	23	23	14	33	19	6.3	6.0	11	15
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	mg/kg	<0.4	<0.4	<0.4	<0.4	0.5	<0.4	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	<2.0	<2.0	<2.0	-	-	-
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<50	<50	<50	<2.0	<2.0	*10*
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	<0.50	<0.50	<0.50	0.60	<0.50	<0.50	<0.30	0.42	<0.30	<0.30	<0.30	0.30
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg												
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	0.9	1.0	1.2	<0.5	2.0	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	5.0	4.3	4.8	4.7	38.2	3.6	2.4	6.2	2.3	<2.0	<2.0	7.0
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	3450	3620	7170	1140	6800	7110	690	4600	1500	399	721	507
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	32	33	36	30	61	19	17	16	8.9	4.7	6.0	60.4
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	46	49	82	38	104	119	13	26	18	11	15	19
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	0.20	0.17	0.15	0.22	0.14	0.08	0.25	0.31	0.15	0.04	0.07	0.12
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	mg/kg	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	3.0	3.0	3.0	2.0	5.0	3.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	*4.7*	*3.8*	*2.9*	*3.0*	*4.1*	*1.8*	*1.8*	*2.3*	*1.9*	<1.0	<1.0	<1.0
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	<5.0	<5.0	<5.0	35	7.0	<5.0	36	12	<5.0	<5.0	8.0	14
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.10	0.15	<0.10	<0.10	<0.10	<0.10
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	3.0	1.0	1.0	<1.0	2.0	1.0	<1.0	*16*	<1.0	3.0	3.0	<2.0
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	1.29	1.15	0.99	<0.50	2.59	1.41	0.11	0.7	1.30	0.20	0.20	<0.10
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	***79***	mg/kg	14.1	14.2	18.9	4.0	32.2	22.7	2.5	7.5	8.8	6.0	9.0	4.0
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	9.0	9.0	12	32	59	31	27	18	<5.0	<5.0	5.0	27

Notes:
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 1: Analytical Results - Metals in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location								SS6		BFR_SS8						BFR_SS9	BFR_SS10	BFR_SS11	
Sample ID	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG [c] (HH and ECO)	Background Range [d] Min	Background Range [d] Max	Maximum	Units	BFR_L1_SS6C	BFR_L1_SS6D	BFR_SS8_SA1	BFR_SS8_SA2	BFR_L1_SS8A	BFR_L1_SS8B	BFR_L1_SS8C	BFR_L1_SS8D	BFR_SS9_SA1	BFR_SS10_SA1	BFR_SS11_SA1	BFR_SS12_SA1
Sample Depth (mbgs)								0 - 0.15	0 - 0.15	0 - 0.15	0.15 - 0.3	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2021-11-18	2021-11-18	2020-12-01	2020-12-01	2021-11-18	2021-11-18	2021-11-18	2021-11-18	2020-12-01	2020-12-01	2020-12-01	2020-12-02
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	937	6340	700	2600	3550	724	2710	2530	5800	3700	1000	6700
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	1.0	<1.0	<2.0	<2.0	<1.0	1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	3.0	2.0	2.7	<2.0	2.0	4.0	3.0	3.0	2.3	<2.0	<2.0	2.7
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	20	5.0	17	7.9	9.0	13.0	6.0	6.0	23	7.9	16	27
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	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
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	<2.0	<2.0	-	-	-	-	<2.0	<2.0	<2.0	<2.0
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	*7.0*	*3.0*	<50	<50	<2.0	*3.0*	<2.0	<2.0	<50	<50	<50	<50
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	0.60	<0.30	***1.5***	<0.30	0.40	1.1	<0.30	<0.30	0.42	<0.30	0.48	0.36
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg												
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	3.0	3.0	2.5	2.5	<2.0	<2.0	<2.0	3.0	3.1	<2.0	2.1	7.4
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	435	286	1600	130	401	1390	2040	471	2800	1100	930	**12000**
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	11.6	3.6	28	1.4	6.9	28.6	5.6	15.6	58	7.3	5.9	45
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	9.0	<2.0	7.9	<2.0	3.0	10	13	3.0	8.2	4.4	5	32
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	0.16	0.08	0.23	0.12	<0.03	0.10	0.09	0.09	0.16	0.12	0.15	0.26
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	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
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	3.3
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	*2.0*	*5.0*	*1.8*	*2.6*	*3.0*	*2.0*	<1.0	*2.0*	*1.5*	*1.1*	*2.3*	*3.3*
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.5	<0.5	<0.50	<0.50	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	57	<5.0	46	7.0	11.0	30.0	14.0	12.0	23	<5.0	27	22
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	0.20	<0.10	<0.10	0.11	<0.10	<0.10	<0.10
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	4.0	3.0	1.9	<1.0	<2.0	4.0	4.0	4.0	1.2	1.5	4.1	1.3
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	<0.10	1.00	<0.10	0.88	0.40	<0.10	0.20	0.30	0.22	0.97	0.19	1.40
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	***79***	mg/kg	5.0	4.0	2.8	<2.0	5.0	5.0	11.0	4.0	<2.0	6.4	<2.0	11
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	28	7.0	33	<5.0	8.0	23	9.0	7.0	16	<5.0	15	19

Notes:
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 1: Analytical Results - Metals in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location								BFR_SS12					BFR_SS13				BFR_SS13		
Sample ID	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG [c] (HH and ECO)	Background Range [d] Min	Background Range [d] Max	Maximum	Units	BFR_L1_SS12_SA2	BFR_L1_SS12_A_SA1	BFR_L1_SS12_B_SA1	BFR_L1_SS12_C_SA1	BFR_L1_SS12_D_SA1	BFR_SS13_SA1	BFR_SS13_SA2	BFR_L1_SS13A_SA1	BFR_L1_SS_DUP2 (Duplicate of BFR_L1_SS13_A_SA1)	BFR_L1_SS13B_SA1	BFR_L1_SS13C_SA1	BFR_L1_SS13D_SA1
Sample Depth (mbgs)								0.15 - 0.30	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0.15 - 0.3	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2021-11-27	2021-11-27	2021-11-27	2021-11-27	2021-11-27	2020-12-02	2020-12-02	2021-11-17	2021-11-17	2021-11-17	2021-11-17	2021-11-17
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	7510	4370	6820	4560	7710	9800	13000	1190	1390	7470	3340	639
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	1.0	1.0	1.0	1.0	1.0	<2.0	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	5.0	3.0	6.0	5.0	5.0	2.9	<2.0	2.0	2.0	3.0	3.0	3.0
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	15	22	18	22	15	34	17	<5.0	6.0	61	7.0	22
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	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
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	<2.0	<2.0	-	-	-	-	-
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	*4.0*	*3.0*	*3.0*	*6.0*	*3.0*	<50	<50	*12*	<2.0	*6.0*	*4.0*	*3.0*
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	0.50	***1.6***	0.80	0.80	0.80	0.54	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg												
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	1	<1.0	<1.0	<1.0	5.0	<1.0	<1.0
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	7.0	5.0	10	5.0	8.0	7.1	2.7	<2.0	<2.0	6.0	<2.0	3.0
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	4180	2400	2520	7150	2820	4900	3400	450	573	**11500**	4790	369
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	45	36	*76*	22	*74*	*120*	9.6	4.6	6.4	5.2	15	4.7
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	26	19	23	29	24	27	6.0	12	9.0	111	23	5.0
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	0.18	0.14	0.17	0.18	0.17	0.31	0.21	0.07	0.08	0.09	0.11	0.09
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	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
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	2.0	<2.0	2.0	<2.0	2.0	3.8	2.8	<2.0	<2.0	6.0	<2.0	<2.0
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	*4.0*	*2.0*	*5.0*	*3.0*	*5.0*	*3.4*	*3.7*	1.0	*2.0*	1.0	*2.0*	*2.0*
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	21	25	22	26	18	17	6.1	<5.0	<5.0	8.0	5.0	54
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	4.0	3.0	5.0	4.0	4.0	1.5	<1.0	3.0	3.0	4.0	3.0	4.0
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	1.20	0.60	1.20	0.60	1.50	1.10	2.30	0.40	0.40	0.20	0.40	<0.10
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	**79**	mg/kg	10.0	6.0	10.0	10.0	13.0	5	8.6	4.0	4.0	**49.0**	10.0	4.0
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	12	14	14	16	13	15	<5.0	16	<5.0	27	9.0	19

Notes:
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 1: Analytical Results - Metals in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location				Background Range[d]				BFR_SS14	BFR_SS15	BFR_SS16						BFR_L1_SS31	BFR_L1_SS32	BFR_L1_SS33
Sample ID	Atlantic RBCA EQS_{Eco}[a]	Atlantic RBCA EQS_{HH}[b]	CCME SQG[c] (HH and ECO)	Min	Max	Maximum	Units	BFR_SS14_SA1	BFR_SS15_SA1	BFR_SS16_SA1	BFR_L1_SS16_SA2	BFR_L1_SS16_A_SA1	BFR_L1_SS16_B_SA1	BFR_L1_SS16_C_SA1	BFR_L1_SS16_D_SA1	BFR_L1_SS31_SA1	BFR_L1_SS32_SA1	BFR_L1_SS33_SA1
Sample Depth (mbgs)								0 - 0.15	0 - 0.15	0 - 0.15	0.15 - 0.30	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2020-12-02	2020-12-02	2020-12-02	2021-11-27	2021-11-27	2021-11-27	2021-11-27	2021-11-27	2022-09-05	2022-09-05	2022-09-05
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	860	2900	8400	7850	1080	3000	12100	4720	2630	7580	6980
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	<2.0	<2.0	<2.0	<1.0	2.0	<1.0	<1.0	<1.0	<1	<1	<1
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	<2.0	<2.0	<2.0	2.0	5.0	2.0	3.0	2.0	4	4	4
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	16	33	9	<5.0	14	<5.0	6.0	<5.0	11	7	6
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	-	-	-	-		-	-	-
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	<50	<50	<50	<2.0	*6.0*	<2.0	<2.0	*3.0*	<2	<2	<2
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	0.78	0.54	0.46	0.40	0.80	<0.30	***1.7***	<0.30	<0.3	<0.3	<0.3
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg									3	8	6
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1	1	<1
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	<2.0	3.7	3.4	4.0	5.0	<2.0	14	<2.0	<2	3	<2
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	880	770	350	3570	581	492	2390	406	641	3320	5250
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	17	8	37	19	13	12	59	4.1	2.2	5.4	6.3
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	4.2	2.6	5.8	81	5.0	29	41	3.0	12	98	36
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	0.15	0.2	0.16	0.04	0.12	0.03	0.09	0.06	0.04	<0.03	0.04
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	<2.0	<2	<2	<2
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	<2.0	2.6	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2	2	<2
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	*1.8*	*1.9*	*3.7*	*2.0*	*3.0*	1.0	*8.0*	*3.0*	<1	<1	<1
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	36	26	<5.0	<5.0	37	<5.0	14	11	8	<5	<5
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	1.2	<1.0	<1.0	4.0	4.0	5.0	3.0	4.0	*6*	5	*6*
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	0.11	0.2	10.0	1.90	0.10	0.50	9.80	0.50	0.4	0.8	0.5
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	***79***	mg/kg	2.1	<2.0	15	21.0	6.0	12.0	8.0	4.0	8	17	25
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	31	11	<5.0	12	39	<5.0	7.0	<5.0	<5	13	7

Notes:
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 1: Analytical Results - Metals in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG [c] (HH and ECO)	Background Range [d]		Maximum	Units	BFR_L1_SS34	BFR_L1_SS35	BFR_L1_SS36	BFR_L1_SS37	BFR_L1_SS38		BFR_L1_SS39	BFR_L1_SS40	BFR_L1_SS41	BFR_L1_SS42	BFR_L1_SS44	
Sample ID								BFR_L1_SS34_SA1	BFR_L1_SS35_SA1	BFR_L1_SS36_SA1	BFR_L1_SS37_SA1	BFR_L1_SS38_SA1	BFR_L1_SS38_DUP1	BFR_L1_SS39_SA1	BFR_L1_SS40_SA1	BFR_L1_SS41_SA1	BFR_L1_SS42_SA1	BFR_L1_SS44_SA1	BFR_L1_SS44_DUP1
Sample Depth (mbgs)				Min	Max			0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2022-09-06	2022-09-06	2022-09-06	2022-09-06	2022-09-05	2022-09-05	2022-09-05	2022-09-06	2022-09-05	2022-09-05	2022-09-05	2022-09-05
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	10400	8910	4890	14400	2060	**16900**	4190	3380	952	5580	8360	8750
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	4	4	7	3	3	4	4	3	3	3	3	3
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	26	27	15	9	16	25	8	19	8	6	7	5
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	<0.3	<0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg	16	13	3	10	5	23	2	3	<2	4	9	7
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	5	2	<1	2	<1	6	<1	1	<1	<1	1	<1
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	6	14	3	2	5	10	<2	3	<2	<2	<2	<2
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	**19200**	7680	678	10000	1220	**15000**	603	4530	658	1730	4510	2210
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	25.4	41.3	4.5	10.2	25.7	5.5	1.7	8.9	4.5	9.8	7.6	6.9
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	222	102	6	99	147	335	3	59	8	75	76	53
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	0.06	0.08	0.06	0.04	0.04	<0.03	0.05	0.05	0.04	<0.03	<0.03	<0.03
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	8	4	<2	3	<2	13	<2	2	<2	<2	3	2
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	<1	*2.0*	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	<5	<5	7	<5	17	<5	5	7	10	<5	<5	<5
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	5	5	*13*	4	*6*	*6*	*7*	5	4	5	*6*	*6*
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	0.7	1.0	1.5	0.4	0.1	0.9	0.6	0.2	0.1	0.6	0.6	0.7
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	**79**	mg/kg	**79**	35	12	28	5	**54**	8	15	9	16	22	17
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	28	16	8	13	10	40	<5	13	11	5	9	6

Notes:
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 1: Analytical Results - Metals in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG [c] (HH and ECO)	Background Range [d]		Maximum	Units	BFR_L1_SS45	BFR_L1_SS46	BFR_L1_SS47	BFR_L1_SS48	BFR_L1_SS49	BFR_L1_SS50	BFR_L1_SS51	BFR_L1_SS52	BFR_L1_SS53	BFR_L1_SS54	BFR_L1_SS55	
Sample ID				Min	Max			BFR_L1_SS45_SA1	BFR_L1_SS46_SA1	BFR_L1_SS47_SA1	BFR_L1_SS48_SA1	BFR_L1_SS49_SA1	BFR_L1_SS50_SA1	BFR_L1_SS51_SA1	BFR_L1_SS52_SA1	BFR_L1_SS53_SA1	BFR_L1_SS54_SA1	BFR_L1_SS55_SA1	BFR_L1_SS55_DUP1
Sample Depth (mbgs)								0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2022-09-05	2022-09-04	2022-09-05	2022-09-05	2022-09-05	2022-09-05	2022-09-05	2022-09-05	2022-09-05	2022-09-05	2022-09-05	2022-09-05
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	3500	8500	14600	**15600**	8980	4780	4260	764	6670	7810	11700	13100
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	4	4	3	4	3	2	2	3	3	3	3	3
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	24	8	63	35	19	<5	6	19	12	20	9	8
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	-	-	-	-	-	-
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	<2	<2	<2	<2	<2	<2	<2	2	<2	<2	<2	<2
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	0.4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.4	<0.3	<0.3	<0.3	<0.3
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg	16	8	21	20	11	8	4	<2	2	9	10	14
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	1	2	10	10	3	<1	<1	<1	<1	1	<1	<1
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	10	5	9	26	3	<2	<2	4	<2	3	6	6
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	8390	5120	**25100**	**17800**	10300	1090	1730	440	148	5180	2870	2640
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	40.0	3.7	4.4	3.5	6.4	10.5	6.1	6.6	1.8	13.4	9.2	6.8
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	156	99	**566**	**538**	158	23	31	13	<2	101	46	42
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	0.07	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.08	0.03	0.09	0.06	0.05
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	mg/kg	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	3	4	13	13	5	<2	<2	<2	<2	3	2	<2
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	*2.0*	*2.0*	*4*	*4*
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	16	<5	<5	<5	<5	<5	<5	53	6	<5	<5	<5
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	*14*	5	*6*	5	5	5	4	4	4	4	4	3
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	0.3	0.6	0.7	1.0	0.9	0.5	0.4	<0.1	0.2	0.8	1.5	1.5
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	***79***	mg/kg	10	21	***77***	***75***	39	21	15	6	5	25	15	17
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	49	13	58	56	18	<5	<5	27	<5	14	8	7

Notes:
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(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 1: Analytical Results - Metals in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG [c] (HH and ECO)	Background Range [d]		Maximum	Units	BFR_L1_SS56	BFR_L1_SS57	BFR_L1_SS58	BFR_L1_SS59	BFR_L1_SS60	BFR_L1_SS61	BFR_L1_SS62	BFR_L1_SS63	BFR_L1_SS64	BFR_L1_SS65
Sample ID								BFR_L1_SS56_SA1	BFR_L1_SS57_SA1	BFR_L1_SS58_SA1	BFR_L1_SS59_SA1	BFR_L1_SS60_SA1	BFR_L1_SS61_SA1	BFR_L1_SS62_SA1	BFR_L1_SS63_SA1	BFR_L1_SS64_SA1	BFR_L1_SS65_SA1
Sample Depth (mbgs)				Min	Max			0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected								2022-09-08	2022-09-08	2022-09-08	2022-09-08	2022-09-08	2022-09-08	2022-09-08	2022-09-08	2022-09-08	2022-09-08
Acid Extractable Aluminum (Al)	-	**15400**	-	640	12000	**16900**	mg/kg	1640	6910	7840	9400	6960	11600	3300	6850	5340	8000
Acid Extractable Antimony (Sb)	20	7.5	20	<0.8	2	2	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acid Extractable Arsenic (As)	17.1	31	12	<1.0	4.3	7	mg/kg	2	2	3	3	2	3	3	3	2	4
Acid Extractable Barium (Ba)	400	6800	750	5	37	84	mg/kg	19	37	29	22	6	6	13	9	6	32
Acid Extractable Beryllium (Be)	5	75	4	<2.0	<2.0	<2 (1)	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	-	-	-	-
Acid Extractable Boron (B)	120	4300	**2**	<2.0	5	*<50 (12)*	mg/kg	<2	<2	*5*	<2	<2	<2	2	<2	<2	*4.0*
Acid Extractable Cadmium (Cd)	3.8	**1.4**	**1.4**	<0.30	3.1	***1.7***	mg/kg	<0.3	<0.3	0.4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.6
Acid Extractable Chromium (Cr)	64	220	64	<2.0	10	23	mg/kg	2	12	<2	8	10	6	4	3	14	3
Acid Extractable Cobalt (Co)	20	22	40	<0.5	2.4	10	mg/kg	<1	3	<1	3	2	<1	<1	<1	<1	<1
Acid Extractable Copper (Cu)	63	1100	63	<2.0	10	38	mg/kg	<2	<2	3	2	<2	6	4	3	3	10
Acid Extractable Iron (Fe)	-	**11000**	-	210	29000	**25100**	mg/kg	252	7300	1840	**12700**	5850	343	633	486	290	2640
Acid Extractable Lead (Pb)	**70**	140	**70**	3.9	57	*120*	mg/kg	1.4	7.2	8.3	11.3	5.9	6.5	3.5	6.3	7.5	39.7
Acid Extractable Manganese (Mn)	-	**360**	-	<2.0	25	**566**	mg/kg	<2	146	9	172	71	2	4	3	4	40
Acid Extractable Mercury (Hg)	12	6.6	6.6	0.13	0.38	0.31	mg/kg	0.09	<0.03	0.10	0.03	<0.03	0.07	0.07	0.06	<0.03	0.10
Acid Extractable Molybdenum (Mo)	4	110	5	<2.0	<2.0	3	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Nickel (Ni)	45	200	45	1	4	14	mg/kg	<2	4	<2	4	4	<2	2	<2	<2	2
Acid Extractable Selenium (Se)	**1**	80	**1**	0.8	3.4	*8*	mg/kg	1	<1	*2*	<1	<1	*4*	*4*	*3*	<1	*2*
Acid Extractable Silver (Ag)	20	77	20	<0.5	<0.50	<0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	9400	-	<5.0	63	57	mg/kg	11	<5	18	<5	<5	<5	15	<5	<5	16
Acid Extractable Thallium (Tl)	1	1	1	<0.10	<0.50	<0.5	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Acid Extractable Tin (Sn)	**5**	9400	**5**	<1.0	4	*16*	mg/kg	5	4	*15*	5	4	4	4	*6*	4	5
Acid Extractable Uranium (U)	33	23	23	<0.10	5.6	10	mg/kg	0.5	0.4	0.5	0.7	0.4	2.2	0.6	1.8	0.6	0.9
Acid Extractable Vanadium (V)	**18**	**39**	130	<2.0	13	**79**	mg/kg	4	30	5	**59**	23	13	6	8	16	8
Acid Extractable Zinc (Zn)	200	10000	250	<5.0	31	62	mg/kg	<5	17	11	22	12	<5	11	<5	<5	17

Notes:
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2021)
(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)
(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use
(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of RBCA Human Health-Based Tier 1
Italicised and shaded = Exceedance of CCME SQG
Yellow Shaded = exceedance is within or below background range and considered naturally occurring
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 2: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG_{Eco} [c]	CCME SQG_{HH} [c]	Background Range [e]		Maximum	Units	BFR_SS1		BFR_SS2	BFR_SS4	BFR_SS5	BFR_SS6	BFR_SS6		
Sample ID					Min	Max			BFR_SS1_SA1	BFR_SS_DUP1	BFR_SS2_SA1	BFR_SS4_SA1	BFR_SS5_SA1	BFR_SS6_SA1	BFR_L1_SS-DUP1 (Duplicate of BFR_L1_SS6_A_SA1)	BFR_L1_SS6A	BFR_L1_SS6B
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-01	2021-11-18	2021-11-18	2021-11-18
1-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.05	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.05	<0.05	<0.05
2-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Acenaphthene	21.5	3900	-	-	<0.00671	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.00671	<0.00671	<0.00671
Acenaphthylene	-	4.5	-	-	<0.004	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.004	<0.004	<0.004
Anthracene	2.5	24000	2.5	-	<0.03	<0.010	<0.03	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.5	see B(a)P TPE	0.1	see B(a)P TPE	<0.01	<0.010	<0.07	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.6	see B(a)P TPE	20	see B(a)P TPE	<0.01	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.010	<0.05	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.020	<0.020	<0.02	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	-	-
Benzo(g,h,i)perylene	6.6	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.32	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	-	-
Benzo(k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	-	-
Benzo(j/k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.05	<0.05	mg/kg	-	-	-	-	-	-	<0.05	<0.05	<0.05
Chrysene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	0.036	mg/kg	<0.010	<0.010	<0.010	0.036	<0.010	<0.010	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	-	see B(a)P TPE	0.1	see B(a)P TPE	<0.006	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.006	<0.006	<0.006
Fluoranthene	15.4	3500	50	-	<0.010	<0.010	<0.05 (0.047)	mg/kg	<0.010	<0.010	<0.010	0.047	<0.010	<0.010	<0.05	<0.05	<0.05
Fluorene	15.4	2700	-	-	<0.010	<0.010	0.030	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.02	0.03	<0.01
Indeno(1,2,3-cd)pyrene	0.38	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	0.054	0.041	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Naphthalene	0.6	2.2	0.013	-	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Perylene [f]	2.5	24000	2.5	-	<0.010	<0.010	1.100	mg/kg	<0.010	<0.010	<0.010	0.078	<0.010	<0.010	<0.05	<0.05	<0.05
Phenanthrene	6.2	-	0.046	-	<0.010	<0.010	<0.03	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.03	<0.03	<0.03
Pyrene	7.7	2100	0.1	-	<0.010	<0.010	<0.06	mg/kg	<0.010	<0.010	<0.010	<0.060	<0.010	<0.010	<0.05	<0.05	<0.05
B[a]P TPE [d]	-	5.3	-	5.3	<0.02	0.03	0.030	-	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.03	<0.03	<0.03

Notes:

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{ECO}) for soil - coarse agricultural soils (2021)

(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)

(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use

(d) CCME (2010) presents a single SQGHH for carcinogenic PAHs via direct contact pathways that is expressed as the benzo[a]pyrene total potency equivalent (B[a]P TPE). The B[a]P TPE is the sum of the estimated cancer potency relative to B[a]P for carcinogenic PAHs

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

(f) Criteria for anthracene applied as a surrogate for perylene, both are non-carcinogenic and have similar number of benzene rings which influences toxicity (CCME 2010)

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

'Yellow Shaded = exceedance is within or below background range

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Bold and shaded = Exceedance of Atlantic RBCA EQS Eco (None reported)

Underline and shaded = Exceedance of Atlantic RBCA EQS HH (None reported)

Italicised and shaded = Exceedance of CCME SQG (None reported)

Table 2: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location									BFR_SS6		BFR_SS8			BFR_SS8			BFR_SS9	BFR_SS10
Sample ID	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG_{Eco} [c]	CCME SQG_{HH} [c]	Background Range [e]		Maximum	Units	BFR_L1_SS6C	BFR_L1_SS6D	BFR_SS8_SA1	BFR_L1_SS8A	BFR_L1_SS8B	BFR_L1_SS8C	BFR_L1_SS8D	BFR_SS9_SA1	BFR_SS10_SA1
					Min	Max												
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2021-11-18	2021-11-18	2020-12-01	2021-11-18	2021-11-18	2021-11-18	2021-11-18	2020-12-01	2020-12-01
1-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.05	mg/kg	<0.05	<0.05	<0.010	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010
2-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.01	mg/kg	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010
Acenaphthene	21.5	3900	-	-	<0.00671	<0.010	<0.01	mg/kg	<0.00671	<0.00671	<0.010	<0.00671	<0.00671	<0.00671	<0.00671	<0.010	<0.010
Acenaphthylene	-	4.5	-	-	<0.004	<0.010	<0.01	mg/kg	<0.004	<0.004	<0.010	<0.004	<0.004	<0.004	<0.004	<0.010	<0.010
Anthracene	2.5	24000	2.5	-	<0.03	<0.010	<0.03	mg/kg	<0.03	<0.03	<0.010	<0.03	<0.03	<0.03	<0.03	<0.010	<0.010
Benzo(a)anthracene	0.5	see B(a)P TPE	0.1	see B(a)P TPE	<0.01	<0.010	<0.07	mg/kg	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010
Benzo(a)pyrene	0.6	see B(a)P TPE	20	see B(a)P TPE	<0.01	<0.010	<0.01	mg/kg	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010
Benzo(b)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.010	<0.05	mg/kg	<0.05	<0.05	<0.010	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010
Benzo(b/j)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.020	<0.020	<0.02	mg/kg	-	-	<0.020	-	-	-	-	<0.020	<0.020
Benzo(g,h,i)perylene	6.6	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.32	mg/kg	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010
Benzo(j)fluoranthene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	-	-	<0.010	-	-	-	-	<0.010	<0.010
Benzo(k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	-	-	<0.010	-	-	-	-	<0.010	<0.010
Benzo(j/k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.05	<0.05	mg/kg	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	-	-
Chrysene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	0.036	mg/kg	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010
Dibenzo(a,h)anthracene	-	see B(a)P TPE	0.1	see B(a)P TPE	<0.006	<0.010	<0.01	mg/kg	<0.006	<0.006	<0.010	<0.006	<0.006	<0.006	<0.006	<0.010	<0.010
Fluoranthene	15.4	3500	50	-	<0.010	<0.010	<0.05 (0.047)	mg/kg	<0.05	<0.05	<0.010	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010
Fluorene	15.4	2700	-	-	<0.010	<0.010	0.030	mg/kg	<0.01	0.02	<0.010	0.02	<0.01	<0.01	0.01	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	0.38	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	0.054	0.041	mg/kg	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	0.041
Naphthalene	0.6	2.2	0.013	-	<0.010	<0.010	<0.01	mg/kg	<0.01	<0.01	<0.010	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010
Perylene [f]	2.5	24000	2.5	-	<0.010	<0.010	1.100	mg/kg	<0.05	<0.05	<0.010	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010
Phenanthrene	6.2	-	0.046	-	<0.010	<0.010	<0.03	mg/kg	<0.03	<0.03	<0.010	<0.03	<0.03	<0.03	<0.03	<0.010	<0.010
Pyrene	7.7	2100	0.1	-	<0.010	<0.010	<0.06	mg/kg	<0.05	<0.05	<0.010	<0.05	<0.05	<0.05	<0.05	<0.010	<0.010
B[a]P TPE [d]	-	5.3	-	5.3	<0.02	0.03	0.030	-	<0.03	<0.03	<0.02	<0.03	<0.03	<0.03	<0.03	<0.02	<0.02

