



**SNC • LAVALIN**

# Preliminary Regional Risk Assessment

For Contamination Related to the 2021  
Atmospheric River Flood Event  
Merritt Study Area

Prepared for:

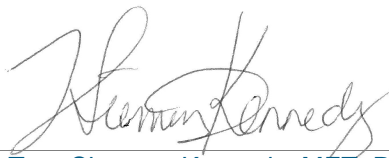
BC Ministry of Environment and Climate Change Strategy

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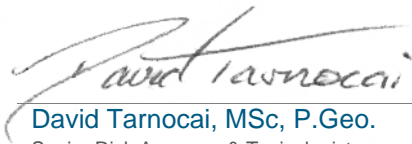
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# Executive Summary

In November 2021, “atmospheric river” events occurred across southwestern British Columbia (BC) causing widespread flooding and damage in some communities, including the City of Merritt. Excessive rainfall combined with warming temperatures resulted in increased snowmelt and rain-on-snow runoff, which led to the rapid and dramatic rise in the Coldwater River stage levels. As a result, the riverbanks and dikes overflowed, and City of Merritt’s sanitary sewer system, wastewater treatment plant, rapid infiltration basins and water supply system were damaged. The Merritt Study Area, defined as the area that was flooded within the City of Merritt, is the subject of this Preliminary Regional Risk Assessment (PRRA).

The objectives of the PRRA are to:

1. Assess the potential for contamination which is both associated with the November 2021 flood event and present at a regional scale to adversely impact human health and the environment, and
2. Identify areas where additional action or communication by government agencies are required.

The PRRA is based on data that are representative of conditions across areas impacted by flooded waters. Evaluation of contamination from point sources and risks to private properties or water wells from point source contamination were not assessed. The PRRA relies on data collected from public lands that were impacted by the flood to assess general conditions across the Study Area, including conditions considered representative of typical flood-related impacts to both public and private lands.

Contaminants of potential concern (COPCs) with the potential to be associated with the flood were identified in soil, sediment and groundwater for the evaluation of risks to human health only. No COPCs were identified for evaluating risks to ecological receptors of concern (ROCs) and, therefore, no unacceptable risks to the environment are predicted.

For evaluating risks to human health, the COPCs in each medium included the following indicators of potential microbiological contamination:

- › Soil: Total coliforms and fecal coliforms and *Escherichia coli* (*E. coli*);
- › Sediment: Total coliforms and fecal coliforms and *E. coli*; and
- › Groundwater: Total coliforms and *E. coli*.

With respect to the potential for adverse impacts to human health, the following conclusions and recommendations are provided.

## Soil and Sediment

Total coliforms, fecal coliforms and *E. coli* were found in soil collected from the Study Area, with the soil data conservatively assumed to be representative of sediment that remains in the waterbodies. When present, these coliforms may indicate the potential for other microorganisms; however, coliforms are also ubiquitous in the environment (Health Canada, 2020). The BC Ministry of Agriculture and Food (2022) indicates that over time (120 days) the extra load of potential bacteria that may result from flooding would be reduced in healthy soils exposed to ultraviolet rays from the sun. Given the time that has elapsed since the flood event, it is unlikely that potential bacteria from the flood remain in surface soils in the Study Area.

Given that coliform bacteria, including *E. coli*, may indicate the potential for other microorganisms, best practices for preventing illness are always recommended and include washing hands after contact with soil or sediment and to wash or cook produce. Further information on reducing risks from *E. coli* and other microorganisms is available at:

- › [Food Safety: Preparing | HealthLink BC](#), [Foodborne Illness and Safe Food Handling | HealthLink BC](#);
- › [Foodborne illness | HealthLink BC](#);
- › [E. Coli Infection from Food or Water | HealthLink BC](#);
- › [Hand Washing: Help Stop the Spread of Germs | HealthLink BC](#);
- › [Food Safety for Fresh Fruits and Vegetables | HealthLink BC](#); and
- › [Foodborne & Waterborne Diseases \(bccdc.ca\)](#).

The above recommendations align with existing BC Ministry of Health and BC Centre for Disease Control guidance for good hand hygiene and food safety.

### **Groundwater and Surface Water**

Total coliforms and *E. coli* were measured in groundwater samples collected from shallow monitoring wells in November 2021 days after the flood. No subsequent sampling of these wells was conducted. These parameters were not measured in groundwater samples from the City of Merritt's water supply wells. Shallow groundwater monitoring wells were likely contaminated during the flooding by flood water entering the well casing and/or by nearby broken sanitary sewer pipes discharging to shallow groundwater, but this has not been confirmed. Although flood-related contaminants were not detected in surface water, bacteria in groundwater have the potential to migrate to surface water over time. Based on this, any users of private water wells and surface water points of diversion in the Study Area should continue to follow health authority guidance for testing and disinfecting their water source. This guidance and information on how to manage flood-related drinking water issues is available at:

- › [Drinking Water | Environmental & Seasonal Health | IH \(interiorhealth.ca\)](#); and
- › [Floods & Landslides | Natural Disasters & Emergencies | IH \(interiorhealth.ca\)](#).

The above recommendations align with existing health authority guidance for private water well and point of diversion users.

### **Summary of the Results of the PRRA**

In summary, the results of the PRRA and recommended actions are as follows:

- › Bacteria were found in soil. However, they are naturally occurring in soil and unlikely to remain in surface soil with exposure to sunlight. Best practices for preventing illness, including good hand hygiene and food safety practices, are always recommended.
- › Potential flood-related impacts to groundwater were identified. Users of private water wells and surface water points of diversion should continue to follow health authority guidance for testing and disinfecting their water source.
- › No unacceptable risks were predicted for ecological receptors, including aquatic receptors in surface water bodies.

No additional actions or communications from government agencies are recommended for management of contamination in the Merritt Study Area from the November 2021 flood event.

# Table of Contents

Executive Summary	i
Acknowledgements	iv
<b>1 Introduction</b>	<b>1</b>
1.1 Preliminary Conceptual Site Model – Merritt Study Area	2
1.2 Guidance and Approach	3
<b>2 Problem Formulation</b>	<b>5</b>
2.1 Site Setting	5
2.2 Ecological Setting	6
2.3 Extent of 2021 Flood Boundary	6
2.3.1 Results of Site Reconnaissance	7
2.4 Priority Media and Potential Contaminants of Concern	9
2.4.1 Priority Potential Contaminants of Concern	10
2.5 Applicable Guidelines & Standards	11
2.6 Data Evaluated in the PRRA	12
2.6.1 SNC-Lavalin 2022 Soil Investigation (SNC-Lavalin, 2022b)	13
2.6.2 Data from Other Sources	14
2.6.3 Evaluation of Data Sources and Identification of Contaminants of Concern	14
2.6.3.1 Soil	17
2.6.3.2 Sediment	18
2.6.3.3 Groundwater	19
2.7 COPC Screening	20
2.7.1 Soil	21
2.7.2 Sediment	22
2.7.3 Groundwater	24
2.7.4 Summary of Contaminants of Potential Concern	25
2.8 Conceptual Site Model	25
2.9 Uncertainty Analysis	27

# Table of Contents (Cont'd)

<b>3</b>	<b>Conclusions and Recommendations</b>	<b>29</b>
3.1	Soil and Sediment .....	29
3.2	Groundwater and Surface Water.....	30
<b>4</b>	<b>Professional Statement</b>	<b>31</b>
<b>5</b>	<b>Notice to Reader</b>	<b>32</b>
<b>6</b>	<b>References</b>	<b>33</b>

## In-Text Figures

Figure 2-1: Estimated Extent of 2021 Flood Boundary – Merritt Study Area.....	7
Figure 2-2: COC Categorization Process .....	16
Figure 2-3: Updated Conceptual Site Model.....	26

## In-Text Photographs

Photographs 1 and 2: Typical observation of flood deposited sediment and debris on City streets, properties and sports fields .....	8
Photograph 3: Example of sediment and flood debris. ....	8

## In-Text Tables

Table 2-1: Soil COCs Identified in the Merritt Study Area .....	18
Table 2-2: Sediment COCs Identified in the Merritt Study Area .....	19
Table 2-3: Groundwater COCs Identified in the Merritt Study Area .....	20
Table 2-4: Secondary Soil COPC Screening for Merritt .....	21
Table 2-5: Secondary Sediment COPC Screening for Merritt .....	23
Table 2-6: Summary of Final COPCs Identified for the Merritt Study Area .....	25

# Table of Contents (Cont'd)

## Tables

- 1: Soil Sampling Log (Merritt)
- 2: Summary of Analytical Results for Soil – Total Metals
- 3: Summary of Analytical Results for Soil – Microbiological Tests
- 4: Summary of Analytical Results for Soil – Hydrocarbons
- 5: Summary of Analytical Results for Soil – Polycyclic Aromatic Hydrocarbons
- 6: Summary of Analytical Results for Soil – Volatile Organic Compounds
- 7: Summary of Analytical Results for Soil – Pesticides, Herbicides and Pyrethroids
- 8: Summary of Analytical Results for Soil – Chlorinated Phenols
- 9: Summary of Analytical Results for Soil – Polychlorinated Biphenyls
- 10: Summary of Analytical Results for Sediment – Total Metals
- 11: Summary of Analytical Results for Sediment – Microbiological Parameters
- 12: Summary of Analytical Results for Sediment – Hydrocarbons
- 13: Summary of Analytical Results for Sediment – Polycyclic Aromatic Hydrocarbons
- 14: Summary of Analytical Results for Sediment – Volatile Organic Compounds
- 15: Summary of Analytical Results for Sediment – Pesticides, Herbicides and Pyrethroids
- 16: Summary of Analytical Results for Sediment – Chlorinated Phenols
- 17: Summary of Analytical Results for Sediment – PCBs
- 18: Summary of Merritt Soil Data from Other Sources
- 19: Summary of Merritt Soil Data from Other Sources Compared to Sediment Standards and Guidelines
- 20: Summary of Merritt Groundwater Data from Other Sources
- 21: Summary of Merritt Surface Water Data from Other Sources

## Drawing

- › 688421-003 - Sample Location Plan - Merritt

## Appendices

- I: SNC-Lavalin Memorandum (2022b) – Results of Surficial Soil Sampling Investigation, Merritt Study Area
- II: PRRA Supporting Information

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## Acknowledgements

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Several members of the multiple agencies that participated in this project have also provided invaluable input into the completion of this Preliminary Regional Risk Assessment. This includes Cindy Meays, Robyn Roome, Danielle Grbavac, Steven Dankevy, Kristy Gabelhouse and Chelsea Eby from the BC ENV, Cara Lachmuth, David Fishwick and Geneen Russo from the BC Ministry of Health and Rob Fleming from the First Nations Health Authority.

# 1 Introduction

In November 2021, “atmospheric river” events occurred across southwestern BC causing widespread flooding and damage in some communities, including the City of Merritt. Excessive rainfall combined with warming temperatures resulted in increased snowmelt and rain-on-snow runoff, which led to the rapid and dramatic rise in the Coldwater River stage levels in the Merritt Study Area. Consequently, riverbanks and dikes overflowed and the City of Merritt’s sanitary sewer system, wastewater treatment plant, rapid infiltration basins and water supply system were damaged. The Merritt Study Area, defined as the area that was flooded within the City of Merritt, is the subject of this Preliminary Regional Risk Assessment (PRRA). The PRRA has been conducted based on data representative of regional conditions in areas impacted by flood waters. The PRRA uses data collected from flood-impacted, public lands to assess general conditions across the Study Area, including conditions considered representative of typical flood-related impacts to public and private lands. The PRRA does not include the evaluation of point source contamination or risks from point sources to private properties or water wells.

The assessment focused on the priority contaminants, environmental media, receptors and pathways, which are defined as those that have the potential to drive risk to human health and the environment. These parameters are identified in the SNC-Lavalin report *Preliminary Conceptual Site Models of Potential Contamination Related to the 2021 Atmospheric River Event in BC, Hope, Sumas Prairie, Princeton and Merritt*, dated March 30, 2022 (SNC-Lavalin, 2022a). The Preliminary Conceptual Site Model (CSM) for the Study Area from SNC-Lavalin (2022a) has been updated based on the findings of the PRRA.

The objectives of the PRRA are to assess the potential for contamination which is both associated with the November 2021 flood event and present on a regional scale to adversely impact human health and the environment. Further it is to identify areas where additional action or communication by government agencies is required. Based on information provided by the province, areas of concern could include, but are not limited to:

- › Identifying public health hazards under the *Public Health Act* and drinking water health hazards under the *Drinking Water Protection Act* by the regional health authorities;
- › Determining whether notifications or water advisories to water users across a specified geographic region are required;
- › Identifying areas where contaminants of potential concern (COPCs) pose an immediate and ongoing risk and require immediate action to protect public health;
- › Identifying areas where COPCs pose a long-term risk and require action to protect public health;
- › Identifying areas which contain media that are considered contaminated under the *Environmental Management Act*<sup>1</sup> (EMA) and/or *Contaminated Sites Regulation*<sup>2</sup> (CSR);
- › Identifying areas with ecological receptors potentially sensitive to COPCs;
- › Identifying areas known or expected to include habitat of animals that the federal or provincial governments recognize as threatened, endangered, or of special concern; and
- › Identifying areas with year-round ecological receptors or migratory birds.

<sup>1</sup> *Environmental Management Act* (EMA), B.C. Reg. 179/2021 / effective July 7, 2021.

<sup>2</sup> *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 179/2021, July 7, 2021.

This PRRA comprises a human health and ecological risk assessment Problem Formulation only, because, based on the results of the Problem Formulation, a more detailed risk assessment is not required.

This report presents the findings of the PRRA and includes:

- › **Section 2:** Human health and ecological risk assessment Problem Formulation, including the identification of contaminants of concern (COCs) that are potentially related to the flood event and have the potential to be present at a regional scale. The Problem Formulation also included a secondary screening of the COCs to identify final COPCs. Based on the results of the secondary screening, final COPCs were limited to total coliforms, fecal coliforms and *Escherichia coli* (*E. coli*) in soil and sediment, and total coliforms and *E. coli* in groundwater. These parameters are used as the indicators for microbiological contaminants, were identified for the evaluation of risks to human health only and were evaluated qualitatively. The updated human health and ecological CSM is presented in **Section 2.8**.
- › **Section 3:** Discussion and Conclusions.
- › **Section 4:** Professional Statement.
- › **Section 5:** Notice to Reader.
- › **Section 6:** References.

Tables and Drawings follow **Section 6**, and SNC-Lavalin (2022b) Surficial Soil Sampling memorandum is included in **Appendix I**. **Appendix II** presents PRRA Supporting Information.

## 1.1 Preliminary Conceptual Site Model – Merritt Study Area

To help understand the potential contamination risks resulting from flooding events in BC, SNC--Lavalin (2022a) developed Preliminary CSMs for each of the study areas impacted by the 2021 atmospheric rivers, including the Merritt Study Area, which is the focus of this PRRA. In addition, data gaps and uncertainties associated with understanding the impacts of the flood event were identified, and recommendations for addressing data gaps were provided.

The Preliminary CSM for the Merritt Study Area described the setting of the Study Area and defined the extent of the 2021 flood boundary; this information is included in **Sections 2.1, 2.2 and 2.3**. Priority sources and activities were also identified, as were related potential contaminants of concern (PCOCs), which are the contaminants identified as having the potential to be present, based on the potential sources of contamination identified in the Study Area. From the PCOCs identified, a list of *priority* PCOCs was created for the Study Area, which included microbiological parameters<sup>3</sup>, metals, fuels (such as gasoline, diesel, heating oil etc.) and nitrogen parameters (e.g., nitrate). These priority PCOCs and potential sources are described in further detail in **Section 2.4**.

Finally, the Preliminary CSM (SNC-Lavalin, 2022a) identified potential exposure pathways between these priority PCOCs and receptors in the Study Area that were considered to have the potential to drive risks. These included:

- › Human consumption of groundwater or surface water as drinking water;
- › Human incidental ingestion of shallow soils contaminated by receding floodwaters;

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<sup>3</sup> Microbiological parameters related to human and animal waste; referred to as pathogens in SNC-Lavalin (2022a).

- › Plant and soil invertebrate direct contact with shallow soils contaminated by receding floodwaters and/or irrigated with contaminated groundwater and/or surface water;
- › Aquatic primary producer direct contact with nitrates in surface water (i.e., potential eutrophication); and
- › Aquatic invertebrate direct contact with contaminated sediments and/or surface water.

In the PRRA, these priority PCOCs were identified as COCs when the measured concentrations exceeded applicable benchmarks or when non-regulated parameters were detected frequently. The COCs were then retained as preliminary COPCs and evaluated in a secondary screening process as final COPCs. The COPC screening is provided in **Section 2.7**.

Based on the results of the secondary screening, final COPCs were limited to total coliforms, fecal coliforms and *E. coli* in soil and sediment, and total coliforms and *E. coli* in groundwater. These parameters are indicators of potential microbiological contamination, were identified for the evaluation of risks to human health only and were evaluated qualitatively, so the PRRA did not proceed past the Problem Formulation phase. The Preliminary CSM was updated based on the results of the PRRA, and the updated model is provided in **Section 2.8**.

## 1.2 Guidance and Approach

Lands under multiple jurisdictions were impacted by the flood event, including the Coldwater 1 Reserve (the Coldwater Band) and the Nicola Mameet 1 Reserve (Lower Nicola Band). Therefore, both federal and provincial regulations were considered in the PRRA, together with risk assessment guidance from Health Canada, the Canadian Council of Ministers of the Environment (CCME) and the BC Ministry of Environment and Climate Change Strategy (BC ENV). The specific methods and guidance applied in this work included Health Canada (2021a,b), CCME (2020) and BC ENV (2021a,b)<sup>4</sup>. The federal and provincial guidance is founded on the best available science and is consistent with risk assessment methods recommended by international regulatory agencies, including the United States Environmental Protection Agency (US EPA).

The PRRA used a phased approach:

- › **Phase 1:** Compiling data, sampling and identifying major data gaps; and
- › **Phase 2:** Problem Formulation, including updating the CSM from SNC-Lavalin (2022a).

As noted, based on the results of the Problem Formulation, a more detailed risk assessment is not required (i.e., the PRRA did not advance past Phase 2).

In Phase 1 existing data from the Merritt Study Area were compiled (including soil and groundwater data available from other sources) and field investigations and sampling were conducted to characterize surface soil within the Study Area. Data representative of the Merritt Study Area are included in tables following the report text. Parameters that exceeded the benchmarks were identified as COCs. Microbiological parameters that were detected and/or that exceeded applicable guidelines were also identified as COCs, as were unregulated parameters that were detected, considered to have the potential to be associated with the flood event and considered to be present at a regional scale.

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<sup>4</sup> Assessment of microbiological parameters was conducted using methods and guidance from health agencies and best practice determined based on the scientific literature.

The Problem Formulation (Phase 2) of the PRRA included the following:

- › **Identifying preliminary COPCs:** All COCs identified as having the potential to be associated with the flood event were identified as preliminary COPCs. These are Category A COCs and are described in **Section 2.6.3**.
- › **Identifying final COPCs:** Final COPCs were identified by screening the maximum concentrations of preliminary COPCs against receptor-pathway specific benchmarks (protective of human and ecological receptors).
- › **Updating the Preliminary CSM:** The Preliminary CSM from SNC-Lavalin (2022a) was updated based on results of the Problem Formulation.
- › **Discussing results and drawing conclusions:** The results of the PRRA are presented.
- › **Providing recommendations:** Based on the results of the PRRA, recommendations are provided.

It is noted that the following items were considered outside of the scope of the PRRA:

- › Assessment of risks from point source contamination on private property, including impacts to individual properties, dwellings or private water wells; and
- › Public communication of health messaging.

SNC-Lavalin understands that the requirement for public communication will be determined by the regulatory agencies, based on the results of the PRRA.

## 2 Problem Formulation

### 2.1 Site Setting

The City of Merritt is in the Nicola Valley at the Nicola-Coldwater River confluence and at an approximate elevation of 605 m. It straddles both the Nicola and Coldwater River watersheds and lies within the 200-year floodplain of both watersheds. The Nicola River is highly sinuous, running westward into Merritt and northwest leaving it. The Coldwater River enters Merritt from the southwest and joins the Nicola River. To mitigate flooding to the City of Merritt, the Nicola River has 700 m of constructed dikes, and the Coldwater River has 2.6 km of dikes.

The Study Area comprises the lands in Merritt that were flooded in November 2021 (see **Figure 2-1** in **Section 2.3**). Lands within the Merritt Study Area are under multiple jurisdictions and include the Coldwater 1 Reserve (Coldwater Band) and the Nicola Mameet 1 Reserve (Lower Nicola Band). The Antiko 21 Reserve (Cook's Ferry Band) and Joeyaska No. 2 Reserve (Lower Nicola Band) are located on the outskirts of Merritt but were outside the flood boundary as defined in the Preliminary CSM (SNC-Lavalin, 2022a).

Land use in the Study Area comprises a mixture of residential, commercial and industrial land, with parklands near the rivers and agricultural land along the perimeter of the city. Industrial land is located mainly in the southern portion of Merritt.

Merritt is primarily underlain by shallow fluvial and glacio-fluvial sands and gravel, up to 50 m thick, which spans the area between the two rivers from their confluence to the Coquihalla Highway. Surficial geology in the valley surrounding Merritt consists of fluvial, glaciofluvial, lacustrine (i.e., lake) and glaciolacustrine deposits, along with till and colluvium along the valley walls and uplands. Bedrock within the eastern portion of Merritt consists of the Eocene Princeton group of sedimentary rocks, which consist of sandstone, conglomerate, argillite and coal. In the western portion of Merritt is the Nicola Group, the western volcanic facies, which consist of mafic to felsic pyroclastic rocks and flows, argillite, sandstone and local carbonate rocks. The depth to bedrock at the Kengard groundwater supply well was 164 m.

Numerous unconfined shallow aquifers and confined deeper aquifers are present. Underlying most of Merritt is the unconfined Upper Merritt sand and gravel Aquifer (#74), which has been classified as high productivity and high vulnerability to contamination. The average static water level of the aquifer is 3.6 m below ground surface (bgs). Other shallow aquifers include the unconfined Shallow Joeyaska Aquifer to the southeast, and the unconfined Stumbles Creek Aquifer to the northwest. Merritt has five groundwater production wells, four of which are screened within the Shallow Merritt Aquifer, and one well (the Kengard well) that is screened in the confined Lower Merritt Aquifer. Both the Nicola and Coldwater Rivers are in hydraulic communication with the underlying Shallow Merritt Aquifer, providing recharge to the aquifer under both pumping and non-pumping conditions.

Merritt and the surrounding area have a semi-arid climate, with hot, dry summers and cold winters, and 321.1 mm of average precipitation. The wettest months are June, November and December, and the driest months are March and April. Infiltration is estimated at 15 mm/year (5% of total precipitation) (BC ENV, 2009). The Environment Canada Merritt weather station is located at 50° 06'51.004" N, 120° 48'03.005" W at an elevation of 609.00 m (Government of Canada, 2022). Data from this station indicate an average daily air temperature of 7.8°C. The mean annual precipitation was recorded at 321.1 mm between 1981 and 2010. The monthly precipitation ranges from 15.1 mm in April to 36.6 mm in June. Most of the snowfall

precipitation occurs between November and January. It is acknowledged that these “normals” do not capture the last 12 years of temperature or precipitation data, and that weather events that would lead to moderate and severe riverine flooding (including extreme precipitation such as the 2021 atmospheric river) have and will continue to become more frequent in the years and decades ahead (BC ENV, 2019).

## 2.2 Ecological Setting

The Merritt Study Area is located within two biogeoclimatic zones: the Bunchgrass (BG) zone, within the very dry warm or middle grassland subzone (BGxw; BC MFLNRD, 2016), and the Ponderosa Pine (PP), very dry hot (PPxh) zone and subzone. The BG zone comprises the grasslands that dominate the lower elevations of the major southern interior valleys of BC, from valley bottoms up to approximately 700 m to 1,000 m; the PP zone and subzone occurs at low elevations along the very dry valleys of the southern Interior Plateau of BC. The climate of these zones is characterized by warm to hot, dry summers and moderately cold winters with relatively little snowfall, as indicated in the climate normals information provided in **Section 2.1**. The following information on the BG and PP zones is summarized from Meidinger and Pojar (1991).

Because spring is relatively dry and summer precipitation evaporates before it can contribute to recharging soil moisture, plant growth in the BG zone depends mainly on winter moisture, with plants becoming increasingly stressed as the summer progresses. Summer drought and warm temperatures are the primary factors contributing to the development of graminoid vegetation, with grasslands characterized by widely spaced bunchgrasses and a cryptogam crust. Patterns of plant communities within the BG zone are poorly understood because livestock overgrazing in these regions has caused dramatic alterations to the composition of the vegetation. The BGxw subzone is generally characterized by the absence of big sagebrush (which is present in the other BG subzone), the presence of more closely spaced bluebunch wheatgrass, a slightly higher diversity of forbs, and a slightly lower diversity of lichens. The occasional Ponderosa Pine or Douglas Fir may be present.

Although the BG zone is one of the smallest zones in BC, it supports a tremendous diversity and density of wildlife. This is partly due to the wide range of habitats created by the grasslands, shrub-steppe, riparian areas and forest that all have the potential to be present in this zone, and partly due to its location, because both southern and northern species frequent this zone.

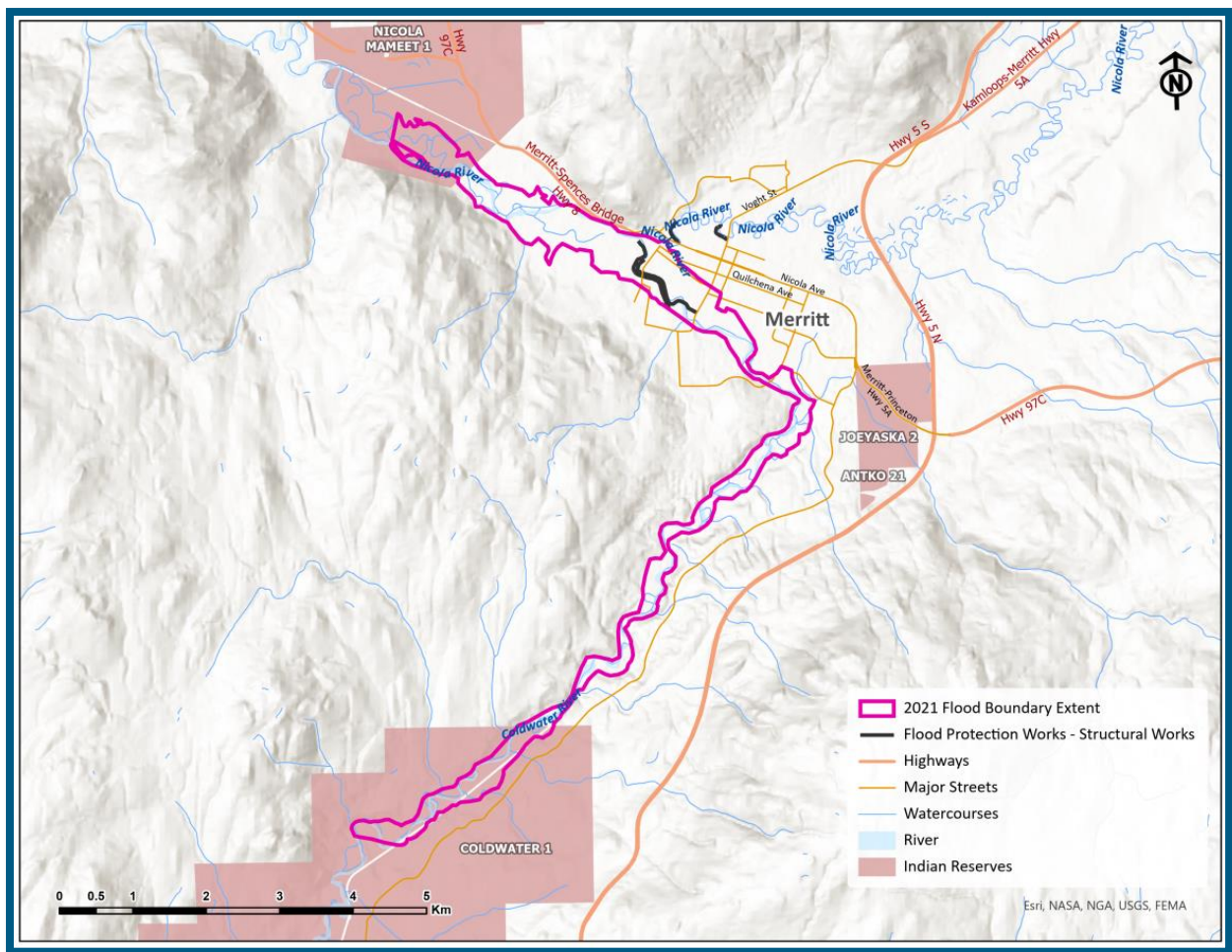
The forests within the PP zone are dominated by Ponderosa Pine, with very open, parklike stands with a Ponderosa Pine canopy and an understory dominated by bluebunch wheatgrass. Ponderosa Pine is well adapted to forest fire, and fires have played an important ecological role in the PP zone. Grasslands also occur throughout the PP zone, likely the result of edaphic and topographic conditions, combined with fire history. The three factors that most influence the wildlife species present in this zone are short winters with low snowfall, the zone’s location between the Great Basin to the south and the boreal forests to the north, and a great diversity of vegetation types.

## 2.3 Extent of 2021 Flood Boundary

The 200-year floodplain was defined in 1988 (BC ENV, 1988) and was re-evaluated in 2021 (BGC, 2021). While the extent of the floodplain evaluated in 2021 was similar to that defined in 1988, there were some variations. The 2021 floodplain model extended further into residential/industrial areas of Merritt than the previous model. The flood extent observed on November 16, 2021, was comparable to the BGC Engineering Inc.’s 2021 (BGC, 2021) 200 m flood extent with 0.6 m of freeboard.

During the flood event on November 15, 2021, the Coldwater River discharge rate increased to over 400 m<sup>3</sup>/s (the prior maximum discharge rate was approximately 125 m<sup>3</sup>/s). BGC (2021) estimated that the 500-year peak discharge rate was 163 m<sup>3</sup>/s which was exceeded during the flood event. Water levels increased to over 3.5 m (the maximum water level previously recorded was approximately 2.3 m). The dikes in Merritt were breached resulting in flooding. The maximum extent of the flood was evaluated using the NRC imaging data, the Rapid Damage Assessment Boundaries - Restricted or Unsafe, the Flood Impact Area, and by carefully reviewing topography along the area of the NRC image. The November 15, 2021, flood boundary is shown in the below figure.

**Figure 2-1: Estimated Extent of 2021 Flood Boundary – Merritt Study Area**



### 2.3.1 Results of Site Reconnaissance

On March 23, 2022, SNC-Lavalin conducted a reconnaissance (i.e., via driving and walking) across most of the Study Area to ground truth the flood boundary that was established in SNC-Lavalin (2022a) and to identify sample locations where flood-related sediment was deposited. This site reconnaissance was limited to areas with public access such as parks, trails, roadways, and school grounds.

Observations and discussions with residents indicated that the flood extent boundary established by SNC-Lavalin (2022a) was well defined. At the time of the reconnaissance, most of the downtown and residential areas were undergoing clean-up and large volumes of sediment, tree branches, logs, construction debris, and household items (e.g., chairs, toys, tires, etc.) were being removed. Riverbanks, dikes, roads, bridges, and buildings were also undergoing repair while some structures appeared to be condemned. Where the Coldwater River changed course before flowing through the City of Merritt, infrastructure was destroyed, including homes and the wastewater treatment plant's rapid infiltration basins. No signs of hydrocarbon fuel releases were observed. The remaining sediments deposited by the flood were identified as silt and/or fine-grained sand with varying amounts of silt and clay. Photographs from the site reconnaissance are presented below, with additional photographs included in the SNC-Lavalin (2022b) surface soil sampling memorandum included in **Appendix I**.



**Photographs 1 and 2: Typical observation of flood deposited sediment and debris on City streets, properties and sports fields.**



**Photograph 3: Example of sediment and flood debris. Material deposited against chain link fence surrounding a sports field. Note the estimated height of the flood water mark.**

Based on the results of the site reconnaissance, five soil sample locations were identified. The results of SNC-Lavalin's soil sampling are documented separately (SNC-Lavalin, 2022b, included in **Appendix I**) and discussed further in **Section 2.6.1**.

## 2.4 Priority Media and Potential Contaminants of Concern

It is well documented that severe flooding events can result in contaminants being mobilized or remobilized and spatially transported and distributed. The 2021 flooding event in the Study Area was a rapid, high-energy event that scoured and transported natural and human-made materials a significant distance. Sediments transported from the Coldwater River were deposited across the Study Area and remained in some locations after the flood water receded.

While the deposited sediments were subsequently removed from some areas, the sediments that remain in other areas are now, effectively, soil. In this report, sediments deposited on land during the flood event will be referred to and treated as surface soil. The potential impacts on the mobility and availability of contaminants in the sediments that have become soil, as well as the smaller soil particle size associated with sediments deposited on soil, were considered in the PRRA.

The potential also exists that prior to receding, flood waters infiltrated soils across the Study Area and mixed with shallow groundwater. The flooding caused damage to the City's water supply system and sanitary sewer system. Some water lines broke and some areas of the water system were depressurized. The City of Merritt immediately issued a notice of "Contaminated Drinking Water" and the Interior Health Authority issued a "Do Not Consume" order while the City worked diligently to isolate, flush and restart the system, and also to disinfect and flush water supply wells. The potential for flood waters to have reached deeper aquifers is anticipated to be low; nonetheless the potential exists that shallow groundwater impacted by the flood event is being used for drinking water or agricultural purposes, specifically outside of the City of Merritt's water distribution system network, or that it could have migrated to downgradient surface water bodies.

For water courses in the Study Area, no data for sediments (i.e., particulate material that remains in rivers, streams or ditches below the highwater mark) that are representative of post-flood conditions were available. Due to the lack of sediment data, the available soil data (i.e., collected from sediments deposited on land during the flood event) were conservatively assumed to be representative of sediment and were screened against the applicable sediment benchmarks to identify COCs.

Given the rapid, high-energy nature of the flood event and resulting safety concerns, limited surface water data was collected after the event. Like sediment, surface water has the potential to have been impacted by flooding through natural and human-made materials being transported across lands that are generally "dry" into the rivers in the Study Area. However, given that the Coldwater River is high-flow and high-volume, flood associated impacts, if any, would have been limited both temporally to a narrow window immediately following the flood event and spatially, given the magnitude of dilution within the river and flow downgradient. That temporal and spatial impacts would have been limited is supported by the available data representative of post-flood conditions in the Sumas Prairie Study Area, which indicated that concentrations of any flood-related PCOCs in surface water returned to baseline levels in December 2021 (Gabelhouse et al., 2022).

The available surface water data for the Study Area came from the BC ENV's Environmental Monitoring System (EMS). They were collected between December 2021 and March 2022. The data are for samples collected both upstream and downstream of the City of Merritt's wastewater treatment plant and rapid infiltration basins, which were identified to be a potential source of contamination during the flood event. Select parameters, including nitrogen (N) parameters (Nitrate+Nitrate-N and Nitrogen), fecal coliforms and *E. coli*, were consistently detected in the surface water samples upstream and downstream of the wastewater treatment plant. While these parameters were detected in December 2021 (i.e., during the first sampling events following the flood), the maximum measured concentrations occurred in the months following, specifically in samples collected on January 18, 2022 (EMS location E326633) and on March 9 and 17, 2022 (EMS locations E326633 and E326634). The maximum concentrations were detected at locations downgradient of the wastewater treatment plant; however, the timing of the events and associated results suggest that the presence of these parameters in surface water is not flood-related.

Based on the considerations described above, the flood does not appear to have impacted surface water quality. Nonetheless, surface water contaminants from other sources are present in the Coldwater River.

Given the mechanisms by which the flood had the potential to impact the environment, the conclusions and recommendations of SNC-Lavalin (2022a) generally focused on the following media:

- › Surface soil, including sediments that were deposited on land during the flood event. Surface soil was defined as ground surface to 0.15 m for land that has not been disturbed since the flood. The rationale is that this is the depth horizon where the highest concentrations of flood-related contaminants would be expected to be found (i.e., material deposited from the flood).
- › Sediments, which are defined as sediments that remain in rivers, streams or ditches below the high-water mark.
- › At-risk drinking water sources.

Available data representative of these priority media, including surface soil (which was also considered to be representative of sediments) and groundwater, are further discussed and evaluated in subsequent sections of the PRRA.

## 2.4.1 Priority Potential Contaminants of Concern

Based on a review of potential sources and activities in both the general region and the interpreted flood extent for the Study Area, the priority sources of contamination were the City of Merritt's sanitary sewer system, wastewater treatment plant, and rapid infiltration basins which were damaged by the rapid, high energy flood event. However, other sources were also considered. Priority PCOCs and the media these contaminants are most likely to be associated with are:

- › Microbiological parameters: Potential sources of microbiological parameters could be the damaged wastewater treatment system and associated infrastructure, the sanitary sewer network and upstream, on-site domestic septic systems and/or livestock feed lots in the Study Area.
- › Metals: Numerous anthropogenic and natural sources of metals are present in the Merritt Study Area. In previous studies on potential contamination caused from flooding, metals were often COCs due to their persistence as pollutants (Ibragimow et al., 2013; Ciszewski and Grygar, 2016; Ponting et al., 2021). These studies indicated the potential for the mobility or availability of some metals to change through altered redox conditions resulting from flooding and/or post-flood changes to surface soil texture (e.g., due to particle size and density).

- › Fuels: Due to potential fuel sources (e.g., vehicles, heating oil tanks, fuel storage tanks, etc.) in the Merritt Study Area, contaminants associated with fuels were retained as priority contaminants. If fuels (e.g., gasoline, diesel) were released in a flooded area, they have the potential to spread and contaminate shallow soil when the flood waters receded. There was no anecdotal evidence and there were no observations of such releases having occurred in the Merritt Study Area.
- › Nitrates: Activities with sources of nitrates were identified in the Study Area (e.g., septic systems, sewage and wastewater treatment plants and rapid infiltration basins).

Other chemical types/families were not considered priorities in SNC-Lavalin (2022a) because it was concluded they would be less of a concern on a regional scale, due to the limited extent of their sources/volume/use, and/or because of their limited persistence in the environment. However, where data for other parameters were available, they were considered in this PRRA.

As noted, microbiological parameters were identified as PCOCs based on potential sources in the Study Area. These parameters included salmonella and the three indicators of fecal contamination: total coliforms, fecal coliforms and *E. coli* (Health Canada, 2020). These bacteria are routinely used as indicators of microbiological contamination.

The term total coliforms describes a group of bacteria that are widespread in nature and are generally not harmful. The total coliform test includes several species that are not of fecal origin (Health Canada, 2020). When total coliforms are detected without the presence of *E. coli*, their source is most likely environmental, not human or animal. Total coliforms are generally not considered to be a reliable measure of fecal organisms that could lead to detrimental health effects (Health Canada, 2020).

Fecal coliforms (also known as thermotolerant coliforms) are a subset of total coliform bacteria that have a more fecal-specific origin (Health Canada, 2020). Fecal coliforms by themselves are not pathogenic but are used as indicator organisms, which, when present, may indicate the presence of other, pathogenic bacteria. Testing for fecal coliforms also captures some species of non-fecal origin, including species of environmental origin (Health Canada, 2020).

*E. coli* is a species of fecal coliform bacteria that is specific to fecal material from humans and other warm-blooded animals. Most *E. coli* strains are harmless (CDC, 2022) and *E. coli* is ubiquitous in the environment. Like fecal coliforms, regulatory agencies use *E. coli* as an indicator of the potential for pathogenic bacteria; however, the presence of *E. coli* does not necessarily indicate that pathogens are present.

The priority PCOCs, as well as the additional parameters for which data were available for the Study Area, are further discussed and evaluated in subsequent sections of this PRRA.

## 2.5 Applicable Guidelines & Standards

The following is a summary of numerical standards and guidelines (i.e., benchmarks) that were used to identify COCs in each of the media types. Given that lands under multiple jurisdictions were impacted by the flood event, both the provincial and federal regulations apply to the Study Area. As a result, the PRRA applies provincial standards and BC ENV risk assessment guidance, as well as federal guidelines and federal risk assessment guidance from Health Canada and the CCME. Accordingly, the analytical results for soil (also evaluated as sediment) and groundwater collected from the Study Area have been evaluated based on both the provincial BC CSR standards and federal guidelines (from various sources) listed below. Land uses within the Study Area are varied, so SNC-Lavalin applied standards and guidelines applicable to the most sensitive land uses, including Agricultural (AL) and Residential (RL) (BC CSR Low Density RL or RLLD). These “sensitive use” standards and guidelines protect other regulatory defined land uses within the Study Area, including parkland (PL), commercial (CL) and industrial (IL) land uses.

## Provincial Standards

- › CSR Schedule 3.1 Part 1 (Matrix), Part 2 and 3 (Generic Numerical) AL and RLLD Land Use Standards for soil;
- › CSR Schedule 3.2 Generic Numerical Water Standards Freshwater Aquatic Life (AW), Irrigation (IW), Livestock (LW) and Drinking Water (DW); and
- › CSR Schedule 3.4 Generic Numerical Sediment Standards, Freshwater Sediment Standard for Sensitive Use (FWSedSU).

The BC Sediment Quality Guidelines have not been included in the analytical chemistry tables presenting sediment data because they largely based on the CCME Canadian Environmental Quality Guidelines (CEQG) for sediment, which have been applied (see below Federal Guidelines), with a few exceptions (e.g., nickel, selenium). Parameters that do not have a CCME CEQG are considered further in the PRRA.

## Federal Guidelines

- › *Canada Wide Standards for Petroleum Hydrocarbons in Soil (CWS-PHC)*, Canadian Council of Ministers of the Environment (CCME), Winnipeg, MB, January 1, 2008;
- › *Canadian Environmental Quality Guidelines (CEQG) for AL and RL Land Use in Soil*, CCME, including updates to 2022;
- › CEQG for sediment including the Interim Sediment Quality Guidelines (ISQG) and the Probable Effect Levels (PELs), CCME, including updates to 2022;
- › *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites (FIGWQG)*, prepared for the Federal Contaminated Sites Action Plan (FSCAP) Secretariat of Environment Canada, Version 4, June 2016; and
- › Guidelines for Canadian Drinking Water Quality (CDWQG).

While these guidelines and standards were applied to identify COCs, parameters that do not have screening benchmarks were also detected in the various media. Those that were considered to have the potential to be associated with the flood event and be present on the regional scale were identified as COCs.

## 2.6 Data Evaluated in the PRRA

Available data representative of post-flood conditions in the Merritt Study Area were compiled and compared to the benchmarks summarized in **Section 2.5** to identify COCs with the potential to be related to the flood event.

The data considered in the PRRA were from limited sources. These included soil data collected by SNC-Lavalin (see **Section 2.6.1**, below), additional soil and groundwater data collected on behalf of the City of Merritt, and BC ENV EMS data collected to assess the impacts of the flood event. The available groundwater data includes data from the City of Merritt's water supply wells and from shallow groundwater within the City of Merritt.

The available data, including from the City of Merritt and the BC ENV EMS, is considered representative of potential flood-related impacts, except for soil data that was representative of stockpiled soil from repairing the rapid infiltration basins associated with the municipality's sewage treatment plant. On this basis, all the data were considered when identifying COCs. The soil data collected during the repair work done on the sewage treatment plant rapid infiltration basins have not been included in the PRRA.

As noted, no sediment data (i.e., sediments that remain in rivers, streams or ditches below the high-water mark) representative of post flood conditions were available for water courses in the Study Area. The soil data were, therefore, conservatively assumed to be representative of sediment and were screened against the applicable sediment benchmarks to identify COCs.

The data considered in the PRRA is further discussed below.

### 2.6.1 SNC-Lavalin 2022 Soil Investigation (SNC-Lavalin, 2022b)

SNC-Lavalin conducted a soil sampling program in the Study Area on March 23, 2022. The sampling locations, methods and results are presented in SNC-Lavalin (2022b), which is included in **Appendix I**. The soil sample locations were selected based on public accessibility (i.e., publicly accessible vs private lands) and visible deposits on land that had not been disturbed since the flood. Parameters chosen for analysis at each location were based on the priority PCOCs identified in SNC-Lavalin (2022a) and on observations at the time of sampling. All samples were collected at depths of ground surface to 0.15 m.

A total of five samples (including one duplicate sample) were collected at locations within the areas flooded by the Coldwater River, where sediment deposition was observed. **Drawing 688421-003** shows the locations of where samples were collected.

The soil analytical results are provided in Tables 1 to 9 following the report text. Parameters in soil samples with concentrations greater than the CSR standards and/or CCME guidelines were as follows:

- › pH: Values exceeded the CCME AL/RL guideline of pH 8.0 in 2 of 5 (40%) sample locations; M-SS22-06-6 at 8.07 and M-SS22-07 at 8.15.
- › Iron: Iron concentrations of 38,200 µg/g exceeded the CSR AL/RLLD standards (35,000 µg/g) at sample location M-SS22-03.
- › Other metals and inorganic parameters: Concentrations of all other metals and inorganic parameters in all samples were less than the CSR standards and CCME guidelines.

There are no standards under the CSR or CCME for the analyzed microbiological parameters in soil. Concentrations of these parameters are as follows:

- › Total coliforms: Concentrations were detected in all samples, ranging from 3.9 most probable number per gram (MPN/g) at location M-SS22-03 to 49 MPN/g at location M-SS22-02.
- › Fecal coliform and *E. coli*: concentrations were below the laboratory method detection limit (MDL) in four of the five (80%) samples, except for sample M-SS22-05/06 (duplicate sample set) where both were measured at 33 MPN/g.
- › Salmonella: All concentrations were less than the laboratory MDL.

In addition to the priority contaminants, soil samples were selectively analyzed for other parameters based on the potential sources of contaminants identified in the Study Area. Measured concentrations of all other parameters analyzed were less than the CSR standards and CCME guidelines. Most of the analytical results for these parameters, including polycyclic aromatic hydrocarbons (PAHs), herbicides and pesticides, polychlorinated biphenyls (PCBs) and chlorinated phenols were also less than the laboratory MDL, with the following exceptions:

- › Concentrations of heavy extractable petroleum hydrocarbons in soil (HEPHs) were greater than the laboratory MDL but below the CSR standards with concentrations ranging from 57 µg/g to 80 µg/g.

Permethrin (insecticide) at sample location M-SS22-07 was detected at 0.0083 µg/g, well below the CSR AL and RLLD standards of 800 µg/g. It is noted that acid herbicides in this sample were analyzed past hold time.

The MDLs for naphthalene, phenanthrene and pentachlorophenol were higher than the CCME AL/RL guideline at all locations tested (i.e., five locations for PAHs and four locations for pentachlorophenol).

## 2.6.2 Data from Other Sources

In addition to the data from SNC-Lavalin (2022b) summarized above, additional soil and groundwater data from the City of Merritt and groundwater data from the BC ENV EMS were compiled and considered when evaluating impacts from the flood event in the Merritt Study Area. All soil data were also assumed to be representative of sediment below the high-water mark in watercourses in the Study Area, as noted.

The additional available data considered in the PRRA include the following:

- › Fifteen soil samples submitted for analysis of one or more of the following: total metals, inorganics and general chemistry, PAHs, microbiological parameters, and petroleum hydrocarbons (PHCs).
- › Twenty groundwater samples representative of the City of Merritt's water supply system and submitted for analysis of one or more of the following: microbiological parameters, inorganics and general chemistry, total metals, volatile organic compounds (VOCs), PHCs and PAHs.
- › Three groundwater samples representative of shallow groundwater quality within the Study Area collected in late November 2021 and submitted for analysis of inorganics and general chemistry, total metals and microbiological parameters.

The COCs in soil, sediment and groundwater are identified in **Section 2.6.3**.

## 2.6.3 Evaluation of Data Sources and Identification of Contaminants of Concern

The COCs in soil/sediment and groundwater were identified by comparing the analytical results for samples collected from the Study Area to the benchmarks summarized in **Section 2.5**. The available data is presented in the tables following the report text, including:

- › Tables 1 to 9 present the analytical results for surface soil collected by SNC-Lavalin;
- › Tables 10 to 17 present the SNC-Lavalin results compared to the sediment benchmarks; and
- › Tables 18 and 19 present a summary of the data available from other sources for soil/sediment and groundwater, respectively.

Based on the objectives of the PRRA, specifically to evaluate contamination that is representative of both impacts from the flood and regional conditions, the data are categorized based on the likelihood that they are representative of flood-related contamination and that the identified contamination has the potential to be present on a regional scale.

All available data carried forward in the PRRA (i.e., from SNC-Lavalin [2022b], City of Merritt and BC ENV EMS) include the priority PCOCs identified in SNC-Lavalin (2022a) and are considered representative of potential flood-related impacts. Therefore, all parameters detected frequently and/or exceeding benchmarks, except those representative of background conditions, were conservatively assumed to have the potential to be flood-related. The data were further evaluated to determine if they have the potential to be representative of impacts at the regional level. In this evaluation, the frequency at which a parameter exceeded a standard or guideline was considered. For non-regulated parameters, the frequency of detection was considered.

Based on the results of the evaluation, the data were categorized as follows:

- › COCs potentially representative of regional, flood-related impacts (Category A COCs): Data for these parameters indicate the potential for the measured concentrations to be both associated with the flood event and representative of impacts on a regional scale.
- › COCs not representative of regional, flood-related impacts (Category B COCs): Data for these parameters indicate they are unlikely to have been associated with or exacerbated by the flood event and/or they are not representative of impacts on a regional scale.

All potential data were conservatively assumed to have the potential to be flood-related. Therefore, the data were evaluated to determine if they were representative of impacts on a regional scale. The following were considered in that evaluation:

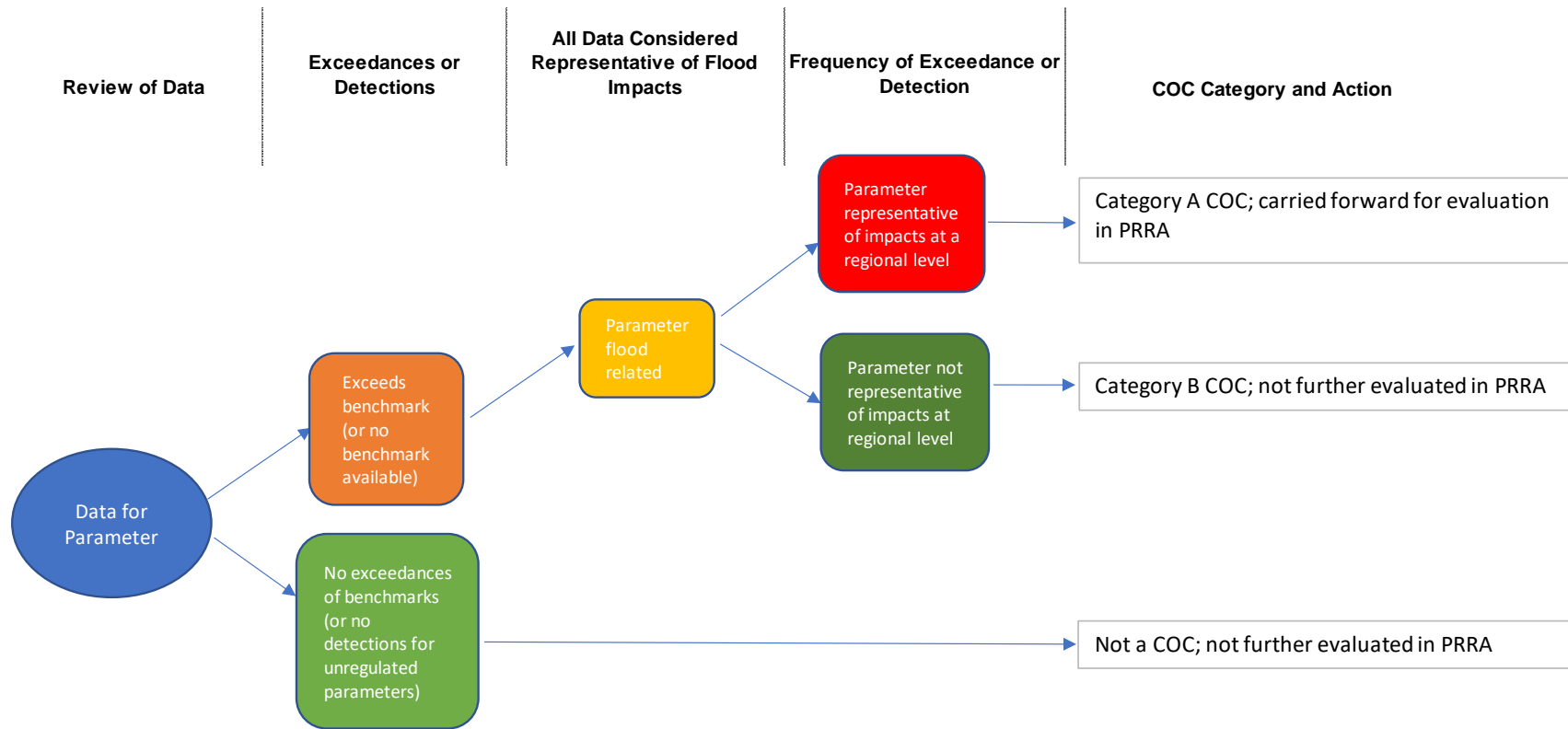
- › Parameters with standards/guidelines: Was the parameter measured at concentrations exceeding standards/guidelines with frequency, i.e., did it exceed standards/guidelines in more than 5% of the samples?
- › Parameters without standards/guidelines: Was the parameter detected with frequency, i.e., did it occur in more than 5% of the samples?

When the answer to one of these questions was *yes*, the parameter was considered to have the potential to be representative of regional conditions in that medium. It was carried forward as a Category A COC for further evaluation in the PRRA.

Parameters not identified as Category A COCs but identified at concentrations exceeding applicable standards/guidelines and/or detected frequently, were identified as Category B COCs. These parameters were not considered further in the PRRA. Category B parameters are identified for future consideration by the regulatory agencies responsible.

**Figure 2-2** below presents the COC categorization process.

Figure 2-2: COC Categorization Process



The following sections:

- › Describe the available data using the categories depicted in **Figure 2-2**, and
- › Identify COCs in each medium.

### 2.6.3.1 Soil

Most of the parameters that do not have regulatory guidelines or standards, but which were detected frequently and considered to have the potential to be associated with the flood event, were also considered as COCs. The exceptions were:

- › Soil minerals that were consistently detected across samples (e.g., calcium, magnesium, potassium) were not retained as COCs.
- › Ammonia-N: This was detected across the samples submitted for analysis; however, it was not retained as a COC. Ammonia-N includes both the ionized form (ammonium,  $\text{NH}_4^+$ ) and the unionized form (ammonia,  $\text{NH}_3$ ). It is unregulated in soil but was within typical levels and was representative of natural conditions in the Study Area. While background levels of ammonia in soil are typically between 1  $\mu\text{g/g}$  and 5  $\mu\text{g/g}$ , ATSDR (2004) indicates that additional ammonia is often present from natural or synthetic fertilizer application, human or animal waste, decaying organic matter or natural nitrogen fixation from the atmosphere. And Horneck et al. (2011) indicate that ammonia-N concentrations greater than 10  $\mu\text{g/g}$  may occur in cold or wet soils. Within the Study Area, the average concentration of ammonia-N measured in soils is 14.4  $\mu\text{g/g}$  but this is likely associated with natural sources and/or elevated because the soils were cold and wet following the flood event.
- › Benzo(g,h,i)perylene: This was detected in a single soil sample (n=20) at a concentration of 0.065  $\mu\text{g/g}$  (compared to the MDL of 0.05  $\mu\text{g/g}$ ). The measured concentration is within the range of laboratory variability, and if it is a true detection, it is localized (i.e., more likely to be related to a point source than the flood event). Therefore, it was not identified as being representative of regional conditions in the Study Area and was not carried forward as a COC.

The laboratory MDLs for select parameters were greater than the CCME guidelines in a limited number of samples. These included benzene, ethylbenzene, toluene, trichloroethylene, naphthalene, phenanthrene, trichloroethylene and pentachlorophenol. These parameters were not detected in any of the samples submitted for analysis. Therefore, while there is some uncertainty whether the samples with elevated detection limits exceed the guidelines, it is considered unlikely they do because they were not detected in any samples and no visual or olfactory evidence of contamination was noted during SNC-Lavalin's site reconnaissance and sampling on March 23, 2022. On this basis, these parameters were not identified as COCs.

Soil pH levels exceeded the CCME Agricultural (AL) and Residential (RL) guideline of pH 6.0 to 8.0 in select soil samples, with soil pH measured as high as 8.3. Nonetheless, the measured soil pH is considered representative of natural conditions in the region. The BC Ministry of Agriculture and Food (2015) indicates that in areas of low rainfall such as the Study Area (i.e., the South-Central Interior), mineral compounds may become concentrated, leading to alkaline soils and saline soils developing. Based on the above, soil pH is not considered to be a COC.

In **Table 2-1** the available soil data has been further evaluated based on the COC categories and associated criteria.

**Table 2-1: Soil COCs Identified in the Merritt Study Area**

Parameter	> Standard / Guidelines	Potential to be Flood-Related?*	Potential to be representative of impacts at a regional level?	Rationale	COC Category
Copper	CCME AL/RL	Yes	No	> CCME AL/RL in 1 of 20 (5%) samples	B
Iron	CSR AL/RL	Yes	No	> CSR AL/RL in 1 of 20 (5%) samples	B
Nickel	CCME AL/RL	Yes	No	> CSR AL/RL in 1 of 20 (5%) samples	B
Microbiological indicator parameters (total coliforms, fecal coliforms, <i>E. coli</i> )	NA	Yes	Yes	Total coliforms detected in 5 of 5 (100%) samples; fecal coliform and <i>E. coli</i> detected in 1 of 5 (20%) samples	<b>A</b>

**Notes:**

- \* All data conservatively assumed to have the potential to be flood-related
- CSR BC Contaminated Sites Regulation
- CCME Canadian Council of Ministers of the Environment
- AL Agricultural
- RL Residential
- Category A Potentially flood-related and representative of regional impacts; carried forward for evaluation in PRRA (see **Section 2.6.3** for details)
- Category B Not flood-related/not representative of regional impacts; not carried forward for further consideration in PRRA (see **Section 2.6.3** for details)
- NA No standards/guidelines available

As presented in **Table 2-1**, Category A COCs identified in soil include the following:

- › Microbiological indicator parameters (*E. coli*, fecal coliforms and total coliforms).

### 2.6.3.2 Sediment

To identify COCs, the soil data collected by SNC-Lavalin as well as on behalf of the City of Merritt were assumed to be representative of sediment and were screened against the applicable sediment standards and guidelines.

Like for soil, naturally occurring parameters such as minerals that were consistently detected across samples (e.g., calcium, magnesium, potassium) were not retained as COCs. Further, ammonia-N was not evaluated as COCs because it is highly soluble and would therefore not remain in sediments once submerged.

Most of the PAHs analyzed for were not detected in the twenty samples submitted for analysis (five by SNC-Lavalin, fifteen by City of Merritt); however, the laboratory detection limits for select PAHs exceeded the CCME ISQG. While there is uncertainty about whether the non-detect PAHs exceed sediment benchmarks, it is premature to identify them as contaminants of concern based on non-detect data. Further, as per CCME (1999), adverse biological effects rarely occur at concentrations below the ISQG but are expected to occur frequently above the PEL. All laboratory detection limits were less than the CCME PELs and therefore they were not retained as COCs. Following the same rationale, while the detection limit for PCBs exceeded the CCME ISQG, it was below the CCME PEL and, PCBs were therefore not identified as a COC.

Although HEPH was measured in eight samples (five by SNC-Lavalin, four by City of Merritt), it was not a COC in soil because it did not exceed the CSR standards. However, there are no sediment standards or guidelines for HEPH, so it was therefore evaluated as a COC.

The COCs are categorized in **Table 2-2** with the Category A COCs carried forward in the PRRA for evaluation.

**Table 2-2: Sediment COCs Identified in the Merritt Study Area**

Parameter	> Standards / Guidelines	Potential to be Flood-Related?*	Potential to be representative of impacts at a regional level?	Rationale	COC Category
HEPH	NA	Yes	Yes	> MDL in 8 of 20 (40%) samples	A
Copper	CCME ISQG	Yes	No	> CCME ISQG in 1 of 20 (5%) samples	B
Chromium	CCME ISQG	Yes	No	> CCME ISQG in 1 of 20 (5%) samples	B
Microbiological indicator parameters (total coliforms, fecal coliforms, <i>E. coli</i> )	NA	Yes	Yes	Total coliforms detected in 5 of 5 (100%) samples; fecal coliform and <i>E. coli</i> detected in 1 of 5 (20%) samples	A

**Notes:**

- \* All data conservatively assumed to have the potential to be flood-related
- CCME ISQG Canadian Council of Ministers of the Environment (CCME) Interim Sediment Quality Guideline
- Category A Potentially flood-related and representative of regional impacts; carried forward for evaluation in PRRA (see **Section 2.6.3** for details)
- Category B Not flood-related/not representative of regional impacts; not carried forward for further consideration in PRRA (see **Section 2.6.3** for details)
- NA No standards or guidelines available
- HEPH Heavy extractable petroleum hydrocarbons

As presented in **Table 2-2**, Category A COCs identified in sediment include the following:

- › HEPH; and
- › Microbiological indicator parameters (*E. coli*, fecal coliforms and total coliforms).

### 2.6.3.3 Groundwater

The available data for groundwater were reviewed to identify COCs. The available groundwater data representative of the City's water supply system was compared to the CSR DW and the CDWQG. Chloroform and chlorine were detected in the groundwater samples representative of the City of Merritt's water supply system; however, because they are associated with the chlorination of drinking water they were not evaluated as COCs for the other water uses.

The available shallow groundwater data from the BC ENV EMS (i.e., from groundwater monitoring wells) were compared to the provincial and federal benchmarks for all water uses (Aquatic Life, Irrigation Water, Livestock Water and Drinking Water). Turbidity was measured in three of the shallow groundwater samples at concentrations exceeding the CDWQG due to particulate matter that is common in samples from groundwater monitoring wells. The particulate matter and associated turbidity are unlikely to be flood-related and therefore turbidity was not carried forward as a COC. Concentrations of turbidity in groundwater representative of the City's water supply system were less than the CDWQG.

In addition to the parameters identified below in **Table 2-3**, copper, iron, manganese and mercury were identified at concentrations exceeding one or more of the applicable water use standards/guidelines, but they are below the BC ENV Protocol 9 (BC ENV, 2021c) local background concentrations in groundwater for the Thompson Okanagan Region. Because the concentrations are within the range of regional background concentrations, they do not appear to have been associated with or exacerbated by the flood event. Therefore, they were not retained as COCs in groundwater.

The COCs identified in groundwater in the Study Area are summarized in **Table 2-3** and were carried forward in the PRRA for evaluation.

**Table 2-3: Groundwater COCs Identified in the Merritt Study Area**

COCs Identified Based on Water Use			
Aquatic Life	Irrigation Water	Livestock Water	Drinking Water
<b>Data Representative of City of Merritt Water Supply System</b>			
<i>Regulated Parameters</i>			
None	None	None	pH <sup>a</sup>
<i>Unregulated Parameters</i>			
None	None	None	None
<b>BC ENV EMS Data</b>			
<i>Regulated Parameters</i>			
None	None	None	<i>E. coli</i> <sup>a</sup> , Total coliforms <sup>a</sup>
<i>Unregulated Parameters</i>			
Zinc	None	None	None

**Notes:**

Aquatic Life	FIGWQG AW and CSR AW applied
Irrigation Water	FIGWQG IW and CSR IW applied
Livestock Water	FIGWQG LW and CSR LW applied
Drinking Water	CDWQG and CSR DW applied
<sup>a</sup>	Parameter measured in excess of the CDWQG

As presented in **Table 2-3**, pH was the only Category A COC identified in groundwater representative of the Merritt water supply wells. The following Category A COCs were identified in shallow groundwater in the Study Area:

- › Microbiological indicator parameters (*E. coli* and total coliforms) (Drinking Water), and
- › Zinc (Aquatic Life).

## 2.7 COPC Screening

All Category A COCs were carried forward as preliminary COPCs. To identify final COPCs, analytical data were screened using receptor-pathway specific benchmarks to identify COPCs for evaluating risks to human and ecological receptors.

To identify final COPCs, the secondary screening process included comparing the maximum concentration of the preliminary COPCs to the lowest of the applicable screening benchmarks protective of human health and the environment. The COPC screening process for each of the media types is described in the following sections.

## 2.7.1 Soil

To identify final soil COPCs for the protection of human and ecological receptors, maximum concentrations of preliminary COPCs are typically compared to applicable receptor-pathway specific benchmarks. In the case of the Study Area, only microbiological parameters were identified as preliminary COPCs. Microbiological parameters are not regulated in soil. All the measured microbiological parameters were retained as final COPCs for the evaluation of risks to human health, as presented in **Table 2-4**. These parameters are not a concern for ecological receptors.

The soil analytical results are presented in Tables 1 to 9 and Table 18, which can be found after the report text. The locations of the SNC-Lavalin soil samples are shown on **Drawing 688421-003**.

**Table 2-4: Secondary Soil COPC Screening for Merritt**

Parameter	No. of Samples Analyzed	Max Conc.	HH Benchmark <sup>a</sup> / No. Samples > <sup>b</sup>	Max Screening Quotient HH <sup>c</sup>	Eco Benchmark <sup>d</sup> / No. Samples > <sup>b</sup>	Max Screening Quotient Eco <sup>e</sup>	Retained as COPC for HH?	Retained as a COPC for Eco?
<b>Microbiological Indicator Parameters</b>								
<i>E. coli</i> (MPN/g)	5	33	n.b. / 1	NA	n.b. / 1	NA	<b>Yes;</b> considered to be flood-related	No <sup>f</sup>
Fecal coliforms (MPN/g)	5	33	n.b. / 1	NA	n.b. / 1	NA	<b>Yes;</b> considered to be flood-related	No <sup>f</sup>
Total coliforms (MPN/g)	5	49	n.b. / 5	NA	n.b. / 5	NA	<b>Yes;</b> considered to be flood-related	No <sup>f</sup>

**Notes:**

- HH Human health
- Eco Ecological receptors (terrestrial)
- n.b. No benchmark available
- <sup>a</sup> The lowest of the applicable matrix factors (CSR) and/or check values (CCME) including human intake of contaminated soil (CSR) and soil ingestion (CCME)
- <sup>b</sup> For parameters with no benchmark, number of detections indicated
- <sup>c</sup> Screening quotient calculated by dividing the maximum reported soil concentration by the HH benchmark
- <sup>d</sup> The lowest of the applicable matrix factors (CSR) and/or check values (CCME) including toxicity to soil invertebrates and plants, livestock ingesting soil and fodder and major microbial impairment (CSR) and soil contact, soil and food ingestion and nutrient and energy cycling check (CCME)
- <sup>e</sup> Screening quotient calculated by dividing the maximum reported soil concentration by the Eco benchmark
- <sup>f</sup> Not identified to be a concern for ecological receptors
- NA Not applicable

Microbiological indicator parameters (fecal coliforms, total coliforms and *E. coli*) were identified as final COPCs in soil for evaluating risks to human health. No additional final COPCs were identified for evaluating risks to human health. No final COPCs were identified in soil for evaluating risks to ecological receptors.

Total coliforms and fecal coliforms were detected in four (n=5) soil samples and *E. coli* was detected in one of the five samples. No pre-flood soil data was available for microbiological parameters and there are no regulatory benchmarks for these parameters. As noted, they are used by regulatory agencies as indicators of the potential for microbiological contamination; however, they are also ubiquitous in the environment at variable concentrations.

The BC Ministry of Agriculture and Food (2022) indicates that over time (120 days) the extra load of potential bacteria that may result from flooding would be reduced in healthy soils exposed to ultraviolet rays from the sun. Given the time that has elapsed since the flood event, it is unlikely that potential bacteria from the flood remain in surface soils in the Study Area.

Based on the above, the available soil data indicates that bacteria from the flood are unlikely to remain in soil in the Study Area. It is however noted the presence of coliforms can indicate the potential for other microorganisms, and therefore recommendations for preventing illness are provided in **Section 3**.

## 2.7.2 Sediment

To identify sediment COPCs for the protection of human and ecological receptors, maximum concentrations of preliminary COPCs (i.e., the sediment COCs) were compared to the applicable provincial and federal benchmarks.

The microbiological indicator parameters and HEPH were identified as preliminary COPCs in sediment. No provincial or federal regulatory benchmarks are available for these parameters in sediment. In the case of HEPH, sediment quality guidelines for petroleum hydrocarbons (Mroz et al., 2016) have been proposed by Environment Canada, with the recommended guideline for HEPH used in the screening shown below. Using the average total organic carbon (TOC) value measured in the soil samples collected from the Study Area and based on a diesel carbon range, a sediment quality guideline for HEPH of 475 µg/g was calculated. The methods and a worked calculation showing how this value was derived are included in **Appendix II**.

As recommended by BC ENV Protocol 1 (2021b), the available CSR HEPH soil standard for the protection of human health (for AL land use) was used to screen HEPH as a COPC for the evaluation of risks to human health.

No sediment benchmarks are available for the microbiological indicator parameters, including from other jurisdictions. The microbiological indicator parameters, as presented in **Table 2-5**, were retained as final COPCs for evaluating risks to human health based on their being detected and having the potential to be related to the flood.

The soil analytical results, which have been used as a proxy for sediment, are summarized in Tables 10 to 17 and in Table 18, which can be found after the report text. Where applicable, maximum measured concentrations of the preliminary sediment COPCs were screened against the lowest applicable COPC screening benchmarks, and screening quotients (SQs) were generated. An SQ less than one indicates that the maximum concentration is below the benchmark; an SQ greater than one indicates the concentration exceeds the benchmark and may require further consideration depending on the magnitude of the SQ and the number of samples exceeding the benchmark. The results of the secondary screening are presented in **Table 2-5**.

**Table 2-5: Secondary Sediment COPC Screening for Merritt**

Parameter	No. of Samples Analyzed	Max Conc.	HH Benchmark <sup>a</sup> / No. Samples > <sup>b</sup>	Max Screening Quotient HH <sup>c</sup>	Eco Benchmark <sup>d</sup> / No. Samples > <sup>b</sup>	Max Screening Quotient Eco <sup>e</sup>	Retained as COPC for HH?	Retained as a COPC for Eco?
<b>Petroleum Hydrocarbons</b>								
HEPH (µg/g)	20	1000	1000 / 0*	1	475 (Mroz et al., 2016) / 1	2.1	No, SQ = 1	No, SQ based on single sample, next highest HEPH = 240 µg/g (SQ = 0.5)
<b>Microbiological Indicator Parameters</b>								
<i>E. coli</i> (MPN/g)	5	33	n.b. / 1	NA	n.b. / 1	NA	<b>Yes;</b> considered to be flood-related	No <sup>h</sup>
Fecal coliforms (MPN/g)	5	33	n.b. / 1	NA	n.b. / 1	NA	<b>Yes;</b> considered to be flood-related	No <sup>h</sup>
Total coliforms (MPN/g)	5	49	n.b. / 5	NA	n.b. / 5	NA	<b>Yes;</b> considered to be flood-related	No <sup>h</sup>

**Notes:**

- Bold** Parameter retained as COPC for further evaluation in the PRRA
- HH Human health
- Eco Ecological receptors
- n.b. No benchmark available
- \* Maximum concentration equivalent to benchmark but not greater than
- <sup>a</sup> The lowest of the applicable matrix factors (CSR) and/or check values (CCME) including human intake of contaminated soil (CSR) and soil ingestion (CCME)
- <sup>b</sup> For parameters with no benchmark, number of detections indicated
- <sup>c</sup> Screening quotient calculated by dividing the maximum reported soil concentration by the HH benchmark
- <sup>d</sup> The lowest of the CSR FWSedSU and CCME PEL when available; when not available, benchmarks from other jurisdictions used (as referenced)
- <sup>e</sup> Screening quotient calculated by dividing the maximum reported soil concentration by the Eco benchmark
- <sup>f</sup> from CSR
- <sup>g</sup> from CCME
- <sup>h</sup> Not identified to be a concern for ecological receptors
- NA Not applicable

As summarized in **Table 2-5**, HEPH was not retained as a COPC in sediment. The maximum measured HEPH concentration was 1,000 µg/g, which exceeded the sediment benchmark and resulted in an SQ of 2.1. In the soil samples used as a proxy for sediment, HEPH was measured in eight of 20 samples. The next highest concentration of HEPH was 240 µg/g, which is below the sediment benchmark of 500 µg/g and results in an SQ of 0.48. Given that only one of the 20 samples had a concentration exceeding the sediment benchmark, HEPH was not retained as a final COPC.

The final COPCs for evaluating risks to human health identified in sediment in the Study Area were microbiological indicator parameters (fecal coliforms, total coliforms and *E. coli*). No final COPCs were identified for evaluating risks to ecological receptors.

As with soil and based on the same rationale, the available soil data indicates that bacteria from the flood are unlikely to have persisted, but their presence may indicate the potential for other microorganisms. Therefore, recommendations for preventing illness are provided in **Section 3**.

### 2.7.3 Groundwater

Preliminary COPCs in groundwater were identified for the evaluation of risks to human health and aquatic life only (i.e., not for irrigation or livestock watering).

The only parameter identified as a preliminary COPC in groundwater representative of the Merritt's water supply wells was pH. The CDWQG for pH is 7.0 to 10.5, and the lowest pH measured in water samples from the supply wells is 6.94. The CDWQG for pH is not health based. Rather, it was based on maximizing treatment effectiveness, controlling corrosion and reducing leaching from distribution system and plumbing components (Health Canada, 2019). The measurement of pH just below the guideline on a single occasion (1 of 16 samples) is not a concern. The pH of the water supply, along with various other parameters, is monitored regularly by the municipality, according to guidance provided by the health authority, and any concerns regarding pH, or other parameters, would, therefore, be identified. Mitigation measures, if required, would be identified in accordance with the health authority's guidance.

*E. coli* and total coliforms were identified as preliminary COPCs in shallow groundwater in the Study Area. Given that these preliminary COPCs were identified based on comparing the measured concentration with the receptor-pathway specific standard/guidelines for drinking water, a secondary screening was not conducted, and they were carried forward as final COPCs.

Similarly, zinc was identified for evaluating risks to aquatic life based on concentrations that exceeded the Aquatic Life FIGWQG. The maximum concentration of zinc measured in the shallow groundwater wells is 130 µg/L compared to the FIGWQG of 30 µg/L. The FIGWQG for zinc has been set equivalent to the CCME Water Quality Guideline for the Protection of Aquatic Life which applies to the receiving water body and groundwater within 10 m of a surface water body (CCME, 2007). The shallow groundwater data were collected further than 10 m from a surface water body. Further, it is recognized that groundwater hardness ameliorates the potential toxicity of zinc to aquatic organisms and therefore, groundwater hardness is typically considered when determining the potential for adverse effects associated with zinc in groundwater. The groundwater hardness in the sample with the maximum zinc concentration was 250 mg/L (as calcium carbonate [CaCO<sub>3</sub>]). Based on this groundwater hardness, the CSR Aquatic Life standard is 1,650 µg/L. In addition, if the measured maximum concentration were present within 10 m of a surface water body, the maximum concentration of 130 µg/L is less than the applicable Aquatic Life BC Water Quality Guideline for zinc (calculated based on sample hardness) of 153 µg/L. Based on the above information, the zinc measured in shallow groundwater in the Study Area was not carried forward as a final COPC.

In summary, the following final COPCs were identified in groundwater in the Study Area and were further evaluated in the PRRA:

- › Microbiological indicator parameters (*E. coli* and total coliforms) (for Drinking Water).

## 2.7.4 Summary of Contaminants of Potential Concern

A summary of the COPCs identified in each medium is presented in **Table 2-6**.

**Table 2-6: Summary of Final COPCs Identified for the Merritt Study Area**

Medium	Human Health	Ecological
Soil	<i>E. coli</i> , total coliforms and fecal coliforms	None
Sediment	<i>E. coli</i> , total coliforms and fecal coliforms	None
Groundwater	<i>E. coli</i> , Total Coliforms*	None

**Notes:**

\* Total coliforms and *E. coli* were not detected in the samples from the City of Merritt's water supply wells. They were only detected in shallow groundwater monitoring wells sampled after the flood in November 2021.

## 2.8 Conceptual Site Model

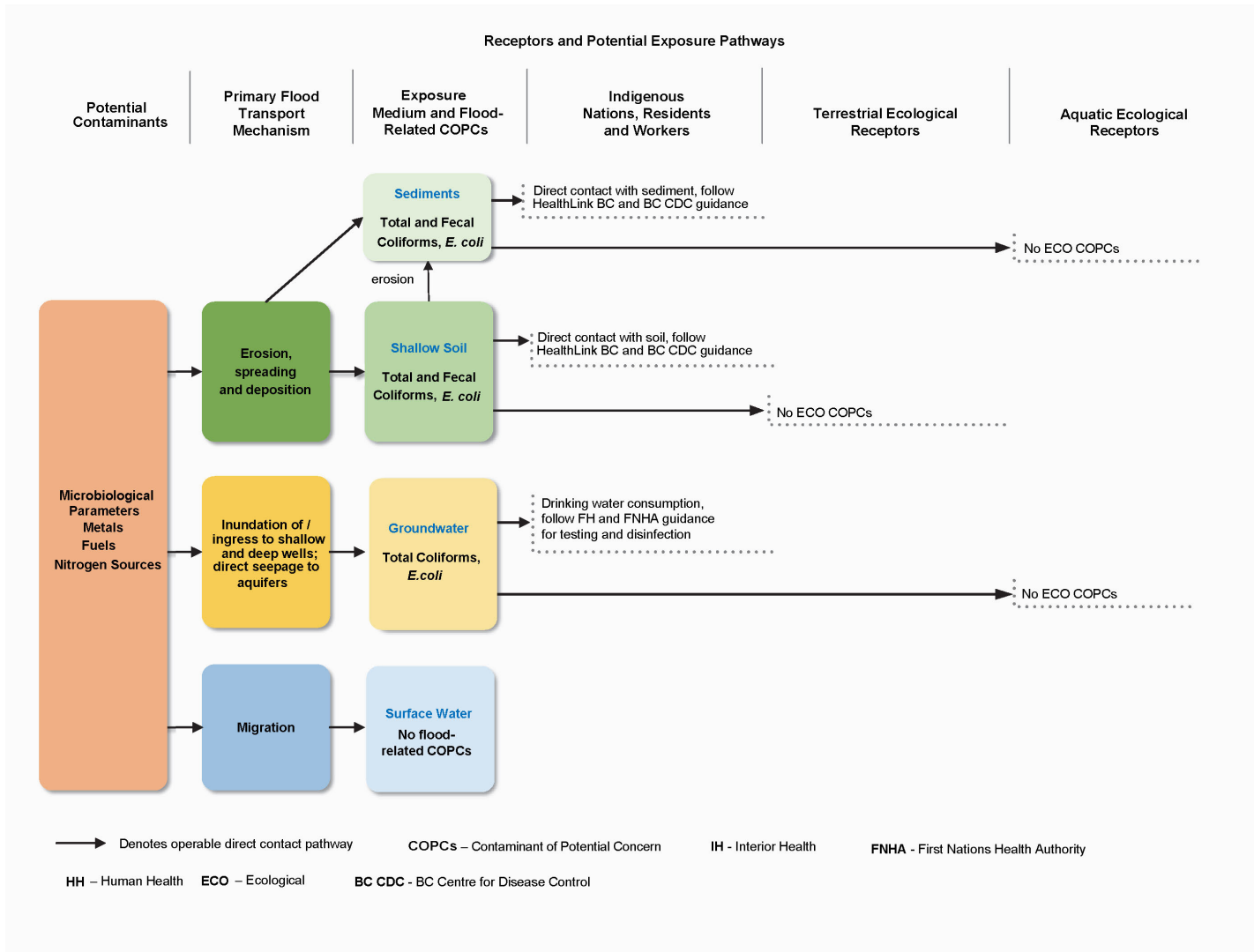
The CSM provided in SNC-Lavalin (2022a) has been updated based on the results of the PRRA, and it is summarized in **Figure 2-3**, below.

Total coliforms, fecal coliforms and *E. coli* were identified as final COPCs in soil and sediment. These parameters are used as indicators of the potential for other microorganisms but are also ubiquitous in the environment (Health Canada, 2020). The BC Ministry of Agriculture and Food (2022) indicates that over time (120 days), the extra load of potential bacteria that may result from flooding would be reduced in healthy soils due to exposure to ultraviolet rays from the sun. Given the time that has elapsed since the flood event, it is unlikely that bacteria from the flood have persisted. Despite this, as their presence may indicate the potential for other microorganisms, recommendations to prevent exposures to microorganisms in soil are provided in **Section 3** and are included in **Figure 2-3**.

Final COPCs (total coliforms and *E. coli*) were identified based on groundwater data collected from shallow groundwater monitoring wells on November 20, 2021, just days after the flooding. No final COPCs were identified in groundwater representative of the City of Merritt's water supply wells. It is considered likely that shallow groundwater monitoring wells were contaminated during the flooding by flood water entering the well casing and/or by nearby broken sanitary sewer pipes discharging to shallow groundwater; however, this has not been confirmed. As total coliforms and *E. coli* were measured in shallow groundwater following the flood, private water well and surface water point of diversion<sup>5</sup> users in the Study Area should continue to follow Interior Health and First Nations Health Authority guidance for testing and disinfection of their water source.

<sup>5</sup> A point of diversion is a water licence that authorizes works related to the diversion and use of water from a waterbody.

**Figure 2-3: Updated Conceptual Site Model**



## 2.9 Uncertainty Analysis

The primary area of uncertainty in the PRRA is measurement uncertainty associated with the data collected to characterize the impacts from the flood event.

Surface soil data collected by SNC-Lavalin and City of Merritt targeted sediment deposited on the ground surface from the flood event in areas considered to be representative of regional (i.e., non-point source) soil conditions within the Study Area. The sediments primarily originated from the Coldwater River, with some contribution from the Nicola River (at the confluence), and based on the source and mechanism of deposition, they are considered likely to be homogenous. This is supported by the relatively consistent results between the data collected by SNC-Lavalin and City of Merritt. Further, no visual or olfactory observations that would suggest the presence of other contaminant types were noted during sampling, and SNC-Lavalin is not aware of any reports of significant contaminant releases (e.g., from tanks etc.) during or following the flood event. Despite the time elapsed between the flood event and the sampling, the data captured persistent COCs which were identified as priority PCOCs for protecting human health and the environment. The potential exists for point source related contamination within private properties within the Study Area; however, assessing those impacts is beyond the scope of the PRRA.