Notes:

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{ECO}) for soil - coarse agricultural soils (2021)

(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)

(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use

(d) CCME (2010) presents a single SQGHH for carcinogenic PAHs via direct contact pathways that is expressed as the benzo[a]pyrene total potency equivalent (B[a]P TPE). The B[a]P TPE is the sum of the estimated cancer potency relative to B[a]P for carcinogenic PAHs

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

(f) Criteria for anthracene applied as a surrogate for perylene, both are non-carcinogenic and have similar number of benzene rings which influences toxicity (CCME 2010)

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

'Yellow Shaded = exceedance is within or below background range

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Bold and shaded = Exceedance of Atlantic RBCA EQS Eco (None reported)

Underline and shaded = Exceedance of Atlantic RBCA EQS HH (None reported)

Italicised and shaded = Exceedance of CCME SQG (None reported)

Table 2: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location									BFR_SS11	BFR_SS12	BFR_SS13			BFR_SS13			BFR_SS14
Sample ID	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG_{Eco} [c]	CCME SQG_{HH} [c]	Background Range [e]		Maximum	Units	BFR_SS11_SA1	BFR_SS12_SA1	BFR_SS13_SA1	BFR_L1_SS13A_SA1	BFR_L1_SS_DUP2 (Duplicate of BFR_L1_SS13_A_SA1)	BFR_L1_SS13B_SA1	BFR_L1_SS13C_SA1	BFR_L1_SS13D_SA1	BFR_SS14_SA1
					Min	Max											
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2020-12-01	2020-12-02	2020-12-02	2021-11-17	2021-11-17	2021-11-17	2021-11-17	2021-11-17	2020-12-02
1-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.05	mg/kg	<0.010	<0.010	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
2-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Acenaphthene	21.5	3900	-	-	<0.00671	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671	<0.010
Acenaphthylene	-	4.5	-	-	<0.004	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.004	<0.004	<0.004	<0.004	<0.004	<0.010
Anthracene	2.5	24000	2.5	-	<0.03	<0.010	<0.03	mg/kg	<0.010	<0.010	<0.010	<0.03	<0.03	<0.03	<0.03	<0.03	<0.010
Benzo(a)anthracene	0.5	see B(a)P TPE	0.1	see B(a)P TPE	<0.01	<0.010	<0.07	mg/kg	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Benzo(a)pyrene	0.6	see B(a)P TPE	20	see B(a)P TPE	<0.01	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Benzo(b)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.010	<0.05	mg/kg	<0.010	<0.010	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Benzo(b/j)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.020	<0.020	<0.02	mg/kg	<0.020	<0.020	<0.020	-	-	-	-	-	<0.020
Benzo(g,h,i)perylene	6.6	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.32	mg/kg	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Benzo(j)fluoranthene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	-	-	-	-	-	<0.010
Benzo(k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	-	-	-	-	-	<0.010
Benzo(j/k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.05	<0.05	mg/kg	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
Chrysene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	0.036	mg/kg	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Dibenzo(a,h)anthracene	-	see B(a)P TPE	0.1	see B(a)P TPE	<0.006	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.006	<0.006	<0.006	<0.006	<0.006	<0.010
Fluoranthene	15.4	3500	50	-	<0.010	<0.010	<0.05 (0.047)	mg/kg	<0.010	<0.010	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Fluorene	15.4	2700	-	-	<0.010	<0.010	0.030	mg/kg	<0.010	<0.010	<0.010	0.03	0.03	<0.01	<0.01	<0.01	<0.010
Indeno(1,2,3-cd)pyrene	0.38	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	0.054	0.041	mg/kg	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Naphthalene	0.6	2.2	0.013	-	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010
Perylene [f]	2.5	24000	2.5	-	<0.010	<0.010	1.100	mg/kg	<0.010	<0.010	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
Phenanthrene	6.2	-	0.046	-	<0.010	<0.010	<0.03	mg/kg	<0.010	<0.010	<0.010	<0.03	<0.03	<0.03	<0.03	<0.03	<0.010
Pyrene	7.7	2100	0.1	-	<0.010	<0.010	<0.06	mg/kg	<0.010	<0.010	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.010
B[a]P TPE [d]	-	5.3	-	5.3	<0.02	0.03	0.030	-	<0.02	<0.02	<0.02	<0.03	<0.03	<0.03	<0.03	<0.03	<0.02

Notes:

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{ECO}) for soil - coarse agricultural soils (2021)

(b) Atlantic Risk-Based Corrective Action (RBCA) Human Health Based Tier 1 Environmental Quality standards (EQS_{HH}) for soil, agricultural land use, non-potable groundwater, coarse-grained soil (2021)

(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use

(d) CCME (2010) presents a single SQGHH for carcinogenic PAHs via direct contact pathways that is expressed as the benzo[a]pyrene total potency equivalent (B[a]P TPE). The B[a]P TPE is the sum of the estimated cancer potency relative to B[a]P for carcinogenic PAHs

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

(f) Criteria for anthracene applied as a surrogate for perylene, both are non-carcinogenic and have similar number of benzene rings which influences toxicity (CCME 2010)

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Italicised and shaded = Exceedance of CCME SQG (None reported)

Table 2: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG_{Eco} [c]	CCME SQG_{HH} [c]	Background Range [e]		Maximum	Units	BFR_SS15	BFR_SS16
Sample ID									BFR_SS15_SA1	BFR_SS16_SA1
Sample Depth (mbgs)					Min	Max			0 - 0.15	0 - 0.15
Date Collected									2020-12-02	2020-12-02
1-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.05	mg/kg	<0.010	<0.010
2-Methylnaphthalene	-	72	-	-	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010
Acenaphthene	21.5	3900	-	-	<0.00671	<0.010	<0.01	mg/kg	<0.010	<0.010
Acenaphthylene	-	4.5	-	-	<0.004	<0.010	<0.01	mg/kg	<0.010	<0.010
Anthracene	2.5	24000	2.5	-	<0.03	<0.010	<0.03	mg/kg	<0.010	<0.010
Benzo(a)anthracene	0.5	see B(a)P TPE	0.1	see B(a)P TPE	<0.01	<0.010	<0.07	mg/kg	<0.010	<0.070
Benzo(a)pyrene	0.6	see B(a)P TPE	20	see B(a)P TPE	<0.01	<0.010	<0.01	mg/kg	<0.010	<0.010
Benzo(b)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.010	<0.05	mg/kg	<0.010	<0.010
Benzo(b/j)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.020	<0.020	<0.02	mg/kg	<0.020	<0.020
Benzo(g,h,i)perylene	6.6	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.32	mg/kg	<0.010	<0.32
Benzo(j)fluoranthene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010
Benzo(k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010
Benzo(j/k)fluoranthene	6.2	see B(a)P TPE	0.1	see B(a)P TPE	<0.05	<0.05	<0.05	mg/kg	-	-
Chrysene	6.2	see B(a)P TPE	-	see B(a)P TPE	<0.010	<0.010	0.036	mg/kg	<0.010	<0.010
Dibenzo(a,h)anthracene	-	see B(a)P TPE	0.1	see B(a)P TPE	<0.006	<0.010	<0.01	mg/kg	<0.010	<0.010
Fluoranthene	15.4	3500	50	-	<0.010	<0.010	<0.05 (0.047)	mg/kg	<0.010	<0.010
Fluorene	15.4	2700	-	-	<0.010	<0.010	0.030	mg/kg	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	0.38	see B(a)P TPE	0.1	see B(a)P TPE	<0.010	0.054	0.041	mg/kg	<0.010	<0.010
Naphthalene	0.6	2.2	0.013	-	<0.010	<0.010	<0.01	mg/kg	<0.010	<0.010
Perylene [f]	2.5	24000	2.5	-	<0.010	<0.010	1.100	mg/kg	<0.010	1.1
Phenanthrene	6.2	-	0.046	-	<0.010	<0.010	<0.03	mg/kg	<0.010	<0.010
Pyrene	7.7	2100	0.1	-	<0.010	<0.010	<0.06	mg/kg	<0.010	<0.010
B[a]P TPE [d]	-	5.3	-	5.3	<0.02	0.03	0.030	-	<0.02	<0.02

Notes:

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{ECO}) for soil - coarse agricultural soils (2021)

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(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the protection of environmental and human health, 2023, for non-potable and coarse grained soil with agricultural land use

(d) CCME (2010) presents a single SQGHH for carcinogenic PAHs via direct contact pathways that is expressed as the benzo[a]pyrene total potency equivalent (B[a]P TPE). The B[a]P TPE is the sum of the estimated cancer potency relative to B[a]P for carcinogenic PAHs

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

(f) Criteria for anthracene applied as a surrogate for perylene, both are non-carcinogenic and have similar number of benzene rings which influences toxicity (CCME 2010)

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Italicised and shaded = Exceedance of CCME SQG (None reported)

Table 3: Analytical Results - Petroleum Hydrocarbons (PHCs) in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Ganderm NL

Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units	BFR_SS1		BFR_SS2	BFR_SS4		BFR
Sample ID					Min	Max			BFR_SS1_SA1	BFR_SS_DUP1	BFR_SS2_SA1	BFR_SS4_SA1 (original)	BFR_SS4_SA1 (revised)	BFR_SS5_SA1 (original)
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-01
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<2.5	<2.5	<2.5	<2.5	<2.5	<5.0
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	<10	<10	<10	94	<10	85
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	<10	<10	<10	190	<10	190
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	<15	<15	56	1900	240	1000
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	<15	<15	56***	2200**	240***	1300**
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg						
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg						
Reached Baseline at C32									NA	NA	Yes	No	No	No
Hydrocarbon Resemblance									NA	NA	Possible lube oil fraction.	Fuel/lube oil range. Possible lube oil fraction.	Lube oil range; natural and organic orgin	Fuel/lube oil range. Possible lube oil fraction.

Notes:

NA = Not Applicable

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

revised results = PHC concentrations after silica gel clean-up, which removed biogenic organics, all samples from 2021 were run after silica gel clean-up

(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2022)

(b) Atlantic Risk-Based Corrective Action (RBCA) Tier 1 Environmental Quality Standards (EQS_{HH}) for Soil, agricultural land use, non-potable groundwater, coarse-grained soil

(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQG) and Canada Wide Standards (CWS) for Petroleum Hydrocarbons (PHCs), agricultural land use, coarse-grained soil, 10-5 incremental risk for surface soils (where applicable)

(d) Volatile Isobutyl benzene surrogate recovery not within acceptance limits due to matrix interference.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Bold and shaded = Naturally occurring exceedance of Atlantic RBCA or CCME criteria , prior to Silica Gel Cleanup

Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units	SS5
Sample ID					Min	Max			BFR_SS5_SA1 (revised)
Sample Depth (mbgs)									0 - 0.15
Date Collected									2020-12-01
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.025
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.10
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.025
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.10
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<5.0
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	<10
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	<10
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	43
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	43***
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg	
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg	
Reached Baseline at C32									Yes
Hydrocarbon Resemblance									Lube oil range; natural and organic orgin

Notes:

NA = Not Applicable

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

revised results = PHC concentrations after silica gel clean-up, which removed biogenic organics, all samples from 2021 were run after silica gel clean-up

(a) Atlantic Risk-Based Corrective Action (RBCA) Soil Ecological Tier 1 Environmental Quality Standards (EQS_{Eco}) for soil - coarse agricultural soils (2022)

(b) Atlantic Risk-Based Corrective Action (RBCA) Tier 1 Environmental Quality Standards (EQS_{HH}) for Soil, agricultural land use, non-potable groundwater, coarse-grained soil

(c) Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQG) and Canada Wide Standards (CWS) for Petroleum Hydrocarbons (PHCs), agricultural land use, coarse-grained soil, 10-5 incremental risk for surface soils (where applicable)

(d) Volatile Isobutyl benzene surrogate recovery not within acceptance limits due to matrix interference.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SS12 to SS16), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Bold and shaded = Naturally occurring exceedance of Atlantic RBCA or CCME criteria , prior to Silica Gel Cleanup

Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units	BFR_SS6		BFR_SS6			
Sample ID					Min	Max			BFR_SS6_SA1 (original)	BFR_SS6_SA1 (revised)	BFR_L1_SS6A	BFR_L1_SS-DUP1 (Duplicate of BFR_L1_SS6_A_SA1)	BFR_L1_SS6B	BFR_L1_SS6C
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2020-12-01	2020-12-01	2021-11-18	2021-11-18	2021-11-18	2021-11-18
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.025	<0.025	<0.02	<0.02	<0.02	<0.02
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.10	<0.10	<0.04	<0.04	<0.04	<0.04
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.03	<0.03	<0.03	<0.03
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.10	<0.10	<0.05	<0.05	<0.05	<0.05
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<5.0	<5.0	<3	<3	<3	<3
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	120	<10	<15	<15	16	47
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	200	<10	<15	<15	16	<15
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	1200	47	312	192	532	191
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	1500**	47***	312	192	564	238
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg						
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg						
Reached Baseline at C32									No	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance									Fuel/lube oil range. Possible lube oil fraction.	Lube oil range; natural and organic orgin	Lube range, Unidentified Compounds.	Lube range, Unidentified Compounds.	Lube range, Unidentified Compounds.	Lube range, Unidentified Compounds.

Notes:

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Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units	BFR_SS8					
Sample ID					Min	Max			BFR_L1_SS6D	BFR_SS8_SA1 (original)	BFR_SS8_SA1 (revised)	BFR_L1_SS8A	BFR_L1_SS8B	BFR_L1_SS8C
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2021-11-18	2020-12-01	2020-12-01	2021-11-18	2021-11-18	2021-11-18
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.02	<0.025	<0.025	<0.02	<0.02	<0.02
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.04	<0.10	<0.10	<0.04	<0.04	<0.04
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.03	<0.025	<0.025	<0.03	<0.03	<0.03
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.05	<0.10	<0.10	<0.05	<0.05	<0.05
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<3	<5.0	<5.0	<3	<3	<3
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	<15	<10	<10	<15	25	102
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	<15	230	<10	16	15	21
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	845	1300	34	504	283	268
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	845	1500**	34***	520	323	391
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg						
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg						
Reached Baseline at C32									Yes	No	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance									Lube range, Unidentified Compounds.	Fuel/lube oil range. Possible lube oil fraction.	Lube oil range; natural and organic orgin	Lube range, Unidentified Compounds.	Lube range, Unidentified Compounds.	Lube range, Unidentified Compounds.

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Table 3: Analytical Results - Petroleum Hydrocarbons (PHCs) in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Ganderm NL

Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units		BFR_SS9		BFR_SS10		BFR_
Sample ID					Min	Max			BFR_L1_SS8D	BFR_SS9_SA1 (original)	BFR_SS9_SA1 (revised)	BFR_SS10_SA1 (original)	BFR_SS10_SA1 (revised)	BFR_SS11_SA1 (original)
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2021-11-18	2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-01
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.02	<0.02	<0.025	<0.025	<0.025	<0.025
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.04	<0.04	<0.10	<0.050	<0.050	<0.10
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.03	<0.03	<0.025	<0.025	<0.025	<0.025
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.05	<0.05	<0.10	<0.050	<0.050	<0.10
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<3	<3	<5.0	<2.5	<2.5	<5.0
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	<15	<15	<10	65	<10	130
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	21	<15	<10	120	<10	290
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	502	192	17	810	51	1600
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	523	860**	17***	990**	51***	2000**
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg						
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg						
Reached Baseline at C32									Yes	Yes	Yes	No	Yes	No
Hydrocarbon Resemblance									Lube range, Unidentified Compounds.	Fuel/lube oil range. Possible lube oil fraction.	Lube oil range; natural and organic orgin	Fuel/lube oil range. Possible lube oil fraction[d].	Lube oil range[d]. Natural and organic orgin.	Fuel/lube oil range. Possible lube oil fraction.

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Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units	SS11	BFR_SS12	BFR_SS13			
Sample ID					Min	Max			BFR_SS11_SA1 (revised)	BFR_SS12_SA1	BFR_SS13_SA1 (original)	BFR_SS13_SA1 (revised)	BFR_L1_SS13A_SA1	BFR_L1_SS_DUP2 (Duplicate of BFR_L1_SS13_A_SA1)
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2020-12-01	2020-12-02	2020-12-02	2020-12-02	2021-11-17	2021-11-17
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.02	<0.02
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.10	<0.050	<0.10	<0.10	<0.04	<0.04
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.03	<0.03
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.10	<0.050	<0.10	<0.10	<0.05	<0.05
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<5.0	<2.5	<5.0	<5.0	<3	<3
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	<10	<10	**160**	<10	<15	<15
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	<10	<10	240	<10	<15	<15
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	38	590	1300	33	586	610
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	38***	590***	1700**	33***	586	610
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg						
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg						
Reached Baseline at C32									Yes	Yes	No	Yes	Yes	Yes
Hydrocarbon Resemblance									Lube oil range. Natural and organic orgin.	Possible lube oil fraction.	Fuel/lube oil range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Lube range, Unidentified Compounds	Lube range, Unidentified Compounds

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Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units	BFR_SS13			BFR_SS14		BFR_
Sample ID					Min	Max			BFR_L1_SS13B_SA1	BFR_L1_SS13C_SA1	BFR_L1_SS13D_SA1	BFR_SS14_SA1 (original)	BFR_SS14_SA1 (revised)	BFR_SS15_SA1 (original)
Sample Depth (mbgs)									0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2021-11-17	2021-11-17	2021-11-17	2020-12-02	2020-12-02	2020-12-02
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.02	<0.02	<0.02	<0.025	<0.025	<0.025
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.04	<0.04	<0.04	<0.10	<0.10	<0.10
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.025	<0.025	<0.025
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<3	<3	<3	<5.0	<5.0	<5.0
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	<15	22	<15	<10	<10	<10
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	<15	<15	<15	190	<10	230
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	240	117	151	1300	250	2200
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	240	139	151***	1500***	250***	**2400*** **
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg						
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg						
Reached Baseline at C32									Yes	Yes	Yes	No	Yes	No
Hydrocarbon Resemblance									Lube range, Unidentified Compounds	Lube range, Unidentified Compounds	Lube range, Unidentified Compounds	Lube oil range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Lube oil range. Possible lube oil fraction.

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Table 3: Analytical Results - Petroleum Hydrocarbons (PHCs) in Soil - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Ganderm NL

Location		Atlantic RBCA EQS_{Eco} [a]	Atlantic RBCA EQS_{HH} [b]	CCME SQG / CWS [c] (HH and ECO)	Background Range [e]		Maximum	Units	SS15	BFR_SS16	
Sample ID									BFR_SS15_SA1 (revised)	BFR_SS16_SA1 (original)	BFR_SS16_SA1 (revised)
Sample Depth (mbgs)					Min	Max			0 - 0.15	0 - 0.15	0 - 0.15
Date Collected									2020-12-02	2020-12-02	2020-12-02
Benzene		31	0.021	0.03	<0.025	<0.025	<0.025	mg/kg	<0.025	<0.025	<0.025
Toluene		75	47	0.082	<0.050	<0.10	<0.1	mg/kg	<0.10	<0.10	<0.10
Ethylbenzene		55	60	0.37	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.025
Total Xylenes		95	4.9	11	<0.050	<0.10	<0.1	mg/kg	<0.10	<0.10	<0.10
PHC F1 (C6 - C10 (less BTEX))		210	-	30	<2.5	<5.0	<5	mg/kg	<5.0	<5.0	<5.0
PHC F2 (>C10-C16)		**150**	-	**150**	<10	110	**160** (revised = <10)	mg/kg	<10	120	<10
PHC F3 (>C16-C21)		300	-	300	<10	290	290	mg/kg	<10	290	<10
PHC (>C21-<C32)		**2800**	-	**2800**	120	2500	**3400** (revised = 850)	mg/kg	550	**3400**	850
Modified TPH	Gasoline*	-	75	-	<15	-	-	mg/kg	550***	**3900****	850***
	Diesel/No. 2 Fuel Oil**	-	**3200**	-		2900**	**3900**** (revised = 850)	mg/kg			
	Lube oil/No. 6 Oil***	-	**1800**	-		2400***	**2400***** (revised =550)	mg/kg			
Reached Baseline at C32									Yes	No	No
Hydrocarbon Resemblance									Lube oil range. Natural and organic orgin.	Fuel/lube oil range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.

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Table 4: Analytical Results - Inorganics in Groundwater - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS_{Eco} [a]	FIGQGs [b]	Maximum	Units	BFR_L1_GW1		BFR_L1_GW2	BFR_L1_GW3	BFR_L1_GW4
Sample ID					BFR_L1_GW1	BFR_L1_GW_DUP1	BFR_L1_GW2	BFR_L1_GW3	BFR_L1_GW4
Groundwater Depth (mbgs)					5.82		1.51	2.40	1.77 (mbTOP)
Screened Unit					Bedrock		Bedrock	Bedrock	Silty Peat
Date Collected					2021-12-19	2021-12-19	2021-12-19	2021-12-19	2022-09-12
Total Alkalinity (Total as CaCO3)	-	-	<5	mg/L	<1.0	<1.0	<1.0	<1.0	<5.0
Dissolved Chloride (Cl-)	120	100	9.5	mg/L	8.2	8.9	9.5	6.8	5
Colour	-	-	69.2	TCU	<5.0	<5.0	23	<5.0	69.2
Nitrate + Nitrite (N)	-	-	0.47	mg/L	0.42	0.47	<0.050	0.33	<0.050
Nitrite (N)	0.06	0.06	<0.05 (0.012	mg/L	0.012	<0.010	<0.010	<0.010	<0.050
Nitrogen (Ammonia Nitrogen) [c]	0.153	0.153	0.081	mg/L	<0.050	0.081	0.064	0.072	<0.030
Total Organic Carbon (C)	-	-	821	mg/L	5.8	5.2	5.1	1.4	821
Orthophosphate (P)	-	-	<0.01	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
pH	6.5-9	6.5-9	5.5 - 7.09	pH	6.94	7.09	6.31	6.50	5.5
Reactive Silica (SiO2)	-	-	7.7	mg/L	7.2	7.7	6.5	7.0	6.3
Dissolved Sulphate (SO4)	128	100	2.7	mg/L	2.7	2.6	<2.0	2.6	<2.0
Turbidity	-	-	61.6	NTU	3.0	5.1	4.10	6.3	61.6
Conductivity	-	-	84	uS/cm	83.0	84.0	58.0	65.0	43.0

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
mbgs = metres below ground surface
mbTOP = metres below top of pipe
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQS) for Groundwater, Discharge to Fresh Water, <10m from Surface Water Body (2021)

(b) Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, June 2016 – Table 1: Agricultural Land, coarse grained soil. Where Tier 1 values were based on marine waters, the next lowest tier 2 guideline value was applied.

(c) Nitrogen criteria based on an average temperature (5.6 °C) and pH (5.54 units)

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)
Blue Shaded = Naturally occurring low levels of pH
Underlined and shaded = Exceedance of EQS or FIGQGs

Sample ID	Atlantic RBCA EQS_{ECO} [a]	FIGQGs [b]	Maximum	Units	BFR_L1_GW1		BFR_L1_GW2	BFR_L1_GW3	BFR_L1_GW4
					BFR_L1_GW1	BFR_L1_GW_DUP1	BFR_L1_GW2	BFR_L1_GW3	BFR_L1_GW4
Date Collected					2021-12-19	2021-12-19	2021-12-19	2021-12-19	2022-09-12
Groundwater Depth (mbgs)					5.82		1.51	2.40	1.77 (mbTOP)
Screened Unit					Bedrock		Bedrock	Bedrock	Silty Peat
pH	6.5-9	6.5-9	**5.5 - 7.09**	pH	6.94	7.09	**6.31**	6.50	**5.50**
Total Aluminum (Al) (1)	**5**	**100**	**348**	ug/L	23	17	**200**	**140**	**348**
Total Antimony (Sb)	9	2000	<2	ug/L	<1.0	<1.0	<1.0	<1.0	<2
Total Arsenic (As)	5	5	<2	ug/L	<1.0	<1.0	<1.0	<1.0	<2
Total Barium (Ba)	1000	2900	13	ug/L	5.3	4.4	8.7	13.0	6
Total Beryllium (Be)	0.15	5.3	<2	ug/L	<0.10	<0.10	<0.10	<0.10	<2
Total Bismuth (Bi)	-	-	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2
Total Boron (B)	1500	500	<50	ug/L	<50	<50	<50	<50	<5
Total Cadmium (Cd)	**0.09**	**0.09**	**0.790**	ug/L	0.030	0.031	**0.790**	**0.100**	<0.09
Total Calcium (Ca)(3)	-	-	6400	ug/L	6300	6400	3000	3500	500
Total Chromium (Cr)	8.9	8.9	2	ug/L	<1.0	<1.0	<1.0	<1.0	2
Total Cobalt (Co)	**1**	50	9.9	ug/L	<0.40	<0.40	9.9	0.55	<1
Total Copper (Cu)	**2**	**2**	**32**	ug/L	2.0	1.0	**2.9**	1.3	**32**
Total Iron (Fe)	**300**	**300**	**881**	ug/L	73	<50	**650**	79	**881**
Total Lead (Pb)	**1**	**1**	**2.7**	ug/L	<0.50	<0.50	<0.50	<0.50	**2.7**
Total Magnesium (Mg)(3)	-	-	1500	ug/L	1200	1200	910	1500	100
Total Manganese (Mn)	430	**200**	**420**	ug/L	24	21	**420**	120	11
Total Mercury (Hg)	0.026	0.026	<0.026	ug/L	<0.013 [2]	<0.013 [2]	<0.013 [2]	<0.013 [2]	<0.026
Total Molybdenum (Mo)	73	73	5.2	ug/L	5.2	<2.0	<2.0	<2.0	<2
Total Nickel (Ni)	25	25	9.5	ug/L	4.0	4.0	9.5	<2.0	3
Total Phosphorus (P)	-	10 - 20 (4)	<100 (0.02)	ug/L	<100	<100	<100	<100	0.02
Total Potassium (K)(3)	-	-	3400	ug/L	1500	1500	1200	3400	<100
Total Selenium (Se)	1	1	<1	ug/L	<0.50	<0.50	<0.50	<0.50	<1
Total Silver (Ag)	0.25	0.25	0.2	ug/L	<0.10	<0.10	<0.10	<0.10	0.2
Total Sodium (Na)(3)	-	-	7800	ug/L	7800	7200	5600	5600	500
Total Strontium (Sr)	21000	-	22	ug/L	22	22	16	18	<5
Total Thallium (Tl)	0.8	0.8	<0.1	ug/L	<0.10	<0.10	<0.10	<0.10	<0.1
Total Tin (Sn)	-	-	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2
Total Titanium (Ti)	-	100	9	ug/L	<2.0	<2.0	<2.0	4.8	9
Total Uranium (U)	15	10	1.7	ug/L	0.96	0.98	1.7	<0.10	<0.2
Total Vanadium (V)	120	100	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2
Total Zinc (Zn)	**7**	30	11	ug/L	6.8	<5.0	11	5.1	9

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
mbgs = metres below ground surface
mbTOP = metres below top of pipe
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQS) for Groundwater, Discharge to Fresh Water, <10m from Surface Water Body (2021).
(b) Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, June 2016 – Table 1: Agricultural Land, coarse grained soil. Where Tier 1 values were based on marine waters, the next lowest tier 2 guideline value was applied.