While measurement uncertainty in the soil data collected from the Study Area is generally considered to be low, the following areas of uncertainty and the associated potential to impact the PRRA results are noted:

Laboratory MDLs for some parameters exceeded the regulatory benchmarks including:

- › Benzene, ethylbenzene, toluene, trichloroethylene, naphthalene, phenanthrene, trichloroethylene and pentachlorophenol in select samples. These parameters were not detected in any of the samples submitted for analysis. Therefore, while there is some uncertainty in whether the samples with elevated detection limits exceed the guidelines, it is considered unlikely since they were not detected in any samples and as no visual or olfactory evidence of contamination was noted during the SNC-Lavalin March 23, 2022, site reconnaissance and sampling. On this basis, these parameters were not identified as COCs. There is low uncertainty in this conclusion.
- › Most of the PAHs analyzed were not detected in the twenty samples submitted for analysis (five by SNC-Lavalin, fifteen by City of Merritt); however, the MDLs for select PAHs exceeded the CCME ISQG. As per CCME (1999), adverse biological effects rarely occur at concentrations below the ISQG, while they are expected to occur frequently above the PEL. All MDLs were less than the CCME PELs. Consequently, non-detect PAHs were not retained as COCs. There is low uncertainty in this conclusion.
- › Following the same rationale, while the detection limit for PCBs exceeded the CCME ISQG, it was below the CCME PEL and thus, PCBs were not identified as a COC. There is low uncertainty in this conclusion.

Limited soil data (also used as a proxy for sediment) was available for total coliform, fecal coliform and *E. coli*. While there is limited data, given the time that has elapsed since the flood event, there is low uncertainty in the conclusion that coliform bacteria from the flood are unlikely to remain in soil. Further, coliform bacteria are ubiquitous in the environment at variable concentrations (Health Canada, 2020).

*E. coli* is a species of fecal coliform bacteria that is specific to fecal material from humans and warm-blooded animals. Most *E. coli* strains are harmless, although some strains can cause illness. Regulatory agencies use *E. coli*, as well as total and fecal coliforms, as indicators of the potential for the presence of other pathogenic microorganisms; however, the presence of these coliform bacteria does not necessarily indicate that pathogens are present. Levels of *E. coli*, total coliforms and fecal coliforms in soil and sediment prior to the flood are not available, and analysis of *E. coli* strains was not completed in this preliminary assessment. This raises some uncertainty in terms of the potential for flood-related exposure to illness-causing strains of *E. coli* and other pathogenic microorganisms in soil and sediment. Regardless, *E. coli* is ubiquitous in the environment and recommendations to mitigate risk of illness from exposure to *E. coli* and other microorganisms in soil and sediment post-flood are consistent to recommendations pre-flood. To mitigate concerns recommendations from local health authorities, HealthLinkBC and BC Centre for Disease Control (BC CDC) should be followed, as detailed in **Section 3**.

The assumption that the soil data evaluated in the PRRA are representative of sediments remaining in waterways in the Study Area is conservative, because the soil sampled has the potential to have been impacted by on-land sources during or following the flood. Based on the conservative approach, and because the soils originated from the rivers (i.e., from sediments), uncertainty in both this assumption and the conclusion of no unacceptable risks to aquatic ecological receptors is low.

In November 2021, just days after the flooding, total coliforms and/or *E. coli* were found in groundwater samples from two of three BC ENV EMS shallow groundwater monitoring wells. No subsequent sampling of these wells was conducted. These coliform parameters were not measured in groundwater samples from the City of Merritt's water supply wells. Monitoring wells are not constructed to the same standards as supply wells, and therefore they are more vulnerable to impacts from flooding. This may also be true for some private water wells, and therefore, the measurement of coliforms in shallow groundwater suggests that private water wells could also have been contaminated by the flood event. There is also the potential for impacted groundwater to migrate to downgradient surface water bodies and thus for surface water point of users to be impacted.

As discussed in **Section 2.4**, given the rapid, high-energy nature of the flood event, limited surface water data was collected after the event. The available surface water data for the Study Area was from the BC ENV EMS and was collected between December 2021 and March 2022. The data is available for samples collected both upstream and downstream of the City of Merritt's wastewater treatment plant and rapid infiltration basins, which were identified as potential sources of contamination during the flood event. Select parameters, including nitrogen (N) parameters (Nitrate+Nitrate-N and Nitrogen), fecal coliform and *E. coli*, were consistently detected in the surface water samples, in locations upstream and downstream of the wastewater treatment plant. While these parameters were detected in December 2021 (i.e., during the first sampling events following the flood), the maximum measured concentrations occurred in January and March 2022. The maximum concentrations were detected at locations downgradient of the wastewater treatment plant; however, the timing of the events and associated results suggest that the presence of these parameters in surface water is not flood-related. On this basis, it was concluded that the flood did not result in adverse impacts to surface water quality. Based on the evidence, uncertainty in the conclusion that the flood did not result in long-term adverse impacts to surface water quality is considered to be low.

## 3 Conclusions and Recommendations

The PRRA was conducted to assess the potential for contamination associated with the November 2021 flood event and which is present on a regional scale in the Study Area to adversely impact human health and the environment. Potential flood-related contaminants were identified in soil, sediment and groundwater, and a secondary screening was conducted to identify final COPCs for evaluating risks to human health and the environment. No final COPCs were identified for evaluating risks to ecological ROCs, and, therefore, no unacceptable risks to the environment are predicted.

Final COPCs identified in each medium for evaluating risks to human health included the following indicators of microbiological contamination:

- › Soil: Total coliforms and fecal coliforms and *Escherichia coli* (*E. coli*);
- › Sediment: Total coliforms and fecal coliforms and *E. coli*; and
- › Groundwater: Total coliforms and *E. coli*.

With respect the potential for adverse impacts to human health, conclusions and recommendations are provided in the sections below.

### 3.1 Soil and Sediment

Total coliforms, fecal coliforms and *E. coli* were found in soil collected from the Study Area, with the soil data conservatively assumed to be representative of sediment that remains in the waterbodies in this area. When present, these coliforms may indicate the potential for other microorganisms; however, coliforms are also ubiquitous in the environment (Health Canada, 2020). The BC Ministry of Agriculture and Food (2022) indicates that over time (120 days) the extra load of potential bacteria that may result from flooding would be reduced in healthy soils exposed to ultraviolet rays from the sun. Given the time that has elapsed since the flood event, it is unlikely that potential bacteria from the flood remain in surface soils in the Study Area.

Given that coliform bacteria, including *E. coli*, may indicate the potential for other microorganisms, best practices for preventing illness are always recommended and include washing hands after contact with soil or sediment and to wash or cook produce. Further information on reducing risks from *E. coli* and other microorganisms is available at:

- › [Food Safety: Preparing | HealthLink BC](#), [Foodborne Illness and Safe Food Handling | HealthLink BC](#);
- › [Foodborne illness | HealthLink BC](#);
- › [E. Coli Infection from Food or Water | HealthLink BC](#);
- › [Hand Washing: Help Stop the Spread of Germs | HealthLink BC](#);
- › [Food Safety for Fresh Fruits and Vegetables | HealthLink BC](#); and
- › [Foodborne & Waterborne Diseases \(bccdc.ca\)](#).

The above recommendations align with existing BC Ministry of Health and BC Centre for Disease Control guidance for good hand hygiene and food safety. No additional actions or communications from government agencies are recommended for management of soil or sediment contamination in the Merritt Study Area from the November 2021 flood event.

## 3.2 Groundwater and Surface Water

Total coliforms and *E. coli* were measured in groundwater samples collected from shallow monitoring wells in November 2021 days after the flood. No subsequent sampling of these wells was conducted. These parameters were not measured in groundwater samples from the City of Merritt's water supply wells. Shallow groundwater monitoring wells were likely contaminated during the flooding by flood water entering the well casing and/or by nearby broken sanitary sewer pipes discharging to shallow groundwater, but this has not been confirmed.

No flood-related impacts to surface water were identified. There is potential for groundwater contaminated by the flood to migrate to surface water over time.

Any users of private water wells and surface water points of diversion in the Study Area should continue to follow health authority guidance for testing and disinfecting their water source. This guidance and information on how to manage flood-related drinking water issues is available at:

- › [Drinking Water | Environmental & Seasonal Health | IH \(interiorhealth.ca\)](#); and
- › [Floods & Landslides | Natural Disasters & Emergencies | IH \(interiorhealth.ca\)](#).

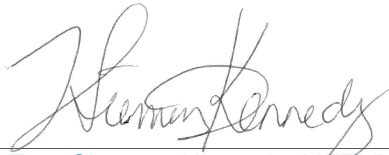
The above recommendations align with existing health authority guidance for private water well and point of diversion users. No additional actions or communications from government agencies are recommended for management of groundwater contamination in the Merritt Study Area from the November 2021 flood event.

## 4 Professional Statement

I declare that I am a qualified person and have the required knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

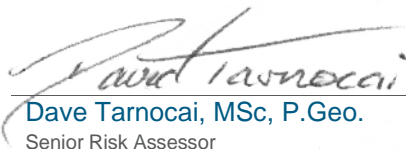
I confirm the:

1. Risk Assessment referred to above has been conducted in accordance with the Environmental Management Act, Contaminated Sites Regulation, director approved protocols, procedures, guidance and standard professional practice; and
2. Information used in the performance of the risk assessment and the conclusions of the risk assessment reported herein are true based on my knowledge as of the date completed.



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**Tara Siemens Kennedy, MET, P.Chem., CSAP**  
Senior Environmental Toxicologist and Risk Assessor



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**Dave Tarnocai, MSc, P.Geo.**  
Senior Risk Assessor

## 5 Notice to Reader

This report has been prepared and the work referred to in this report have been undertaken by SNC-Lavalin Inc. (SNC-Lavalin) for the exclusive use of BC Ministry of the Environment and Climate Change Strategy (BC ENV), who has been party to the development of the scope of work and understands its limitations. The methodology, findings, conclusions and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations described in the proposal and/or contract pursuant to which this report was issued. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. SNC-Lavalin accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

The findings, conclusions and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin's best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our original contract and included in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered, site conditions change or standards are amended, modifications to this report may be necessary. The results of this assessment should in no way be construed as a warranty that the subject site is free from any and all environmental impact.

This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final version of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

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# Tables

- 1: Soil Sampling Log (Merritt)
- 2: Summary of Analytical Results for Soil – Total Metals
- 3: Summary of Analytical Results for Soil – Microbiological Tests
- 4: Summary of Analytical Results for Soil – Hydrocarbons
- 5: Summary of Analytical Results for Soil – Polycyclic Aromatic Hydrocarbons
- 6: Summary of Analytical Results for Soil – Volatile Organic Compounds
- 7: Summary of Analytical Results for Soil – Pesticides, Herbicides and Pyrethroids
- 8: Summary of Analytical Results for Soil – Chlorinated Phenols
- 9: Summary of Analytical Results for Soil – Polychlorinated Biphenyls
- 10: Summary of Analytical Results for Sediment – Total Metals
- 11: Summary of Analytical Results for Sediment – Microbiological Parameters
- 12: Summary of Analytical Results for Sediment – Hydrocarbons
- 13: Summary of Analytical Results for Sediment – Polycyclic Aromatic Hydrocarbons
- 14: Summary of Analytical Results for Sediment – Volatile Organic Compounds
- 15: Summary of Analytical Results for Sediment – Pesticides, Herbicides and Pyrethroids
- 16: Summary of Analytical Results for Sediment – Chlorinated Phenols
- 17: Summary of Analytical Results for Sediment – PCBs
- 18: Summary of Merritt Soil Data from Other Sources
- 19: Summary of Merritt Soil Data from Other Sources Compared to Sediment Standards and Guidelines
- 20: Summary of Merritt Groundwater Data from Other Sources
- 21: Summary of Merritt Surface Water Data from Other Sources

**TABLE 1: Soil Sampling Log - Merritt**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Sample Type	Description	Depth (m)	Comments
M-SS22-01	M-SS22-01A	2022 03 23	Surface Sample	SILT, some fine grained sand, brown, loose, dry.	0.01	Same location as M-SS22-01
M-SS22-01	M-SS22-01	2022 03 23	Surface Sample	SAND, fine grained, some silt, trace medium grained sand, brown, loose, moist.	0.3	
M-SS22-02	M-SS22-02	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, moist.	0.05	
M-SS22-03	M-SS22-03	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, moist.	0.05	
M-SS22-04	M-SS22-04	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, damp.	0.15	
M-SS22-05	M-SS22-05	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, moist.	0.15	
M-SS22-05	M-SS22-06	Duplicate	Surface Sample	Blind field Duplicate of M-SS22-05	0.15	
M-SS22-07	M-SS22-07	2022 03 23	Surface Sample	SAND, fine grained, some silt, trace medium grained sand, brown, loose, moist.	0.15	

**TABLE 2: Summary of Analytical Results for Soil - Total Metals.**

Sample Location Sample ID Sample Date (yyyy mm dd) Depth Interval (m)		M-SS22-01		M-SS22-02	M-SS22-03	BC Standard		Federal Guideline	
		M-SS22-01A 2022 03 23 0.0 - 0.01	M-SS22-01 2022 03 23 0.0 - 0.3	M-SS22-02 2022 03 23 0.0 - 0.05	M-SS22-03 2022 03 23 0.0 - 0.05	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use	CCME CEQG Agricultural Surface (AL Surface) <sup>c</sup>	CCME CEQG Residential Surface (RL Surface) <sup>d</sup>
Parameter	Units	Analytical Results							
<b>Physical Parameters</b>									
pH	pH	7.88	<b>8.64</b>	7.98	7.62	n/a	n/a	6.0 - 8.0	6.0 - 8.0
Solid Content	%	93.6	90.4	73.9	92.4	n/a	n/a	n/a	n/a
Total Organic Carbon	%	-	-	2.33	1.53	n/a	n/a	n/a	n/a
Total Organic Carbon	µg/g	-	-	23,300	15,300	n/a	n/a	n/a	n/a
Ammonia Nitrogen	µg/g	-	14.4	15.0	9.9	n/a	n/a	n/a	n/a
Water Soluble Nitrate Nitrogen	µg/g	-	0.882	4.13	52.2	25,000	25,000	n/a	n/a
Water Soluble Nitrite Nitrogen	µg/g	-	< 0.500	< 0.500	< 0.500	1,500	1,500	n/a	n/a
Water Soluble Phosphate	µg/g	-	< 0.500	< 0.500	< 0.500	n/a	n/a	n/a	n/a
<b>Total Metals</b>									
Aluminum	µg/g	13,800	9,910	18,500	20,300	40,000	40,000	n/a	n/a
Antimony	µg/g	0.34	0.24	0.38	0.35	20	20	20	20
Arsenic	µg/g	4.12	3.80	5.68	5.88	10	10	12	12
Barium	µg/g	143	76.0	197	196	350	700	750	500
Beryllium	µg/g	0.33	0.24	0.44	0.48	85 (pH >=8.0)	85 (pH >=8.0)	4	4
Boron	µg/g	2.7	2.4	3.1	3.2	8,500	8,500	n/a	n/a
Cadmium	µg/g	0.150	0.084	0.230	0.203	10 (pH >=8.0)	20 (pH >=8.0)	1.4	10
Chromium	µg/g	27.4	19.3	36.7	38.1	60 <sup>e</sup>	60 <sup>e</sup>	64 <sup>f</sup>	64 <sup>f</sup>
Chromium, hexavalent	µg/g	-	< 0.40	< 0.40	< 0.40	60	60	0.4	0.4
Chromium, trivalent	µg/g	-	19.3	36.7	38.1	60	100	64 <sup>f</sup>	64 <sup>f</sup>
Cobalt	µg/g	11.2	9.08	14.6	15.7	25	25	40	50
Copper	µg/g	39.6	25.7	53.6	57.6	150 (pH >=7.5)	150 (pH >=7.5)	63	63
Iron	µg/g	27,100	24,200	34,800	<b>38,200</b>	35,000	35,000	n/a	n/a
Lead	µg/g	4.36	6.57	6.50	6.92	120 (pH >=7.5)	120 (pH >=7.5)	70	140
Lithium	µg/g	8.02	6.21	11.2	11.6	30	30	n/a	n/a
Manganese	µg/g	637	427	952	986	2,000	2,000	n/a	n/a
Mercury	µg/g	< 0.040	< 0.040	0.044	0.051	0.6	10	6.6	6.6
Molybdenum	µg/g	0.80	0.42	1.15	1.14	3	80	5	10
Nickel	µg/g	19.4	14.8	25.7	26.8	150 (pH >=8.0)	150 (pH >=8.0)	45	45
Selenium	µg/g	< 0.20	< 0.20	0.25	0.23	1	1	1	1
Silver	µg/g	< 0.10	< 0.10	0.15	0.13	20	20	20	20
Strontium	µg/g	81.2	50.9	94.5	95.4	9,500	9,500	n/a	n/a
Thallium	µg/g	< 0.10	< 0.10	< 0.10	< 0.10	2	9	1	1
Tin	µg/g	0.52	0.25	0.49	0.51	5	50	5	50
Tungsten	µg/g	< 0.20	< 0.20	< 0.20	< 0.20	15	15	n/a	n/a
Uranium	µg/g	0.717	0.307	1.09	0.956	15	100	23	23
Vanadium	µg/g	68.0	61.0	86.1	90.6	100	150	130	130
Zinc	µg/g	60.5	48.8	80.0	87.0	200 (pH >=8.0)	450 (pH >=8.0)	250	250
Potassium	µg/g	-	734	1,410	1,510	n/a	n/a	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline
<b>OUTLINE</b>	Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Historical Guideline, Soil General.

<sup>e</sup> Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.

<sup>f</sup> Chromium guideline does not include nutrient and energy-cycling check.

**TABLE 2: Summary of Analytical Results for Soil - Total Metals.**

Sample Location		M-SS22-04	M-SS22-05		M-SS22-07	BC Standard		Federal Guideline		
Sample ID	Sample Date (yyyy mm dd)	M-SS22-04	M-SS22-05	M-SS22-06	QA/QC RPD %	M-SS22-07	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>b</sup>	CCME CEQG Agricultural Surface (AL Surface) <sup>c</sup>	CCME CEQG Residential Surface (RL Surface) <sup>d</sup>
Parameter	Units	2022 03 23	2022 03 23	Duplicate		2022 03 23				
Depth Interval (m)		0.0 - 0.15	0.0 - 0.15	0.0 - 0.15		0.0 - 0.15				
<b>Physical Parameters</b>										
pH	pH	7.91	<b>8.02</b>	<b>8.07</b>	1	<b>8.15</b>	n/a	n/a	6.0 - 8.0	6.0 - 8.0
Solid Content	%	84.2	71.7	69.2	4	79.5	n/a	n/a	n/a	n/a
Total Organic Carbon	%	1.15	2.86	3.18	11	0.645	n/a	n/a	n/a	n/a
Total Organic Carbon	µg/g	11,500	28,600	31,800	11	6,450	n/a	n/a	n/a	n/a
Ammonia Nitrogen	µg/g	9.3	17.8	20.1	*	13.5	n/a	n/a	n/a	n/a
Water Soluble Nitrate Nitrogen	µg/g	3.81	0.996	< 0.500	*	< 0.500	25,000	25,000	n/a	n/a
Water Soluble Nitrite Nitrogen	µg/g	< 0.500	< 0.500	< 0.500	*	< 0.500	1,500	1,500	n/a	n/a
Water Soluble Phosphate	µg/g	< 0.500	< 0.500	< 0.500	*	< 0.500	n/a	n/a	n/a	n/a
<b>Total Metals</b>										
Aluminum	µg/g	14,800	14,800	15,200	3	12,200	40,000	40,000	n/a	n/a
Antimony	µg/g	0.30	0.36	0.25	*	0.22	20	20	20	20
Arsenic	µg/g	4.49	4.40	4.49	2	3.61	10	10	12	12
Barium	µg/g	157	160	161	1	123	350	700	750	500
Beryllium	µg/g	0.36	0.37	0.36	*	0.30	85 (pH >=8.0)	85 (pH >=8.0)	4	4
Boron	µg/g	2.8	3.2	2.9	*	3.8	8,500	8,500	n/a	n/a
Cadmium	µg/g	0.139	0.162	0.159	*	0.150	10 (pH >=8.0)	20 (pH >=8.0)	1.4	10
Chromium	µg/g	28.4	28.6	29.3	2	22.9	60 <sup>e</sup>	60 <sup>e</sup>	64 <sup>f</sup>	64 <sup>f</sup>
Chromium, hexavalent	µg/g	-	< 0.40	-	-	-	60	60	0.4	0.4
Chromium, trivalent	µg/g	-	28.6	-	-	-	60	100	64 <sup>f</sup>	64 <sup>f</sup>
Cobalt	µg/g	11.8	11.8	12.2	3	10.1	25	25	40	50
Copper	µg/g	43.2	42.9	43.8	2	32.1	150 (pH >=7.5)	150 (pH >=7.5)	63	63
Iron	µg/g	28,300	28,000	28,900	3	24,400	35,000	35,000	n/a	n/a
Lead	µg/g	5.19	5.22	5.02	4	4.25	120 (pH >=7.5)	120 (pH >=7.5)	70	140
Lithium	µg/g	8.56	9.18	8.96	2	8.06	30	30	n/a	n/a
Manganese	µg/g	707	709	723	2	519	2,000	2,000	n/a	n/a
Mercury	µg/g	< 0.040	< 0.040	0.058	*	< 0.040	0.6	10	6.6	6.6
Molybdenum	µg/g	0.89	0.88	0.80	10	0.62	3	80	5	10
Nickel	µg/g	21.3	20.6	21.2	3	17.3	150 (pH >=8.0)	150 (pH >=8.0)	45	45
Selenium	µg/g	< 0.20	< 0.20	0.25	*	< 0.20	1	1	1	1
Silver	µg/g	< 0.10	< 0.10	0.11	*	< 0.10	20	20	20	20
Strontium	µg/g	85.5	84.6	85.4	1	70.2	9,500	9,500	n/a	n/a
Thallium	µg/g	< 0.10	< 0.10	< 0.10	*	< 0.10	2	9	1	1
Tin	µg/g	0.40	0.31	0.49	*	0.39	5	50	5	50
Tungsten	µg/g	< 0.20	< 0.20	< 0.20	*	< 0.20	15	15	n/a	n/a
Uranium	µg/g	0.837	0.870	0.879	1	0.480	15	100	23	23
Vanadium	µg/g	69.1	68.3	70.4	3	59.9	100	150	130	130
Zinc	µg/g	63.7	62.1	64.5	4	54.5	200 (pH >=8.0)	450 (pH >=8.0)	250	250
Potassium	µg/g	1,130	1,150	1,230	7	974	n/a	n/a	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

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irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

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<sup>e</sup> Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.

<sup>f</sup> Chromium guideline does not include nutrient and energy-cycling check.

**TABLE 3: Summary of Analytical Results for Soil - Microbiological Tests.**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Microbiological Tests			
				Fecal Coliform MPN/g	E. Coli MPN/g	Total Coliforms MPN/g	Salmonella MPN/g
M-SS22-01	M-SS22-01A	2022 03 23	0.0 - 0.01	3.8	3.8	3.8	< 0.2
	M-SS22-01	2022 03 23	0.0 - 0.3	< 3.0	< 3.0	10	< 0.2
M-SS22-02	M-SS22-02	2022 03 23	0.0 - 0.05	< 4.1	< 4.1	49	< 0.3
M-SS22-03	M-SS22-03	2022 03 23	0.0 - 0.05	< 3.0	< 3.0	3.9	< 0.2
M-SS22-04	M-SS22-04	2022 03 23	0.0 - 0.15	< 3.0	< 3.0	11	< 0.2
M-SS22-05	M-SS22-05	2022 03 23	0.0 - 0.15	13	13	21	< 0.3
	M-SS22-06	Duplicate	0.0 - 0.15	33	33	33	< 0.3
<b>QA/QC RPD%</b>				*	*	44	*
M-SS22-07	M-SS22-07	2022 03 23	0.0 - 0.15	< 3.8	< 3.8	29	< 0.3
<b>BC Standard</b>							
CSR Agricultural Land Use (AL) <sup>a</sup>				n/a	n/a	n/a	n/a
CSR Low Density Residential Land Use (RLLD) <sup>a</sup>				n/a	n/a	n/a	n/a
<b>Federal Guideline</b>							
CCME CEQG Agricultural Surface (AL Surface)				n/a	n/a	n/a	n/a
CCME CEQG Residential Surface (RL Surface)				n/a	n/a	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

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RDL Denotes reported detection limit.

**BOLD** Concentration greater than CSR Agricultural Land Use (AL) Standard

**SHADED** Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**SHADOW** Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline

**OUTLINE** Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

**TABLE 4: Summary of Analytical Results for Soil - Hydrocarbons**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Monocyclic Aromatic Hydrocarbons					Gross Parameters				MTBE		
				Benzene µg/g	Ethylbenzen µg/g	Toluene µg/g	Xylenes µg/g	Styrene µg/g	VPHs µg/g	EPH (C10-C19) <sup>f</sup> µg/g	LEPHs <sup>f</sup> µg/g	EPH (C19-C32) <sup>f</sup> µg/g	HEPHs <sup>f</sup> µg/g	Methyl Tert-butyl Ether [MTBE] µg/g	
M-SS22-01	M-SS22-01	2022 03 23	0.0 - 0.3	< 0.020 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.200 <sup>a</sup>	< 0.100	< 0.050	< 20	< 50	< 50	< 50	< 50	< 0.040	
M-SS22-02	M-SS22-02	2022 03 23	0.0 - 0.05	-	-	-	-	-	-	< 50	< 50	71	71	-	
M-SS22-03	M-SS22-03	2022 03 23	0.0 - 0.05	-	-	-	-	-	-	< 50	< 50	< 50	< 50	-	
M-SS22-04	M-SS22-04	2022 03 23	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	68	68	-	
M-SS22-05	M-SS22-05	2022 03 23	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	63	63	-	
	M-SS22-06	Duplicate	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	80	80	-	
				<b>QA/QC RPD%</b>				-	-	-	-	*	*	*	*
M-SS22-07	M-SS22-07	2022 03 23	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	57	57	-	
<b>BC Standard</b>															
CSR Agricultural Land Use (AL) <sup>b</sup>				0.035	15	0.5	6.5	0.1	200	1,000	1,000	1,000	1,000	4,000	
CSR Low Density Residential Land Use (RLLD) <sup>c</sup>				2.5	200	0.5	20	5	200	1,000	1,000	1,000	1,000	4,000	
<b>Federal Guideline</b>															
CCME CEQG Agricultural Surface (AL Surface) <sup>d</sup>				0.0068 <sup>g</sup>	0.018	0.08	2.4	0.1	n/a	n/a	n/a	n/a	n/a	n/a	
CCME CEQG Residential Surface (RL Surface) <sup>e</sup>				1	50	0.1	37	5	n/a	n/a	n/a	n/a	n/a	n/a	

Associated CARO file(s): 22C3371, 22C3377.

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline
<b>OUTLINE</b>	Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

<sup>e</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Historical Guideline, Soil General.

<sup>f</sup> Where no LEPH and HEPH are available, EPH has been compared to LEPH and HEPH standards, which are conservative comparisons.

<sup>g</sup> Guidelines use 10-5 incremental risk.

**TABLE 5: Summary of Analytical Results for Soil - Polycyclic Aromatic Hydrocarbons.**

Sample Location Sample ID	M-SS22-01	M-SS22-02	M-SS22-03	M-SS22-04	M-SS22-05			M-SS22-07	BC Standard		Federal Guideline	
	M-SS22-01	M-SS22-02	M-SS22-03	M-SS22-04	M-SS22-05	M-SS22-06	QA/QC	M-SS22-07	CSR Agricultural Land Use (AL) <sup>b</sup>	CSR Low Density Residential Land Use (RLLD) <sup>c</sup>	CCME CEQG Agricultural Surface (AL Surface) <sup>d</sup>	CCME CEQG Residential Surface (RL Surface) <sup>e</sup>
Sample Date (yyyy mm dd)	2022 03 23	2022 03 23	2022 03 23	2022 03 23	2022 03 23		RPD %	2022 03 23				
Depth Interval (m)	0.0 - 0.3	0.0 - 0.01	0.0 - 0.05	0.0 - 0.15	0.0 - 0.15			0.0 - 0.15				
Parameter	Units	Analytical Results										
<b>Polycyclic Aromatic Hydrocarbons</b>												
Naphthalene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.6	0.6	0.013	0.013
Methylnaphthalene, 1-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	250	250	n/a	n/a
Methylnaphthalene, 2-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	60	60	n/a	n/a
Acenaphthylene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	320	320
Acenaphthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	950	950	0.28	0.28
Fluorene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	600	600	0.25	0.25
Phenanthrene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.1	5	0.046	0.046
Anthracene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	2.5	2.5	2.5	2.5
Fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	50	50	15.4	15.4
Pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	10	0.1	7.7
Benz(a)anthracene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	0.1	1
Chrysene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	200	200	6.2	6.2
Benzo(b)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	0.1	1
Benzo(b+)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	0.1	1
Benzo(k)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	0.1	1
Benzo(a)pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	5	5	0.6	0.6
Indeno(1,2,3-cd)pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	0.1	1
Dibenz(a,h)anthracene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	0.1	1
Benzo(g,h,i)perylene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a	n/a
Quinoline	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	2.5	2.5	0.1	n/a
Chloronaphthalene, 2-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	1,500	1,500	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline
<b>OUTLINE</b>	Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

<sup>e</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Historical Guideline, Soil General.

**TABLE 6: Summary of Analytical Results for Soil - Volatile Organic Compounds.**

Sample Location		M-SS22-01	BC Standard		Federal Guideline	
Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	CSR Agricultural Land Use (AL) <sup>b</sup>	CSR Low Density Residential Land Use (RLLD) <sup>c</sup>	CCME CEQG Agricultural Surface (AL Surface) <sup>d</sup>	CCME CEQG Residential Surface (RL Surface) <sup>e</sup>
Parameter	Units	Analytical Results				
<b>Volatile Organic Compounds</b>						
Bromodichloromethane [BDCM]	µg/g	< 0.100	100	100	n/a	n/a
Bromoform	µg/g	< 0.100	300	300	n/a	n/a
Carbon Tetrachloride	µg/g	< 0.050	0.1	5	0.1	5
Chlorobenzene	µg/g	< 0.050	0.1	1	0.1	1
Chloroform	µg/g	< 0.050	0.1	5	0.1	5
Dibromochloromethane [DBCM]	µg/g	< 0.100	85	85	n/a	n/a
Dibromoethane, 1,2-	µg/g	< 0.100	3.5	3.5	n/a	n/a
Dibromomethane	µg/g	< 0.100	n/a	n/a	n/a	n/a
Dichlorobenzene, 1,2-	µg/g	< 0.050	0.1	1	0.1	1
Dichlorobenzene, 1,3-	µg/g	< 0.050	0.1	1	0.1	1
Dichlorobenzene, 1,4-	µg/g	< 0.050	0.1	1	0.1	1
Dichloroethane, 1,1-	µg/g	< 0.050	0.1	5	0.1	5
Dichloroethane, 1,2-	µg/g	< 0.050	0.1	5	0.1	5
Dichloroethylene, 1,1-	µg/g	< 0.050	0.1	5	0.1	5
Dichloroethylene, 1,2-cis-	µg/g	< 0.050	0.1	5	0.1	5
Dichloroethylene, 1,2-trans-	µg/g	< 0.050	0.1	5	0.1	5
Dichloromethane	µg/g	< 0.100	0.1	5	0.1	5
Dichloropropane, 1,2-	µg/g	< 0.050	0.1	5	0.1	5
Dichloropropene, 1,3- (cis+trans)	µg/g	< 0.050	0.1	5	n/a	n/a
Tetrachloroethane, 1,1,2,2-	µg/g	< 0.050	35	35	0.1	5
Tetrachloroethylene	µg/g	< 0.050	2.5	2.5	0.1	0.2
Trichloroethane, 1,1,1-	µg/g	< 0.050	0.1	5	0.1	5
Trichloroethane, 1,1,2-	µg/g	< 0.050	0.1	5	0.1	5
Trichloroethylene	µg/g	< 0.040 <sup>a</sup>	0.3	0.3	0.01	0.05
Trichlorofluoromethane	µg/g	< 0.100	4,500	4,500	n/a	n/a
Vinyl Chloride	µg/g	< 0.100	0.95	0.95	n/a	n/a

Associated CARO file(s): 22C3371.

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\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline
<b>OUTLINE</b>	Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

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**TABLE 7: Summary of Analytical Results for Soil - Pesticides, Herbicides, Pyrethroids.**

Sample Location		M-SS22-01	M-SS22-07	BC Standard		Federal Guideline	
Sample ID		M-SS22-01	M-SS22-07	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>b</sup>	CCME CEQG Agricultural Surface (AL Surface) <sup>c</sup>	CCME CEQG Residential Surface (RL Surface) <sup>d</sup>
Sample Date (yyyy mm dd)		2022 03 23	2022 03 23				
Depth Interval (m)		0.0 - 0.3	0.0 - 0.15				
Parameter	Units	Analytical Results					
<b>Organochlorine Pesticides</b>							
Alachlor	µg/g	< 0.0050	< 0.0050	100	100	n/a	n/a
Aldrin	µg/g	< 0.0050	< 0.0050	0.4	0.4	n/a	n/a
Captan	µg/g	< 0.0400	< 0.0400	2,000	2,000	n/a	n/a
Chlordane (cis+trans)	µg/g	< 0.0050	< 0.0050	8	8	n/a	n/a
Chlorothalonil	µg/g	< 0.0050	< 0.0050	250	250	n/a	n/a
DDT + Metabolites	µg/g	< 0.0100	< 0.0100	0.7	0.7	0.1	0.1
Dieldrin	µg/g	< 0.0050	< 0.0050	0.45	0.45	n/a	n/a
Endosulfan (I+II)	µg/g	< 0.0050	< 0.0050	250	250	n/a	n/a
Endosulfan Sulphate	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a
Endrin	µg/g	< 0.0050	< 0.0050	4.5	4.5	n/a	n/a
Endrin Aldehyde	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a
Endrin Ketone	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a
Heptachlor	µg/g	< 0.0050	< 0.0050	1.5	1.5	n/a	n/a
Heptachlor Epoxide	µg/g	< 0.0050	< 0.0050	0.2	0.2	n/a	n/a
Hexachlorocyclohexane, alpha-	µg/g	< 0.0050	< 0.0050	1	1	n/a	n/a
Hexachlorocyclohexane, beta-	µg/g	< 0.0050	< 0.0050	4	4	n/a	n/a
Hexachlorocyclohexane, delta-	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a
Hexachlorocyclohexane, gamma-	µg/g	< 0.0050	< 0.0050	10	10	0.01	n/a
Methoxychlor	µg/g	< 0.0050	< 0.0050	80	80	n/a	n/a
<b>Organophosphorus Pesticides</b>							
Azinphos-Methyl	µg/g	< 0.0100	< 0.0100	45	45	n/a	n/a
Bromacil	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a
Chlorpyrifos	µg/g	< 0.0100	< 0.0100	15	15	n/a	n/a
Diazinon	µg/g	< 0.0100	< 0.0100	10	10	n/a	n/a
Dichlorvos	µg/g	< 0.0100	< 0.0100	8	8	n/a	n/a
Dimethoate	µg/g	< 0.0100	< 0.0100	3	3	n/a	n/a
Disulfoton	µg/g	< 0.0200	< 0.0200	0.6	0.6	n/a	n/a
Malathion	µg/g	< 0.0100	< 0.0100	300	300	n/a	n/a
Parathion	µg/g	< 0.0100	< 0.0100	95	95	n/a	n/a
Parathion Methyl	µg/g	< 0.0100	< 0.0131	4	4	n/a	n/a
Phorate	µg/g	< 0.0100	< 0.0100	3	3	n/a	n/a
Ronnel	µg/g	< 0.0100	< 0.0100	800	800	n/a	n/a
Sulfotep	µg/g	< 0.0100	< 0.0100	8	8	n/a	n/a
Temephos	µg/g	< 0.0500	< 0.0500	n/a	300	n/a	n/a
Terbufos	µg/g	< 0.0100	< 0.0100	0.4	0.4	n/a	n/a
<b>Miscellaneous Pesticides</b>							
Diclofop-methyl	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

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\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline
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<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Historical Guideline, Soil General.

**TABLE 7: Summary of Analytical Results for Soil - Pesticides, Herbicides, Pyrethroids.**

Parameter	Units	Sample Location		BC Standard		Federal Guideline		
		Sample ID	M-SS22-01	M-SS22-07	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>b</sup>	CCME CEQG Agricultural Surface (AL Surface) <sup>c</sup>	CCME CEQG Residential Surface (RL Surface) <sup>d</sup>
		Sample Date (yyyy mm dd)	2022 03 23	2022 03 23				
		Depth Interval (m)	0.0 - 0.3	0.0 - 0.15				
		Analytical Results						
<b>Herbicides</b>								
Acetic acid, 2-methyl-4-chlorophenoxy- [MCPA]	µg/g	< 0.010	< 0.013	8	8	n/a	n/a	
Bentazon	µg/g	< 0.010	< 0.013	450	450	n/a	n/a	
Bromoxynil	µg/g	< 0.010	< 0.013	300	300	n/a	n/a	
Butanoic Acid, 4-(4-chloro-2-methylphenoxy)- [MCPE]	µg/g	< 0.010	< 0.013	150	150	n/a	n/a	
Chloramben	µg/g	< 0.010	< 0.013	250	250	n/a	n/a	
Clopyralid	µg/g	< 0.010	< 0.013	n/a	n/a	n/a	n/a	
Cyanazine	µg/g	< 0.0100	< 0.0100	8.5	8.5	n/a	n/a	
Dicamba	µg/g	< 0.010	< 0.013	450	450	n/a	n/a	
Dichlorophenoxy Acetic Acid, 2,4- [2,4-D]	µg/g	< 0.010	< 0.013	150	150	n/a	n/a	
Dichlorophenoxy Butyric Acid, 2,4- [2,4-DB]	µg/g	< 0.010	< 0.013	150	150	n/a	n/a	
Dichlorprop	µg/g	< 0.010	< 0.013	n/a	n/a	n/a	n/a	
Dinoseb	µg/g	< 0.010	< 0.013	15	15	n/a	n/a	
Diuron	µg/g	< 0.0200	< 0.0200	30	30	n/a	n/a	
Linuron	µg/g	< 0.0400	< 0.0400	30	30	n/a	n/a	
Metolachlor	µg/g	< 0.0100	< 0.0100	2,500	2,500	n/a	n/a	
Metribuzin	µg/g	< 0.0100	< 0.0100	400	400	n/a	n/a	
Picloram	µg/g	< 0.010	< 0.013	1,000	1,000	n/a	n/a	
Prometon	µg/g	< 0.0100	< 0.0100	250	250	n/a	n/a	
Prometryn	µg/g	< 0.0050	< 0.0050	60	60	n/a	n/a	
Silvex [2,4,5-TP]	µg/g	< 0.010	< 0.013	150	150	n/a	n/a	
Simazine	µg/g	< 0.0100	< 0.0100	60	60	n/a	n/a	
Tebuthiuron	µg/g	< 0.0200	< 0.0200	1,000	1,000	n/a	n/a	
Triallate	µg/g	< 0.0050	< 0.0050	200	200	n/a	n/a	
Trichlorophenoxyacetic Acid, 2,4,5- [2,4,5-T]	µg/g	< 0.010	< 0.013	150	150	n/a	n/a	
Triclopyr	µg/g	< 0.010	< 0.013	n/a	n/a	n/a	n/a	
Trifluralin	µg/g	< 0.0100	< 0.0100	100	100	n/a	n/a	
Butachlor	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a	
2-(2-Methyl-4-chlorophenoxy) propionic acid	µg/g	< 0.010	< 0.013	n/a	n/a	n/a	n/a	
Atrazine + N-dealkylated metabolites	ug/g	< 0.0050	< 0.0050	n/a	n/a	n/a	n/a	
<b>Pyrethroids</b>								
Deltamethrin	µg/g	< 0.0500	< 0.0500	n/a	n/a	n/a	n/a	
Permethrin (cis+trans)	µg/g	< 0.0050	0.0083	800	800	n/a	n/a	
<b>Fungicides</b>								
Pentachloronitrobenzene [PCNB]	µg/g	< 0.0050	< 0.0050	25	25	n/a	n/a	

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline
<b>OUTLINE</b>	Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Historical Guideline, Soil General.

**TABLE 8: Summary of Analytical Results for Soil - Chlorinated Phenols.**

Sample Location		M-SS22-02	M-SS22-03	M-SS22-05	M-SS22-07	BC Standard		Federal Guideline	
Sample ID	Sample Date (yyyy mm dd)	M-SS22-02	M-SS22-03	M-SS22-05	M-SS22-07	CSR Agricultural Land Use (AL) <sup>b</sup>	CSR Low Density Residential Land Use (RLLD) <sup>c</sup>	CCME CEQG Agricultural Surface (AL Surface) <sup>d</sup>	CCME CEQG Residential Surface (RL Surface) <sup>e</sup>
Depth Interval (m)		2022 03 23	2022 03 23	2022 03 23	2022 03 23				
Parameter	Units	0.0 - 0.05	0.0 - 0.05	0.0 - 0.15	0.0 - 0.15				
<b>Physical Parameters</b>									
pH	pH	7.98	7.62	<b>8.02</b>	<b>8.15</b>	n/a	n/a	6.0 - 8.0	6.0 - 8.0
<b>Chlorinated Phenols</b>									
Chlorophenol, 2-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Chlorophenol, 3-&4-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05 <sup>f</sup>	0.5 <sup>f</sup>	n/a	n/a
Dichlorophenol, 2,3-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Dichlorophenol, 2,4-&2,5-	µg/g	< 0.030	< 0.030	< 0.030	< 0.030	0.05 <sup>f</sup>	0.5 <sup>f</sup>	0.05 <sup>i</sup>	0.5 <sup>i</sup>
Dichlorophenol, 2,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Dichlorophenol, 3,4-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Dichlorophenol, 3,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Methylphenol, 4-chloro-3-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	1,500	1,500	n/a	n/a
Trichlorophenol, 2,3,4-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Trichlorophenol, 2,3,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	n/a	n/a
Trichlorophenol, 2,3,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Trichlorophenol, 2,4,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Trichlorophenol, 2,4,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Trichlorophenol, 3,4,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Tetrachlorophenol, 2,3,4,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.05	0.5
Tetrachlorophenol, 2,3,4,5 & 2,3,5,6	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05 <sup>f</sup>	0.5 <sup>f</sup>	0.05 <sup>f</sup>	0.5 <sup>f</sup>
Pentachlorophenol [PCP]	µg/g	< 0.020 <sup>a</sup>	< 0.020 <sup>a</sup>	< 0.020 <sup>a</sup>	< 0.020 <sup>a</sup>	25 (pH >=6.5) <sup>g</sup>	25 (pH >=6.5) <sup>h</sup>	0.009 (pH >=8.0)	0.009 (pH >=8.0)

Associated Caro file(s): 22C3371, 22C3377.

Associated CARO file(s): 22C3371, 22C3377.

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QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL)
<b>OUTLINE</b>	Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

<sup>e</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Historical Guideline, Soil General.

<sup>f</sup> Standard is for most stringent of individual isomers.

**TABLE 9: Summary of Analytical Results for Soil - PCBs.**

Sample Location		M-SS22-01	M-SS22-02	M-SS22-05	BC Standard		Federal Guideline	
Sample ID	Sample Date (yyyy mm dd)	M-SS22-01	M-SS22-02	M-SS22-05	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>b</sup>	CCME CEQG Agricultural Surface (AL Surface) <sup>c</sup>	CCME CEQG Residential Surface (RL Surface) <sup>d</sup>
Depth Interval (m)		2022 03 23	2022 03 23	2022 03 23				
Parameter	Units	Analytical Results						
<b>PCBs</b>								
Aroclor 1016	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1221	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1232	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1242	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1248	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1254	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1260	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1262	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Aroclor 1268	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a	n/a
Polychlorinated Biphenyls, Total [PCBs]	µg/g	< 0.040	< 0.040	< 0.040	1.5	1.5	0.5	1.3 <sup>e</sup>

Associated Caro file(s): 22C3371, 22C3377.

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n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

<b>BOLD</b>	Concentration greater than CSR Agricultural Land Use (AL) standard
<b>SHADED</b>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
<b>SHADOW</b>	Concentration greater than CCME CEQG Agricultural Surface (AL Surface) Guideline
<b>OUTLINE</b>	Concentration greater than CCME CEQG Residential Surface (RL Surface) Guideline

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>b</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent). Samples with depths greater than 3.0 m are compared to Industrial Land Use (IL) standards.

<sup>c</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy cycling, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Protection of Potable Groundwater, Historical Guideline, Soil General.

<sup>d</sup> Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Soil and Food Ingestion, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Historical Guideline, Soil General.

<sup>e</sup> Guideline includes most stringent soil and food ingestion guideline (see factsheet for more details).

**TABLE 10: Summary of Analytical Results for Sediment - Total Metals.**

Sample Location		M-SS22-01		M-SS22-02	M-SS22-03	BC Standard CSR Freshwater Sediment (FW) <sup>a</sup>	Federal Guideline	
Sample ID	M-SS22-01A	M-SS22-01	M-SS22-02	M-SS22-03	CCME CEQG Interim Sediment Quality (ISQG) <sup>b</sup>		CCME CEQG Probable Effect Level (PEL) <sup>b</sup>	
Sample Date (yyyy mm dd)	2022 03 23	2022 03 23	2022 03 23	2022 03 23				
Depth Interval (m)	0.0 - 0.01	0.0 - 0.3	0.0 - 0.05	0.0 - 0.05				
Parameter	Units	Analytical Results						
<b>Physical Parameters</b>								
pH	pH	7.88	8.64	7.98	7.62	n/a	n/a	n/a
Total Organic Carbon	%	-	-	2.33	1.53	n/a	n/a	n/a
Total Organic Carbon	µg/g	-	-	23,300	15,300	n/a	n/a	n/a
Ammonia Nitrogen	µg/g	-	14.4	15.0	9.9	n/a	n/a	n/a
Water Soluble Nitrate Nitrogen	µg/g	-	0.882	4.13	52.2	n/a	n/a	n/a
Water Soluble Nitrite Nitrogen	µg/g	-	< 0.500	< 0.500	< 0.500	n/a	n/a	n/a
Phosphate Water Soluble	µg/g	-	< 0.500	< 0.500	< 0.500	n/a	n/a	n/a
<b>Total Metals</b>								
Antimony	µg/g	0.34	0.24	0.38	0.35	n/a	n/a	n/a
Arsenic	µg/g	4.12	3.80	5.68	5.88	11	5.9	17
Barium	µg/g	143	76.0	197	196	n/a	n/a	n/a
Beryllium	µg/g	0.33	0.24	0.44	0.48	n/a	n/a	n/a
Cadmium	µg/g	0.150	0.084	0.230	0.203	2.2	0.6	3.5
Chromium	µg/g	27.4	19.3	36.7	<b>38.1</b>	56	37.3	90
Chromium, hexavalent	µg/g	-	< 0.40	< 0.40	< 0.40	n/a	n/a	n/a
Chromium, trivalent	µg/g	-	19.3	36.7	38.1	n/a	n/a	n/a
Cobalt	µg/g	11.2	9.08	14.6	15.7	n/a	n/a	n/a
Copper	µg/g	<b>39.6</b>	25.7	<b>53.6</b>	<b>57.6</b>	120	35.7	197
Lead	µg/g	4.36	6.57	6.50	6.92	57	35	91.3
Lithium	µg/g	8.02	6.21	11.2	11.6	n/a	n/a	n/a
Manganese	µg/g	637	427	952	986	n/a	n/a	n/a
Mercury	µg/g	< 0.040	< 0.040	0.044	0.051	0.3	0.17	0.486
Molybdenum	µg/g	0.80	0.42	1.15	1.14	n/a	n/a	n/a
Nickel	µg/g	19.4	14.8	25.7	26.8	n/a	n/a	n/a
Selenium	µg/g	< 0.20	< 0.20	0.25	0.23	n/a	n/a	n/a
Silver	µg/g	< 0.10	< 0.10	0.15	0.13	n/a	n/a	n/a
Strontium	µg/g	81.2	50.9	94.5	95.4	n/a	n/a	n/a
Tin	µg/g	0.52	0.25	0.49	0.51	n/a	n/a	n/a
Uranium	µg/g	0.717	0.307	1.09	0.956	n/a	n/a	n/a
Vanadium	µg/g	68.0	61.0	86.1	90.6	n/a	n/a	n/a
Zinc	µg/g	60.5	48.8	80.0	87.0	200	123	315
Aluminum	µg/g	13,800	9,910	18,500	20,300	n/a	n/a	n/a
Boron	µg/g	2.7	2.4	3.1	3.2	n/a	n/a	n/a
Iron	µg/g	27,100	24,200	34,800	38,200	n/a	n/a	n/a
Potassium	µg/g	-	734	1,410	1,510	n/a	n/a	n/a
Thallium	µg/g	< 0.10	< 0.10	< 0.10	< 0.10	n/a	n/a	n/a
Tungsten	µg/g	< 0.20	< 0.20	< 0.20	< 0.20	n/a	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

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RDL Denotes reported detection limit.

**BOLD**

Concentration greater than CSR Freshwater Sediment (FW) standard

**SHADED**

Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

**RED**

Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Pathways Included: Sensitive Site.

<sup>b</sup> Guideline to protect freshwater aquatic life.

**TABLE 10 (cont): Summary of Analytical Results for Sediment - Total Metals.**

Sample Location		M-SS22-04	M-SS22-05		M-SS22-07	BC Standard	Federal Guideline	
Sample ID	M-SS22-04	M-SS22-05	M-SS22-06	QA/QC	M-SS22-07	CSR Freshwater Sediment (FW) <sup>a</sup>	CCME CEQG Interim Sediment Quality (ISQG) <sup>b</sup>	CCME CEQG Probable Effect Level (PEL) <sup>b</sup>
Sample Date (yyyy mm dd)	2022 03 23	2022 03 23	Duplicate	RPD %	2022 03 23			
Depth Interval (m)	0.0 - 0.15	0.0 - 0.15	0.0 - 0.15		0.0 - 0.15			
Parameter	Units							
<b>Physical Parameters</b>								
pH	pH	7.91	8.02	8.07	1	8.15	n/a	n/a
Total Organic Carbon	%	1.15	2.86	3.18	11	0.645	n/a	n/a
Total Organic Carbon	µg/g	11,500	28,600	31,800	11	6,450	n/a	n/a
Ammonia Nitrogen	µg/g	9.3	17.8	20.1	*	13.5	n/a	n/a
Water Soluble Nitrate Nitrogen	µg/g	3.81	0.996	< 0.500	*	< 0.500	n/a	n/a
Water Soluble Nitrite Nitrogen	µg/g	< 0.500	< 0.500	< 0.500	*	< 0.500	n/a	n/a
Phosphate Water Soluble	µg/g	< 0.500	< 0.500	< 0.500	*	< 0.500	n/a	n/a
<b>Total Metals</b>								
Antimony	µg/g	0.30	0.36	0.25	*	0.22	n/a	n/a
Arsenic	µg/g	4.49	4.40	4.49	2	3.61	11	5.9
Barium	µg/g	157	160	161	1	123	n/a	n/a
Beryllium	µg/g	0.36	0.37	0.36	*	0.30	n/a	n/a
Cadmium	µg/g	0.139	0.162	0.159	*	0.150	2.2	0.6
Chromium	µg/g	28.4	28.6	29.3	2	22.9	56	37.3
Chromium, hexavalent	µg/g	-	< 0.40	-	-	-	n/a	n/a
Chromium, trivalent	µg/g	-	28.6	-	-	-	n/a	n/a
Cobalt	µg/g	11.8	11.8	12.2	3	10.1	n/a	n/a
Copper	µg/g	<b>43.2</b>	<b>42.9</b>	<b>43.8</b>	2	32.1	120	35.7
Lead	µg/g	5.19	5.22	5.02	4	4.25	57	35
Lithium	µg/g	8.56	9.18	8.96	2	8.06	n/a	n/a
Manganese	µg/g	707	709	723	2	519	n/a	n/a
Mercury	µg/g	< 0.040	< 0.040	0.058	*	< 0.040	0.3	0.17
Molybdenum	µg/g	0.89	0.88	0.80	10	0.62	n/a	n/a
Nickel	µg/g	21.3	20.6	21.2	3	17.3	n/a	n/a
Selenium	µg/g	< 0.20	< 0.20	0.25	*	< 0.20	n/a	n/a
Silver	µg/g	< 0.10	< 0.10	0.11	*	< 0.10	n/a	n/a
Strontium	µg/g	85.5	84.6	85.4	1	70.2	n/a	n/a
Tin	µg/g	0.40	0.31	0.49	*	0.39	n/a	n/a
Uranium	µg/g	0.837	0.870	0.879	1	0.480	n/a	n/a
Vanadium	µg/g	69.1	68.3	70.4	3	59.9	n/a	n/a
Zinc	µg/g	63.7	62.1	64.5	4	54.5	200	123
Aluminum	µg/g	14,800	14,800	15,200	3	12,200	n/a	n/a
Boron	µg/g	2.8	3.2	2.9	*	3.8	n/a	n/a
Iron	µg/g	28,300	28,000	28,900	3	24,400	n/a	n/a
Potassium	µg/g	1,130	1,150	1,230	7	974	n/a	n/a
Thallium	µg/g	< 0.10	< 0.10	< 0.10	*	< 0.10	n/a	n/a
Tungsten	µg/g	< 0.20	< 0.20	< 0.20	*	< 0.20	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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**BOLD**

Concentration greater than CSR Freshwater Sediment (FW) standard

**SHADED**

Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

**RED**

Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Pathways Included: Sensitive Site.

<sup>b</sup> Guideline to protect freshwater aquatic life.

**TABLE 11: Summary of Analytical Results for Sediment - Microbiological Tests.**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Microbiological Tests			
				Fecal Coliform MPN/g	E. Coli MPN/g	Total Coliforms MPN/g	Salmonella MPN/g
M-SS22-01	M-SS22-01A	2022 03 23	0.0 - 0.3	3.8	3.8	3.8	< 0.2
	M-SS22-01	2022 03 23	0.0 - 0.01	< 3.0	< 3.0	10	< 0.2
M-SS22-02	M-SS22-02	2022 03 23	0.0 - 0.05	< 4.1	< 4.1	49	< 0.3
M-SS22-03	M-SS22-03	2022 03 23	0.0 - 0.05	< 3.0	< 3.0	3.9	< 0.2
M-SS22-04	M-SS22-04	2022 03 23	0.0 - 0.15	< 3.0	< 3.0	11	< 0.2
M-SS22-05	M-SS22-05	2022 03 23	0.0 - 0.15	13	13	21	< 0.3
	M-SS22-06	Duplicate	0.0 - 0.15	33	33	33	< 0.3
<b>QA/QC RPD%</b>				*	*	44	*
M-SS22-07	M-SS22-07	2022 03 23	0.0 - 0.15	< 3.8	< 3.8	29	< 0.3
CSR Freshwater Sediment (FW) <sup>a</sup>				n/a	n/a	n/a	n/a
CCME CEQG Interim Sediment Quality (ISQG) <sup>b</sup>				n/a	n/a	n/a	n/a
CCME CEQG Probable Effect Level (PEL) <sup>b</sup>				n/a	n/a	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD** Concentration greater than CSR Freshwater Sediment (FW) standard

**SHADED** Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

**RED** Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Pathways Included: Sensitive Site.

<sup>b</sup> Guideline to protect freshwater aquatic life.

**TABLE 12: Summary of Analytical Results for Sediment - Hydrocarbons.**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Monocyclic Aromatic Hydrocarbons					Gross Parameters					MTBE
				Benzene µg/g	Ethylbenzene µg/g	Toluene µg/g	Xylenes µg/g	Styrene µg/g	VPH (C6-C10) µg/g	EPH (C10-C19) µg/g	LEPH (C10-C19) µg/g	EPH (C19-C32) µg/g	HEPH (C19-C32) µg/g	Methyl Tert-butyl Ether [MTBE] µg/g
M-SS22-01	M-SS22-01	2022 03 23	0.0 - 0.3	< 0.020	< 0.050	< 0.200	< 0.100	< 0.050	< 20	< 50	< 50	< 50	< 50	< 0.040
M-SS22-02	M-SS22-02	2022 03 23	0.0 - 0.05	-	-	-	-	-	-	< 50	< 50	71	71	-
M-SS22-03	M-SS22-03	2022 03 23	0.0 - 0.05	-	-	-	-	-	-	< 50	< 50	< 50	< 50	-
M-SS22-04	M-SS22-04	2022 03 23	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	68	68	-
M-SS22-05	M-SS22-05	2022 03 23	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	63	63	-
	M-SS22-06	Duplicate	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	80	80	-
<b>QA/QC RPD%</b>				-	-	-	-	-	-	*	*	*	*	-
M-SS22-07	M-SS22-07	2022 03 23	0.0 - 0.15	-	-	-	-	-	-	< 50	< 50	57	57	-
<b>BC Standards</b>														
CSR Freshwater Sediment (FW) <sup>a</sup>				n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
<b>Federal Standard</b>														
CCME CEQG Interim Sediment Quality (ISQG) <sup>b</sup>				n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CCME CEQG Probable Effect Level (PEL) <sup>b</sup>				n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

- BOLD** Concentration greater than CSR Freshwater Sediment (FW) standard
- SHADED** Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline
- RED** Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Pathways Included: Sensitive Site.

<sup>b</sup> Guideline to protect freshwater aquatic life.

**TABLE 13: Summary of Analytical Results for Sediment - Polycyclic Aromatic Hydrocarbons.**

Sample Location	M-SS22-01	M-SS22-02	M-SS22-03	M-SS22-04	M-SS22-05			M-SS22-07	BC Standard	Federal Guideline		
Sample ID	M-SS22-01	M-SS22-02	M-SS22-03	M-SS22-04	M-SS22-05	M-SS22-06	QA/QC	M-SS22-07	CSR Freshwater Sediment (FW) <sup>b</sup>	CCME CEQG Interim Sediment Quality (ISQG) <sup>c</sup>	CCME CEQG Probable Effect Level (PEL) <sup>c</sup>	
Sample Date (yyyy mm dd)	2022 03 23	2022 03 23	2022 03 23	2022 03 23	2022 03 23	Duplicate	RPD %	2022 03 23				
Depth Interval (m)	0.0 - 0.3	0.0 - 0.0	0.0 - 0.1	0.0 - 0.2	0.0 - 0.2	0.0 - 0.2		0.0 - 0.2				
Parameter	Units	Analytical Results										
<b>Polycyclic Aromatic Hydrocarbons</b>												
Naphthalene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.24	0.0346	0.391
Methylnaphthalene, 1-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Methylnaphthalene, 2-	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.12	0.0202	0.201
Acenaphthylene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.08	0.00587	0.128
Acenaphthene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.055	0.00671	0.0889
Fluorene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.089	0.0212	0.144
Phenanthrene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.32	0.0419	0.515
Anthracene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.15	0.0469	0.245
Fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	1.5	0.111	2.355
Pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.54	0.053	0.875
Benz(a)anthracene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.24	0.0317	0.385
Chrysene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.53	0.0571	0.862
Benzo(b)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Benzo(b+j)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Benzo(k)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Benzo(a)pyrene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.48	0.0319	0.782
Indeno(1,2,3-cd)pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Dibenz(a,h)anthracene	µg/g	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	< 0.050 <sup>a</sup>	*	< 0.050 <sup>a</sup>	0.084	0.00622	0.135
Benzo(g,h,i)perylene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Quinoline	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Chloronaphthalene, 2-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD**

Concentration greater than CSR Freshwater Sediment (FW) standard

**SHADED**

Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

**RED**

Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

<sup>b</sup> Pathways Included: Sensitive Site.

<sup>c</sup> Guideline to protect freshwater aquatic life.

**TABLE 14: Summary of Analytical Results for Sediment - Volatile Organic Compounds.**

Sample Location		M-SS22-01			
Sample ID		M-SS22-01	CSR Freshwater Sediment (FW) <sup>a</sup>	CCME CEQG Interim Sediment Quality (ISQG) <sup>b</sup>	CCME CEQG Probable Effect Level (PEL) <sup>b</sup>
Sample Date (yyyy mm dd)		2022 03 23			
Depth Interval (m)		0.0 - 0.3			
Parameter	Units	Analytical Results			
<b>Volatile Organic Compounds</b>					
Bromodichloromethane [BDCM]	µg/g	< 0.100	n/a	n/a	n/a
Bromoform	µg/g	< 0.100	n/a	n/a	n/a
Carbon Tetrachloride	µg/g	< 0.050	n/a	n/a	n/a
Chlorobenzene	µg/g	< 0.050	n/a	n/a	n/a
Chloroform	µg/g	< 0.050	n/a	n/a	n/a
Dibromochloromethane [DBCM]	µg/g	< 0.100	n/a	n/a	n/a
Dibromoethane, 1,2-	µg/g	< 0.100	n/a	n/a	n/a
Dichlorobenzene, 1,2-	µg/g	< 0.050	n/a	n/a	n/a
Dichlorobenzene, 1,3-	µg/g	< 0.050	n/a	n/a	n/a
Dichlorobenzene, 1,4-	µg/g	< 0.050	n/a	n/a	n/a
Dichloroethane, 1,1-	µg/g	< 0.050	n/a	n/a	n/a
Dichloroethane, 1,2-	µg/g	< 0.050	n/a	n/a	n/a
Dichloroethylene, 1,1-	µg/g	< 0.050	n/a	n/a	n/a
Dichloroethylene, 1,2-cis-	µg/g	< 0.050	n/a	n/a	n/a
Dichloroethylene, 1,2-trans-	µg/g	< 0.050	n/a	n/a	n/a
Dichloromethane	µg/g	< 0.100	n/a	n/a	n/a
Dichloropropane, 1,2-	µg/g	< 0.050	n/a	n/a	n/a
Dichloropropene, 1,3- (cis+trans)	µg/g	< 0.050	n/a	n/a	n/a
Dibromomethane	µg/g	< 0.100	n/a	n/a	n/a
Tetrachloroethane, 1,1,2,2-	µg/g	< 0.050	n/a	n/a	n/a
Tetrachloroethylene	µg/g	< 0.050	n/a	n/a	n/a
Trichloroethane, 1,1,1-	µg/g	< 0.050	n/a	n/a	n/a
Trichloroethane, 1,1,2-	µg/g	< 0.050	n/a	n/a	n/a
Trichloroethylene	µg/g	< 0.040	n/a	n/a	n/a
Trichlorofluoromethane	µg/g	< 0.100	n/a	n/a	n/a
Vinyl Chloride	µg/g	< 0.100	n/a	n/a	n/a

Associated CARO file(s): 22C3371.

All terms defined within the body of SNC-Lavalin's report.

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n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD**

Concentration greater than CSR\_SE\_FW\_SEN

**SHADED**

Concentration greater than CCME\_CEQG\_SE\_ISQG\_FW

**RED**

Concentration greater than CCME\_CEQG\_SE\_PEL\_FW

<sup>a</sup> Pathways Included: Sensitive Site.

<sup>b</sup> Guideline to protect freshwater aquatic life.

**TABLE 15: Summary of Analytical Results for Sediment - Pesticides, Herbicides, Pyrethroids.**

Sample Location		M-SS22-01	M-SS22-07	BC Standard	Federal Guideline	
Sample ID		M-SS22-01	M-SS22-07	CSR Freshwater Sediment (FW) <sup>b</sup>	CCME CEQG Interim Sediment Quality (ISQG) <sup>c</sup>	CCME CEQG Probable Effect Level (PEL) <sup>c</sup>
Sample Date (yyyy mm dd)		2022 03 23	2022 03 23			
Depth Interval (m)		0.0 - 0.3	0.0 - 0.2			
Parameter	Units	Analytical Results				
<b>Organochlorine Pesticides</b>						
Alachlor	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Aldrin	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Captan	µg/g	< 0.0400	< 0.0400	n/a	n/a	n/a
Chlordane (cis+trans)	µg/g	< 0.0050 <sup>a</sup>	< 0.0050 <sup>a</sup>	0.0055	0.0045	0.00887
Chlorothalonil	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
DDT + Metabolites	µg/g	< 0.0100 <sup>a</sup>	< 0.0100 <sup>a</sup>	n/a	0.00119	0.00477
Dieldrin	µg/g	< 0.0050 <sup>a</sup>	< 0.0050 <sup>a</sup>	0.0041	0.00285	0.00667
Endosulfan (I+II)	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Endosulfan Sulphate	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Endrin	µg/g	< 0.0050 <sup>a</sup>	< 0.0050 <sup>a</sup>	0.039	0.00267	0.0624
Endrin Aldehyde	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Endrin Ketone	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Heptachlor	µg/g	< 0.0050 <sup>a</sup>	< 0.0050 <sup>a</sup>	0.0017	n/a	n/a
Heptachlor Epoxide	µg/g	< 0.0050 <sup>a</sup>	< 0.0050 <sup>a</sup>	0.0017	0.0006	0.00274
Hexachlorocyclohexane, alpha-	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Hexachlorocyclohexane, beta-	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Hexachlorocyclohexane, delta-	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Hexachlorocyclohexane, gamma-	µg/g	< 0.0050 <sup>a</sup>	< 0.0050 <sup>a</sup>	0.00086	0.00094	0.00138
Methoxychlor	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
<b>Organophosphorus Pesticides</b>						
Azinphos-Methyl	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Bromacil	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Chlorpyrifos	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Diazinon	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Dichlorvos	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Dimethoate	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Disulfoton	µg/g	< 0.0200	< 0.0200	n/a	n/a	n/a
Malathion	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Parathion	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Parathion Methyl	µg/g	< 0.0100	< 0.0131	n/a	n/a	n/a
Phorate	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Ronnel	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Sulfotep	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Temephos	µg/g	< 0.0500	< 0.0500	n/a	n/a	n/a
Terbufos	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
<b>Miscellaneous Pesticides</b>						
Diclofop-methyl	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD**

**SHADED**

**RED**

Concentration greater than CSR Freshwater Sediment (FW) standard

Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

<sup>b</sup> Pathways Included: Sensitive Site.

<sup>c</sup> Guideline to protect freshwater aquatic life.

**TABLE 15 (cont): Summary of Analytical Results for Sediment - Pesticides, Herbicides, Pyrethroids.**

Sample Location		M-SS22-01	M-SS22-07	BC Standard	Federal Guideline	
Sample ID		M-SS22-01	M-SS22-07	CSR Freshwater Sediment (FW) <sup>b</sup>	CCME CEQG Interim Sediment Quality (ISQG) <sup>c</sup>	CCME CEQG Probable Effect Level (PEL) <sup>c</sup>
Sample Date (yyyy mm dd)		2022 03 23	2022 03 23			
Depth Interval (m)		0.0 - 0.3	0.0 - 0.2			
Parameter	Units	Analytical Results				
<b>Herbicides</b>						
Acetic acid, 2-methyl-4-chlorophenoxy- [MCPA]	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Bentazon	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Bromoxynil	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Butanoic Acid, 4-(4-chloro-2-methylphenoxy)- [MCPB]	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Chloramben	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Clopyralid	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Cyanazine	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Dicamba	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Dichlorophenoxy Acetic Acid, 2,4- [2,4-D]	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Dichlorophenoxy Butyric Acid, 2,4- [2,4-DB]	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Dichlorprop	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Dinoseb	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Diuron	µg/g	< 0.0200	< 0.0200	n/a	n/a	n/a
Linuron	µg/g	< 0.0400	< 0.0400	n/a	n/a	n/a
Metolachlor	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Metribuzin	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Picloram	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Prometon	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Prometryn	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Silvex [2,4,5-TP]	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Simazine	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Tebuthiuron	µg/g	< 0.0200	< 0.0200	n/a	n/a	n/a
Triallate	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
Trichlorophenoxyacetic Acid, 2,4,5- [2,4,5-T]	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Triclopyr	µg/g	< 0.010	< 0.013	n/a	n/a	n/a
Trifluralin	µg/g	< 0.0100	< 0.0100	n/a	n/a	n/a
Butachlor	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a
<b>Pyrethroids</b>						
Deltamethrin	µg/g	< 0.0500	< 0.0500	n/a	n/a	n/a
Permethrin (cis+trans)	µg/g	< 0.0050	0.0083	n/a	n/a	n/a
<b>Fungicides</b>						
Pentachloronitrobenzene [PCNB]	µg/g	< 0.0050	< 0.0050	n/a	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD**

**SHADED**

**RED**

Concentration greater than CSR Freshwater Sediment (FW) standard

Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

<sup>b</sup> Pathways Included: Sensitive Site.

<sup>c</sup> Guideline to protect freshwater aquatic life.

**TABLE 16: Summary of Analytical Results for Sediment - Chlorinated Phenols.**

Sample Location		M-SS22-01	M-SS22-02	M-SS22-03	M-SS22-05	M-SS22-07	BC Standard		
Sample ID		M-SS22-01	M-SS22-02	M-SS22-03	M-SS22-05	M-SS22-07	CSR Freshwater Sediment (FW) <sup>a</sup>	CCME CEQG Interim Sediment Quality (ISQG) <sup>b</sup>	CCME CEQG Probable Effect Level (PEL) <sup>b</sup>
Sample Date (yyyy mm dd)		2022 03 23	2022 03 23	2022 03 23	2022 03 23	2022 03 23			
Depth Interval (m)		0.0 - 0.3	0.0 - 0.0	0.0 - 0.1	0.0 - 0.2	0.0 - 0.2			
Parameter	Units	Analytical Results							
<b>Chlorinated Phenols</b>									
Chlorophenol, 2-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Chlorophenol, 3-&4-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Dichlorophenol, 2,3-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Dichlorophenol, 2,4-&2,5-	µg/g	-	< 0.030	< 0.030	< 0.030	< 0.030	n/a	n/a	n/a
Dichlorophenol, 2,6-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Dichlorophenol, 3,4-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Dichlorophenol, 3,5-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Methylphenol, 4-chloro-3-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Trichlorophenol, 2,3,4-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Trichlorophenol, 2,3,5-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Trichlorophenol, 2,3,6-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Trichlorophenol, 2,4,5-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Trichlorophenol, 2,4,6-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Trichlorophenol, 3,4,5-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Tetrachlorophenol, 2,3,4,6-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Tetrachlorophenol, 2,3,4,5 & 2,3,5,6-	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	n/a	n/a	n/a
Pentachlorophenol [PCP]	µg/g	-	< 0.020	< 0.020	< 0.020	< 0.020	0.4	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD**

Concentration greater than CSR Freshwater Sediment (FW) standard

**SHADED**

Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

**RED**

Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Pathways Included: Sensitive Site.

<sup>c</sup> Guideline to protect freshwater aquatic life.

**TABLE 17: Summary of Analytical Results for Sediment - PCBs**

Sample Location		M-SS22-01	M-SS22-02	M-SS22-05	BC Standard	Federal Guideline	
Sample ID	Sample Date (yyyy mm dd)	M-SS22-01	M-SS22-02	M-SS22-05		CSR Freshwater Sediment (FW) <sup>b</sup>	CCME CEQG Interim Sediment Quality (ISQG) <sup>c</sup>
Depth Interval (m)		0.0 - 0.3	0.0 - 0.0	0.0 - 0.2			
Parameter	Units	Analytical Results					
<b>PCBs</b>							
Aroclor 1016	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1221	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1232	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1242	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1248	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1254	µg/g	< 0.040	< 0.040	< 0.040	n/a	0.06	0.34
Aroclor 1260	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1262	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1268	µg/g	< 0.040	< 0.040	< 0.040	n/a	n/a	n/a
Polychlorinated Biphenyls, Total [PCBs]	µg/g	< 0.040 <sup>a</sup>	< 0.040 <sup>a</sup>	< 0.040 <sup>a</sup>	0.17	0.0341	0.277

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD**

Concentration greater than CSR Freshwater Sediment (FW) standard

**SHADED**

Concentration greater than CCME CEQG Interim Sediment Quality (ISQG) Guideline

**RED**

Concentration greater than CCME CEQG Probable Effect Level (PEL) Guideline

<sup>a</sup> Laboratory detection limit exceeds regulatory standard/guideline.

<sup>b</sup> Pathways Included: Sensitive Site.

<sup>c</sup> Guideline to protect freshwater aquatic life.

**TABLE 18: Summary of City of Merritt Soil Data**

Source: City of Merritt					
Date: Feb 14 2022					
Applicable Reg Criteria: CSR AL; CSR RLLD; CCME AL; CCME RL					
Parameter	Units	# of Samples	# of Exceedances/Detections	Max Conc.	Benchmarks exceeded
BTEX/VPH/VH/MTBE	µg/g	9	0	ND	none
HEPH/EPHC19-32	µg/g	9	3	1000	none
Benzo(g,h,i)perylene	µg/g	9	0	0.065	n/a
PAHs (sum of total)	µg/g	9	3	0.24	none
pH	unitless	9	9	<b>8.32</b>	CCME AL/RL

Source: City of Merritt					
Date: Dec 13 2021					
Parameter	Units	# of Samples	# of Exceedances/Detections	Max Conc.	Benchmarks exceeded
Benzene	µg/g	6	2	<0.012	CCME AL/RL
Ethylbenzene	µg/g	6	2	<0.024	CCME AL/RL
Toluene	µg/g	6	2	<0.12	CCME AL/RL
VPH/VH/MTBE	µg/g	6	0	ND	none
HEPH	µg/g	6	1	140	none
EPHC19-32	µg/g	6	1	140	none
pH	unitless	6	11	<b>8.29</b>	CCME AL/RL
Copper	µg/g	6	1	<b>71</b>	CCME AL/RL
Nickel	µg/g	6	1	<b>66.8</b>	CCME AL/RL

**bold shade** measured concentration exceeds standard/guideline

**Notes:**

CSR AL - CSR Agricultural Land Use (AL) standard

CSR RL - CSR Low Density Residential Land Use (RLLD) standard

CCME AL - CCME CEQG Agricultural Surface (AL Surface) Guideline

CCME RL - CCME CEQG Residential Surface (RL Surface) Guideline

n/a: no available benchmarks (i.e., standards or guidelines)

none: no benchmarks (i.e., standards or guidelines) exceeded; parameters are listed to indicate they were analyzed or that they were detected

ND: not detected

BTEX = benzene, ethylbenzene, toluene, xylenes; VPH = volatile petroleum hydrocarbons; VH = volatile hydrocarbons; MTBE = methyl tert-butyl ether; HEPH = heavy extractable petroleum hydrocarbons

EPHC19-32 = extractable petroleum hydrocarbons carbon range 19 to 32; PAHs = polycyclic aromatic hydrocarbons

**TABLE 19: Summary of City of Merritt Soil Data Compared to Sediment Standards and Guidelines**

Source: City of Merritt					
Date: Feb 14 2022					
Applicable Reg Criteria: CSR FWSed <sub>SU</sub> , CCME ISQG, CCME PEL					
Parameter	Units	# of Samples	# of Exceedances/Detections	Max Conc.	Benchmarks exceeded
BTEX/VPH/VH/MTBE	µg/g	9	0	ND	n/a
HEPH/EPHC19-32	µg/g	9	1	1000	n/a
Benzo(g,h,i)perylene	µg/g	9	0	0.065	n/a
PAHs (sum of total)	µg/g	9	3	0.24	none
Total Metals	µg/g	9	0	-	none

Source: City of Merritt					
Date: Dec 13 2021					
Parameter	Units	# of Samples	# of Exceedances/Detections	Max Conc.	Benchmarks exceeded
VPH/VH/MTBE	µg/g	6	0	ND	n/a
HEPH	µg/g	6	1	140	n/a
EPHC19-32	µg/g	6	1	140	n/a
PAHs	µg/g	6	minor detections all <	-	none
Copper	µg/g	6	1	<b>71</b>	CCME ISQG

**bold shade** parameter exceeds standard/guideline

**Notes:**

CSR FWSed<sub>SU</sub>: CSR Freshwater Sediment (FW) standard for Sensitive Use (SU)

CCME ISQG: CCME CEQG Interim Sediment Quality (ISQG) Guideline

CCME PEL: CCME CEQG Probable Effect Level (PEL) Guideline

n/a: no available benchmarks (i.e., standards or guidelines)

none: no benchmarks (i.e., standards or guidelines) exceeded; parameters are listed to indicate they were analyzed or that they were detected

ND: not detected

BTEX = benzene, ethylbenzene, toluene, xylenes; VPH = volatile petroleum hydrocarbons; VH = volatile hydrocarbons; MTBE = methyl tert-butyl ether; HEPH = heavy extractable petroleum hydrocarbons

EPHC19-32 = extractable petroleum hydrocarbons carbon range 19 to 32; PAHs = polycyclic aromatic hydrocarbons

**TABLE 20: Summary of City of Merritt Groundwater Data**

Source: City of Merritt Water Supply Wells (two within flooded area)						
Date: Nov 23 2021 to Jan 31 2022 (10 events)						
Applicable Reg Criteria: CSR DW; CDWQG						
# of Samples	Exceeding/Detected Parameter	Units	Benchmarks exceeded	# of Samples With Exceeding/Detected Parameter	Max Conc.	Date
1	Chlorine (total), field	mg/L	none	1	0.82	10-Jan-22
1	Chlorine (free), field	mg/L	none	1	0.78	10-Jan-22
16	pH, lab	unitless	CDWQG	1	<b>6.94</b>	04-Jan-22
16	Dissolved Inorganics/General Parameters		none	0	-	all events
20	<i>E. coli</i>	CFU/100 mL	none	0	<1	all events
20	Total coliforms	CFU/100 mL	none	0	<1	all events
16	BTEX/VPH/VH/MTBE/LEPH/HEPH/EPH	µg/L	none	0	ND	all events
16	Chloroethane	µg/L	none	0	ND	all events
16	1,2-Dibromoethane	µg/L	none	0	ND	all events
16	1,2-Dichloropropane	µg/L	none	0	ND	all events
16	1,3-Dichloropropene	µg/L	none	0	ND	all events
16	Chlorinated Hydrocarbons	µg/L	none	0	ND	all events
16	PAHs	µg/L	none	0	ND	all events
16	Chloroform	mg/L	none	1	0.0133	06-Dec-21
Source: City of Merritt Shallow Groundwater Monitoring Wells (three within flooded area)						
Date: Nov 20 2021 (1 event)						
Applicable Reg Criteria: CSR DW / AW / IW / LW; CDWQG; FIGWQG AW / LW / IW						
# of Samples	Exceeding/Detected Parameter	Units	Benchmarks exceeded	# of Samples With Exceeding/Detected Parameter	Max Conc.	Date
3 (1 per location)	aluminium	µg/L	FIGWQG IW and LW, CDWQG	1	<b>584</b>	20-Nov-21
3 (1 per location)	copper	µg/L	FIGWQG AW	1	<b>4.96</b>	20-Nov-21
3 (1 per location)	iron	µg/L	FIGWQG AW, CDWQG	2	<b>1,230</b>	20-Nov-21
3 (1 per location)	manganese	µg/L	CDWQG	2	<b>124</b>	20-Nov-21
3 (1 per location)	mercury	µg/L	FIGWQG AW	1 detected/2 MDL >guideline	<b>0.079</b>	20-Nov-21
3 (1 per location)	zinc	µg/L	FIGWQG AW	1	<b>130</b>	20-Nov-21
3 (1 per location)	turbidity	NTU	CDWQG	3	<b>505</b>	20-Nov-21
3 (1 per location)	coliforms	CFU/100 mL	CDWQG	2	<b>24,200</b>	20-Nov-21
3 (1 per location)	<i>E. coli</i>	CFU/100 mL	CDWQG	1	<b>42</b>	20-Nov-21

**bold shade** parameter exceeds standard/guideline

**Notes:**  
 CSR DW / AW / LW / IW - CSR Drinking Water (DW) / Aquatic Life (AW) / Livestock (LW) / Irrigation (IW) standards  
 CDWQG - Canadian Drinking Water Quality Guidelines  
 FIGWQG - Federal Interim Groundwater Quality Guidelines  
 FIGWQG AW / LW / IW - FIGWQG Aquatic Life (AW) / Livestock (LW) / Irrigation (IW) guidelines  
 CFU = colony-forming units  
 NTU = nephelometric turbidity unit  
 n/a: no available benchmarks (i.e., standards or guidelines)  
 none: no benchmarks (i.e., standards or guidelines) exceeded; parameters are listed to indicate they were analyzed or that they were detected  
 ND: not detected  
 BETX = benzene, ethylbenzene, toluene, xylenes; VPH = volatile petroleum hydrocarbons; VH = volatile hydrocarbons; MTBE = methyl tert-butyl ether; HEPH = heavy extractable petroleum hydrocarbons  
 LEPH = light extractable petroleum hydrocarbons; PAHs = polycyclic aromatic hydrocarbons

**TABLE 21: Summary of BC ENV Environmental Management System (EMS) Surface Water Data**

Source BC ENV EMS: Stations E326632, E326631, E326633, E326634							
Date: Dec 14 2021 to Mar 28 2022 (16 events)			Applicable Reg Criteria: BCWQG DW / AW / WL / IW / LW; CDWQG; CGRWQ; CCME CEQG AW / LW / IW				
# of Samples	Exceeding/Detected Parameter	Units	Benchmarks exceeded	# of Samples With Exceeding/Detected Parameter	Max Conc.	Date	Location
63	Turbidity	NTU	BCWQG AW/WL/IW/LW; CDWQG; CGRWQ	73	<b>686</b>	2022 03 28	E326632
63	TSS	mg/L	BCWQG AW/WL/IW/LW (Chronic); CCME CEQG AW	34	<b>1,360</b>	2022 03 28	E326632
63	Ammonia	µg/L as N	BCWQG AW (Chronic); CCME CEQG AW	5	<b>370</b>	2022 02 07	E326632
63	NO3/NO2/TKN/Total N	µg/L as N	none	0	-	all events	all locations
63	Ortho-P/Total P	mg/L	none	0	-	all events	all locations
63	Chloride	mg/L	none	0	-	all events	all locations
63	<i>E. coli</i>	MPN/100 mL	CDWQG; BCWQG DW MAC; CGRWQ	56	<b>488</b>	2022 01 18	E326633
63	Fecal coliforms	MPN/100 mL	n/a	60	980	2022 01 18	E326633

**bold shade** parameter exceeds standard/guideline

**Notes:**

BCWQG DW (AO and MAC) - BCWQG Drinking Water (DW) guideline, Aesthetic Objective (AO) and Maximum Acceptable Concentrations (MAC)