(1) Aluminum FIGQG = 5 µg/L if pH < 6.5; = 100 µg/L if pH ≥ 6.5

(2) Mercury analyzed past recommended hold time.
(3) There is no available criteria for calcium, magnesium, potassium, and sodium as they are considered innocuous and essential elements to living organisms

(4) As per FCSAP guidance, the CCME WQGs for surface water are applied for phosphorous as groundwater concentrations discharge to the nearby waterbodies

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1

Table 5: Analytical Results - Metals in Groundwater - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Bold and shaded = Exceedance of FIGQGs

Table 6: Analytical Results - Polycyclic Aromatic Hydrocarbons - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS_{Eco} [a]	FIGQGs [b]	Maximum	Units	BFR_L1_GW1		BFR_L1_GW2	BFR_L1_GW3
Sample ID					BFR_L1_GW1	BFR_L1_GW_DUP1	BFR_L1_GW2	BFR_L1_GW3
Date Collected					2021-12-19	2021-12-19	2021-12-19	2021-12-19
1-Methylnaphthalene	2	180	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene	2	180	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050
Acenaphthene	5.8	5.8	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Acenaphthylene	-	46	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Acridine	-	0.05	-	ug/L	-	-	-	-
Anthracene	0.012	0.012	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Benzo(a)anthracene	0.018	0.018	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Benzo(a)pyrene	0.015	0.01	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Benzo(b/j)fluoranthene	-	0.48	<0.02	ug/L	<0.020	<0.020	<0.020	<0.020
Benzo(g,h,i)perylene	-	0.17	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Benzo(j)fluoranthene	-	-	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Benzo(k)fluoranthene	-	0.48	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Chrysene	0.1	0.1	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Dibenzo(a,h)anthracene	-	0.26	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Fluoranthene	0.04	0.04	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Fluorene	3	3	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	-	0.21	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Naphthalene	1.1	1.1	<0.2	ug/L	<0.20	<0.20	<0.20	<0.20
Perylene	-	-	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Phenanthrene	0.4	0.4	0.01	ug/L	0.01	<0.010	<0.010	<0.010
Pyrene	0.025	0.025	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010
Quinoline	-	3.4	-	ug/L	-	-	-	-

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQS) for Groundwater, Discharge to Fresh Water, <10m from Surface Water Body (2021)

(b) Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, June 2016 – Table 1: Agricultural Land, coarse grained soil. Where Tier 1 values were based on marine waters, the next lowest tier 2 guideline value was applied.

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS Eco (None reported)

Italicised and shaded = Exceedance of FIGQGs (None reported)

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Location		Atlantic RBCA EQS_{ECO} [a]	FCSAP FIGQGs [b]	Maximum	Units	BFR_L1_GW1		BFR_L1_GW2	BFR_L1_GW3	BFR_L1_GW4
Sample ID						BFR_L1_GW1	BFR_L1_GW_DUP1	BFR_L1_GW2	BFR_L1_GW3	BFR_L1_GW4
Date Collected						2021-12-19	2021-12-19	2021-12-19	2021-12-19	2022-09-12
Benzene		2.1	0.088	<0.001	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.001
Toluene		0.77	0.083	<0.001	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.001
Ethylbenzene		0.32	3.2	<0.001	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.001
Total Xylenes		0.33	3.9	<0.002	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.002
PHC F1 (C6 - C10 (less BTEX))		-	0.81	<0.09	mg/L	<0.090	<0.090	<0.090	<0.090	<0.01
PHC F2 (>C10-C16)		-	1.3	<0.05	mg/L	<0.050	<0.050	<0.050	<0.050	<0.05
PHC F3 (>C16-C21)		-	-	0.067	mg/L	0.067	<0.050	<0.050	<0.050	<0.05
PHC (>C21-<C32)		-	-	<0.1	mg/L	<0.090	<0.090	<0.090	<0.090	<0.1
Modified TPH	Gasoline*	1.5	-	<0.1	mg/L	<0.090	<0.090	<0.090	<0.090	<0.1
	Diesel/No. 2 Fuel Oil**	0.1	-		mg/L					
	Lube oil/No. 6 Oil***	0.1	-		mg/L					
Reached Baseline at C32						NA	NA	NA	NA	NA
Hydrocarbon Resemblance						NA	NA	NA	NA	NA

Notes:
NA = Not Applicable
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQS) for Groundwater, Discharge to Fresh Water, <10m from Surface Water Body (2021)
(b) Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, June 2016
*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of Atlantic RBCA EQS_{ECO} (None reported)
Bold and shaded = Exceedance of $FIGQG_s$ (None reported)

Table 8: Analytical Results - Volatile Organic Compounds in Groundwater - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	FIGQGs[b]	Units	BFR_L1_GW4
				BFR_L1_GW4
Date Collected				2022-09-12
1,1,1,2-Tetrachloroethane	20	3.3	ug/L	<0.5
1,1,1-Trichloroethane	10	640	ug/L	<1
1,1,2,2-Tetrachloroethane	70	3.2	ug/L	<1
1,1,2-Trichloroethane	800	4.7	ug/L	<1
1,1-Dichloroethane	200	320	ug/L	<1
1,1-Dichloroethylene	400	-	ug/L	<0.6
1,2-Dibromoethane	-	-	ug/L	<0.5
1,2-Dichlorobenzene	0.7	0.7	ug/L	<0.7
1,2-Dichloroethane	100	5	ug/L	<2
1,2-Dichloropropane	0.7	16	ug/L	<0.7
1,3-Dichlorobenzene	150	42	ug/L	<1
1,4-Dichlorobenzene	26	26	ug/L	<1
2-Hexanone	-	-	ug/L	<10.0
Acetone	-	13,000	ug/L	<10
Benzene	2100	88	ug/L	<1
Bromodichloromethane	200	8500	ug/L	<1
Bromoform	60	380	ug/L	<1
Bromomethane	0.9	5.6	ug/L	<0.89
Carbon Tetrachloride	13.3	0.56	ug/L	<0.56
Chlorobenzene	1.3	1.3	ug/L	<1
Chloroethane	1100	-	ug/L	<5
Chloroform	1.8	1.8	ug/L	<1
Chloromethane	700	-	ug/L	<1
cis-1,2-Dichloroethylene	200	-	ug/L	<2
cis-1,3-Dichloropropene	-	-	ug/L	<0.5
Dibromochloromethane	40	100	ug/L	<1
Ethylbenzene	320	3200	ug/L	<2
m,p-Xylene	-	-	ug/L	<4
Methylene Chloride (Dichloromethane)	98.1	50	ug/L	<2
o-Xylene	-	-	ug/L	<1
Styrene	72	72	ug/L	<1
Tetrachloroethylene	1100	110	ug/L	<2
Toluene	770	83	ug/L	<2
trans-1,2-Dichloroethylene	200	-	ug/L	<2
trans-1,3-Dichloropropene	-	-	ug/L	<0.5
Trichloroethylene	21	20	ug/L	<1

Trichlorofluoromethane (FREON 11)	-	-	ug/L	<5
Vinyl Chloride	600	1.1	ug/L	<0.6

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental
(b) Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, June 2016 – Table 1: Agricultural Land, coarse grained soil. Where Tier 1 values were based on marine waters, the next lowest tier 2 guideline value was applied.

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Underline and shaded = Exceedance of RBCA Ecological Tier 1

Bold and shaded = Exceedance of FIGQGs

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 9: Analytical Results - Metals in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED1	BFR_SED2	BFR_SED3	BFR_SED5	
Sample ID								BFR_SED1	BFR_SED2	BFR_SED3	BFR_SED5	BFR_SED_DUP2
Date Collected				Min	Max			2020-12-01	2020-12-01	2020-12-01	2020-12-02	2020-12-02
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	7300	8000	11000	2100	2400
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	<2.0	2.2	<2.0	<2.0	<2.0
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	34	33	29	9.7	11
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<50	<50	<50	<50	<50
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	0.42	0.52	0.6	<0.30	<0.30
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	10	9.3	5.4	3.1	2.9
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	1.5	1.7	<1.0	<1.0	<1.0
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	8.4	9.6	9.1	<2.0	2.2
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	7500	8800	1900	6000	6400
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	35	35	34	17	21
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	74	130	15	71	76
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	0.15	**0.18**	**0.26**	<0.10	<0.10
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	7	6.5	4.5	<2.0	2.1
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	1.9	2.7	5.6	<0.50	<0.50
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	9.5	11	22	<5.0	<5.0
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	<0.10	0.13	<0.10	<0.10	<0.10
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	1.3	1.2	1	<1.0	1
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	1.9	2.4	1.3	0.36	0.65
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	28	32	8.4	13	15
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	45	37	13	8.4	10

Notes:
"-" = no guideline or data available
NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction
< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater.

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs
Yellow Shaded =exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 9: Analytical Results - Metals in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED6	BFR_SED7	BFR_SED8	BFR_SED9	BFR_SED10	BFR_SED11	BFR_SED12
Sample ID								BFR_SED6	BFR_SED7	BFR_SED8	BFR_SED9	BFR_SED10	BFR_SED11	BFR_SED12
Date Collected				Min	Max			2020-12-01	2020-12-02	2020-12-02	2020-12-02	2020-12-01	2020-12-01	2020-12-01
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	14000	7700	17000	7800	2500	9400	7400
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	5.3	<2.0	<2.0	<2.0	<2.0	<2.0	3.1
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	50	15	170	5.4	8.3	61	19
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<50	<50	<50	<50	<50	<50	<50
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	**0.8**	<0.30	<0.30	<0.30	<0.30	<0.30	0.47
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	12	3.9	**45**	6	3.3	13	5.5
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	1.1	<1.0	9.9	<1.0	2.5	5	<1.0
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	15	7.5	12	2.5	<2.0	<2.0	10
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	3800	1400	25000	320	8600	12000	3800
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	***140***	18	17	5.3	5.6	8.9	***100***
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	52	22	290	2	160	260	7.8
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	**0.32**	0.13	<0.10	<0.10	<0.10	<0.10	**0.24**
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	9.9	3.3	19	<2.0	2.4	8.7	5.2
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	4.9	2.1	<0.50	1.9	<0.50	<0.50	5.3
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	17	9.7	<5.0	<5.0	<5.0	<5.0	8.4
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	0.11	<0.10	0.37	<0.10	<0.10	0.24	<0.10
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	5.9	1.5	1.2	1.3	<1.0	1.8	3.4
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	1.8	3.4	1.6	1.2	0.66	1.2	1.4
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	36	12	95	18	22	44	22
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	42	8.1	45	<5.0	10	34	13

Notes:
"-" = no guideline or data available
NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction
< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only

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(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs
Yellow Shaded =exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 9: Analytical Results - Metals in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED13	BFR_SED14	BFR_SED15	BFR_SED26
Sample ID								BFR_SED13	BFR_SED14	BFR_SED15	BFR_L1_SED26
Date Collected				Min	Max			2020-12-02	2020-12-02	2020-12-02	2021-11-21
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	4900	7500	6700	5990
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<2.0	<2.0	<2.0	<1.0
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	2.1	<2.0	2.2	5.0
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	24	33	22	15
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	-
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<50	<50	<50	<2.0
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	0.44	<0.30	0.37	<0.30
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	4.5	8.4	6.2	8.0
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	<1.0	2.5	1.2	2.0
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	8.7	2.3	5.4	9.0
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	2400	7800	8400	29100
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	**63**	6.5	4.8	23.9
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	10	170	100	62
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	**0.23**	<0.10	<0.10	0.11
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2.0	<2.0	<2.0	<2.0
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	4.6	4.4	2.6	4.0
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	5.1	0.52	1.6	3.0
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	27	<5.0	14	8.0
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	<0.10	0.13	<0.10	<0.10
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	1.7	1.1	<1.0	3.0
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	0.78	0.55	1.3	1.1
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	10	28	24	33
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	19	20	11	32

Notes:
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NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction
< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater.

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
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Italicised and shaded = Exceedance of CCME PELs
Yellow Shaded =exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 9: Analytical Results - Metals in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED27	BFR_SED28		BFR_SED29		BFR_SED30	BFR_SED31
Sample ID								BFR_L1_SED27	BFR_L1_SED28	BFR_L1_SED_DUP1	BFR_L1_SED29	BFR_L1_SED_DUP2	BFR_L1_SED30	BFR_L1_SED31
Date Collected				Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	7310	2760	2570	7260	4090	16800	20100
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<1.0	3.0	2.0	2.0	1.0	1.0	<1.0
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	4.0	3.0	3.0	**6.0**	5.0	***18***	5.0
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	19	25	22	17	13	7.0	19
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	-
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<2.0	5.0	3.0	2.0	<2.0	3.0	2.0
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	0.40	0.60	<0.30	0.60	0.50	<0.30	0.60
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	12	<2.0	3.0	7.0	5.0	15	18
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	2.0	<1.0	<1.0	<1.0	<1.0	2.0	3.0
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	14	21	12	10	7.0	13	11
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	8420	5950	5630	7180	4690	73600	17200
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	27.2	***126***	***114***	**62.5**	**68.6**	**64.3**	26.6
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	154	60	51	28	21	56	129
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	0.11	0.17	0.11	0.17	0.12	**0.21**	0.08
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	5.0	4.0
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	6.0	<2.0	<2.0	4.0	3.0	8.0	11
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	3.0	2.0	<1.0	6.0	3.0	7.0	6.0
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	11	28	21	17	12	<5.0	8.0
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	3.0	4.0	4.0	6.0	5.0	6.0	4.0
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	1.5	0.60	0.50	1.2	0.90	1.0	1.7
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	39	7.0	6.0	32	23	57	60
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	38	28	23	34	24	29	48

Notes:
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(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
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Underline and shaded = Exceedance of RBCA Ecological Tier 1
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Table 9: Analytical Results - Metals in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED32	BFR_SED33	BFR_SED34	BFR_SED35	BFR_SED36	BFR_SED39	BFR_SED40
Sample ID								BFR_L1_SED32	BFR_L1_SED33	BFR_L1_SED34	BFR_L1_SED35	BFR_L1_SED36	BFR_L1_SED39	BFR_L1_SED40
Date Collected				Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-20	2021-11-20	2021-11-20	2021-11-20
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	6250	10300	6390	1760	7910	5910	9150
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	2.0	**6.0**	3.0	2.0	2.0	3.0	4.0
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	5.0	11	11	<5.0	17	25	25
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	-
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	<0.30	<0.30	0.40	<0.30	<0.30	0.50	0.50
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	5.0	9.0	5.0	8.0	12	3.0	11
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	<1.0	1.0	<1.0	<1.0	3.0	<1.0	2.0
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	<2.0	7.0	5.0	<2.0	2.0	4.0	6.0
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	2410	23400	1750	2120	5550	4540	11100
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	5.6	**63.2**	4.7	34.0	15.3	18.7	28.9
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	46	46	6.0	50	117	12	88
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	<0.03	0.15	0.11	<0.03	<0.03	0.06	0.16
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	<2.0	5.0	3.0	<2.0	4.0	2.0	5.0
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	1.0	5.0	7.0	<1.0	<1.0	2.0	3.0
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	<5.0	<5.0	11	<5.0	<5.0	19	8.0
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	4.0	5.0	5.0	4.0	5.0	4.0	5.0
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	0.40	1.5	0.70	0.70	0.60	0.60	1.1
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	21	41	13	10	30	8.0	36
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	8.0	24	10	7.0	22	15	45

Notes:
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NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction
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(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Underline and shaded = Exceedance of RBCA Ecological Tier 1

Bold and shaded = Exceedance of CCME ISQGs

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Yellow Shaded =exceedance is within or below background range

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 9: Analytical Results - Metals in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED41	BFR_SED42	BFR_SED44	BFR_SED45	BFR_SED46	BFR-SED-51		BFR-SED-52
Sample ID								BFR_L1_SED41	BFR_L1_SED42	BFR_L1_SED44	BFR_L1_SED45	BFR_L1_SED46	BFR_L1_SED51	BFR_SED_DUP2	BFR_L1_SED52
Date Collected				Min	Max			2021-11-21	2021-11-21	2021-11-20	2021-11-20	2021-11-20	2022-09-09	2022-09-09	2022-09-09
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	4770	4610	2840	11100	4050	5990	9210	6710
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<1.0	1.0	<1.0	<1.0	<1.0	<1	1	<1
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	2.0	**6.0**	4.0	3.0	2.0	4	4	3
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	9.0	20	14	29	8.0	11	16	14
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	-	-
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<2.0	<2.0	2.0	<2.0	<2.0	<2	2	<2
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	<0.30	0.30	<0.30	<0.30	<0.30	0.4	0.6	<0.3
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	6.0	4.0	3.0	19	7.0	5	8	7
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	2.0	<1.0	<1.0	9.0	<1.0	1	2	2
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	<2.0	5.0	3.0	7.0	<2.0	6	7	4
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	5810	20100	9950	33900	3190	4050	6280	6160
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	7.8	**38.7**	31.5	6.5	19.9	19.0	22.5	8.8
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	84	46	30	402	50	70	111	122
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	<0.03	**0.20**	0.12	<0.03	0.04	0.05	0.08	<0.03
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2	<2	<2
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	3.0	<2.0	<2.0	11	<2.0	4	6	4
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	<1.0	1.0	2.0	<1.0	<1.0	2	3	<1
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	<5.0	20	17	<5.0	<5.0	12	15	7
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	3.0	5.0	5.0	5.0	4.0	3	4	2
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	0.60	0.70	0.40	0.50	0.40	0.8	0.9	2.6
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	19	16	9.0	82	16	18	24	25
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	14	23	16.0	50	7.0	31	49	24

Notes:
"-" = no guideline or data available
NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction
< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater.

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs
Yellow Shaded =exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 9: Analytical Results - Metals in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR-SED-53	BFR-SED-54
Sample ID								BFR_L1_SED53	BFR_L1_SED54
Date Collected				Min	Max			2022-09-09	2022-09-09
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	9830	3800
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<1	<1
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	5	4
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	14	15
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2	<2
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<2	<2
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	0.3	<0.3
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	7	4
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	1	<1
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	8	5
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	5450	1520
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	30.8	22.5
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	74	32
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	0.08	0.07
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2	<2
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	5	3
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	2	1
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	12	10
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	<0.1	<0.1
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	3	4
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	1.3	0.8
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	32	16
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	24	12

Notes:
"-" = no guideline or data available
NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction
< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater.

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs
Yellow Shaded =exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Location	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR-SED-55	BFR-SED-56	BFR-SED-57	BFR-SED-58	BFR-SED-59		BFR-SED-60	BFR-SED-61
Sample ID								BFR_L1_SED55	BFR_L1_SED56	BFR_L1_SED57	BFR_L1_SED58	BFR_L1_SED59	BFR_SED_DUP1	BFR_L1_SED60	BFR_L1_SED61
Date Collected				Min	Max			2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09
Acid Extractable Aluminum (Al)	-	-	-	1100	21400	20100	mg/kg	4790	8360	7840	8630	9160	14600	12700	18900
Acid Extractable Antimony (Sb)	25	-	-	<1.0	<2.0	3	mg/kg	<1	<1	<1	1	<1	<1	<1	<1
Acid Extractable Arsenic (As)	**17**	**5.9**	**17**	<2.0	7	***18***	mg/kg	4	4	4	5	5	5	2	**6**
Acid Extractable Barium (Ba)	-	-	-	<5.0	210	170	mg/kg	22	28	19	21	13	18	27	13
Acid Extractable Beryllium (Be)	-	-	-	<2.0	<2.0	<2	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2
Acid Extractable Bismuth (Bi)	-	-	-	<2.0	<2.0	<2	mg/kg	-	-	-	-	-	-	-	-
Acid Extractable Boron (B)	-	-	-	<2.0	<50	<50 (5)	mg/kg	<2	<2	<2	2	<2	< 2	<2	<2
Acid Extractable Cadmium (Cd)	3.5	**0.6**	3.5	<0.30	0.45	**0.8**	mg/kg	<0.3	0.5	<0.3	0.5	<0.3	<0.3	0.4	<0.3
Acid Extractable Chromium (Cr)	90	**37.3**	90	<2.0	99	**45**	mg/kg	8	10	11	9	8	5	11	15
Acid Extractable Cobalt (Co)	-	-	-	<1.0	17	12	mg/kg	<1	2	3	2	<1	5	3	12
Acid Extractable Copper (Cu)	197	35.7	197	<2.0	8	21	mg/kg	5	8	5	9	9	10	7	12
Acid Extractable Iron (Fe)	**43766**	-	-	1200	41800	73600	mg/kg	3560	5220	8320	3600	9630	5820	9660	41900
Acid Extractable Lead (Pb)	**91.3**	**35**	**91.3**	2.6	31	***140***	mg/kg	8.0	20.1	12.6	**43.1**	**37.6**	9.5	15.6	18.6
Acid Extractable Manganese (Mn)	1100	-	-	18	434	583	mg/kg	47	74	154	43	40	80	166	583
Acid Extractable Mercury (Hg)	0.486	**0.17**	0.486	<0.03	0.13	**0.32**	mg/kg	0.04	0.07	0.04	0.16	0.09	**0.18**	0.03	0.04
Acid Extractable Molybdenum (Mo)	-	-	-	<2.0	6	5	mg/kg	<2	<2	<2	<2	<2	5	<2	2
Acid Extractable Nickel (Ni)	75	-	-	<2.0	42	19	mg/kg	3	5	5	6	6	10	6	5
Acid Extractable Selenium (Se)	**2**	-	-	<0.50	2.9	7	mg/kg	2	2	1	4	3	1	2	<1
Acid Extractable Silver (Ag)	0.5	-	-	<0.50	<0.50	<0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acid Extractable Strontium (Sr)	-	-	-	<5.0	14	28	mg/kg	10	11	12	8	<5	21	11	<5
Acid Extractable Thallium (Tl)	-	-	-	<0.10	0.17	0.4	mg/kg	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1
Acid Extractable Tin (Sn)	-	-	-	<1.0	5	6	mg/kg	3	4	3	4	4	5	<2	3
Acid Extractable Uranium (U)	-	-	-	0.23	3.2	3.5	mg/kg	0.9	1.5	2.0	1.0	0.9	2.1	3.5	3.5
Acid Extractable Vanadium (V)	-	-	-	4.3	93	95	mg/kg	25	30	36	26	29	5	46	68
Acid Extractable Zinc (Zn)	315	123	315	<5.0	80	50	mg/kg	17	28	27	13	13	45	47	31

Notes:
"-" = no guideline or data available
NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction
< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater.

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs
Yellow Shaded =exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED1	BFR_SED2	BFR_SED3
								BFR_SED1	BFR_SED2	BFR_SED3
Date Collected				Min	Max			2020-12-01	2020-12-01	2020-12-01
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.0050	<0.0050	<0.0050
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.0050	<0.0050	<0.0050
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.0050	<0.0050	<0.0050
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.0050
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.0050	<0.0050	0.038
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	<0.010	<0.010	0.038
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.0050	<0.080	<0.19
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	<0.0050
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	<0.0050
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.0050	<0.0050	0.042
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.0050	<0.0050	<0.0050
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.0050	<0.0050	0.077
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.0050	<0.0050	<0.0050
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.0050	<0.0050	<0.0050
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	1.0	1.2	0.7
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.0050
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.0050	<0.0050	0.05

Notes:

"-" = no guideline or data available

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only.

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Yellow Shaded = exceedance is within or below background range

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Underline and shaded = Exceedance of RBCA Ecological Tier 1

Bold and shaded = Exceedance of CCME ISQGs

Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED5		BFR_SED6	BFR_SED7	BFR_SED8
								BFR_SED5	BFR_SED_DUP2	BFR_SED6	BFR_SED7	BFR_SED8
Date Collected				Min	Max			2020-12-02	2020-12-02	2020-12-01	2020-12-02	2020-12-02
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.0050	<0.0050	0.18	<0.0050	<0.0050
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	<0.010	<0.010	0.18	<0.010	<0.010
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.0080	<0.0050	<0.15	<0.80	<0.0050
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.0050	<0.0050	**0.12**	<0.0050	<0.0050
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.0050	<0.0050	**0.15**	<0.0050	<0.0050
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.0050	<0.0050	0.13	<0.0050	<0.0050
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	0.028	0.028	1.8	2.0	<0.0050
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.0050	<0.0050	**0.11**	<0.0050	<0.0050

Notes:

"-" = no guideline or data available

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only.

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Yellow Shaded = exceedance is within or below background range

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Underline and shaded = Exceedance of RBCA Ecological Tier 1

Bold and shaded = Exceedance of CCME ISQGs

Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED9	BFR_SED10	BFR_SED11	BFR_SED12	BFR_SED13
								BFR_SED9	BFR_SED10	BFR_SED11	BFR_SED12	BFR_SED13
Date Collected				Min	Max			2020-12-02	2020-12-01	2020-12-01	2020-12-01	2020-12-02
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.0050	<0.0050	<0.0050	0.082	0.053
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	<0.010	<0.010	<0.010	0.082	0.053
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.030	<0.0050	<0.040	<0.0050	<0.19
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	**0.059**
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.0050	<0.0050	<0.0050	0.063	0.094
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	0.58	<0.0050	0.041	<0.0050	<0.16
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	**0.061**

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only.

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
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Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_SED14	BFR_SED15	BFR_L1_SED26	BFR_L1_SED27	BFR_L1
								BFR_SED14	BFR_SED15	BFR_L1_SED26	BFR_L1_SED27	BFR_L1_SED28
Date Collected				Min	Max			2020-12-02	2020-12-02	2021-11-21	2021-11-21	2021-11-21
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.0050	<0.0050	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.01	<0.01	<0.01
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.0050	<0.0050	<0.00671	<0.00671	<0.00671
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.0050	<0.0050	<0.004	<0.004	<0.004
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.0050	<0.0050	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	<0.010	<0.010	-	-	-
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.050	<1.2	0.01	<0.01	<0.01
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	-	-	-
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	<0.0050	<0.0050	-	-	-
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.0050	<0.0050	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.0050	<0.0050	<0.006	<0.006	<0.006
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.0050	<0.0050	<0.05	<0.05	<0.05
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.0050	<0.0050	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.0050	<0.0050	0.01	<0.01	<0.01
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.0050	<0.0050	<0.01	<0.01	<0.01
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	0.35	1.3	<0.05	<0.05	<0.05
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.0050	<0.0050	<0.03	<0.03	<0.03
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.0050	<0.0050	<0.05	<0.05	<0.05

Notes:
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(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only.