BCWQG AW / WL / LW / IW - BCWQG Aquatic Life (AW) / Wildlife (WL) / Livestock (LW) / Irrigation (IW) guideline for Acute and Chronic

CDWQG - Canadian Drinking Water Quality Guidelines

CGRWQ - Canadian Guidelines for Recreational Water Quality

CCME CEQG AW / LW / IW - CCME Canadian Environmental Quality Guidelines (CEQG) Aquatic Life (AW) / Wildlife (WL) / Livestock (LW) / Irrigation (IW)

NTU = nephelometric turbidity unit

MPN = most probable number

n/a: no available benchmarks (i.e., standards or guidelines)

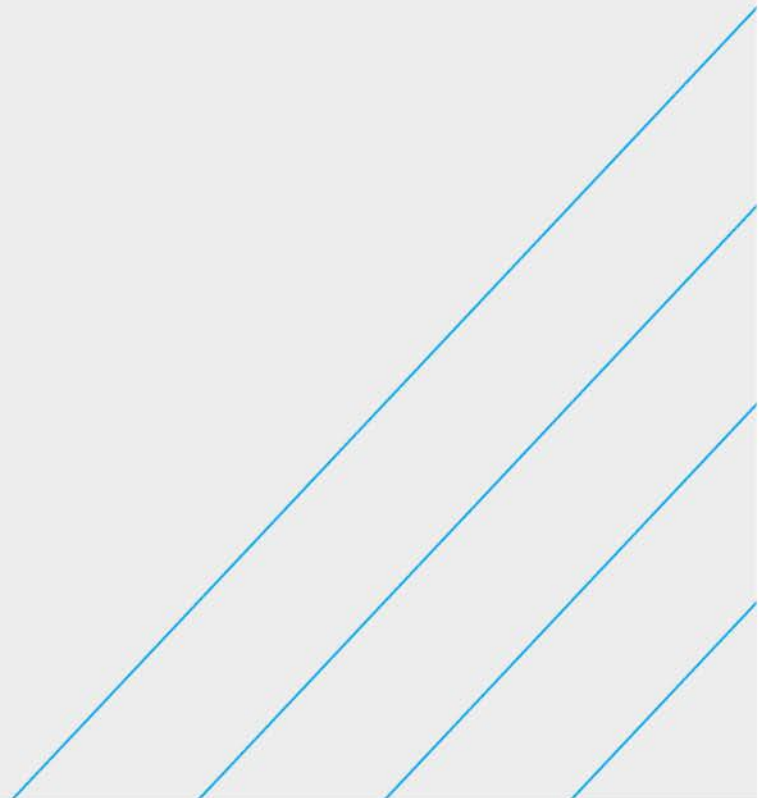
none: no benchmarks (i.e., standards or guidelines) exceeded; parameters are listed to indicate they were analyzed or that they were detected

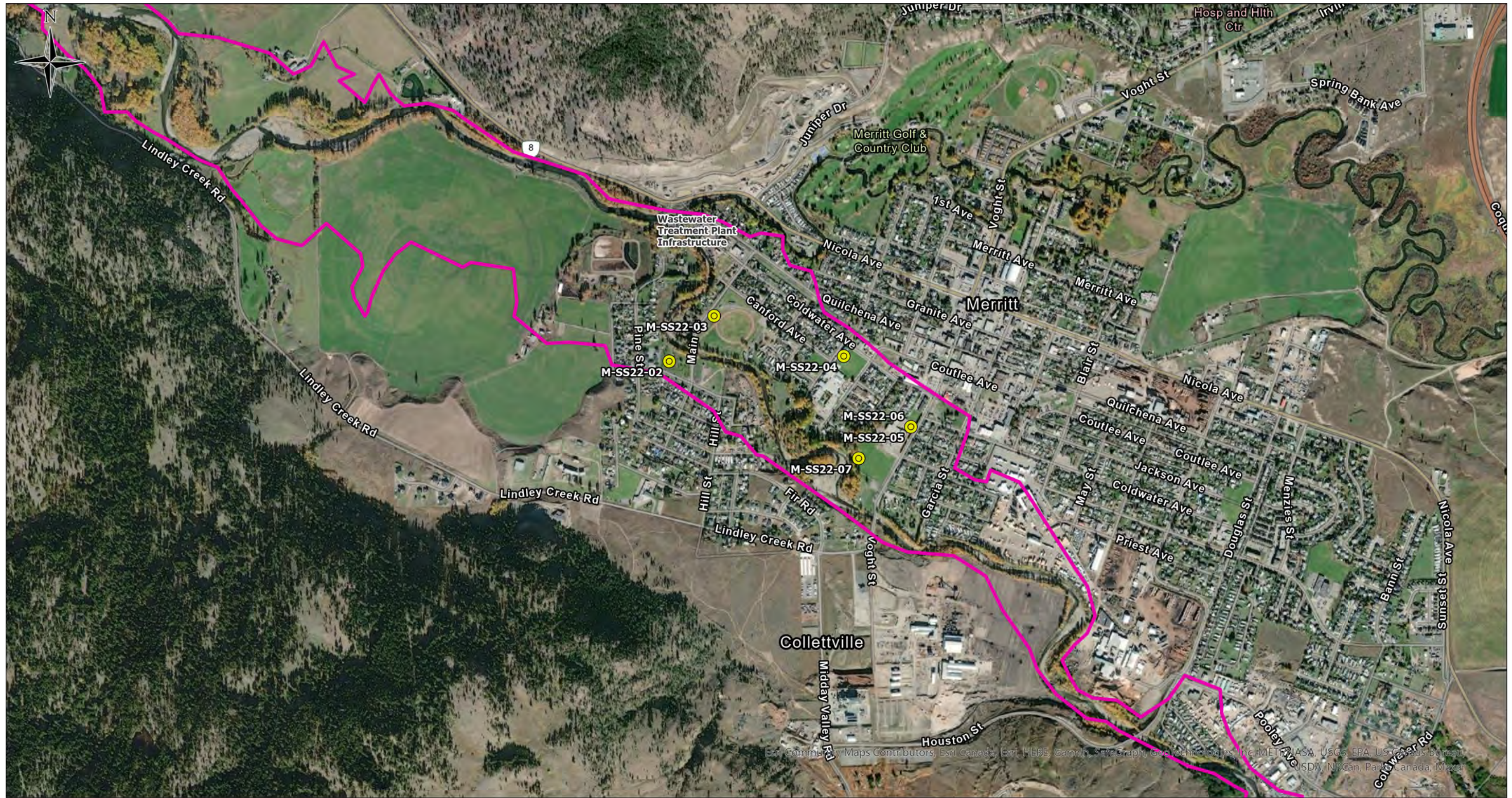
TSS = total suspended solids; NO3 = nitrate; NO2 = nitrite; TKN = total kjeldal nitrogen; N = nitrogen

Ortho-P = orthophosphate; total P = total phosphate




# Drawing

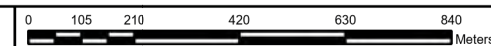
> 688421-003 - Sample Location Plan - Merritt





**LEGEND**

-  Surface Soil Sample Location
-  Monitoring Wells
-  2021 Flood Boundary Extent



**REFERENCES**

1. Data from SNC-Lavalin and DataBC,

**NOTES**

1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.



**SNC • LAVALIN**

CLIENT NAME:  
Ministry of Environment and  
Climate Change Strategy

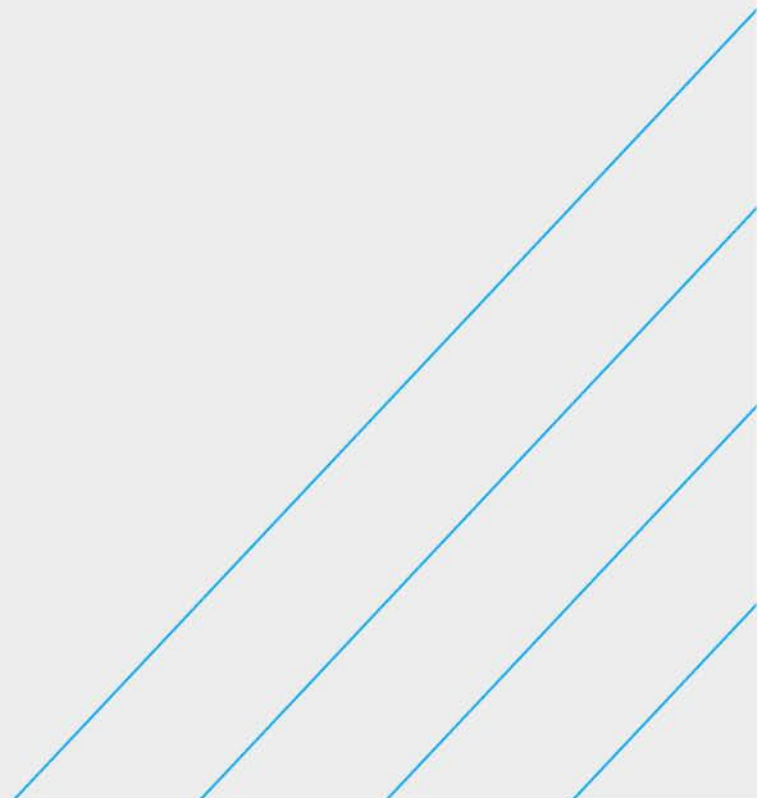
PROJECT LOCATION:  
Merritt, BC

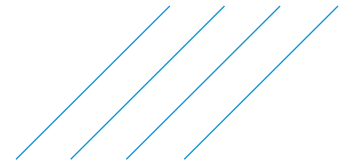
**Sample Location Plan - Merritt**

BY: SS	SCALE: 1:15,000	DATE: 2022-06-14	REF No:	REV: 01
CHK'D: TL	PROJ COORD SYS: NAD 1983 UTM Zone 10N	<b>688421-003</b>		

# Appendix I

SNC-Lavalin Memorandum (2022b) – Results of Surficial  
Soil Sampling Investigation, Merritt Study Area





## Memorandum

**To:** Ministry of Environment & Climate Change Strategy **Date:** June 14, 2022

**Attention:** Cindy Meays, PhD, RPBio, P.Ag.  
Provincial Lead – Flood Water Quality Monitoring Task Force

**From:** Tania Lazorko, BSc, EP **Ref:** 688421  
Patty Carmichael, MSc, P.Geo., CSAP

**Subject:** Results of Surficial Soil Sampling Investigation, Merritt Study Area

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SNC-Lavalin has conducted a surficial soil sampling investigation at multiple locations in Merritt, BC, which were identified to be impacted by flood events in November 2021. The work was completed to address data gaps identified during development of a Preliminary Conceptual Site Model (CSM) for the Study Area, dated March 30, 2022<sup>1</sup>. This memo provides results of work completed at the Merritt Study Area.

## 1 Background and Objectives

In November 2021, “atmospheric river” events occurred across southwestern BC causing widespread flooding and damage in some communities. A Preliminary CSM was developed for each of three identified Study Areas: Sumas Prairie, Merritt, and Princeton. The Preliminary CSMs focussed on priority contaminants, media, receptors, and pathways, defined as those with the potential to drive risks to human health and the environment. Through this process, data gaps were identified if there was uncertainty in any of these areas. A phased approach for collection of data was recommended to address these data gaps to support completion of a Preliminary Regional Risk Assessment (PRRA), planned for completion in June 2022.

The initial phase of field work comprised a site reconnaissance and sampling of surficial soil/sediment deposited from flood waters in the Study Area (workplan dated March 21, 2022<sup>2</sup>).

### 1.1 Merritt

Four data gaps were identified for the Merritt Study Area, as follows:

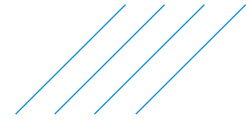
1. Uncertain aquifer water quality – the shallow, middle and deep Merritt aquifers are recharged by the Coldwater and Nicola Rivers and represent potential pathways to receptors. The Stumbles Creek aquifer and other aquifers downgradient of Merritt may have been affected.
2. Unknown quality of material deposited on land by flood waters.
3. Uncertain post-flood sediment quality.

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<sup>1</sup> *Preliminary Conceptual Site Models of Potential Contamination Related to the 2021 Atmospheric River Event in BC, Hope, Sumas Prairie, Princeton and Merritt*, March 30, 2022, SNC-Lavalin Inc.

<sup>2</sup> *Workplan for Addressing Preliminary CSM Data Gaps*, March 21, 2022, SNC-Lavalin Inc.

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# Memorandum

Ref: 688421 | June 14, 2022

4. Sawmills and wood processing – it is not known if wood treatment has occurred at sites affected by flooding.

The scope of work for this report included investigating items 2, 3 and 4. For groundwater quality (item 1), post-flood analytical data was provided by the City of Merritt for two water supply wells that were within the flood boundary, as well as for three shallow groundwater monitoring wells. This groundwater data will be included in the PRRA. Priority potential contaminants of concern (PCOC) identified in soil include microbiological parameters (i.e., fecal coliform, *E. coli*, total coliforms, salmonella) metals, nitrate and light nonaqueous phase liquid (LNAPL: pure phase hydrocarbon fuels, such as gasoline, diesel, heating oil etc.). If hydrocarbon releases were reported or LNAPL was observed during site reconnaissance, the LNAPL and related hydrocarbon parameters would be further assessed. Other secondary potential contaminants and parameters were also assessed at the same time. The table below indicates the number of samples submitted for various test parameters.

**Table A: Analytical Plan for Soil Testing**

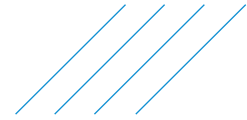
Priority Contaminants	No. Samples (including duplicates)
microbiological parameters (total coliform, fecal coliforms, Escherichia coli [ <i>E. coli</i> ], Salmonella)	6
metals	6
nitrate	6
Other Parameters	
polycyclic aromatic hydrocarbons (PAHs)	6
light and heavy extractable petroleum hydrocarbons (LEPHs/HEPHs)	6
polychlorinated biphenyls (PCBs)	2
nitrite, ammonia, phosphate, potassium (i.e., inorganics)	6
speciated chromium	4
herbicides and pesticides	1
chlorinated phenols	4
total organic carbon (TOC)	6

## 2 Regulatory Context

In BC, the *Environmental Management Act – Part 4*<sup>3</sup> (EMA) provides the legal requirements for managing contaminated sites. Under EMA, the Contaminated Sites Regulation<sup>4</sup> (CSR) contains the provision for the establishment of environmental quality standards to determine the acceptability of substances in soil, sediment, groundwater and vapour at sites. All the environmental quality standards listed in the CSR are based on, and are designed to be protective of, the toxicological effects of contaminating substances for a variety of land uses. Accordingly, soil analytical results are compared to the applicable BC CSR low density residential land use (RLLD), CSR urban park land use (PL), and CSR agricultural land use (AL) soil standards, including matrix and generic standards (CSR Schedule 3.1).

<sup>3</sup> *Environmental Management Act* (EMA), B.C. Reg. 179/2021 / effective July 7, 2021.

<sup>4</sup> *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 179/2021, July 7, 2021.



# Memorandum

Generic standards are based on land use, while matrix standards are based on a series of site-specific factors. The following site-specific factors are applicable to the locations sampled and the most stringent of each is applied to data analysis:

- Human intake of contaminated soil (mandatory for all sites);
- Toxicity to soil invertebrates and plants (mandatory for all sites);
- Groundwater flow to surface water used by freshwater aquatic life (AW);
- Groundwater used for drinking (DW);
- Major microbial functional impairment;
- Livestock ingesting soil and fodder;
- Groundwater used for irrigation (IW); and
- Groundwater used for Livestock (LW).

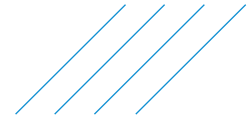
## 3 Methods

On March 23, 2022, a site reconnaissance (i.e., via driving and walking) was carried out across a majority of the Study Area to ground truth the flood boundary that was established in the Preliminary CSM and to identify sample locations where flood related sediment was deposited. This site reconnaissance was limited to areas with public access only (e.g., parks, trails, roadways and school grounds).

Soil sampling at identified locations in the Merritt Study Area was also conducted on March 23, 2022. As indicated above, the sample locations were selected based on public accessibility and areas with visible deposits on land that had not been disturbed since the flood. Parameters chosen for analysis at each site were based on PCOC identified in SNC-Lavalin's March 30 report, as well as site observations at the time of sampling. All samples were collected in accordance with our written Preferred Operating Procedures which includes:

- Soil samples were logged in detail for soil type, colour, texture, moisture content and apparent hydrocarbon impacts;
- Samples were collected directly into laboratory-supplied containers immediately upon collection and transferred to an ice-chilled cooler;
- Collection of blind field duplicate samples at an approximate rate of 10% (i.e., one duplicate for every ten samples collected). Duplicate samples were collected from the same layer(s) and material within the sampling location and confirmed in the field to be consistent with regard to observable criteria (e.g., lithology, colour, grain size, moisture). However, as natural materials are not isotropic, some heterogeneity is anticipated; and
- All samples were stored in ice-chilled coolers and were transported to the project laboratory for analysis under chain-of-custody control.

A total of six samples (including one duplicate sample) were collected from five locations within the areas flooded by the Coldwater River, where soil deposition was observed. The attached Drawing 688421-003 shows the locations of where samples were collected. Photographs of sample locations are provided in Attachment 1. Samples were submitted to CARO Analytical Services (CARO) for analysis of parameters as indicated in Table B, below.



# Memorandum

Ref: 688421 | June 14, 2022

**Table B: Summary of Soil Sample Locations**

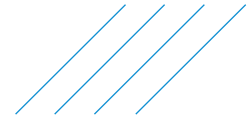
Sample ID	Location	Depth (m)	Parameters Analyzed
M-SS22-02	Centennial Park, 60 m southeast of sanitary lift station	0.05	Priority Contaminants, LEPHs/HEPHs, PAHs, inorganics, speciated chromium, chlorinated phenols, PCBs
M-SS22-03	Northwest side of Voght Park, near washroom facilities	0.05	Priority Contaminants, LEPHs/HEPHs, PAHs, inorganics, speciated chromium, chlorinated phenols
M-SS22-04	Northwest side of Merritt Secondary School sports field	0.15	Priority Contaminants, LEPHs/HEPHs, PAHs, inorganics
M-SS22-05/ M-SS22-06	Merritt Central Elementary School, playground north of buildings	0.15	Priority Contaminants, LEPHs/HEPHs, PAHs, inorganics, speciated chromium, chlorinated phenols, PCBs
M-SS22-07	Merritt Central Elementary School, sports field near Coldwater River	0.15	Priority Contaminants, LEPHs/HEPHs, PAHs, inorganics, chlorinated phenols, herbicides/ pesticides

Priority Contaminants include: microbiological parameters (i.e., fecal coliform, *E. coli*, total coliforms, salmonella), metals, nitrate

## 4 Results

### 4.1 Site Reconnaissance

As indicated above, SNC-Lavalin conducted a site reconnaissance of the Merritt 2021 Study Area on March 23, 2022, and that the site reconnaissance was limited to areas with public access only. Observations and discussions with local residents indicated that the flood extent boundary established by SNC-Lavalin in the Preliminary CSM study was fairly well defined. A major portion of the downtown / residential area was undergoing massive cleanup with the removal of large volumes of soil, tree branches, logs, construction debris, and household items (chairs, toys, tires, etc.). See Photograph 1 and Photograph 2 below. Riverbanks, dykes, roads, bridges, schools, houses and other buildings were also undergoing repair while some structures appeared to be condemned. Where the Coldwater River changed course, prior to flowing through the City of Merritt rapid infiltration (RI) basins, houses, other structures and vehicles were destroyed. No signs of hydrocarbon fuel releases were observed throughout the site visit. Most of the soil that was deposited by the flood and remained afterwards was silt and/or fine-grained sand with various percentages of silt and clay. Photographs from the site reconnaissance are presented below.



# Memorandum

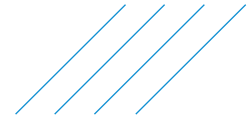
Ref: 688421 | June 14, 2022



**Photograph 1:** Typical observation of flood deposited sediment and debris along City of Merritt streets and on properties and sports fields.



**Photograph 2:** Example of flood debris deposited against chain link fence surrounding a sports field. Note estimated height of flood water mark.



# Memorandum

Ref: 688421 | June 14, 2022

Based on the results of the site reconnaissance, five soil sample locations were identified.

## 4.2 Analytical Results

A soil sample log is provided in attached Table 1. Detailed analytical results are presented on the Tables 2 to 8.

### 4.2.1 Priority Contaminants

#### Metals and Inorganics

Analytical results for metals and inorganics (cations) parameters indicate the following:

- An iron concentration of 38,200 µg/g exceeded the CSR AL, RL<sub>LD</sub>, and PL standards (35,000 µg/g ) at sample location M-SS22-03. The concentration at location M-SS22-02 (34,800 µg/g ) was marginally less than the CSR standards.
- Concentrations of nitrate were less than 5 µg/g at all locations, except for M-SS22-03 (52.2 µg/g).

Concentrations of all other metals and inorganic parameters analyzed were less than the applied CSR standards, in all samples.

#### Microbiological Parameters

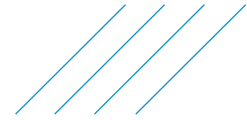
There are no standards under the CSR for the analyzed microbiological parameters in soil. Even though there are no standards or guidelines available for these parameters in soil, they will be carried forward and evaluated in the PRRA. Concentrations of these parameters are summarized as follows:

- Total coliforms: concentrations were detected in all samples, ranging from 3.9 most probable number per gram (MPN/g) at location M-SS22-03, to 49 MPN/g at location M-SS22-02.
- Fecal coliform: concentrations were below the laboratory method detection limit (MDL) in most of the samples analyzed, with the exception of sample location M-SS22-05/06 (duplicate sample set). Concentrations ranged from 13 MPN/g to 33 MPN/g in the duplicate set.
- *E. coli*: concentrations were below the laboratory MDL in most of the samples analyzed, except for sample location M-SS22-05/06 (duplicate sample set). Concentrations ranged from 13 MPN/g to 33 MPN/g as well. It is noted that concentrations of *E. coli* are equal to concentrations of fecal coliforms in all samples.
- Salmonella: all concentrations were less than the laboratory MDL.

### 4.2.2 Other Contaminants

Soil samples were selectively analyzed for other parameters in addition to the priority contaminants, as identified in Table B, above. Concentrations of all other parameters analyzed were less than the applied CSR standards, in all samples and typically less than the laboratory MDL. For those parameters that do not have CSR standards, results were less than the MDL.

Metals (arsenic, chromium, copper), PAHs and chlorinated phenols were analyzed in soil to assess the potential impacts from historic wood treatment activities that may have been carried out within the flood boundary. Concentrations of these parameters did not exceed the applied CSR standards; furthermore, PAHs and chlorinated phenols were not detected in the soil samples analyzed indicating limited likelihood that potential contamination related to historical wood treatment activities was exacerbated by the flood event.



# Memorandum

## 4.2.3 Quality Assurance / Quality Control (QA/QC)

To assess the QA/QC for the blind duplicate sets, SNC-Lavalin calculates the practical quantitation limit (PQL) (defined as five times the laboratory MDL) and, if appropriate, the relative percent difference (RPD) (defined as the absolute value of the difference between a sample set divided by the average of the two results). If sample concentrations are less than the PQL, RPDs are not considered meaningful due to a relative increase in analytical variability at or near detection limits. Therefore, RPDs in such scenarios were not calculated.

All RPDs were less than SNC-Lavalin’s acceptance criteria of 50%, where calculated. As such, SNC-Lavalin considers the data to be representative and reliable.

## 5 Notice to Reader

This report has been prepared and the work referred to in this report have been undertaken by SNC-Lavalin Inc. (SNC-Lavalin) for the exclusive use of BC Ministry of the Environment and Climate Change Strategy (BC ENV), who has been party to the development of the scope of work and understands its limitations. The methodology, findings, conclusions and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations described in the proposal and/or contract pursuant to which this report was issued. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. SNC-Lavalin accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report.

The findings, conclusions and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin’s best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our original contract and included in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered, site conditions change or standards are amended, modifications to this report may be necessary. The results of this assessment should in no way be construed as a warranty that the subject site is free from any and all environmental impact.

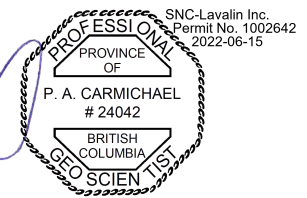
This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final version of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

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# Tables

- 1: Soil Sampling Log – Merritt
- 2: Summary of Analytical Results for Soil – Physical and Inorganic Parameters and Total Metals
- 3: Summary of Analytical Results for Soil – Microbiological Tests
- 4: Summary of Analytical Results for Soil – Hydrocarbons
- 5: Summary of Analytical Results for Soil – Polycyclic Aromatic Hydrocarbons
- 6: Summary of Analytical Results for Soil – Pesticides, Herbicides, Pyrethroids
- 7: Summary of Analytical Results for Soil – Chlorinated Phenols
- 8: Summary of Analytical Results for Soil – PCBs



**TABLE 1: Soil Sampling Log - Merritt**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Sample Type	Description	Depth (m)
M-SS22-02	M-SS22-02	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, moist.	0.05
M-SS22-03	M-SS22-03	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, moist.	0.05
M-SS22-04	M-SS22-04	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, damp.	0.15
M-SS22-05	M-SS22-05	2022 03 23	Surface Sample	SILT, some clay, some fine grained sand, brown, trace organics, moist.	0.15
M-SS22-05	M-SS22-06	Duplicate	Surface Sample	Blind field Duplicate of M-SS22-05	0.15
M-SS22-07	M-SS22-07	2022 03 23	Surface Sample	SAND, fine grained, some silt, trace medium grained sand, brown, loose, moist.	0.15

**TABLE 2: Summary of Analytical Results for Soil - Physical and Inorganic Parameters and Total Metals**

Sample Location Sample ID Sample Date (yyyy mm dd) Depth Interval (m)	M-SS22-02	M-SS22-03	M-SS22-04	M-SS22-05			M-SS22-07	BC Standard			
	M-SS22-02	M-SS22-03	M-SS22-04	M-SS22-05	M-SS22-06	QA/QC	M-SS22-07	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>a</sup>	CSR Urban Park Land Use (PL) <sup>a</sup>	
	2022 03 23	2022 03 23	2022 03 23	2022 03 23	Duplicate	RPD %	2022 03 23				
Parameter	Units	0.0 - 0.05	0.0 - 0.05	0.0 - 0.15	0.0 - 0.15	0.0 - 0.15	0.0 - 0.15				
<b>Physical Parameters</b>											
pH	pH	7.98	7.62	7.91	8.02	8.07	1	8.15	n/a	n/a	n/a
Total Organic Carbon	%	2.33	1.53	1.15	2.86	3.18	11	0.645	n/a	n/a	n/a
Total Organic Carbon	µg/g	23,300	15,300	11,500	28,600	31,800	11	6,450	n/a	n/a	n/a
Ammonia Nitrogen	µg/g	15.0	9.9	9.3	17.8	20.1	*	13.5	n/a	n/a	n/a
Water Soluble Nitrate Nitrogen	µg/g	4.13	52.2	3.81	0.996	< 0.500	*	< 0.500	25,000	25,000	50,000
Water Soluble Nitrite Nitrogen	µg/g	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	*	< 0.500	1,500	1,500	3,000
Water Soluble Phosphate	µg/g	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	*	< 0.500	n/a	n/a	n/a
<b>Total Metals</b>											
Aluminum	µg/g	18,500	20,300	14,800	14,800	15,200	3	12,200	40,000	40,000	40,000
Antimony	µg/g	0.38	0.35	0.30	0.36	0.25	*	0.22	20	20	20
Arsenic	µg/g	5.68	5.88	4.49	4.40	4.49	2	3.61	10	10	10
Barium	µg/g	197	196	157	160	161	1	123	350	350	350
Beryllium	µg/g	0.44	0.48	0.36	0.37	0.36	*	0.30	85 (pH>=7.5)	85 (pH>=7.5)	150 (pH >=7.5)
Boron	µg/g	3.1	3.2	2.8	3.2	2.9	*	3.8	8,500	8,500	15,000
Cadmium	µg/g	0.230	0.203	0.139	0.162	0.159	*	0.150	10 (pH >=7.5)	10 (pH >=7.5)	10 (pH >=7.5)
Chromium	µg/g	36.7	38.1	28.4	28.6	29.3	2	22.9	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>
Chromium, hexavalent	µg/g	< 0.40	< 0.40	-	< 0.40	-	-	-	60	60	60
Chromium, trivalent	µg/g	36.7	38.1	-	28.6	-	-	-	60	100	200
Cobalt	µg/g	14.6	15.7	11.8	11.8	12.2	3	10.1	25	25	25
Copper	µg/g	53.6	57.6	43.2	42.9	43.8	2	32.1	150 (pH >=7.5)	150 (pH >=7.5)	150 (pH >=7.5)
Iron	µg/g	34,800	<b>38,200</b>	28,300	28,000	28,900	3	24,400	35,000	35,000	35,000
Lead	µg/g	6.50	6.92	5.19	5.22	5.02	4	4.25	120 (pH >=7.5)	120 (pH >=7.5)	120 (pH >=7.5)
Lithium	µg/g	11.2	11.6	8.56	9.18	8.96	2	8.06	30	30	65
Manganese	µg/g	952	986	707	709	723	2	519	2,000	2,000	2,000
Mercury	µg/g	0.044	0.051	< 0.040	< 0.040	0.058	*	< 0.040	0.6	10	25
Molybdenum	µg/g	1.15	1.14	0.89	0.88	0.80	10	0.62	3	3	15
Nickel	µg/g	25.7	26.8	21.3	20.6	21.2	*	17.3	150 (pH >=7.5)	150 (pH >=7.5)	150 (pH >=7.5)
Selenium	µg/g	0.25	0.23	< 0.20	< 0.20	0.25	*	< 0.20	1	1	1
Silver	µg/g	0.15	0.13	< 0.10	< 0.10	0.11	*	< 0.10	20	20	20
Strontium	µg/g	94.5	95.4	85.5	84.6	85.4	1	70.2	9,500	9,500	20,000
Thallium	µg/g	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	*	< 0.10	2	9	9
Tin	µg/g	0.49	0.51	0.40	0.31	0.49	*	0.39	5	50	50
Tungsten	µg/g	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	*	< 0.20	15	15	25
Uranium	µg/g	1.09	0.956	0.837	0.870	0.879	1	0.480	15	15	30
Vanadium	µg/g	86.1	90.6	69.1	68.3	70.4	3	59.9	100	100	100
Zinc	µg/g	80.0	87.0	63.7	62.1	64.5	*	54.5	200 (pH >=7.5)	450 (pH >=7.5)	450 (pH >=7.5)
Potassium	µg/g	1,410	1,510	1,130	1,150	1,230	7	974	n/a	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD**

Concentration greater than CSR Agricultural Land Use (AL) standard

**SHADED**

Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**RED**

Concentration greater than CSR Urban Park Land Use (PL) standard

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

<sup>b</sup> Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.

**TABLE 3: Summary of Analytical Results for Soil - Microbiological Tests**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Microbiological Tests			
				Fecal MPN/g	E. Coli MPN/g	Total MPN/g	Salmonella MPN/g
M-SS22-02	M-SS22-02	2022 03 23	0.0 - 0.05	< 4.1	< 4.1	49	< 0.3
M-SS22-03	M-SS22-03	2022 03 23	0.0 - 0.05	< 3.0	< 3.0	3.9	< 0.2
M-SS22-04	M-SS22-04	2022 03 23	0.0 - 0.15	< 3.0	< 3.0	11	< 0.2
M-SS22-05	M-SS22-05	2022 03 23	0.0 - 0.15	13	13	21	< 0.3
	M-SS22-06	Duplicate	0.0 - 0.15	33	33	33	< 0.3
	<b>QA/QC RPD%</b>			*	*	44	*
M-SS22-07	M-SS22-07	2022 03 23	0.0 - 0.15	< 3.8	< 3.8	29	< 0.3
<b>BC Standard</b>							
CSR Agricultural Land Use (AL) <sup>a</sup>				n/a	n/a	n/a	n/a
CSR Low Density Residential Land Use (RLLD) <sup>a</sup>				n/a	n/a	n/a	n/a
CSR Urban Park Land Use (PL) <sup>a</sup>				n/a	n/a	n/a	n/a

Associated CARO file(s): 22C3371, 22C3377.

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QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD** Concentration greater than CSR Agricultural Land Use (AL) standard

**SHADED** Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**RED** Concentration greater than CSR Urban Park Land Use (PL) standard

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

**TABLE 4: Summary of Analytical Results for Soil - Hydrocarbons**

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Gross Parameters			
				EPH (C10-C19) <sup>b</sup> µg/g	LEPHs µg/g	EPH (C19-C32) <sup>b</sup> µg/g	HEPHs µg/g
M-SS22-02	M-SS22-02	2022 03 23	0.0 - 0.05	< 50	< 50	71	71
M-SS22-03	M-SS22-03	2022 03 23	0.0 - 0.05	< 50	< 50	< 50	< 50
M-SS22-04	M-SS22-04	2022 03 23	0.0 - 0.15	< 50	< 50	68	68
M-SS22-05	M-SS22-05	2022 03 23	0.0 - 0.15	< 50	< 50	63	63
	M-SS22-06	Duplicate	0.0 - 0.15	< 50	< 50	80	80
<b>QA/QC RPD%</b>				*	*	*	*
M-SS22-07	M-SS22-07	2022 03 23	0.0 - 0.15	< 50	< 50	57	57
<b>BC Standard</b>							
CSR Agricultural Land Use (AL) <sup>a</sup>				1,000	1,000	1,000	1,000
CSR Low Density Residential Land Use (RLLD) <sup>a</sup>				1,000	1,000	1,000	1,000
CSR Urban Park Land Use (PL) <sup>a</sup>				1,000	1,000	1,000	1,000

Associated CARO file(s): 22C3371, 22C3377.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

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\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD** Concentration greater than CSR Agricultural Land Use (AL) standard

**SHADED** Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**RED** Concentration greater than CSR Urban Park Land Use (PL) standard

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

<sup>b</sup> EPH has been compared to LEPH and HEPH standards, which are conservative comparisons.

**TABLE 5: Summary of Analytical Results for Soil - Polycyclic Aromatic Hydrocarbons**

Sample Location Sample ID Sample Date (yyyy mm dd) Depth Interval (m)	M-SS22-02	M-SS22-03	M-SS22-04	M-SS22-05			M-SS22-07	BC Standard			
	M-SS22-02 2022 03 23 0.0 - 0.01	M-SS22-03 2022 03 23 0.0 - 0.05	M-SS22-04 2022 03 23 0.0 - 0.15	M-SS22-05 2022 03 23 0.0 - 0.15	M-SS22-06 Duplicate 0.0 - 0.15	QA/QC RPD %	M-SS22-07 2022 03 23 0.0 - 0.15	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>a</sup>	CSR Urban Park Land Use (PL) <sup>a</sup>	
Parameter	Units										
<b>Polycyclic Aromatic Hydrocarbons</b>											
Naphthalene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.6	0.6	0.6
Methylnaphthalene, 1-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	250	250	500
Methylnaphthalene, 2-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	60	60	100
Acenaphthylene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Acenaphthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	950	950	2,000
Fluorene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	600	600	1,000
Phenanthrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	5	5
Anthracene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	2.5	2.5	2.5
Fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	50	50	50
Pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	10	10
Benz(a)anthracene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	1
Chrysene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	200	200	400
Benzo(b)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	1
Benzo(b+j)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	1
Benzo(k)fluoranthene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	1
Benzo(a)pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	5	5	10
Indeno(1,2,3-cd)pyrene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	1
Dibenz(a,h)anthracene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	0.1	1	1
Benzo(g,h,i)perylene	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	n/a	n/a	n/a
Quinoline	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	2.5	2.5	4.5
Chloronaphthalene, 2-	µg/g	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	*	< 0.050	1,500	1,500	2,500

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

\* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

**BOLD** Concentration greater than CSR Agricultural Land Use (AL) standard

**SHADED** Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**RED** Concentration greater than CSR Urban Park Land Use (PL) standard

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

**TABLE 6: Summary of Analytical Results for Soil - Pesticides, Herbicides, Pyrethroids**

Sample Location		M-SS22-07	BC Standard		
Sample ID		M-SS22-07	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>a</sup>	CSR Urban Park Land Use (PL) <sup>a</sup>
Sample Date (yyyy mm dd)		2022 03 23			
Depth Interval (m)		0.0 - 0.15			
Parameter	Units	Analytical Results			
<b>Organochlorine Pesticides</b>					
Alachlor	µg/g	< 0.0050	100	100	250
Aldrin	µg/g	< 0.0050	0.4	0.4	0.8
Captan	µg/g	< 0.0400	2,000	2,000	4,000
Chlordane (cis+trans)	µg/g	< 0.0050	8	8	15
Chlorothalonil	µg/g	< 0.0050	250	250	500
DDT + Metabolites	µg/g	< 0.0100	0.7	0.7	0.7
Dieldrin	µg/g	< 0.0050	0.45	0.45	0.85
Endosulfan (I+II)	µg/g	< 0.0050	250	250	500
Endosulfan Sulphate	µg/g	< 0.0050	n/a	n/a	n/a
Endrin	µg/g	< 0.0050	4.5	4.5	9
Endrin Aldehyde	µg/g	< 0.0050	n/a	n/a	n/a
Endrin Ketone	µg/g	< 0.0050	n/a	n/a	n/a
Heptachlor	µg/g	< 0.0050	1.5	1.5	3
Heptachlor Epoxide	µg/g	< 0.0050	0.2	0.2	0.4
Hexachlorocyclohexane, alpha-	µg/g	< 0.0050	1	1	2
Hexachlorocyclohexane, beta-	µg/g	< 0.0050	4	4	8
Hexachlorocyclohexane, delta-	µg/g	< 0.0050	n/a	n/a	n/a
Hexachlorocyclohexane, gamma-	µg/g	< 0.0050	10	10	25
Methoxychlor	µg/g	< 0.0050	80	80	150
<b>Organophosphorus Pesticides</b>					
Azinphos-Methyl	µg/g	< 0.0100	45	45	90
Bromacil	µg/g	< 0.0050	n/a	n/a	n/a
Chlorpyrifos	µg/g	< 0.0100	15	15	30
Diazinon	µg/g	< 0.0100	10	10	20
Dichlorvos	µg/g	< 0.0100	8	8	15
Dimethoate	µg/g	< 0.0100	3	3	6.5
Disulfoton	µg/g	< 0.0200	0.6	0.6	1
Malathion	µg/g	< 0.0100	300	300	650
Parathion	µg/g	< 0.0100	95	95	200
Parathion Methyl	µg/g	< 0.0131	4	4	8
Phorate	µg/g	< 0.0100	3	3	6.5
Ronnel	µg/g	< 0.0100	800	800	1,500
Sulfotep	µg/g	< 0.0100	8	8	15
Temephos	µg/g	< 0.0500	n/a	n/a	650
Terbufos	µg/g	< 0.0100	0.4	0.4	0.8
<b>Miscellaneous Pesticides</b>					
Diclofop-methyl	µg/g	< 0.0050	n/a	n/a	n/a

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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RDL Denotes reported detection limit.

**BOLD**

Concentration greater than CSR Agricultural Land Use (AL) standard

**SHADED**

Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**RED**

Concentration greater than CSR Urban Park Land Use (PL) standard

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

**TABLE 6: Summary of Analytical Results for Soil - Pesticides, Herbicides, Pyrethroids**

Sample Location		M-SS22-07	BC Standard		
Sample ID		M-SS22-07	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>a</sup>	CSR Urban Park Land Use (PL) <sup>a</sup>
Sample Date (yyyy mm dd)		2022 03 23			
Depth Interval (m)		0.0 - 0.15			
Parameter	Units	Analytical Results			
<b>Herbicides</b>					
Acetic acid, 2-methyl-4-chlorophenoxy- [MCPA]	µg/g	< 0.013	8	8	15
Bentazon	µg/g	< 0.013	450	450	900
Bromoxynil	µg/g	< 0.013	300	300	650
Butanoic Acid, 4-(4-chloro-2-methylphenoxy)- [MCPB]	µg/g	< 0.013	150	150	300
Chloramben	µg/g	< 0.013	250	250	500
Clopyralid	µg/g	< 0.013	n/a	n/a	n/a
Cyanazine	µg/g	< 0.0100	8.5	8.5	15
Dicamba	µg/g	< 0.013	450	450	900
Dichlorophenoxy Acetic Acid, 2,4- [2,4-D]	µg/g	< 0.013	150	150	300
Dichlorophenoxy Butyric Acid, 2,4- [2,4-DB]	µg/g	< 0.013	150	150	250
Dichlorprop	µg/g	< 0.013	n/a	n/a	n/a
Dinoseb	µg/g	< 0.013	15	15	30
Diuron	µg/g	< 0.0200	30	30	65
Linuron	µg/g	< 0.0400	30	30	65
Metolachlor	µg/g	< 0.0100	2,500	2,500	5,000
Metribuzin	µg/g	< 0.0100	400	400	800
Picloram	µg/g	< 0.013	1,000	1,000	2,000
Prometon	µg/g	< 0.0100	250	250	500
Prometryn	µg/g	< 0.0050	60	60	100
Silvex [2,4,5-TP]	µg/g	< 0.013	150	150	250
Simazine	µg/g	< 0.0100	60	60	100
Tebuthiuron	µg/g	< 0.0200	1,000	1,000	2,000
Triallate	µg/g	< 0.0050	200	200	400
Trichlorophenoxyacetic Acid, 2,4,5- [2,4,5-T]	µg/g	< 0.013	150	150	300
Triclopyr	µg/g	< 0.013	n/a	n/a	n/a
Trifluralin	µg/g	< 0.0100	100	100	250
Butachlor	µg/g	< 0.0050	n/a	n/a	n/a
2-(2-Methyl-4-chlorophenoxy) propionic acid	µg/g	< 0.013	n/a	n/a	n/a
<b>Pyrethroids</b>					
Deltamethrin	µg/g	< 0.0500	n/a	n/a	n/a
Permethrin (cis+trans)	µg/g	0.0083	800	800	1,500
<b>Fungicides</b>					
Pentachloronitrobenzene [PCNB]	µg/g	< 0.0050	25	25	55

Associated Caro file(s): 22C3371, 22C3377.