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

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Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	_SED28	BFR_L1_SED29	BFR_L1_SED29	BFR_L1_SED30	BFR_L1_SED31
								BFR_L1_SED_DUP 1	BFR_L1_SED29	BFR_L1_SED_DUP 2	BFR_L1_SED30	BFR_L1_SED31
Date Collected				Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.004	<0.004	<0.004	0.005	<0.004
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	-	-	-	-	-
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.01	0.08	<0.01	0.07	<0.01
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.05	0.1	0.1	<0.05	<0.05
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.01	<0.01	<0.01	0.1	<0.01
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	0.09	<0.05	0.83	<0.05	<0.05
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.05	**0.08**	<0.05	<0.05	<0.05

Notes:
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(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

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(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

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Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_L1_SED32	BFR_L1_SED33	BFR_L1_SED34	BFR_L1_SED35	BFR_L1_SED36
								BFR_L1_SED32	BFR_L1_SED33	BFR_L1_SED34	BFR_L1_SED35	BFR_L1_SED36
Date Collected				Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-20	2021-11-20
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.004	<0.004	<0.004	<0.004	<0.004
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	-	-	-	-	-
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.01	0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.01	<0.01	0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.01	0.02	<0.01	<0.01	<0.01
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

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(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

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Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_L1_SED39	BFR_L1_SED40	BFR_L1_SED41	BFR_L1_SED42	BFR_L1_SED44
								BFR_L1_SED39	BFR_L1_SED40	BFR_L1_SED41	BFR_L1_SED42	BFR_L1_SED44
Date Collected				Min	Max			2021-11-20	2021-11-20	2021-11-21	2021-11-21	2021-11-20
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.004	<0.004	<0.004	<0.004	<0.004
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	-	-	-	-	-
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only.

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Yellow Shaded = exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_L1_SED45	BFR_L1_SED46	BFR_L1_SED51		BFR_L1_SED52	BFR_L1_SED53
								BFR_L1_SED45	BFR_L1_SED46	BFR_L1_SED51	BFR_SED_DUP2	BFR_L1_SED52	BFR_L1_SED53
Date Collected				Min	Max			2021-11-20	2021-11-20	2022-09-09	2022-09-09	2022-09-09	2022-09-09
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	-	-	-	-	-	-
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-	-
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-	-
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.05	<0.05	0.05	0.06	<0.05	<0.05
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	<0.05	<0.05	2.06	2.3	3.66	4.52
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

(b) Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guidelines (ISQGs) for the protection of aquatic life, 2010, for freshwater. Presented for informational purposes only.

(c) Canadian Council of Ministers of the Environment (CCME) Probable Effect Levels (PELs) for the protection of aquatic life, 2010, for freshwater

(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
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Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_L1_SED54	BFR_L1_SED55	BFR_L1_SED56	BFR_L1_SED57	BFR_L1_SED58
								BFR_L1_SED54	BFR_L1_SED55	BFR_L1_SED56	BFR_L1_SED57	BFR_L1_SED58
Date Collected				Min	Max			2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.004	<0.004	<0.004	<0.004	<0.004
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	-	-	-	-	-
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-	-
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	2.66	2.38	2.76	2.88	<0.05
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

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(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
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Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)
Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs

Table 10: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Sample ID	Atlantic RBCA EQS[a]	CCME ISQGs[b]	CCME PELs[c]	Background Range[d]		Maximum	Units	BFR_L1_SED59		BFR_L1_SED60	BFR_L1_SED61
								BFR_L1_SED59	BFR_SED_DUP1	BFR_L1_SED60	BFR_L1_SED61
Date Collected				Min	Max			2022-09-09	2022-09-09	2022-09-09	2022-09-09
1-Methylnaphthalene	0.201	-	-	<0.05	<0.05	<0.05	mg/kg	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	0.201	0.0202	0.201	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01
Acenaphthene	0.0889	0.00671	0.0889	<0.00671	<0.00671	<0.00671	mg/kg	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	0.128	0.00587	0.128	<0.004	<0.004	0.005	mg/kg	<0.004	<0.004	<0.004	<0.004
Anthracene	0.245	0.0469	0.245	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	0.693	0.0317	0.385	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	0.763	0.0319	0.782	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	4.5	-	-	<0.05	<0.05	0.18	mg/kg	<0.05	<0.05	<0.05	<0.05
Benzo(b/j)fluoranthene	4.5	-	-	<0.010	<0.010	0.18	mg/kg	-	-	-	-
Benzo(g,h,i)perylene	0.78	-	-	<0.01	<0.01	<1.2 (0.08)	mg/kg	<0.01	<0.02	<0.01	<0.01
Benzo(j)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-
Benzo(k)fluoranthene	4.5	-	-	<0.0050	<0.0050	<0.005	mg/kg	-	-	-	-
Chrysene	0.846	**0.0571**	0.862	<0.01	<0.01	**0.12**	mg/kg	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	0.135	0.00622	0.135	<0.006	<0.006	<0.006	mg/kg	<0.006	<0.006	<0.006	<0.006
Fluoranthene	1.494	**0.111**	2.355	<0.05	<0.05	**0.15**	mg/kg	<0.05	<0.05	<0.05	<0.05
Fluorene	0.144	0.0212	0.144	<0.01	<0.01	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	0.88	-	-	<0.01	<0.01	0.13	mg/kg	<0.01	<0.01	<0.01	<0.01
Naphthalene	0.391	0.0346	0.391	<0.01	<0.01	<0.01	mg/kg	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	1.98	<0.05	4.52	mg/kg	<0.05	0.6	2.24	2.87
Phenanthrene	0.544	0.0419	0.515	<0.03	<0.03	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03
Pyrene	1.298	**0.053**	0.875	<0.05	<0.05	**0.11**	mg/kg	<0.05	<0.05	<0.05	<0.05

Notes:
"-" = no guideline or data available
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(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier I Environmental Quality Standards (EQS) for Sediment

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(d) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Yellow Shaded = exceedance is within or below background range
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Underline and shaded = Exceedance of RBCA Ecological Tier 1
Bold and shaded = Exceedance of CCME ISQGs
Italicised and shaded = Exceedance of CCME PELs

Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS$_{Eco}$ [a]	Background Range [b]		Maximum	Units	BFR_SED1		BFR_SED2		BFR_SED3		
Sample ID							BFR_SED1 (original)	BFR_SED1 (revised)	BFR_SED2 (original)	BFR_SED2 (revised)	BFR_SED3 (original)	BFR_SED3 (revised)	BFR_SED5 (original)
Date Collected			Minimum	Max			2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-01	2020-12-02
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	7.9
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<10	<10	<10	<10	<10	<10	<10
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	<10	<10	110	<10	170	<10	18
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	510	160	880	300	2300	640	120
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	510**	160***	990**	300***	2500**	640***	150**
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg							
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg							
Reached Baseline at C32							Yes	Yes	Yes	Yes	Yes	No	Yes
Hydrocarbon Resemblance							Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.

Notes:
NA = Not Applicable
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
revised results = PHC concentrations after silica gel clean-up, which removed biogenic organics, all samples in 2021 were analyzed after silica gel clean-up

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Sediment - Freshwater Sediment (2022)

(b) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
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Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS$_{Eco}$ [a]	Background Range [b]		Maximum	Units	BFR_SED5			BFR_SED6		BFR_SED7	
Sample ID							BFR_SED5 (revised)	BFR_SED_DUP2 (original)	BFR_SED_DUP2 (revised)	BFR_SED6 (original)	BFR_SED6 (revised)	BFR_SED7 (original)	BFR_SED7 (revised)
Date Collected			Minimum	Max			2020-12-02	2020-12-02	2020-12-02	2020-12-01	2020-12-01	2020-12-02	2020-12-02
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.025	<0.025	<0.025	<0.050	<0.050	<0.025	<0.025
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.10	<0.10	<0.050	<0.050
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.10	<0.10	<0.050	<0.050
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	7.9	<2.5	<2.5	<5.0	<5.0	<2.5	<2.5
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<10	<10	<10	<10	<10	<10	<10
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	<10	23	<10	<10	<10	190	<10
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	26	120	23	1000	290	1300	370
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	34***	140**	23***	1000***	290***	1400**	370***
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg							
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg							
Reached Baseline at C32							Yes	No	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance							Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.

Notes:
NA = Not Applicable
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(b) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

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Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS$_{Eco}$ [a]	Background Range [b]		Maximum	Units	BFR_SED8	BFR_SED9	BFR_SED9	BFR_SED10	BFR_SED11		BFR_
Sample ID							BFR_SED8	BFR_SED9 (original)	BFR_SED9 (revised)	BFR_SED10	BFR_SED11 (original)	BFR_SED11 (revised)	BFR_SED12 (original)
Date Collected			Minimum	Max			2020-12-02	2020-12-02	2020-12-02	2020-12-01	2020-12-01	2020-12-01	2020-12-01
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<10	55	<10	<10	<10	<10	<10
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	<10	170	<10	<10	17	<10	160
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	36	2300	550	<15	160	42	1700
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	36***	2500**	550***	<15	180**	42***	1800**
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg							
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg							
Reached Baseline at C32							Yes	No	No	NA	Yes	Yes	Yes
Hydrocarbon Resemblance							Lube oil range.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	NA	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.

Notes:
NA = Not Applicable
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< = concentration is below Reportable Detection Limit (RDL)
revised results = PHC concentrations after silica gel clean-up, which removed biogenic organics, all samples in 2021 were analyzed after silica gel clean-up

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(b) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
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Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS$_{Eco}$ [a]	Background Range [b]		Maximum	Units	SED12	BFR_SED13	BFR_SED13	BFR_SED14		BFR_SED15	
Sample ID							BFR_SED12 (revised)	BFR_SED13 (original)	BFR_SED13 (revised)	BFR_SED14 (original)	BFR_SED14 (revised)	BFR_SED15 (original)	BFR_SED15 (revised)
Date Collected			Minimum	Max			2020-12-01	2020-12-02	2020-12-02	2020-12-02	2020-12-02	2020-12-02	2020-12-02
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<10	<10	<10	<10	<10	<10	<10
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	<10	210	<10	25	<10	110	<10
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	540	2800	790	210	54	1100	310
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	540***	3000**	790***	240**	54***	1200**	310***
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg							
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg							
Reached Baseline at C32							Yes	Yes	No	No	Yes	No	Yes
Hydrocarbon Resemblance							Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.	Fuel/lube range. Possible lube oil fraction.	Lube oil range. Natural and organic orgin.

Notes:
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*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

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Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS$_{Eco}$ [a]	Background Range [b]		Maximum	Units	BFR_L1_SED26	BFR_L1_SED27	BFR_L1_SED28		BFR_L1_SED29		BFR_L1_SED30
Sample ID							BFR_L1_SED26	BFR_L1_SED27	BFR_L1_SED28	BFR_L1_SED_DUP1	BFR_L1_SED29	BFR_L1_SED_DUP2	BFR_L1_SED30
Date Collected			Minimum	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	<3	<3	<3	<3	<3	<3	<3
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<15	<15	<15	<15	<15	<15	<15
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	<15	<15	<15	<15	41	54	<15
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	55	59	160	254	468	614	29
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	55***	59***	160***	254***	509***	668***	29***
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg							
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg							
Reached Baseline at C32							Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance							Lube oil range. Natural and organic orgin.	Lube oil range. Natural and organic orgin.	Lube oil range. Natural and organic orgin.	Lube oil range. Natural and organic orgin.	Lube oil range. Natural and organic orgin.	Lube oil range. Natural and organic orgin.	Lube oil range.

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Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS$_{Eco}$ [a]	Background Range [b]		Maximum	Units	BFR_L1_SED31	BFR_L1_SED32	BFR_L1_SED33	BFR_L1_SED34	BFR_L1_SED35	BFR_L1_SED36	BFR_L1_SED39
Sample ID							BFR_L1_SED31	BFR_L1_SED32	BFR_L1_SED33	BFR_L1_SED34	BFR_L1_SED35	BFR_L1_SED36	BFR_L1_SED39
Date Collected			Minimum	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-20	2021-11-20	2021-11-20
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	<3	<3	<3	<3	<3	<3	<3
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<15	<15	<15	<15	<15	<15	<15
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	<15	<15	<15	<15	<15	<15	<15
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	<15	122	24	606	<15	62	343
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	<15	122***	24***	606***	<15	62***	343***
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg							
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg							
Reached Baseline at C32							Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance							No Resemblance.	Lube oil range. Natural and organic orgin.	Lube oil range.	Lube oil range. Natural and organic orgin.	No Resemblance.	Lube oil range. Natural and organic orgin.	Lube oil range. Natural and organic orgin.

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Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS_{Eco} [a]	Background Range [b]		Maximum	Units	BFR_L1_SED40	BFR_L1_SED41	BFR_L1_SED42	BFR_L1_SED44	BFR_L1_SED45	BFR_L1_SED46	BFR_L1_SED47
Sample ID							BFR_L1_SED40	BFR_L1_SED41	BFR_L1_SED42	BFR_L1_SED44	BFR_L1_SED45	BFR_L1_SED46	BFR_L1_SED47
Date Collected			Minimum	Max			2021-11-20	2021-11-21	2021-11-21	2021-11-20	2021-11-20	2021-11-20	2021-11-20
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	<3	<3	<3	<3	<3	<3	<3
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<15	<15	<15	<15	<15	<15	<15
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	27	<15	<15	<15	<15	<15	<15
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	428	<15	82	121	<15	54	<15
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	455***	<15	82***	121***	<15	54***	<15
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg							
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg							
Reached Baseline at C32							Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance							Lube oil range. Natural and organic orgin.	No Resemblance.	Lube oil range. Natural and organic orgin.	Lube oil range. Natural and organic orgin.	No Resemblance.	Lube oil range. Natural and organic orgin.	No Resemblance.

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Table 11: Analytical Results - Petroleum Hydrocarbon (PHCs) in Sediment - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS_{Eco} [a]	Background Range [b]		Maximum	Units	BFR_L1_SED48	BFR_L1_SED49	BFR_L1_SED50
Sample ID							BFR_L1_SED48	BFR_L1_SED49	BFR_L1_SED50
Date Collected			Minimum	Max			2021-11-20	2021-11-20	2021-11-20
Benzene		1.2	<0.025	<0.025	<0.05	mg/kg	<0.02	<0.02	<0.02
Toluene		1.4	<0.050	<0.050	<0.1	mg/kg	<0.04	<0.04	<0.04
Ethylbenzene		1.2	<0.025	<0.025	<0.03	mg/kg	<0.03	<0.03	<0.03
Total Xylenes		1.3	<0.050	<0.050	<0.1	mg/kg	<0.05	<0.05	<0.05
PHC F1 (C6 - C10 (less BTEX))		-	<2.5	<2.5	7.9	mg/kg	<3	<3	<3
PHC F2 (>C10-C16)		-	<10	76	55	mg/kg	<15	<15	<15
PHC F3 (>C16-C21)		-	<10	220	210	mg/kg	<15	<15	<15
PHC (>C21-<C32)		-	<15	2700	2800	mg/kg	<15	<15	76
Modified TPH	Gasoline*	15	<15	-	-	mg/kg	<15	<15	76***
	Diesel/No. 2 Fuel Oil**	**25**		2900**	3000** (not detected in revised samples)	mg/kg			
	Lube Oil/No. 6 Oil***	**43**		690***	1000*** (revised = 790)	mg/kg			
Reached Baseline at C32							Yes	Yes	Yes
Hydrocarbon Resemblance							No Resemblance.	No Resemblance.	Lube oil range. Natural and organic orgin.

Notes:
NA = Not Applicable
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
revised results = PHC concentrations after silica gel clean-up, which removed biogenic organics, all samples in 2021 were analyzed after silica gel clean-up

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Sediment - Freshwater Sediment (2022)

(b) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)
Underline and shaded = Naturally occurring exceedance

Table 12: Analytical Results - Inorganics in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Winge Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL [c]	Health Canada GCDWQ[d]	Background Range[i]		Maximum	Units	BFR_SW5		BFR_SW7
Sample ID									BFR_SW5	BFR_SW_DUP2	BFR_SW7
Date Collected					Min	Max			2020-12-02	2020-12-02	2020-12-02
Total Alkalinity (Total as CaCO3)	-	-	-	-	<5.0	<5.0	<5	mg/L	<5.0	<5.0	<5.0
Dissolved Chloride (Cl-) [g]	120	120	250	250	3	14	13	mg/L	10	10	13
Colour [g]	-	-	**15**	**15**	80	144	160	TCU	110[N,H]	110[N,H]	79[N,H]
Hardness					4.1	4.4		mg/L	-	-	-
Nitrate + Nitrite (N)	-	-	10	-	<0.050	<0.050	0.14	mg/L	<0.050	<0.050	<0.050
Nitrite (N)	60	0.197	-	3	<0.050	0.013	<0.05 (0.013)	mg/L	0.011	0.012	0.013
Nitrogen (Ammonia Nitrogen) [e]	153	153	-	-	<0.050	0.07	2.2	mg/L	<0.050	<0.050	<0.050
Orthophosphate (P)	-	-	-	-	<0.010	<0.010	<0.01	mg/L	<0.010	<0.010	<0.010
pH	6.5 - 9.0	6.5 - 9.0	6.5 - 8.5	7.0 - 10.5	5.08	5.6	4.40 - 6.46	pH	6.20	5.94	5.84
Reactive Silica (SiO2)	-	-	-	-	0.5	2.9	16.1	mg/L	1.7	1.7	2.6
Dissolved Sulphate (SO4) [g]	128	-	500	500	<2.0	3.1	6.0	mg/L	2.8	2.2	<2.0
Turbidity [f]	-	<2 NTU above background levels	<1	-	0.44	1.4	4.3	NTU	4.3	3.7	0.26
Total Organic Carbon (C)	-	-	-	-	14	15	16.0	mg/L	-	-	-
Total Organic Carbon (C)	-	-	-	-	3.59	5.7	26.2	%	-	-	-
Fraction Organic Carbon in Soil	-	-	-	-	0.04	0.06	0.3	-	-	-	-
Conductivity	-	-	-	-	26	63	80.0	uS/cm	40	39	50

Notes:

"-" = no guideline or data available

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Nitrogen criteria based on an average temperature (5.6 °C) and pH (5.54 units)

(f) For turbidity drinking water criteria, to ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less

(g) Drinking water criteria is an aesthetic objective, exceedances not related to a human health concern

(h) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a]

Underline and shaded = Exceedance of CCME WQG_{ECO}

(N) = Exceedance of Guidelines for Drinking Water Quality in Newfoundland & Labrador

(H) = Exceedance of Health Canada Drinking Water Standards

Blue Shaded = Naturally occurring low levels of pH

Yellow Shaded = exceedance is within or below background range

Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 12: Analytical Results - Inorganics in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Winge Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL [c]	Health Canada GCDWQ[d]	Background Range[i]		Maximum	Units	BFR_SW8	BFR_SW10	BFR_SW13
Sample ID									BFR_SW8	BFR_SW10	BFR_SW13
Date Collected					Min	Max			2020-12-02	2020-12-04	2020-12-04
Total Alkalinity (Total as CaCO3)	-	-	-	-	<5.0	<5.0	<5	mg/L	<5.0	<5.0	<5.0
Dissolved Chloride (Cl-) [g]	120	120	250	250	3	14	13	mg/L	9.3	12	12
Colour [g]	-	-	**15**	**15**	80	144	160	TCU	85[N,H]	91[N,H]	100[N,H]
Hardness					4.1	4.4		mg/L	-	-	-
Nitrate + Nitrite (N)	-	-	10	-	<0.050	<0.050	0.14	mg/L	0.054	0.052	0.14
Nitrite (N)	60	0.197	-	3	<0.050	0.013	<0.05 (0.013)	mg/L	0.011	0.012	0.013
Nitrogen (Ammonia Nitrogen) [e]	153	153	-	-	<0.050	0.07	2.2	mg/L	<0.050	<0.050	<0.050
Orthophosphate (P)	-	-	-	-	<0.010	<0.010	<0.01	mg/L	<0.010	<0.010	<0.010
pH	6.5 - 9.0	6.5 - 9.0	6.5 - 8.5	7.0 - 10.5	5.08	5.6	4.40 - 6.46	pH	6.11	6.05	5.30
Reactive Silica (SiO2)	-	-	-	-	0.5	2.9	16.1	mg/L	1.1	1.9	0.70
Dissolved Sulphate (SO4) [g]	128	-	500	500	<2.0	3.1	6.0	mg/L	2.1	<2.0	<2.0
Turbidity [f]	-	<2 NTU above background levels	<1	-	0.44	1.4	4.3	NTU	0.57	1.3	2.7
Total Organic Carbon (C)	-	-	-	-	14	15	16.0	mg/L	8.5	-	-
Total Organic Carbon (C)	-	-	-	-	3.59	5.7	26.2	%	-	-	-
Fraction Organic Carbon in Soil	-	-	-	-	0.04	0.06	0.3	-	-	-	-
Conductivity	-	-	-	-	26	63	80.0	uS/cm	37	45	49

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Nitrogen criteria based on an average temperature (5.6 °C) and pH (5.54 units)
(f) For turbidity drinking water criteria, to ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less
(g) Drinking water criteria is an aesthetic objective, exceedances not related to a human health concern
(h) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a]
Underline and shaded = Exceedance of CCME WQG_{ECO}
(N) = Exceedance of Guidelines for Drinking Water Quality in Newfoundland & Labrador
(H) = Exceedance of Health Canada Drinking Water Standards
Blue Shaded = Naturally occurring low levels of pH
Yellow Shaded = exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 12: Analytical Results - Inorganics in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Winge Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL [c]	Health Canada GCDWQ[d]	Background Range[i]		Maximum	Units	BFR_L1_SW29		BFR_L1_SW38	BFR_L2_SW4	BFR_L2_SW10	BFR_L1_SW58
Sample ID									BFR_L1_SW29	BFR_L1_DUP2	BFR_L1_SW38	BFR_L2_SW4	BFR_L2_SW10	BFR_L1_SW58
Date Collected					Min	Max			2021-11-21	2021-11-21	2021-11-20	2021-11-21	2021-11-27	2022-09-09
Total Alkalinity (Total as CaCO3)	-	-	-	-	<5.0	<5.0	<5	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl-) [g]	120	120	250	250	3	14	13	mg/L	7.0	7.0	6.0	5.0	8.0	5.0
Colour [g]	-	-	**15**	**15**	80	144	160	TCU	78.8 N,H	136 N,H	89.3 N,H	21.8 N,H	46.8 N,H	48.1 N,H
Hardness					4.1	4.4		mg/L	-	-	-	-	-	1.7
Nitrate + Nitrite (N)	-	-	10	-	<0.050	<0.050	0.14	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	60	0.197	-	3	<0.050	0.013	<0.05 (0.013)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrogen (Ammonia Nitrogen) [e]	153	153	-	-	<0.050	0.07	2.2	mg/L	0.040	0.090	<0.030	<0.030	<0.050	<0.03
Orthophosphate (P)	-	-	-	-	<0.010	<0.010	<0.01	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	6.5 - 9.0	6.5 - 9.0	6.5 - 8.5	7.0 - 10.5	5.08	5.6	4.40 - 6.46	pH	6.46	5.40	5.39	5.36	4.85	5.1
Reactive Silica (SiO2)	-	-	-	-	0.5	2.9	16.1	mg/L	10.6	1.5	1.1	16.1	1.4	<0.5
Dissolved Sulphate (SO4) [g]	128	-	500	500	<2.0	3.1	6.0	mg/L	<2.0	<2.0	<2.0	<2.0	6.0	<2.0
Turbidity [f]	-	<2 NTU above background levels	<1	-	0.44	1.4	4.3	NTU	1.0	0.90	1.8	1.40	1.4	1.0
Total Organic Carbon (C)	-	-	-	-	14	15	16.0	mg/L	10	10	11	12	7	9.1
Total Organic Carbon (C)	-	-	-	-	3.59	5.7	26.2	%	-	-	-	-	-	26.2
Fraction Organic Carbon in Soil	-	-	-	-	0.04	0.06	0.3	-	-	-	-	-	-	0.3
Conductivity	-	-	-	-	26	63	80.0	uS/cm	41	44	42	32	80	31

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Nitrogen criteria based on an average temperature (5.6 °C) and pH (5.54 units)
(f) For turbidity drinking water criteria, to ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less
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(h) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a]
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Table 12: Analytical Results - Inorganics in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Winge Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL [c]	Health Canada GCDWQ[d]	Background Range[i]		Maximum	Units	BFR_L1_SW59		BFR_L1_SW60	BFR_L1_SW61
Sample ID									BFR_L1_SW59	BFR_SW_DUP3	BFR_L1_SW60	BFR_L1_SW61
Date Collected					Min	Max			2022-09-09	2022-09-09	2022-09-09	2022-09-09
Total Alkalinity (Total as CaCO3)	-	-	-	-	<5.0	<5.0	<5	mg/L	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl-) [g]	120	120	250	250	3	14	13	mg/L	6.0	5.0	4.0	4.0
Colour [g]	-	-	**15**	**15**	80	144	160	TCU	51[N,H]	64.7[N,H]	148[N,H]	160[N,H]
Hardness					4.1	4.4		mg/L	2.1	2.1	3.4	3.4
Nitrate + Nitrite (N)	-	-	10	-	<0.050	<0.050	0.14	mg/L	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	60	0.197	-	3	<0.050	0.013	<0.05 (0.013)	mg/L	<0.050	<0.050	<0.050	<0.050
Nitrogen (Ammonia Nitrogen) [e]	153	153	-	-	<0.050	0.07	2.2	mg/L	0.41	<0.03	2.17	<0.03
Orthophosphate (P)	-	-	-	-	<0.010	<0.010	<0.01	mg/L	<0.010	<0.010	<0.010	<0.010
pH	6.5 - 9.0	6.5 - 9.0	6.5 - 8.5	7.0 - 10.5	5.08	5.6	4.40 - 6.46	pH	4.40	5.3	5.1	5.2
Reactive Silica (SiO2)	-	-	-	-	0.5	2.9	16.1	mg/L	<0.5	<0.5	0.7	0.7
Dissolved Sulphate (SO4) [g]	128	-	500	500	<2.0	3.1	6.0	mg/L	<2.0	<2.0	<2.0	<2.0
Turbidity [f]	-	<2 NTU above background levels	<1	-	0.44	1.4	4.3	NTU	1.10	1.20	1.6	2.40
Total Organic Carbon (C)	-	-	-	-	14	15	16.0	mg/L	8.9	8.8	14.8	16
Total Organic Carbon (C)	-	-	-	-	3.59	5.7	26.2	%	19.8	3.20	18.1	3.41
Fraction Organic Carbon in Soil	-	-	-	-	0.04	0.06	0.3	-	0.20	0.03	0.181	0.03
Conductivity	-	-	-	-	26	63	80.0	uS/cm	44	31	29	29

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Nitrogen criteria based on an average temperature (5.6 °C) and pH (5.54 units)
(f) For turbidity drinking water criteria, to ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less
(g) Drinking water criteria is an aesthetic objective, exceedances not related to a human health concern
(h) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

Exceedance Identification:
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Table 12: Analytical Results - Inorganics in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Winge Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL [c]	Health Canada GCDWQ[d]	Background Range[i]		Maximum	Units	BFR_L1_SW62	BFR_L1_SW63		BFR_L1_SW64
Sample ID									BFR_L1_SW62	BFR_L1_SW63	BFR_SW_DUP1	BFR_L1_SW64
Date Collected					Min	Max			2022-09-11	2022-09-11	2022-09-11	2022-09-11
Total Alkalinity (Total as CaCO3)	-	-	-	-	<5.0	<5.0	<5	mg/L	<5.0	<5.0	<5.0	<5.0
Dissolved Chloride (Cl-) [g]	120	120	250	250	3	14	13	mg/L	3.0	3.0	3.0	3.0
Colour [g]	-	-	**15**	**15**	80	144	160	TCU	136[N,H]	138[N,H]	134[N,H]	144[N,H]
Hardness					4.1	4.4		mg/L	4.4	4.1	4.1	4.1
Nitrate + Nitrite (N)	-	-	10	-	<0.050	<0.050	0.14	mg/L	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	60	0.197	-	3	<0.050	0.013	<0.05 (0.013)	mg/L	<0.050	<0.050	<0.050	<0.050
Nitrogen (Ammonia Nitrogen) [e]	153	153	-	-	<0.050	0.07	2.2	mg/L	<0.03	<0.03	<0.03	0.07
Orthophosphate (P)	-	-	-	-	<0.010	<0.010	<0.01	mg/L	<0.010	<0.010	<0.010	<0.010
pH	6.5 - 9.0	6.5 - 9.0	6.5 - 8.5	7.0 - 10.5	5.08	5.6	4.40 - 6.46	pH	5.6	5.6	5.60	5.6
Reactive Silica (SiO2)	-	-	-	-	0.5	2.9	16.1	mg/L	0.7	0.6	<0.5	0.5
Dissolved Sulphate (SO4) [g]	128	-	500	500	<2.0	3.1	6.0	mg/L	<2.0	<2.0	<2.0	<2.0
Turbidity [f]	-	<2 NTU above background levels	<1	-	0.44	1.4	4.3	NTU	0.80	1.30	0.80	1.4
Total Organic Carbon (C)	-	-	-	-	14	15	16.0	mg/L	14	15	13.9	14.6
Total Organic Carbon (C)	-	-	-	-	3.59	5.7	26.2	%	5.70	3.59	20.3	4.46
Fraction Organic Carbon in Soil	-	-	-	-	0.04	0.06	0.3	-	0.06	0.04	0.20	0.0446
Conductivity	-	-	-	-	26	63	80.0	uS/cm	26	26	26	26

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)
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(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
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Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[d]	Guidelines for DW Quality in NL [b]	Health Canada GCDWQ[c]	Background Range[f]		Maximum	Units	BFR_SW1	BFR_SW2	BFR_SW3	BFR_SW5		BFR_SW6	BFR_SW7	BFR_SW8	BFR_SW9	BFR_SW10	BFR_SW11	BFR_SW12
Sample ID									BFR_SW1	BFR_SW2	BFR_SW3	BFR_SW5	BFR_SW_DUP2	BFR_SW6	BFR_SW7	BFR_SW8	BFR_SW9	BFR_SW10	BFR_SW11	BFR_SW12
Date Collected					Min	Max			2020-12-01	2020-12-01	2020-12-01	2020-12-02	2020-12-02	2020-12-01	2020-12-02	2020-12-02	2020-12-02	2020-12-01	2020-12-01	2020-12-01
Total Aluminum (Al)	**5**	**5** [g]	2900	2900	110	436	**520**	ug/L	**250**[N,H]	**270**[N,H]	**300**[N,H]	**270**[N,H]	**250**[N,H]	**260**[N,H]	**180**[N,H]	**200**[N,H]	**100**	**210**[N,H]	**230**[N,H]	**170**[N,H]
Total Antimony (Sb)	9	-	6	6	<1.0	<2.0	<2	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	5	5	10	10	<1.0	<2.0	<2	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Barium (Ba)	1000	-	2000	2000	2.1	5.4	<5 (4)	ug/L	3.7	4.0	3.0	2.3	2.3	1.9	2.7	2.2	1.4	2.3	2.4	1.9
Total Beryllium (Be)	0.15	-	-	-	<1.0	<2.0	<2	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	-	-	-	-	<2	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	1500	1500	5000	5000	<5.0	<50	<50 (7)	ug/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	0.09	0.04 [h]	7	7	0.013	<0.09	<0.09	ug/L	0.020	0.017	0.017	0.013	0.020	0.016	0.018	0.018	0.015	0.017	0.017	0.020
Total Calcium (Ca)[e]	-	-	-	-	200	1200	2000.0	ug/L	1400	1700	550	800	820	310	1100	740	400	780	710	480
Total Chromium (Cr)	8.9	-	50	50	<1	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	1	-	-	-	<0.40	<1.0	<1	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper (Cu)	2	2 [h]	2000	2000	<0.50	2	2.0	ug/L	0.57	0.56	<0.50	1.5	1.3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Iron (Fe)	**300**	**300**	**300** [k]	**300** [k]	73	562	**1200**	ug/L	**310**[N,H]	**370**[N,H]	270	**330**[N,H]	300	110	200	160	83	260	260	150
Total Lead (Pb)	**1**	**1** [h]	5	5	<0.50	0.9	**4.1**	ug/L	0.61	0.52	0.80	**2.7**	**2.6**	0.60	<0.50	0.61	0.61	0.69	0.64	0.61
Total Magnesium (Mg)[e]	-	-	-	-	400	940	850.0	ug/L	850	820	780	640	610	520	800	570	760	720	710	760
Total Manganese (Mn)	430	190 [g,h]	120	120	<2.0	18	34.0	ug/L	14	14	5.9	18	18	4.4	11	8.4	<2.0	10	9.2	3.6
Total Mercury (Hg)	**0.026**	**0.026**	1	1	<0.013	0.043	0.052	ug/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Total Molybdenum (Mo)	73	73	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	25	25 [h]	-	-	<2	<2.0	25.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	-	10 - 20 [i]	-	-	<0.02	<100	<100 (20)	ug/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total Potassium (K)[e]	-	-	-	-	150	400	420.0	ug/L	400	420	180	220	230	150	190	240	150	180	230	170
Total Selenium (Se)	1	1	50	50	<0.50	<1.0	<1.0	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Silver (Ag)	0.25	0.25	-	-	<0.1	<0.10	<0.11	ug/L	<0.10	<0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na) [e]	-	-	200000 [k]	200000 [k]	3200	6200	8500.0	ug/L	7900	8500	5500	4900	4900	4000	5600	4700	5700	5100	5400	5500
Total Strontium (Sr)	21000	-	7000	7000	<5	8	7.9	ug/L	7.9	7.6	6.4	4.9	5.5	4.4	6.8	4.7	5.5	6.1	6.0	5.6
Total Thallium (Tl)	0.8	0.8	-	-	<0.1	<0.10	<0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	-	-	-	-	<2	<2.0	4.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	-	-	-	-	<2.0	9	12.0	ug/L	4.4	5.5	4.0	5.0	5.2	2.6	2.4	3.5	<2.0	2.5	3.7	2.1
Total Uranium (U)	15	15	20	20	<0.10	0.3	<0.20	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	120	-	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	7	7 [j]	5000 [k]	5000 [k]	<5.0	32	5.2	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.2
Hardness	-	-	-		--	--		mg/kg	7.0	7.6	4.6	4.6	4.5	2.9	6.0	4.2	4.1	4.9	4.7	4.3

Notes:
"-" = no guideline or data available

NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water

(b) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(c) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(e) There is no available criteria for calcium, magnesium, potassium, and sodium as they are considered innocuous and essential elements to living organisms

(f) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

(g) Average temperature (5.4 °C) and pH (5.6 units) used for lookup table

(h) Average water hardness (2.5 mg/L) used for calculation, where half of detection limit was used for values below RDL

(i) Value for mesotrophic freshwater used

(j) Water chemistry parameters outside of valid range for CCME equation; therefore, the default WQG was applied

(k) Operation guidance and/or aesthetic objective not related to human health

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO}[a]
Underline and shaded = Exceedance of CCME WQG_{ECO}
(N) = Exceedance of Guidelines for Drinking Water Quality in Newfoundland & Labrador
(H) = Exceedance of Health Canada Drinking Water Standards
Yellow Shaded = exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[d]	Guidelines for DW Quality in NL [b]	Health Canada GCDWQ[c]	Background Range[f]		Maximum	Units	BFR_SW13	BFR_SW14	BFR_SW15	BFR_L1_SW26	BFR_L1_SW27	BFR_L1_SW28		BFR_L1_SW29		BFR_L1_SW30
Sample ID									BFR_SW13	BFR_SW14	BFR_SW15	BFR_L1_SW26	BFR_L1_SW27	BFR_L1_SW28	BFR_L1_DUP1	BFR_L1_SW29	BFR_L1_DUP2	BFR_L1_SW30
Date Collected					Min	Max			2020-12-02	2020-12-02	2020-12-02	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21
Total Aluminum (Al)	**5**	**5** [g]	2900	2900	110	436	**520**	ug/L	**120**[N,H]	**200**[N,H]	**130**[N,H]	**335**[N,H]	**377**[N,H]	**262**[N,H]	**268**[N,H]	**174**[N,H]	**175**[N,H]	**253**[N,H]
Total Antimony (Sb)	9	-	6	6	<1.0	<2.0	<2	ug/L	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	5	5	10	10	<1.0	<2.0	<2	ug/L	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Barium (Ba)	1000	-	2000	2000	2.1	5.4	<5 (4)	ug/L	1.9	1.6	2.8	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Beryllium (Be)	0.15	-	-	-	<1.0	<2.0	<2	ug/L	<1.0	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Bismuth (Bi)	-	-	-	-	<2	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	1500	1500	5000	5000	<5.0	<50	<50 (7)	ug/L	<50	<50	<50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cadmium (Cd)	0.09	0.04 [h]	7	7	0.013	<0.09	<0.09	ug/L	0.017	0.014	0.018	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Total Calcium (Ca)[e]	-	-	-	-	200	1200	2000.0	ug/L	450	600	650	-	-	-	-	500	500	-
Total Chromium (Cr)	8.9	-	50	50	<1	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	1	-	-	-	<0.40	<1.0	<1	ug/L	<0.40	<0.40	<0.40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Copper (Cu)	2	2 [h]	2000	2000	<0.50	2	2.0	ug/L	<0.50	<0.50	0.99	<1.0	<1.0	1.0	1.0	<1.0	<1.0	<1.0
Total Iron (Fe)	**300**	**300**	**300** [k]	**300** [k]	73	562	**1200**	ug/L	140	110	210	**348**[N,H]	**437**[N,H]	**303**[N,H]	294	249	247	151
Total Lead (Pb)	**1**	**1** [h]	5	5	<0.50	0.9	**4.1**	ug/L	0.77	<0.50	<0.50	0.80	0.70	**2.8**	**3.0**	**1.4**	**1.4**	0.60
Total Magnesium (Mg)[e]	-	-	-	-	400	940	850.0	ug/L	760	570	630	-	-	-	-	600	600	-
Total Manganese (Mn)	430	190 [g,h]	120	120	<2.0	18	34.0	ug/L	2.3	5.0	7.3	10	17	13	14	4.0	4.0	6.0
Total Mercury (Hg)	**0.026**	**0.026**	1	1	<0.013	0.043	0.052	ug/L	<0.013	<0.013	<0.013	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026
Total Molybdenum (Mo)	73	73	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	25	25 [h]	-	-	<2	<2.0	25.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	12	<2.0	<2.0	8.0	<2.0
Total Phosphorus (P)	-	10 - 20 [i]	-	-	<0.02	<100	<100 (20)	ug/L	<100	<100	<100	-	-	-	-	20	<20	-
Total Potassium (K)[e]	-	-	-	-	150	400	420.0	ug/L	150	190	210	-	-	-	-	200	200	-
Total Selenium (Se)	1	1	50	50	<0.50	<1.0	<1.0	ug/L	<0.50	<0.50	<0.50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	0.25	0.25	-	-	<0.1	<0.10	<0.11	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na) [e]	-	-	200000 [k]	200000 [k]	3200	6200	8500.0	ug/L	5500	4900	4800	-	-	-	-	4400	4500	-
Total Strontium (Sr)	21000	-	7000	7000	<5	8	7.9	ug/L	5.9	4.8	5.3	5.0	6.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Thallium (Tl)	0.8	0.8	-	-	<0.1	<0.10	<0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	-	-	-	-	<2	<2.0	4.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	-	-	-	-	<2.0	9	12.0	ug/L	3.1	2.5	<2.0	6.0	8.0	3.0	4.0	2.0	2.0	2.0
Total Uranium (U)	15	15	20	20	<0.10	0.3	<0.20	ug/L	<0.10	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Vanadium (V)	120	-	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	7	7 [j]	5000 [k]	5000 [k]	<5.0	32	5.2	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness	-	-	-		--	--		mg/kg	4.2	3.8	4.2	-	-	-	-	3.7	3.7	-

Notes:
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NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction

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(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water

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(e) There is no available criteria for calcium, magnesium, potassium, and sodium as they are considered innocuous and essential elements to living organisms

(f) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

(g) Average temperature (5.4 °C) and pH (5.6 units) used for lookup table

(h) Average water hardness (2.5 mg/L) used for calculation, where half of detection limit was used for values below RDL

(i) Value for mesotrophic freshwater used

(j) Water chemistry parameters outside of valid range for CCME equation; therefore, the default WQG was applied

(k) Operation guidance and/or aesthetic objective not related to human health

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Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a]
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Yellow Shaded = exceedance is within or below background range
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Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[d]	Guidelines for DW Quality in NL [b]	Health Canada GCDWQ[c]	Background Range[f]		Maximum	Units	BFR_L1_SW31	BFR_L1_SW32	BFR_L1_SW33	BFR_L1_SW34	BFR_L1_SW35	BFR_L1_SW36	BFR_L1_SW37	BFR_L1_SW38	BFR_L1_SW39	BFR_L1_SW40
Sample ID									BFR_L1_SW31	BFR_L1_SW32	BFR_L1_SW33	BFR_L1_SW34	BFR_L1_SW35	BFR_L1_SW36	BFR_L1_SW37	BFR_L1_SW38	BFR_L1_SW39	BFR_L1_SW40
Date Collected					Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-20	2021-11-20	2021-11-20	2021-11-20	2021-11-20	2021-11-20
Total Aluminum (Al)	**5**	**5** [g]	2900	2900	110	436	**520**	ug/L	**245**[N,H]	**214**[N,H]	**232**[N,H]	**169**[N,H]	**231**[N,H]	**310**[N,H]	**235**[N,H]	**269**[N,H]	**280**[N,H]	**189**[N,H]
Total Antimony (Sb)	9	-	6	6	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	5	5	10	10	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Barium (Ba)	1000	-	2000	2000	2.1	5.4	<5 (4)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Beryllium (Be)	0.15	-	-	-	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Bismuth (Bi)	-	-	-	-	<2	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	1500	1500	5000	5000	<5.0	<50	<50 (7)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cadmium (Cd)	0.09	0.04 [h]	7	7	0.013	<0.09	<0.09	ug/L	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Total Calcium (Ca)[(e)]	-	-	-	-	200	1200	2000.0	ug/L	-	-	-	-	-	-	-	300	-	-
Total Chromium (Cr)	8.9	-	50	50	<1	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	1	-	-	-	<0.40	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Copper (Cu)	2	2 [h]	2000	2000	<0.50	2	2.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Iron (Fe)	**300**	**300**	**300** [k]	**300** [k]	73	562	**1200**	ug/L	201	181	225	206	172	**348**[N,H]	**325**[N,H]	194	190	235
Total Lead (Pb)	**1**	**1** [h]	5	5	<0.50	0.9	**4.1**	ug/L	0.60	0.70	0.60	0.60	0.70	0.70	0.60	0.70	0.70	<0.50
Total Magnesium (Mg)[(e)]	-	-	-	-	400	940	850.0	ug/L	-	-	-	-	-	-	-	400	-	-
Total Manganese (Mn)	430	190 [g,h]	120	120	<2.0	18	34.0	ug/L	6.0	4.0	7.0	<2.0	2.0	11	12	3.0	3.0	3.0
Total Mercury (Hg)	**0.026**	**0.026**	1	1	<0.013	0.043	0.052	ug/L	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026
Total Molybdenum (Mo)	73	73	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	25	25 [h]	-	-	<2	<2.0	25.0	ug/L	<2.0	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	-	10 - 20 [i]	-	-	<0.02	<100	<100 (20)	ug/L	-	-	-	-	-	-	-	20	-	-
Total Potassium (K)[(e)]	-	-	-	-	150	400	420.0	ug/L	-	-	-	-	-	-	-	200	-	-
Total Selenium (Se)	1	1	50	50	<0.50	<1.0	<1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	0.25	0.25	-	-	<0.1	<0.10	<0.11	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na) [(e)]	-	-	200000 [k]	200000 [k]	3200	6200	8500.0	ug/L	-	-	-	-	-	-	-	4100	-	-
Total Strontium (Sr)	21000	-	7000	7000	<5	8	7.9	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Thallium (Tl)	0.8	0.8	-	-	<0.1	<0.10	<0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	-	-	-	-	<2	<2.0	4.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	4.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	-	-	-	-	<2.0	9	12.0	ug/L	2.0	3.0	3.0	3.0	2.0	12	3.0	3.0	3.0	<2.0
Total Uranium (U)	15	15	20	20	<0.10	0.3	<0.20	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Vanadium (V)	120	-	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	7	7 [j]	5000 [k]	5000 [k]	<5.0	32	5.2	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness	-	-	-		--	--		mg/kg	-	-	-	-	-	-	-	2.4	-	-

Notes:
"-" = no guideline or data available

NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water

(b) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(c) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(e) There is no available criteria for calcium, magnesium, potassium, and sodium as they are considered innocuous and essential elements to living organisms

(f) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report
(g) Average temperature (5.4 °C) and pH (5.6 units) used for lookup table

(h) Average water hardness (2.5 mg/L) used for calculation, where half of detection limit was used for values below RDL

(i) Value for mesotrophic freshwater used

(j) Water chemistry parameters outside of valid range for CCME equation; therefore, the default WQG was applied

(k) Operation guidance and/or aesthetic objective not related to human health

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO}[a]
Underline and shaded = Exceedance of CCME WQG_{ECO}
(N) = Exceedance of Guidelines for Drinking Water Quality in Newfoundland & Labrador
(H) = Exceedance of Health Canada Drinking Water Standards
Yellow Shaded = exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 13: Analytical Results - Metals in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[d]	Guidelines for DW Quality in NL [b]	Health Canada GCDWQ[c]	Background Range[f]		Maximum	Units	BFR_L1_SW41	BFR_L1_SW42	BFR_L1_SW43	BFR_L1_SW44	BFR_L1_SW45	BFR_L1_SW46
Sample ID									BFR_L1_SW41	BFR_L1_SW42	BFR_L1_SW43	BFR_L1_SW44	BFR_L1_SW45	BFR_L1_SW46
Date Collected					Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-20	2021-11-20
Total Aluminum (Al)	**5**	**5** g	2900	2900	110	436	**520**	ug/L	**337**[N,H]	**249**[N,H]	**188**[N,H]	**234**[N,H]	**268**[N,H]	**162**[N,H]
Total Antimony (Sb)	9	-	6	6	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	5	5	10	10	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Barium (Ba)	1000	-	2000	2000	2.1	5.4	<5 (4)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Beryllium (Be)	0.15	-	-	-	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Bismuth (Bi)	-	-	-	-	<2	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	1500	1500	5000	5000	<5.0	<50	<50 (7)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Cadmium (Cd)	0.09	0.04 h	7	7	0.013	<0.09	<0.09	ug/L	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Total Calcium (Ca)[e]	-	-	-	-	200	1200	2000.0	ug/L	-	-	-	-	-	-
Total Chromium (Cr)	8.9	-	50	50	<1	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	1	-	-	-	<0.40	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Copper (Cu)	2	2 h	2000	2000	<0.50	2	2.0	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	<1.0
Total Iron (Fe)	**300**	**300**	**300** k	**300** k	73	562	**1200**	ug/L	290	**316**[N,H]	**325**[N,H]	**342**[N,H]	294	177
Total Lead (Pb)	**1**	**1** h	5	5	<0.50	0.9	**4.1**	ug/L	0.70	0.60	0.50	<0.50	**3.0**	0.70
Total Magnesium (Mg)[e]	-	-	-	-	400	940	850.0	ug/L	-	-	-	-	-	-
Total Manganese (Mn)	430	190 g,h	120	120	<2.0	18	34.0	ug/L	8.0	7.0	7.0	6.0	14	2.0
Total Mercury (Hg)	**0.026**	**0.026**	1	1	<0.013	0.043	0.052	ug/L	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026
Total Molybdenum (Mo)	73	73	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	25	25 h	-	-	<2	<2.0	25.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	-	10 - 20 i	-	-	<0.02	<100	<100 (20)	ug/L	-	-	-	-	-	-
Total Potassium (K)[e]	-	-	-	-	150	400	420.0	ug/L	-	-	-	-	-	-
Total Selenium (Se)	1	1	50	50	<0.50	<1.0	<1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	0.25	0.25	-	-	<0.1	<0.10	<0.11	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na) [e]	-	-	200000 k	200000 k	3200	6200	8500.0	ug/L	-	-	-	-	-	-
Total Strontium (Sr)	21000	-	7000	7000	<5	8	7.9	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Thallium (Tl)	0.8	0.8	-	-	<0.1	<0.10	<0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	-	-	-	-	<2	<2.0	4.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	-	-	-	-	<2.0	9	12.0	ug/L	5.0	4.0	3.0	3.0	4.0	2.0
Total Uranium (U)	15	15	20	20	<0.10	0.3	<0.20	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total Vanadium (V)	120	-	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	7	7 j	5000 k	5000 k	<5.0	32	5.2	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness	-	-	-		--	--		mg/kg	-	-	-	-	-	-

Notes:
"-" = no guideline or data available

NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water

(b) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(c) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(e) There is no available criteria for calcium, magnesium, potassium, and sodium as they are considered innocuous and essential elements to living organisms

(f) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

(g) Average temperature (5.4 °C) and pH (5.6 units) used for lookup table

(h) Average water hardness (2.5 mg/L) used for calculation, where half of detection limit was used for values below RDL

(i) Value for mesotrophic freshwater used

(j) Water chemistry parameters outside of valid range for CCME equation; therefore, the default WQG was applied

(k) Operation guidance and/or aesthetic objective not related to human health

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO}[a]
Underline and shaded = Exceedance of CCME WQG_{ECO}
(N) = Exceedance of Guidelines for Drinking Water Quality in Newfoundland & Labrador
(H) = Exceedance of Health Canada Drinking Water Standards
Yellow Shaded = exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[d]	Guidelines for DW Quality in NL [b]	Health Canada GCDWQ[c]	Background Range[f]		Maximum	Units	BFR_L1_SW47	BFR_L1_SW48	BFR_L1_SW49	BFR_L1_SW50	BFR_L1_SW51		BFR_L1_SW52	BFR_L1_SW53	BFR_L1_SW54
Sample ID									BFR_L1_SW47	BFR_L1_SW48	BFR_L1_SW49	BFR_L1_SW50	BFR_L1_SW51	BFR_L1_SW_DUP2	BFR_L1_SW52	BFR_L1_SW53	BFR_L1_SW54
Date Collected					Min	Max			2021-11-20	2021-11-20	2021-11-20	2021-11-20	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09
Total Aluminum (Al)	**5**	**5** [g]	2900	2900	110	436	**520**	ug/L	**366**[N,H]	**378**[N,H]	**436**[N,H]	**183**[N,H]	**490**[N,H]	**491**[N,H]	**321**[N,H]	**322**[N,H]	**520**[N,H]
Total Antimony (Sb)	9	-	6	6	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2
Total Arsenic (As)	5	5	10	10	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2
Total Barium (Ba)	1000	-	2000	2000	2.1	5.4	<5 (4)	ug/L	<5.0	<5.0	<5.0	<5.0	<5	<5	<5	<5	<5
Total Beryllium (Be)	0.15	-	-	-	<1.0	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2
Total Bismuth (Bi)	-	-	-	-	<2	<2.0	<2	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2
Total Boron (B)	1500	1500	5000	5000	<5.0	<50	<50 (7)	ug/L	<5.0	<5.0	<5.0	<5.0	6	6	5	5	7
Total Cadmium (Cd)	0.09	0.04 [h]	7	7	0.013	<0.09	<0.09	ug/L	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Total Calcium (Ca)[e]	-	-	-	-	200	1200	2000.0	ug/L	-	-	-	-	-	2000	-	-	-
Total Chromium (Cr)	8.9	-	50	50	<1	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1
Total Cobalt (Co)	1	-	-	-	<0.40	<1.0	<1	ug/L	<1.0	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1
Total Copper (Cu)	2	2 [h]	2000	2000	<0.50	2	2.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1	<1	1	<1	<1
Total Iron (Fe)	**300**	**300**	**300** [k]	**300** [k]	73	562	**1200**	ug/L	**342**[N,H]	**369**[N,H]	**361**[N,H]	156	**1200**[N,H]	**704**[N,H]	**546**[N,H]	**635**[N,H]	**840**[N,H]
Total Lead (Pb)	**1**	**1** [h]	5	5	<0.50	0.9	**4.1**	ug/L	0.90	0.90	0.80	0.60	**2.4**	**2.4**	**3.2**	1	**1.5**
Total Magnesium (Mg)[e]	-	-	-	-	400	940	850.0	ug/L	-	-	-	-	-	600	-	-	-
Total Manganese (Mn)	430	190 [g,h]	120	120	<2.0	18	34.0	ug/L	6.0	7.0	8.0	4.0	30	31	24	3	7
Total Mercury (Hg)	**0.026**	**0.026**	1	1	<0.013	0.043	0.052	ug/L	<0.026	<0.026	<0.026	<0.026	**0.037**	<0.026	**0.029**	**0.027**	**0.052**
Total Molybdenum (Mo)	73	73	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2
Total Nickel (Ni)	25	25 [h]	-	-	<2	<2.0	25.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	25
Total Phosphorus (P)	-	10 - 20 [i]	-	-	<0.02	<100	<100 (20)	ug/L	-	-	-	-	-	0.03	-	-	-
Total Potassium (K)[e]	-	-	-	-	150	400	420.0	ug/L	-	-	-	-	-	200	-	-	-
Total Selenium (Se)	1	1	50	50	<0.50	<1.0	<1.0	ug/L	<1.0	<1.0	<1.0	<1.0	<1	<1	<1	<1	<1
Total Silver (Ag)	0.25	0.25	-	-	<0.1	<0.10	<0.11	ug/L	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na) [e]	-	-	200000 [k]	200000 [k]	3200	6200	8500.0	ug/L	-	-	-	-	-	4300	-	-	-
Total Strontium (Sr)	21000	-	7000	7000	<5	8	7.9	ug/L	<5.0	5.0	5.0	<5.0	6	7	<5	<5	5
Total Thallium (Tl)	0.8	0.8	-	-	<0.1	<0.10	<0.10	ug/L	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1
Total Tin (Sn)	-	-	-	-	<2	<2.0	4.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2
Total Titanium (Ti)	-	-	-	-	<2.0	9	12.0	ug/L	7.0	7.0	8.0	3.0	8	8	5	5	9
Total Uranium (U)	15	15	20	20	<0.10	0.3	<0.20	ug/L	<0.20	<0.20	<0.20	<0.20	<0.2	<0.2	<0.2	<0.2	<0.2
Total Vanadium (V)	120	-	-	-	<2	<2.0	<2.0	ug/L	<2.0	<2.0	<2.0	<2.0	<2	<2	<2	<2	<2
Total Zinc (Zn)	7	7 [j]	5000 [k]	5000 [k]	<5.0	32	5.2	ug/L	<5.0	<5.0	<5.0	<5.0	<5	<5	<5	<5	<5
Hardness	-	-	-		--	--		mg/kg	-	-	-	-	-	7.4	-	-	-

Notes:
"-" = no guideline or data available

NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction

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(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water

(b) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(c) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(e) There is no available criteria for calcium, magnesium, potassium, and sodium as they are considered innocuous and essential elements to living organisms

(f) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

(g) Average temperature (5.4 °C) and pH (5.6 units) used for lookup table

(h) Average water hardness (2.5 mg/L) used for calculation, where half of detection limit was used for values below RDL

(i) Value for mesotrophic freshwater used

(j) Water chemistry parameters outside of valid range for CCME equation; therefore, the default WQG was applied

(k) Operation guidance and/or aesthetic objective not related to human health

Exceedance Identification:

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Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO}[a]
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Table 13: Analytical Results - Metals in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[d]	Guidelines for DW Quality in NL [b]	Health Canada GCDWQ[c]	Background Range[f]		Maximum	Units	BFR_L1_SW55	BFR_L1_SW56	BFR_L1_SW57	BFR_L1_SW58	BFR_L1_SW59		BFR_L1_SW60	BFR_L1_SW61
Sample ID									BFR_L1_SW55	BFR_L1_SW56	BFR_L1_SW57	BFR_L1_SW58	BFR_L1_SW59	BFR_L1_SW_DUP3	BFR_L1_SW60	BFR_L1_SW61
Date Collected					Min	Max			2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09
Total Aluminum (Al)	**5**	**5** g	2900	2900	110	436	**520**	ug/L	**412**[N,H]	**461**[N,H]	**446**[N,H]	**229**[N,H]	**232**[N,H]	**245**[N,H]	**320**[N,H]	**313**[N,H]
Total Antimony (Sb)	9	-	6	6	<1.0	<2.0	<2	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Arsenic (As)	5	5	10	10	<1.0	<2.0	<2	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Barium (Ba)	1000	-	2000	2000	2.1	5.4	<5 (4)	ug/L	<5	<5	<5	<5	<5	<5	<5	<5
Total Beryllium (Be)	0.15	-	-	-	<1.0	<2.0	<2	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Bismuth (Bi)	-	-	-	-	<2	<2.0	<2	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Boron (B)	1500	1500	5000	5000	<5.0	<50	<50 (7)	ug/L	6	6	6	<5	<5	<5	5	5
Total Cadmium (Cd)	0.09	0.04 h	7	7	0.013	<0.09	<0.09	ug/L	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Total Calcium (Ca)[e]	-	-	-	-	200	1200	2000.0	ug/L	-	-	-	200	200	200	700	700
Total Chromium (Cr)	8.9	-	50	50	<1	<1.0	<1	ug/L	<1	<1	<1	<1	<1	<1	<1	<1
Total Cobalt (Co)	1	-	-	-	<0.40	<1.0	<1	ug/L	<1	<1	<1	<1	<1	<1	<1	<1
Total Copper (Cu)	2	2 h	2000	2000	<0.50	2	2.0	ug/L	<1	<1	<1	<1	<1	<1	2	2
Total Iron (Fe)	**300**	**300**	**300** k	**300** k	73	562	**1200**	ug/L	**603**[N,H]	**836**[N,H]	**903**[N,H]	131	132	131	**604**[N,H]	**623**[N,H]
Total Lead (Pb)	**1**	**1** h	5	5	<0.50	0.9	**4.1**	ug/L	**1.3**	1	1	<0.5	<0.5	<0.5	**4.1**	**4.1**
Total Magnesium (Mg)[e]	-	-	-	-	400	940	850.0	ug/L	-	-	-	400	400	400	400	400
Total Manganese (Mn)	430	190 g,h	120	120	<2.0	18	34.0	ug/L	9	9	22	4	4	4	34	34
Total Mercury (Hg)	**0.026**	**0.026**	1	1	<0.013	0.043	0.052	ug/L	**0.042**	**0.044**	**0.042**	**0.036**	<0.026	**0.043**	<0.026	<0.026
Total Molybdenum (Mo)	73	73	-	-	<2	<2.0	<2.0	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Nickel (Ni)	25	25 h	-	-	<2	<2.0	25.0	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Phosphorus (P)	-	10 - 20 i	-	-	<0.02	<100	<100 (20)	ug/L	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Total Potassium (K)[e]	-	-	-	-	150	400	420.0	ug/L	-	-	-	100	100	200	200	200
Total Selenium (Se)	1	1	50	50	<0.50	<1.0	<1.0	ug/L	<1	<1	<1	<1	<1	<1	<1	<1
Total Silver (Ag)	0.25	0.25	-	-	<0.1	<0.10	<0.11	ug/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na) [e]	-	-	200000 k	200000 k	3200	6200	8500.0	ug/L	-	-	-	3600	3800	3900	3800	3700
Total Strontium (Sr)	21000	-	7000	7000	<5	8	7.9	ug/L	5	<5	5	<5	<5	<5	<5	<5
Total Thallium (Tl)	0.8	0.8	-	-	<0.1	<0.10	<0.10	ug/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Tin (Sn)	-	-	-	-	<2	<2.0	4.0	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Titanium (Ti)	-	-	-	-	<2.0	9	12.0	ug/L	6	7	7	<2	<2	<2	4	4
Total Uranium (U)	15	15	20	20	<0.10	0.3	<0.20	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Vanadium (V)	120	-	-	-	<2	<2.0	<2.0	ug/L	<2	<2	<2	<2	<2	<2	<2	<2
Total Zinc (Zn)	7	7 j	5000 k	5000 k	<5.0	32	5.2	ug/L	<5	<5	<5	<5	<5	<5	<5	<5
Hardness	-	-	-		--	--		mg/kg	-	-	-	2.1	2.1	2.1	3.4	3.4

Notes:
"-" = no guideline or data available

NR = Guideline is Not Required, as an applicable guideline is available from another more appropriate jurisdiction

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water

(b) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(c) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(e) There is no available criteria for calcium, magnesium, potassium, and sodium as they are considered innocuous and essential elements to living organisms

(f) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

(g) Average temperature (5.4 °C) and pH (5.6 units) used for lookup table

(h) Average water hardness (2.5 mg/L) used for calculation, where half of detection limit was used for values below RDL

(i) Value for mesotrophic freshwater used

(j) Water chemistry parameters outside of valid range for CCME equation; therefore, the default WQG was applied

(k) Operation guidance and/or aesthetic objective not related to human health

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO}[a]
Underline and shaded = Exceedance of CCME WQG_{ECO}
(N) = Exceedance of Guidelines for Drinking Water Quality in Newfoundland & Labrador
(H) = Exceedance of Health Canada Drinking Water Standards
Yellow Shaded = exceedance is within or below background range
Orange shaded = exceedance above maximum background range but naturally occurring (refer to report text for discussion)

Table 14: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{Eco} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	BFR_SW1	BFR_SW2	BFR_SW3	BFR_SW5		BFR_SW6	BFR_SW7	BFR_SW8	BFR_SW9	BFR_SW10
Sample ID									BFR_SW1	BFR_SW2	BFR_SW3	BFR_SW5	BFR_SW_DUP2	BFR_SW6	BFR_SW7	BFR_SW8	BFR_SW9	BFR_SW10
Date Collected					Min	Max			2020-12-01	2020-12-01	2020-12-01	2020-12-02	2020-12-02	2020-12-01	2020-12-02	2020-12-02	2020-12-02	2020-12-01
1-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05 (0.01)	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthene	5.8	5.8	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Acenaphthylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Acridine	-	4.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene	0.012	0.012	-	-	<0.010	<0.010	<0.012	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(a)anthracene	0.018	0.018	-	-	<0.010	<0.010	<0.018	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(a)pyrene	0.015	0.015	-	0.04	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b/j)fluoranthene	-	-	-	-	<0.020	<0.020	<0.02	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Benzo(g,h,i)perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(j)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(k)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chrysene	0.1	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Dibenzo(a,h)anthracene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Fluoranthene	0.04	0.04	-	-	<0.010	<0.010	0.00	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Fluorene	3	3	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Naphthalene	1.1	1.1	-	-	<0.20	<0.20	<0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phenanthrene	0.4	0.4	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Pyrene	0.025	0.025	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Quinoline	-	3.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water (Fresh Water)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Table 14: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	BFR_SW11	BFR_SW12	BFR_SW13	BFR_SW14	BFR_SW15	BFR_L1_SW26	BFR_L1_SW27	BFR_L1
Sample ID									BFR_SW11	BFR_SW12	BFR_SW13	BFR_SW14	BFR_SW15	BFR_L1_SW26	BFR_L1_SW27	BFR_L1_SW28
Date Collected					Min	Max			2020-12-01	2020-12-01	2020-12-02	2020-12-02	2020-12-02	2021-11-21	2021-11-21	2021-11-21
1-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.01	<0.01	<0.01
2-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05 (0.01)	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.01	0.01	<0.01
Acenaphthene	5.8	5.8	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Acenaphthylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Acridine	-	4.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.01	<0.01	<0.01
Anthracene	0.012	0.012	-	-	<0.010	<0.010	<0.012	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.012	<0.012	<0.012
Benzo(a)anthracene	0.018	0.018	-	-	<0.010	<0.010	<0.018	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.018	<0.018	<0.018
Benzo(a)pyrene	0.015	0.015	-	0.04	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Benzo(b/j)fluoranthene	-	-	-	-	<0.020	<0.020	<0.02	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	-	-	-
Benzo(k)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	-	-	-
Chrysene	0.1	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Fluoranthene	0.04	0.04	-	-	<0.010	<0.010	0.00	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Fluorene	3	3	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Naphthalene	1.1	1.1	-	-	<0.20	<0.20	<0.2	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.01	<0.01	<0.01
Perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Phenanthrene	0.4	0.4	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Pyrene	0.025	0.025	-	-	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.01	<0.01
Quinoline	-	3.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.01	<0.01	<0.01

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water (Fresh Water)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Table 14: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	_SW28	BFR_L1_SW29	BFR_L1_SW29	BFR_L1_SW30	BFR_L1_SW31	BFR_L1_SW32	BFR_L1_SW33
Sample ID									BFR_L1_DUP1	BFR_L1_SW29	BFR_L1_DUP2	BFR_L1_SW30	BFR_L1_SW31	BFR_L1_SW32	BFR_L1_SW33
Date Collected					Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21
1-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05 (0.01)	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	5.8	5.8	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acridine	-	4.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	0.012	0.012	-	-	<0.010	<0.010	<0.012	ug/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Benzo(a)anthracene	0.018	0.018	-	-	<0.010	<0.010	<0.018	ug/L	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
Benzo(a)pyrene	0.015	0.015	-	0.04	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b/j)fluoranthene	-	-	-	-	<0.020	<0.020	<0.02	ug/L	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Chrysene	0.1	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	0.04	0.04	-	-	<0.010	<0.010	0.00	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	3	3	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	1.1	1.1	-	-	<0.20	<0.20	<0.2	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.4	0.4	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	0.025	0.025	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Quinoline	-	3.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water (Fresh Water)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Table 14: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	BFR_L1_SW34	BFR_L1_SW35	BFR_L1_SW36	BFR_L1_SW37	BFR_L1_SW38	BFR_L1_SW39	BFR_L1_SW40
Sample ID									BFR_L1_SW34	BFR_L1_SW35	BFR_L1_SW36	BFR_L1_SW37	BFR_L1_SW38	BFR_L1_SW39	BFR_L1_SW40
Date Collected					Min	Max			2021-11-21	2021-11-20	2021-11-20	2021-11-20	2021-11-20	2021-11-20	2021-11-20
1-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05 (0.01)	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	5.8	5.8	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acridine	-	4.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	0.012	0.012	-	-	<0.010	<0.010	<0.012	ug/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Benzo(a)anthracene	0.018	0.018	-	-	<0.010	<0.010	<0.018	ug/L	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
Benzo(a)pyrene	0.015	0.015	-	0.04	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b/j)fluoranthene	-	-	-	-	<0.020	<0.020	<0.02	ug/L	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Chrysene	0.1	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	0.04	0.04	-	-	<0.010	<0.010	0.00	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	3	3	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	1.1	1.1	-	-	<0.20	<0.20	<0.2	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.4	0.4	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	0.025	0.025	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Quinoline	-	3.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water (Fresh Water)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Table 14: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	BFR_L1_SW41	BFR_L1_SW42	BFR_L1_SW43	BFR_L1_SW44	BFR_L1_SW45	BFR_L1_SW46	BFR_L1_SW51
Sample ID									BFR_L1_SW41	BFR_L1_SW42	BFR_L1_SW43	BFR_L1_SW44	BFR_L1_SW45	BFR_L1_SW46	BFR_L1_SW51
Date Collected					Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-20	2021-11-20	2022-09-09
1-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05 (0.01)	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	5.8	5.8	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acridine	-	4.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	0.012	0.012	-	-	<0.010	<0.010	<0.012	ug/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Benzo(a)anthracene	0.018	0.018	-	-	<0.010	<0.010	<0.018	ug/L	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
Benzo(a)pyrene	0.015	0.015	-	0.04	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b/j)fluoranthene	-	-	-	-	<0.020	<0.020	<0.02	ug/L	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Chrysene	0.1	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	0.04	0.04	-	-	<0.010	<0.010	0.00	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	3	3	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	1.1	1.1	-	-	<0.20	<0.20	<0.2	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.4	0.4	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	0.025	0.025	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Quinoline	-	3.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water (Fresh Water)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Table 14: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	BFR_L1_SW51	BFR_L1_SW52	BFR_L1_SW53	BFR_L1_SW54	BFR_L1_SW55	BFR_L1_SW56	BFR_L1_SW57
Sample ID									BFR_L1_DUP2	BFR_L1_SW52	BFR_L1_SW53	BFR_L1_SW54	BFR_L1_SW55	BFR_L1_SW56	BFR_L1_SW57
Date Collected					Min	Max			2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09
1-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05 (0.01)	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	5.8	5.8	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acridine	-	4.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	0.012	0.012	-	-	<0.010	<0.010	<0.012	ug/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Benzo(a)anthracene	0.018	0.018	-	-	<0.010	<0.010	<0.018	ug/L	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
Benzo(a)pyrene	0.015	0.015	-	0.04	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b/j)fluoranthene	-	-	-	-	<0.020	<0.020	<0.02	ug/L	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-	-	-
Chrysene	0.1	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	0.04	0.04	-	-	<0.010	<0.010	0.00	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	3	3	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	1.1	1.1	-	-	<0.20	<0.20	<0.2	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.4	0.4	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	0.025	0.025	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Quinoline	-	3.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:
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(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water (Fresh Water)
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(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Table 14: Analytical Results - Polycyclic Aromatic Hydrocarbons (PAHs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location	Atlantic RBCA Tier I EQS_{ECO} [a]	CCME WQGs[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	BFR_L1_SW58	BFR_L1_SW59		BFR_L1_SW60	BFR_L1_SW61
Sample ID									BFR_L1_SW58	BFR_L1_SW59	BFR_L1_DUP3	BFR_L1_SW60	BFR_L1_SW61
Date Collected					Min	Max			2022-09-09	2022-09-09	2022-09-09	2022-09-09	2022-09-09
1-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methylnaphthalene	2	-	-	-	<0.050	<0.050	<0.05 (0.01)	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	5.8	5.8	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Acridine	-	4.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	0.012	0.012	-	-	<0.010	<0.010	<0.012	ug/L	<0.012	<0.012	<0.012	<0.012	<0.012
Benzo(a)anthracene	0.018	0.018	-	-	<0.010	<0.010	<0.018	ug/L	<0.018	<0.018	<0.018	<0.018	<0.018
Benzo(a)pyrene	0.015	0.015	-	0.04	<0.010	<0.010	<0.01	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(b)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b/j)fluoranthene	-	-	-	-	<0.020	<0.020	<0.02	ug/L	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(j)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	-	-	-	-	-
Chrysene	0.1	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	0.04	0.04	-	-	<0.010	<0.010	0.00	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	3	3	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	1.1	1.1	-	-	<0.20	<0.20	<0.2	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	-	-	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	0.4	0.4	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	0.025	0.025	-	-	<0.010	<0.010	<0.01	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01
Quinoline	-	3.4	-	-	<0.050	<0.050	<0.05	ug/L	<0.01	<0.01	<0.01	<0.01	<0.01

Notes:
"-" = no guideline or data available
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic RBCA - Ecological Tier I Environmental Quality Standards (EQS) for Surface Water (Fresh Water)
(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term
(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.
(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.
(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), , as presented in the WSP (2023) assessment report

Table 15: Analytical Results - Petroleum Hydrocarbons (PHCs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA	CCME	Guidelines for DW Quality in NL [c]	Health Canada	Background Range[e]		Maximum	Units	BFR_SW1	BFR_SW2	BFR_SW3	BFR_SW5	
Sample ID										BFR_SW1	BFR_SW2	BFR_SW3	BFR_SW5	BFR_SW_DUP2
Date Collected		EQS_{Eco} [a]	WQG_{Eco} [b]		GCDWQ[d]	Min	Max			2020-12-01	2020-12-01	2020-12-01	2020-12-02	2020-12-02
Benzene		2.1	0.37	-	0.005	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene		0.77	0.002	-	0.06	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene		0.32	0.09	-	0.14	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes		0.33	-	-	0.09	<0.0020	<0.0020	<0.0020	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
PHC F1 (C6 - C10 (less BTEX))		-	-	-	-	<0.090	<0.090	<0.090	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090
PHC F2 (>C10-C16)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
PHC F3 (>C16-C21)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
PHC (>C21-<C32)		-	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090
Modified TPH	Gasoline	1.5*	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090
	Diesel/No. 2 Fuel Oil	0.10**	-	-	-			0.00	mg/L					
	Lube oil/No. 6 Oil	0.10***	-	-	-			0.00	mg/L					
Reached Baseline at C32										NA	NA	NA	NA	NA
Hydrocarbon Resemblance										NA	NA	NA	NA	NA

Notes:
NA = not applicable
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a] (None reported)
Underline and shaded = Exceedance of CCME WQG_{ECO} (None reported)
Yellow Shaded = exceedance is within or below background range

Table 15: Analytical Results - Petroleum Hydrocarbons (PHCs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA	CCME	Guidelines for DW Quality in NL [c]	Health Canada	Background Range[e]		Maximum	Units	BFR_SW6	BFR_SW7	BFR_SW8	BFR_SW9	BFR_SW10	BFR_SW11	BFR_SW12
Sample ID										BFR_SW6	BFR_SW7	BFR_SW8	BFR_SW9	BFR_SW10	BFR_SW11	BFR_SW12
Date Collected		EQS_{Eco} [a]	WQG_{Eco} [b]		GCDWQ[d]	Min	Max			2020-12-01	2020-12-02	2020-12-02	2020-12-02	2020-12-01	2020-12-01	2020-12-01
Benzene		2.1	0.37	-	0.005	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene		0.77	0.002	-	0.06	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene		0.32	0.09	-	0.14	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes		0.33	-	-	0.09	<0.0020	<0.0020	<0.0020	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
PHC F1 (C6 - C10 (less BTEX))		-	-	-	-	<0.090	<0.090	<0.090	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
PHC F2 (>C10-C16)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PHC F3 (>C16-C21)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PHC (>C21-<C32)		-	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Modified TPH	Gasoline	1.5*	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
	Diesel/No. 2 Fuel Oil	0.10**	-	-	-			0.00	mg/L							
	Lube oil/No. 6 Oil	0.10***	-	-	-			0.00	mg/L							
Reached Baseline at C32										NA	NA	NA	NA	NA	NA	NA
Hydrocarbon Resemblance										NA	NA	NA	NA	NA	NA	NA

Notes:
NA = not applicable
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a] (None reported)
Underline and shaded = Exceedance of CCME WQG_{ECO} (None reported)
Yellow Shaded = exceedance is within or below background range

Table 15: Analytical Results - Petroleum Hydrocarbons (PHCs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA	CCME	Guidelines for DW Quality in NL[c]	Health Canada	Background Range[e]		Maximum	Units	BFR_SW13	BFR_SW14	BFR_SW15	BFR_SW26
Sample ID										BFR_SW13	BFR_SW14	BFR_SW15	BFR_L1_SW26
Date Collected		EQS_{Eco}[a]	WQG_{Eco}[b]		GCDWQ[d]	Min	Max			2020-12-02	2020-12-02	2020-12-02	2021-11-21
Benzene		2.1	0.37	-	0.005	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.001
Toluene		0.77	0.002	-	0.06	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.001
Ethylbenzene		0.32	0.09	-	0.14	<0.0010	<0.0010	<0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.001
Total Xylenes		0.33	-	-	0.09	<0.0020	<0.0020	<0.0020	mg/L	<0.0020	<0.0020	<0.0020	<0.002
PHC F1 (C6 - C10 (less BTEX))		-	-	-	-	<0.090	<0.090	<0.090	mg/L	<0.090	<0.090	<0.090	<0.01
PHC F2 (>C10-C16)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.050	<0.050	<0.050	<0.05
PHC F3 (>C16-C21)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.050	<0.050	<0.050	<0.05
PHC (>C21-<C32)		-	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.090	<0.090	<0.090	<0.1
Modified TPH	Gasoline	1.5*	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.090	<0.090	<0.090	<0.1
	Diesel/No. 2 Fuel Oil	0.10**	-	-	-			0.00	mg/L				
	Lube oil/No. 6 Oil	0.10***	-	-	-			0.00	mg/L				
Reached Baseline at C32										NA	NA	NA	Yes
Hydrocarbon Resemblance										NA	NA	NA	No Resemblance

Notes:
NA = not applicable
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO}[a] (None reported)
Underline and shaded = Exceedance of CCME WQG_{ECO} (None reported)
Yellow Shaded = exceedance is within or below background range

Table 15: Analytical Results - Petroleum Hydrocarbons (PHCs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS_{Eco}[a]	CCME WQG_{Eco}[b]	Guidelines for DW Quality in NL[c]	Health Canada GCDWQ[d]	Background Range[e]		Maximum	Units	BFR_SW27	BFR_SW28		BFR_SW29		BFR_SW30
Sample ID										BFR_L1_SW27	BFR_L1_SW28	BFR_L1_DUP1	BFR_L1_SW29	BFR_L1_DUP2	BFR_L1_SW30
Date Collected						Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-21
Benzene		2.1	0.37	-	0.005	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene		0.77	0.002	-	0.06	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene		0.32	0.09	-	0.14	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Xylenes		0.33	-	-	0.09	<0.0020	<0.0020	<0.0020	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PHC F1 (C6 - C10 (less BTEX))		-	-	-	-	<0.090	<0.090	<0.090	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHC F2 (>C10-C16)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC F3 (>C16-C21)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC (>C21-<C32)		-	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Modified TPH	Gasoline	1.5*	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Diesel/No. 2 Fuel Oil	0.10**	-	-	-			0.00	mg/L						
	Lube oil/No. 6 Oil	0.10***	-	-	-			0.00	mg/L						
Reached Baseline at C32										Yes	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance										No Resemblance	No Resemblance	No Resemblance	No Resemblance	No Resemblance	No Resemblance

Notes:
NA = not applicable
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO}[a] (None reported)
Underline and shaded = Exceedance of CCME WQG_{ECO} (None reported)
Yellow Shaded = exceedance is within or below background range

Table 15: Analytical Results - Petroleum Hydrocarbons (PHCs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA	CCME	Guidelines for DW Quality in NL [c]	Health Canada	Background Range [e]		Maximum	Units	BFR_SW31	BFR_SW32	BFR_SW33	BFR_SW34	BFR_SW35	BFR_SW36
Sample ID										BFR_L1_SW31	BFR_L1_SW32	BFR_L1_SW33	BFR_L1_SW34	BFR_L1_SW35	BFR_L1_SW36
Date Collected		EQS_{Eco} [a]	WQG_{Eco} [b]		GCDWQ [d]	Min	Max			2021-11-21	2021-11-21	2021-11-21	2021-11-21	2021-11-20	2021-11-20
Benzene		2.1	0.37	-	0.005	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene		0.77	0.002	-	0.06	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene		0.32	0.09	-	0.14	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Xylenes		0.33	-	-	0.09	<0.0020	<0.0020	<0.0020	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PHC F1 (C6 - C10 (less BTEX))		-	-	-	-	<0.090	<0.090	<0.090	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHC F2 (>C10-C16)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC F3 (>C16-C21)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC (>C21-<C32)		-	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Modified TPH	Gasoline	1.5*	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Diesel/No. 2 Fuel Oil	0.10**	-	-	-			0.00	mg/L						
	Lube oil/No. 6 Oil	0.10***	-	-	-			0.00	mg/L						
Reached Baseline at C32										Yes	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance										No Resemblance	No Resemblance	No Resemblance	No Resemblance	No Resemblance	No Resemblance

Notes:

NA = not applicable

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a] (None reported)

Underline and shaded = Exceedance of CCME WQG_{ECO} (None reported)

Yellow Shaded = exceedance is within or below background range

Table 15: Analytical Results - Petroleum Hydrocarbons (PHCs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA	CCME	Guidelines for DW Quality in NL [c]	Health Canada	Background Range[e]		Maximum	Units	BFR_SW37	BFR_SW38	BFR_SW39	BFR_SW40	BFR_SW41	BFR_SW42
Sample ID										BFR_L1_SW37	BFR_L1_SW38	BFR_L1_SW39	BFR_L1_SW40	BFR_L1_SW41	BFR_L1_SW42
Date Collected		EQS_{Eco} [a]	WQG_{Eco} [b]		GCDWQ[d]	Min	Max			2021-11-20	2021-11-20	2021-11-20	2021-11-20	2021-11-21	2021-11-21
Benzene		2.1	0.37	-	0.005	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene		0.77	0.002	-	0.06	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethylbenzene		0.32	0.09	-	0.14	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Xylenes		0.33	-	-	0.09	<0.0020	<0.0020	<0.0020	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PHC F1 (C6 - C10 (less BTEX))		-	-	-	-	<0.090	<0.090	<0.090	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHC F2 (>C10-C16)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC F3 (>C16-C21)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PHC (>C21-<C32)		-	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Modified TPH	Gasoline	1.5*	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Diesel/No. 2 Fuel Oil	0.10**	-	-	-			0.00	mg/L						
	Lube oil/No. 6 Oil	0.10***	-	-	-			0.00	mg/L						
Reached Baseline at C32										Yes	Yes	Yes	Yes	Yes	Yes
Hydrocarbon Resemblance										No Resemblance	No Resemblance	No Resemblance	No Resemblance	No Resemblance	No Resemblance

Notes:

NA = not applicable

"-" = no guideline or data available

mbgs = metres below ground surface

< = concentration is below Reportable Detection Limit (RDL)

(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

Exceedance Identification:

Bold and dotted = Criteria is exceeded by maximum on-site concentration

Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a] (None reported)

Underline and shaded = Exceedance of CCME WQG_{ECO} (None reported)

Yellow Shaded = exceedance is within or below background range

Table 15: Analytical Results - Petroleum Hydrocarbons (PHCs) in Surface Water - RA Property Outside of Remedial Area
Burgeo Firing Range, 9 Wing Gander, NL

Location		Atlantic RBCA EQS_{Eco} [a]	CCME WQG_{Eco} [b]	Guidelines for DW Quality in NL [c]	Health Canada GCDWQ [d]	Background Range [e]		Maximum	Units	BFR_SW43	BFR_SW44	BFR_SW45	BFR_SW46
Sample ID										BFR_L1_SW43	BFR_L1_SW44	BFR_L1_SW45	BFR_L1_SW46
Date Collected						Min	Max			2021-11-21	2021-11-21	2021-11-20	2021-11-20
Benzene		2.1	0.37	-	0.005	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001
Toluene		0.77	0.002	-	0.06	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001
Ethylbenzene		0.32	0.09	-	0.14	<0.0010	<0.0010	<0.0010	mg/L	<0.001	<0.001	<0.001	<0.001
Total Xylenes		0.33	-	-	0.09	<0.0020	<0.0020	<0.0020	mg/L	<0.002	<0.002	<0.002	<0.002
PHC F1 (C6 - C10 (less BTEX))		-	-	-	-	<0.090	<0.090	<0.090	mg/L	<0.01	<0.01	<0.01	<0.01
PHC F2 (>C10-C16)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05
PHC F3 (>C16-C21)		-	-	-	-	<0.050	<0.050	<0.050	mg/L	<0.05	<0.05	<0.05	<0.05
PHC (>C21-<C32)		-	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1
Modified TPH	Gasoline	1.5*	-	-	-	<0.090	<0.090	<0.1	mg/L	<0.1	<0.1	<0.1	<0.1
	Diesel/No. 2 Fuel Oil	0.10**	-	-	-			0.00	mg/L				
	Lube oil/No. 6 Oil	0.10***	-	-	-			0.00	mg/L				
Reached Baseline at C32										Yes	Yes	Yes	Yes
Hydrocarbon Resemblance										No Resemblance	No Resemblance	No Resemblance	No Resemblance

Notes:
NA = not applicable
"-" = no guideline or data available
mbgs = metres below ground surface
< = concentration is below Reportable Detection Limit (RDL)
(a) Atlantic Risk-Based Corrective Action (RBCA) Ecological Tier 1 Environmental Quality Standards (EQSEco) for Surface Water - Fresh Water (2022)

(b) Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (2010) - Freshwater, Long Term

(c) Guidelines for Drinking Water Quality in Newfoundland & Labrador (2020). Where available the maximum acceptable concentration (MAC) was used.