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**BOLD**

Concentration greater than CSR Agricultural Land Use (AL) standard

**SHADED**

Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**RED**

Concentration greater than CSR Urban Park Land Use (PL) standard

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

**TABLE 7: Summary of Analytical Results for Soil - Chlorinated Phenols**

Sample Location Sample ID Sample Date (yyyy mm dd) Depth Interval (m)		M-SS22-02	M-SS22-03	M-SS22-05	M-SS22-07	BC Standard		
		M-SS22-02 2022 03 23 0.0 - 0.05	M-SS22-03 2022 03 23 0.0 - 0.05	M-SS22-05 2022 03 23 0.0 - 0.15	M-SS22-07 2022 03 23 0.0 - 0.15	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>a</sup>	CSR Urban Park Land Use (PL) <sup>a</sup>
Parameter	Units	Analytical Results						
<b>Chlorinated Phenols</b>								
Chlorophenol, 2-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Chlorophenol, 3-&4-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05 <sup>b</sup>	0.5 <sup>b</sup>	0.5 <sup>b</sup>
Dichlorophenol, 2,3-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Dichlorophenol, 2,4-&2,5-	µg/g	< 0.030	< 0.030	< 0.030	< 0.030	0.05 <sup>b</sup>	0.5 <sup>b</sup>	0.5 <sup>b</sup>
Dichlorophenol, 2,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Dichlorophenol, 3,4-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Dichlorophenol, 3,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Methylphenol, 4-chloro-3-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	1,500	1,500	3,000
Trichlorophenol, 2,3,4-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Trichlorophenol, 2,3,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Trichlorophenol, 2,3,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Trichlorophenol, 2,4,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Trichlorophenol, 2,4,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Trichlorophenol, 3,4,5-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Tetrachlorophenol, 2,3,4,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05	0.5	0.5
Tetrachlorophenol, 2,3,4,5 & 2,3,5,6-	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	0.05 <sup>b</sup>	0.5 <sup>b</sup>	0.5 <sup>b</sup>
Pentachlorophenol [PCP]	µg/g	< 0.020	< 0.020	< 0.020	< 0.020	25 (pH >=6.5)	25 (pH >=6.5)	25 (pH >=6.5)

Associated Caro file(s): 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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**SHADED**

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**RED**

Concentration greater than CSR Urban Park Land Use (PL) standard

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<sup>b</sup> Standard is for most stringent of individual isomers.

**TABLE 8: Summary of Analytical Results for Soil - PCBs**

Sample Location Sample ID		M-SS22-02	M-SS22-05	BC Standard		
		M-SS22-02	M-SS22-05	CSR Agricultural Land Use (AL) <sup>a</sup>	CSR Low Density Residential Land Use (RLLD) <sup>a</sup>	CSR Urban Park Land Use (PL) <sup>a</sup>
Sample Date (yyyy mm dd)		2022 03 23	2022 03 23			
Depth Interval (m)		0.0 - 0.05	0.0 - 0.15			
Parameter	Units	Analytical Results				
<b>PCBs</b>						
Aroclor 1016	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1221	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1232	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1242	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1248	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1254	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1260	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1262	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Aroclor 1268	µg/g	< 0.040	< 0.040	n/a	n/a	n/a
Polychlorinated Biphenyls, Total [PCBs]	µg/g	< 0.040	< 0.040	1.5	1.5	1.5

Associated Caro file(s): 22C3371, 22C3377.

All terms defined within the body of SNC-Lavalin's report.

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Concentration greater than CSR Agricultural Land Use (AL) standard

**SHADED**

Concentration greater than CSR Low Density Residential Land Use (RLLD) standard

**RED**

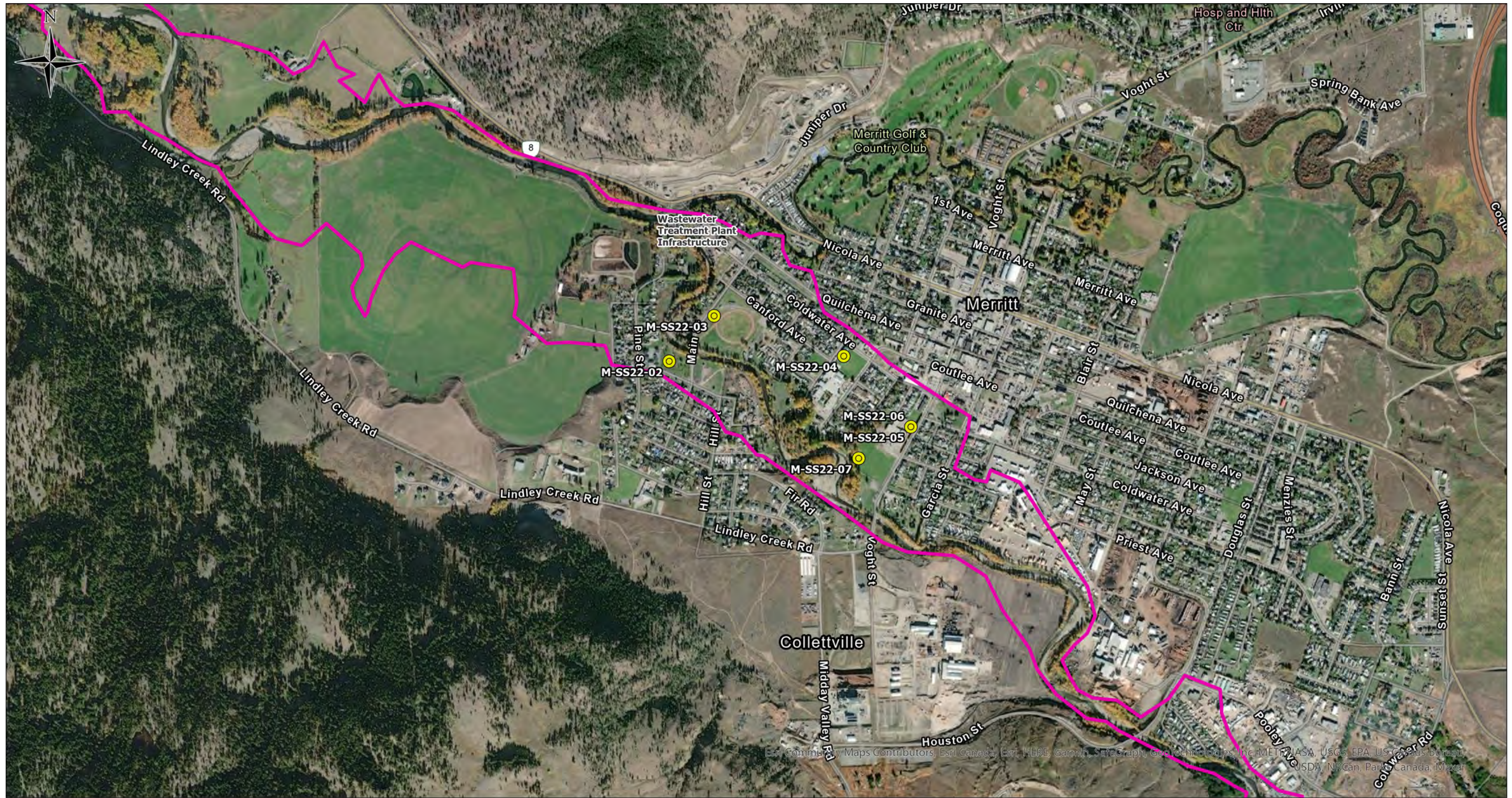
Concentration greater than CSR Urban Park Land Use (PL) standard

<sup>a</sup> The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, groundwater used for irrigation, groundwater used for livestock watering, livestock ingesting soil and fodder, toxicity to soil invertebrates and plants, major microbial functional impairment, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

# Drawing

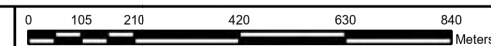
- 688421-003 – Sample Location Plan - Merritt





**LEGEND**

- Surface Soil Sample Location
- Monitoring Wells
- 2021 Flood Boundary Extent



**REFERENCES**

1. Data from SNC-Lavalin and DataBC,

**NOTES**

1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.



**SNC • LAVALIN**

CLIENT NAME:  
Ministry of Environment and  
Climate Change Strategy

PROJECT LOCATION:  
Merritt, BC

**Sample Location Plan - Merritt**

BY: SS	SCALE: 1:15,000	DATE: 2022-06-14	REF No:	REV: 01
CHK'D: TL	PROJ COORD SYS: NAD 1983 UTM Zone 10N	<b>688421-003</b>		

# Attachment 1

Site Photographs





Photograph 1: Centennial Park, location of M-SS22-02, looking northwest towards sanitary lift station.



Photograph 2: M-SS22-02: SILT, some clay, some fine grained sand, brown, trace organics, moist.



Photograph 3: Voght Park sports field, along east side of Main Street, near washroom facilities.



Photograph 4: Voght Park, view of stockpiled soil and soil deposition across the area from flood event.



Photograph 5: M-SS22-03: SILT, some clay, some fine grained sand, brown, trace organics, moist.



Photograph 6: Soil deposition on Merritt Secondary School sports field, looking south with location of M-SS22-04 indicated with red circle.



Photograph 7: M-SS22-04: SILT, some clay, some fine grained sand, brown, trace organics, damp.



Photograph 8: Significant soil deposition in playground and surrounding area of Central Elementary School, looking east.



Photograph 9: M-SS22-05/06: SILT, some clay, some fine grained sand, brown, trace organics, moist.



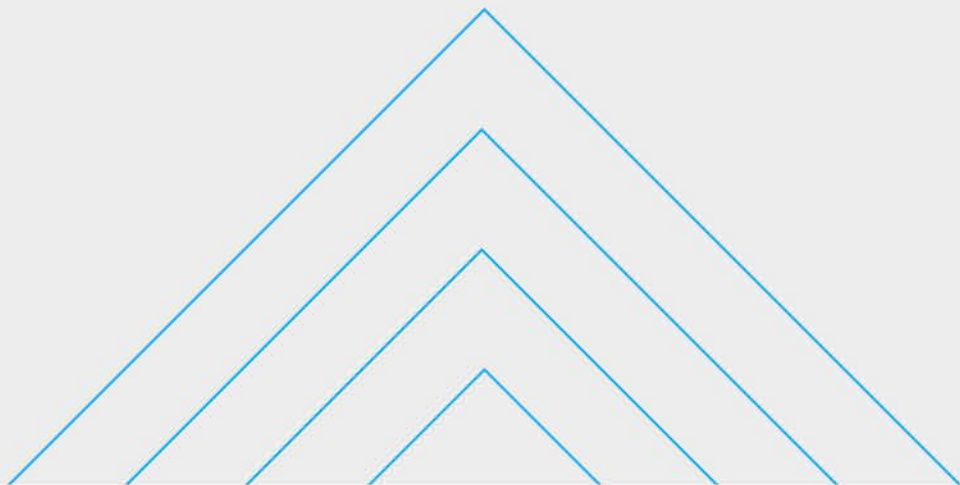
Photograph 10: South end of sports field, south of Central Elementary School and 50 m from the Coldwater River.



Photograph 11: M-SS22-07: SAND, fine grained, some silt, trace medium grained sand, brown, loose, moist.

# Attachment 2

Laboratory Analytical Reports





## CERTIFICATE OF ANALYSIS

**REPORTED TO** SNC-Lavalin Inc. (Burnaby)  
3777 Kingsway, Suite 1300  
Burnaby, BC V5H3Z7

**ATTENTION** Alan Walker

**PO NUMBER**

**PROJECT** 688421

**PROJECT INFO**

**WORK ORDER** 22C3377

**RECEIVED / TEMP** 2022-03-23 16:07 / 5.7°C

**REPORTED** 2022-04-13 15:51

**COC NUMBER** 13349

### Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

#### *Big Picture Sidekicks*



You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

#### *We've Got Chemistry*



It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

#### *Ahead of the Curve*



Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

### Work Order Comments:

Custody Seals Intact: N/A

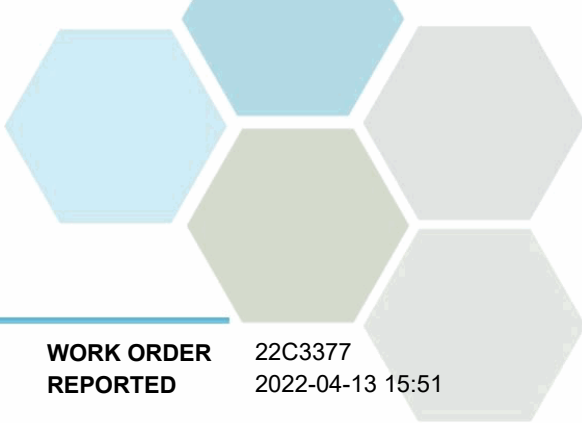
If you have any questions or concerns, please contact me at [bwhitehead@caro.ca](mailto:bwhitehead@caro.ca)

### Authorized By:

Brent Whitehead  
Account Manager

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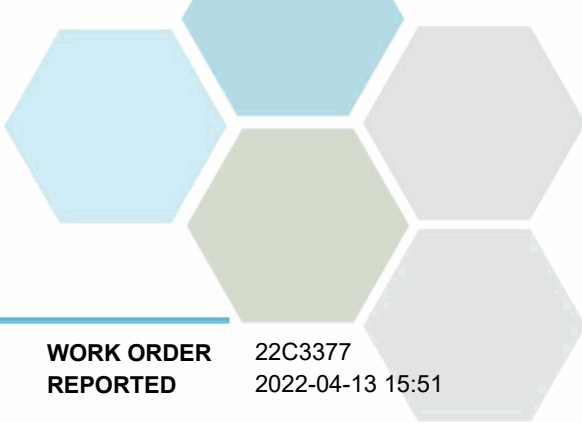


# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-02 (22C3377-01)   Matrix: Soil   Sampled: 2022-03-23 09:45</b>					
<b>BCMOE Aggregate Hydrocarbons</b>					
EPHs10-19	< 50	50	mg/kg dry	2022-03-29	
EPHs19-32	71	50	mg/kg dry	2022-03-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	71	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	95	60-140	%	2022-03-29	
<b>Calculated Parameters</b>					
Chromium, Trivalent	36.7	1.00	mg/kg dry	N/A	
<b>Chlorinated Phenols</b>					
2-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3 & 4-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
4-Chloro-3-Methylphenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4 & 2,5-Dichlorophenol	< 0.030	0.030	mg/kg dry	2022-04-01	
2,6-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,5-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,5 & 2,3,5,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Pentachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Surrogate: 2,4-Dibromophenol	82	50-140	%	2022-04-01	
Surrogate: 2,4,6-Tribromophenol	91	50-140	%	2022-04-01	
<b>Fertility / Nutrient Parameters</b>					
Ammonia, Water-Soluble (as N)	15.0	2.0	mg/kg dry	2022-03-30	
<b>General Parameters</b>					
Chromium, Hexavalent	< 0.40	0.40	mg/kg	2022-03-31	
Moisture	26.1	1.0	% wet	2022-03-29	
Nitrate, Water-Soluble (as N)	4.13	0.050	mg/kg dry	2022-03-29	
Nitrite, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	
pH (1:2 H2O Solution)	7.98	0.10	pH units	2022-03-30	
Phosphate, Water-Soluble (as P)	< 0.500	0.050	mg/kg dry	2022-03-29	
<b>Microbiological Parameters</b>					
Salmonella	< 0.3	0.2	MPN/g dry	2022-03-25	
Coliforms, Total	49	3.0	MPN/g dry	2022-03-25	
Coliforms, Fecal	< 4.1	3.0	MPN/g dry	2022-03-25	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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**M-SS22-02 (22C3377-01) | Matrix: Soil | Sampled: 2022-03-23 09:45, Continued**

**Microbiological Parameters, Continued**

E. coli	< 4.1	3.0	MPN/g dry	2022-03-25	
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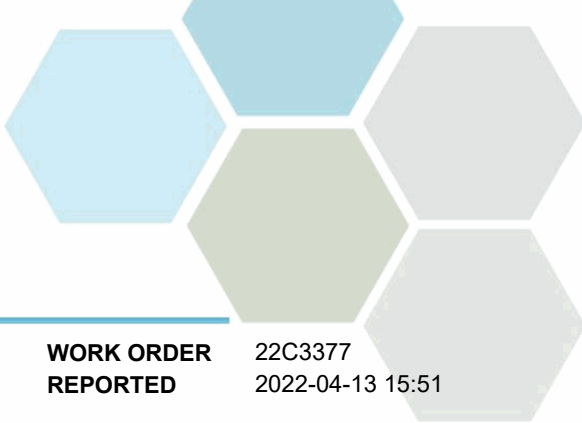
**Polychlorinated Biphenyl Aroclors**

PCB-1016	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1221	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1232	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1242	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1248	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1254	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1260	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1262	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1268	< 0.040	0.040	mg/kg dry	2022-03-30	
Total PCBs	< 0.040	0.040	mg/kg dry	2022-03-30	
Surrogate: Decachlorobiphenyl	119	50-140	%	2022-03-30	

**Polycyclic Aromatic Hydrocarbons (PAH)**

Acenaphthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Chloronaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Chrysene	< 0.050	0.050	mg/kg dry	2022-03-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluorene	< 0.050	0.050	mg/kg dry	2022-03-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Quinoline	< 0.050	0.050	mg/kg dry	2022-03-29	
Surrogate: Acenaphthene-d10	109	50-140	%	2022-03-29	
Surrogate: Chrysene-d12	127	50-140	%	2022-03-29	
Surrogate: Naphthalene-d8	107	50-140	%	2022-03-29	
Surrogate: Perylene-d12	124	50-140	%	2022-03-29	
Surrogate: Phenanthrene-d10	107	55-140	%	2022-03-29	

**Strong Acid Leachable Metals**



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-02 (22C3377-01)   Matrix: Soil   Sampled: 2022-03-23 09:45, Continued</b>					
<b>Strong Acid Leachable Metals, Continued</b>					
Aluminum	18500	40	mg/kg dry	2022-03-30	
Antimony	0.38	0.10	mg/kg dry	2022-03-30	
Arsenic	5.68	0.30	mg/kg dry	2022-03-30	
Barium	197	1.0	mg/kg dry	2022-03-30	
Beryllium	0.44	0.10	mg/kg dry	2022-03-30	
Boron	3.1	2.0	mg/kg dry	2022-03-30	
Cadmium	0.230	0.040	mg/kg dry	2022-03-30	
Chromium	36.7	1.0	mg/kg dry	2022-03-30	
Cobalt	14.6	0.10	mg/kg dry	2022-03-30	
Copper	53.6	0.40	mg/kg dry	2022-03-30	
Iron	34800	20	mg/kg dry	2022-03-30	
Lead	6.50	0.20	mg/kg dry	2022-03-30	
Lithium	11.2	0.10	mg/kg dry	2022-03-30	
Manganese	952	0.40	mg/kg dry	2022-03-30	
Mercury	0.044	0.040	mg/kg dry	2022-03-30	
Molybdenum	1.15	0.10	mg/kg dry	2022-03-30	
Nickel	25.7	0.60	mg/kg dry	2022-03-30	
Potassium	1410	40	mg/kg dry	2022-03-30	
Selenium	0.25	0.20	mg/kg dry	2022-03-30	
Silver	0.15	0.10	mg/kg dry	2022-03-30	
Strontium	94.5	0.20	mg/kg dry	2022-03-30	
Thallium	< 0.10	0.10	mg/kg dry	2022-03-30	
Tin	0.49	0.20	mg/kg dry	2022-03-30	
Tungsten	< 0.20	0.20	mg/kg dry	2022-03-30	
Uranium	1.09	0.050	mg/kg dry	2022-03-30	
Vanadium	86.1	2.5	mg/kg dry	2022-03-30	
Zinc	80.0	2.0	mg/kg dry	2022-03-30	

**M-SS22-03 (22C3377-02) | Matrix: Soil | Sampled: 2022-03-23 11:10**

**BCMOE Aggregate Hydrocarbons**

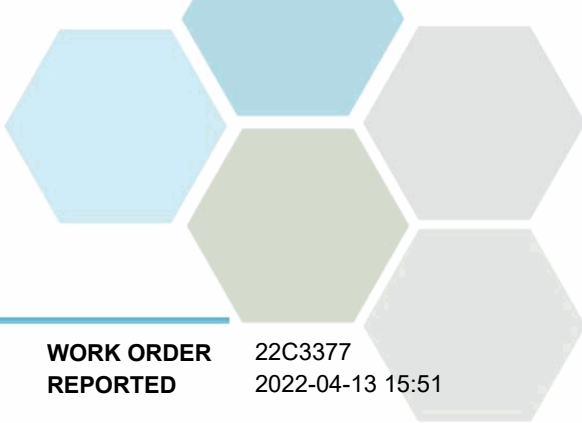
EPHs10-19	< 50	50	mg/kg dry	2022-03-29	
EPHs19-32	< 50	50	mg/kg dry	2022-03-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	101	60-140	%	2022-03-29	

**Calculated Parameters**

Chromium, Trivalent	38.1	1.00	mg/kg dry	N/A	
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**Chlorinated Phenols**

2-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3 & 4-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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**M-SS22-03 (22C3377-02) | Matrix: Soil | Sampled: 2022-03-23 11:10, Continued**

**Chlorinated Phenols, Continued**

4-Chloro-3-Methylphenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4 & 2,5-Dichlorophenol	< 0.030	0.030	mg/kg dry	2022-04-01	
2,6-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,5-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,5 & 2,3,5,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Pentachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Surrogate: 2,4-Dibromophenol	75	50-140	%	2022-04-01	
Surrogate: 2,4,6-Tribromophenol	76	50-140	%	2022-04-01	

**Fertility / Nutrient Parameters**

Ammonia, Water-Soluble (as N)	9.9	2.0	mg/kg dry	2022-03-30	
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**General Parameters**

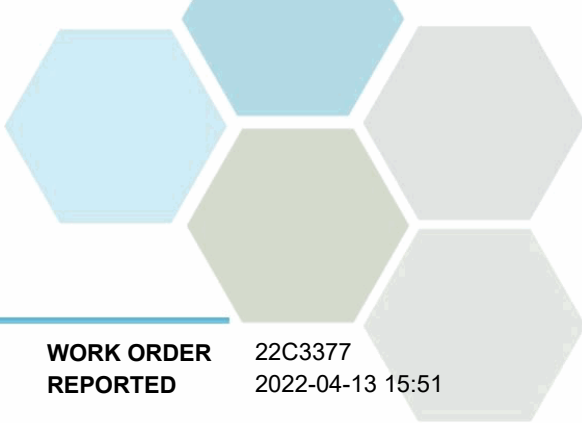
Chromium, Hexavalent	< 0.40	0.40	mg/kg	2022-03-31	
Moisture	7.6	1.0	% wet	2022-03-29	
Nitrate, Water-Soluble (as N)	52.2	0.050	mg/kg dry	2022-03-29	
Nitrite, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	
pH (1:2 H2O Solution)	7.62	0.10	pH units	2022-03-31	
Phosphate, Water-Soluble (as P)	< 0.500	0.050	mg/kg dry	2022-03-29	

**Microbiological Parameters**

Salmonella	< 0.2	0.2	MPN/g dry	2022-03-25	
Coliforms, Total	3.9	3.0	MPN/g dry	2022-03-25	
Coliforms, Fecal	< 3.0	3.0	MPN/g dry	2022-03-25	
E. coli	< 3.0	3.0	MPN/g dry	2022-03-25	

**Polycyclic Aromatic Hydrocarbons (PAH)**

Acenaphthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2022-03-29	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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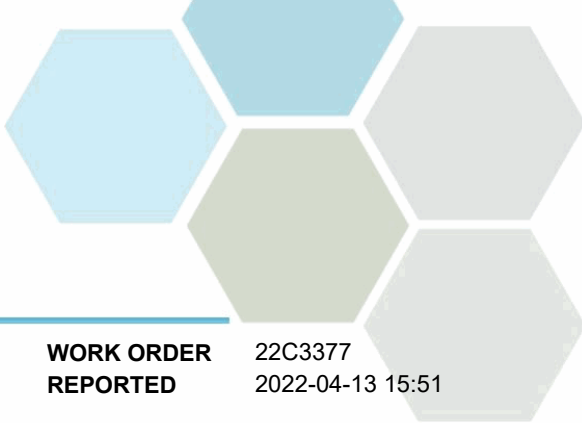
**M-SS22-03 (22C3377-02) | Matrix: Soil | Sampled: 2022-03-23 11:10, Continued**

**Polycyclic Aromatic Hydrocarbons (PAH), Continued**

Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Chloronaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Chrysene	< 0.050	0.050	mg/kg dry	2022-03-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluorene	< 0.050	0.050	mg/kg dry	2022-03-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Quinoline	< 0.050	0.050	mg/kg dry	2022-03-29	
Surrogate: Acenaphthene-d10	120	50-140	%	2022-03-29	
Surrogate: Chrysene-d12	127	50-140	%	2022-03-29	
Surrogate: Naphthalene-d8	116	50-140	%	2022-03-29	
Surrogate: Perylene-d12	131	50-140	%	2022-03-29	
Surrogate: Phenanthrene-d10	115	55-140	%	2022-03-29	

**Strong Acid Leachable Metals**

Aluminum	20300	40	mg/kg dry	2022-03-30	
Antimony	0.35	0.10	mg/kg dry	2022-03-30	
Arsenic	5.88	0.30	mg/kg dry	2022-03-30	
Barium	196	1.0	mg/kg dry	2022-03-30	
Beryllium	0.48	0.10	mg/kg dry	2022-03-30	
Boron	3.2	2.0	mg/kg dry	2022-03-30	
Cadmium	0.203	0.040	mg/kg dry	2022-03-30	
Chromium	38.1	1.0	mg/kg dry	2022-03-30	
Cobalt	15.7	0.10	mg/kg dry	2022-03-30	
Copper	57.6	0.40	mg/kg dry	2022-03-30	
Iron	38200	20	mg/kg dry	2022-03-30	
Lead	6.92	0.20	mg/kg dry	2022-03-30	
Lithium	11.6	0.10	mg/kg dry	2022-03-30	
Manganese	986	0.40	mg/kg dry	2022-03-30	
Mercury	0.051	0.040	mg/kg dry	2022-03-30	
Molybdenum	1.14	0.10	mg/kg dry	2022-03-30	
Nickel	26.8	0.60	mg/kg dry	2022-03-30	
Potassium	1510	40	mg/kg dry	2022-03-30	
Selenium	0.23	0.20	mg/kg dry	2022-03-30	
Silver	0.13	0.10	mg/kg dry	2022-03-30	
Strontium	95.4	0.20	mg/kg dry	2022-03-30	
Thallium	< 0.10	0.10	mg/kg dry	2022-03-30	
Tin	0.51	0.20	mg/kg dry	2022-03-30	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-03 (22C3377-02)   Matrix: Soil   Sampled: 2022-03-23 11:10, Continued</b>					
<i>Strong Acid Leachable Metals, Continued</i>					
Tungsten	< 0.20	0.20	mg/kg dry	2022-03-30	
Uranium	<b>0.956</b>	0.050	mg/kg dry	2022-03-30	
Vanadium	<b>90.6</b>	2.5	mg/kg dry	2022-03-30	
Zinc	<b>87.0</b>	2.0	mg/kg dry	2022-03-30	

**M-SS22-04 (22C3377-03) | Matrix: Soil | Sampled: 2022-03-23 11:30**

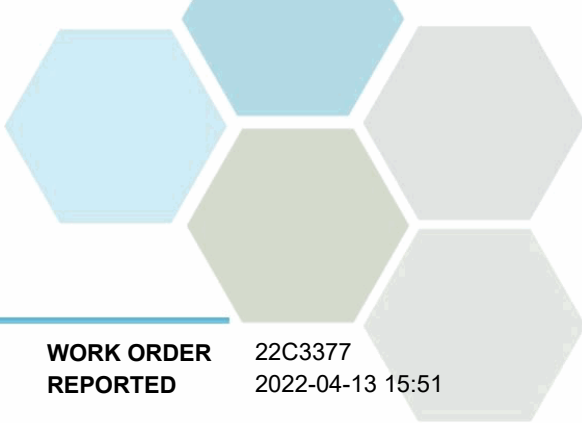
<i>BCMOE Aggregate Hydrocarbons</i>					
EPHs10-19	< 50	50	mg/kg dry	2022-03-29	
EPHs19-32	<b>68</b>	50	mg/kg dry	2022-03-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	<b>68</b>	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	96	60-140	%	2022-03-29	

<i>Fertility / Nutrient Parameters</i>					
Ammonia, Water-Soluble (as N)	<b>9.3</b>	2.0	mg/kg dry	2022-03-30	

<i>General Parameters</i>					
Moisture	<b>15.8</b>	1.0	% wet	2022-03-29	HT1
Nitrate, Water-Soluble (as N)	<b>3.81</b>	0.050	mg/kg dry	2022-03-29	
Nitrite, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	
pH (1:2 H2O Solution)	<b>7.91</b>	0.10	pH units	2022-03-30	
Phosphate, Water-Soluble (as P)	< 0.500	0.050	mg/kg dry	2022-03-29	

<i>Microbiological Parameters</i>					
Salmonella	< 0.2	0.2	MPN/g dry	2022-03-25	
Coliforms, Total	<b>11</b>	3.0	MPN/g dry	2022-03-25	
Coliforms, Fecal	< 3.0	3.0	MPN/g dry	2022-03-25	
E. coli	< 3.0	3.0	MPN/g dry	2022-03-25	

<i>Polycyclic Aromatic Hydrocarbons (PAH)</i>					
Acenaphthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Chloronaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Chrysene	< 0.050	0.050	mg/kg dry	2022-03-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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**M-SS22-04 (22C3377-03) | Matrix: Soil | Sampled: 2022-03-23 11:30, Continued**

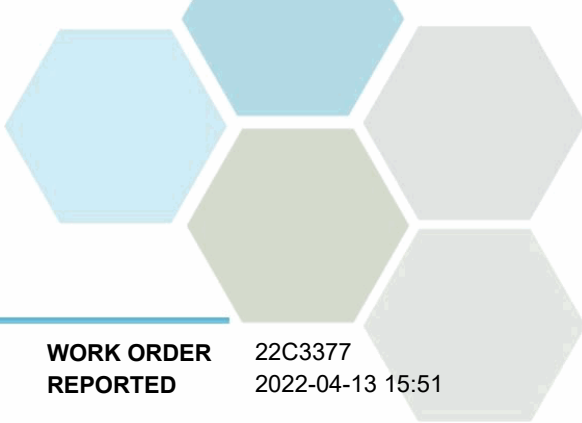
*Polycyclic Aromatic Hydrocarbons (PAH), Continued*

Fluorene	< 0.050	0.050	mg/kg dry	2022-03-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Quinoline	< 0.050	0.050	mg/kg dry	2022-03-29	
Surrogate: Acenaphthene-d10	110	50-140	%	2022-03-29	
Surrogate: Chrysene-d12	135	50-140	%	2022-03-29	
Surrogate: Naphthalene-d8	107	50-140	%	2022-03-29	
Surrogate: Perylene-d12	121	50-140	%	2022-03-29	
Surrogate: Phenanthrene-d10	107	55-140	%	2022-03-29	

*Strong Acid Leachable Metals*

Aluminum	14800	40	mg/kg dry	2022-03-30	
Antimony	0.30	0.10	mg/kg dry	2022-03-30	
Arsenic	4.49	0.30	mg/kg dry	2022-03-30	
Barium	157	1.0	mg/kg dry	2022-03-30	
Beryllium	0.36	0.10	mg/kg dry	2022-03-30	
Boron	2.8	2.0	mg/kg dry	2022-03-30	
Cadmium	0.139	0.040	mg/kg dry	2022-03-30	
Cobalt	11.8	0.10	mg/kg dry	2022-03-30	
Copper	43.2	0.40	mg/kg dry	2022-03-30	
Iron	28300	20	mg/kg dry	2022-03-30	
Lead	5.19	0.20	mg/kg dry	2022-03-30	
Lithium	8.56	0.10	mg/kg dry	2022-03-30	
Manganese	707	0.40	mg/kg dry	2022-03-30	
Mercury	< 0.040	0.040	mg/kg dry	2022-03-30	
Molybdenum	0.89	0.10	mg/kg dry	2022-03-30	
Nickel	21.3	0.60	mg/kg dry	2022-03-30	
Potassium	1130	40	mg/kg dry	2022-03-30	
Selenium	< 0.20	0.20	mg/kg dry	2022-03-30	
Silver	< 0.10	0.10	mg/kg dry	2022-03-30	
Strontium	85.5	0.20	mg/kg dry	2022-03-30	
Thallium	< 0.10	0.10	mg/kg dry	2022-03-30	
Tin	0.40	0.20	mg/kg dry	2022-03-30	
Tungsten	< 0.20	0.20	mg/kg dry	2022-03-30	
Uranium	0.837	0.050	mg/kg dry	2022-03-30	
Vanadium	69.1	2.5	mg/kg dry	2022-03-30	
Zinc	63.7	2.0	mg/kg dry	2022-03-30	

**M-SS22-05 (22C3377-04) | Matrix: Soil | Sampled: 2022-03-23 11:45**

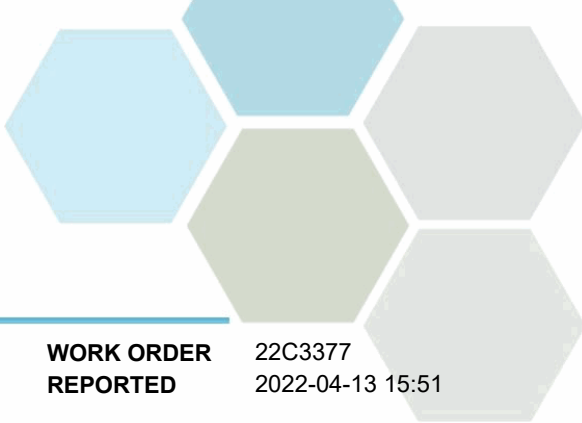


# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-05 (22C3377-04)   Matrix: Soil   Sampled: 2022-03-23 11:45, Continued</b>					
<b>BCMOE Aggregate Hydrocarbons</b>					
EPHs10-19	< 50	50	mg/kg dry	2022-03-29	
EPHs19-32	<b>63</b>	50	mg/kg dry	2022-03-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	<b>63</b>	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	92	60-140	%	2022-03-29	
<b>Calculated Parameters</b>					
Chromium, Trivalent	<b>28.6</b>	1.00	mg/kg dry	N/A	
<b>Chlorinated Phenols</b>					
2-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3 & 4-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
4-Chloro-3-Methylphenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4 & 2,5-Dichlorophenol	< 0.030	0.030	mg/kg dry	2022-04-01	
2,6-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,5-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,5 & 2,3,5,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Pentachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Surrogate: 2,4-Dibromophenol	91	50-140	%	2022-04-01	
Surrogate: 2,4,6-Tribromophenol	99	50-140	%	2022-04-01	
<b>Fertility / Nutrient Parameters</b>					
Ammonia, Water-Soluble (as N)	<b>17.8</b>	2.0	mg/kg dry	2022-03-30	
<b>General Parameters</b>					
Chromium, Hexavalent	< 0.40	0.40	mg/kg	2022-03-31	
Moisture	<b>28.3</b>	1.0	% wet	2022-03-29	
Nitrate, Water-Soluble (as N)	<b>0.996</b>	0.050	mg/kg dry	2022-03-29	
Nitrite, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	
pH (1:2 H2O Solution)	<b>8.02</b>	0.10	pH units	2022-03-30	
Phosphate, Water-Soluble (as P)	< 0.500	0.050	mg/kg dry	2022-03-29	
<b>Microbiological Parameters</b>					
Salmonella	< 0.3	0.2	MPN/g dry	2022-03-25	
Coliforms, Total	<b>21</b>	3.0	MPN/g dry	2022-03-25	
Coliforms, Fecal	<b>13</b>	3.0	MPN/g dry	2022-03-25	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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**M-SS22-05 (22C3377-04) | Matrix: Soil | Sampled: 2022-03-23 11:45, Continued**

**Microbiological Parameters, Continued**

E. coli	13	3.0	MPN/g dry	2022-03-25	
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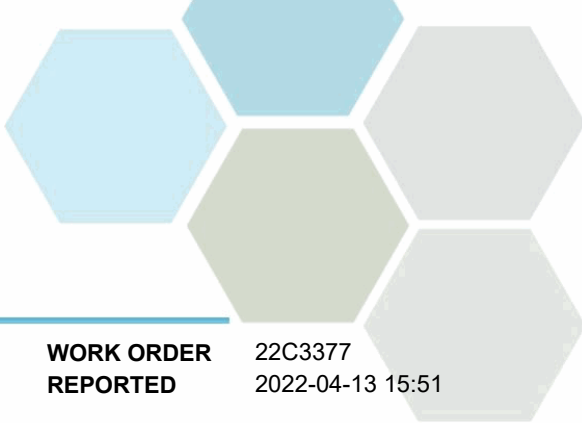
**Polychlorinated Biphenyl Aroclors**

PCB-1016	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1221	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1232	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1242	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1248	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1254	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1260	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1262	< 0.040	0.040	mg/kg dry	2022-03-30	
PCB-1268	< 0.040	0.040	mg/kg dry	2022-03-30	
Total PCBs	< 0.040	0.040	mg/kg dry	2022-03-30	
Surrogate: Decachlorobiphenyl	110	50-140	%	2022-03-30	

**Polycyclic Aromatic Hydrocarbons (PAH)**

Acenaphthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Chloronaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Chrysene	< 0.050	0.050	mg/kg dry	2022-03-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluorene	< 0.050	0.050	mg/kg dry	2022-03-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Quinoline	< 0.050	0.050	mg/kg dry	2022-03-29	
Surrogate: Acenaphthene-d10	105	50-140	%	2022-03-29	
Surrogate: Chrysene-d12	133	50-140	%	2022-03-29	
Surrogate: Naphthalene-d8	101	50-140	%	2022-03-29	
Surrogate: Perylene-d12	117	50-140	%	2022-03-29	
Surrogate: Phenanthrene-d10	103	55-140	%	2022-03-29	

**Strong Acid Leachable Metals**



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-05 (22C3377-04)   Matrix: Soil   Sampled: 2022-03-23 11:45, Continued</b>					
<b>Strong Acid Leachable Metals, Continued</b>					
Aluminum	14800	40	mg/kg dry	2022-03-30	
Antimony	0.36	0.10	mg/kg dry	2022-03-30	
Arsenic	4.40	0.30	mg/kg dry	2022-03-30	
Barium	160	1.0	mg/kg dry	2022-03-30	
Beryllium	0.37	0.10	mg/kg dry	2022-03-30	
Boron	3.2	2.0	mg/kg dry	2022-03-30	
Cadmium	0.162	0.040	mg/kg dry	2022-03-30	
Chromium	28.6	1.0	mg/kg dry	2022-03-30	
Cobalt	11.8	0.10	mg/kg dry	2022-03-30	
Copper	42.9	0.40	mg/kg dry	2022-03-30	
Iron	28000	20	mg/kg dry	2022-03-30	
Lead	5.22	0.20	mg/kg dry	2022-03-30	
Lithium	9.18	0.10	mg/kg dry	2022-03-30	
Manganese	709	0.40	mg/kg dry	2022-03-30	
Mercury	< 0.040	0.040	mg/kg dry	2022-03-30	
Molybdenum	0.88	0.10	mg/kg dry	2022-03-30	
Nickel	20.6	0.60	mg/kg dry	2022-03-30	
Potassium	1150	40	mg/kg dry	2022-03-30	
Selenium	< 0.20	0.20	mg/kg dry	2022-03-30	
Silver	< 0.10	0.10	mg/kg dry	2022-03-30	
Strontium	84.6	0.20	mg/kg dry	2022-03-30	
Thallium	< 0.10	0.10	mg/kg dry	2022-03-30	
Tin	0.31	0.20	mg/kg dry	2022-03-30	
Tungsten	< 0.20	0.20	mg/kg dry	2022-03-30	
Uranium	0.870	0.050	mg/kg dry	2022-03-30	
Vanadium	68.3	2.5	mg/kg dry	2022-03-30	
Zinc	62.1	2.0	mg/kg dry	2022-03-30	

**M-SS22-06 (22C3377-05) | Matrix: Soil | Sampled: 2022-03-23 11:45**

**BCMOE Aggregate Hydrocarbons**

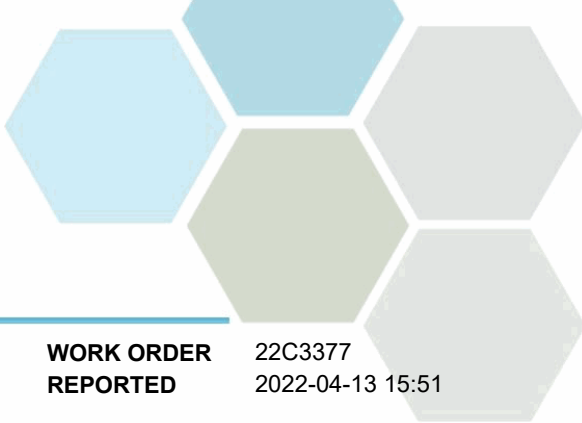
EPHs10-19	< 50	50	mg/kg dry	2022-03-29	
EPHs19-32	80	50	mg/kg dry	2022-03-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	80	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	97	60-140	%	2022-03-29	

**Fertility / Nutrient Parameters**

Ammonia, Water-Soluble (as N)	20.1	2.0	mg/kg dry	2022-03-30	
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**General Parameters**

Moisture	30.8	1.0	% wet	2022-03-29	HT1
Nitrate, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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**M-SS22-06 (22C3377-05) | Matrix: Soil | Sampled: 2022-03-23 11:45, Continued**

**General Parameters, Continued**

Nitrite, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	
pH (1:2 H2O Solution)	<b>8.07</b>	0.10	pH units	2022-03-30	
Phosphate, Water-Soluble (as P)	< 0.500	0.050	mg/kg dry	2022-03-29	

**Microbiological Parameters**

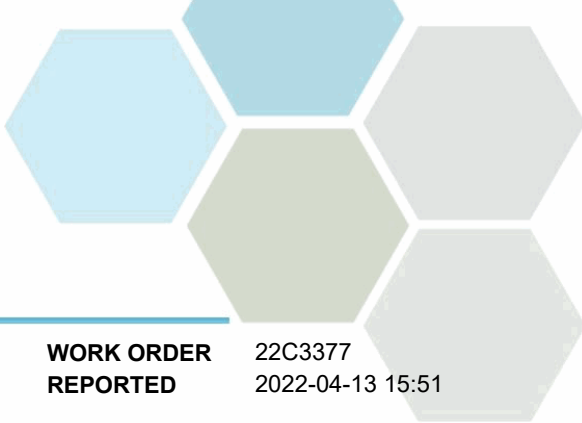
Salmonella	< 0.3	0.2	MPN/g dry	2022-03-25	
Coliforms, Total	<b>33</b>	3.0	MPN/g dry	2022-03-25	
Coliforms, Fecal	<b>33</b>	3.0	MPN/g dry	2022-03-25	
E. coli	<b>33</b>	3.0	MPN/g dry	2022-03-25	

**Polycyclic Aromatic Hydrocarbons (PAH)**

Acenaphthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Chloronaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Chrysene	< 0.050	0.050	mg/kg dry	2022-03-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluorene	< 0.050	0.050	mg/kg dry	2022-03-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Quinoline	< 0.050	0.050	mg/kg dry	2022-03-29	
Surrogate: Acenaphthene-d10	107	50-140	%	2022-03-29	
Surrogate: Chrysene-d12	138	50-140	%	2022-03-29	
Surrogate: Naphthalene-d8	103	50-140	%	2022-03-29	
Surrogate: Perylene-d12	121	50-140	%	2022-03-29	
Surrogate: Phenanthrene-d10	109	55-140	%	2022-03-29	

**Strong Acid Leachable Metals**

Aluminum	<b>15200</b>	40	mg/kg dry	2022-03-30	
Antimony	<b>0.25</b>	0.10	mg/kg dry	2022-03-30	
Arsenic	<b>4.49</b>	0.30	mg/kg dry	2022-03-30	
Barium	<b>161</b>	1.0	mg/kg dry	2022-03-30	
Beryllium	<b>0.36</b>	0.10	mg/kg dry	2022-03-30	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

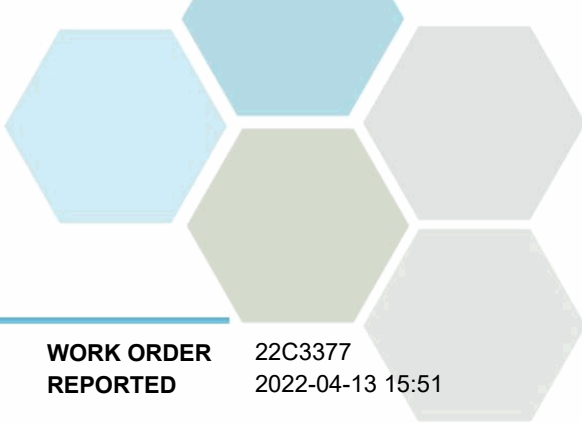
Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-06 (22C3377-05)   Matrix: Soil   Sampled: 2022-03-23 11:45, Continued</b>					
<i>Strong Acid Leachable Metals, Continued</i>					
Boron	2.9	2.0	mg/kg dry	2022-03-30	
Cadmium	0.159	0.040	mg/kg dry	2022-03-30	
Cobalt	12.2	0.10	mg/kg dry	2022-03-30	
Copper	43.8	0.40	mg/kg dry	2022-03-30	
Iron	28900	20	mg/kg dry	2022-03-30	
Lead	5.02	0.20	mg/kg dry	2022-03-30	
Lithium	8.96	0.10	mg/kg dry	2022-03-30	
Manganese	723	0.40	mg/kg dry	2022-03-30	
Mercury	0.058	0.040	mg/kg dry	2022-03-30	
Molybdenum	0.80	0.10	mg/kg dry	2022-03-30	
Nickel	21.2	0.60	mg/kg dry	2022-03-30	
Potassium	1230	40	mg/kg dry	2022-03-30	
Selenium	0.25	0.20	mg/kg dry	2022-03-30	
Silver	0.11	0.10	mg/kg dry	2022-03-30	
Strontium	85.4	0.20	mg/kg dry	2022-03-30	
Thallium	< 0.10	0.10	mg/kg dry	2022-03-30	
Tin	0.49	0.20	mg/kg dry	2022-03-30	
Tungsten	< 0.20	0.20	mg/kg dry	2022-03-30	
Uranium	0.879	0.050	mg/kg dry	2022-03-30	
Vanadium	70.4	2.5	mg/kg dry	2022-03-30	
Zinc	64.5	2.0	mg/kg dry	2022-03-30	

**M-SS22-07 (22C3377-06) | Matrix: Soil | Sampled: 2022-03-23 12:10**

*Acid Herbicides*

MCPP	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Bromoxynil	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Clopyralid	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Picloram	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
2,4,5-T	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Fenoprop	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Chloramben	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Triclopyr	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
MCPA	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Dinoseb	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
2,4-DB	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Bentazon	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Dichlorprop (2,4-DP)	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
MCPB	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
Dicamba	< 0.013	0.010	mg/kg dry	2022-04-13	HT1
2,4-D	< 0.013	0.010	mg/kg dry	2022-04-13	HT1

*BCMOE Aggregate Hydrocarbons*



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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**M-SS22-07 (22C3377-06) | Matrix: Soil | Sampled: 2022-03-23 12:10, Continued**

**BCMOE Aggregate Hydrocarbons, Continued**

EPHs10-19	< 50	50	mg/kg dry	2022-03-29	
EPHs19-32	57	50	mg/kg dry	2022-03-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	57	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	93	60-140	%	2022-03-29	

**Chlorinated Phenols**

2-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3 & 4-Chlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
4-Chloro-3-Methylphenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4 & 2,5-Dichlorophenol	< 0.030	0.030	mg/kg dry	2022-04-01	
2,6-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,5-Dichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,4,6-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
3,4,5-Trichlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,5 & 2,3,5,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
2,3,4,6-Tetrachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Pentachlorophenol	< 0.020	0.020	mg/kg dry	2022-04-01	
Surrogate: 2,4-Dibromophenol	91	50-140	%	2022-04-01	
Surrogate: 2,4,6-Tribromophenol	98	50-140	%	2022-04-01	

**Fertility / Nutrient Parameters**

Ammonia, Water-Soluble (as N)	13.5	2.0	mg/kg dry	2022-03-30	
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**General Parameters**

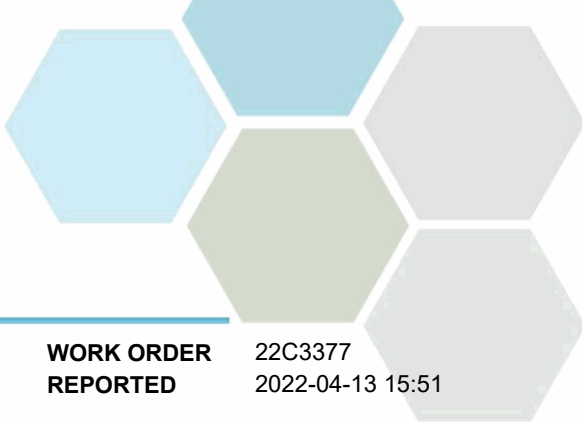
Moisture	20.5	1.0	% wet	2022-03-29	
Nitrate, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	
Nitrite, Water-Soluble (as N)	< 0.500	0.050	mg/kg dry	2022-03-29	
pH (1:2 H2O Solution)	8.15	0.10	pH units	2022-03-30	
Phosphate, Water-Soluble (as P)	< 0.500	0.050	mg/kg dry	2022-03-29	

**Microbiological Parameters**

Salmonella	< 0.3	0.2	MPN/g dry	2022-03-25	
Coliforms, Total	29	3.0	MPN/g dry	2022-03-25	
Coliforms, Fecal	< 3.8	3.0	MPN/g dry	2022-03-25	
E. coli	< 3.8	3.0	MPN/g dry	2022-03-25	

**Pesticides, Herbicides, and Fungicides**

Alachlor	< 0.0050	0.0050	mg/kg dry	2022-03-31	
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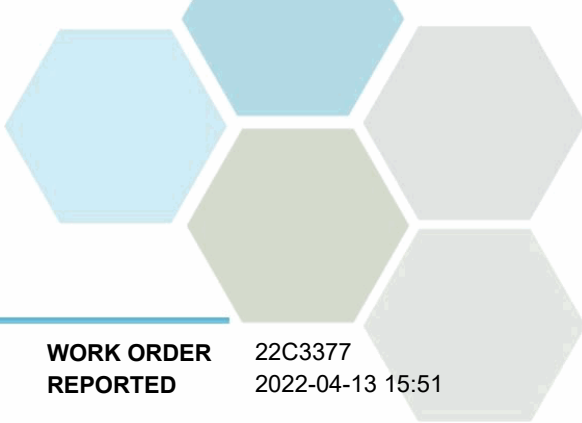


# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-07 (22C3377-06)   Matrix: Soil   Sampled: 2022-03-23 12:10, Continued</b>					
<i>Pesticides, Herbicides, and Fungicides, Continued</i>					
Aldrin	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Atrazine and metabolites	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Azinphos-methyl	< 0.0100	0.0100	mg/kg dry	2022-03-31	
alpha-BHC	< 0.0050	0.0050	mg/kg dry	2022-03-31	
beta-BHC	< 0.0050	0.0050	mg/kg dry	2022-03-31	
delta-BHC	< 0.0050	0.0050	mg/kg dry	2022-03-31	
gamma-BHC (Lindane)	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Bromacil	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Bromoxynil	< 0.0200	0.0200	mg/kg dry	2022-03-31	
Butachlor	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Captan	< 0.0400	0.0200	mg/kg dry	2022-03-31	RA1
Chlordane (cis + trans)	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Chlorothalonil	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Chlorpyrifos	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Cyanazine	< 0.0100	0.0100	mg/kg dry	2022-03-31	
DDT, Total	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Deltamethrin	< 0.0500	0.0500	mg/kg dry	2022-03-31	
Diazinon	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Dichlorvos	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Diclofop-methyl	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Dieldrin	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Dimethoate	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Disulfoton	< 0.0200	0.0200	mg/kg dry	2022-03-31	
Diuron	< 0.0200	0.0200	mg/kg dry	2022-03-31	
Endosulfan I + II	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Endosulfan sulfate	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Endrin	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Endrin aldehyde	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Endrin ketone	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Fenchlorphos (Ronnel)	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Heptachlor	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Heptachlor epoxide	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Linuron	< 0.0400	0.0400	mg/kg dry	2022-03-31	
Malathion	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Methoxychlor	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Methyl parathion	< 0.0131	0.0100	mg/kg dry	2022-03-31	RA1
Metolachlor	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Metribuzin	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Parathion	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Pentachloronitrobenzene	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Permethrin	<b>0.0083</b>	0.0050	mg/kg dry	2022-03-31	
Phorate	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Prometon	< 0.0100	0.0100	mg/kg dry	2022-03-31	



# TEST RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
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**M-SS22-07 (22C3377-06) | Matrix: Soil | Sampled: 2022-03-23 12:10, Continued**

**Pesticides, Herbicides, and Fungicides, Continued**

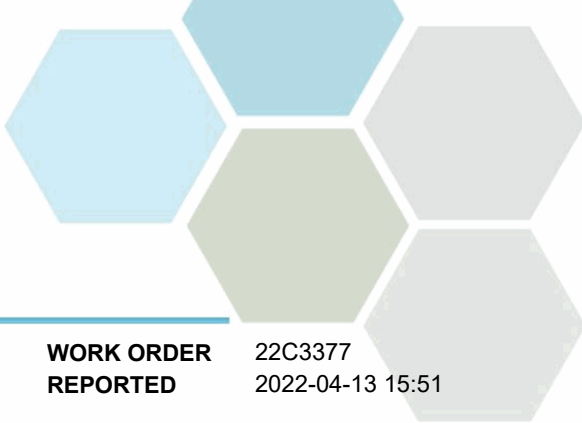
Prometryne	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Simazine	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Sulfotep	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Tebuthiuron	< 0.0200	0.0200	mg/kg dry	2022-03-31	
Temephos (Abate)	< 0.0500	0.0500	mg/kg dry	2022-03-31	
Terbufos	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Triallate	< 0.0050	0.0050	mg/kg dry	2022-03-31	
Trifluralin	< 0.0100	0.0100	mg/kg dry	2022-03-31	
Surrogate: Tributyl Phosphate	120	50-140	%	2022-03-31	
Surrogate: 4-chloro-3-nitrobenzotrifluoride	59	50-140	%	2022-03-31	

**Polycyclic Aromatic Hydrocarbons (PAH)**

Acenaphthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2022-03-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Chloronaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Chrysene	< 0.050	0.050	mg/kg dry	2022-03-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2022-03-29	
Fluorene	< 0.050	0.050	mg/kg dry	2022-03-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2022-03-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Pyrene	< 0.050	0.050	mg/kg dry	2022-03-29	
Quinoline	< 0.050	0.050	mg/kg dry	2022-03-29	
Surrogate: Acenaphthene-d10	99	50-140	%	2022-03-29	
Surrogate: Chrysene-d12	131	50-140	%	2022-03-29	
Surrogate: Naphthalene-d8	89	50-140	%	2022-03-29	
Surrogate: Perylene-d12	116	50-140	%	2022-03-29	
Surrogate: Phenanthrene-d10	103	55-140	%	2022-03-29	

**Strong Acid Leachable Metals**

Aluminum	12200	40	mg/kg dry	2022-03-30	
Antimony	0.22	0.10	mg/kg dry	2022-03-30	
Arsenic	3.61	0.30	mg/kg dry	2022-03-30	
Barium	123	1.0	mg/kg dry	2022-03-30	



# TEST RESULTS

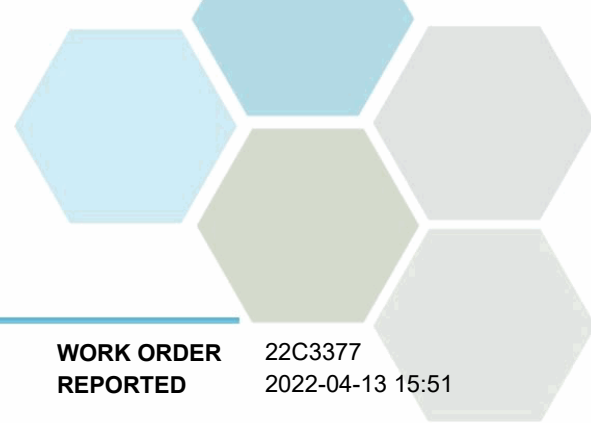
**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL	Units	Analyzed	Qualifier
<b>M-SS22-07 (22C3377-06)   Matrix: Soil   Sampled: 2022-03-23 12:10, Continued</b>					
<i>Strong Acid Leachable Metals, Continued</i>					
Beryllium	0.30	0.10	mg/kg dry	2022-03-30	
Boron	3.8	2.0	mg/kg dry	2022-03-30	
Cadmium	0.150	0.040	mg/kg dry	2022-03-30	
Cobalt	10.1	0.10	mg/kg dry	2022-03-30	
Copper	32.1	0.40	mg/kg dry	2022-03-30	
Iron	24400	20	mg/kg dry	2022-03-30	
Lead	4.25	0.20	mg/kg dry	2022-03-30	
Lithium	8.06	0.10	mg/kg dry	2022-03-30	
Manganese	519	0.40	mg/kg dry	2022-03-30	
Mercury	< 0.040	0.040	mg/kg dry	2022-03-30	
Molybdenum	0.62	0.10	mg/kg dry	2022-03-30	
Nickel	17.3	0.60	mg/kg dry	2022-03-30	
Potassium	974	40	mg/kg dry	2022-03-30	
Selenium	< 0.20	0.20	mg/kg dry	2022-03-30	
Silver	< 0.10	0.10	mg/kg dry	2022-03-30	
Strontium	70.2	0.20	mg/kg dry	2022-03-30	
Thallium	< 0.10	0.10	mg/kg dry	2022-03-30	
Tin	0.39	0.20	mg/kg dry	2022-03-30	
Tungsten	< 0.20	0.20	mg/kg dry	2022-03-30	
Uranium	0.480	0.050	mg/kg dry	2022-03-30	
Vanadium	59.9	2.5	mg/kg dry	2022-03-30	
Zinc	54.5	2.0	mg/kg dry	2022-03-30	

**Sample Qualifiers:**

- HT1 The sample was prepared and/or analyzed past the recommended holding time.
- RA1 The Reporting Limit has been raised due to matrix interference.



## APPENDIX 1: SUPPORTING INFORMATION

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

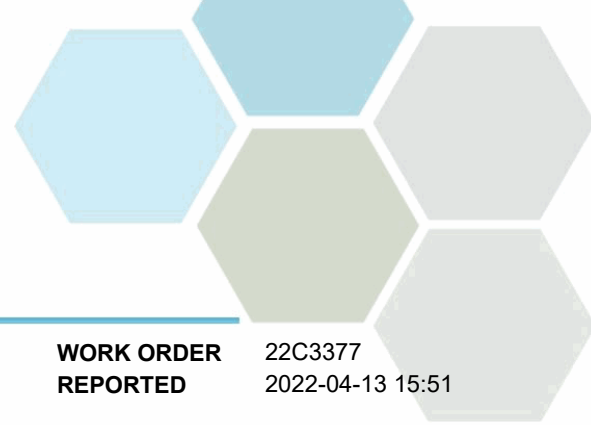
**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analysis Description	Method Ref.	Technique	Accredited	Location
Acid Herbicides in Soil in Soil	EURLRP QuEChERS	LC-MS/MS		Richmond
Ammonia, Water-Soluble in Soil	Carter 15.2.2 / SM 4500-NH3 G* (2017)	Fixed Ratio H2O Ext (1:5) / Automated Colorimetry (Phenate)		Kelowna
Anions in Soil	Carter 15.2.2 / SM 4110 B (2017)	Fixed Ratio H2O Ext (1:5) / Ion Chromatography		Kelowna
Chromium, Hexavalent in Soil	EPA 3060A / EPA 7196A	Alkaline Digestion / Colorimetry	✓	Richmond
Coliforms, Fecal in Soil	TMECC 07.01 B	Most Probable Number / Most Probable Number		Kelowna
Coliforms, Total in Soil	TMECC 07.01 A	Most Probable Number / Most Probable Number		Kelowna
E. coli in Soil	TMECC 07.01 C	Most Probable Number / Most Probable Number		Kelowna
EPH in Soil	EPA 3570* / BCMOE EPHs*	Shaker Extraction (Hexane-Acetone 1:1) / Gas Chromatography (GC-FID)	✓	Richmond
HEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
LEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
Moisture in Soil	ASTM D2974-87*	Gravimetry (Dried at 105C)		N/A
Pesticides in Soil	EPA 3570* / EPA 8270D*	Shaker Extraction (DCM) / GC-MSD (SIM)	✓	Richmond
pH in Soil	Carter 16.2 / SM 4500-H+ B (2017)	1:2 Soil/Water Slurry / Electrometry	✓	Richmond
Phenols, Chlorinated in Soil	EPA 3570* / EPA 8270D	Shaker Extraction (DCM) / GC-MSD (SIM)	✓	Richmond
Polychlorinated Biphenyl Aroclors in Soil	EPA 3570* / EPA 8082A	Shaker Extraction (Hexane-Acetone 1:1) / Gas Chromatography (GC-ECD)	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Soil	EPA 3570* / EPA 8270D	Shaker Extraction (Hexane-Acetone 1:1) / GC-MSD (SIM)	✓	Richmond
SALM in Soil	BCMOE SALM V.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Salmonella in Soil	TMECC 07.02	Most Probable Number / Most Probable Number		Kelowna

*Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method*

### Glossary of Terms:

RL	Reporting Limit (default)
% wet	Percent (as received basis)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/kg	Milligrams per kilogram (dry weight basis)
mg/kg dry	Milligrams per kilogram (dry weight basis)
MPN/g dry	Most Probable Number per gram (dry weight basis)
pH units	pH < 7 = acidic, pH > 7 = basic
ASTM	ASTM International Test Methods
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association
TMECC	Test Method for the Examination of Composting and Compost, US Composting Council



## APPENDIX 1: SUPPORTING INFORMATION

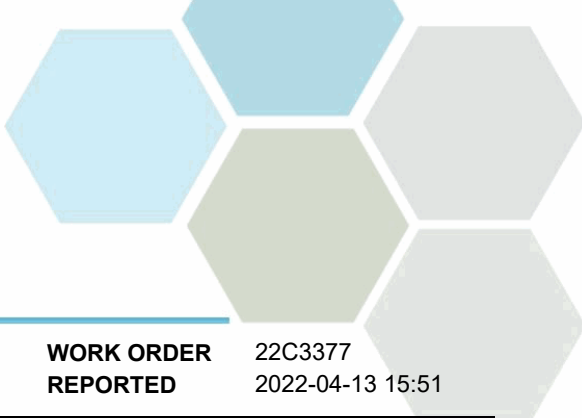
**REPORTED TO** SNC-Lavalin Inc. (Burnaby)  
**PROJECT** 688421

**WORK ORDER** 22C3377  
**REPORTED** 2022-04-13 15:51

**General Comments:**

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

*Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.*



## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO** SNC-Lavalin Inc. (Burnaby)  
**PROJECT** 688421

**WORK ORDER** 22C3377  
**REPORTED** 2022-04-13 15:51

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in “batches” and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk):** A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup):** An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS):** A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS):** A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM):** A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

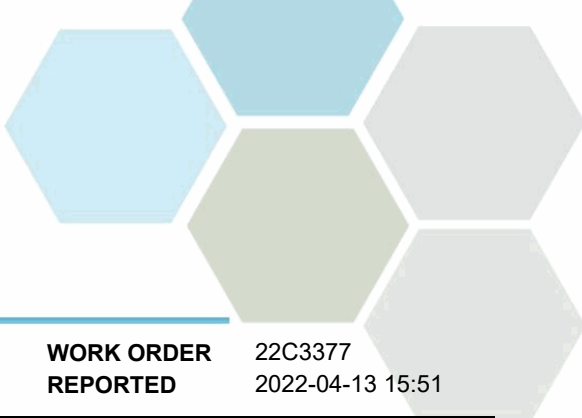
Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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**Acid Herbicides, Batch B2D1075**

<b>Blank (B2D1075-BLK1)</b>			Prepared: 2022-04-12, Analyzed: 2022-04-13						
MCPB	< 0.010	0.010 mg/kg wet							
Bromoxynil	< 0.010	0.010 mg/kg wet							
Clopyralid	< 0.010	0.010 mg/kg wet							
Picloram	< 0.010	0.010 mg/kg wet							
2,4,5-T	< 0.010	0.010 mg/kg wet							
Fenoprop	< 0.010	0.010 mg/kg wet							
Chloramben	< 0.010	0.010 mg/kg wet							
Triclopyr	< 0.010	0.010 mg/kg wet							
MCPA	< 0.010	0.010 mg/kg wet							
Dinoseb	< 0.010	0.010 mg/kg wet							
2,4-DB	< 0.010	0.010 mg/kg wet							
Bentazon	< 0.010	0.010 mg/kg wet							
Dichlorprop (2,4-DP)	< 0.010	0.010 mg/kg wet							
MCPB	< 0.010	0.010 mg/kg wet							
Dicamba	< 0.010	0.010 mg/kg wet							
2,4-D	< 0.010	0.010 mg/kg wet							

<b>LCS (B2D1075-BS1)</b>			Prepared: 2022-04-12, Analyzed: 2022-04-13						
MCPB	0.054	0.010 mg/kg wet	0.0497		109	70-130			
Bromoxynil	0.056	0.010 mg/kg wet	0.0500		112	70-130			
Clopyralid	0.056	0.010 mg/kg wet	0.0510		110	70-130			
Picloram	0.058	0.010 mg/kg wet	0.0510		113	70-130			
2,4,5-T	0.056	0.010 mg/kg wet	0.0515		110	70-130			
Fenoprop	0.052	0.010 mg/kg wet	0.0500		104	70-130			
Chloramben	0.055	0.010 mg/kg wet	0.0500		111	70-130			
Triclopyr	0.057	0.010 mg/kg wet	0.0515		110	70-130			
MCPA	0.052	0.010 mg/kg wet	0.0500		105	70-130			
Dinoseb	0.052	0.010 mg/kg wet	0.0510		102	70-130			
2,4-DB	0.057	0.010 mg/kg wet	0.0505		114	70-130			
Bentazon	0.053	0.010 mg/kg wet	0.0510		104	70-130			
Dichlorprop (2,4-DP)	0.049	0.010 mg/kg wet	0.0500		97	70-130			
MCPB	0.053	0.010 mg/kg wet	0.0505		104	70-130			
Dicamba	0.052	0.010 mg/kg wet	0.0505		103	70-130			
2,4-D	0.055	0.010 mg/kg wet	0.0505		109	70-130			



## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

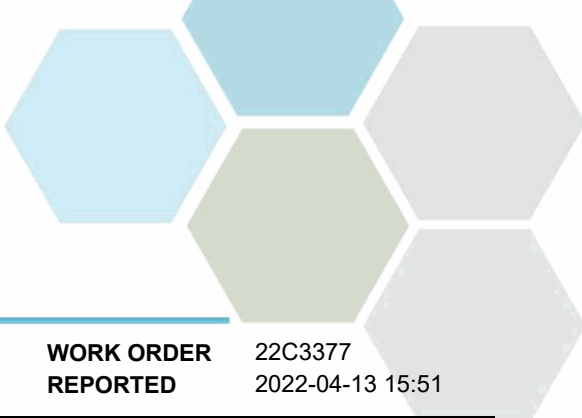
Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Acid Herbicides, Batch B2D1075, Continued</b>									
<b>LCS Dup (B2D1075-BSD1)</b>					Prepared: 2022-04-12, Analyzed: 2022-04-13				
MCPP	0.053	0.010 mg/kg wet	0.0497		107	70-130	2		
Bromoxynil	0.058	0.010 mg/kg wet	0.0500		116	70-130	3		
Clopyralid	0.061	0.010 mg/kg wet	0.0510		119	70-130	8		
Picloram	0.061	0.010 mg/kg wet	0.0510		119	70-130	5		
2,4,5-T	0.060	0.010 mg/kg wet	0.0515		117	70-130	6		
Fenoprop	0.049	0.010 mg/kg wet	0.0500		99	70-130	6		
Chloramben	0.059	0.010 mg/kg wet	0.0500		119	70-130	7		
Triclopyr	0.059	0.010 mg/kg wet	0.0515		115	70-130	5		
MCPA	0.057	0.010 mg/kg wet	0.0500		115	70-130	9		
Dinoseb	0.052	0.010 mg/kg wet	0.0510		103	70-130	< 1		
2,4-DB	0.059	0.010 mg/kg wet	0.0505		117	70-130	3		
Bentazon	0.055	0.010 mg/kg wet	0.0510		108	70-130	4		
Dichlorprop (2,4-DP)	0.050	0.010 mg/kg wet	0.0500		101	70-130	4		
MCPB	0.053	0.010 mg/kg wet	0.0505		106	70-130	1		
Dicamba	0.057	0.010 mg/kg wet	0.0505		113	70-130	9		
2,4-D	0.057	0.010 mg/kg wet	0.0505		113	70-130	3		

### BCMOE Aggregate Hydrocarbons, Batch B2C3040

<b>Blank (B2C3040-BLK1)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
EPHs10-19	< 50	50 mg/kg wet							
EPHs19-32	< 50	50 mg/kg wet							
Surrogate: 2-Methylnonane (EPH/F2-4)	71.8	mg/kg wet	82.2		87	60-140			
<b>Blank (B2C3040-BLK2)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
EPHs10-19	< 50	50 mg/kg wet							
EPHs19-32	< 50	50 mg/kg wet							
Surrogate: 2-Methylnonane (EPH/F2-4)	74.3	mg/kg wet	83.2		89	60-140			
<b>LCS (B2C3040-BS2)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
EPHs10-19	2300	50 mg/kg wet	2570		89	70-130			
EPHs19-32	3500	50 mg/kg wet	3710		95	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	61.9	mg/kg wet	74.9		83	60-140			
<b>LCS (B2C3040-BS4)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
EPHs10-19	2400	50 mg/kg wet	2760		85	70-130			
EPHs19-32	3700	50 mg/kg wet	3980		93	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	65.6	mg/kg wet	80.4		82	60-140			
<b>Reference (B2C3040-SRM1)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
<b>Reference (B2C3040-SRM2)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				

### Chlorinated Phenols, Batch B2C3451

<b>Blank (B2C3451-BLK1)</b>					Prepared: 2022-03-31, Analyzed: 2022-03-31				
2-Chlorophenol	< 0.020	0.020 mg/kg wet							
3 & 4-Chlorophenol	< 0.020	0.020 mg/kg wet							
4-Chloro-3-Methylphenol	< 0.020	0.020 mg/kg wet							
2,3-Dichlorophenol	< 0.020	0.020 mg/kg wet							
2,4 & 2,5-Dichlorophenol	< 0.030	0.030 mg/kg wet							
2,6-Dichlorophenol	< 0.020	0.020 mg/kg wet							
3,4-Dichlorophenol	< 0.020	0.020 mg/kg wet							
3,5-Dichlorophenol	< 0.020	0.020 mg/kg wet							
2,3,4-Trichlorophenol	< 0.020	0.020 mg/kg wet							
2,3,5-Trichlorophenol	< 0.020	0.020 mg/kg wet							



## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO** SNC-Lavalin Inc. (Burnaby)  
**PROJECT** 688421

**WORK ORDER** 22C3377  
**REPORTED** 2022-04-13 15:51

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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### Chlorinated Phenols, Batch B2C3451, Continued

#### Blank (B2C3451-BLK1), Continued

Prepared: 2022-03-31, Analyzed: 2022-03-31

2,3,6-Trichlorophenol	< 0.020	0.020 mg/kg wet							
2,4,5-Trichlorophenol	< 0.020	0.020 mg/kg wet							
2,4,6-Trichlorophenol	< 0.020	0.020 mg/kg wet							
3,4,5-Trichlorophenol	< 0.020	0.020 mg/kg wet							
2,3,4,5 & 2,3,5,6-Tetrachlorophenol	< 0.020	0.020 mg/kg wet							
2,3,4,6-Tetrachlorophenol	< 0.020	0.020 mg/kg wet							
Pentachlorophenol	< 0.020	0.020 mg/kg wet							
Surrogate: 2,4-Dibromophenol	0.671	mg/kg wet	0.820		82	50-140			
Surrogate: 2,4,6-Tribromophenol	0.642	mg/kg wet	0.820		78	50-140			

#### LCS (B2C3451-BS1)

Prepared: 2022-03-31, Analyzed: 2022-03-31

2-Chlorophenol	0.647	0.020 mg/kg wet	0.829		78	50-140			
3 & 4-Chlorophenol	1.62	0.020 mg/kg wet	1.67		97	50-140			
4-Chloro-3-Methylphenol	0.859	0.020 mg/kg wet	0.833		103	50-140			
2,3-Dichlorophenol	0.712	0.020 mg/kg wet	0.829		86	50-140			
2,4 & 2,5-Dichlorophenol	1.48	0.030 mg/kg wet	1.68		88	50-140			
2,6-Dichlorophenol	0.721	0.020 mg/kg wet	0.829		87	50-140			
3,4-Dichlorophenol	0.780	0.020 mg/kg wet	0.829		94	50-140			
3,5-Dichlorophenol	0.771	0.020 mg/kg wet	0.829		93	50-140			
2,3,4-Trichlorophenol	0.749	0.020 mg/kg wet	0.829		90	50-140			
2,3,5-Trichlorophenol	0.789	0.020 mg/kg wet	0.829		95	50-140			
2,3,6-Trichlorophenol	0.754	0.020 mg/kg wet	0.829		91	50-140			
2,4,5-Trichlorophenol	0.783	0.020 mg/kg wet	0.829		95	50-140			
2,4,6-Trichlorophenol	0.790	0.020 mg/kg wet	0.833		95	50-140			
3,4,5-Trichlorophenol	0.791	0.020 mg/kg wet	0.833		95	50-140			
2,3,4,5 & 2,3,5,6-Tetrachlorophenol	1.47	0.020 mg/kg wet	1.66		89	50-140			
2,3,4,6-Tetrachlorophenol	0.759	0.020 mg/kg wet	0.833		91	50-140			
Pentachlorophenol	0.773	0.020 mg/kg wet	0.829		93	50-140			
Surrogate: 2,4-Dibromophenol	0.827	mg/kg wet	0.829		100	50-140			
Surrogate: 2,4,6-Tribromophenol	0.824	mg/kg wet	0.829		99	50-140			

### Fertility / Nutrient Parameters, Batch B2C3255

#### Blank (B2C3255-BLK1)

Prepared: 2022-03-30, Analyzed: 2022-03-30

Ammonia, Water-Soluble (as N)	0.03	0.02 mg/kg wet							
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#### Blank (B2C3255-BLK2)

Prepared: 2022-03-30, Analyzed: 2022-03-30

Ammonia, Water-Soluble (as N)	0.03	0.02 mg/kg wet							
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#### LCS (B2C3255-BS1)

Prepared: 2022-03-30, Analyzed: 2022-03-30

Ammonia, Water-Soluble (as N)	1.0	0.02 mg/kg wet	1.00		102	85-115			
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#### LCS (B2C3255-BS2)

Prepared: 2022-03-30, Analyzed: 2022-03-30

Ammonia, Water-Soluble (as N)	1.0	0.02 mg/kg wet	1.00		101	85-115			
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### General Parameters, Batch B2C2907

#### Blank (B2C2907-BLK1)

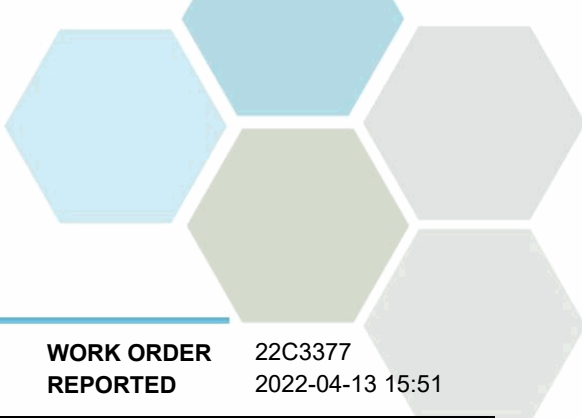
Prepared: 2022-03-29, Analyzed: 2022-03-29

Nitrate, Water-Soluble (as N)	< 0.050	0.050 mg/kg dry							
Nitrite, Water-Soluble (as N)	< 0.050	0.050 mg/kg dry							
Phosphate, Water-Soluble (as P)	< 0.050	0.050 mg/kg dry							

#### LCS (B2C2907-BS1)

Prepared: 2022-03-29, Analyzed: 2022-03-29

Nitrate, Water-Soluble (as N)	3.91	0.050 mg/kg dry	4.00		98	90-110			
Nitrite, Water-Soluble (as N)	1.99	0.050 mg/kg dry	2.00		100	85-115			
Phosphate, Water-Soluble (as P)	1.01	0.050 mg/kg dry	1.00		101	80-120			



## APPENDIX 2: QUALITY CONTROL RESULTS

<b>REPORTED TO PROJECT</b>	SNC-Lavalin Inc. (Burnaby) 688421	<b>WORK ORDER REPORTED</b>	22C3377 2022-04-13 15:51
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Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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### General Parameters, Batch B2C3024

<b>Reference (B2C3024-SRM1)</b>	Prepared: 2022-03-29, Analyzed: 2022-03-29								
Moisture	99.0	1.0 % wet	6.5		99	80-120			

### General Parameters, Batch B2C3219

<b>Blank (B2C3219-BLK1)</b>	Prepared: 2022-03-29, Analyzed: 2022-03-31								
Chromium, Hexavalent	< 0.40	0.40 mg/kg							

<b>LCS (B2C3219-BS1)</b>	Prepared: 2022-03-29, Analyzed: 2022-03-31								
Chromium, Hexavalent	11.5	0.40 mg/kg	12.5		92	70-130			

<b>Reference (B2C3219-SRM1)</b>	Prepared: 2022-03-29, Analyzed: 2022-03-31								
Chromium, Hexavalent	167	0.40 mg/kg	203		82	40-160			

### General Parameters, Batch B2C3264

<b>Duplicate (B2C3264-DUP2)</b>	<b>Source: 22C3377-04</b>	Prepared: 2022-03-30, Analyzed: 2022-03-30							
pH (1:2 H2O Solution)	7.99	0.10 pH units		8.02			< 1	4	

### General Parameters, Batch B2C3420

<b>Duplicate (B2C3420-DUP1)</b>	<b>Source: 22C3377-02</b>	Prepared: 2022-03-31, Analyzed: 2022-03-31							
pH (1:2 H2O Solution)	7.65	0.10 pH units		7.62			< 1	4	

### Microbiological Parameters, Batch B2C2698

<b>Blank (B2C2698-BLK1)</b>	Prepared: 2022-03-25, Analyzed: 2022-03-25								
Coliforms, Total	< 3.0	3.0 MPN/g wet							
Coliforms, Fecal	< 3.0	3.0 MPN/g wet							
E. coli	< 3.0	3.0 MPN/g wet							

<b>Blank (B2C2698-BLK2)</b>	Prepared: 2022-03-25, Analyzed: 2022-03-25								
Coliforms, Total	< 3.0	3.0 MPN/g wet							
Coliforms, Fecal	< 3.0	3.0 MPN/g wet							
E. coli	< 3.0	3.0 MPN/g wet							

<b>Duplicate (B2C2698-DUP1)</b>	<b>Source: 22C3377-05</b>	Prepared: 2022-03-25, Analyzed: 2022-03-25							
Coliforms, Total	220	3.0 MPN/g dry		33		147	148		
Coliforms, Fecal	22	3.0 MPN/g dry		33		42	147		
E. coli	22	3.0 MPN/g dry		33		42	145		

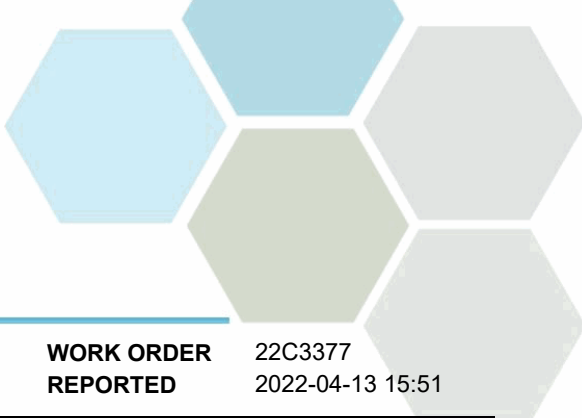
### Microbiological Parameters, Batch B2C2700

<b>Blank (B2C2700-BLK1)</b>	Prepared: 2022-03-25, Analyzed: 2022-03-25								
Salmonella	< 0.2	0.2 MPN/g wet							

<b>Blank (B2C2700-BLK2)</b>	Prepared: 2022-03-25, Analyzed: 2022-03-25								
Salmonella	< 0.2	0.2 MPN/g wet							

<b>Duplicate (B2C2700-DUP1)</b>	<b>Source: 22C3377-06</b>	Prepared: 2022-03-25, Analyzed: 2022-03-25							
Salmonella	< 0.3	0.2 MPN/g dry		< 0.3				130	