(d) Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) (2020). Where available the maximum acceptable concentration (MAC) was used.

(e) Background range calculated based on Location 1 (all samples in Zone 2 and 3) and Location 2 (samples SW1, SW2, SW10), as presented in the WSP (2023) assessment report

*Guideline for gas range **Guideline for fuel range ***Guideline for lube range

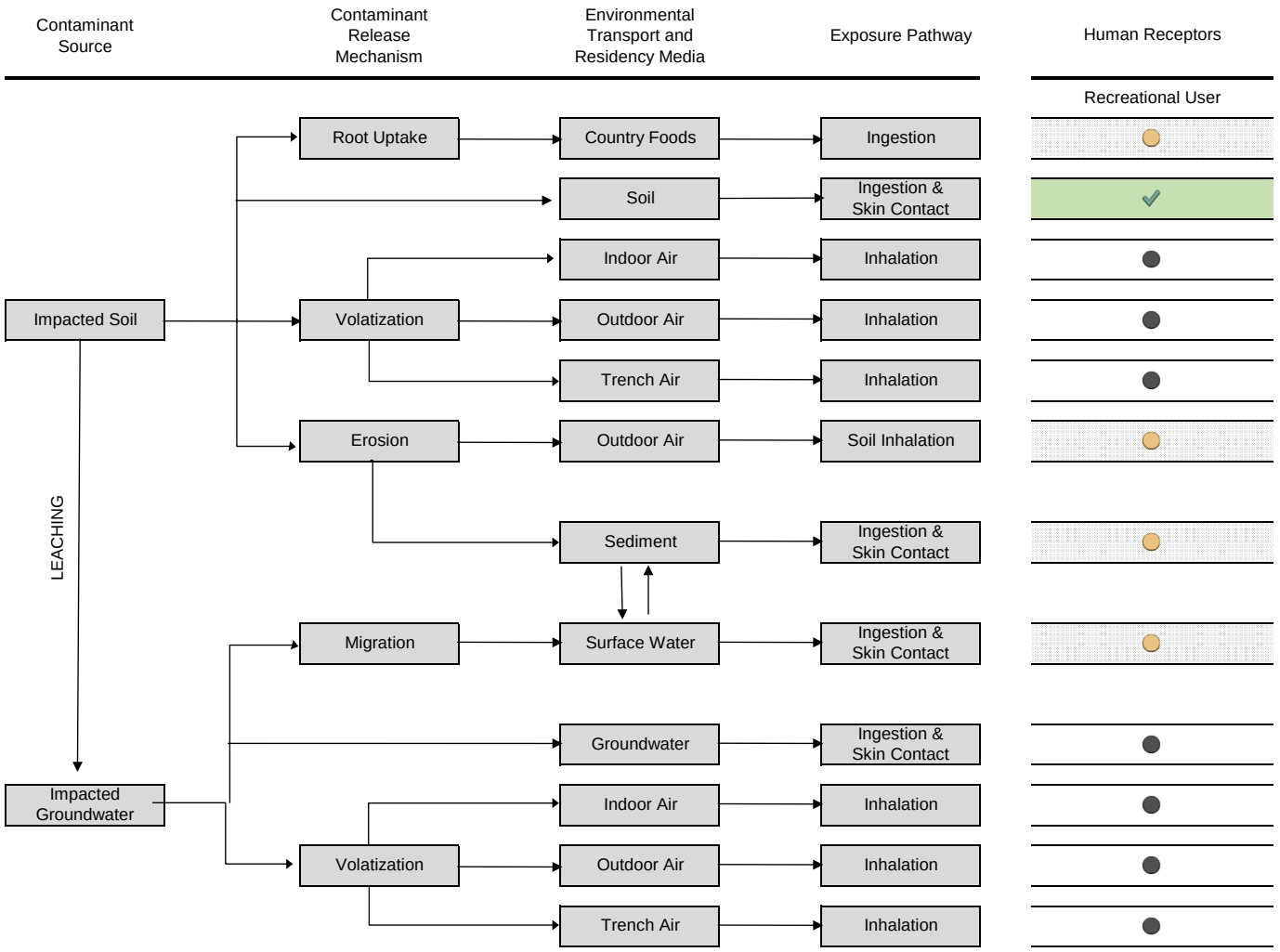
Exceedance Identification:
Bold and dotted = Criteria is exceeded by maximum on-site concentration
Bold and shaded = Exceedance of Atlantic RBCA EQS_{ECO} [a] (None reported)
Underline and shaded = Exceedance of CCME WQG_{ECO} (None reported)
Yellow Shaded = exceedance is within or below background range

APPENDIX B

HHERA CSM

Conceptual Site Model for Human Receptors: Burgeo Range, Burgeo, Newfoundland

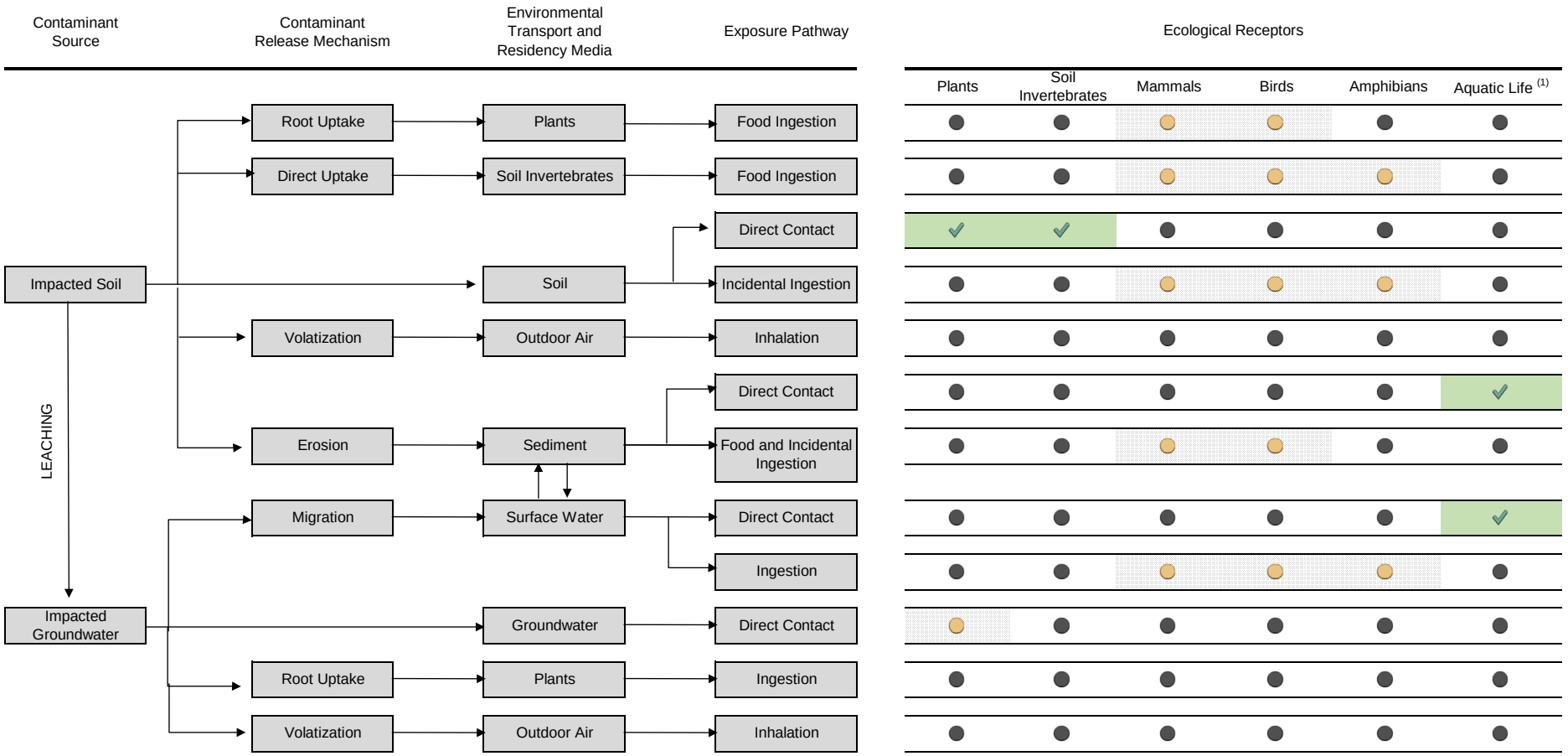
FIGURE B-1



Date: March 2023		CAD: LF
Project Number: 21497139		CKD: MZ

Conceptual Site Model for Human Receptors: Burgeo Range, Burgeo, Newfoundland

FIGURE B2



(1) Aquatic life includes aquatic plants, pelagic invertebrates, benthic invertebrates, fish, and aquatic phase amphibians

✓ Exposure pathway is complete and evaluated in the Ecological Risk Assessment (ERA).
Exposure pathway is complete, but considered negligible and not further evalauated in the ERA
Exposure pathway is incomplete and not evaluated in the ERA.

Date: March 2023		CAD: LF
Project Number: 21497139		CKD: MZ

APPENDIX C

ProUCL Inputs and Outputs

Aluminum	D_Aluminu	Lead (Pb)	D_Lead (P	Manganes	D_Mangar	Tin (Sn)	D_Tin (Sn)	Vanadium	D_Vanadium (V)
5600	1	3.95	1	130	1	1	0	19	1
4520	1	6.0	1	125	1	1	0	17.8	1
12100	1	29	1	116	1	2.0	1	36.5	1
2640	1	30	1	88	1	1.0	1	26.5	1
7800	1	17	1	330	1	1	0	34.0	1
7800	1	20	1	**449**	1	1	0	35.6	1
7310	1	18	1	**387**	1	1	0	**42.0**	1
10390	1	53.5	1	497.5	1	1	1	55.05	1
13000	1	52	1	47	1	1.4	1	25.0	1
5850	1	36	1	82	1	1.0	1	18.9	1
2280	1	30	1	38	1	1	0	4.0	1
12000	1	61	1	104	1	2.0	1	32.2	1
7990	1	19	1	119	1	1.0	1	22.7	1
840	1	17	1	13	1	1	0	2.5	1
5800	1	16	1	26	1	*16*	*1*	7.5	1
1234	1	5.35	1	13	1	3	1	7.5	1
519	1	60.4	1	19	1	2	0	4.0	1
937	1	11.6	1	9.0	1	4.0	1	5.0	1
6340	1	3.6	1	2	0	3.0	1	4.0	1
700	1	28	1	7.9	1	1.9	1	2.8	1
3550	1	6.9	1	3.0	1	2.0	0	5.0	1
724	1	28.6	1	10	1	4.0	1	5.0	1
2710	1	5.6	1	13	1	4.0	1	11.0	1
2530	1	15.6	1	3.0	1	4.0	1	4.0	1
5800	1	58	1	8.2	1	1.2	1	2.0	0
3700	1	7.3	1	4.4	1	1.5	1	6.4	1
1000	1	5.9	1	5	1	4.1	1	2.0	0
6700	1	45	1	32	1	1.3	1	11	1
4370	1	36	1	19	1	3.0	1	6.0	1
6820	1	*76*	1	23	1	5.0	1	10.0	1
4560	1	22	1	29	1	4.0	1	10.0	1
7710	1	*74*	1	24	1	4.0	1	13.0	1
9800	1	*120*	1	27	1	1.5	1	5	1
1290	1	5.5	1	10.5	1	3	1	4	1
7470	1	5.2	1	111	1	4.0	1	**49.0**	1
3340	1	15	1	23	1	3.0	1	10.0	1
639	1	4.7	1	5.0	1	4.0	1	4.0	1
860	1	17	1	4.2	1	1.2	1	2.1	1
2900	1	8	1	2.6	1	1	0	2.0	0
8400	1	37	1	5.8	1	1	0	15	1
1080	1	13	1	5.0	1	4.0	1	6.0	1
3000	1	12	1	29	1	5.0	1	12.0	1
12100	1	59	1	41	1	3.0	1	8.0	1
4720	1	4.1	1	3.0	1	4.0	1	4.0	1
2630	1	2.2	1	12	1	*6*	*1*	8	1
7580	1	5.4	1	98	1	5	1	17	1
6980	1	6.3	1	36	1	*6*	*1*	25	1
10400	1	25.4	1	222	1	5	1	**79**	1
8910	1	41.3	1	102	1	5	1	35	1
4890	1	4.5	1	6	1	*13*	*1*	12	1
14400	1	10.2	1	99	1	4	1	28	1

9480	1	15.6	1	241	1	6	1	29.5	1
4190	1	1.7	1	3	1	*7*	*1*	8	1
3380	1	8.9	1	59	1	5	1	15	1
952	1	4.5	1	8	1	4	1	9	1
5580	1	9.8	1	75	1	5	1	16	1
8555	1	7.25	1	64.5	1	6	1	19.5	1
8500	1	3.7	1	99	1	5	1	21	1
14600	1	4.4	1	**566**	1	*6*	*1*	**77**	1
15600	1	3.5	1	**538**	1	5	1	**75**	1
8980	1	6.4	1	158	1	5	1	39	1
4780	1	10.5	1	23	1	5	1	21	1
4260	1	6.1	1	31	1	4	1	15	1
764	1	6.6	1	13	1	4	1	6	1
6670	1	1.8	1	2	0	4	1	5	1
7810	1	13.4	1	101	1	4	1	25	1
12400	1	8	1	44	1	3.5	1	16	1
1640	1	1.4	1	2	0	5	1	4	1
6910	1	7.2	1	146	1	4	1	30	1
7840	1	8.3	1	9	1	*15*	*1*	5	1
9400	1	11.3	1	172	1	5	1	**59**	1
6960	1	5.9	1	71	1	4	1	23	1
11600	1	6.5	1	2	1	4	1	13	1
3300	1	3.5	1	4	1	4	1	6	1
6850	1	6.3	1	3	1	*6*	*1*	8	1
5340	1	7.5	1	4	1	4	1	16	1
8000	1	39.7	1	40	1	5	1	8	1

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 2023-02-19 8:28:22 PM
From File	Soil Data for UCLM_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (Al)

General Statistics

Total Number of Observations	77	Number of Distinct Observations	74
		Number of Missing Observations	0
Minimum	519	Mean	5994
Maximum	15600	Median	5800
SD	3813	Std. Error of Mean	434.5
Coefficient of Variation	0.636	Skewness	0.449

Normal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**
1% Shapiro Wilk P Value	0.00305	Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.0755	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.117	Data appear Normal at 1% Significance Level

Data appear Approximate Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6718	95% Adjusted-CLT UCL (Chen-1995)	6733
		95% Modified-t UCL (Johnson-1978)	6721

Gamma GOF Test

A-D Test Statistic	1.379	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.765	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.121	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.103	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.844	k star (bias corrected MLE)	1.781
Theta hat (MLE)	3250	Theta star (bias corrected MLE)	3365
nu hat (MLE)	284.1	nu star (bias corrected)	274.3
MLE Mean (bias corrected)	5994	MLE Sd (bias corrected)	4491
		Approximate Chi Square Value (0.05)	237
Adjusted Level of Significance	0.0469	Adjusted Chi Square Value	236.3

Assuming Gamma Distribution

95% Approximate Gamma UCL	6939	95% Adjusted Gamma UCL	6959

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk P Value	7.5353E-8	Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.145	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.0924	Data Not Lognormal at 10% Significance Level

56	**Data Not Lognormal at 10% Significance Level**											
57												
58	**Lognormal Statistics**											
59						Minimum of Logged Data	6.252			Mean of logged Data	8.404	
60						Maximum of Logged Data	9.655			SD of logged Data	0.888	
61												
62	**Assuming Lognormal Distribution**											
63						95% H-UCL	8242			90% Chebyshev (MVUE) UCL	8877	
64						95% Chebyshev (MVUE) UCL	9921			97.5% Chebyshev (MVUE) UCL	11370	
65						99% Chebyshev (MVUE) UCL	14217					
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution**											
69												
70	**Nonparametric Distribution Free UCLs**											
71						95% CLT UCL	6709			95% BCA Bootstrap UCL	6679	
72						95% Standard Bootstrap UCL	6706			95% Bootstrap-t UCL	6773	
73						95% Hall's Bootstrap UCL	6760			95% Percentile Bootstrap UCL	6678	
74						90% Chebyshev(Mean, Sd) UCL	7298			95% Chebyshev(Mean, Sd) UCL	7888	
75						97.5% Chebyshev(Mean, Sd) UCL	8708			99% Chebyshev(Mean, Sd) UCL	10318	
76												
77	**Suggested UCL to Use**											
78						95% Student's-t UCL	6718					
79												
80	When a data set follows an approximate distribution passing only one of the GOF tests,											
81	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
82												
83	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
84	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
85	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
86												
87												
88	**Lead (Pb)**											
89												
90	**General Statistics**											
91						Total Number of Observations	77			Number of Distinct Observations	68	
92										Number of Missing Observations	0	
93						Minimum	1.4			Mean	19.54	
94						Maximum	120			Median	10.2	
95						SD	21.74			Std. Error of Mean	2.478	
96						Coefficient of Variation	1.113			Skewness	2.138	
97												
98	**Normal GOF Test**											
99						Shapiro Wilk Test Statistic	0.749			**Shapiro Wilk GOF Test**		
100						1% Shapiro Wilk P Value	0			Data Not Normal at 1% Significance Level		
101						Lilliefors Test Statistic	0.222			**Lilliefors GOF Test**		
102						1% Lilliefors Critical Value	0.117			Data Not Normal at 1% Significance Level		
103	**Data Not Normal at 1% Significance Level**											
104												
105	**Assuming Normal Distribution**											
106	**95% Normal UCL**									**95% UCLs (Adjusted for Skewness)**		
107						95% Student's-t UCL	23.67			95% Adjusted-CLT UCL (Chen-1995)	24.26	
108										95% Modified-t UCL (Johnson-1978)	23.77	
109												
110	**Gamma GOF Test**											

111				A-D Test Statistic	2.038	**Anderson-Darling Gamma GOF Test**						
112				5% A-D Critical Value	0.779	Data Not Gamma Distributed at 5% Significance Level						
113				K-S Test Statistic	0.146	**Kolmogorov-Smirnov Gamma GOF Test**						
114				5% K-S Critical Value	0.104	Data Not Gamma Distributed at 5% Significance Level						
115	**Data Not Gamma Distributed at 5% Significance Level**											
116												
117	**Gamma Statistics**											
118				k hat (MLE)	1.13					k star (bias corrected MLE)	1.094	
119				Theta hat (MLE)	17.3					Theta star (bias corrected MLE)	17.86	
120				nu hat (MLE)	174					nu star (bias corrected)	168.5	
121				MLE Mean (bias corrected)	19.54					MLE Sd (bias corrected)	18.68	
122										Approximate Chi Square Value (0.05)	139.5	
123				Adjusted Level of Significance	0.0469					Adjusted Chi Square Value	139	
124												
125	**Assuming Gamma Distribution**											
126				95% Approximate Gamma UCL	23.6					95% Adjusted Gamma UCL	23.69	
127												
128	**Lognormal GOF Test**											
129				Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk Lognormal GOF Test**						
130				10% Shapiro Wilk P Value	0.0849	Data Not Lognormal at 10% Significance Level						
131				Lilliefors Test Statistic	0.105	**Lilliefors Lognormal GOF Test**						
132				10% Lilliefors Critical Value	0.0924	Data Not Lognormal at 10% Significance Level						
133	**Data Not Lognormal at 10% Significance Level**											
134												
135	**Lognormal Statistics**											
136				Minimum of Logged Data	0.336					Mean of logged Data	2.468	
137				Maximum of Logged Data	4.787					SD of logged Data	1.008	
138												
139	**Assuming Lognormal Distribution**											
140				95% H-UCL	25.51					90% Chebyshev (MVUE) UCL	27.43	
141				95% Chebyshev (MVUE) UCL	31.05					97.5% Chebyshev (MVUE) UCL	36.08	
142				99% Chebyshev (MVUE) UCL	45.96							
143												
144	**Nonparametric Distribution Free UCL Statistics**											
145	**Data do not follow a Discernible Distribution**											
146												
147	**Nonparametric Distribution Free UCLs**											
148				95% CLT UCL	23.61					95% BCA Bootstrap UCL	24.57	
149				95% Standard Bootstrap UCL	23.65					95% Bootstrap-t UCL	24.66	
150				95% Hall's Bootstrap UCL	24.7					95% Percentile Bootstrap UCL	23.9	
151				90% Chebyshev(Mean, Sd) UCL	26.97					95% Chebyshev(Mean, Sd) UCL	30.34	
152				97.5% Chebyshev(Mean, Sd) UCL	35.01					99% Chebyshev(Mean, Sd) UCL	44.19	
153												
154	**Suggested UCL to Use**											
155				95% Student's-t UCL	23.67							
156												
157	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
158	**Please verify the data were collected from random locations.**											
159	**If the data were collected using judgmental or other non-random methods,**											
160	**then contact a statistician to correctly calculate UCLs.**											
161												
162	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
163	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
164	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
165												

166	**Manganese (Mn)**											
167												
168	**General Statistics**											
169					Total Number of Observations	77			Number of Distinct Observations	58		
170					Number of Detects	74			Number of Non-Detects	3		
171					Number of Distinct Detects	58			Number of Distinct Non-Detects	1		
172					Minimum Detect	2			Minimum Non-Detect	2		
173					Maximum Detect	566			Maximum Non-Detect	2		
174					Variance Detects	16235			Percent Non-Detects	3.896%		
175					Mean Detects	82.31			SD Detects	127.4		
176					Median Detects	29			CV Detects	1.548		
177					Skewness Detects	2.49			Kurtosis Detects	5.915		
178					Mean of Logged Detects	3.382			SD of Logged Detects	1.526		
179												
180	**Normal GOF Test on Detects Only**											
181					Shapiro Wilk Test Statistic	0.636			**Normal GOF Test on Detected Observations Only**			
182					1% Shapiro Wilk P Value	0			Detected Data Not Normal at 1% Significance Level			
183					Lilliefors Test Statistic	0.264			**Lilliefors GOF Test**			
184					1% Lilliefors Critical Value	0.119			Detected Data Not Normal at 1% Significance Level			
185	**Detected Data Not Normal at 1% Significance Level**											
186												
187	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
188					KM Mean	79.18			KM Standard Error of Mean	14.35		
189					90KM SD	125			95% KM (BCA) UCL	102.1		
190					95% KM (t) UCL	103.1			95% KM (Percentile Bootstrap) UCL	103.1		
191					95% KM (z) UCL	102.8			95% KM Bootstrap t UCL	111.1		
192					90% KM Chebyshev UCL	122.2			95% KM Chebyshev UCL	141.7		
193					97.5% KM Chebyshev UCL	168.8			99% KM Chebyshev UCL	221.9		
194												
195	**Gamma GOF Tests on Detected Observations Only**											
196					A-D Test Statistic	1.656			**Anderson-Darling GOF Test**			
197					5% A-D Critical Value	0.808			Detected Data Not Gamma Distributed at 5% Significance Level			
198					K-S Test Statistic	0.116			**Kolmogorov-Smirnov GOF**			
199					5% K-S Critical Value	0.109			Detected Data Not Gamma Distributed at 5% Significance Level			
200	**Detected Data Not Gamma Distributed at 5% Significance Level**											
201												
202	**Gamma Statistics on Detected Data Only**											
203					k hat (MLE)	0.601			k star (bias corrected MLE)	0.585		
204					Theta hat (MLE)	137			Theta star (bias corrected MLE)	140.6		
205					nu hat (MLE)	88.9			nu star (bias corrected)	86.62		
206					Mean (detects)	82.31						
207												
208	**Gamma ROS Statistics using Imputed Non-Detects**											
209	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
210	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)											
211	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
212	This is especially true when the sample size is small.											
213	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
214					Minimum	0.01			Mean	79.1		
215					Maximum	566			Median	27		
216					SD	125.9			CV	1.592		
217					k hat (MLE)	0.49			k star (bias corrected MLE)	0.48		
218					Theta hat (MLE)	161.4			Theta star (bias corrected MLE)	164.9		
219					nu hat (MLE)	75.48			nu star (bias corrected)	73.87		
220					Adjusted Level of Significance (β)	0.0469						

221					Approximate Chi Square Value (73.87, α)	55.08				Adjusted Chi Square Value (73.87, β)		54.77
222					95% Gamma Approximate UCL	106.1				95% Gamma Adjusted UCL		106.7
223												
224					**Estimates of Gamma Parameters using KM Estimates**							
225					Mean (KM)	79.18				SD (KM)		125
226					Variance (KM)	15633				SE of Mean (KM)		14.35
227					k hat (KM)	0.401				k star (KM)		0.394
228					nu hat (KM)	61.76				nu star (KM)		60.68
229					theta hat (KM)	197.4				theta star (KM)		200.9
230					80% gamma percentile (KM)	127.6				90% gamma percentile (KM)		224.2
231					95% gamma percentile (KM)	330.7				99% gamma percentile (KM)		598.8
232												
233					**Gamma Kaplan-Meier (KM) Statistics**							
234					Approximate Chi Square Value (60.68, α)	43.77				Adjusted Chi Square Value (60.68, β)		43.5
235					95% KM Approximate Gamma UCL	109.8				95% KM Adjusted Gamma UCL		110.5
236												
237					**Lognormal GOF Test on Detected Observations Only**							
238					Shapiro Wilk Approximate Test Statistic	0.948				**Shapiro Wilk GOF Test**		
239					10% Shapiro Wilk P Value	0.0102				Detected Data Not Lognormal at 10% Significance Level		
240					Lilliefors Test Statistic	0.0821				**Lilliefors GOF Test**		
241					10% Lilliefors Critical Value	0.0943				Detected Data appear Lognormal at 10% Significance Level		
242					**Detected Data appear Approximate Lognormal at 10% Significance Level**							
243												
244					**Lognormal ROS Statistics Using Imputed Non-Detects**							
245					Mean in Original Scale	79.13				Mean in Log Scale		3.237
246					SD in Original Scale	125.9				SD in Log Scale		1.664
247					95% t UCL (assumes normality of ROS data)	103				95% Percentile Bootstrap UCL		103.6
248					95% BCA Bootstrap UCL	106.1				95% Bootstrap t UCL		109.3
249					95% H-UCL (Log ROS)	180.3						
250												
251					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
252					KM Mean (logged)	3.277				KM Geo Mean		26.5
253					KM SD (logged)	1.575				95% Critical H Value (KM-Log)		2.896
254					KM Standard Error of Mean (logged)	0.181				95% H-UCL (KM -Log)		154.5
255					KM SD (logged)	1.575				95% Critical H Value (KM-Log)		2.896
256					KM Standard Error of Mean (logged)	0.181						
257												
258					**DL/2 Statistics**							
259					**DL/2 Normal**					**DL/2 Log-Transformed**		
260					Mean in Original Scale	79.14				Mean in Log Scale		3.25
261					SD in Original Scale	125.9				SD in Log Scale		1.635
262					95% t UCL (Assumes normality)	103				95% H-Stat UCL		171.2
263					**DL/2 is not a recommended method, provided for comparisons and historical reasons**							
264												
265					**Nonparametric Distribution Free UCL Statistics**							
266					**Detected Data appear Approximate Lognormal Distributed at 10% Significance Level**							
267												
268					**Suggested UCL to Use**							
269					KM H-UCL	154.5						
270												
271					**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**							
272					**Please verify the data were collected from random locations.**							
273					**If the data were collected using judgmental or other non-random methods,**							
274					**then contact a statistician to correctly calculate UCLs.**							
275												