### Pesticides, Herbicides, and Fungicides, Batch B2C3182

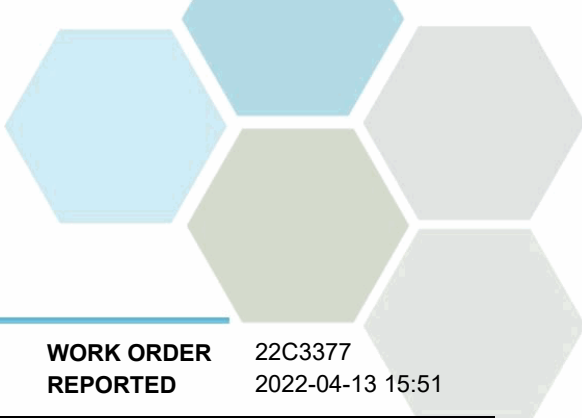


## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Pesticides, Herbicides, and Fungicides, Batch B2C3182, Continued</b>									
<b>Blank (B2C3182-BLK1)</b>					Prepared: 2022-03-29, Analyzed: 2022-03-30				
Alachlor	< 0.0050	0.0050 mg/kg wet							
Aldrin	< 0.0050	0.0050 mg/kg wet							
Atrazine and metabolites	< 0.0050	0.0050 mg/kg wet							
Azinphos-methyl	< 0.0100	0.0100 mg/kg wet							
alpha-BHC	< 0.0050	0.0050 mg/kg wet							
beta-BHC	< 0.0050	0.0050 mg/kg wet							
delta-BHC	< 0.0050	0.0050 mg/kg wet							
gamma-BHC (Lindane)	< 0.0050	0.0050 mg/kg wet							
Bromacil	< 0.0050	0.0050 mg/kg wet							
Bromoxynil	< 0.0200	0.0200 mg/kg wet							
Butachlor	< 0.0050	0.0050 mg/kg wet							
Captan	< 0.0200	0.0200 mg/kg wet							
Chlordane (cis + trans)	< 0.0050	0.0050 mg/kg wet							
Chlorothalonil	< 0.0050	0.0050 mg/kg wet							
Chlorpyrifos	< 0.0100	0.0100 mg/kg wet							
Cyanazine	< 0.0100	0.0100 mg/kg wet							
DDT, Total	< 0.0100	0.0100 mg/kg wet							
Deltamethrin	< 0.0500	0.0500 mg/kg wet							
Diazinon	< 0.0100	0.0100 mg/kg wet							
Dichlorvos	< 0.0100	0.0100 mg/kg wet							
Diclofop-methyl	< 0.0050	0.0050 mg/kg wet							
Dieldrin	< 0.0050	0.0050 mg/kg wet							
Dimethoate	< 0.0100	0.0100 mg/kg wet							
Disulfoton	< 0.0200	0.0200 mg/kg wet							
Diuron	< 0.0200	0.0200 mg/kg wet							
Endosulfan I + II	< 0.0050	0.0050 mg/kg wet							
Endosulfan sulfate	< 0.0050	0.0050 mg/kg wet							
Endrin	< 0.0050	0.0050 mg/kg wet							
Endrin aldehyde	< 0.0050	0.0050 mg/kg wet							
Endrin ketone	< 0.0050	0.0050 mg/kg wet							
Fenchlorphos (Ronnell)	< 0.0100	0.0100 mg/kg wet							
Heptachlor	< 0.0050	0.0050 mg/kg wet							
Heptachlor epoxide	< 0.0050	0.0050 mg/kg wet							
Linuron	< 0.0400	0.0400 mg/kg wet							
Malathion	< 0.0100	0.0100 mg/kg wet							
Methoxychlor	< 0.0050	0.0050 mg/kg wet							
Methyl parathion	< 0.0100	0.0100 mg/kg wet							
Metolachlor	< 0.0100	0.0100 mg/kg wet							
Metribuzin	< 0.0100	0.0100 mg/kg wet							
Parathion	< 0.0100	0.0100 mg/kg wet							
Pentachloronitrobenzene	< 0.0050	0.0050 mg/kg wet							
Permethrin	< 0.0050	0.0050 mg/kg wet							
Phorate	< 0.0100	0.0100 mg/kg wet							
Prometon	< 0.0100	0.0100 mg/kg wet							
Prometryne	< 0.0050	0.0050 mg/kg wet							
Simazine	< 0.0100	0.0100 mg/kg wet							
Sulfotep	< 0.0100	0.0100 mg/kg wet							
Tebuthiuron	< 0.0200	0.0200 mg/kg wet							
Temephos (Abate)	< 0.0500	0.0500 mg/kg wet							
Terbufos	< 0.0100	0.0100 mg/kg wet							
Triallate	< 0.0050	0.0050 mg/kg wet							
Trifluralin	< 0.0100	0.0100 mg/kg wet							
Surrogate: Tributyl Phosphate	0.0889	mg/kg wet	0.0810		110	50-140			
Surrogate: 4-chloro-3-nitrobenzotrifluoride	0.0414	mg/kg wet	0.0812		51	50-140			

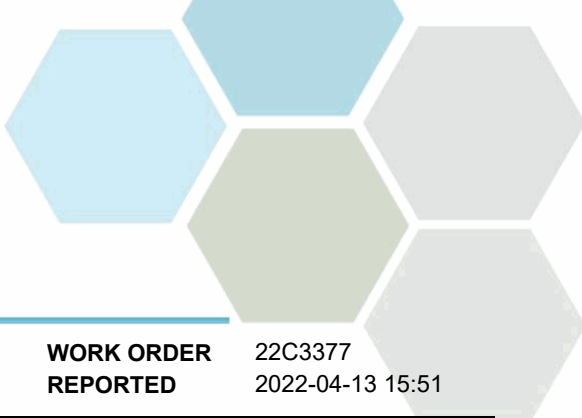


## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Pesticides, Herbicides, and Fungicides, Batch B2C3182, Continued</b>									
<b>LCS (B2C3182-BS1)</b>					Prepared: 2022-03-29, Analyzed: 2022-03-30				
Alachlor	0.0811	0.0050 mg/kg wet	0.0787		103	50-140			
Aldrin	0.0882	0.0050 mg/kg wet	0.0779		113	50-140			
Atrazine and metabolites	0.153	0.0050 mg/kg wet	0.157		97	50-140			
Azinphos-methyl	0.0781	0.0100 mg/kg wet	0.0765		102	50-140			
alpha-BHC	0.0727	0.0050 mg/kg wet	0.0787		92	50-140			
beta-BHC	0.0791	0.0050 mg/kg wet	0.0787		101	50-140			
delta-BHC	0.0746	0.0050 mg/kg wet	0.0779		96	50-140			
gamma-BHC (Lindane)	0.0747	0.0050 mg/kg wet	0.0779		96	50-140			
Bromacil	0.0742	0.0050 mg/kg wet	0.0787		94	50-140			
Bromoxynil	0.0837	0.0200 mg/kg wet	0.0762		110	50-140			
Butachlor	0.0893	0.0050 mg/kg wet	0.0787		113	50-140			
Captan	0.0948	0.0200 mg/kg wet	0.0776		122	50-140			
Chlordane (cis + trans)	0.180	0.0050 mg/kg wet	0.157		115	50-140			
Chlorothalonil	0.0702	0.0050 mg/kg wet	0.0762		92	50-140			
Chlorpyrifos	0.0864	0.0100 mg/kg wet	0.0779		111	50-140			
Cyanazine	0.0885	0.0100 mg/kg wet	0.0787		112	50-140			
DDT, Total	0.492	0.0100 mg/kg wet	0.392		125	50-140			
Deltamethrin	0.0897	0.0500 mg/kg wet	0.811		11	50-140			SPK1
Diazinon	0.0785	0.0100 mg/kg wet	0.0779		101	50-140			
Dichlorvos	0.0776	0.0100 mg/kg wet	0.0850		91	50-140			
Diclofop-methyl	0.0998	0.0050 mg/kg wet	0.0795		126	50-140			
Dieldrin	0.0803	0.0050 mg/kg wet	0.0779		103	50-140			
Dimethoate	0.0831	0.0100 mg/kg wet	0.0772		108	50-140			
Disulfoton	0.0981	0.0200 mg/kg wet	0.0795		123	50-140			
Diuron	0.0986	0.0200 mg/kg wet	0.0826		119	50-140			
Endosulfan I + II	0.158	0.0050 mg/kg wet	0.157		101	50-140			
Endosulfan sulfate	0.0757	0.0050 mg/kg wet	0.0787		96	50-140			
Endrin	0.0788	0.0050 mg/kg wet	0.0787		100	50-140			
Endrin aldehyde	0.0915	0.0050 mg/kg wet	0.0779		117	50-140			
Endrin ketone	0.0705	0.0050 mg/kg wet	0.0787		90	50-140			
Fenchlorphos (Ronnel)	0.0887	0.0100 mg/kg wet	0.0803		110	50-140			
Heptachlor	0.0737	0.0050 mg/kg wet	0.0787		94	50-140			
Heptachlor epoxide	0.0813	0.0050 mg/kg wet	0.0787		103	50-140			
Linuron	0.100	0.0400 mg/kg wet	0.0834		120	50-140			
Malathion	0.0912	0.0100 mg/kg wet	0.0779		117	50-140			
Methoxychlor	0.0740	0.0050 mg/kg wet	0.0787		94	50-140			
Methyl parathion	0.140	0.0100 mg/kg wet	0.0756		185	50-140			SPK1
Metolachlor	0.0869	0.0100 mg/kg wet	0.0779		111	50-140			
Metribuzin	0.0801	0.0100 mg/kg wet	0.0779		103	50-140			
Parathion	0.0760	0.0100 mg/kg wet	0.0779		98	50-140			
Pentachloronitrobenzene	0.0641	0.0050 mg/kg wet	0.0771		83	50-140			
Permethrin	0.0763	0.0050 mg/kg wet	0.0811		94	50-140			
Phorate	0.0815	0.0100 mg/kg wet	0.0779		105	50-140			
Prometon	0.0627	0.0100 mg/kg wet	0.0779		80	50-140			
Prometryne	0.0837	0.0050 mg/kg wet	0.0779		107	50-140			
Simazine	0.0774	0.0100 mg/kg wet	0.0787		98	50-140			
Sulfotep	0.198	0.0100 mg/kg wet	0.0834		237	50-140			SPK1
Tebuthiuron	0.0633	0.0200 mg/kg wet	0.0787		80	50-140			
Temephos (Abate)	0.976	0.0500 mg/kg wet	0.818		119	50-140			
Terbufos	0.0802	0.0100 mg/kg wet	0.0775		103	50-140			
Triallate	0.0780	0.0050 mg/kg wet	0.0773		101	50-140			
Trifluralin	0.0866	0.0100 mg/kg wet	0.0779		111	50-140			
Surrogate: Tributyl Phosphate	0.0861	mg/kg wet	0.0778		111	50-140			
Surrogate: 4-chloro-3-nitrobenzotrifluoride	0.0479	mg/kg wet	0.0779		61	50-140			

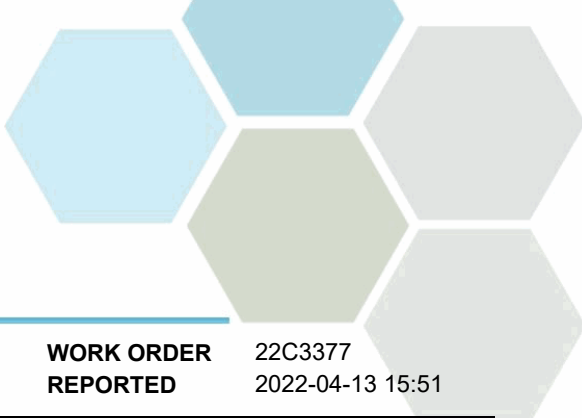


## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Polychlorinated Biphenyl Aroclors, Batch B2C3124</b>									
<b>Blank (B2C3124-BLK1)</b>					Prepared: 2022-03-29, Analyzed: 2022-03-30				
PCB-1016	< 0.040	0.040 mg/kg wet							
PCB-1221	< 0.040	0.040 mg/kg wet							
PCB-1232	< 0.040	0.040 mg/kg wet							
PCB-1242	< 0.040	0.040 mg/kg wet							
PCB-1248	< 0.040	0.040 mg/kg wet							
PCB-1254	< 0.040	0.040 mg/kg wet							
PCB-1260	< 0.040	0.040 mg/kg wet							
PCB-1262	< 0.040	0.040 mg/kg wet							
PCB-1268	< 0.040	0.040 mg/kg wet							
Total PCBs	< 0.040	0.040 mg/kg wet							
Surrogate: Decachlorobiphenyl	0.354	mg/kg wet	0.333		106	50-140			
<b>LCS (B2C3124-BS1)</b>					Prepared: 2022-03-29, Analyzed: 2022-03-30				
PCB-1016	1.68	0.040 mg/kg wet	1.65		102	60-130			
PCB-1260	1.47	0.040 mg/kg wet	1.64		90	60-130			
Surrogate: Decachlorobiphenyl	0.343	mg/kg wet	0.332		103	50-140			
<b>LCS Dup (B2C3124-BSD1)</b>					Prepared: 2022-03-29, Analyzed: 2022-03-30				
PCB-1016	1.67	0.040 mg/kg wet	1.60		104	60-130	< 1	50	
PCB-1260	1.36	0.040 mg/kg wet	1.59		85	60-130	7	50	
Surrogate: Decachlorobiphenyl	0.333	mg/kg wet	0.323		103	50-140			
<b>Polycyclic Aromatic Hydrocarbons (PAH), Batch B2C3040</b>									
<b>Blank (B2C3040-BLK1)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
Acenaphthene	< 0.050	0.050 mg/kg wet							
Acenaphthylene	< 0.050	0.050 mg/kg wet							
Anthracene	< 0.050	0.050 mg/kg wet							
Benz(a)anthracene	< 0.050	0.050 mg/kg wet							
Benzo(a)pyrene	< 0.050	0.050 mg/kg wet							
Benzo(b)fluoranthene	< 0.050	0.050 mg/kg wet							
Benzo(b+j)fluoranthene	< 0.050	0.050 mg/kg wet							
Benzo(g,h,i)perylene	< 0.050	0.050 mg/kg wet							
Benzo(k)fluoranthene	< 0.050	0.050 mg/kg wet							
2-Chloronaphthalene	< 0.050	0.050 mg/kg wet							
Chrysene	< 0.050	0.050 mg/kg wet							
Dibenz(a,h)anthracene	< 0.050	0.050 mg/kg wet							
Fluoranthene	< 0.050	0.050 mg/kg wet							
Fluorene	< 0.050	0.050 mg/kg wet							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050 mg/kg wet							
1-Methylnaphthalene	< 0.050	0.050 mg/kg wet							
2-Methylnaphthalene	< 0.050	0.050 mg/kg wet							
Naphthalene	< 0.050	0.050 mg/kg wet							
Phenanthrene	< 0.050	0.050 mg/kg wet							
Pyrene	< 0.050	0.050 mg/kg wet							
Quinoline	< 0.050	0.050 mg/kg wet							
Surrogate: Acenaphthene-d10	0.738	mg/kg wet	0.814		91	50-140			
Surrogate: Chrysene-d12	2.37	mg/kg wet	0.814		291	50-140			S02
Surrogate: Naphthalene-d8	0.715	mg/kg wet	0.784		91	50-140			
Surrogate: Perylene-d12	0.953	mg/kg wet	0.814		117	50-140			
Surrogate: Phenanthrene-d10	0.730	mg/kg wet	0.814		90	55-140			
<b>Blank (B2C3040-BLK2)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
Acenaphthene	< 0.050	0.050 mg/kg wet							
Acenaphthylene	< 0.050	0.050 mg/kg wet							
Anthracene	< 0.050	0.050 mg/kg wet							

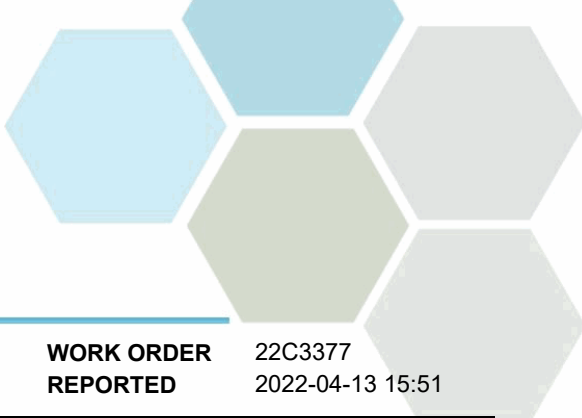


## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO** SNC-Lavalin Inc. (Burnaby)  
**PROJECT** 688421

**WORK ORDER** 22C3377  
**REPORTED** 2022-04-13 15:51

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Polycyclic Aromatic Hydrocarbons (PAH), Batch B2C3040, Continued</b>									
<b>Blank (B2C3040-BLK2), Continued</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
Benz(a)anthracene	< 0.050	0.050 mg/kg wet							
Benzo(a)pyrene	< 0.050	0.050 mg/kg wet							
Benzo(b)fluoranthene	< 0.050	0.050 mg/kg wet							
Benzo(b+j)fluoranthene	< 0.050	0.050 mg/kg wet							
Benzo(g,h,i)perylene	< 0.050	0.050 mg/kg wet							
Benzo(k)fluoranthene	< 0.050	0.050 mg/kg wet							
2-Chloronaphthalene	< 0.050	0.050 mg/kg wet							
Chrysene	< 0.050	0.050 mg/kg wet							
Dibenz(a,h)anthracene	< 0.050	0.050 mg/kg wet							
Fluoranthene	< 0.050	0.050 mg/kg wet							
Fluorene	< 0.050	0.050 mg/kg wet							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050 mg/kg wet							
1-Methylnaphthalene	< 0.050	0.050 mg/kg wet							
2-Methylnaphthalene	< 0.050	0.050 mg/kg wet							
Naphthalene	< 0.050	0.050 mg/kg wet							
Phenanthrene	< 0.050	0.050 mg/kg wet							
Pyrene	< 0.050	0.050 mg/kg wet							
Quinoline	< 0.050	0.050 mg/kg wet							
Surrogate: Acenaphthene-d10	0.779	mg/kg wet	0.824		95	50-140			
Surrogate: Chrysene-d12	2.48	mg/kg wet	0.824		301	50-140			S02
Surrogate: Naphthalene-d8	0.752	mg/kg wet	0.793		95	50-140			
Surrogate: Perylene-d12	1.11	mg/kg wet	0.824		135	50-140			
Surrogate: Phenanthrene-d10	0.781	mg/kg wet	0.824		95	55-140			
<b>LCS (B2C3040-BS1)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
Acenaphthene	0.767	0.050 mg/kg wet	0.764		100	50-140			
Acenaphthylene	0.727	0.050 mg/kg wet	0.766		95	50-140			
Anthracene	0.776	0.050 mg/kg wet	0.766		101	50-140			
Benz(a)anthracene	1.58	0.050 mg/kg wet	0.764		207	50-140			SPK1
Benzo(a)pyrene	0.763	0.050 mg/kg wet	0.764		100	50-140			
Benzo(b)fluoranthene	1.03	0.050 mg/kg wet	0.764		134	50-140			
Benzo(b+j)fluoranthene	2.05	0.050 mg/kg wet	1.53		134	50-140			
Benzo(g,h,i)perylene	0.715	0.050 mg/kg wet	0.766		93	50-140			
Benzo(k)fluoranthene	0.637	0.050 mg/kg wet	0.765		83	50-140			
2-Chloronaphthalene	0.580	0.050 mg/kg wet	0.773		75	50-140			
Chrysene	1.96	0.050 mg/kg wet	0.766		256	50-140			SPK1
Dibenz(a,h)anthracene	0.160	0.050 mg/kg wet	0.764		21	50-140			SPK1
Fluoranthene	0.682	0.050 mg/kg wet	0.766		89	50-140			
Fluorene	0.702	0.050 mg/kg wet	0.764		92	50-140			
Indeno(1,2,3-cd)pyrene	0.504	0.050 mg/kg wet	0.766		66	50-140			
1-Methylnaphthalene	0.726	0.050 mg/kg wet	0.763		95	50-140			
2-Methylnaphthalene	0.772	0.050 mg/kg wet	0.766		101	50-140			
Naphthalene	0.785	0.050 mg/kg wet	0.766		103	50-140			
Phenanthrene	0.797	0.050 mg/kg wet	0.773		103	50-140			
Pyrene	0.713	0.050 mg/kg wet	0.765		93	50-140			
Quinoline	0.749	0.050 mg/kg wet	0.773		97	50-140			
Surrogate: Acenaphthene-d10	0.774	mg/kg wet	0.766		101	50-140			
Surrogate: Chrysene-d12	1.88	mg/kg wet	0.766		246	50-140			S02
Surrogate: Naphthalene-d8	0.735	mg/kg wet	0.737		100	50-140			
Surrogate: Perylene-d12	0.928	mg/kg wet	0.766		121	50-140			
Surrogate: Phenanthrene-d10	0.751	mg/kg wet	0.766		98	55-140			
<b>LCS (B2C3040-BS3)</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
Acenaphthene	0.800	0.050 mg/kg wet	0.788		101	50-140			
Acenaphthylene	0.760	0.050 mg/kg wet	0.790		96	50-140			
Anthracene	0.809	0.050 mg/kg wet	0.790		102	50-140			



## APPENDIX 2: QUALITY CONTROL RESULTS

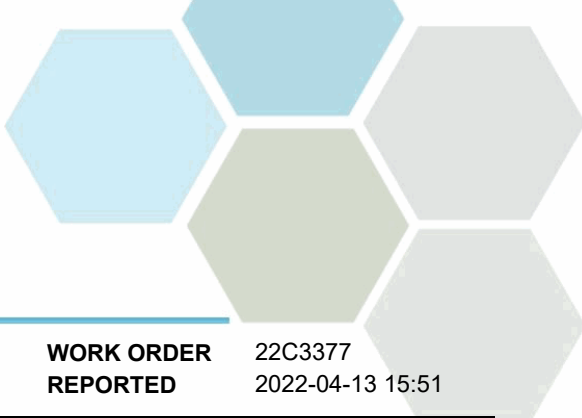
**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
<b>Polycyclic Aromatic Hydrocarbons (PAH), Batch B2C3040, Continued</b>									
<b>LCS (B2C3040-BS3), Continued</b>					Prepared: 2022-03-28, Analyzed: 2022-03-28				
Benz(a)anthracene	1.53	0.050 mg/kg wet	0.788		194	50-140			SPK1
Benzo(a)pyrene	0.837	0.050 mg/kg wet	0.788		106	50-140			
Benzo(b)fluoranthene	0.597	0.050 mg/kg wet	0.788		76	50-140			
Benzo(b+j)fluoranthene	1.88	0.050 mg/kg wet	1.58		119	50-140			
Benzo(g,h,i)perylene	0.614	0.050 mg/kg wet	0.790		78	50-140			
Benzo(k)fluoranthene	0.676	0.050 mg/kg wet	0.789		86	50-140			
2-Chloronaphthalene	0.584	0.050 mg/kg wet	0.798		73	50-140			
Chrysene	1.91	0.050 mg/kg wet	0.790		242	50-140			SPK1
Dibenz(a,h)anthracene	0.428	0.050 mg/kg wet	0.788		54	50-140			
Fluoranthene	0.710	0.050 mg/kg wet	0.790		90	50-140			
Fluorene	0.732	0.050 mg/kg wet	0.788		93	50-140			
Indeno(1,2,3-cd)pyrene	0.549	0.050 mg/kg wet	0.790		70	50-140			
1-Methylnaphthalene	0.759	0.050 mg/kg wet	0.787		96	50-140			
2-Methylnaphthalene	0.790	0.050 mg/kg wet	0.790		100	50-140			
Naphthalene	0.809	0.050 mg/kg wet	0.790		102	50-140			
Phenanthrene	0.831	0.050 mg/kg wet	0.798		104	50-140			
Pyrene	0.738	0.050 mg/kg wet	0.789		93	50-140			
Quinoline	0.825	0.050 mg/kg wet	0.798		103	50-140			
Surrogate: Acenaphthene-d10	0.767	mg/kg wet	0.790		97	50-140			
Surrogate: Chrysene-d12	1.82	mg/kg wet	0.790		230	50-140			S02
Surrogate: Naphthalene-d8	0.725	mg/kg wet	0.761		95	50-140			
Surrogate: Perylene-d12	0.960	mg/kg wet	0.790		122	50-140			
Surrogate: Phenanthrene-d10	0.758	mg/kg wet	0.790		96	55-140			

### Strong Acid Leachable Metals, Batch B2C3121

<b>Blank (B2C3121-BLK1)</b>			Prepared: 2022-03-29, Analyzed: 2022-03-30						
Aluminum	< 40	40 mg/kg dry							
Antimony	< 0.10	0.10 mg/kg dry							
Arsenic	< 0.30	0.30 mg/kg dry							
Barium	< 1.0	1.0 mg/kg dry							
Beryllium	< 0.10	0.10 mg/kg dry							
Boron	< 2.0	2.0 mg/kg dry							
Cadmium	< 0.040	0.040 mg/kg dry							
Chromium	< 1.0	1.0 mg/kg dry							
Cobalt	< 0.10	0.10 mg/kg dry							
Copper	< 0.40	0.40 mg/kg dry							
Iron	< 20	20 mg/kg dry							
Lead	< 0.20	0.20 mg/kg dry							
Lithium	< 0.10	0.10 mg/kg dry							
Manganese	< 0.40	0.40 mg/kg dry							
Mercury	< 0.040	0.040 mg/kg dry							
Molybdenum	< 0.10	0.10 mg/kg dry							
Nickel	< 0.60	0.60 mg/kg dry							
Potassium	< 40	40 mg/kg dry							
Selenium	< 0.20	0.20 mg/kg dry							
Silver	< 0.10	0.10 mg/kg dry							
Strontium	< 0.20	0.20 mg/kg dry							
Thallium	< 0.10	0.10 mg/kg dry							
Tin	< 0.20	0.20 mg/kg dry							
Tungsten	< 0.20	0.20 mg/kg dry							
Uranium	< 0.050	0.050 mg/kg dry							
Vanadium	< 1.0	1.0 mg/kg dry							
Zinc	< 2.0	2.0 mg/kg dry							



## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO PROJECT** SNC-Lavalin Inc. (Burnaby)  
688421

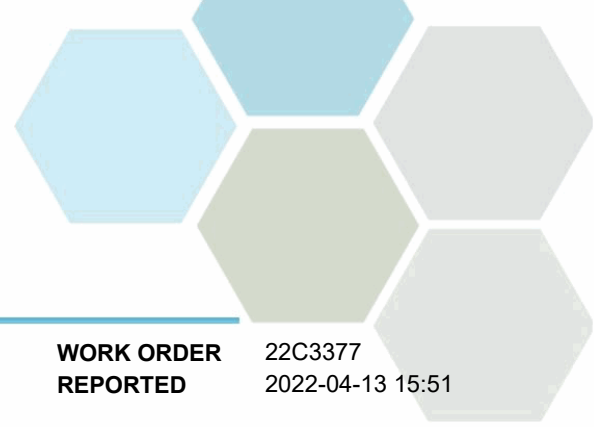
**WORK ORDER REPORTED** 22C3377  
2022-04-13 15:51

Analyte	Result	RL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
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**Strong Acid Leachable Metals, Batch B2C3121, Continued**

LCS (B2C3121-BS1)			Prepared: 2022-03-29, Analyzed: 2022-03-30						
Aluminum	< 40	40 mg/kg dry	2.00		102	80-120			
Antimony	1.87	0.10 mg/kg dry	2.00		94	80-120			
Arsenic	1.77	0.30 mg/kg dry	2.00		88	80-120			
Barium	1.7	1.0 mg/kg dry	2.00		86	80-120			
Beryllium	1.80	0.10 mg/kg dry	2.00		90	80-120			
Boron	2.1	2.0 mg/kg dry	2.00		106	80-120			
Cadmium	1.80	0.040 mg/kg dry	2.00		90	80-120			
Chromium	1.9	1.0 mg/kg dry	2.00		95	80-120			
Cobalt	1.95	0.10 mg/kg dry	2.00		98	80-120			
Copper	2.04	0.40 mg/kg dry	2.00		102	80-120			
Iron	190	20 mg/kg dry	200		95	80-120			
Lead	1.85	0.20 mg/kg dry	2.00		92	80-120			
Lithium	1.85	0.10 mg/kg dry	2.00		93	80-120			
Manganese	1.88	0.40 mg/kg dry	2.00		94	80-120			
Mercury	0.091	0.040 mg/kg dry	0.101		90	80-120			
Molybdenum	1.86	0.10 mg/kg dry	2.00		93	80-120			
Nickel	2.01	0.60 mg/kg dry	2.00		100	80-120			
Potassium	183	40 mg/kg dry	200		92	80-120			
Selenium	1.81	0.20 mg/kg dry	2.00		91	80-120			
Silver	2.18	0.10 mg/kg dry	2.00		109	80-120			
Strontium	1.81	0.20 mg/kg dry	2.00		90	80-120			
Thallium	1.92	0.10 mg/kg dry	2.00		96	80-120			
Tin	1.89	0.20 mg/kg dry	2.00		95	80-120			
Tungsten	1.86	0.20 mg/kg dry	2.00		93	80-120			
Uranium	1.75	0.050 mg/kg dry	2.00		87	80-120			
Vanadium	1.9	1.0 mg/kg dry	2.00		93	80-120			
Zinc	< 2.0	2.0 mg/kg dry	2.00		97	80-120			

Reference (B2C3121-SRM1)			Prepared: 2022-03-29, Analyzed: 2022-03-30						
Aluminum	10700	40 mg/kg dry	11500		93	70-130			
Antimony	0.78	0.10 mg/kg dry	0.723		107	70-130			
Arsenic	80.4	0.30 mg/kg dry	82.0		98	70-130			
Barium	37.7	1.0 mg/kg dry	39.9		94	70-130			
Beryllium	0.33	0.10 mg/kg dry	0.368		90	70-130			
Chromium	63.8	1.0 mg/kg dry	63.0		101	70-130			
Cobalt	10.7	0.10 mg/kg dry	10.4		103	70-130			
Copper	28.0	0.40 mg/kg dry	19.8		141	70-130			SRM
Iron	19800	20 mg/kg dry	20200		98	70-130			
Lead	16.4	0.20 mg/kg dry	17.3		95	70-130			
Manganese	304	0.40 mg/kg dry	314		97	70-130			
Mercury	0.108	0.040 mg/kg dry	0.110		99	70-130			
Molybdenum	0.70	0.10 mg/kg dry	0.618		114	70-130			
Nickel	32.9	0.60 mg/kg dry	31.6		104	70-130			
Silver	1.55	0.10 mg/kg dry	1.75		89	70-130			
Strontium	20.6	0.20 mg/kg dry	20.3		102	70-130			
Uranium	1.03	0.050 mg/kg dry	1.18		87	70-130			
Vanadium	31.7	1.0 mg/kg dry	33.4		95	70-130			
Zinc	39.5	2.0 mg/kg dry	40.1		98	70-130			



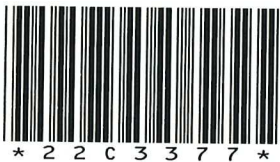
## APPENDIX 2: QUALITY CONTROL RESULTS

**REPORTED TO** SNC-Lavalin Inc. (Burnaby)  
**PROJECT** 688421

**WORK ORDER** 22C3377  
**REPORTED** 2022-04-13 15:51

**QC Qualifiers:**

S02 Surrogate recovery outside of control limits. Data accepted based on acceptable recovery of other surrogates.  
SPK1 The recovery of this analyte was outside of established control limits. The data was accepted based on performance of other batch QC.  
SRM Recovery of one or more analytes on Standard Reference Material (SRM) analysis are outside of control limits.



**CARO.ca** 1-888-311-8846  
 #110-4011 Viking Way, Richmond, BC V6V 2K9  
 #102-3677 Highway 97N, Kelowna, BC V1X 5C3  
 17225 109 Avenue NW, Edmonton, AB T5S 1H7  
 #108-4475 Wayburne Dr, Burnaby, BC V5G 4X4

**CHAIN OF CUSTODY RECORD** COC# **13349** PAGE **1** OF **1**

RELINQUISHED BY: Nicole Walker DATE: 22/03/23 RECEIVED BY: J.S/W DATE: 3/2  
 TIME: 16:00 TIME: 16:00

**REPORT TO:**  
 COMPANY: SNC-Lavalin Inc.  
 ADDRESS: 1300-3777 Kingsway  
Burnaby BC V5H 3Z7  
 CONTACT: Alan Walker / Max Sakelarios  
 TEL/FAX: 604-515-5101  
 DELIVERY METHOD: EMAIL  MAIL  OTHER\*   
 DATA FORMAT: EXCEL  WATERTRAX  ESdat   
 EQUIS  AEP EMS  OTHER\*   
 Copy of COC with report   
 EMAIL 1: alan.walker@snc-lavalin.com  
 EMAIL 2: max.sakelarios@snc-lavalin.com

**INVOICE TO:** SAME AS REPORT TO   
 COMPANY: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 CONTACT: \_\_\_\_\_  
 TEL: \_\_\_\_\_  
 DELIVERY METHOD: EMAIL  MAIL  OTHER\*   
 EMAIL 1: \_\_\_\_\_  
 EMAIL 2: \_\_\_\_\_  
 Quote ID: \_\_\_\_\_  
 PO #: \_\_\_\_\_

**TURNAROUND TIME REQUESTED:**  
 Routine: (5-7 Days)   
 Rush: 1 Day\*  2 Day\*  3 Day\*   
 Other\* \_\_\_\_\_  
 \*Contact Lab To Confirm. Surcharge May Apply

**REGULATORY APPLICATION:**  
 Canadian Drinking Water Quality   
 AB T1 SOIL/GW: NA  AG  RES/PL  CL  IL   
 AB SWQG: FWAL  IW  LW   
 CCME: \_\_\_\_\_ Other: \_\_\_\_\_

**PROJECT NUMBER / INFO:** 688421

A: Biohazard D: Asbestos G: Strong Odour  
 B: Cyanide E: Heavy Metals H: High Contamination  
 C: PCBs F: Flammable I: Other (please specify\*)

\*\* If you would like to sign up for ClientConnect, CARO's online service offerings, please check here:

SAMPLED BY: MJA/PAC

CLIENT SAMPLE ID:	MATRIX:				CONTAINER QTY	SAMPLING:		CHLORINATED FILTERED PRESERVED	COMMENTS: <small>(e.g. flow/volume, media ID, upload ID, notes)</small>
	DRINKING WATER	OTHER WATER	SOIL	OTHER		DATE	TIME		
M-SS22-02			X		3	22- March-23	0945		
M-SS22-03			X		3	22- March-23	1110		
M-SS22-04			X		3	22- March-23	1130		
M-SS22-05			X		3	22- March-23	1145		
M-SS22-06			X		3	22- March-23	1145		
M-SS22-07			X		3	22- March-23	1210		

**ANALYSES REQUESTED:**

PHC F1	BTEX	PAH	HAA	THM	DISSOLVED METALS	TOTAL METALS	SOIL METALS	SOIL SALINITY	PSA HYDROMETER	CLASS 2 LANDFILL	ROUTINE WATER	COD	TSS	AMMONIA	TO&G	TCOL	TOX TROUT MULTI CON.	TOX DAPHNIA MULTI CON.	Possible Sample Hazard Code(s)
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

*Handwritten notes in table:*  
 - Column 1: H4B/MSL + LSPH/MSL  
 - Column 2: HVPH  
 - Column 18: PCB Analyzers  
 - Column 19: Microbiology / Ammonia  
 - Column 20: Phosphorus / Potassium / TOC  
 - Column 21: Salmonella  
 - Column 22: Cr 6 (separated)  
 - Column 23: herbicide / pesticide  
 - Column 24: HOLD

**SHIPPING INSTRUCTIONS:** Return Cooler(s)   
 Supplies Needed: \_\_\_\_\_

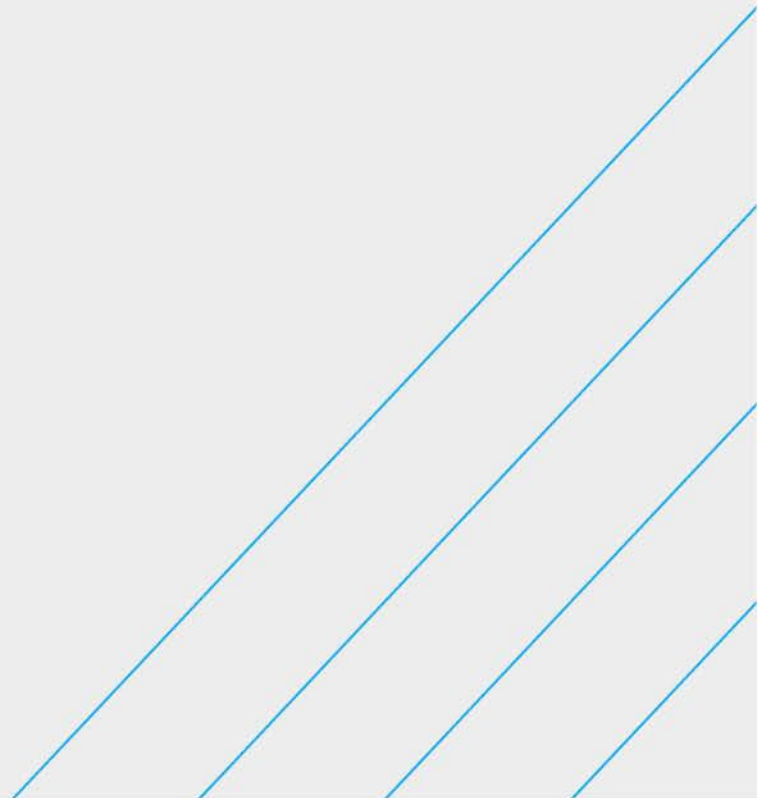
**SAMPLE RETENTION:**  
 30 Days (default)   
 60 Days  90 Days   
 Other (surcharges may apply): \_\_\_\_\_

**\* OTHER INSTRUCTIONS:**  
 \_\_\_\_\_  
 If you would like to talk to a real live Scientist about your project requirements, please check here:

**SAMPLE RECEIPT CONDITION:**  
 COOLER 1 (°C): 5.7 ICE: Y  N   
 COOLER 2 (°C): \_\_\_\_\_ ICE: Y  N   
 COOLER 3 (°C): \_\_\_\_\_ ICE: Y  N   
 CUSTODY SEALS INTACT: NA  Y  N

# Appendix II

PRRA Supporting Information



# HEPH/EPH<sub>C19-C32</sub> Sediment Guideline Derivation

The HEPH/EPH<sub>C19-32</sub> sediment guideline was derived based on Environment Canada methodology described by Mroz et al. (2016). Mroz et al. (2016) applied an equilibrium partitioning model, which assumed toxicity was based on the chemical concentration in the aqueous phase. For organic compounds, the partitioning behaviour is the function of the chemicals organic carbon-water partitioning coefficient ( $K_{oc}$ ) and the sediments fraction of organic carbon ( $F_{oc}$ ). The equation below described this relationship:

$$S_{ESL} = SW_{ESL} \cdot K_{oc} \cdot F_{oc}$$

Where:

$S_{ESL}$  = Sediment Ecological Screening Level ( $\mu\text{g/g}$ )

$SW_{ESL}$  = Surface Water Ecological Screening Level (mg/L)

$K_{oc}$  = Organic carbon-water partitioning coefficient (chemical specific, L/kg)

$F_{oc}$  = Sediment fraction organic carbon (Site-specific, g/g)

The above equation allows for site-specific adjustment based on  $F_{oc}$ . Mroz et al. (2016) provides sediment ecological screening levels for some petroleum-based substances based on an  $F_{oc}$  of 0.01 (see **Table II-1**, below), with a maximum of 500  $\mu\text{g/g}$  for modified total petroleum hydrocarbons (TPH).

**Table II-1: Sediment Ecological Screening Levels for the Protection of Aquatic Life ( $\mu\text{g/g}$ )**

Sediment Type	Substance							
	Benzene	Toluene	Ethylbenzene	Xylenes	Modified TPH			
					Gas	Diesel/#2	#6 Oils/Lube	Max
Typical	1.2	1.4	1.2	1.3	15	25	43	500
Other	5.4	6.1	5.0	5.5	67	110	190	500

**Notes:**

- Typical Sediment is used as a habitat for sensitive components of freshwater, marine or estuarine aquatic ecosystems
- Other Sites were the sediment is not classified as typical, such as ditches, industrial-influence receiving areas or urban harbours, etc.

In the PRRA, no sediment benchmarks were available for heavy and extractable petroleum hydrocarbons that elute between C19 and C32 (HEPH/EPH<sub>C19-32</sub>); these include most diesels, lubricating oils, greases, waxes and hydraulic oils. Based on the equation described by Mroz et al. (2016), a sediment guideline could be calculated. A site specific  $F_{oc}$  of 0.19 g/g for the Merritt Study Area was used (the average measured  $F_{oc}$  in soil samples collected by SNC-Lavalin, 2022b) and based on the Diesel/#2 sediment screening level of 25 for typical sediment types ( $F_{oc} = 0.01$ ), a site-specific sediment ecological screening level of 475  $\mu\text{g/g}$  for HEPH/EPH<sub>C19-32</sub> was derived for the Merritt Study Area for application in the PRRA.

Mroz et al. (2016) indicates that the screening levels indicated in Table II-1 are based on an  $F_{oc}$  of 0.01 and that they change proportionally with the  $F_{oc}$  (sample provided indicated an  $F_{oc}$  of 0.04 results in a 4-fold increase in the screening levels) to a maximum value of 500  $\mu\text{g/g}$ . The  $F_{oc}$  for the Study Area of 0.19 therefore results in a 19-fold increase in the Table II-1 screening value for diesel/#2. As a result, a value of 475  $\mu\text{g/g}$  was used.



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