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Tin (Sn)

General Statistics

Total Number of Observations	77	Number of Distinct Observations	17
Number of Detects	66	Number of Non-Detects	11
Number of Distinct Detects	17	Number of Distinct Non-Detects	2
Minimum Detect	1	Minimum Non-Detect	1
Maximum Detect	16	Maximum Non-Detect	2
Variance Detects	7.438	Percent Non-Detects	14.29%
Mean Detects	4.312	SD Detects	2.727
Median Detects	4	CV Detects	0.632
Skewness Detects	2.48	Kurtosis Detects	8.619
Mean of Logged Detects	1.295	SD of Logged Detects	0.6

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.733	**Normal GOF Test on Detected Observations Only**
1% Shapiro Wilk P Value	5.551E-16	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.126	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	3.843	KM Standard Error of Mean	0.317
90KM SD	2.757	95% KM (BCA) UCL	4.473
95% KM (t) UCL	4.37	95% KM (Percentile Bootstrap) UCL	4.409
95% KM (z) UCL	4.364	95% KM Bootstrap t UCL	4.524
90% KM Chebyshev UCL	4.793	95% KM Chebyshev UCL	5.223
97.5% KM Chebyshev UCL	5.82	99% KM Chebyshev UCL	6.994

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.991	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.757	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.11	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)	3.154	k star (bias corrected MLE)	3.021
Theta hat (MLE)	1.367	Theta star (bias corrected MLE)	1.427
nu hat (MLE)	416.3	nu star (bias corrected)	398.8
Mean (detects)	4.312		

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	3.772
Maximum	16	Median	4
SD	2.856	CV	0.757

331					k hat (MLE)	1.369				k star (bias corrected MLE)		1.324
332					Theta hat (MLE)	2.756				Theta star (bias corrected MLE)		2.849
333					nu hat (MLE)	210.8				nu star (bias corrected)		203.9
334					Adjusted Level of Significance (β)	0.0469						
335					Approximate Chi Square Value (203.88, α)	171.8				Adjusted Chi Square Value (203.88, β)		171.3
336					95% Gamma Approximate UCL	4.475				95% Gamma Adjusted UCL		4.49
337												
338					**Estimates of Gamma Parameters using KM Estimates**							
339					Mean (KM)	3.843				SD (KM)		2.757
340					Variance (KM)	7.602				SE of Mean (KM)		0.317
341					k hat (KM)	1.943				k star (KM)		1.876
342					nu hat (KM)	299.2				nu star (KM)		288.8
343					theta hat (KM)	1.978				theta star (KM)		2.049
344					80% gamma percentile (KM)	5.797				90% gamma percentile (KM)		7.588
345					95% gamma percentile (KM)	9.303				99% gamma percentile (KM)		13.12
346												
347					**Gamma Kaplan-Meier (KM) Statistics**							
348					Approximate Chi Square Value (288.83, α)	250.5				Adjusted Chi Square Value (288.83, β)		249.8
349					95% KM Approximate Gamma UCL	4.431				95% KM Adjusted Gamma UCL		4.443
350												
351					**Lognormal GOF Test on Detected Observations Only**							
352					Shapiro Wilk Approximate Test Statistic	0.879				**Shapiro Wilk GOF Test**		
353					10% Shapiro Wilk P Value	5.1493E-7				Detected Data Not Lognormal at 10% Significance Level		
354					Lilliefors Test Statistic	0.258				**Lilliefors GOF Test**		
355					10% Lilliefors Critical Value	0.0997				Detected Data Not Lognormal at 10% Significance Level		
356					**Detected Data Not Lognormal at 10% Significance Level**							
357												
358					**Lognormal ROS Statistics Using Imputed Non-Detects**							
359					Mean in Original Scale	3.855				Mean in Log Scale		1.12
360					SD in Original Scale	2.765				SD in Log Scale		0.709
361					95% t UCL (assumes normality of ROS data)	4.379				95% Percentile Bootstrap UCL		4.378
362					95% BCA Bootstrap UCL	4.435				95% Bootstrap t UCL		4.5
363					95% H-UCL (Log ROS)	4.632						
364												
365					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
366					KM Mean (logged)	1.113				KM Geo Mean		3.043
367					KM SD (logged)	0.71				95% Critical H Value (KM-Log)		1.992
368					KM Standard Error of Mean (logged)	0.0816				95% H-UCL (KM -Log)		4.603
369					KM SD (logged)	0.71				95% Critical H Value (KM-Log)		1.992
370					KM Standard Error of Mean (logged)	0.0816						
371												
372					**DL/2 Statistics**							
373					**DL/2 Normal**					**DL/2 Log-Transformed**		
374					Mean in Original Scale	3.781				Mean in Log Scale		1.029
375					SD in Original Scale	2.843				SD in Log Scale		0.865
376					95% t UCL (Assumes normality)	4.32				95% H-Stat UCL		5.027
377					**DL/2 is not a recommended method, provided for comparisons and historical reasons**							
378												
379					**Nonparametric Distribution Free UCL Statistics**							
380					**Data do not follow a Discernible Distribution**							
381												
382					**Suggested UCL to Use**							
383					95% KM (t) UCL	4.37						
384												
385					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							

386	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
387	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
388												
389	**Vanadium (V)**											
390												
391	**General Statistics**											
392						Total Number of Observations	77			Number of Distinct Observations	43	
393						Number of Detects	74			Number of Non-Detects	3	
394						Number of Distinct Detects	42			Number of Distinct Non-Detects	1	
395						Minimum Detect	2.1			Minimum Non-Detect	2	
396						Maximum Detect	79			Maximum Non-Detect	2	
397						Variance Detects	312.2			Percent Non-Detects	3.896%	
398						Mean Detects	18.6			SD Detects	17.67	
399						Median Detects	12.5			CV Detects	0.95	
400						Skewness Detects	1.821			Kurtosis Detects	3.32	
401						Mean of Logged Detects	2.533			SD of Logged Detects	0.897	
402												
403	**Normal GOF Test on Detects Only**											
404						Shapiro Wilk Test Statistic	0.784			**Normal GOF Test on Detected Observations Only**		
405						1% Shapiro Wilk P Value	4.774E-15			Detected Data Not Normal at 1% Significance Level		
406						Lilliefors Test Statistic	0.175			**Lilliefors GOF Test**		
407						1% Lilliefors Critical Value	0.119			Detected Data Not Normal at 1% Significance Level		
408	**Detected Data Not Normal at 1% Significance Level**											
409												
410	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
411						KM Mean	17.95			KM Standard Error of Mean	2.008	
412						90KM SD	17.5			95% KM (BCA) UCL	21.04	
413						95% KM (t) UCL	21.29			95% KM (Percentile Bootstrap) UCL	21.23	
414						95% KM (z) UCL	21.25			95% KM Bootstrap t UCL	22.21	
415						90% KM Chebyshev UCL	23.97			95% KM Chebyshev UCL	26.7	
416						97.5% KM Chebyshev UCL	30.49			99% KM Chebyshev UCL	37.93	
417												
418	**Gamma GOF Tests on Detected Observations Only**											
419						A-D Test Statistic	1.055			**Anderson-Darling GOF Test**		
420						5% A-D Critical Value	0.771			Detected Data Not Gamma Distributed at 5% Significance Level		
421						K-S Test Statistic	0.113			**Kolmogorov-Smirnov GOF**		
422						5% K-S Critical Value	0.106			Detected Data Not Gamma Distributed at 5% Significance Level		
423	**Detected Data Not Gamma Distributed at 5% Significance Level**											
424												
425	**Gamma Statistics on Detected Data Only**											
426						k hat (MLE)	1.425			k star (bias corrected MLE)	1.377	
427						Theta hat (MLE)	13.05			Theta star (bias corrected MLE)	13.51	
428						nu hat (MLE)	210.9			nu star (bias corrected)	203.7	
429						Mean (detects)	18.6					
430												
431	**Gamma ROS Statistics using Imputed Non-Detects**											
432	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
433	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)											
434	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
435	This is especially true when the sample size is small.											
436	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
437						Minimum	0.01			Mean	17.87	
438						Maximum	79			Median	12	
439						SD	17.69			CV	0.99	
440						k hat (MLE)	0.927			k star (bias corrected MLE)	0.899	

441					Theta hat (MLE)	19.28					Theta star (bias corrected MLE)	19.87
442					nu hat (MLE)	142.7					nu star (bias corrected)	138.5
443					Adjusted Level of Significance (β)	0.0469						
444					Approximate Chi Square Value (138.50, α)	112.3					Adjusted Chi Square Value (138.50, β)	111.9
445					95% Gamma Approximate UCL	22.04					95% Gamma Adjusted UCL	22.13
446												
447					**Estimates of Gamma Parameters using KM Estimates**							
448					Mean (KM)	17.95					SD (KM)	17.5
449					Variance (KM)	306.3					SE of Mean (KM)	2.008
450					k hat (KM)	1.052					k star (KM)	1.019
451					nu hat (KM)	162					nu star (KM)	157
452					theta hat (KM)	17.06					theta star (KM)	17.61
453					80% gamma percentile (KM)	28.84					90% gamma percentile (KM)	41.13
454					95% gamma percentile (KM)	53.4					99% gamma percentile (KM)	81.86
455												
456					**Gamma Kaplan-Meier (KM) Statistics**							
457					Approximate Chi Square Value (157.00, α)	129					Adjusted Chi Square Value (157.00, β)	128.6
458					95% KM Approximate Gamma UCL	21.84					95% KM Adjusted Gamma UCL	21.92
459												
460					**Lognormal GOF Test on Detected Observations Only**							
461					Shapiro Wilk Approximate Test Statistic	0.961					**Shapiro Wilk GOF Test**	
462					10% Shapiro Wilk P Value	0.0727					Detected Data Not Lognormal at 10% Significance Level	
463					Lilliefors Test Statistic	0.0853					**Lilliefors GOF Test**	
464					10% Lilliefors Critical Value	0.0943					Detected Data appear Lognormal at 10% Significance Level	
465					**Detected Data appear Approximate Lognormal at 10% Significance Level**							
466												
467					**Lognormal ROS Statistics Using Imputed Non-Detects**							
468					Mean in Original Scale	17.93					Mean in Log Scale	2.447
469					SD in Original Scale	17.64					SD in Log Scale	0.978
470					95% t UCL (assumes normality of ROS data)	21.27					95% Percentile Bootstrap UCL	21.2
471					95% BCA Bootstrap UCL	21.51					95% Bootstrap t UCL	21.79
472					95% H-UCL (Log ROS)	23.96						
473												
474					**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**							
475					KM Mean (logged)	2.461					KM Geo Mean	11.72
476					KM SD (logged)	0.943					95% Critical H Value (KM-Log)	2.207
477					KM Standard Error of Mean (logged)	0.108					95% H-UCL (KM -Log)	23.2
478					KM SD (logged)	0.943					95% Critical H Value (KM-Log)	2.207
479					KM Standard Error of Mean (logged)	0.108						
480												
481					**DL/2 Statistics**							
482					**DL/2 Normal**						**DL/2 Log-Transformed**	
483					Mean in Original Scale	17.91					Mean in Log Scale	2.434
484					SD in Original Scale	17.65					SD in Log Scale	1.008
485					95% t UCL (Assumes normality)	21.26					95% H-Stat UCL	24.63
486					**DL/2 is not a recommended method, provided for comparisons and historical reasons**							
487												
488					**Nonparametric Distribution Free UCL Statistics**							
489					**Detected Data appear Approximate Lognormal Distributed at 10% Significance Level**							
490												
491					**Suggested UCL to Use**							
492					KM H-UCL	23.2						
493												
494					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
495					Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.							

	A	B	C	D	E	F	G	H	I	J	K	L
496	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
497												

Arsenic (As	D_Arsenic	Lead (Pb)	D_Lead (Pb)
2	0	35	1
2.2	1	35	1
2	0	34	1
2	0	19	1
5.3	1	***140***	1
2	0	18	1
2	0	17	1
2	0	5.3	1
2	0	5.6	1
2	0	8.9	1
3.1	1	***100***	1
2.1	1	**63**	1
2	0	6.5	1
2.2	1	4.8	1
5.0	1	23.9	1
4.0	1	27.2	1
3	1	120	1
5.5	1	65.55	1
18	1	**64.3**	1
5.0	1	26.6	1
2.0	1	5.6	1
6.0	1	**63.2**	1
3.0	1	4.7	1
2.0	1	34.0	1
2.0	1	15.3	1
3.0	1	18.7	1
4.0	1	28.9	1
2.0	1	7.8	1
6.0	1	**38.7**	1
4.0	1	31.5	1
3.0	1	6.5	1
2.0	1	19.9	1
4.5	1	14.25	1
3	1	8.8	1
5	1	30.8	1
4	1	22.5	1
4	1	8.0	1
4	1	20.1	1
4	1	12.6	1
5	1	**43.1**	1
4.5	1	30.05	1
2	1	15.6	1
6	1	18.6	1
6	1	17.0	1
4	1	14.7	1
7	1	31.0	1

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 2023-02-19 9:15:55 PM
From File	SED Data for UCLM_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (As)

General Statistics

Total Number of Observations	46	Number of Distinct Observations	13
Number of Detects	37	Number of Non-Detects	9
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	2	Minimum Non-Detect	2
Maximum Detect	18	Maximum Non-Detect	2
Variance Detects	7.415	Percent Non-Detects	19.57%
Mean Detects	4.254	SD Detects	2.723
Median Detects	4	CV Detects	0.64
Skewness Detects	3.689	Kurtosis Detects	18.24
Mean of Logged Detects	1.325	SD of Logged Detects	0.471

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.647	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.814	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.168	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	3.813	KM Standard Error of Mean	0.384
90KM SD	2.57	95% KM (BCA) UCL	4.585
95% KM (t) UCL	4.458	95% KM (Percentile Bootstrap) UCL	4.515
95% KM (z) UCL	4.445	95% KM Bootstrap t UCL	4.85
90% KM Chebyshev UCL	4.965	95% KM Chebyshev UCL	5.487
97.5% KM Chebyshev UCL	6.212	99% KM Chebyshev UCL	7.635

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.057	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.752	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.128	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.146	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.219	k star (bias corrected MLE)	3.895
Theta hat (MLE)	1.008	Theta star (bias corrected MLE)	1.092
nu hat (MLE)	312.2	nu star (bias corrected)	288.2
Mean (detects)	4.254		

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	3.496
Maximum	18	Median	3.05
SD	2.894	CV	0.828
k hat (MLE)	0.987	k star (bias corrected MLE)	0.937
Theta hat (MLE)	3.542	Theta star (bias corrected MLE)	3.73
nu hat (MLE)	90.81	nu star (bias corrected)	86.22
Adjusted Level of Significance (β)	0.0448		
Approximate Chi Square Value (86.22, α)	65.82	Adjusted Chi Square Value (86.22, β)	65.24
95% Gamma Approximate UCL	4.58	95% Gamma Adjusted UCL	4.62

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.813	SD (KM)	2.57
Variance (KM)	6.603	SE of Mean (KM)	0.384
k hat (KM)	2.202	k star (KM)	2.073
nu hat (KM)	202.6	nu star (KM)	190.7
theta hat (KM)	1.732	theta star (KM)	1.84
80% gamma percentile (KM)	5.685	90% gamma percentile (KM)	7.354
95% gamma percentile (KM)	8.943	99% gamma percentile (KM)	12.46

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (190.70, α)	159.8	Adjusted Chi Square Value (190.70, β)	158.8
95% KM Approximate Gamma UCL	4.552	95% KM Adjusted Gamma UCL	4.578

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**

83			10% Shapiro Wilk Critical Value		0.946	Detected Data Not Lognormal at 10% Significance Level						
84			Lilliefors Test Statistic		0.147	**Lilliefors GOF Test**						
85			10% Lilliefors Critical Value		0.132	Detected Data Not Lognormal at 10% Significance Level						
86	**Detected Data Not Lognormal at 10% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89			Mean in Original Scale		3.684	Mean in Log Scale						1.118
90			SD in Original Scale		2.705	SD in Log Scale						0.606
91			95% t UCL (assumes normality of ROS data)		4.353	95% Percentile Bootstrap UCL						4.369
92			95% BCA Bootstrap UCL		4.53	95% Bootstrap t UCL						4.675
93			95% H-UCL (Log ROS)		4.386							
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96			KM Mean (logged)		1.201	KM Geo Mean						3.324
97			KM SD (logged)		0.486	95% Critical H Value (KM-Log)						1.875
98			KM Standard Error of Mean (logged)		0.0727	95% H-UCL (KM -Log)						4.286
99			KM SD (logged)		0.486	95% Critical H Value (KM-Log)						1.875
100			KM Standard Error of Mean (logged)		0.0727							
101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**					**DL/2 Log-Transformed**						
104			Mean in Original Scale		3.617	Mean in Log Scale						1.066
105			SD in Original Scale		2.763	SD in Log Scale						0.678
106			95% t UCL (Assumes normality)		4.302	95% H-Stat UCL						4.478
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 Approximate Gamma Distributed at 5% Significance Level**											
111												
112	**Suggested UCL to Use**											
113			95% KM Adjusted Gamma UCL		4.578	95% GROS Adjusted Gamma UCL						4.62
114												
115	When a data set follows an approximate distribution passing only one of the GOF tests,											
116	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
117												
118	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
119	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
120	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
121												
122												
123	**Lead (Pb)**											
124												
125	**General Statistics**											
126			Total Number of Observations		46	Number of Distinct Observations						41
127						Number of Missing Observations						0
128			Minimum		4.7	Mean						30.03
129			Maximum		140	Median						20
130			SD		29.25	Std. Error of Mean						4.313
131			Coefficient of Variation		0.974	Skewness						2.215
132												
133	**Normal GOF Test**											
134			Shapiro Wilk Test Statistic		0.746	**Shapiro Wilk GOF Test**						
135			1% Shapiro Wilk Critical Value		0.927	Data Not Normal at 1% Significance Level						
136			Lilliefors Test Statistic		0.237	**Lilliefors GOF Test**						
137			1% Lilliefors Critical Value		0.151	Data Not Normal at 1% Significance Level						
138	**Data Not Normal at 1% Significance Level**											
139												
140	**Assuming Normal Distribution**											
141	**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**						
142			95% Student's-t UCL		37.28	95% Adjusted-CLT UCL (Chen-1995)						38.63
143						95% Modified-t UCL (Johnson-1978)						37.51
144												
145	**Gamma GOF Test**											
146			A-D Test Statistic		0.753	**Anderson-Darling Gamma GOF Test**						
147			5% A-D Critical Value		0.768	Detected data appear Gamma Distributed at 5% Significance Level						
148			K-S Test Statistic		0.126	**Kolmogorov-Smirnov Gamma GOF Test**						
149			5% K-S Critical Value		0.133	Detected data appear Gamma Distributed at 5% Significance Level						
150	**Detected data appear Gamma Distributed at 5% Significance Level**											
151												
152	**Gamma Statistics**											
153			k hat (MLE)		1.511	k star (bias corrected MLE)						1.427
154			Theta hat (MLE)		19.88	Theta star (bias corrected MLE)						21.05
155			nu hat (MLE)		139	nu star (bias corrected)						131.3
156			MLE Mean (bias corrected)		30.03	MLE Sd (bias corrected)						25.14
157						Approximate Chi Square Value (0.05)						105.8
158			Adjusted Level of Significance		0.0448	Adjusted Chi Square Value						105.1
159												
160	**Assuming Gamma Distribution**											
161			95% Approximate Gamma UCL		37.26	95% Adjusted Gamma UCL						37.52
162												
163	**Lognormal GOF Test**											
164			Shapiro Wilk Test Statistic		0.962	**Shapiro Wilk Lognormal GOF Test**						

10% Shapiro Wilk Critical Value	0.953	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.0784	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.119	Data appear Lognormal at 10% Significance Level
Data appear Lognormal at 10% Significance Level		

Lognormal Statistics			
Minimum of Logged Data	1.548	Mean of logged Data	3.036
Maximum of Logged Data	4.942	SD of logged Data	0.864

Assuming Lognormal Distribution			
95% H-UCL	40.11	90% Chebyshev (MVUE) UCL	42.9
95% Chebyshev (MVUE) UCL	48.78	97.5% Chebyshev (MVUE) UCL	56.94
99% Chebyshev (MVUE) UCL	72.97		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs			
95% CLT UCL	37.13	95% BCA Bootstrap UCL	38.74
95% Standard Bootstrap UCL	37.04	95% Bootstrap-t UCL	39.97
95% Hall's Bootstrap UCL	39.44	95% Percentile Bootstrap UCL	37.3
90% Chebyshev(Mean, Sd) UCL	42.97	95% Chebyshev(Mean, Sd) UCL	48.83
97.5% Chebyshev(Mean, Sd) UCL	56.97	99% Chebyshev(Mean, Sd) UCL	72.94

Suggested UCL to Use			
95% Adjusted Gamma UCL	37.52		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

APPENDIX D

HHRA Calculations

D HUMAN HEALTH CALCULATIONS

This appendix provides the equations and sample calculations for estimating exposures for all pathways quantitatively evaluated in the HHRA and their associated health risks, including:

- Direct soil contact (ingestion and dermal) See Section: D .1

D .1 DIRECT CONTACT WITH SOIL

This section describes the equations (including associated parameters and assumptions) and provides sample calculations for estimating the exposure and risk to human receptors from direct contact with soil contaminants.

Direct contact represents the total exposure from incidental ingestion of soil and dermal contact with soil. The equations used to calculate the dose due to incidental soil ingestion and dermal contact with soil (based on Health Canada, 2021) are as follows:

Equation for Calculating Exposure Dose from Soil Ingestion:

$$(L)ADD = \frac{C_S \times IR_S \times RAF_{oral} \times D_2 \times D_3 \times D_4}{BW \times LE} \quad \text{(Eqn .1 .1)}$$

Equation for Calculating Exposure Dose from Dermal Contact:

$$L(ADD) = \frac{[(C_S \times SA_H \times SL_H) + (C_S \times SA_O \times SL_O)] \times RAF_{Derm} \times D_2 \times D_3 \times D_4}{BW \times LE} \quad \text{(Eqn .1 .2)}$$

Equation for Calculating Exposure Dose from Direct Contact:

$$(L)ADD_{total} = (L)ADD_{SI} + (L)ADD_{DC} \quad \text{(Eqn .1 .3)}$$

Where:

ADD_{SI}	= Average Daily Dose from Soil Ingestion (mg/kg/day)
ADD_{DC}	= Average Daily Dose from Dermal Contact (mg/kg/day)
$LADD_{SI}$	= Lifetime Average Daily Dose from Soil Ingestion (mg/kg/day) – for carcinogens
$LADD_{DC}$	= Lifetime Average Daily Dose from Dermal Contact (mg/kg/day) – for carcinogens
C_s	= EPC of COC in soil (mg/kg)
IR_s	= Receptor soil ingestion rate (kg/day)
RAF_{oral}	= Relative absorption factor from the gastrointestinal tract (unitless)
SA_H	= Surface area of hands exposed for soil loading (cm^2)
SA_O	= Surface area other than hands exposed for soil loading (cm^2)
SL_H	= Soil loading rate to exposed skin of hands (kg/cm^2 – event)
SL_O	= Soil loading rate to exposed skin other than hands (kg/cm^2 – event)
RAF_{derm}	= Relative dermal absorption factor (unitless)
D_2	= Days per week exposed / 7 days
D_3	= Weeks per year exposed / 52 weeks
D_4	= Total years exposed (for carcinogens only)
BW	= Body weight (kg)
LE	= Life expectancy (years) (for carcinogens only)

The risk from direct contact with soil was calculated for non-carcinogenic and carcinogenic toxicity endpoints, expressed in the equations below:

Equation for Calculating Non-Carcinogenic Risk from Direct Contact:

$$HQ = \frac{Exposure\ Estimate}{TRV_{threshold}} \quad \text{(Eqn .1 .4)}$$

Where:

HQ = Hazard Quotient

Exposure Estimate = ADD_{total} (mg/kg/day)

$TRV_{threshold}$ = Threshold Toxicity Reference Value (Oral Reference Dose) (mg/kg/day)

D .1 .1 *SAMPLE CALCULATIONS FOR DIRECT CONTACT WITH SOIL - NON-CARCINOGENIC ASSESSMENT*

The following calculations were completed to predict exposure and non-carcinogenic hazard quotients associated with direct contact with soil for:

COC: **Aluminium**
Receptor: **Toddler**

STEP 1: SOIL INGESTION DOSE

The soil ingestion average daily dose is calculated as follows:

$$ADD = \frac{C_S \times IR_S \times RAF_{oral} \times D_2 \times D_3}{BW} \quad \text{(Eqn .1 .1)}$$

The input values are as follows:

PARAMETER	VALUE	UNITS	SOURCE
C_s	6.7E+03	mg/kg	95% UCLM
IRs	0.00008	kg/day	Health Canada, 2021
RAF_o	1	unitless	Health Canada, 2021
D_2	1.00	d/wks / 7 d	Site-Specific (2 d/wk)
D_3	1.00	wks/yr / 52 wks	Site-Specific (40 wk/yr)
BW	16.5	kg	Health Canada, 2021

Based on the above parameters, the average daily dose from incidental soil ingestion is:

3.3E-02 mg/kg/d

STEP 2: DERMAL CONTACT DOSE

The dermal contact average daily dose is calculated as follows:

$$ADD = \frac{[(C_S \times SA_H \times SL_H) + (C_S \times SA_O \times SL_O)] \times RAF_{Derm} \times D_2 \times D_3}{BW} \quad \text{(Eqn .1 .2)}$$

The input values are as follows:

PARAMETER	VALUE	UNITS	SOURCE
C_s	6.7E+03	mg/kg	95% UCLM
SA_H	430	cm^2	Health Canada, 2021
SA_O	2580	cm^2	Health Canada, 2021
SL_H	0.0000001	kg/cm^2 – event	Health Canada, 2021
SL_O	0.00000001	kg/cm^2 – event	Health Canada, 2021
RAF_{derm}	1		default
D_2	1.00	d/wks/7 d	Site-Specific (2 d/wk)
D_3	1.00	wks/yr/52 wks	Site-Specific (40 wk/yr)
BW	16.5	kg	Health Canada, 2021

Based on the above parameters, the average daily dose from dermal contact is:
2.8E-02 mg/kg/d

STEP 3: DIRECT CONTACT WITH SOIL DOSE

The direct contact with soil average daily dose is calculated as follows:

$$ADD_{Total} = ADD_{SI} + ADD_{DC} \quad \text{(Eqn .1 .3)}$$

The input values are as follows:

PARAMETER	VALUE	UNITS	SOURCE
ADD_{SI}	3.3E-02	mg/kg/d	Step 1
ADD_{DC}	2.8E-02	mg/kg/d	Step 2

Based on the above parameters, the average daily dose from direct contact with soil is:
6.1E-02 mg/kg/d

STEP 4: HAZARD QUOTIENT ASSOCIATED WITH DIRECT CONTACT WITH SOIL

The non-carcinogenic hazard quotient (HQ) associated with direct contact with soil is calculated as follows:

$$HQ = \frac{ADDtotal}{Oral\ Reference\ Dose} \quad \text{(Eqn .1 .4)}$$

The input values are as follows:

PARAMETER	VALUE	UNITS	SOURCE
ADD_{total}	6.1E-02	mg/kg/d	Step 3
Oral Reference Dose	1.0E+00	mg/kg/d	US EPA PPRTV 2006

Based on the above parameters, the HQ for direct contact with soil is:
6.1E-02 mg/kg/d

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